

ACCEPTABLE KNOWLEDGE SOURCE DOCUMENT SUMMARY

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# Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements

Date Completed: June 1987

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Prepared for the U.S. Department of Energy  
under Contract DE-AC06-87RL10930

RETURN TO: RECORDS SERVICE CENTER  
BUILDING 102  
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Title: HANFORD RADIOACTIVE SOLID WASTE  
PACKAGING, STORAGE, AND  
DISPOSAL REQUIREMENTS

Issue Approval:

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## PREFACE

Radioactive solid wastes are stored or disposed of in the 200 Areas burial ground facilities in the Hanford Site by Westinghouse Hanford Corporation (Westinghouse) for the U.S. Department of Energy-Richland Operations Office (DOE-RL) as specified in contract DE-AC06-87RL10930.

Westinghouse is required to perform waste management duties in a cost-effective, safe, and environmentally sound manner. In addition to following written instructions and directions from the U.S. Department of Energy (DOE), judgment must be used by Westinghouse in all areas in which specific instructions have not been provided. It is therefore necessary to compile rules, regulations, guidelines, and methods of implementation for radioactive solid waste storage and disposal at the Hanford Site. This manual is the compilation of these rules, regulations, and guidelines, although it is not intended to be all-inclusive by anticipating every current and future waste type. Among other topics, the following are discussed: applicable State and Federal hazardous waste regulations, standards and specifications for waste packages, waste criteria, the waste minimization program, labeling, storage and disposal documentation, and the storage or disposal approval cycle.

The scope of this manual is limited to waste management only. The manual is not intended to provide complete information on transportation,

safety, security, nuclear material accountability, or other requirements. Since all waste generators must comply with safety, packaging, shipping, and security regulations, as well as storage and disposal requirements. It will also be necessary for the shipper to refer to the documents listed in the Bibliography, and possibly other State and Federal regulations and directives, before shipping waste to the Hanford Site 200 Areas burial ground facilities. Packaging, transportation, and waste management requirements are not always identical. Therefore, the waste generator must be particularly careful to meet all requirements.

This manual is intended for use by all waste generators preparing radioactive solid waste for storage or disposal at the Hanford Site 200 Areas burial ground facilities. Westinghouse will, in turn, use it as a basis for evaluating requests for these services. Department of Transportation shipping and packaging regulations do not apply per se to onsite shipments on the Hanford Site. Alternate procedures may be used for onsite shipments in the interest of economy or expediency provided equivalent safety requirements are imposed. Thus, discrepancies may exist between onsite and offsite handling of wastes in some cases.

Part I describes the general requirements that apply to both transuranic (TRU) solid waste storage and low-level waste (LLW) storage or disposal at the Hanford Site 200 Areas burial ground facilities. Included are descriptions of the storage or disposal approval cycle, steps to be taken prior to shipping waste to the Hanford Site, and steps taken by Westinghouse in the event noncompliant waste is received.

Part II describes requirements for acceptance of TRU waste for storage at the Hanford Site pending later shipment to the Waste Isolation Pilot Plant (WIPP). These requirements have been revised to incorporate the latest WIPP Waste Acceptance Criteria (WIPP-WAC), and the Westinghouse plan for certifying newly generated contact-handled TRU waste according to this criteria. The requirements for acceptance and certification of remote-handled TRU waste will be treated on a case-by-case basis by the Westinghouse 200 West Area Support Unit.

Part III describes requirements for the acceptance of LLW for storage or disposal at the Hanford Site 200 Areas burial ground facilities.

Part IV describes requirements for acceptance of mixed waste for storage and disposition at the Hanford Site 200 West Areas waste disposal facilities.

The glossary defines various abbreviations, acronyms, and other terms used throughout this manual.

The appendixes provide supplemental information to assist shippers.

## WESTINGHOUSE AND DOE-RL CONTACTS

Westinghouse and DOE-RL personnel with responsibilities in specific areas of waste management are identified below. (Names and telephone numbers are subject to change, but were accurate at the time of publication.)

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Storage and Transportation Division  
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FTS 444-6152  
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Robert F. Jarrell  
509-376-8699

A. W. Kellogg, Operations Officer  
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U.S. Department of Energy  
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Richland, Washington 99352  
509-376-8853  
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P. F. Shaw, Program Manager  
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W. G. Jasen, Manager  
West Area Support Unit  
509-373-1018  
FTS 440-1018

Westinghouse Tank Farm Scheduler  
Tank Farm Production Control  
509-373-1881  
FTS 440-1881

Westinghouse Hanford Production Operations Facsimile Transmissions

Address: P.O. Box 1970  
Richland, Washington 99352  
Onsite Generators: 373-3403  
Verification: 373-3845  
Offsite Generators: 509-373-2908; FTS 440-2908  
Verification: 509-373-1854; FTS 440-1854

Westinghouse Shipping Address:

U.S. Department of Energy  
c/o Westinghouse Hanford Corporation  
Solid Waste Processing  
2401 Stevens Drive  
1167 Building, 1100 Area  
Richland, Washington 99352

Attention S. H. Norton, Manager  
Solid Waste Processing  
509-373-4585  
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## PART I GENERAL REQUIREMENTS

### I.1.0 INTRODUCTION

Westinghouse Hanford Corporation (Westinghouse) manages and operates the Hanford Site 200 Areas burial ground facilities for the U.S. Department of Energy (DOE). These facilities include radioactive solid waste disposal sites, radioactive solid waste storage areas, and the Transuranic Storage and Assay Facility. The requirements described in this manual were developed to ensure that radioactive solid waste received by Westinghouse would be compatible with these facilities and stored or disposed safely, efficiently, in strict accordance with Federal and State law, and in an environmentally sound manner.

The general requirements described in Part I of this manual apply to all radioactive solid waste stored or disposed at the Hanford Site by Westinghouse.

### I.2.0 WASTE CLASSIFICATION

Radioactive waste is defined as any material or combination of materials designated as waste that spontaneously emits ionizing radiation, is radioactively contaminated, or is suspected of being radioactively contaminated. Only radioactive solid waste is acceptable for storage or disposal in the Hanford Site 200 Areas burial ground facilities. Nonradioactive waste and radioactive liquid waste will not be accepted (except as noted in Part III, section III.3.1.2 of this manual). Radioactive waste shall be designated as transuranic (TRU), low-level waste (LLW), or radioactive mixed waste (RMW) as described in the following sections.

#### I.2.1 TRANSURANIC WASTE

Transuranic waste is any radioactive waste contaminated with alpha-emitting radionuclides of atomic number greater than 92 with half-lives greater than 20 yr in concentrations greater than 100 nCi/g of waste matrix in any single waste package.\*

Westinghouse has also designated radioactive waste contaminated with radium sources and/or  $^{233}\text{U}$  in concentrations greater than 100 nCi/g of waste matrix in any single waste package as TRU waste.

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\*In addition to radionuclides greater than 92, radium and  $^{233}\text{U}$  are treated similarly to transuranic waste due to the similarity of hazards.

In determining whether radioactive waste is TRU, radioactive decay and the accumulation or ingrowth of transuranium daughter products shall be included as described in the following excerpt from DOE Order 5820.2, Radioactive Waste Management:

"For isotopes with other decay modes or alpha half-lives less than 20 yr, the radioactivity concentration at the time of maximum activity for the radionuclide of concern must correspond, by calculations, to the concentration limit for TRU waste. For example,  $^{241}\text{Pu}$  is a beta emitter which decays with a 14.37 yr half-life to  $^{241}\text{Am}$ , an alpha emitter with alpha half-life of 438 yr. The peak buildup of  $^{241}\text{Am}$  is 2.9% of the initial  $^{241}\text{Pu}$  activity in the waste. By dividing the 100 nCi/g maximum alpha activity by 0.029, a concentration limit of 3,400 nCi/g (beta) is obtained for waste contaminated with only  $^{241}\text{Pu}$ ."

High-level waste (HLW) and spent nuclear fuel, as defined by DOE Order 5820.2, are specifically excluded from the TRU waste definition; however, the HLW and spent nuclear fuel are handled in the same manner as TRU waste.

#### I.2.2 LOW-LEVEL WASTE

Low-level waste is radioactive waste not classified as high-level waste, TRU waste, spent nuclear fuel, or byproduct material as defined by DOE Order 5820.2, and which is not mixed with hazardous waste.

#### I.2.3 RADIOACTIVE MIXED WASTES

Radioactive mixed wastes are radioactive wastes that contain hazardous or dangerous waste materials as defined in 40 CFR 261, 49 CFR 172, Subpart B, and/or in Washington Administrative Code (WAC) 173-303.

#### I.2.4 PROHIBITED MATERIALS

The following materials are prohibited in radioactive solid waste packages stored or disposed at the Hanford Site:

- Free liquids (except as noted in Part III, section III.3.1.2 of this manual)
- Unreacted alkali metals (except as noted in Part IV of this manual)
- Chemically incompatible materials
- Explosives

- Pyrophorics
- Gas cylinders (excluding aerosol cans) not permanently vented.

### I.3.0 APPROVAL TO STORE OR DISPOSE RADIOACTIVE SOLID WASTE

Each waste generator shall receive formal approval from Westinghouse for the storage or disposal of each radioactive solid waste package prior to shipping that waste to the Hanford Site. The process of obtaining Westinghouse approval and the responsibilities and authorities of the various organizations involved in that process are described in the following sections.

#### I.3.1 RESPONSIBILITIES AND AUTHORITIES

Description of the responsibilities and authorities of each of the organizations involved in determining the acceptability of radioactive solid waste packages for storage or disposal at the Hanford Site are presented in sections I.3.1.1 through I.3.1.6.

##### I.3.1.1 Waste Generator

The waste generator (this term may refer to an individual, corporation, government agency, or other institution) is responsible for the following:

- Meeting all applicable transportation requirements, in addition to meeting storage and disposal requirements. Approval to store or dispose radioactive solid waste at the Hanford Site does not signify nor imply transportation approval
- Ensuring that the information provided with each radioactive solid waste package is complete and accurate
- Designating an individual to serve as the primary contact for all communications with DOE and/or Westinghouse involving the storage or disposal of radioactive solid waste
- Sustaining all transportation costs including those for the return of any reusable transport overpacks
- Providing funding to cover the costs of storage and/or disposal

- Providing assistance and sustaining all costs and liabilities incurred in the disposition or return of noncompliant waste packages (see Part I, section I.5.0 of this manual)
- Reducing the volume of waste generated and the amount of radioactivity in such waste whenever cost effective and practical.

#### I.3.1.2 Westinghouse Program Manager

The Laboratories and Solid Waste Storage and Disposal Program Manager shall be the primary Westinghouse contact for all communications involving the storage or disposal of radioactive solid waste between Westinghouse and the U.S. Department of Energy-Richland Operations Office (DOE-RL) or non-Westinghouse waste generators.

#### I.3.1.3 200 West Area Support Unit, Waste Management Plant and Process Engineering

The 200 West Area Support Unit manager shall be the primary contact for all communications between Waste Management Plant and Process Engineering and other Westinghouse organizations. The 200 West Area Support Unit is responsible for the following:

- Determining whether each request for the disposition of radioactive solid waste meets all applicable requirements in this manual and, in the case of a dispute, determining whether a waiver by the Westinghouse Safety and Environmental Advisory Council (SEAC) is required, warranted, or both
- Requesting the Approval Authority to waive compliance with requirements in this manual for disposition of radioactive solid waste that has been determined to not meet specific requirements, if an equivalent degree of safety can be achieved through other means
- Preparing a Burial Compliance Checksheet (BCC) for radioactive wastes that have been determined to meet all applicable requirements in this manual or that have been waived from complying with specific requirements by the SEAC Approval Authority.

#### I.3.1.4 Westinghouse Safety and Environmental Advisory Council (SEAC) Waste Management Subcouncil

The Westinghouse SEAC Waste Management Subcouncil shall review waiver requests made by the 200 West Area Support Unit and make recommendations to the Manager, Defense Waste Management Division to approve or disapprove each waiver request.

### I.3.1.5 Manager, Defense Waste Management Division

The Manager, Defense Waste Management Division shall approve or disapprove the waiver of radioactive solid waste storage and disposal requirements based upon recommendations from the SEAC Waste Management Subcouncil.

### I.3.1.6 Waste Management Division, U.S. Department of Energy-Richland Operations Office

The Director of the Waste Management Division of DOE-RL shall be the primary contact for all communications between DOE-RL and Westinghouse, or between Westinghouse and non-Hanford waste generators.

## **I.3.2 REQUESTS TO STORE OR DISPOSE RADIOACTIVE SOLID WASTE**

Each request to store or dispose radioactive solid waste shall be submitted in writing to Westinghouse in accordance with the steps described in sections I.3.2.1 and I.3.2.2.

### I.3.2.1 Information Required With Storage/Disposal Requests

Each request to store or dispose of radioactive solid waste package shall, as a minimum, be accompanied by the following information:

- A complete description of the proposed internal packaging, container, returnable transport overpack (if applicable), and the physical, chemical, and radiological characteristics of the waste
- A copy of the current Certificate of Compliance (COC) and unloading and handling procedures for any returnable transport overpacks proposed to be used
- For LLW only, evidence demonstrating that the waste package complies with the applicable criteria in Part III or Part IV of this manual
- For TRU waste only, a TRU waste handling and packaging plan which describes how the criteria discussed in part II of this manual are met
- For mixed waste, in addition to characterization of radionuclides, the manifest shall provide a complete listing of all dangerous and extremely hazardous waste species together with the weight proportions in the package. (Total weight must add up to 100% of the waste in the package. Nonhazardous material may be lumped into a single line item.)

- Any other pertinent information such as the previous acceptance of similar waste packages by Westinghouse, special handling requirements, drawings, specifications, etc. (NOTE: a draft BCC prepared by the shipper will help expedite approval.)

### I.3.2.2 Submitting Storage/Disposal Requests

Each request to store or dispose radioactive solid waste packages shall be submitted in writing for evaluation to the organizations described below, as applicable.

- Non-Hanford waste generators shall submit written storage and/or disposal requests to the Director, Waste Management Division, DOE-RL through the waste generator's DOE office. After review by DOE-RL, these requests will be forwarded to Westinghouse for evaluation and cost estimation.
- Non-Westinghouse Hanford Site waste generators shall submit written storage and/or disposal requests to the Program Manager, Laboratories Solid Waste Storage and Disposal, for evaluation.
- Westinghouse waste generators shall submit written storage and/or disposal requests to the 200 West Area Support Unit Manager for evaluation.

### **I.3.3 DETERMINATION OF ACCEPTABILITY OF RADIOACTIVE SOLID WASTE**

Upon receipt of a request to store or dispose of a radioactive solid waste package, the request is evaluated for acceptability by Westinghouse, and the waste generator is notified of this determination as described in the following paragraphs.

The 200 West Area Support Unit evaluates the information provided for each waste package and determines if it complies with all of the requirements in Part II (TRU waste), Part III (LLW) and/or Part IV (RMW) of this manual; if a waiver of the requirements should be requested from the SEAC Approval Authority; or if the waste package is unacceptable.

If the waste package is determined to be unacceptable, the waste generator is notified through the 200 West Area Support Unit Manager (for Westinghouse waste generators); Solid Waste Storage and Disposal Program Manager (for other Hanford Site waste generators); or the Director, Waste Management Division, DOE-RL (for non-Hanford Site waste generators).

If the waste package is determined to be acceptable, the 200 West Area Support Unit shall prepare a storage or disposal cost estimate (non-Hanford Site waste generators only), assign a Storage and Disposal Approval Number, and complete a BCC, which shall be used as formal technical approval for storage or disposal of that waste package.

The completed BCC is transmitted to Westinghouse waste generators through the 200 West Area Support Unit Manager, and to other Hanford Site waste generators through the Solid Waste Storage and Disposal Program Manager. For non-Hanford Site waste generators, the completed BCC and cost estimate are transmitted to the Director, Waste Management Division, DOE-RL through the Solid Waste Storage and Disposal Program Manager. After reviewing Westinghouse's determination, DOE-RL responds formally to non-Hanford Site waste generators through the waste generator's DOE office.

#### **I.3.4 AUTHORIZATION TO SCHEDULE WASTE SHIPMENTS**

Upon formal receipt of a completed BCC, Westinghouse and other Hanford Site waste generators are authorized to schedule shipments of waste packages in compliance with that BCC.

Non-Hanford Site waste generators are authorized to schedule shipments of waste packages upon formal receipt of a completed BCC and completion of the following additional requirements in compliance with that BCC:

- A memorandum purchase order (MPO) approved by the waste generator's DOE office for the estimated storage or disposal costs shall be transmitted to the Operations Officer, Assistant Manager for Operations, DOE-RL, for approval.
- After approving the MPO, DOE-RL shall provide, in writing, a Radioactive Material (RRM) number to the waste generator.

#### **I.4.0 SHIPPING RADIOACTIVE SOLID WASTE**

As the shipper, the waste generator is responsible for complying with all applicable safety, security, environmental, and transportation requirements pertaining to the shipment of radioactive solid waste to Westinghouse as well as all storage and disposal requirements, including State and Federal regulations controlling disposal of dangerous or hazardous materials. Scheduling, preparation, notification, and receiving requirements are described in the following subsections.

#### I.4.1 SCHEDULING

After completing all of the requirements in part I, section 3.0 of this manual, waste generators may schedule the shipment of radioactive solid waste packages to Westinghouse in compliance with the applicable BCC, as follows.

- Shipments of classified radioactive solid waste from non-Hanford Site waste generators requiring Safe Secure Trailer (SST) transportation are scheduled through the DOE Albuquerque Operations Office-Transportation Safeguards Division (ALO-TSD).
- All other shipments of radioactive solid waste are scheduled through Westinghouse Tank Farm Production Control (TFPC),\* with the exception of a limited number of onsite routine shipments.
- Shipments that require special handling or unloading of waste packages in returnable overpacks should be scheduled 6 to 8 weeks in advance and confirmed 1 to 2 weeks (minimum) prior to shipment.

#### I.4.2 PREPARATION

After scheduling shipments of radioactive solid waste to Westinghouse, all waste generators shall perform the following actions, in accordance with this manual, prior to shipping:

- Prepare and package waste, and load and label containers in accordance with the applicable BCC, Federal and State hazardous waste requirements, and applicable DOT shipping requirements
- Prepare accurate, complete, and consistent shipping, storage, and/or disposal documentation
- Prepare Uniform Hazardous Waste Manifest (U.S. Environmental Protection Agency (EPA) Form 8700-22) for all mixed waste packages
- Prepare an accurate and complete DOE/U.S. Nuclear Regulatory Commission (NRC) 741 form, or equivalent, if the waste contains accountable nuclear material
- Address all shipments (from non-Hanford Site waste generators) to the Westinghouse shipping address given in the list of contacts in this document
- Provide a name and shipping address for the return of any reusable overpacks.

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\*See page vii.

- Provide lifting, handling, and rigging instructions for all items requiring special rigging or lifting. All lift points and centers of gravity shall be clearly marked.

#### I.4.3 NOTIFICATION

Notification of the expected arrival date at Hanford of classified shipments from non-Hanford Site waste generators shall be made by DOE ALO-TSD.

Non-Hanford Site waste generators shall schedule shipments with the TFPC Scheduler at least two weeks prior to shipping. Shippers shall also notify TFPC at Westinghouse of unclassified shipments at the time the shipment leaves the originating facility.

If the shipment is four days overdue, notification procedures required by DOE Order 5480.3, Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes, will be followed.

Hanford Site waste generators shall notify the Westinghouse TFPC when a scheduled shipment leaves the originating facility and the estimated time of arrival (ETA) of the shipment. If the shipment does not arrive within a reasonable time of the ETA, the TFPC will notify the waste generator.

Routine shipments from Hanford Site waste generators may be exempted from notification requirements by the solid waste processing unit or the TFPC scheduler.

#### I.4.4 RECEIPT

Upon receipt of radioactive solid waste shipments at Hanford, the following actions are completed.

- All waste shipments from non-Hanford Site waste generators are inspected at the 1100 Area by the Westinghouse Receiving Department prior to arrival at the Hanford Site 200 Areas burial ground facilities. This inspection includes an inventory of waste packages, radiological survey of all external surfaces (i.e., enclosed vehicles are not opened), and a review of the documentation accompanying the shipment.
- Waste shipments will receive a thorough inspection upon arrival at the Hanford Site 200 Areas burial ground facilities. This inspection includes an inventory of waste packages; radiological survey of waste packages, internal and external surfaces of transport vehicles, and returnable transport overpacks; and a review of accompanying documentation.

- After unloading, returnable transport overpacks are reassembled, and the overpacks and transport vehicles are radiologically surveyed and released.
- Any conditions that are determined as not being in compliance with all of the requirements of this manual and the applicable BCC are resolved as described in Part I, section I.5.0 of this manual.

### I.5.0 DISPOSITION OF NONCOMPLIANT CONDITIONS

Upon receipt of radioactive solid waste packages at Hanford, conditions which are determined as not in compliance with the requirements in this manual or the applicable BCC, and/or State hazardous waste requirements, may be resolved through the use of one or more of the following alternatives, depending upon the seriousness of the condition.

- Westinghouse may hold the waste packages and request the waste generators to provide written instructions for use by Westinghouse to correct the condition before the waste package is accepted.
- Westinghouse may correct the condition and charge the waste generator for any costs incurred.
- Westinghouse may hold the waste packages and request that the waste generators correct the condition at Hanford.
- Westinghouse may require waste generator to return the waste packages to his/her facilities for correction.

In addition, serious or repeated instances of noncompliant conditions may result in a suspension of storage or disposal privileges.

8-24-87

## PART II TRANSURANIC WASTE REQUIREMENTS

### II.1.0 INTRODUCTION

In accordance with DOE Order 5820.2, Radioactive Waste Management, TRU solid waste, including Westinghouse-generated TRU wastes and TRU wastes shipped to Westinghouse from Hanford Site and non-Hanford Site DOE contractors, is placed in interim storage at the Hanford Site pending eventual shipment to the Waste Isolation Pilot Plant (WIPP). Prior to shipment to WIPP, each waste package must be certified to meet the requirements of WIPP-DOE-069, Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant. In accordance with the Westinghouse WIPP certification plan (Rockwell 1986a), all TRU waste received for storage will be segregated in two categories: (1) waste meeting the WIPP criteria; and (2) waste not meeting the WIPP criteria. This segregation will be performed by Westinghouse upon receipt of the waste at the Hanford Site 200 Area waste management facilities.

The requirements presented in Part II of this manual are based upon the Westinghouse WIPP certification plan (Rockwell 1986a), interim storage criteria, and WIPP Waste Acceptance Criteria (WAC). These requirements are intended to minimize the receipt of TRU waste which does not meet all WIPP-WAC. Noncertified TRU waste will not be accepted at the Hanford Site after November 1, 1987.

The requirements presented in Part II of this manual apply to all TRU waste received for storage at the Hanford Site 200 Areas waste management facilities.

