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**CERTIFICATION DOCUMENT FOR NEWLY GENERATED
CONTACT-HANDLED TRANSURANIC WASTE**

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*Operations Division.

Date of Issue - January 1984

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**CERTIFICATION DOCUMENT FOR NEWLY GENERATED
CONTACT-HANDLED TRANSURANIC WASTE**

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ABSTRACT

The U.S. Department of Energy has requested that all national laboratories handling defense waste develop and augment a program whereby all newly generated contact-handled transuranic (TRU) waste be contained, stored, and then shipped to the Waste Isolation Pilot Plant (WIPP) in accordance with the requirements set forth in WIPP-DOE-114.

The program described in this report delineates how Oak Ridge National Laboratory intends to comply with these requirements and lists the procedures used by each generator to ensure that their TRU wastes are certifiable for shipment to WIPP.

1. INTRODUCTION

The primary objectives of Oak Ridge National Laboratory's (ORNL's) Certification Program are to ensure that all newly generated contact-handled transuranic (TRU) wastes meet the criteria set forth in ref. 1 and are packaged so that both transportation to the Waste Isolation Pilot Plant (WIPP) and subsequent operations may be performed safely and adequately. The diverse activities of the various ORNL divisions necessitate the use of general Laboratory-wide policies and procedures, which are then supplemented on the Division level by those of a specific nature addressing the particular field of research and/or development unique to the individual facility.

An example of general Laboratory-wide policies is Procedure 5.1 of the ORNL Health Physics Procedures Manual.² An individual facility procedure is shown in the Radioactive Solid Waste Operation Manual.³

This certification plan describes the methods and procedures utilized by ORNL in meeting the criteria set forth in WIPP-DOE-069, Rev. 2 (ref. 1) and states the requirements contained in pertinent ORNL policies as well as the quality assurance (QA) requirements in WIPP-DOE-120, Rev. 1.⁴

This plan also presents the organizational structure of ORNL, an overview of the waste generation and treatment operation, and details on data collection and archiving. The appendix contains information describing ORNL's retrievable solid waste storage facilities where the contact-handled TRU waste will be stored until it is shipped to WIPP.

2. PURPOSE AND FEATURES

2.1 REQUIREMENTS FOR CERTIFICATION

The purpose of this document is to provide the required information supporting the premise that the contact-handleable (CH) TRU waste generated at ORNL meets the criteria set forth in WIPP-DOE-069, Rev. 2¹ and the underlying compliance requirements in WIPP-DOE-114, Rev. 1.⁵

This information pertains to the operating and QA procedures utilized during the generation, containerization, and storage of the waste, as well as pertinent data concerning all phases of the specific TRU waste package. The waste package is the combination of waste container and waste.

The procedures referenced in Sects. 3, 5, 6, 7, and 8, which cover the 19 requirements presented in WIPP-DOE-114, Rev. 1,⁵ have been addressed under four main headings: (1) general requirements, (2) waste container requirements, (3) waste form requirements, and (4) waste package requirements.

The general requirements deal with the organizational structure of the plant, site flow diagrams, and general waste stream control methods. Those requirements that pertain primarily to the purchase of the waste containers with respect to construction material, size, and features incorporated for handling are considered waste container requirements. The waste form requirements deal with the specific physical and chemical properties of the waste that is to be emplaced in the containers for shipment to WIPP. Finally, the waste package requirements address the total package criteria for factors such as weight, criticality, dose rate, surface contamination, thermal power, gas generation, color-coding, and labeling.

2.2 OVERVIEW OF WASTE GENERATING OPERATIONS

Contact-handleable TRU wastes are those materials (without regard to source or form) which at the end of institutional control periods are contaminated with alpha-emitting radionuclides of atomic numbers greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nCi/g as defined in DOE Order 5820, as well as materials specifically designated by the ORO Manager.

Materials to be managed as TRU-contaminated materials are ^{226}Ra isotopic sources and those other materials that, without regard to source or form, are contaminated with transuranic elements with half-lives greater than 20 years and are above either of the following control values:

1. TRU alpha contamination greater than 100 nCi/g, or
2. smearable TRU alpha contamination greater than 4000 dpm/cm² averaged over the accessible surface.