### II.2.0 TRANSURANIC WASTE HANDLING AND PACKAGING PLAN

Each waste generator shall prepare and transmit to Westinghouse a plan for TRU waste handling and packaging. These plans will be used to supplement certification activities for TRU wastes that will eventually be shipped to the WIPP by Westinghouse, and will identify wastes that can be certified upon receipt and wastes which will require processing by Westinghouse in order to be certified.

A TRU waste handling and packaging plan shall include the following as a minimum.

- A description of the TRU waste generating facility, and the process or other activities that generates the waste.

- A description of the types of TRU waste generated, including whether the waste meets, can be processed to meet, or cannot be processed to meet Westinghouse acceptance requirements. (Refer to Part II, section II.3.0 or II.4.0 of this manual for details.)
- A description of the containers used to package the TRU waste, including container procurement or fabrication, inspection, and U.S. Department of Transportation (DOT) Type A testing qualification documentation.
- A description of the method (i.e., assay equipment, material balance, etc.) used to determine fissile and other radioactive material content of the waste.
- A description of the quality assurance requirements (WIPP 1983), which, as a minimum, shall include: (1) identification of the organizational structure, functional responsibilities, levels of authority, and lines of communication for activities affecting waste processing and certification; (2) a records management and document control system for the maintenance of procurement documents, procedures, drawings, calibration and test results, and certification records; (3) measures to ensure that correct tests and procedures are used, personnel conducting the tests are adequately trained, suitable sampling and test frequencies are used, and that tests and test equipment are standardized and calibrated; and (4) procedures for identifying and implementing corrective actions when unacceptable waste forms or packages are found.
- A brief description of the waste handling and packaging activities from waste generation to shipment to Westinghouse.

### II.3.0 CONTACT-HANDLED TRANSURANIC SOLID WASTE REQUIREMENTS

The minimum requirements presented in this section apply to all contact-handled (CH) TRU solid waste received for storage at the Hanford Site.

The BCCs for individual CH-TRU waste packages may be more, but not less restrictive than these requirements. All CH-TRU solid waste stored at the Hanford Site 200 Areas facilities shall comply with the BCC applicable to that waste.

### II.3.1 WASTE CONTAINER REQUIREMENTS

All containers used for CH-TRU waste storage at the Hanford Site 200 Area facilities shall meet or exceed the requirements described in the following sections.

#### II.3.1.1 Waste Containers

Waste containers shall be noncombustible, shall meet as a minimum, all the applicable requirements of 49 CFR 173.412 for Type A packaging, and shall have a design life of at least 25 yr from date of packaging.

The following requirements also apply to containers used for CH-TRU waste storage at the Hanford Site 200 Areas facilities.

- All 55-gal drums shall meet DOT specification 17C, and all interior and exterior surfaces shall be either galvanized in accordance with specification HS-BP-008, REV G (Rockwell 1986b), or aluminized in accordance with specification HS-BP-0069, Basic (Rockwell 1985). Other container materials will be approved by the 200 West Area Support Unit on a case-by-case basis.
- All other containers shall be constructed of 16-ga. or thicker steel, and all interior and exterior surfaces shall be either galvanized (minimum coating 1.25 oz/ft<sup>2</sup>) or painted with a two-component, epoxy-polyamide (or functionally equivalent) paint system (minimum coating thickness 4 mil). The 200 West Area Support Unit will determine the acceptability of specific paint systems.
- All containers shall be in good condition with no cracks, dents, holes, bulges, corrosion or other damage that could compromise container integrity.
- All labels and markings required by the WIPP-WAC shall be permanently applied with paint or other materials that have a demonstrated 25-yr design life and are compatible with the container and its coating. The 200 West Area Support Unit will determine the acceptability of individual labeling and marking systems.
- Containers shall not be loaded beyond the weight for which the container has been certified in accordance with applicable DOT standards for Type A packaging.
- Bulky or heavy waste items shall be blocked inside the container to prevent shifting during handling.

- The integrity of waste containers shall not be compromised from waste form reactions such as gas generation or corrosion. Waste forms that might produce such effects should be packaged or processed to ensure container integrity.

### II.3.1.2 Waste Package Size

Waste packages or package assemblies, including all protrusions and considering maximum tolerances, shall have dimensions not exceeding 12-ft long by 8-ft wide by 8.5-ft high.

Waste packages shall not be smaller than a 55-gal drum or equivalent size container.

### II.3.1.3 Waste Package Handling \*\*

Waste packages shall be provided with cleats, offsets, chimes, or skids for handling by fork trucks, cranes, or similar devices. Lifting rings and other auxiliary lifting devices on the packages shall be recessed, offset, hinged or removable so as not to prevent the stacking of the packages. All lifting attachments shall be designed to a 5:1 safety factor based upon the ultimate strength of the materials and the maximum allowable weight of a full container.

## II.3.2 WASTE FORM REQUIREMENTS

All CH-TRU waste stored at the Hanford Site 200 Areas facilities shall meet the waste form requirements described in the following sections.

### II.3.2.1 Immobilization

Powders, ashes, and similar particulate waste materials shall be immobilized\* if more than 1 wt% of the waste matrix is in the form of particles below 10 microns in diameter, or if more than 15 wt% is in the form of particles below 200 microns in diameter.

Particulate waste materials shall be immobilized in concrete, glass, or a similar solidified matrix compatible with the chemical nature of the waste.

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\*The immobilization requirement does not apply to incidental dust associated with nonparticulate waste, to Portland cement or to other desiccants added as liquid absorbents.

Waste that is known to be in a powder form or in a form that could mechanically or chemically be transformed to a powder during handling and interim storage, or waste in which powder content is unknown, shall be immobilized.

Waste containing chelating compounds shall not be stored at the Hanford Site except on a case-by-case basis after analysis by the 200 West Area Support Unit.

### II.3.2.2 Liquid Waste

A free liquid is any liquid, radioactive or nonradioactive, from any source (e.g., equipment flushing, precipitation intrusion, etc.) capable of flowing out of the waste package under any circumstances, including rupture of one or more containment barriers.

The CH-TRU waste shipped to Hanford for storage shall not contain waste in liquid form. Liquid waste packaged for storage at the Hanford Site 200 Areas facilities shall be solidified, absorbed, or otherwise bound in the waste matrix by inert materials.

The resultant waste matrix shall not be capable of spontaneous combustion, decomposition, explosion, liquid desorption, or of affecting the integrity of the container and packaging system in any way.

If liquids are bound by absorption, the absorbent material shall be placed in direct contact with the liquid (i.e., within the same containment barrier). The quantity of absorbent material shall be sufficient to absorb at least twice the volume of liquid potentially present. Use of absorbents outside a sealed bag that contains trapped liquid does not meet the intent of this criterion. The 200 West Area Support Unit shall determine the acceptability of absorbent materials used for specific applications. (NOTE: In a few special cases, it may not be possible to place absorbent in direct contact with liquids. Those cases will be handled on a case-by-case basis by the 200 West Area Support Unit.)

### II.3.2.3 Pyrophoric Materials

Pyrophoric materials (other than radionuclides) present in CH-TRU waste shall be rendered safe through mixture with chemically stable materials such as glass or concrete, or through processing to remove the hazardous properties. No more than 1 wt% of the waste in each package shall be pyrophoric forms of radionuclides, and these shall be generally dispersed in the waste.

The 200 West Area Support Unit shall determine the acceptability of specific processing used to convert pyrophoric materials, including flammable solids, organic peroxides, water-reactive materials and other materials described in 49 CFR 173, Subparts D and E, into safe forms.

#### II.3.2.4 Explosives and Compressed Gases

Contact-handled TRU waste shall contain no explosives or compressed gases as defined by 49 CFR 173, Subparts C and G. No pressurized vessels shall be permitted in CH-TRU waste.

#### II.3.2.5 Radioactive Mixed TRU Waste

Transuranic waste shall contain no hazardous wastes unless they exist as co-contaminants with transuranics. All CH-TRU waste packages containing hazardous co-contaminants shall meet the following requirements.

- Hazardous contaminants in TRU waste packages shall be listed on a uniform hazardous waste manifest in accordance with WAC 173-303-180 and 40 CFR 262 (see appendix H). (The total weight or percentage shall be equal to the total waste in the package. Nonhazardous waste shall be lumped into a single line item.)
- TRU-contaminated corrosive materials shall be neutralized, rendered noncorrosive, or packaged in a manner to ensure container adequacy through the design lifetime. Hazardous materials to be reported are listed in 40 CFR 261; Subparts C and D.
- All quantities of hazardous materials as defined in 49 CFR 171.8 and listed in 49 CFR 172.101 shall be chemically identified, quantified and documented (see Part II, section 5.0 of this manual).
- All waste packages containing greater than limited quantities of hazardous materials as defined in 49 CFR 171.8 and listed in 49 CFR 172.101 shall be identified with the appropriate DOT label.
- Chemically incompatible substances shall not be packaged in the same container. Examples of chemically incompatible substances are presented in appendix G.

#### II.3.3 WASTE PACKAGE REQUIREMENTS

The waste package includes the waste, internal packaging, waste container, and any disposable overpack intended to be stored at Hanford Site

200 Areas facilities. All CH-TRU waste packages accepted for storage by Westinghouse shall meet or exceed the requirements listed in the following sections.

### II.3.3.1 Waste Package Weight

The following weight requirements apply to all CH-TRU waste packages.

- The gross weight of any waste package shall not exceed the weight for which the container has been certified in accordance with applicable DOT standards for Type A packaging.
- The gross weight of any waste package shall not exceed 25,000 lb.
- The gross weight of any waste package containing greater than DOT A1 or A2 quantities of radioactive material shall not exceed 17,000 lb.
- The gross weight of each waste package shall be reported in the corresponding documentation (see Part II, section II.5.0 of this manual) and marked on the waste package (see Part II, section II.3.4 of this manual).

### II.3.3.2 Nuclear Criticality

The fissile isotope content of individual CH-TRU waste packages shall not exceed the following values in  $^{239}\text{Pu}$  fissile gram equivalents or total fissile material, whichever is more restrictive:\*

- 200 g per 55-gal drum
- 100 g per 30-gal drum
- 500 g per DOT 6M container
- 5 g in any cubic foot in boxes, up to 350 g maximum.

Conversion factors for determining  $^{239}\text{Pu}$  fissile gram equivalents; and for determining the total fissile material curie content are provided in appendix C.

\*Additional restrictions may be imposed by Westinghouse Criticality Engineering Analysis.

#### II.3.3.3 Plutonium-239 Equivalent Transuranic Activity

The  $^{239}\text{Pu}$  Equivalent TRU Activity (PE-Ci) of individual CH-TRU waste packages shall not exceed 1000 PE-Ci. Conversion factors for determining PE-Ci are provided in appendix C.

#### II.3.3.4 Surface Dose Rate

Waste packages shall have a maximum surface dose rate no greater than 200 mRem/h (beta, gamma, and neutron) at any point. Neutron dose rate contributions of greater than 20 mRem/h shall be reported in the corresponding documentation (see Part II, section II.5.0 of this manual).

#### II.3.3.5 Surface Contamination

Waste packages shall have removable surface contamination no greater than 50 pCi per 100 cm<sup>2</sup> (100 dpm/100 cm<sup>2</sup>) for alpha-emitting radioisotopes, and no greater than 450 pCi/100 cm<sup>2</sup> (1,000 dpm/100 cm<sup>2</sup>) for beta-gamma-emitting radioisotopes.

Fixation of surface contamination shall not be allowed.

#### II.3.3.6 Thermal Power

The following requirements apply to all individual waste packages in which the average thermal power exceeds 0.1 W/ft<sup>3</sup> (3.5 W/m<sup>3</sup>):

- Thermal output of the waste package shall be determined through the use of documented thermal power measurements or assay-based calculations
- Thermal output shall be recorded in the documentation corresponding to that waste package (see Part II, section II.5.0 of this manual)
- Each waste package shall meet the requirements of 49 CFR 173.442 for heat generation and temperature.

#### II.3.3.7 Gas Generation

The following requirements apply to all waste packages.

- The total alpha curie content, description of waste form (matrix), volume percentage, and mass of organic content in each waste package shall be determined and reported in the corresponding

documentation (see Part II, section II.5.0 of this manual). This information may be determined by assay, records, measurements or calculations.

- Each waste package containing waste forms known or suspected of potentially generating gas shall be vented in a suitable manner to prevent jeopardizing the ability of the waste package to meet all applicable DOT shipping requirements including design pressure ratings.

#### II.3.4 LABELING AND MARKING

All CH-TRU waste packages stored at the Hanford Site 200 Areas facilities shall meet the following labeling and marking requirements:

##### II.3.4.1 General Labeling and Marking Requirements

All labels and markings shall be permanently applied to the waste package with paint or other materials that have a predicted 25-yr design life and are compatible with the container and the protective coating.

All labels and markings shall be in clear, legible English and made in a color contrasting with the background.

All labels and markings shall be nonfading and nonsmearing.

The 200 West Area Support Unit shall determine the acceptability of labeling and marking materials used in specific applications.

##### II.3.4.2 Labeling and Marking Character Size

All characters used in labeling and marking 55-gal drums shall be at least 1 in. high.

All characters used in labeling and marking waste packages larger than 2 ft by 2 ft by 2.9 ft shall be at least 2 in. high.

##### II.3.4.3 Labeling and Marking Locations

Unless otherwise indicated in Part II, section II.3.4.4 of this manual, all labeling and marking shall be placed on waste packages in the following locations:

- Cylindrical containers - three labels on sides, 120° apart, within the bottom 5 inches of the drum

- Rectangular containers - once on top, once on upper one-third of each side.

#### II.3.4.4 Required Information

All CH-TRU waste packages shall be labeled and/or marked with the following information:

- Package Identification Number (PIN) - For non-Hanford Site waste generators, the PIN is a number from a unique numbering system that is approved in writing by the 200 West Area Support Unit
- Gross Weight in Kilograms - Required to be placed below the PIN
- Radioactive Material - Approved DOT (or an approved equivalent) radioactive material label required on opposite sides
- Additional transportation labels as applicable - Required on side.
- If TRU waste is contaminated with hazardous material as defined in WAC 173-303, 40 CFR 261, Subparts C and D, or in 49 CFR 172.101 or .102, then the proper hazard label(s) shall be affixed in accordance with 49 CFR 172, Subpart E. The official classification of the waste is "radioactive material" as outlined in 49 CFR 173.2(a).

#### II.4.0 REMOTE-HANDLED TRANSURANIC SOLID WASTE REQUIREMENTS

The requirements for remote-handled (RH) TRU solid waste storage at the Hanford Site 200 Areas facilities will be provided on a case-by-case basis by the 200 West Area Support Unit.

#### II.5.0 DOCUMENTATION

Documentation that must be included with CH-TRU and RH-TRU waste package shipments is detailed in sections II.5.1 and II.5.2.

##### II.5.1 CONTACT-HANDLED TRANSURANIC WASTE DOCUMENTATION REQUIREMENTS

In addition to shipping papers, the following documentation shall be prepared accurately and completely by the waste generator for each CH-TRU

waste package and shall be included with the waste package shipped to Westinghouse for storage at the Hanford Site 200 Areas burial ground facilities:

- DOE/NRC 741 form, or equivalent, if the waste contains accountable nuclear material (the contents of more than one waste package may be included on this form)
- Contents Inventory Sheet (Rockwell form BC-6400-131)
- WIPP Certification Checksheet (Rockwell form BC-6400-132)
- Solid Waste Storage Record - Transuranic (Rockwell form 54-3000-623).

Instructions for completing these forms are provided in appendix E of this manual. Blank forms may be obtained from the 200 West Area Support Unit.

#### II.5.2 REMOTE-HANDLED TRANSURANIC WASTE DOCUMENTATION REQUIREMENTS

In addition to shipping papers, the following documentation shall be prepared accurately and completely by the waste generator for each RH-TRU waste package or shipment and shall be included with the waste package shipped to Westinghouse for storage at the Hanford Site 200 Areas facilities:

- DOE/NRC 741 form, or equivalent, if the waste contains accountable nuclear material (the contents of more than one waste package may be included on this form)
- Contents Inventory Sheet (Rockwell form BC-6400-131)
- Solid Waste Storage Record - Transuranic (Rockwell form 54-3000-623).

Instructions for completing these forms are provided in appendix E of this manual. Blank forms may be obtained from the 200 West Area Support Unit.

#### II.5.3 CONTACT-HANDLED AND REMOTE-HANDLED TRANSURANIC MIXED WASTE DOCUMENTATION REQUIREMENTS

If the TRU waste contains dangerous waste materials as defined in WAC 173-303, then additional documentation relative to the dangerous component materials must be prepared. This documentation shall include, as a minimum, the following:

- A chemical waste disposal request form (Rockwell form A-6400-245) (to accompany the request for a BCC)

- A Uniform Hazardous Waste Manifest Form (EPA Form 8700-22) properly filled out and certified to by an authorized employee.

Transuranic mixed waste must be documented, marked, and labeled both for its radioactive nature and its hazardous nature as defined in WAC 173-303. For details on use of the hazardous waste documentation forms and stickers on the waste, refer to Part IV of this manual and applicable parts of the appendix.

## PART III LOW-LEVEL WASTE REQUIREMENTS

### III.1.0 INTRODUCTION

Radioactive solid LLW (free from hazardous waste) is disposed of by Westinghouse at the Hanford Site 200 Areas burial ground facilities using shallow-land-burial techniques. In addition, certain LLW may be retrievably stored at the Hanford Site 200 Areas burial ground facilities with the approval of DOE-RL. The minimum requirements described in Part III of this manual apply to all LLW disposed or stored at the Hanford Site. The BCCs for individual LLW packages may be more, but not less restrictive than these requirements. All LLW stored or disposed at the Hanford Site 200 Areas burial ground facilities shall comply with the BCC applicable to that waste.

### III.2.0 WASTE CONTAINER REQUIREMENTS

All containers used for LLW storage or disposal at the Hanford Site 200 Areas burial ground facilities shall meet or exceed the requirements described in the following sections.

#### III.2.1 GENERAL CONTAINER REQUIREMENTS

Containers shall be in good condition with no cracks, dents, holes, bulges, excessive corrosion or other damage that could compromise integrity.

Containers shall not be used for wastes that could react with or degrade the container by physical, chemical, or radiological mechanisms, unless internal container protection has been provided.

##### III.2.1.1 Container Requirements for Retrievably Stored Low-Level Waste

All LLW accepted for storage at the Hanford Site 200 Areas burial ground facilities shall be packaged in DOT specification 17C steel 55-gal drums unless larger packages are dictated by size, shape, or form of waste. Interior and exterior surfaces shall be either galvanized in accordance with Rockwell specification HS-BP-008 (Rockwell 1986b), or aluminized in accordance with Rockwell specification HS-BP-0069, Basic (Rockwell 1985). Deviations from this packaging shall be approved by the 200 West Area Support Unit on a case-by-case basis.

### III.2.2 CONTAINMENT

All containers shall provide at least two containment barriers to prevent the release of contamination. Plastic wrap may be considered one barrier.

With the exception of plastic wrap, containment barriers shall not be jeopardized by wind, blowing sand, precipitation, sunlight, extreme temperatures, or stresses due to the weight or configuration of the container or its contents plus the loads associated with handling and transportation.

The following containers are exceptions to the two-containment barrier requirement and shall provide at least one containment barrier, unless otherwise noted in Part III, sections III.3.1, III.3.2, III.3.3, or III.3.4 of this manual:

- Containers designed for and/or restricted to DOT Low Specific Activity (LSA) or limited quantities of radioactive material
- Containers which have been demonstrated by engineering analysis or testing to meet the appropriate DOT Drop Test and Penetration Test requirements in 49 CFR 173 Subpart I. Westinghouse Waste Management Plant and Process Engineering shall approve all engineering analysis and testing of containers
- Self-contained packages containing DOT-LSA or limited quantities of radioactive materials
- Containers disposed of by drag-off procedures
- Heavy-walled, high-pressure equipment that meets the following requirements:
  - A life expectancy in excess of 300 yr, when buried at the Hanford Site
  - External wall thickness of 1 in. or more carbon or stainless steel with nozzles welded closed using 1-in. thick or heavier covers, or approved equals
  - No TRU or hazardous materials contained in internal or external contamination.

Examples of components meeting these requirements include steam generators, high-pressure preheaters, high-pressure circulating pumps (canned-rotor type), high-pressure tanks, submarine reactor compartments, reactor vessels, and large-diameter piping.

### III.2.3 HANDLING

Containers shall meet the following handling requirements whenever practical.

- With the exception of plastic wrap and fiberboard boxes, all containers used for CH-LLW with maximum gross weights of less than 16,000 lb should be compatible with forklift handling.
- Containers used for CH-LLW should be designed to withstand 12 ft of stacking with similar containers.
- Crane-unloaded containers used for LLW shall be equipped with lifting devices designed to safely lift the fully loaded container. All lifting attachments shall be designed with a 5:1 safety factor based upon the ultimate strength of the materials and the loaded container's maximum gross weight. Lead shall not be used in fabricating the rigging.

### III.2.4 FIRE RETARDANCY

All containers used for CH-LLW storage or disposal, with the exception of fiberboard boxes and plastic wrap, shall be fire retardant unless specifically exempted by the 200 West Area Support Unit. Wood containers shall be constructed of fire-retardant wood; or all exterior surfaces shall be treated for fire retardancy with a fire-retardant coating having a maximum flame-spread index of 25 when tested to ASTM E-84 (ASTM 1985).

## III.3.0 WASTE FORM REQUIREMENTS

Reporting, packaging, labeling and other requirements that apply to the storage or disposal of specific waste forms are presented in the following sections. All LLW stored or disposed at the Hanford Site 200 Areas burial ground facilities shall meet these or more stringent requirements.

### III.3.1 LIQUID WASTE

The storage and disposal requirements for liquids in LLW are detailed in sections III.3.1.1 and III.3.1.2.

### III.3.1.1 Disposal Requirements

Free liquids shall not be disposed of as LLW in the Hanford Site 200 Areas burial ground facilities. All liquids disposed of as LLW shall be solidified, absorbed, or otherwise bound in the waste matrix by inert materials. The resultant waste matrix shall not be capable of spontaneous combustion, decomposition, explosion, or affecting the integrity of the containment barriers in any way. If the resultant waste matrix is capable of gas generation, the container shall be vented.

- If liquids are bound by absorption, the absorbent material shall be placed in direct contact with the liquid (i.e., within the same containment barrier), and the quantity of absorbent material shall be sufficient to absorb at least twice the volume of liquid potentially present. The 200 West Area Support Unit shall determine the acceptability of absorbent materials for specific applications.

(NOTE: In a few special cases, it may not be possible to place absorbent in direct contact with liquids. These cases will be handled by the 200 West Area Support Unit on a case-by-case basis.)

### III.3.1.2 Storage Requirements

Requests for storage of specific free or absorbed liquid organic waste will be evaluated by the 200 West Area Support Unit on a case-by-case basis. If accepted for storage, organic liquids shall be packaged to meet DOT requirements.\*

III.3.1.2.1 Free-Liquid Organics. Normally, free liquids are not accepted for storage at the Hanford Site. If, however, the waste is accepted, it shall be sealed in a leak resistant container of not more than 15-gal capacity and packaged in a 55-gal galvanized drum, DOT specification 17C or approved equivalent. (NOTE: Most organic liquids are also classified as hazardous material in WAC 173-303; therefore, these materials are handled according to Part IV of this manual).

The inner container shall be packaged with a combustible absorbent such as Conwed pads or approved equivalent for absorption of oils. Sufficient absorbent shall be included in the package to absorb at least twice the maximum amount of organic liquids potentially present.

If the waste matrix is capable of gas generation, the drum shall be vented and or include a catalyst package for recombining hydrogen and oxygen.

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\*If organic wastes are accepted for storage at the Hanford Site, it is assumed that the ultimate disposition will be at an approved incinerator for destruction by burning when such a facility becomes available.

The maximum quantity of fissile material in 55-gal drums containing free organic liquids is 100 g total.

III.3.1.2.2 Absorbed Liquid Organics. If the liquids are bound by absorption, the absorbent material shall be placed directly in contact with the liquid (i.e., within the same containment barrier) and the quantity of absorbent material shall be sufficient to absorb at least twice the volume of liquid potentially present. The 200 West Area Support Unit shall determine the acceptability of absorbent materials and immobilization techniques or processes for specific applications.

For absorbed organic liquids, the liquid with the absorbent shall be packaged within two impervious barriers, the outer barrier of which shall be a galvanized 55-gal drum, DOT Specification 17C or approved equivalent. The inner barrier shall be a plastic bag 4 mil or heavier, which shall be sealed with a pigtail that shall be twisted, folded double, and sealed with a 2-in.-wide, water-resistant-fabric, reinforced tape. A 90-mil polyethylene drum liner may be also used as the inner barrier. The plastic material used for the inner barrier shall be compatible with the specific organic material being packaged.

If the waste matrix is capable of gas generation, the container shall be vented and/or include a catalyst package for hydrogen and oxygen combining.

III.3.1.2.3 Marking Waste Containing Organic Liquids. In addition to the labeling and marking required in Part III, section III.5.0 of this manual, the following information shall be marked on the side of each drum containing free organic liquids:

- An identification number from a unique numbering system, which is approved in writing by the 200 West Area Support Unit.
- "LIQUID ORGANIC WASTE"
- The flashpoint or flashpoint range of the material in degrees fahrenheit, e.g., "FLASHPOINT 160-180°F".

### III.3.2 TRITIATED WASTE

Tritiated waste is any waste containing greater than 20 mCi of tritium/m<sup>3</sup> of waste (4.2 mCi per 55-gal drum). The following are disposal requirements for tritiated waste.

- Liquid tritiated waste shall be absorbed on an inert absorbent material within an inner leak-resistant container. The quantity of absorbent material shall be sufficient to absorb at least twice the quantity of liquid tritiated waste potentially present. The 200 West Area Support Unit shall determine the acceptability of absorbent materials for specific applications.

- Inner containers with  $<100$ -Ci tritium/m<sup>3</sup> (21 Ci per 55-gal drum) (either absorbed liquids or solids) shall be either sealed in one layer of 4 mil (nominal) or thicker polyethylene, or coated with 10-mil-thick (minimum) asphalt or asphalt-based paint, and disposed in a steel or concrete container.
- Inner containers with  $\geq 100$  Ci tritium/m<sup>3</sup> (21 Ci per 55-gal drum) shall be coated completely with 1-in.-thick (minimum) asphalt and disposed in a steel or concrete container.
- Westinghouse Waste Management Plant and Process Engineering shall determine the acceptability of all asphalts or asphalt-based paints used for packaging tritiated wastes.
- Sealing systems not dependent on asphalt diffusion barriers have been used to contain tritium. All welded structures, bellows-sealed valving, and flanged joints with metallic gaskets and knife-edged sealing surfaces have been used for tritium-containing materials. Such systems are acceptable for disposing of tritium provided suitable technical data are furnished by the shipper to demonstrate that the tritium-containing capability of containers based on these systems is equivalent to that of the asphalt barrier system. The 200 West Area Support Unit will approve such containment systems on a case-by-case basis.

### III.3.3 ASBESTOS

All LLW containing asbestos shall be packaged in accordance with the requirements of 40 CFR 61.152(b)(1)(iii). The material shall be wetted, placed in a 4 mil or heavier plastic bag, and sealed wet using 2-in.-wide, fabric-reinforced tape or approved equivalent. The material shall then be packaged in a leak-resistant packaging container that meets applicable shipping requirements for the radioactive content of the package involved. Sharp edges and corners within the package shall be padded or otherwise protected to minimize damage to the plastic inner wrap during handling and shipping.

The outer package shall be marked with the proper asbestos warning label as outlined in Part III, section III.5.4 of this manual.

### III.3.4 ION EXCHANGE RESINS

All ion exchange resins disposed as LLW shall be thoroughly drained, stable, and shall not react with normal surroundings in storage to create excessive heat, or corrosive-reactive products. The container shall be vented and/or contain a catalyst pack if the ion exchange resin is capable of gas generation.

All resins received at the Hanford Site for disposal shall be evaluated by the 200 West Area Support Unit for hazardous material content. Sufficient analytical data, including quantities of absorbed material and the type, nature and condition of the resin, shall be provided by the shipper. Data provided shall include a processing history, which should describe any materials absorbed on the resin in processing, chemical compositions of column washes, operating temperatures, and dates of column loading, unloading, and operation.

### III.3.5 ALKALI METALS

The disposal requirements for LLW containing alkali metals are as follows.

- All waste items contaminated with free-alkali metals shall be processed in a cleaning process equivalent to U.S. Energy Research and Development Administration RDT Standard F 5-9 (ERDA 1977) or immersed in hot water (180 °F minimum) until no reaction is detectable prior to packaging.
- There shall be no unreacted alkali metal on any outside or exposed surfaces of the waste.
- The maximum quantity of unreacted alkali metal in waste items accepted for disposal shall be that quantity distributed in crevices of any depth or geometry but in crevices less than 39-mil clearance, or that quantity distributed on surfaces or other areas with a film thickness not exceeding 3 mil.
- Internal void spaces in waste items known to have been contaminated with alkali metals shall be filled with vermiculite or other inert material to the maximum practical extent.
- Containers shall be vented if alkali-metal contaminated waste is capable of gas generation.

### III.3.6 LONG-TERM HEALTH HAZARD WASTES

Low-level waste containing significant concentrations of  $^{14}\text{C}$ ,  $^{99}\text{Tc}$ , and/or  $^{129}\text{I}$  have been determined to pose long-term health hazards at the Hanford Site and, therefore, will be evaluated for storage or disposal acceptability on a case-by-case basis. Significant concentrations of these radionuclides means concentrations that exceed the following values:

- $^{14}\text{C}$  in miscellaneous waste: 8 Ci/m<sup>3</sup> of waste matrix
- $^{14}\text{C}$  in activated metals or graphite: 80 Ci/m<sup>3</sup> of waste matrix

- $^{99}\text{Tc}$ : 3 Ci/m<sup>3</sup> of waste matrix
- $^{129}\text{I}$ : 0.08 Ci/m<sup>3</sup> of waste matrix.

### III.3.7 RADIOACTIVE LOW LEVEL MIXED WASTE

Radioactive low level mixed waste is defined as waste contaminated with both radioactive and hazardous material. Radioactive mixed waste will not be mixed in the same package with LLW. Mixed waste will be packaged, handled, and shipped as described in Part IV of this document. When feasible, LLW will be shipped in separate truck loads from mixed waste. When separate truck loads are not feasible, the wastes will be loaded as required in paragraph IV.5.6 of this document.

### III.3.8 COMPACTIBLE LOW-LEVEL WASTE

Every reasonable effort will be made by the shipper to reduce the volume of LLW that must be disposed at the Hanford Site. The following steps are typical of those to be taken to the maximum practical extent:

- Segregate radioactive waste from nonradioactive material prior to packaging
- Segregate "soft" radioactive material such as wipe rags, gloves, cardboard, or paper into fiberboard boxes
- Crush or "nest" machinery, piping, duct work, etc., to minimize size of packages
- Fill voids between metallic pieces of equipment with compacted soft waste, grout, vermiculite, diatomaceous earth, or other inert void-filling material
- Cut large pieces such as piping or duct work into small, compactible pieces
- Separate nonradioactive components from radioactive components (e.g., separate pump motors from pumps that have been used in radioactive service, provided that the motors have been surveyed and found suitable for release).

### III.4.0 WASTE PACKAGE REQUIREMENTS

The waste package includes the waste, internal packaging, waste container and any disposable overpacks intended to be stored or disposed at the Hanford Site 200 Areas burial ground facilities. All LLW packages accepted for storage or disposal at Hanford shall meet the requirements presented in the following sections.

#### III.4.1 SURFACE DOSE RATE

Surface dose rates for all packaged waste shall meet requirements of 49 CFR 173.441 or the applicable SARP limits (for onsite shipments). Waivers may be granted on an individual case-by-case basis for onsite shippers by the 200 West Area Support Unit. Maximum surface-radiation dose rate for any one package shall not exceed the following:

- CH radioactive waste packages:
  - CH 55-gal drums or smaller packages: 500 mrem/h at any point
  - CH cardboard boxes less than 7.4 ft<sup>3</sup> volume and/or less than 60 lb weight: 500 mrem/h at any point
  - CH waste packages larger than 55-gal drums: Normal surface radioactivity shall not exceed 200 mrem/h. However, marked points with surface radioactivity up to 1000 mrem/h on the bottom and/or one side may be permitted with prior approval of the 200 West Area Support Group. Such points shall be marked with large orange, yellow, or red painted dots.
- RH radioactive waste packages: The radioactive levels may be waived on a case-by-case basis for onsite shipments of RH waste within the following limits. (Limits must be established in the applicable SARP.)
  - Dose rates may not exceed 3000 mrem/h at 1 m from a truck or 5000 mrem/h at 1 m from the side of a railcar being used to transport the waste package to the burial ground facilities. All RH-LLW packages shall be either unloaded by dump truck or pre-rigged by the waste generator for crane or drag-off unloading.
  - Radioactive packages prepared for crane or drag-off unloading shall include sacrificial rigging provided by the shipper. The rigging shall be packaged in such a manner that it may be attached to handling equipment without exposing waste field personnel to excessive radioactivity. As a target, waste field personnel shall not work in fields in excess of 200 mrem/h. Lead shall not be used in the preparation of sacrificial rigging.

- Waste packages inside returnable overpacks: Surface dose rates shall not exceed limitations discussed in this section. In addition, the inner packages shall be suitably rigged in such a manner that burial ground personnel shall not be exposed to a radioactive background in excess of 200 mrem/h while removing the overpacks or attaching the overpacks to the prepared riggings unless specifically waived, in writing, by the 200 West Area Support Unit.

### III.4.2 SURFACE CONTAMINATION

Removable contamination on the exterior surfaces of all LLW packages shall not exceed the following limits:\*

- 220 dpm/100 cm<sup>2</sup> for alpha contamination
- 2,200 dpm/100 cm<sup>2</sup> for beta-gamma contamination.

Fixation of surface contamination on returnable overpacks shall not be permitted.

### III.4.3 NUCLEAR CRITICALITY

The nuclear criticality limits for all LLW containing fissile materials are as follows:

- 55-gal drums containing 8-in. by 8-in. by 6-in. high-efficiency particulate air filters with 40 g or more fissile material each: 100 g total fissile material per drum
- 55-gal drums containing free or absorbed liquid organics: 100 g total fissile material per drum
- 55-gal drums containing all other LLW: 200 g total fissile material per drum. If more than 100 g of total fissile material is included in a single drum, then the fissile material must be distributed uniformly within a minimum of 20% of the total volume of the drum
- Criticality limits for all other LLW packages are established by Westinghouse Criticality Engineering Analysis Unit on a case-by-case basis.

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\*Smearable contamination on the interior surfaces of returnable overpacks may range up to 10 times the contamination limits listed in section III.4.2.

Natural (0.72 wt%  $^{235}\text{U}$ ) or depleted uranium is exempt from nuclear criticality limits.

Conversion factors for determining the total equivalent fissile material content of mixed fissile isotopes are provided in appendix C.

#### III.4.4 THERMAL POWER

The storage and disposal requirements for any LLW with the potential to generate greater than 0.1 W/ft<sup>3</sup> shall be established on a case-by-case basis by the 200 West Area Support unit.

#### III.4.5 GAS GENERATION

All LLW with the potential to generate sufficient gas to pressurize the waste package or to reach flammable concentrations of hydrogen and oxygen, with the exception of those discussed in Part III, section III.3.2 of this manual, shall be vented. The 200 West Area Support Unit may require the use of hydrogen-oxygen recombinant catalysts to deplete free oxygen in LLW packages and prevent flammable concentrations of hydrogen and oxygen. The 200 West Area Support Unit shall determine the acceptability of individual venting devices and recombinant catalysts.

#### III.4.6 INTERIOR VOID SPACES

Interior void spaces shall be minimized to the maximum practical extent for the following reasons:

- To forestall the potential for subsidence after package deterioration
- To minimize probability of low-density packages migrating upward through the soil.

The interior void space shall not exceed 20% of the total volume of any LLW package disposed at the Hanford Site 200 Areas burial ground facilities, and only inert materials shall be used to fill interior void spaces.

The following waste packages may be exempted from this requirement by the 200 West Area Support Unit on a case-by-case basis:

- Waste packages that will be crushed or filled during the scheduled burial procedure
- Fiberboard boxes, plastic-wrapped waste, and self-contained waste

- HEPA filters that pose hazards to personnel during filling/crushing operations
- Waste packages with a total internal void space less than 1.5 ft<sup>3</sup>
- Specially designed reinforced-concrete burial boxes with a design life in excess of 300 yr under burial conditions expected in the Hanford Site burial grounds. Provisions will be made to ensure against migration of the boxes through the soil.
- Waste packages in which ALARA considerations indicate that personnel exposure and/or potential contamination spread during the void space filling process is a greater threat than subsidence in the burial grounds.
- Heavy-walled (high-pressure) vessels meeting one or both of the following requirements:
  - Nominal wall thickness of 1 in. or more stainless or carbon steel
  - The vessel contains a high proportion of internals such as tube bundles that make satisfactory void-filling impractical.
  - For purposes of this exception, all penetrations in heavy wall vessels shall be sealed with welded plates at least 1 in. thick, or no less than the nominal vessel wall, whichever is less. No TRU contamination and little or no hazardous material shall be contained.
  - Examples of components that meet these requirements include high-pressure steam generators, high-pressure feedwater heaters, submarine reactor compartments, reactor vessels, pumps, and heavy-walled pipe.

### III.5.0 LABELING AND MARKING REQUIREMENTS

Plastic-wrapped, self-contained, dumped, and RH waste packages may be exempted from labeling and marking requirements on a case-by-case basis by the 200 West Area Support Unit for onsite shipments. Hanford Standard Fiberboard Boxes with preprinted labeling are exempted from the labeling and marking requirements in this section provided all requirements in the applicable SARP are met. All other LLW packages stored or disposed at the Hanford Site 200 Areas burial ground facilities shall meet the labeling and marking requirements identified in the following sections.

### III.5.1 GENERAL LABELING AND MARKING

General labeling and marking requirements include the following.

- All labels and markings shall be permanently applied to LLW package with paint or other materials that are compatible with the container and coating.
- All labels and markings shall be in clear, legible English in a color contrasting with the background.
- All labels and markings shall be nonfading and nonsmearing.
- Labels and markings on LLW packages stored at the Hanford Site 200 Areas burial ground facilities shall be permanently applied with paint or other materials that have a predicted 25-yr life expectancy and are compatible with the container and coating.

The 200 West Area Support Unit shall determine the acceptability of labeling and marking materials used in specific applications.

### III.5.2 LABELING AND MARKING CHARACTER SIZE

Character size requirements include the following.

- All characters used in labeling and marking 55-gal drums shall be at least 1 in. high.
- All characters used in labeling and marking LLW packages 2 ft by 2 ft by 2.9 ft or smaller shall be at least 1 in. high.
- All characters used in labeling or marking LLW packages larger than 2 ft by 2 ft by 2.9 ft shall be at least 2 in. high.
- Markings shall conform to requirements in 49 CFR 172, Subpart D. Labeling shall conform to requirements in 49 CFR 172, Subpart E.

### III.5.3 LABELING AND MARKING LOCATIONS

Unless otherwise indicated in Part III, section III.5.4 of this manual, all labeling and marking shall be placed on LLW packages in the following locations:

- Fiberboard boxes and drag-off boxes - once each on two sides except for preprinted labeling

- Other rectangular waste packages - once on top, once in upper one third of at least two sides
- Cylindrical waste packages - once on top, once on side (between first and third rolling hoops for 55-gal drums).

#### III.5.4 REQUIRED INFORMATION

All LLW packages except those exempted by the 200 West Area Support Unit (see Part III, section III.5.0 of this manual) shall be labeled with the following information:

- RRM Number (non-Hanford Site waste only)
- Point of Origin (disposed LLW from Hanford Site generators only, not required for fiberboard boxes)
- Container Identification Number (CIN) The CIN may be a drawing number, specification number, or the Storage and Disposal Approval number; not required for 55-gal drums or fiberboard boxes (see appendix I). (Packages may also be identified with a unique package identification number.)
- Gross Weight Maximum-allowable gross weight may be substituted with prior approval of the 200 West Area Support Unit (not required for fiberboard boxes). Gross weight may be reported in pounds (preferred) or kilograms.
- DOT "RADIOACTIVE" hazard class labels; (or "RADIOACTIVE, LSA" marking) affixed to the package unless exempt under the following conditions:
  - In lieu of the marking requirement for material with specific activity less than 0.002 microcuries per gram of waste matrix, the description of the material on the bill of lading or attached to the Solid Waste Burial Record, Low-Level, shall read as follows:

"Radioactively contaminated material (soil, piping, machinery, etc.) with a specific activity less than 0.002 microcuries per gram of waste matrix."

In addition to this material description, the following statement shall be included on the bill of lading:

It is hereby certified that the contents of this consignment, irrespective of name or appearance, are not restricted or regulated for transportation by the U.S. Department of Transportation, Title 49, Code of Federal Regulations, Parts 100-177.

For additional information regarding this shipment contact:

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Signature of Shipper

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Date

- Packages containing asbestos shall bear the following warning on the sides of drums or on at least two sides of rectangular packages:

**CAUTION**  
**Contains Asbestos.**  
**Avoid Opening or**  
**Breaking Container.**  
**Breathing Asbestos is Hazardous**  
**to Your Health.**

- Any additional labeling or marking required in Part III, sections III.3.1, III.3.2, or III.3.3 (as applicable) of this manual is required on the waste package sides only.

### III.6.0 DOCUMENTATION REQUIREMENTS

In addition to shipping papers, each shipment of LLW shall be accompanied by accurate and complete Solid Waste Burial Record-Low-Level forms (Rockwell form 54-3000-581), which are prepared by the waste generator.

Instructions for completing these forms are provided in appendix F of this document. Blank forms may be obtained from the 200 West Area Support Unit.

## PART IV RADIOACTIVE MIXED WASTE REQUIREMENTS

### IV.1.0 INTRODUCTION

#### IV.1.1 WASTE DESCRIPTION

Radioactive mixed wastes are low-level wastes that also contain dangerous wastes as defined in WAC 173-303. According to WAC 173-303, dangerous waste is divided into dangerous waste (DW) and extremely hazardous waste (EHW). EHW includes a category of banned waste that cannot be land-disposed in Washington State. Banned waste may be received at the Hanford Site for storage and future treatment or disposition on a case-by-case basis. Appendix G lists the constituents in RMWs that are banned from land disposal at the Hanford Site. Additional banned wastes will be added to this list if required by future regulations promulgated by the EPA and/or State of Washington Department of Ecology (WDOE).

#### IV.1.2 PURPOSE AND SCOPE

The purpose of this section is to outline minimum requirements for identifying, packaging, labeling/marketing, documenting, storing, and/or disposing of RMW at the Hanford Site to meet the regulations promulgated by the EPA, DOT, WDOE, and DOE-RL. Additional requirements may be identified in the BCC for individual RMW packages. Compliance with these requirements does not relieve the generator as the responsible party for meeting all applicable Federal and State regulations concerning RMW.

A logic diagram of the steps required to identify, package, transport, document, and minimize RMW is provided in appendix D. Laboratory analyses, analyzed data, or other information used for characterization of the waste should be included with the request for burial or disposition.

Based on analyses, RMW waste should be classified according to the proper hazardous characteristic as outlined in 49 CFR 173.2. Waste designations for DW, EHW, and banned waste are defined by WDOE and EPA. The DOT classification (corrosive, poisonous, flammable, etc.) can be determined from 49 CFR 173.2, 172.101, 172.102 and 173, Subparts C through O.

#### IV.1.3 WASTE MINIMIZATION

Radioactive mixed waste will not be packaged with LLW or TRU waste. Low-level waste and/or hazardous waste shall not be packaged in RMW containers. Radioactive mixed waste shall be compacted and consolidated to minimize total volume to the maximum practical extent. Generators shall actively seek nonhazardous alternatives for the hazardous constituents in the waste (see appendix A.)

## IV.2.0 WASTE CONTAINER REQUIREMENTS

All containers used for RMW storage or disposal at the Hanford Site 200 Areas facilities shall meet or exceed the requirements described in the following sections.

### IV.2.1 GENERAL CONTAINER REQUIREMENTS

Containers shall be in good condition with no cracks, dents, holes, bulges, corrosion or other damage that could compromise integrity.

Containers shall not be used for wastes that could react with or degrade the container by physical, chemical, or radiological mechanisms, unless internal container protection has been provided.

### IV.2.2 CONTAINERS FOR STORAGE OF RADIOACTIVE MIXED WASTE

All RMW to be stored at the Hanford Site shall preferably be packaged in DOT Specification 17C galvanized steel 55-gal drums, with all interior and exterior surfaces galvanized in accordance with Specification HS-BP-008, or aluminized in accordance with Specification HS-BP-0069 (current versions). High-strength plastic containers meeting DOT 7A or equal requirements with a predicted storage life in covered storage in excess of 25 yr are an acceptable alternative for waste forms or quantities not suitable for 55-gal drums.

Radioactive mixed waste shall be packaged in double-containment packaging systems, which shall consist of an outer container of 16 ga. or heavier steel or high-strength plastic, and an inner barrier that may be a sealed 4 mil or heavier plastic liner, or a 90-mil polyethylene drum liner. For materials that are not compatible with polyethylene, the inner container shall be a material which is compatible (e.g., plastic, metal, etc.). If glass is required, it shall be protected with a suitable inert packaging material such as diatomaceous earth.

Materials with special property requirements such as corrosion resistance or chemical compatibility shall be packaged in materials selected specifically for the specific properties involved, with the case-by-case approval of the 200 West Area Support Unit.

All exterior packaging for transportation of RMW shall meet DOT requirements or approved equivalent based on radioactive material and hazardous material content. Exterior finish of all RMW waste packages shall be suitable for a minimum 25-yr life in the Hanford environment. Galvanized or aluminized steel, polyamide coating, natural plastic finish, or FRP containers meeting DOT 7A requirements are typical of suitable finishes.

#### IV.2.3 CONTAINMENT FOR THE DISPOSAL OF RADIOACTIVE MIXED WASTE

All packages for disposal of solid RMW shall provide at least two containment barriers, or as specified in the approved BCC, to prevent the release of contamination. With the exception of plastic wrap, containment barriers shall not be jeopardized by wind, blowing sand, precipitation, sunlight, extreme temperatures, or stresses due to the weight or configuration of the container or its contents plus the loads associated with handling and transportation.

Examples of two containment barriers include a plastic bag or a plastic liner inside a steel drum, or a steel drum inside another steel drum. Construction material of the container shall be compatible with the contained waste.

The following containers may be exceptions to the two-containment barrier requirement and shall provide at least one containment barrier:

- Containers that have been demonstrated by engineering analysis or testing to meet the appropriate DOT Drop Test and Penetration Test requirements in 49 CFR 173, Subpart I. The Westinghouse Waste Management Plant and Process Engineering Unit shall approve all engineering analysis and testing of containers
- Self-contained DOT-LSA or limited quantities of radioactive materials
- Containers disposed of by drag-off procedures
- Heavy-walled vessels with sealed nozzles, such as high-pressure tanks, heat exchangers, pumps, piping, etc. in which the vessel pressure boundary serves as the primary containment boundary.

#### IV.2.4 HANDLING

##### IV.2.4.1 Containers

Containers shall meet the following handling requirements.

- All outer containers used for RMW with maximum gross weights of less than 16,000 lb should be compatible with forklift handling.
- Containers used for RMW should be designed to withstand 12 ft of stacking with similar containers.

- Crane-unloaded containers used for RMW shall be equipped with lifting devices designed to safely lift the fully loaded container. All lifting attachments shall be designed to a 5:1 safety factor based upon the ultimate strength of the materials and the loaded container's maximum gross weight.
- Rigging details shall be provided to Westinghouse by the generator at least two weeks before each shipment if special rigging or lifting is required. Details shall include a sketch showing overall dimensions, lift points, weights at each lift point, and centers of gravity of the object. If available, sketches of strong backs or lift rigs used for loading should be furnished.

#### IV.2.5 FIRE RETARDANCY

Containers for RMW shall be composed of steel or fire-resistant plastic. Radioactive mixed waste shall not be packaged in plywood, cardboard, or plastic wrap. Exceptions will be considered on a case-by-case basis.

#### IV.2.6 CORROSIVE RADIOACTIVE MIXED WASTE

Corrosive RMW shall be neutralized, rendered noncorrosive, or packaged in a manner to ensure integrity of the containment barriers.

### IV.3.0 WASTE FORM REQUIREMENTS

Reporting, packaging, labeling, and other requirements that apply to the storage or disposal of specific waste forms are presented in the following section. All RMW stored or disposed by Westinghouse at the Hanford Site 200 Areas facilities shall meet or exceed these requirements.

#### IV.3.1 LIQUID WASTE

Storage requirements for liquid RMW are detailed in sections IV.3.1.1 and IV.3.1.2. The preferred form for shipment, disposal, and storage of liquid radioactive waste is as a solidified material, either absorbed on a suitable absorbent or solidified with a suitable solidification agent such as cement.

#### IV.3.1.1 Disposal Requirements

Radioactive mixed waste as free liquid shall not be buried\* at the Hanford Site 200 Areas burial ground facilities. All RMW liquids that do not require storage shall be solidified, absorbed, or otherwise bound in the waste matrix by inert materials. The resultant waste matrix shall not be capable of spontaneous combustion, decomposition, explosion, or affecting the integrity of the containment barriers in any way. Waste packaging shall meet the requirements of 40 CFR, 49 CFR, WAC 173-303, and the following minimum package requirements.

- If the resultant waste matrix is capable of gas generation, the container shall be vented. Catalyst packs for the recombination of hydrogen and oxygen may be required.
- If liquids are bound by absorption, the absorbed material shall be placed in direct contact with the liquid (i.e., within the same containment barrier), and the quantity of absorbent material shall be sufficient to absorb at least twice the volume of liquid potentially present. For organic liquid waste, a combustible absorbent shall be used. The 200 West Area Support Unit shall determine the acceptability of absorbent materials for specific applications.
- Reactive wastes (waste code D003), other than cyanide or sulfide-bearing wastes, must be treated or rendered nonreactive before placement in an inner container.

#### IV.3.1.2 Storage Requirements

IV.3.1.2.1 Liquid Organic Waste. Specific organic liquid wastes such as polychlorinated biphenyls (PCB), scintillation liquids, and banned waste may be accepted as free liquids for storage when approved by Westinghouse upon case-by-case basis. Approval by DOE-RL may also be required for certain liquid wastes. If accepted for storage, organic liquids shall be packaged as follows.

- Free organic liquid shall be sealed in leak-tight inner containers. Inner containers shall be limited in size such that remaining drum volume shall accommodate twice the amount of absorbent required to absorb the maximum amount of liquid potentially present. Inner containers shall preferably be of metallic or plastic materials. Container materials shall be compatible with, and shall not be corroded or deteriorated by the waste material.

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\*All EHW must be stored. Liquid organics will be stored.

- Inner containers shall be filled to a suitable level such that the container shall have adequate liquid expansion space to ensure against overpressure to a temperature of at least 130 °F.
- The inner container shall be surrounded on all sides by a suitable absorbent material within a polyethylene or equal plastic liner. Outer container shall be a galvanized or aluminized steel, or high-strength plastic DOT Specification 17C 55-gal drum. The quantity of absorbent shall be sufficient to absorb at least twice the quantity of liquid potentially present. Outer containers shall be essentially full after packaging.
- Absorbent material and plastic liners shall be compatible with, and must not react dangerously with, corrode, be decomposed by, or be ignited by the contents of the inner containers. For organic liquid waste, a combustible absorbent is required. The 200 West Area Support Unit shall determine the acceptability of absorbent materials and plastic liners for specific applications.
- The maximum quantity of fissile material in 55-gal drums containing free organic liquids shall be 100 g total.

In addition to the labeling and marking required in Part IV, section IV.5.0 of this manual, the following information shall be marked on the side of each drum containing free organic liquids. Both inner and outer containers shall be marked to indicate their contents.

- "LIQUID ORGANIC WASTE"
- The flashpoint or flashpoint range of the material in degrees fahrenheit for flashpoints below 212 °F, e.g., "FLASHPOINT 160-180°F."
- No drum of liquid organic waste shall contain more than 100 g of fissionable material. Drums containing more than 100 nCi/g of TRU in liquid waste shall be nondestructive assayed (NDA) to determine TRU inventory prior to shipment.
- No drum shall contain greater than the following quantities of listed isotopes without prior approval of Rockwell Radiological Engineering:  $^{239}\text{Pu}$ : 5 g;  $^{241}\text{Am}$ : 3 g;  $^{238}\text{Pu}$ : 0.5 g.
- Loading of drums onto vehicle and transport will depend on plutonium concentration. Special instructions will be provided on a case-to-case basis.
- Multiple hazard, limited quantity radioactive waste requirements are given in 49 CFR 173.421-2.

- Packages shall not contain materials of two or more hazard classes, the mixture of which would be liable to cause a dangerous evolution of heat or gas; or produce corrosive materials (see 49 CFR 173.21)

#### IV.3.1.2.3 Polychlorinated Biphenyl-Contaminated Organic Liquids.

Polychlorinated biphenyl oils are TSCA-regulated waste 50 ppm and above; and State-regulated at 2 ppm. Polychlorinated biphenyl oils contaminated with radioactivity are received at the Hanford Site on a very selective basis for storage and future incineration in an approved incinerator for radioactive materials. Acceptability of PCB-contaminated materials at the Hanford Site will be determined by the 200 West Area Support Unit on a case-by-case basis.

Polychlorinated biphenyls shall be packaged as organic liquids in accordance with paragraph IV.3.1.2.1 above, subject to the following restrictions:

- High strength plastic outer containers shall not be used
- Gross weight of the drum shall be limited to 450 lb
- In addition to the labeling and marking required section IV.5.0 of this manual, and the requirements on section IV.3.1.2.1, the drum shall be marked to reflect the PCB contamination in accordance with the requirements of 40 CFR 761, Subpart C.

IV.3.1.2.4 Scintillation Liquids. Scintillation liquids such as xylene, toluene, dioxin, and pseudocumen are defined by Washington State as banned waste and are accepted at the Hanford Site on a very restrictive case-by-case basis.

As a part of the hazardous waste minimization program, scintillation liquids may be prohibited for storage at the Hanford Site in the future. In response to the waste minimization program, alternate liquids should be used when feasible.

IV.3.1.2.5 Nonorganic Liquid Radioactive Mixed Waste. Nonorganic liquid RMW is accepted at the Hanford Site on a very limited case-by-case basis. Each case is evaluated by the 200 West Area Support Unit and accepted only on the basis of overriding technical reasons demonstrating why solidification is not a viable alternate.

If accepted for storage, nonorganic liquid RMW shall be packaged similarly to organic liquids as outlined in section IV.3.1.2.1.

Loading of drums onto vehicle and transport will depend on plutonium concentration. Special instructions will be provided on a case-to-case basis.

200 Areas facilities. All CH-TRU waste packages accepted for storage by Westinghouse shall meet or exceed the requirements listed in the following sections.

#### II.3.3.1 Waste Package Weight

The following weight requirements apply to all CH-TRU waste packages.

- The gross weight of any waste package shall not exceed the weight for which the container has been certified in accordance with applicable DOT standards for Type A packaging.
- The gross weight of any waste package shall not exceed 25,000 lb.
- The gross weight of any waste package containing greater than DOT A1 or A2 quantities of radioactive material shall not exceed 17,000 lb.
- The gross weight of each waste package shall be reported in the corresponding documentation (see Part II, section II.5.0 of this manual) and marked on the waste package (see Part II, section II.3.4 of this manual).

#### II.3.3.2 Nuclear Criticality

The fissile isotope content of individual CH-TRU waste packages shall not exceed the following values in  $^{239}\text{Pu}$  fissile gram equivalents or total fissile material, whichever is more restrictive:\*

- 200 g per 55-gal drum
- 100 g per 30-gal drum
- 500 g per DOT 6M container
- 5 g in any cubic foot in boxes, up to 350 g maximum.

Conversion factors for determining  $^{239}\text{Pu}$  fissile gram equivalents; and for determining the total fissile material curie content are provided in appendix C.

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\*Additional restrictions may be imposed by Westinghouse criticality engineering analysis.

#### IV.3.2 ANIMAL WASTE

Animal waste by itself is not RMW, but due to the addition of calcium hydroxide ( $Ca(OH)_2$ ) as a gas-absorbent agent, the package is classified RMW. Calcium oxide should be limited to 10% by weight of the weight matrix, thus limiting the waste classification to DW; greater than 10% calcium oxide would change the classification of the package to EHW, prohibiting disposal at the Hanford Site.

#### IV.3.3 ALKALI METALS

Bulk quantities of free-alkali metals are hazardous because they react with air and water and form basic solutions that are corrosive and hazardous to living organisms. Free-alkali metals contaminated with radioactivity will be accepted for storage on a very limited and restrictive case-by-case basis.

All waste items contaminated with alkali metals shall be processed in a cleaning process equivalent to the U.S. Energy Research and Development Administration RDT Standard F 5-9 (ERDA 1977) or immersed in hot water (180 °F minimum) until no reaction is detectable.

The maximum quantity of unreacted alkali metal in waste items acceptable for disposal shall be evaluated on a case-by-case basis by the 200 West Area Support Unit.

#### IV.3.4 LEAD WASTE

Lead is classified as EHW based on WDOE toxicity tests. Contaminated lead will preferably be packaged in 55-gal drums for disposal. If the quantity and/or form of the lead-bearing parts prohibits use of 55-gal drums, alternate equivalent packaging shall be used.

Lead shielding will be approved by Westinghouse only on the basis of overriding technical justification (i.e., ALARA) that demonstrates the technical nonapplicability of other alternatives. When used as shielding, lead does not require two containment barriers prescribed for EHW (see Part IV, section IV.2.1 of this manual). A single steel outer container at least 18-ga. thickness or approved equivalent shall be approved as an outer container for lead.

#### IV.3.5 MERCURY

Mercury is banned from disposal by burial. Contaminated mercury may be stored at the Hanford Site for future treatment and disposal.

Prior to packaging, mercury shall be solidified by amalgamation with zinc powder to prevent migration from the package in event of a leak.

The solid amalgam shall be sealed inside a wide-mouthed plastic container. The plastic container shall be compatible with the waste amalgam. The container shall then be sealed inside a secondary containment barrier such as a 4-mil plastic bag or equivalent. The doubly contained amalgam in turn shall be packaged inside DOT Specification 7A galvanized-steel drum or box. Voids shall be filled with vermiculite or diatomaceous earth. The container shall be marked "Mercury" in addition to the other labeling/markings indicated in Part IV, section IV.5.0 of this manual. The maximum quantity of mercury in the waste matrix of a single container will be evaluated by the 200 West Area Support Unit on a case-by-case basis.

Solid waste material containing mercury (compounds, wipe rags, etc.) are packaged as normal solid RMW, and suitably marked.

Large quantities of liquid mercury (e.g., in excess of one lb) will be handled on a case-by-case basis by the west area support unit.

#### IV.3.6 ASBESTOS

If asbestos is included in a mixed-waste package because of previous mixed-waste contamination of the asbestos, the material shall be prepackaged in accordance with Part III, section III.3.3. Outer packaging shall be marked with an asbestos warning label per Part III, section III.5.4. (NOTE: When properly handled and packaged, asbestos is not a "dangerous" waste according to WAC 173-303.)

#### IV.3.7 BANNED WASTE

Certain wastes that are banned from land disposal at the Hanford Site are listed in appendix G, table G-1. These wastes may be received at the Hanford Site for storage on a case-by-case basis.

#### IV.3.8 OTHER RADIOACTIVE MIXED WASTE

The 200 West Area Support Unit shall determine the packaging requirements for all other RMW on a case-by-case basis.

### IV.4.0 WASTE PACKAGE REQUIREMENTS

The waste package includes the waste, internal packaging, waste container and any disposable overpacks intended to be stored or disposed at the Hanford Site 200 Areas burial ground facilities. All RMW packages accepted for storage or disposal by Rockwell shall meet the requirements presented in the following sections.

#### IV.4.1 SURFACE DOSE RATE

Surface dose rate limits for all RMW packages are the same as those listed for LLW in Part III, section III.4.1 of this manual.

#### IV.4.2 SURFACE CONTAMINATION

Removable contamination on the exterior surfaces of all RMW packages shall not exceed the limits outlined in Part III, section III.4.2 of this manual.

Returnable overpacks shall be packaged to minimize internal contamination of the overpacks. If returnable overpacks are contaminated, costs of decontamination will be back-charged to the shipper.

#### IV.4.3 NUCLEAR CRITICALITY

The nuclear criticality limits for all RMW containing fissile materials are the same as those limits outlined in Part III, section III.4.3 of this manual.

#### IV.4.4 THERMAL POWER

Storage and disposal requirements for any RMW with the potential to generate greater than 0.1 W/ft<sup>3</sup> shall be established on a case-by-case basis by the 200 West Area Support Unit.

#### IV.4.5 GAS GENERATION

All RMW with the potential to generate sufficient gas to pressurize the waste package or to reach flammable concentrations of hydrogen and oxygen, with the exception of the RMW discussed in Part III, section III.3.2 of this manual, shall be vented. The 200 West Area Support Unit may require the use of hydrogen-oxygen recombinant catalysts to deplete free oxygen/hydrogen in RMW packages and prevent flammable concentrations of hydrogen and oxygen. The 200 West Area Support Unit shall determine the acceptability of individual venting devices and recombinant catalysts.

#### IV.4.6 INTERIOR VOID SPACES

Requirements for filling interior void spaces in RMW packages for disposal are those listed in Part III, section III.4.6 of this manual, with the following exceptions:

- RMW packages accepted for storage are exempt from requirements for filling void spaces

- RMW packages accepted for disposal must be at least 90% full.

#### IV.5.0 LABELING AND MARKING REQUIREMENTS

Self-contained and RH waste packages may be exempted from labeling and marking requirements by the 200 West Area Support Unit. All other RMW packages stored or disposed at the Hanford Site 200 Areas burial ground facilities shall meet the labeling and marking requirements identified in the following sections.

##### IV.5.1 GENERAL LABELING AND MARKING

General labeling and marking requirements for RMW packages are the same as those identified in Part III, section III.5.1 of this manual.

##### IV.5.2 LABELING AND MARKING CHARACTER SIZE

Character-size requirements for RMW packages are the same as those listed in Part III, section III.5.2 of this manual.

##### IV.5.3 LABELING AND MARKING LOCATIONS

Labeling and marking locations are the same as those outlined in Part III, section III.5.3 of this manual.

##### IV.5.4 REQUIRED INFORMATION

All RMW containers shall be labeled and marked to indicate the radioactive, as well as the hazardous character of the waste. The information outlined in Part III, section III.5.4 of this manual is required for all RMW packages. This information shall be supplemented with labeling/marketing requirements provided in 49 CFR 172, subpart D and E and WAC 173-303-190. As a minimum, the following labels/marketing shall be applied:

- RRM Number (non-Hanford Site waste only)
- Point of Origin (RMW from Hanford Site generators only, not required for fiberboard boxes)
- Packaging Identification Number (PIN) Each RMW container shall bear a unique identification number. The PIN shall be indicated in the manifest and other documents for cross reference

- Gross Weight
- DOT "RADIOACTIVE" markings, labels and other Hazard Class Markings as per 49 CFR 172, Subpart D, and 172, Subpart E (required on waste package side only). Examples of labeling, marking, and placarding, are given in appendix J. Except for limited quantity radioactive material, the proper hazard class will be "Radioactive Material" per 49 CFR 173.2
- Any additional labeling or marking required in specific sections in Part II, III, or IV of this manual (required on waste package side(s) only)
- "RMW-EHW" or "RMW-DW," (required on waste package side(s) only)
- Markings and labels for stored RMW waste shall have an expected life of at least 20 yr to ensure against peeling or fading of the paint during the storage period.
- Packages containing inner containers of liquid shall be marked on the sides and near the top with "this end up," or directional arrows to indicate proper package orientation.

#### IV.5.5 MANIFEST AND PACKAGE IDENTIFICATION NUMBERS

Manifest numbers and PINs are used for the traceability of the RMW. These numbers are cross referenced on the container, SWBR-LL, Uniform Hazardous Waste Manifest form, and Chemical Waste Disposal Request Form (CWDR).

The PIN is a unique identification number assigned to each container. No two containers shall have the same PIN. The generator shall keep a record of all PINs.

The manifest number is a unique number for each uniform manifest. Details of generating the manifest number are provided in appendix J. The manifest number shall be marked on the EPA Hazardous Waste Sticker, the RMW container, the SWBR-LL, the Uniform Hazardous Waste Manifest Form, and the CWDR.

#### IV.5.6 RADIOACTIVE MIXED WASTE TRANSPORT

Onsite (Hanford) generators shall not load LLW packages and RMW packages on the same vehicle when transporting to the burial ground. Similarly, nonradioactive hazardous waste packages shall not be shipped with RMW packages.

Radioactive mixed wastes from offsite shippers shall preferably be shipped separately from other wastes. If RMW must be shipped with LLW on the same truck, the LLW will be loaded on the forward end of the truck, and the RMW shall be loaded on the rear. Both loads will be braced and blocked separately such that they can be unloaded in separate storage or disposal areas. The blocking or an equivalent barrier shall present a definite line of demarcation between the two loads. No RMW will be accepted unless accompanied by a properly filled-out and certified Uniform Hazardous Waste Manifest.

The transportation vehicle shall be placarded according to 49 CFR 172, Subpart F.

#### IV.6.0 DOCUMENTATION REQUIREMENTS

##### IV.6.1 PRIOR TO SHIPMENT

Prior to shipment of RMW to Hanford for disposal/storage, the generator shall submit the following forms for review and approval:

- BCCs (appendix A)
- Chemical Waste Disposal Request form (appendix H, Rockwell Form A-6400-245).\*

All dangerous waste constituents in RMW shall be identified and quantified in these forms. Any change to waste constituents will require reapproval.\*\*

After review, Westinghouse will return the approved BCC to the generator.

##### IV.6.2 AT THE TIME OF SHIPMENT

In addition to shipping papers, each container of RMW shall be accompanied by an SWBR form (appendix F, Rockwell form 54-3000-581), and Uniform Hazardous Waste Manifest form (appendix H, EPA form 8700-22).

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\*For well-characterized waste streams (e.g., waste streams from production type operations wherein the average analysis of the material does not change appreciably from day to day), a new analysis is not required for each shipment. A new analysis is required for this situation each time a major change occurs in the process or analysis.

\*\*The total quantity shall equal the total waste in the package. Non-hazardous material may be lumped as a single line item.

The quantities of dangerous waste constituents in RMW packages must be documented on an SWBR form. If flash points are marked on the packages, these flash points must be recorded on the SWBR.

If waste packages contain oils or asbestos, the materials must be described in the "REMARKS" section of the SWBR.

#### IV.6.3 INSPECTION/CERTIFICATION

The generators shall sign and certify to the generator certification, item 16 on the uniform hazardous waste manifest. Manifests shall be held on file by the shipper for a minimum of three years according to WAC 173-303-210.

Any Hanford Site employee signing a Uniform Hazardous Waste Manifest must have completed a "Hazardous Waste Shipment Certification" training course.

Any employee of an offsite shipper who is authorized to sign a Uniform Hazardous Waste Manifest shall have received training as described in 40 CFR 264.16. Such authorized personnel must participate in an annual review of this training program. Records of the initial training program and annual reviews (or retraining) shall be established for each authorized individual as required by 40 CFR 264.16.

#### IV.6.4 MAINTAINING RECORDS

An itemized listing of the chemicals, concentrations, and quantities by container must be retained by the generator; and must be readily available in case of an emergency during transport and for use in preparing annual reports (WAC 173-303-161). Consequently, the generator must provide a copy of this list with the shipping papers. A second copy of this list, encased in plastic, must be affixed to the container prior to transport.

For a period of three years, all test results, waste analyses, or other determinations made to designate dangerous waste (retention period starts as of date of shipping), copies of all manifests (including the signed facility receipt), and copies of each annual report and exception report must be maintained (the Westinghouse Hazardous Waste Unit will prepare the annual report). Periods of retention will be extended during any unresolved enforcement action or upon request of the Director, WDOE.

#### IV.6.5 SHIPMENT NOTIFICATION

All RMW shipments for storage/disposal on the Hanford Site must be scheduled through the Westinghouse Tank Farm scheduler, (509) 373-1881 (FTS 440-1881).

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GLOSSARY

## GLOSSARY

The following abbreviations, acronyms, and definitions are provided to clarify material contained in this manual and apply to the use of this manual only.

"A<sub>1</sub>" - The maximum activity of special form radioactive material permitted in DOT Type A packaging.

"A<sub>2</sub>" - The maximum activity of radioactive material, other than special form or low specific activity radioactive material, permitted in DOT Type A packaging.

**accumulation date** - Date a generator first generates a dangerous waste, or accumulates 55 gal total of dangerous waste, or accumulates 1 qt total of acutely hazardous waste.

**activation product** - Material that is radioactive as a result of bombardment by neutrons and/or charged particles.

**acutely dangerous waste** - Any dangerous waste specifically identified in WAC 173-303-9903, "Discarded Chemical Products List", which is designated by WDOE as EHW.

**acutely hazardous waste** - Some of the wastes specifically identified in WAC 173-303-9903 and WAC 173-303-9904. Discarded chemical products

that are "acutely hazardous" are those with dangerous waste numbers beginning with a "P" or marked with an "X" or an "A" in the Reason for Designation column. Dangerous waste sources that are "acutely hazardous" are those wastes having waste codes F020, F021, F022, F023, F026 or F027, as listed in WAC 173-303-9904.

Empty containers of "acutely hazardous" waste are regulated by WDOE.

**administrative controls** - Limits imposed on the method of conducting a particular operation, as distinguished from limits imposed by facility or equipment design. Once established, administrative controls are maintained through incorporation into written procedures and through verified adherence to the procedures.

**ALARA** - as low as reasonably achievable.

**ALO-TSD** - Albuquerque Operations Office-Transportation Safeguards Division.

**aquatic LC<sub>50</sub>** - Same as TLM<sub>96</sub>. A concentration in mg/L (ppm) that kills in 96 h half of a group of 10 or more of a medium-sensitivity, warm-water species of fish, such as *Lepomis macrochirus* (bluegill) or *Pimephales promelas* (flathead minnow), or cold-water species such as salmonidae, when using the testing method described in WAC 173-303-110.

**asphalt pad** - A storage facility for transuranic wastes that includes a paved (asphalt) pad as a foundation for the storage area.

**ASTM** - American Society for Testing Materials.

**batch** - Any waste that is generated less frequently than once a month.

**BCC** - Burial Compliance Checksheet.

**burial ground** - Land area specifically set aside to receive packaged radioactive solid wastes for storage or disposal.

**CFR** - Code of Federal Regulations.

**CH** - Contact-handled.

**chemically stable form** - A chemical compound that is solid and will not spontaneously decompose when in contact with air or moisture in the temperature range of -40 to 107 °C (-40 to 225 °F).

**CIN** - Container Identification Number (see paragraph III.5.4)

**Class I-A Flammable Liquid** - See Flammable Liquid, Class I-A.

**Class I-B Flammable Liquid** - See Flammable Liquid, Class I-B.

**Class 4 Oxidizer** - An oxidizing material that can undergo an explosive reaction when catalyzed or exposed to heat, shock, or friction.  
(Ref: NFPA 43A, Chapter 1.)

**classified material** - Material bearing a security classification (restricted, confidential, secret, etc.) such that special security precautions are required during transport, handling, and disposal.

**COC** - Certificate of Compliance issued by DOE or USNRC for radioactive material shipping containers.

**combustible** - Any material that will sustain combustion in air when exposed to an ignition source of 800 °C (1472 °F) for a period of 5 min.

**combustible Liquid** - Term used by the DOT (49 CFR 173.115) for liquids having closed cup flash points at or above 100 °F and below 200 °F.

**compressed gas** - Any gas that exerts a pressure on a container greater than atmospheric.

**constituent (or dangerous waste constituent)** A chemically distinct component of a dangerous waste stream or mixture.

**container** - A vessel, box, or other rigid device to contain radioactive waste for storage, transportation, or disposal.

**contamination barrier** - A physical restraint to limit the release or inhalation of material during any one accident.

**corrective action** - Measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

**corrosive material** - Any liquid or solid that causes destruction of human skin tissue or which has a severe corrosion rate on steel.

**CPS** - Criticality Prevention Specification.

**CSAR** - Criticality Safety Analysis Report.

**Curie (Ci)** - A unit of radioactivity equal to  $3.7 \times 10^{10}$  disintegrations per second; also equal to  $3.7 \times 10^{10}$  Becquerels (Bq).

**CWDR** - Chemical Waste Disposal Request.

**DW** - A regulated waste material that is considered "dangerous waste," but is not extremely hazardous waste.

**Dangerous Waste** - Those solid wastes designated in WAC 173-303-070 through 103 as dangerous or extremely hazardous wastes. The words "dangerous waste" refer to the full universe of regulated wastes, while the abbreviation "DW" refers to that part of the universe which is dangerous only, and not extremely hazardous.

**dermal LD<sub>50</sub>** - The single dosage in milligrams per kilogram (mg/kg) body weight which, when dermally (skin) applied for 24 hours, within 14 days kills half of a group of 10 rabbits each weighing between 2.0 and 3.0 kg.

**disposal** - The permanent emplacement of radioactive and other waste without expectation of its retrieval.

**DOE** - U.S. Department of Energy

**DOE-RL** - U.S. Department of Energy - Richland Operations Office

**DOE-WMD** - U.S. Department of Energy - Waste Management Division

**DOT** - U.S. Department of Transportation.

**EAU** - Engineering Analysis Unit, Packaging and Shipping Team, Westinghouse

**empty** - An "empty" container is a container that was originally used for containing, shipping, and handling dangerous or extremely hazardous materials, which have subsequently been removed from the container. Residual quantities of the hazardous material are assumed to remain in the container thus rendering the container itself a "hazardous material." (See 40 CFR 261.7 and 49 CFR 173.29 for a detailed discussion of this subject. See 49 CFR 173.427 for proper handling of "empty" radioactive material containers.)

**EP** - Extraction procedure.

**EPA** - United States Environmental Protection Agency.

**ETA** - Estimated time of arrival.

**explosive** - Any chemical compound, mixture, or device, the primary purpose of which is to function by explosion with substantial instantaneous release of gas and heat.

**extremely hazardous waste (EHW)** - Those dangerous wastes designated in WAC 173-303-070 through 103 as extremely hazardous. The abbreviation "EHW" refers to those dangerous wastes that are extremely hazardous.

**fissile material** - Any material capable of self-sustaining a nuclear chain reaction (e.g.,  $^{233}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{Pu}$ ,  $^{239}\text{Pu}$ , and  $^{241}\text{Pu}$ ).

**Flammable Liquid** - Term used by the DOT (49 CFR 173.115) for liquids having closed cup flash points below 100 °F.

**Flammable Liquid, Class I-A** - Term used in the Uniform Fire Code for a liquid with a flash point below 73 °F and a boiling point below 100 °F.

**Flammable Liquid, Class I-B** - Term used in the Uniform Fire Code for a liquid with a flash point below 73 °F and a boiling point at or above 100 °F.

**flammable solid** - Any solid material, other than one classed as an explosive, which, under conditions normally incident to transportation, is liable to cause fire through friction, retained heat from manufacturing or processing, or which can be ignited readily and burns vigorously and persistently such as to create a serious transportation hazard (see 49 CFR 173.150).

**flash point** - The minimum temperature at which a substance gives off a flammable vapor that will ignite when in contact with spark or flame.

**free alkali metals** - Alkali metals (Li, Na, K, Cs) in the free metallic form.

**free liquid** - Any liquid that is not sorbed into a host material and which could spill or drain from its container.

**generator** - Any person, by site, whose act or process produces dangerous waste or whose act first causes a dangerous waste to become subject to regulation. For the purposes of this manual, the generator is an employee assigned by a contractor to be a prime contact with the Westinghouse Hazardous Waste Unit.

**hazardous material** - A material that has a biological, chemical, or physical hazard associated with it.

**hazardous waste** - Waste that is identified or listed in 40 CFR 261. Source, special nuclear material, and byproduct material as defined by the Atomic Energy Act of 1954, as amended, are specifically excluded from the term "hazardous waste."

**halogenated hydrocarbons (HH)** - Any organic compounds which, as part of their composition, include one or more atoms of fluorine, chlorine, bromine, or iodine.

**high-level waste (HLW)** - Highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, which contains a combination of transuranic waste and fission products in concentrations as to require permanent isolation.

**HSF** - Hanford Standard fiberboard box.

**IAEA** - International Atomic Energy Agency.

**ignitable** - Term used by WDOE (WAC 173-303-090) for a waste which can cause a fire through friction, absorption of moisture, or spontaneous chemical reaction, etc. (This term generally applies to oxidizers as defined in 49 CFR 173.151. It also applies to liquids with flash points below 140 °F.)

**incompatible waste** - A dangerous waste that is unsuitable for placement in a particular device or facility because it may corrode or decay the containment materials, or is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, fumes, mists or gases, or flammable fumes or gasses.

**independent reviewers** - Persons whose technical expertise qualifies them to judge the acceptability of radioactive waste and waste packaging and determine if it meets the Waste Isolation Pilot Plant Waste Acceptance Criteria. Independent reviewers shall be responsible to management that is independent of the packaging organization.

**inert material** - Generally an absorbant material or void filler material that does not react chemically with most materials contained in waste and/or with materials comprising waste packaging.

**inhalation LC<sub>50</sub>** - A concentration in milligrams of substance per liter of air which, when administered to the respiratory tract for 4 h, kills within 14 d half of a group of 10 rats each weighing between 200 and 300 g.

**inspection** - Examination or measurement to verify whether an item or activity conforms to specific requirements.

**inspector** - A person who performs inspection activities to verify conformance to specific requirements.

**internal audit** - An audit of those portions of an organization's quality assurance program, which are retained under its direct control and within its organizational structure.

**land-disposal banned waste** - Waste that is prohibited from land disposal in accordance with 40 CFR Part 268.

**Leak resistant** - Sufficiently leak-tight that no evidence of leakage from the package would be noted were the package filled with water at atmospheric pressure.

**limited quantity of radioactive material** - A quantity of radioactive material not exceeding the materials package limits specified in 49 CFR 173.423 and which conform with requirements specified in 49 CFR 173.421.

**Low-level waste (LLW)** - Radioactive waste not classified as high-level waste, TRU waste, spent nuclear fuel or byproduct material as defined by DOE Order 5820.2; and which is not mixed with hazardous waste.

**LSA** - Low specific activity radioactive material defined as any of the following (49 CFR 173.403(n)):

- Uranium or thorium ores and physical or chemical concentrates of those ores
- Unirradiated natural or depleted uranium or unirradiated natural thorium
- Tritium oxide in aqueous solutions, provided the concentration does not exceed 5.0 mCi/mL
- Material in which the radioactivity is essentially uniformly distributed, and the estimated average concentration of contents does not exceed 0.0001 mCi/g of radionuclides for which the A<sub>2</sub> quantity is not more than .05 Ci; 0.005 mCi/g of radionuclides for which the A<sub>2</sub> quantity is more than .05 Ci, but not more than 1 Ci; or 0.3 mCi/g of radionuclides for which the A<sub>2</sub> quantity is more than 1 Ci

- Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination, when averaged over an area of 1 m<sup>2</sup>, does not exceed 0.0001 mCi (220,000 dpm) per cm<sup>2</sup> of radionuclides for which the A<sub>2</sub> quantity is not more than .05 Ci, or 0.001 mCi/cm<sup>2</sup> (2,200,000 dpm/cm<sup>2</sup>) for other radionuclides.

**Manifest** - The shipping document, prepared in accordance with the requirements of WAC 173-303-180, which is used to identify hazardous waste while it is being transported to a point of transfer, disposal, treatment, or storage. (See EPA Form 8700-22; see Appendix I.)

**MFP** - Mixed fission products; generally includes mixtures of isotopes produced by nuclear fission (e.g., <sup>137</sup>Cs and <sup>90</sup>Sr).

**MPO** - Memorandum Purchase Order.

**nonconformance** - A deficiency in characteristics, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.

**nonregulated waste** - Waste which is exempted from WDOE hazardous waste regulatory requirements.

**NRC** - U.S. Nuclear Regulatory Commission.

**operator** - The person responsible for the overall operation of a hazardous waste facility.

**oral LD<sub>50</sub>** - The single dosage in milligrams per kilogram (mg/kg) body weight, when orally administered, which within 14 day kills half of a group of ten or more white rats each weighing between 200 and 300 g.

**organic** - Chemical compounds based on carbon, hydrogen, and oxygen, usually derived from living matter. Included in this group are paper, rags, plastic, wood, oils, solvents, and hydrocarbon diluents used in solvent extraction (e.g., hexone, and normal paraffin hydrocarbon).

**ORM** - Other regulated material.

**oxidizing material** - Any solid or liquid that readily yields oxygen or other oxidizing gas or that readily reacts to oxidize combustible materials. (NFPA 43A, Chapter 1).

**package** - The final configuration of waste ready for emplacement in a storage or disposal site.

**PCB** - Polychlorinated biphenyls. (Waste containing polychlorinated biphenyls as designated in 40 CFR 761 and/or WAC 173-303-071).

**PE-Ci** -  $^{239}\text{Pu}$  equivalent activity.

**persistence** - The quality of a material that retains more than half of its initial activity after one year (365 days) in either a dark-anaerobic or dark-aerobic environment of ambient conditions.

**PIN** - Package identification number (unique for each package).

**Poison A** - Extremely Dangerous Poisons, Class A: Poisonous gases or liquids in which a small amount of the gas or vapor of the liquid mixed with air is dangerous to life.

**Poison B** - Less Dangerous Poisons: Substances, liquids, or solids (including pastes and semi-solids), other than Class A poisons or irritating materials, which are known or presumed to be so toxic to man as to afford a hazard to health during transportation.

**Polycyclic aromatic hydrocarbons (PAH)** - Those hydrocarbon molecules composed of two or more benzene rings (WDOE only regulates PAH with 4, 5, or 6 benzene rings).

**procedure** - Written instructions that specify or describe how an activity is to be performed, which may include methods to be employed, equipment or materials to be used, and sequence of operations.

**pyrophoric material** - Materials that may ignite spontaneously under the ambient conditions of shipment, storage, or disposal.

**quality assurance** - Planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily and meet specified requirements.

**radioactive material** - Any material or combination of materials that spontaneously emits ionizing radiation, is radioactively contaminated, or is suspected of being radioactively contaminated.

**radioactive mixed waste (RMW)** - Radioactive wastes that are also hazardous waste and/or dangerous waste.

**removable radioactive contamination** - Radioactive contamination that can be readily removed in measurable quantities by wiping the contaminated surface with an absorbent material.

**residual liquid** - Liquid remaining in or on particulate, granular, or sludge-like waste material after the normal separation process (filtration, centrifuging, settling, and decontamination, etc.) has taken place.

**RH** - Remote-handled.

**Rockwell** - Rockwell Hanford Operations (superceded by Westinghouse Hanford Corporation in June 1987)

**RRM** - Radioactive material (number).

**SARP** - Safety Analysis Report for Packaging.

**SEAC** - Safety and Environmental Advisory Council.

**self-contained waste** - Radioactive waste (generally a piece of equipment or apparatus) that meets the DOT transport requirements for LSA radioactive materials in 49 CFR 173.425 without overpacking.

**sludge** - A semisolid material consisting of an unspecified mixture of solids and liquids.

**solid waste** - Any discarded solid, semisolid, or solidified liquid material such as garbage, refuse, sludge, or discarded commodity resulting from industrial, commercial, mining, agricultural, or community operations or activities that is not a primary product of such operations or activities. For purposes of this document, only solid waste that is contaminated with radioactive isotopes is considered.

**SOP** - Standard Operating Procedure.

**spent material** - Any material that has been used and can no longer serve the purpose for which it was produced.

**spent nuclear fuel** - Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituents elements of which have not been separated by reprocessing.

**SST** - Safe secure trailer (required of classified material).

**storage** - Emplacement of radioactive waste to allow for later retrieval.

**SWBR** - Solid Waste Burial Record - Low-Level.

**SWSR** - Solid Waste Storage Record - Transuranic.

**SWIMS** - Solid Waste Information Management System.

**temporary aboveground storage** - Temporary storage mode for waste not immediately placed into its final storage or disposal position. Temporary above ground storage may be used for low-level or transuranic waste packages.

**TFPC** - Tank Farm Production Control, Rockwell Hanford Operations.  
(Superceded by Westinghouse Hanford Corporation in June 1987.)

**TLM<sub>6</sub>** - See "Aquatic LC<sub>50</sub>".

**toxic** - Having the properties to cause or to significantly contribute to death or illness of men or wildlife.

**trench, TRU waste** - An excavation intended for TRU or organic liquid waste packages that are not suitable for storage on an asphalt pad or in a caisson. This waste is placed in retrievable storage in TRU trenches due to its chemical composition, security requirements, or surface radiation levels.

**trench, low-level dry waste** - An excavation that receives LLW. The waste in the trench is covered with a minimum of 2.4 m (8 ft) of earth.

**triple rinsing** - The act of cleaning containers in accordance with requirements of WAC 173-303-160.

**TRU** - transuranic.

**TRUSAF** - Transuranic Storage and Assay Facility.

**TRU waste** - Waste without regard to source or form, which is contaminated with radium sources, <sup>233</sup>U, and/or alpha-emitting radionuclides of atomic number greater than 92 and half-lives greater than 20 yr in concentrations greater than 100 nCi/g of waste matrix at the end of institutional control periods.

**Type A packaging** - Packaging designed to withstand normal conditions of transport as demonstrated by the retention of containment and shielding.

**void space** - The empty space in a partially filled container.

**WDOE** - Washington State Department of Ecology.

**WIPP** - Waste Isolation Pilot Plant, Carlsbad, New Mexico.

**WIPP-WAC** - WIPP - Waste Acceptance Criteria.

**WMSC** - Waste Management Safety Committee, Rockwell Hanford Operations.  
(Superceded by the Westinghouse Safety and Environmental Advisory Council.)

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**APPENDIX A**  
**WASTE MINIMIZATION PROGRAM**



## A.1 INTRODUCTION

Congress passed the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) in November 1984. The policy statement reads as follows:

"The Congress hereby declares it to be a National policy of the United States that, whenever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is, nevertheless, generated should be treated, stored, or disposed of so as to minimize the present threat to human health and the environment."

The waste minimization requirements established by RCRA, as amended, are discussed in this appendix, and shall be applied by all shippers of hazardous waste to the Hanford Site.

## A.2 REPORTING AND CERTIFICATION REQUIREMENTS

The HSWA policy statement is implemented by the following requirements.

- Waste Disposal Manifests - All RCRA-required manifests must contain a certification by the generator that a program is in place to reduce the waste volume or quantity and the toxicity to the degree determined by the generator to be economically practicable, and the proposed method of treatment, storage, or disposal is a practicable method that is currently available to the generator which minimizes the present and future threat to human health and the environment.
- Generator Minimization Reports - Waste generators must submit, at least biennially, a report describing their efforts to reduce the volume or quantity and toxicity of waste generated, and must describe and explain changes in volume, quantity, and toxicity of waste during the year in comparison with previous years.
- RCRA Permits for Onsite Treatment, Storage or Disposal - These permits contain a certification by the permittee reporting efforts taken to minimize the amount and toxicity of the generated wastes. In addition, the permittee must record, at least annually, the waste minimization certification in the written operating records that are retained at the generating facility.

### A.3 BASIC OBJECTIVES OF WASTE MINIMIZATION PROGRAM

Environmental management objective directly related to RCRA and the HSWA waste minimization provisions have been established by the U.S. Department of Energy - Richland Operations Office (DOE-RL) and include the following:

- Operations will be conducted to minimize the quantities of waste generated
- Recycling or reuse of waste materials will be implemented to the maximum extent practicable
- Disposal to the ground of liquid radioactive or nonradioactive materials will be minimized and meet regulatory requirements
- Water management practices will minimize water use in plant operations and waste streams
- Treatment, storage, and disposal of waste materials will comply with applicable regulations
- Detailed records of quantities, types, and locations of waste, including points of discharge, will be maintained.

Hanford Site contractors and on- and offsite waste generators are responsible for incorporating these objectives into the performance and accomplishment of their individual tasks.

Hazardous waste is defined in Chapter 173-303, "Dangerous Waste Regulations," of the Washington Administrative Code (WAC). This definition of hazardous waste is slightly broader than the definition used by the U.S. Environmental Protection Agency (EPA). The following wastes are subject to the waste minimization requirements:

- Hazardous and dangerous waste - as defined in 40 CFR 261.3 and WAC 173-303, respectively (hereafter referred to as hazardous waste)
- Radioactive mixed waste - defined as waste that is both hazardous (40 CFR 261.3 and WAC 173-303) and radioactive (excluding "source, special nuclear or byproduct material" as defined by the Atomic Energy Act of 1954, as amended).

While the focus of waste minimization should be directed toward these wastes, it is the responsibility of all generators to reduce to the degree practicable, the output of all nonproduct hazardous materials, even though

they may be within permitted or licensed limits. This philosophy is also extended to strictly radioactive waste:

"The volume of radioactive solid waste shall be minimized to the extent technically and economically practicable both as generated and by additional volume reduction processes".

It can be assumed that the cost of waste treatment and disposal will continue to rise precipitously as more and more authority is vested in EPA regulatory officials. Thus, the economic incentive to minimize waste will become dominant.

#### A.4 WASTE MINIMIZATION VS. WASTE MANAGEMENT

Waste minimization includes all practices that reduce, avoid, or eliminate the generation of waste at its sources, in contrast to controlling, treating, or otherwise managing waste after its generation. Examples of waste minimization activities include:

- Material substitution - Replacing hazardous materials with nonhazardous (or less hazardous) materials
- Inventory reduction - Minimizing the existing chemical inventory, thus reducing the undue accumulation of partially used or unused materials requiring disposal or other disposition at shelf-life expiration
- Procurement modification - Minimizing the variety of chemicals used to perform the same or similar process(es)
- Unused stock - Incorporating provisions for returning unused chemical stock having an expired shelf-life into procurement bids. Return empty, unrinsed containers to the original manufacturer.
- Waste segregation - Enforcing waste segregation to avoid the inclusion of nonhazardous materials in hazardous waste packages and the commingling of wastes that may render recycling of materials and containers impractical
- Recycling - Recycling certain materials to extend their useful life and reduce the volume or quantity of waste produced
- Process modification - Modifying or eliminating processes or process steps to reduce the volume, quantity, or toxicity of resulting waste.

A variety of other actions taken outside of the generating activity can effectively reduce the volume or quantity, and potentially, the toxicity of generated waste. However, these actions occur after a waste has been produced and are collectively termed waste management activities. The following are examples of waste management activities that are commonly referred to as waste minimization:

- Waste incineration
- Waste evaporation and compaction
- Waste reclamation or brokering
- Effluent treatment.

## A.5 FUNDAMENTAL ELEMENTS OF WASTE MINIMIZATION

The following sections contain a general outline of the basic elements of a waste minimization program.

### A.5.1 ESTABLISHING A WASTE MINIMIZATION TEAM

Each generating facility should designate a team responsible for planning and implementing the waste minimization effort. The team members should consist of individuals normally responsible for procurement, inventory control, shipping and transportation, maintenance, health and safety, quality assurance, facilities, and environmental and processing engineering.

### A.5.2 EVALUATING AVAILABLE RESOURCES

Existing resources available to the team should be established and evaluated. The following resources should be considered:

- Company policy manuals
- Budget reports
- Purchasing records
- Annual reports
- Federal, State and local regulations
- Federal (RCRA) and State permits (or applications)

- Regulatory violations and compliance orders
- Facility layouts
- Process flow diagrams
- Waste manifests
- Operating manuals
- Training records
- Contracts with waste management firms
- Results of any relevant audits and inspections.

#### A.5.3 AUDIT GENERAL OPERATIONS, PROCESSES OR FACILITIES

Information that must be verified or investigated includes:

- Define the raw chemical stocks involved
- Determine the point of waste stream generation
- Classify waste streams by process
- Define details of subsequent waste stream handling
- Identify hazardous vs. non-hazardous components and streams
- Define physical and chemical characteristics of identified streams
- Specify waste stream quantities
- Itemize potential variations in rate of waste stream production
- Identify potential for contamination and upset conditions
- Define current costs for all aspects of waste stream management.

#### A.5.4 ESTABLISHING A QUANTIFIABLE WASTE STREAM BASELINE

Establishing baseline waste stream generation rates is fundamental to the quantification of waste reduction progress and accomplishments.

#### A.5.5 PRIORITIZING WASTE STREAMS

When the data gathering and investigations are complete, the waste minimization team should prioritize the waste streams according to their management costs, environmental impacts, and regulatory concerns.

#### A.5.6 ADMINISTRATIVE CONTROL

Some examples of administrative control for the purpose of waste minimization are listed below:

- Limit the volume and variety of materials coming into radiation zones
- Recycle potential waste materials whenever possible
- Sort waste on the basis of activity level and contamination to prevent nonradioactive materials from storage/disposal as radioactive waste.

#### A.5.7 PROCESS MODIFICATIONS

Direct materials substitutions, increased quality control, process instrumentation upgrades, and improved technologies are all reasonable examples of process modifications for use in waste minimization.

#### A.5.8 WASTE MANAGEMENT CONSIDERATIONS

While generally not considered an authentic waste minimization activity, the method of treatment, storage or disposal selected for generated waste is addressed in the generator's certification. The chosen method of treatment should be the most practical method available that minimizes the present and future threat to human health and the environment. Toward this goal, greater restrictions have recently been placed on the types of waste being accepted for disposal at the Hanford Site burial grounds. Restrictions on use of lead, segregation of radioactive mixed waste, and case-by-case acceptance of banned wastes for storage and future treatment are examples of recent efforts to minimize present and potential future health and environmental impacts. As the list of materials banned from landfilling continues to expand, so will the restrictions governing landfill design. Consequently, so will the overall costs of land-based disposal. It will be a continuing responsibility of generators to reduce the amount and toxicity of generated waste, and for waste management and operational organizations to periodically evaluate existing, new, and emerging technologies as alternatives to land disposal.

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**APPENDIX B**  
**BURIAL COMPLIANCE CHECKSHEET**

BURIAL COMPLIANCE CHECKSHEET  
FOR RADIOACTIVE SOLID WASTE MATERIAL

Storage & Disposal  
Approval Number

Date

West Area Support Unit-  
Approval Signature

Waste Generator: \_\_\_\_\_

Reference Letter #

Dated

File #

Waste Title: \_\_\_\_\_

Storage/Disposal Container: \_\_\_\_\_

Reference: RHO-MA-222, Rev.4 (Unclassified), June, 1987,  
W. G. Jasen, "Hanford Radioactive Solid Waste  
Packaging, Storage and Disposal Requirements"

Waste Type:  Transuranic  Unclassified  
 High Level  Classified  
 Low Level  Radioactive Mixed  
Waste

Disposal  
Type:  Burial  Scheduled  
 Retrievable Storage  Routine  
 Contact Handled  One Time Only  
 Remote Handled

Transport  
Approval:  U.S.Department of Transportation  
 Waste Generator  
 Hanford Transport Approval Number: \_\_\_\_\_

Transport  
Category:  Low Specific Activity  Limited Quantity  
 Type A  Type B  Highway Route  
Controlled Quantity

A. WASTE DESCRIPTION

Storage & Disposal  
Approval Number

1. Waste Contents Included:

- | Yes                      | No                       |   | Yes                      | No                       |
|--------------------------|--------------------------|---|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Miscellaneous Solid Waste                           | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Animal Carcasses                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Unabsorbed Liquid Organics                          | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Ion Exchange Resins                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Significant Concentrations<br>of C-14, Tc-99, I-129 | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Heat Generating Potential<br>( < 0.1 watts/cu. ft.) | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | Other: _____  | <input type="checkbox"/> | <input type="checkbox"/> |

Note: The following are prohibited: Free inorganic liquids, incompatible materials, pyrophorics, explosives, unreacted alkali metals, and unvented gas cylinders.

2. Physical Description of Waste:

3. Radioactive Material Description  
Low Level:

Transuranic:

4. Radioactive Mixed Waste Hazardous Constituent Description:

5. Maximum Allowable Fissile Quantity:

6. Void Space Filler Material:

B. WASTE PACKAGING SYSTEM

Storage & Disposal  
Approval Number

1. Container Name: \_\_\_\_\_
2. Drawing or Specification Number: \_\_\_\_\_
3. External Dimensions: \_\_\_\_\_
4. Disposal Volume: \_\_\_\_\_
5. Maximum Gross Weight: \_\_\_\_\_
6. General Description:
7. Required Internal Packaging:
8. Closure Mechanism:
9. Maximum Allowable Radiation Levels: 

Less than	mRem/hr.	(Contact)
N/A		(Other)
- 9,a. Neutron Dose Rate Contribution\* 

	mRem/hr.	
--	----------	--
10. Maximum Allowable Surface Contamination: 

Less than	dpm/100 sq cm alpha	
Less than	dpm/100 sq cm beta-gamma	
11. Required Labels:

\* Required when in excess of 20 mRem/hr.

B. WASTE PACKAGING SYSTEM (Continued)

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Storage & Disposal  
Approval Number

12. Returnable Transport Overpacks:

Note: The Waste Generator must send a current Certificate of Compliance (COC) and Unloading and Handling Procedures for each type of Returnable Transport Overpack to the West Area Support Unit prior to the initial shipment and each time these documents are revised.

C. OTHER REQUIREMENTS

1. Administrative Controls:

2. Hanford Storage/Disposal Information:

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APPENDIX C  
FISSILE MATERIALS - EQUIVALENTS  
AND CONVERSION FACTORS

### C.1. Gram Equivalents of Fissile Isotopes

The total  $^{239}\text{Pu}$  fissile gram equivalent content of all waste packages shall be determined by multiplying the total weight (in grams) of each isotope present by the corresponding correction factor listed below, and adding the individual products. Contact Westinghouse Criticality Engineering Analysis for correction factors of isotopes not listed.

<u>Isotope</u>	<u>Correction factor</u>
Any Pu isotope	1
$^{235}\text{U}$	1
$^{233}\text{U}$	10
Any Am isotope	1/50
$^{237}\text{Np}$	1
$^{244}\text{Cm}$	1

#### Example

If a waste package contains 20 g  $^{239}\text{Pu}$ , 10 g  $^{233}\text{U}$ , and 5 g  $^{241}\text{Am}$ , the total fissile material content of the waste package is

$$20(1) + 10(10) + 5(1/50) = 120.1 \text{ g.}$$

This list of conversion factors was developed to ensure criticality safety for storage/disposal conditions specific to the Hanford Site. Use of less restrictive correction factors may be allowed on a case by case basis after detailed analysis and approval by Westinghouse Criticality Engineering Analysis.

For the purpose of reporting in the WIPP Waste Data package, fissile gram equivalent content of WIPP certified TRU waste packages shall be determined using the following table:

<u>Isotope</u>	<u>Correction factor</u>
$^{233}\text{U}$	1
$^{235}\text{U}$	1
$^{238}\text{Pu}$	9/80
$^{239}\text{Pu}$	1
$^{240}\text{Pu}$	9/400
$^{241}\text{Pu}$	9/4
$^{242}\text{Pu}$	9/1200
$^{241}\text{Am}$	9/480
$^{242}\text{Am}$	450/13
$^{243}\text{Am}$	9/700
$^{243}\text{Cm}$	5
$^{244}\text{Cm}$	9/100
$^{245}\text{Cm}$	15
$^{247}\text{Cm}$	1/2
$^{249}\text{Cf}$	45
$^{251}\text{Cf}$	90

**C.2 Plutonium-239 Equivalent Curie Content**  
Basis: Plutonium-239 = 1

To determine the plutonium equivalent curies (PE-Ci) content of a waste package, multiply the total activity (in curies) of each isotope present by the following correction factors and add the individual PE-Ci:

<u>Isotope</u>	<u>Correction factor</u>
$^{233}\text{U}$	1/250
$^{238}\text{Pu}$	1
$^{239}\text{Pu}$	1
$^{240}\text{Pu}$	1
$^{241}\text{Pu}$	1/45
$^{242}\text{Pu}$	1
$^{244}\text{Pu}$	1
$^{241}\text{Am}$	1/3
$^{242\text{m}}\text{Am}$	1/3
$^{243}\text{Am}$	1/3
$^{243}\text{Cm}$	1/3
$^{244}\text{Cm}$	2/9
$^{245}\text{Cm}$	2/5
$^{246}\text{Cm}$	2/5
$^{247}\text{Cm}$	2/5
$^{248}\text{Cm}$	10/3
$^{250}\text{Cm}$	10/3
$^{249}\text{Cf}$	1
$^{251}\text{Cf}$	1
$^{252}\text{Cf}$	1/3
$^{247}\text{Bk}$	10/3

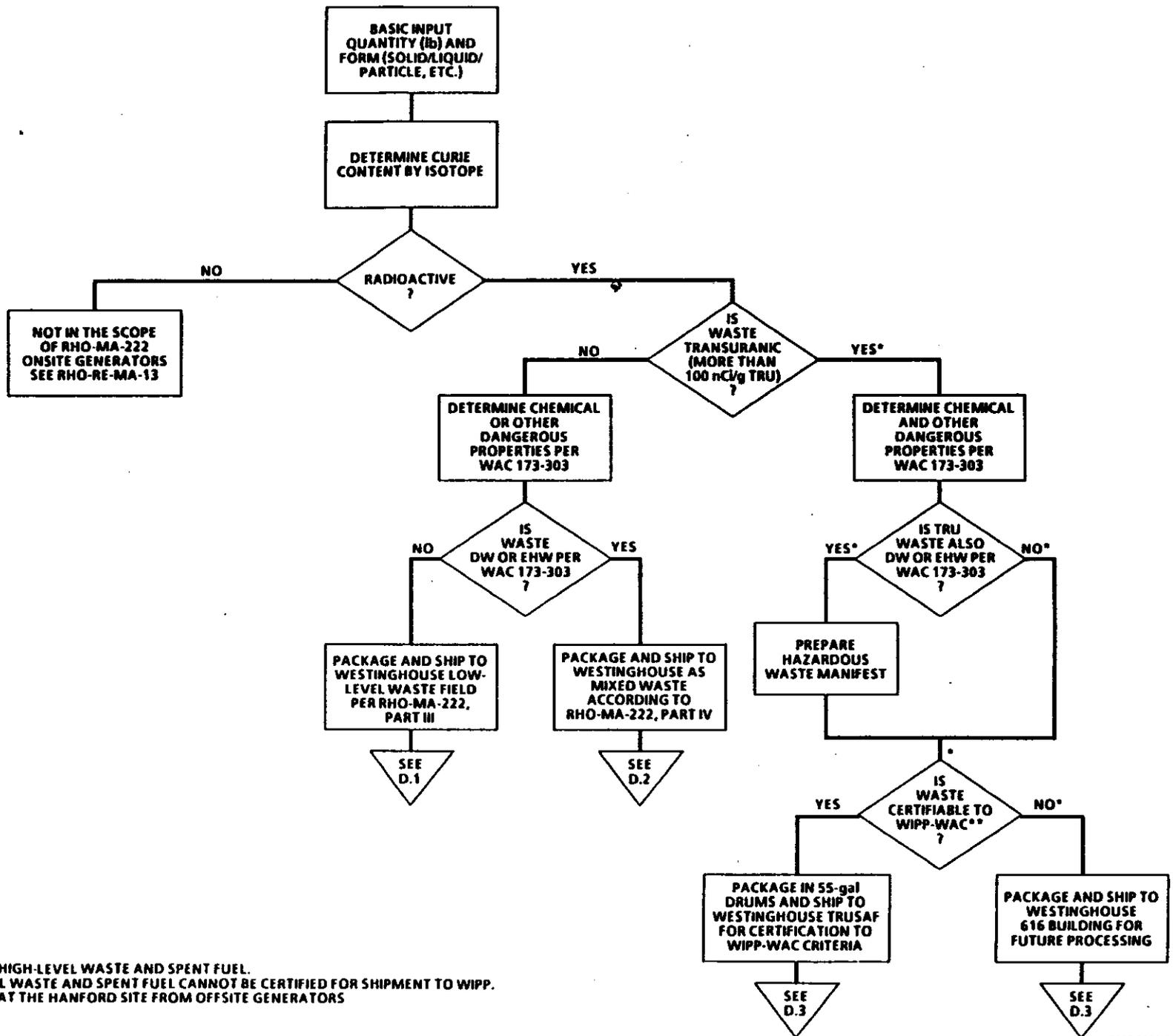
Example

If a waste package contains 3 Ci of  $^{239}\text{Pu}$ , 4 Ci of  $^{233}\text{U}$  and 5 Ci of  $^{241}\text{Am}$ , the PE-Ci content of the waste package would be  $3(1) + 4(1/250) + 5(1/3) = 4.68$  PE-Ci.

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**APPENDIX D**

**GUIDELINES FOR CLASSIFICATION OF WASTE;  
AND PROCESSING CHECKLISTS**



\*INCLUDES HIGH-LEVEL WASTE AND SPENT FUEL.

\*\*HIGH-LEVEL WASTE AND SPENT FUEL CANNOT BE CERTIFIED FOR SHIPMENT TO WIPP.

\*\*\*RECEIVED AT THE HANFORD SITE FROM OFFSITE GENERATORS

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D.1 PROCESSING OF LOW-LEVEL WASTE

1. Determine packaging requirements for disposal according to RHO-MA-222, Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements, Part III, and 49 CFR 173 (if offsite).
2. Submit request for burial (through proper channels) with draft Burial Compliance Checksheet (BCC) to Westinghouse West Area Support Unit according to applicable sections of RHO-MA-222.
3. Provide Westinghouse with the supplementary data outlined in sections I.3.2.1 and I.3.2.2 of RHO-MA-222.
4. Determine shipping and marking requirements per 49 CFR 173.
5. Segregate waste to maximum practical extent, on the basis of dose rate, contamination, physical configuration of the waste, etc.
6. Upon receipt of an approved BCC from Westinghouse, package waste for shipment in strict accordance with provisions of BCC.
7. Mark, label, and placard packages in accordance with 49 CFR 172, Subparts D, E, and F.
8. Prepare a Memorandum Purchase Order according to RHO-MA-222, section I.3.4, and transmit to DOE-RL (offsite generators only).
9. Schedule shipment in accordance with RHO-MA-222, section I.4.1.
10. Prepare Solid Waste Burial Record-Low Level in accordance with RHO-MA-222, appendix F and section I.4.2.
11. Ship. Notify Westinghouse Receiving of expected dates and time of arrival, routing, and carrier.

## D.2 PROCESSING OF MIXED WASTE

1. Determine packaging requirements for mixed waste per RHO-MA-222, Part IV; select a preferred package system.
2. Submit request for storage (including the Chemical Waste Storage Request) with draft BCC to Westinghouse through proper channels, according to applicable sections of RHO-MA-222. Determine whether material can be stored underground (EHW and waste banned from land disposal may not be buried in the State of Washington).
3. Provide all supplementary information available including at least the following:
  - Radioactive content in curies by species
  - A full characterization and quantification (percentage or ppm by weight) of all EHW or DW in accordance with designation requirements of WAC 173-303.

This information must be prepared for each individual drum, with the exception of multiple drums of homogeneous waste, which can be grouped together. Note that the total analysis must total 100% of the waste. Nonhazardous material may be grouped into a single line item.

4. Determine shipping and marking requirements per 49 CFR 172, WAC 173-303, and RHO-MA-222.
5. Segregate waste to the maximum-practical extent:
  - Do not combine mixed waste with nonradioactive waste, low-level waste, high-level waste, or transuranic waste
  - Do not mix incompatible waste materials in the same container
  - To the maximum practical extent, do not mix two or more waste streams (e.g., solidified sludge with metal parts; organics with metal shavings or sludges).
6. Upon receipt of an approved BCC, package the waste in strict accordance with RHO-MA-222, Part IV, and the approved BCC.
7. Prepare all necessary documentation including at least the following:
  - Solid Waste Burial Record-Low Level (see appendix F)
  - Chemical Waste Disposal Request, (see appendix H)
  - Uniform Hazardous Waste Manifest (EPA Form 8700-22) (see appendix H).

8. Prepare a Memorandum Purchase Order according to RHO-MA-222, section I.3.4, and transmit to DOE-RL.
9. Schedule shipment in accordance with RHO-MA-222, section I.4.1.
10. Load on separate trucks, or if using one truck, separate according to RHO-MA-222, section IV.5.6.
11. Ship. Notify Westinghouse Receiving of expected date and time of arrival, routing, and carrier.

### D.3 PROCESSING OF TRU WASTE

1. Select a waste packaging system according to RHO-MA-222, section II.3.1.
2. Immobilize fines according to RHO-MA-222, section II.3.2.1 (if required).
3. Solidify all liquids according to RHO-MA-222, section II.3.2.2 (if required).
4. Neutralize or render noncorrosive all corrosive wastes according to RHO-MA-222, section II.3.2.5 (if required).
5. Check quantities of fissionable material in each package to ensure compliance with RHO-MA-222, sections II.3.3.3 and III.3.3.2.
6. Package wastes for shipment.
7. Prepare required documentation in accordance with RHO-MA-222, section II.5 including at least the following:
  - DOE/NRC Form 741 (if waste contains accountable nuclear material)
  - Rockwell Form BC-6400-131 (Contents Inventory Sheet)
  - Rockwell Form BC-6400-132 (WIPP Certification Checksheet)
  - Rockwell Form 54-3000-623 (Solid Waste Storage Record - Transuranic)
  - EPA Form 8700-22, Uniform Hazardous Waste Manifest (if package contains DW or EHW per WAC 173-303)
  - Laboratory reports presenting support of stated radioactive content and content of dangerous or hazardous materials (if applicable). Include lead as a hazardous material if used as shielding or packaging material.
8. Mark and/or label drums as outlined in RHO-MA-222, section II.3.4. Minimum requirements include:
  - Package identification number (see appendix J).
  - Gross weight in kilograms
  - DOT "Radioactive Material" label
  - Hazardous material labels as required by WAC 173-303 and 49 CFR 172, Subpart E
  - Radioactive material label per 49 CFR 172, Subpart E.

**APPENDIX E**  
**TRANSURANIC SOLID WASTE DOCUMENTATION REQUIREMENTS**

The waste generator must provide an accurate and complete Solid Waste Storage Record-Transuranic (Rockwell form 54-3000-623), Contents Inventory Sheet (Rockwell form BC-6400-131), and WIPP Certification Checksheet (Rockwell form BC-6400-132) for each waste package. Blank forms may be obtained from Westinghouse West Area Support Unit. Instructions for completing these forms are provided in the following sections as well as on the back of the blank forms.

#### D.1 SOLID WASTE STORAGE RECORD-TRANSURANIC

The following instructions are number keyed to figure E-1. Items 2 through 32 are required to be completed by the waste generator prior to shipping the waste to Westinghouse. Item 1 and items 33 through 43 are completed by Westinghouse after receipt of the waste.

2. **Container Number** - Enter the assigned container number as labeled on the container.
3. **Waste Generator** - Enter the name of the company generating waste.
4. **Charge Code** - (Hanford Generators Only) Enter the charge code to be billed for storage costs.
5. **Address/Phone** - Enter the address (i.e., building number and area for Hanford generators) of the facility generating the waste and the phone number of the person completing the form.
6. **Signature and Date** - Read the statement and sign and date the form.
7. **Container-Name** - Check the box for the 55-gal drum or enter the name of the other container.
8. **BCC Approval Number** - Enter the Storage and Disposal Approval number from corresponding Burial Compliance Checksheet.
9. **Surface Dose Rate** - Enter maximum surface total (beta, gamma, and neutron) and neutron dose rates of waste package or of transport cask for caisson loads in the appropriate spaces.

NOTE: DO NOT FILL IN LENGTH x WIDTH OR DIAMETER OR HEIGHT FOR 55-GAL DRUMS

10. **Length x Width or Diameter** - Enter the outside length and width of rectangular waste packages or the diameter of cylindrical waste packages and units of measurement.

11. **Height** - Enter the outside height of the waste package and units of measurement.
12. **Nuclear Transaction Number** - Enter number from block 3 of corresponding DOE/NRC form. Enter "N/A" if no 741 form is required.
13. **Property Disposal Request Number** - (Hanford Generators Only) Enter property disposal request number if capital equipment is in waste or "N/A" if no capital equipment is present in waste.
14. **Total Volume** - Enter the total volume of the waste package in cubic meters.
15. **Gross Weight** - Enter the actual gross weight of the waste package in kilograms.
16. **Waste Categories** - Check waste category box(es) that best describe waste as follows:
  - BW=Biological Wastes (sewage sludge, animal carcasses, excreta, etc.)
  - CE=Contaminated Equipment (components, maintenance wastes, etc.)
  - DD=Decontamination Debris (wastes resulting from decontamination and decommissioning efforts, construction debris, etc.)
  - DS=Dry Solids (normal plant wastes, blotting paper, combustible materials, etc.)
  - SS=Solidified Sludge (any wastes solidified from a process sludge such as evaporator bottoms solidification of precipitated salts)
  - NC=Not categorized (materials that are not included in these categories)
17. **Organic Material Vol %** - Enter the volume percentage of organic material in the waste.
18. **Organic Material Wt** - Enter the weight in kilograms of organic material in the waste.
19. **Thermal Power** - Check box if thermal power is 0.1 W/cu ft or less or enter measured or calculated value if greater than 0.1 W/cu ft.
20. **Waste Description** - Enter material contents of the waste in appropriate spaces in volume percentages of the total (100%). Enter totals for combustible and noncombustible columns.

21. **Hazardous/Corrosive Constituents** - Enter material name and amount present in kilograms of all hazardous/corrosive constituents in the waste package.
22. **Element** - Enter each transuranium element and uranium present in the waste. Enter "None" if none are present.
23. **Isotopic Distribution** - Enter the isotopic distribution for each transuranium element and uranium as a percentage of total (100%) for that element.
24. **Total Element Weight** - Enter the total weight in grams for each transuranium element and uranium present in the waste.
25. **Total Alpha Curies** - Enter Total Alpha Curies for each transuranium element and uranium present in the waste.
26.  **$^{239}\text{Pu}$  Fissile Gram Equivalent** - Enter  $^{239}\text{Pu}$  fissile gram equivalent for each transuranium element and uranium.
27. **PE-Ci** - Enter  $^{239}\text{Pu}$  equivalent transuranic activity (PE-Ci) for each transuranium element and uranium.
28. **Isotope** - Enter each nontransuranium radioisotope present in waste. Enter "None" if none are present.
29. **Grams or Curies** - Enter the activity of each nontransuranium radioisotope. Record thorium in grams and all others in curies.
30. **Totals** - Enter totals from Total Element Weight (Item 24), Total Alpha Curies (Item 25),  $^{239}\text{Pu}$  Fissile Gram Equivalent (Item 26), PE-Ci (Item 27), and Grams or Curies (Item 29) in the appropriate spaces.
31. **Measurement Method** - Enter the name of the method used to determine radioactive material content of waste.
32. **Determined By** - Enter (do not sign) the name of person who determined the radioactive material content of waste.

NOTE: ITEM 1 AND ITEMS 33 THROUGH 43 ARE COMPLETED BY WESTINGHOUSE AT THE STORAGE SITE.

1. **SWSR No.** - Completed by Westinghouse West Area Support Unit.
33. **Area** - Enter the Hanford area designation where the storage site is located.

34. **Burial Ground Number** - Enter the burial ground facility designation (i.e., burial ground number or building number and floor).
35. **Trench Number** - Enter the trench number if the waste is placed on asphalt pad, otherwise leave blank.
36. **Caisson Number** - Enter the caisson number if the waste is placed in a caisson, otherwise leave blank.
37. **Module Number** - Enter the module number where waste is stored.
38. **Tier** - Enter the tier number where waste is stored.
39. **Beginning Coordinates** - Enter the beginning coordinates if the waste is placed on asphalt pad, otherwise leave blank.
40. **Ending Coordinates** - Enter the ending coordinates if waste is placed on asphalt pad, otherwise leave blank.
41. **Remarks** - Enter any other pertinent information.
42. **Signature-Acceptance** - Sign and date if the waste is accepted.
43. **Signature-Storage Mode** - Sign and date when the waste has been placed in retrievable storage mode.



## E.2 CONTENTS INVENTORY SHEET

The following instructions are number keyed to figure E-2.

1. Page \_\_\_\_\_ of \_\_\_\_\_ - Enter the page number and the total number of pages.
2. Waste Generator/Location - Enter the company, building and room location.
3. Container No. - Enter the assigned container number. (This must be permanently labeled on the container.)
4. Container Type - Enter the type of waste container used (i.e., 55-gal drum, 6 by 6 by 7 box, etc.).
5. Initials - The person who places waste in the container and enters page totals shall initial this block.
6. Article Description - Physically describe the waste placed in the container.
7. Mass of Organics - Enter the mass of organic waste described in block 6 in kilograms.
8. Volume of Organics - Enter the volume of organic waste described in block 6 in cubic feet or cubic meters.
9. Hazardous Material - Enter the major hazardous, corrosive or toxic materials in the waste. If none, write "none".
10. Qty - Enter the quantities of hazardous materials listed in block 9 in kilograms.
11. TRU Isotopes - Enter each TRU radioisotope present. If the element and its isotopic ratio (e.g.,  $^{239}\text{Pu}$  94%,  $^{240}\text{Pu}$  5%, etc.) is the same for all articles placed in the container, only one entry is required.
12. Grams - Enter the grams of each TRU element present in each item listed in block 6.
13. Mass of Organics - Enter the total mass of organic waste listed on this page.
14. Total Mass of Organics - Enter the total mass of organic waste from all pages. (Required on page 1 only).
15. Volume of Organics - Enter the total volume of organic waste listed on this page.

16. Total Volume of Organics - Enter the total volume of organic waste from all pages. (Required on page 1 only).
17. Qty - Enter the total of all hazardous materials listed on this page in kilograms.
18. Total Qty - Enter the total of all hazardous materials from all pages in kilograms. (Required on page 1 only).
19. Grams - Enter the total TRU material listed on this page in grams.
20. Total Grams - Enter the total TRU material from all pages in grams. (Required on page 1 only).
21. Plant Operations Authority Signature/Date - The Plant Operations Authority or delegate must sign and date the Contents Inventory Sheet indicating that the form has been properly completed.
22. Independent Reviewer Signature/Date - The independent reviewer must sign and date each page signifying the Contents Inventory Sheet has been reviewed and verified.
23. Other Radioactive Content - Enter the isotope and curie content of any non-TRU isotope contained in the waste package. The radioactive content should be specified in grams for uranium or thorium.
24. Comments - Enter any other pertinent information.



### E.3 WIPP CERTIFICATION CHECKLIST

The following instructions are number keyed to figure E-3.

1. Container Number - Specify the container number as labeled on the container.
2. Date Container Sealed - Enter the date the container was sealed.

NOTE: IF THE WASTE DOES NOT MEET THE CRITERIA LISTED BELOW, CHECK NO FOR THAT CRITERION.

3. DOT Type A Container - Check yes if the container meets all DOT Type A requirements.
4. Heavy or bulky items are blocked to prevent shifting - Check yes if the waste is loaded so that bulky and heavy items are blocked to prevent shifting. Check yes or enter "N/A" if there are no heavy or bulky items.
5. Container is free of defects - Check yes if the container has been inspected and no defects were found.
6. Waste contains less than 1% by weight powders - Check yes if powders, ashes, and particulates are less than 1 wt% or have been immobilized or if no powders are present.
7. Waste does not contain any free liquids - Check yes if the waste contains no free liquids.
8. Waste does not contain any explosives or compressed gases - Check yes if the waste contains no explosives or compressed gases.
9. Waste does not contain any organic peroxides, oxidizers, flammable solids, or metal fines - Check yes if the waste contains no pyrophoric materials.
10. Waste does not contain any sludges with pH <4.0 - Check yes if all sludges present are neutralized and solidified. Check yes or enter "N/A" if no sludges are present.
11. Waste contents will not react with each other or with the container - Check yes if the waste package contains no materials chemically incompatible with each other or the container.
12. Surface contamination is <50 pCi (100 dpm)/ 100 sq cm alpha and <450 pCi (1000 dpm)/100 sq cm beta-gamma - Check yes if the removable surface contamination on the container is less than the specified limits.

13. Proper labelling has been applied - Check yes if the proper labelling has been applied.
14. Hazardous and corrosive co-contaminants are identified on the Contents Inventory Sheet - Check yes if hazardous or corrosive co-contaminants present in the waste are listed on the Contents Inventory Sheet. Check yes or enter "N/A" if no hazardous or corrosive materials are present.
15. Gross weight is less than qualified DOT Type A limit (    kg) - Check yes if the gross weight does not exceed the qualified Type A limit. Enter the Type A limit in the space provided.
16. Pu-239 Fissile Gram Equivalent content is less than WIPP specified limit (    g) - Check yes if the <sup>239</sup>Pu Fissile Gram Equivalent content is less than the WIPP-specified limit. Enter the WIPP-specified limit in the spaces provided.
17. Pu-239 equivalent TRU activity (PE-Ci) is less than the WIPP specified limit of 1000 PE-Ci - Check yes if the <sup>239</sup>Pu equivalent TRU activity is less than 1000 PE-Ci.
18. Surface dose rate <200 mrem/hr (beta, gamma and neutron) at any point - Check yes if the combined beta, gamma and neutron dose rate is <200 mrem/hr at any point on the container.
19. Neutron dose rate contribution is <50 mrem/hr - Check no if the neutron dose rate is greater than 50 mrem/hr at any point on the container.
20. Exceptions - If any items do not fully comply with all Waste Acceptance Criteria, check the appropriate box and provide a complete explanation. The lack of an approved certification plan is a deviation and must be listed. Check no exceptions if none exist.
21. Plant Operations Authority Signature and Date - The appointed Plant Operations Authority or delegate must sign and date the form.
22. Independent Reviewer Signature and Date - The Independent Reviewer must sign and date the form verifying accuracy and completeness of information.



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**APPENDIX F**  
**LOW-LEVEL WASTE DOCUMENTATION REQUIREMENTS**

The waste generator must provide accurate and complete Solid Waste Burial Record-Low-Level forms (Rockwell form 54-3000-581) for each waste shipment or for individual waste packages if required by the corresponding Burial Compliance Checksheet (BCC). Blank forms may be obtained from the 200 West Area Support Unit. Instructions for completing these forms are provided in the following sections as well as on the back of the blank forms.

#### F.1 SOLID WASTE BURIAL RECORD-LOW-LEVEL

The following instructions are number keyed to figure F-1. Items 2 through 28 are required to be completed by the waste generator prior to shipping the waste to Hanford. Item 1 and items 30 through 38 are completed by Westinghouse after receipt of the waste.

2. Waste Generator - Enter the name of company generating waste.
3. Charge Code - (Hanford Generators Only) Enter the charge code to be billed for storage costs.
4. RRM Number - (Non-Hanford Generators Only) Enter the RRM Number obtained from DOE-RL for the shipment.
5. Address/Phone - Enter the address of facility generating waste and the phone number of the person completing form.
6. Signature and Date - Read the statement and sign and date the form.
7. Quantity & Name - Enter the quantity of 55-gal drums and Hanford Standard Fiberboard Boxes; enter the quantity and name of all other containers.
8. BCC Approval Number - Enter the Storage and Disposal Approval number from the corresponding Burial Compliance Checksheet.
9. Dose Rate-Package - Enter the maximum surface dose rate of waste packages or of the transport cask for caisson loads.

NOTE: DO NOT FILL IN LENGTH x WIDTH OR DIAMETER, HEIGHT OR MATERIALS OF CONSTRUCTION FOR 55-GAL DRUMS OR HANFORD STANDARD FIBERBOARD BOXES

10. Length x Width or Diameter - Enter the outside length and width of rectangular waste packages or the diameter of cylindrical waste packages and units of measurement.

11. Height - Enter the outside height of the waste package and units of measurement.
12. Materials of Construction - Enter the materials of construction of the waste packages.
13. Nuclear Transaction Number - Enter the number from block 3 of the corresponding DOE/NRC form. Enter "N/A" if 741 form is not required.
14. Property Disposal Request Number - (Hanford Generators Only) Enter the properly disposal request number if capital equipment is in the waste, or "N/A" if no capital equipment is present in waste.
15. Total Volume - Enter the total volume of the waste package or shipment and units of measurement.
16. Gross Weight - Enter the actual gross weight of the waste package in kilograms or pounds and check the appropriate box.
17. Waste Categories - Check waste category box(es) that best describe waste as follows:
  - BW=Biological Wastes (sewage sludge, animal carcasses, excreta, etc.)
  - CE=Contaminated Equipment (components, maintenance wastes, etc.)
  - DD=Decontamination Debris (wastes resulting from decontamination and decommissioning efforts, construction debris, etc.)
  - DS=Dry Solids (normal plant wastes, blotting paper, combustible materials, etc.)
  - SS-Solidified Sludge (any wastes solidified from a process sludge such as evaporator bottoms solidification of precipitated salts)
  - NC=Not Categorized (materials that are not included in any of these categories)
18. Thermal Power - Check the box if the thermal power is 0.1 W/cu ft or less or enter the measured or calculated value if greater than 0.1 W/cu ft.
19. Waste Description - Enter the material contents of the waste in appropriate spaces in volume percentages of the total (100%)  
Enter totals for combustible and noncombustible columns.

20. Hazardous/Corrosive Constituents - Enter the name and amount present and units of measure of all hazardous/corrosive constituents in the waste package. Enter "N/A" if none are present.
21. Element - Enter each transuranium element and uranium present in the waste. Enter "None" if none are present.
22. Isotopic Distribution - Enter isotopic distribution for each transuranium element and uranium as a percentage of total (100%) for that element.
23. Total Element Weight - Enter the total weight in grams for each transuranium element and uranium present in waste.
24. Isotopes - Enter each nontransuranium radioisotope present in the waste. Enter "None" if none are present.
25. Grams or Curies - Enter the activity of each nontransuranium radioisotope. Record thorium in grams and all others in curies.
26. Totals - Enter the totals from Total Element Weight (Item 23) and Grams or Curies (Item 25) in the appropriate space.
27. Measurement Method - Enter the name of the method used to determine the radioactive material content of waste.
28. Determined By - Enter (do not sign) the name of the person determining the radioactive material content of waste.
29. Remarks - Enter other pertinent information as desired (e.g., shipment number, description of capital equipment, etc.)

NOTE: ITEM 1 AND ITEMS 30 THROUGH 38 ARE COMPLETED BY WESTINGHOUSE AT THE STORAGE SITE.

1. SWBR No. - Completed by the 200 West Area Support Unit.
30. Area - Enter the Hanford area designation where the burial ground is located.
31. Burial Ground Number - Enter the burial ground facility designation.
32. Trench Number - Enter the trench number the waste is disposed in.
33. Caisson Number - Enter the caisson number if the waste is placed in a caisson, otherwise leave blank.

34. Beginning Coordinates - Enter the beginning coordinates where waste is disposed.
35. Ending Coordinates - Enter the ending coordinates where the waste is disposed.
36. Remarks - Enter any other pertinent information.
37. Signature-Acceptance - Sign and date when the waste is accepted.
38. Signature-Burial - Sign and date when the waste has been disposed (not required if disposal occurs the same day as acceptance).



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APPENDIX G

HAZARDOUS OR DANGEROUS WASTE MATERIALS -  
CLASSIFICATIONS AND CHARACTERISTICS

### Appendix G.1 Incompatible Waste Combinations

In the lists below, the mixing of a Group A material with a Group B material may have the potential consequence as noted.

#### Group 1-A

Acetylene sludge  
Alkaline caustic liquids  
Alkaline cleaner  
Alkaline corrosive liquids  
Alkaline corrosive battery fluid  
Caustic wastewater  
Lime sludge and other corrosive  
alkalies  
Lime wastewater  
Lime and water  
Spent caustic

#### Group 1-B

Acid sludge  
Acid and water  
Battery acid  
Chemical cleaners  
Electrolyte, acid  
Etching acid liquid or solvent  
Picking liquor and other  
corrosive acids  
Spent acid  
Spent mixed acid  
Spent sulfuric acid

Potential consequences: Heat generation; violent reaction.

#### Group 2-A

Aluminum  
Beryllium  
Calcium  
Lithium  
Magnesium  
Potassium  
Sodium  
Zinc powder  
Other reactive metals and metal  
hydrides

#### Group 2-B

Any waste in Group 1-A or 1-B

Potential consequences: Fire or explosion; generation of flammable hydrogen gas.

#### Group 3-A

Alcohols  
Water

#### Group 3-B

Any concentrated waste in  
Groups 1-A or 1-B  
Calcium  
Lithium  
Metal hydrides  
Potassium  
SO<sub>2</sub>Cl<sub>2</sub>, SOCl<sub>2</sub>, PCl<sub>3</sub>, CH<sub>3</sub>SiCl<sub>3</sub>  
Other water-reactive waste

Potential consequences: Fire, explosion, or heat generation; generation of flammable or toxic gases.

Group 4-A

Alcohols  
Aldehydes  
Halogenated hydrocarbons  
Nitrated hydrocarbons  
Unsaturated hydrocarbons  
Other reactive organic compounds and solvents

Group 4-B

Concentrated Group 1-A or 1-B wastes  
Group 2-A wastes

Potential consequences: Fire, explosion or violent reaction.

Group 5-A

Spent cyanide and sulfide solutions

Group 5-B

Group 1-B wastes

Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.

Group 6-A

Chlorates  
Chlorine  
Chlorites  
Chromic acid  
Hyphochlorites  
Nitrates  
Nitric acid, fuming  
Perchlorates  
Permangantes  
Peroxides  
Other strong oxidizers

Group 6-B

Acetic acid and other organic acids  
Concentrated mineral acids  
Group 2-A wastes  
Group 4-A wastes  
Other flammable and combustible wastes

Potential consequences: Fire, explosion, or violent reaction.

Table G-1. Radioactive Mixed Waste Prohibited from Land Disposal. (sheet 1 of 2)

Solvents and Dioxins <sup>a</sup>		
F001-F005 spent solvents	Concentration	
	Waste waters containing spent solvents	All other spent solvent wastes
Acetone	0.05 mg/L	0.59 mg/L
n-Butyl alcohol	5.0 mg/L	5.0 mg/L
Carbon disulfide	1.05 mg/L	4.81 mg/L
Carbon tetrachloride	.05 mg/L	.98 mg/L
Chlorobenzene	.15 mg/L	.05 mg/L
Cresols (and cresylic acid)	2.82 mg/L	.75 mg/L
Cyclohexanone	.125 mg/L	.75 mg/L
1,2-dichlorobenzene	.65 mg/L	.125 mg/L
Ethyl acetate	.05 mg/L	.75 mg/L
Ethyl benzene	.05 mg/L	.053 mg/L
Ethyl ether	.05 mg/L	.75 mg/L
Isobutanol	5.0 mg/L	5.0 mg/L
Methanol	.25 mg/L	.75 mg/L
Methylene chloride	.20 mg/L	.96 mg/L
Methylene chloride (from the pharmaceutical industry)	12.7 mg/L	.96 mg/L
Methyl ethyl ketone	0.05 mg/L	0.75 mg/L
Methyl isobutyl ketone	0.05 mg/L	0.33 mg/L
Nitrobenzene	0.66 mg/L	0.125 mg/L
Pyridine	1.12 mg/L	0.33 mg/L
Tetrachloroethylene	0.079 mg/L	0.05 mg/L
Toluene	1.12 mg/L	0.33 mg/L
1,1,1-Trichloroethane	1.05 mg/L	0.41 mg/L
1,2,2-Trichloro-1,2,2-trifluoroethane	1.05 mg/L	0.96 mg/L
Trichloroethylene	0.062 mg/L	0.091 mg/L
Trichlorofluoromethane	0.05 mg/L	0.96 mg/L
Xylene	0.05 mg/L	0.15 mg/L
F020-F023 and F026-F028 dioxin containing wastes		
HxCDD-All Hexachlorodibenzo-p-dioxins		1 ppb
HxCDF-All Hexachlorodibenzofurans		1 ppb
PeCDD-All Pentachlorodibenzo-p-dioxins		1 ppb
PeCDF-All Pentachlorodibenzofurans		1 ppb
TCDD-All Tetrachlorodibenzo-p-dioxins		1 ppb
TCDF-All Tetrachlorodibenzofurans		1 ppb
2,4,5-Trichlorophenol		0.05 ppm
2,4,6-Trichlorophenol		0.05 ppm
2,3,4,6-Tetrachlorophenol		0.10 ppm
Pentachlorophenol		0.01 ppm

Table G-1. Radioactive Mixed Waste Prohibited  
from Land Disposal. (sheet 2 of 2)

California list of material barred from land disposal <sup>b</sup>
Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing free cyanides at concentrations greater than or equal to 1,000 mg/L
Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing the following metals (or elements) or compounds of these metals (or elements) of concentrations greater than or equal to the following:
Arsenic and/or compounds (as As) 500 mg/L
Cadmium and/or compounds (as Cd) 100 mg/L
Chromium (VI and/or compounds (as Cr VI) 500 mg/L
Lead and/or compounds (as Pb) 500 mg/L
Mercury and/or compounds (as Hg) 20 mg/L
Nickel and/or compounds (as Ni) 134 mg/L <sup>c</sup>
Selenium and/or compounds (as Se) 20 mg/L
Thallium and/or compounds (as Tl) 130 mg/L
Liquid hazardous wastes having a pH less than or equal to two (2.0)
Liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm <sup>d</sup>
Hazardous wastes containing halogenated organic compounds in total concentration greater than or equal to 1,000 mg/kg

NOTE: Reference: 40 CFR 268.41.

<sup>a</sup>Solvents and dioxins in concentrations greater than listed in this table are barred from land disposal.

<sup>b</sup>Source: 51 CFR 40574 (November 7, 1986).

<sup>c</sup>Prohibited items do not include solid metal (particles) larger than 100 microns or nickel as a component of high nickel alloys.

<sup>d</sup>PCBs are exempt from state regulation under WAC 173-303 in quantities of 50 ppm or greater because this material is controlled by EPA under 40 CFR 761.60. All radioactive waste containing PCBs in excess of 50 ppm is stored at the Hanford Site for future treatment. In concentrations between 1 and 50 ppm, PCBs are buried as hazardous waste, unless prohibited for other reasons. In quantities below 1 ppm, PCBs are not regulated.

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**APPENDIX H**  
**HAZARDOUS WASTE DOCUMENTATION REQUIREMENTS**



### I.1 Applicability

The Uniform Hazardous Waste Manifest is required to accompany all shipments of hazardous waste by the WDOE, EPA, and DOT. A separate manifest is needed for shipments to individual locations. Manifests are initiated by each generator.

### I.2 Required Information

The following information must be entered on each Uniform Hazardous Waste Manifest (fig. H-1):

PLEASE NOTE THAT THE MANIFEST IS A 5-CARBON-COPY FORM. A TYPEWRITER OR HARD POINT PEN SHOULD BE USED SO THAT ALL COPIES ARE LEGIBLE.

- Item 1: Enter the generator EPA identification number and the unique manifest document number. Transfer this number to remarks column in the SWBR and on Hazardous Waste Sticker that is attached to the drum.
- Item 2: Enter the total number of pages used to complete the manifest (first page plus continuation sheets).
- Item 3: Enter the generator's name and mailing address. This address should be the location that will manage the returned manifest forms. The waste location may also be noted when it differs from the generator's address.
- Item 4: Enter the telephone number where authorized generator personnel may be reached in the event of an emergency.
- Item 5: Enter the transporter's name in this block.
- Item D: Enter the transporter's telephone number.
- Item 6: Enter the transporter's EPA identification number.
- Item 7: Enter the second transporter's name (if applicable).
- Item 8: Enter the second transporter's EPA identification number.
- Item 9: Enter the name and complete site address of the facility designated to receive the waste listed on the manifest.
- Item H: Enter the receiving facility telephone number.

Item 10: Enter the Hanford EPA identification number ("WA 789 000 8967").

Item 11: Enter the DOT proper shipping name, hazard class, and identification number (UN/NA) for each waste, as identified in 49 CFR 172.101. Each entry shall have the same waste category.

NOTE: If additional space is needed for waste descriptions, enter the additional information in block J or in item 28 of the continuation sheet.

Item 12: Enter the number of containers for each waste type and the appropriate abbreviation for the type of container:

- DM: metal drums, barrels, kegs
- DW: wooden drums, barrels, kegs
- DF: fiberboard or plastic drums, barrels, kegs
- TP: tanks, portable
- TT: cargo tanks (tank trucks)
- TC: tank cars
- DT: dump truck
- CY: cylinders
- CM: metal boxes, cartons, cases
- CW: wooden boxes, cartons, cases
- CF: fiber or plastic boxes, cartons, cases
- BA: burlap, cloth, paper, or plastic bags.

Item 13: Enter the total quantity of waste described on each line. (Do not include the container.)

Item 14: Enter the appropriate abbreviation for the unit of measure:

- G: gallons (liquids only)
- P: pounds
- T: tons (2000 lb)
- Y: cubic yards
- L: liters (liquids only)
- K: kilograms
- M: metric tons (1000 kg)
- N: cubic meters

Item I: Enter the applicable WDOE waste number(s) for the waste described on each line.

Item J: Enter all package identification numbers (PIN) sent with this manifest. Use item 28 of the continuation page if additional space is required. No containers shall be listed on manifest if not in the shipment.

- Item 15: Generators may use this space to indicate special transportation, treatment, storage or disposal information, or additional waste package information.
- Item 16: The generator must read, sign (by hand), and date the certification statement. In addition, the Traffic Department representative will initial this space when the packages have been inspected.
- Item 17: The transporter must sign and date this block to acknowledge acceptance of the waste described on the manifest.
- Item 19: The receiving facility operator must note in this space any significant discrepancy between the waste described on the manifest and the waste actually received at the facility. Significant discrepancies must be resolved within 15 days after the waste is received. Some discrepancies may be grounds for refusing to accept wastes. Unresolved discrepancies older than 15 days must be reported to WDOE.
- Item 20: The receiving facility operator signs and enters the date of receipt in this space to certify receipt of hazardous materials covered by the manifest, except as noted in Item 19.

Note: Corrosive liquids must not be shipped above or adjacent to oxidizers, flammable solids, or organic peroxides. Consequently, these items should be manifested separately unless transportation can provide space or barriers between these items in the truck. Segregation of hazardous wastes is specified in 49 CFR 177.848. General requirements for loading and unloading hazardous wastes are given in 49 CFR 177.834. The same requirements are applicable to RMW.

### I.3 Distribution

The following is a list of the required distribution for the Uniform Hazardous Waste Manifest.

- The generator obtains the initials of the Traffic Department representative and the transporter's signature, then removes and retains the "generator" carbon copy of the manifest.
- The transporter obtains the signature of the receiving facility operator, then removes and retains the "Transporter #1" carbon copy of the manifest.

- The receiving facility operator, after signing the manifest, removes and retains the treatment, storage, and disposal facility (TSD Facility) carbon copy. The operator then forwards the original and remaining copies to the 200 West Area Support Unit, Room A110, 2750-E Building, 200 East Area.
- The 200 West Area Support Unit makes a copy of the original for reference, and forwards the original manifest to the generator.

NOTE: A generator who does not receive the original manifest within 35 days after shipment must contact the transporter, the receiving facility operator, and the 200 West Area Support Unit to determine the status of the waste.

Complete unshaded parts and forward to: <b>HAZARDOUS WASTE UNIT</b> 2750-E/A119/200-E Rockwell		<b>Rockwell Hanford Operations</b> <b>CHEMICAL WASTE DISPOSAL REQUEST</b>					Logbook No. _____					
Requested by _____		Telephone Number _____	Address _____		Company _____		Manifest(s) cross-reference _____					
Signature _____			Date _____		Waste Location: _____							
<b>WASTE DESCRIPTION (For additional items, continue on the back of this form)</b>												
A Item No.	B No. of Containers	C Container Size	D Total Waste Quantity (kg)	E Container Description	F Waste Description	G Chemical Components	H Weight %	I Physical State	J Hazards	K Waste Status	L Container Status	M Accumulation Date
Example 1	1	55 gal	205	Steel Drum	TURCO Decon 4521 Solution, 10% in Water	TURCO 4521, MSDS Attached Water	10.0 90.0	L	C	O	F	7-3-88
Example 2	1	5 gal	34	Metal Can	Waste from Hg Cleanup	Mercury Rags Soil	1.3 4.0 94.7	S	EP	S	PF	7-7-88
Example 3	23	55 gal	0	Steel Drum	Empty Conoco 32 Oil Drums - Contained Used Oil	Oil - MSDS Attached PCB - Lab Data Attached	100.0 < 1 ppm	L	None	U	MT	7-10-88

**INSTRUCTIONS**

- COLUMN A - ITEM NUMBER** - Item number for each unique waste.
- COLUMN B - NUMBER OF CONTAINERS** - Number of containers of a unique waste to be disposed.
- COLUMN C - CONTAINER SIZE** - Size of containers specified in Column B. If multiple container sizes, specify number and size of each.
- COLUMN D - TOTAL WASTE QUANTITY** - Total waste quantity (in kilograms only) of each unique waste to be disposed.
- COLUMN E - CONTAINER DESCRIPTION** - Specify container type e.g. steel drum, glass bottle.
- COLUMN F - WASTE DESCRIPTION** - Specify trade name or general description of each unique waste.
- COLUMN G - CHEMICAL COMPONENTS** - List all organic and inorganic components of the unique waste using specific chemical names. Attach Material Safety Data Sheets, analytical data, or other documents to adequately describe the composition of the waste.

- COLUMN H - WEIGHT (%)** - For each waste component indicate percent or range of per cents in which the component is present in the waste. Trace amounts of pesticides, herbicides, heavy metals and PCB's should be specified. Components must add up to 100% including water, earth, or other components. If a unit other than percent is used, indicate the unit. When possible, provide test results or other documentation to verify percentages.
- COLUMN I - PHYSICAL STATE** - Indicate whether Solid (S), Liquid (L), or Gas (G) or any combination of these phases.
- COLUMN J - HAZARDS** - Indicate whether waste is Corrosive (C), Ignitable (I), Reactive (R), Toxic (T), Explosive (E), Persistent (P), EP Toxic (EP) or Carcinogenic (X).
- COLUMN K - WASTE STATUS** - Indicate whether waste is: Reacted (R), Treated (T) New (unused) (N), Used (U), Old (or expired) (O), Spill Material (S).
- COLUMN L - CONTAINER STATUS** - Indicate whether container is: Full (F), Partially Full (PF), Empty (< 1/2 in. in 55 Gal Drums) (MT), Triple Rinsed (TR).
- COLUMN M - ACCUMULATION DATE** - Indicate the accumulation date marked on each container.

A 6400-245 (8-86)

Figure H-2. Chemical Waste Disposal Request.

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RHO-MA-222  
REV 4

RHO-MA-222  
REV 4

APPENDIX I

UNIQUE IDENTIFICATION NUMBERS

Each package of transuranic (TRU) waste, and each package of radioactive mixed waste (RMW), whether TRU\* mixed waste or low-level mixed waste, shall have a unique Package Identification Number (PIN). For the remainder of fiscal year (FY) 1987 (until October 1, 1987), the present system of packaging numbering is used. For FY 1988 and future years, a new system will be used. For those waste generators who require explanations, numbering systems will be furnished by the 200 West Area Support Unit upon request of the generator. For future fiscal years, the following system will be used:

- For offsite waste generators:

The numbering system consists of a 12-field code number divided as follows:

RRM#-S#-XXXX

RRM# represents the four-field numeric Westinghouse Radioactive Material Number (RRM number) issued to the various shippers with a new number for each fiscal year.

S# represents a two-field numeric number which identifies the number of the shipment for that year. For example, 01 would be the first shipment of the fiscal year; 02 would be the second shipment, etc.

XXXX represents a four-field numeric number identifying the specific box within the shipment previously designated.

For example, a box labeled 6508-02-0057 would be a box shipped from a waste generator that had been issued the RRM number 6508 for the current fiscal year. The box would be included in the second shipment of radioactive waste from that particular generator in the current fiscal year. Finally, the box would be the 57th individual box, drum, or package within that shipment.

- For onsite waste generators:

The numbering system for onsite waste generators will be similar to the numbering system used by offsite waste generators. The numbering system will consist of a 12-field number as follows:

CCCC-YY-XXXX

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\*While those requirements apply specifically to packages of low-level and TRU mixed wastes, individual numbering of low-level waste packages is not prohibited. It is possible that, in the future, more types of waste will require such identification.

CCCC is a four-field alphanumeric number issued by the 200 West Area Support Unit to each individual onsite waste generator. In general, this number will represent the building from where the waste originated. For example, for the 340 Building, the number may be 340W.

The second two digits (YY) represent the current fiscal year. For FY 1988, the YY would be 88.

The third 4 digits (XXXX) again represent a series of numbers beginning with 0001, which identify the number of the box, drum, or package within the shipping year. For example, a box numbered 309W-88-0231, represents the 231st box shipped from the 309 Building to the 200 Areas of the Hanford Site in FY 1988.

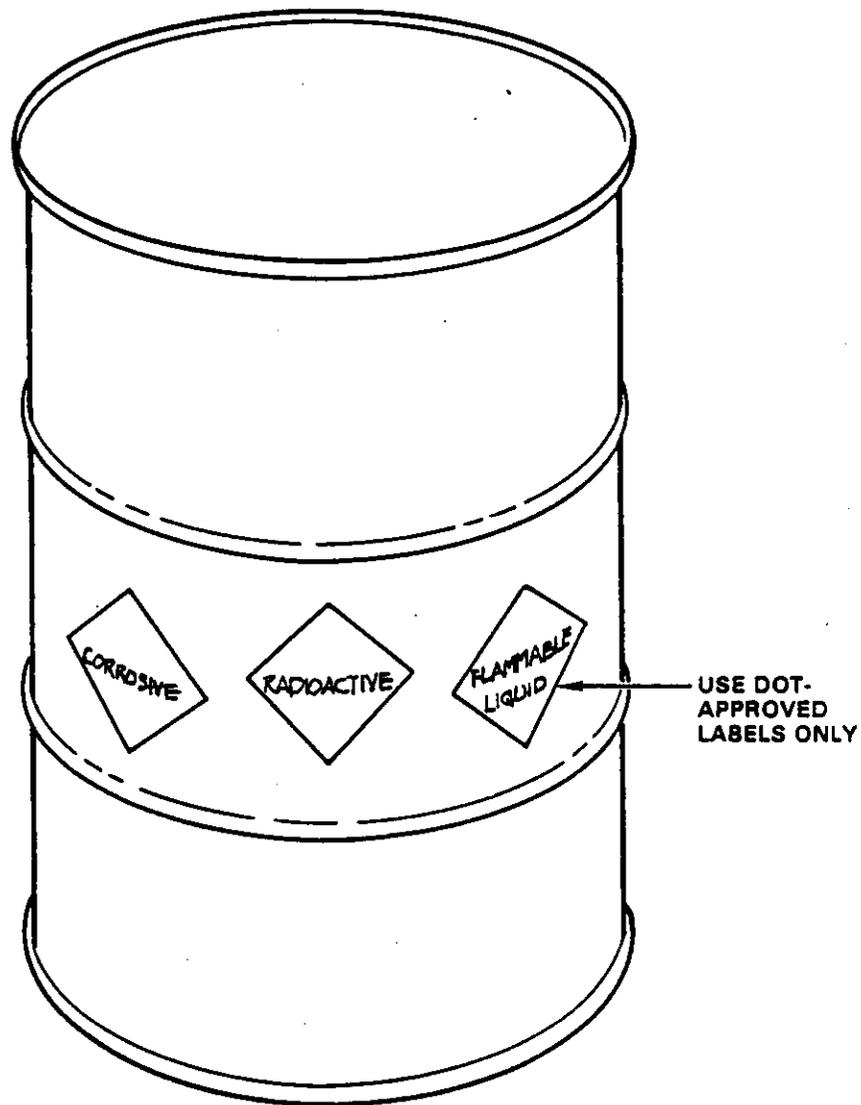
To facilitate correlating hazardous waste manifests with specific boxes, waste manifest numbers will consist of the box number of the first box listed on the manifest, modified as follows:

- Manifest number 309W-88M0231 will be the manifest on which box number 309W-88-0231 is the first box listed on the manifest. Box number 309W-88-0232 and succeeding boxes may also be listed on this manifest. In this manner, if more than one manifest is required in a shipment, it can easily be identified, since the number represents the first box listed on the manifest.

RHO-MA-222  
REV 4

**APPENDIX J**

**MARKING AND LABELING**

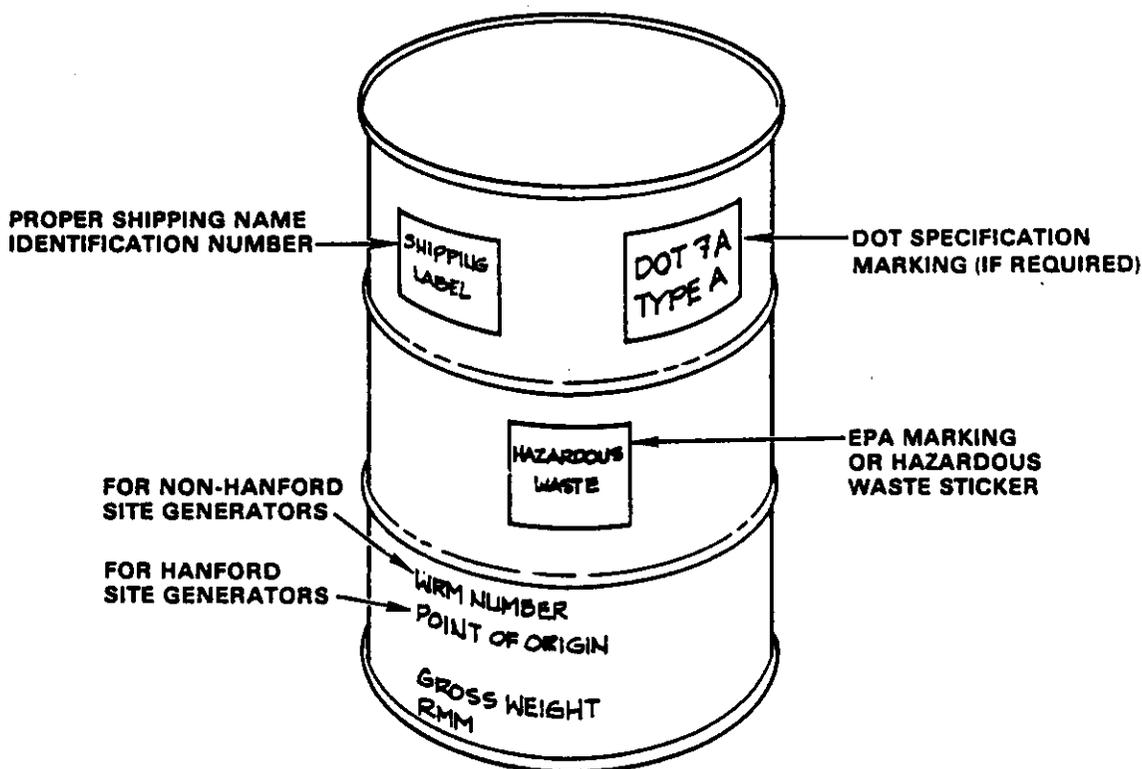


**EXAMPLE**

- APPLY LABELS SPECIFIED IN HAZARDOUS MATERIALS TABLE IN 49 CFR 172.101
- IF MULTIPLE HAZARDS EXIST, APPLY LABEL FOR EACH HAZARD
- USE U.S. DEPARTMENT OF TRANSPORTATION (DOT) APPROVED LABELS ONLY
- APPLY LABELS NEAR PROPER SHIPPING NAME AND IDENTIFICATION NUMBERS

2PS8706-22

Figure J-1. Container Labeling.



DOT - U.S. DEPARTMENT OF TRANSPORTATION  
EPA - U.S. ENVIRONMENTAL PROTECTION AGENCY  
ORM - OTHER REGULATED MATERIALS  
RMW - RADIOACTIVE MIXED WASTE  
RQ - REPORTABLE QUANTITY  
WRM - WESTINGHOUSE RADIOACTIVE MATERIAL

- PROPER SHIPPING NAME
- IDENTIFICATION NUMBER
- EPA MARKING OR HAZARDOUS WASTE STICKER
- SHIPPER/RECEIVER NAME AND ADDRESS (IF NOT TRUCKLOAD)
- "THIS END UP" OR "THIS SIDE UP" (IF INNER PACKAGES WITH LIQUIDS)
- **ORM-XXXX** (IF APPROPRIATE)
- RQ (IF APPROPRIATE)
- SEE 49 CFR 172.101, (C), (9)
- DOT SPECIFICATION
- MARKINGS SHALL BE PLACED IN THE UPPER ONE-THIRD OF THE DRUM AS PER DOT

2P88706-23

# HAZARDOUS WASTE

STATE AND FEDERAL LAW  
PROHIBITS IMPROPER DISPOSAL  
IF FOUND, CONTACT THE NEAREST POLICE, OR  
PUBLIC SAFETY AUTHORITY, OR THE  
U.S. ENVIRONMENTAL PROTECTION AGENCY

① PROPER D.O.T.  
SHIPPING NAME WASTE ACID, LIQUID, N.O.S. UN or NA# 1760

GENERATOR INFORMATION:

NAME DEPARTMENT OF ENERGY

ADDRESS P.O. BOX 555, 2401 STEVENS DR.

CITY RICHLAND STATE WA ZIP 99352

② EPA ID NO. WA7890008967 ③ EPA WASTE NO. D002, WT02

ACCUMULATION START DATE 9-22-86 ④ MANIFEST DOCUMENT NO. \_\_\_\_\_

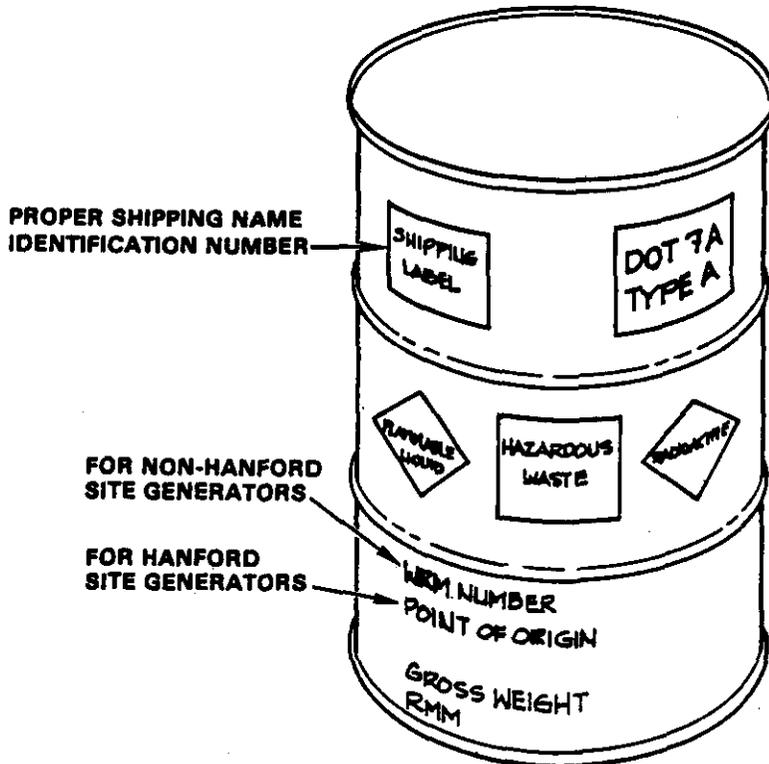
**HANDLE WITH CARE!**  
CONTAINS HAZARDOUS OR TOXIC WASTES  
STYLE WM-6-P

Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., INC., CHICAGO, IL 60648

- ① FROM 49 CFR 101, HAZARDOUS MATERIALS TABLE
- ② EACH GENERATOR SHALL HAVE AN IDENTIFICATION NUMBER
- ③ FROM APPROVED BCC (PAGE 3)
- ④ FROM ITEM 1 OF EPA HAZARDOUS WASTE MANIFEST

2PS8706-24

Figure J-3. Hazardous Waste Marking.

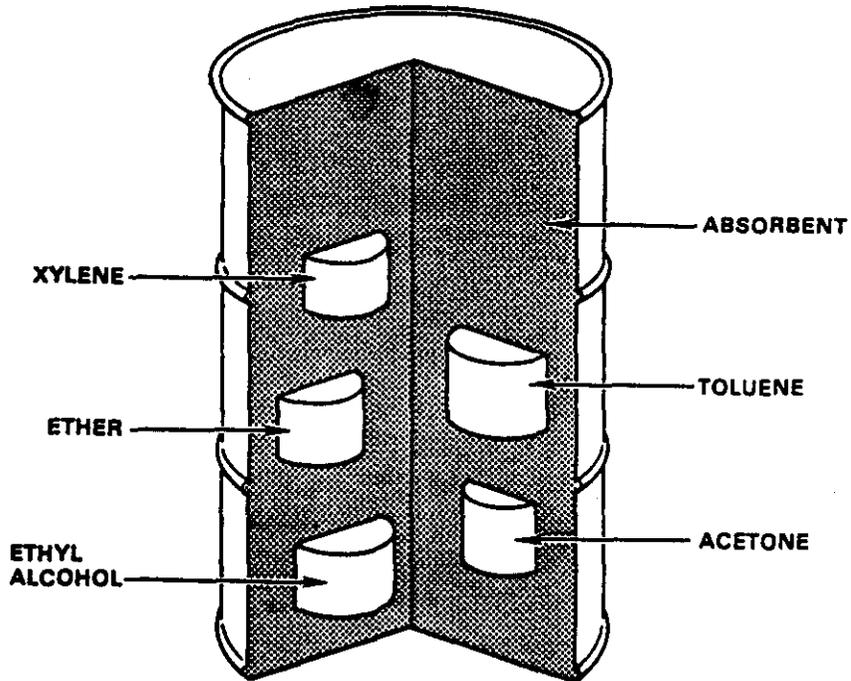


FOR NON-HANFORD  
SITE GENERATORS

FOR HANFORD  
SITE GENERATORS

EXAMPLE

- DOT - U.S. DEPARTMENT OF TRANSPORTATION
- EHW - EXTREMELY HAZARDOUS WASTE
- RMW - RADIOACTIVE MIXED WASTE
- WRM - WESTINGHOUSE RADIOACTIVE MATERIAL



RADIOACTIVELY CONTAMINATED  
LIQUID CHEMICALS

2PS8706-2B

Figure J-4. Liquid Radioactive Mixed Waste Packaging (note: liquid radioactive mixed waste is not routinely accepted at the Hanford Site).

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