The ingrowth of TRU daughter products shall be considered in determining whether materials are above or below the control values. For emitters with alpha half-lives less than 20 years and for beta emitters, the concentration of the first alpha-emitting daughter at the time of maximum activity must correspond by calculation to the control values of alpha activity. For example, ^{241}Pu is a beta emitter which decays with a 14.37-year half-life into ^{241}Am , an alpha emitter with an alpha half-life of 438 years. The peak buildup of ^{241}Am (or subsequent alpha emitters) is 2.6% of the initial ^{241}Pu activity in the waste. By dividing the 100-mCi/g maximum alpha activity by 0.026, a control value of 3850 mCi/g (beta) is obtained for waste contaminated only with ^{241}Pu .

Most TRU waste at ORNL is generated by divisions that have research projects, and usually only small quantities (fraction of a gram to several grams) of the TRU isotopes are contained in large quantities (kilograms) of discarded material. Most TRU waste has such low levels of penetrating radiation (<200 mrem/h at the container surface) that the containers can be handled without extensive shielding; this CH waste generates very little heat (a few hundredths of a watt per container).

About 1 vol % of the stored TRU waste is considered as remote handled and has high neutron and/or beta-gamma radiation levels, up to 30,000 rem/h. Thermal output of this waste may be a few hundred watts per container. Separate procedures will address the handling of this type of waste.

As stated in the preceding paragraph, the majority of TRU waste results from research projects that have finite life spans. This means

that although a particular glove box may be used in a project from a few weeks to years, in most cases the type of TRU waste discharged is about the same for all projects.

2.3 SCOPE AND ORGANIZATION OF THE CERTIFICATION PLAN

The following sections describe, with appropriate reference to documented controls and supporting data, various site-specific activities relating to the CH-TRU Waste Certification Program. Specifically, the Certification Plan (1) details the QA/quality control (QC) requirements for safe packaging and transportation of contact-handleable TRU waste as well as the procedures used to implement this plan; (2) outlines and illustrates by organization chart the structures, management responsibilities and authorities, and interfaces of the waste generating, processing, and supporting organizations that participate in the Certification Program; (3) describes the data collecting and archiving methods and records control; (4) references the procedures used in the procurement and handling of waste containers and related control methods; and (5) describes the waste generating and processing operations.

3. IMPLEMENTATION OF CERTIFICATION QUALITY ASSURANCE REQUIREMENTS

3.1 PURPOSE AND SCOPE

As defined collectively in the Code of Federal Regulations (10 CFR 50, Appendix B), DOE Order 5700.6A, Quality Assurance Program Requirements for Nuclear Power Plants [ANSI/ASME NQA-1-1979 (NQA-1)], and WIPP-DOE-120, Rev. 1,⁴ QA comprises all those planned and systematic

actions necessary to provide adequate confidence that a facility, structure, system, component, or process will perform satisfactorily in service. Quality assurance includes QC, which comprises all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.⁵ If the QA activities are effective, the documentation related to waste certification will be valid and adequate for performing the waste package certification activities.

DOE Order 5700.6A requires all DOE programs and their contractors to have QA. In addition to the general requirement for QA in all DOE programs, all TRU waste that is packaged for shipment to WIPP is required to have QA and the concomitant documentation. The Department of Energy issued Certification QA Requirements, adapted from the basic requirements of NQA-1, that are to be the bases for the certification-related QA activities of the waste generators. The following principles adapted from the ORNL Quality Assurance Manual⁶ are considered:

- Primary emphasis shall be on achieving a high degree of operational success, recognizing that safety, environmental protection, reliability, and performance are integrally related through the compliance requirements.
- QA activities shall be identified to the extent to which the Certification QA Requirements shall be applied.
- Organizational responsibility and authority for activities affecting waste processing and certification shall provide for the effective implementation of the Certification Program and command effective management support.

- The Certification Plan must be amenable to internal and external audits and surveillance.

3.2 CERTIFICATION QA PLAN

This section describes the content of the Certification QA Plan for TRU waste. The use of the term QA Plan in this section provides consistency with the terminology used in the Certification QA Requirements.⁴ In developing this plan, the maximum advantage has been taken of existing QA personnel, policies, and practices. Existing site documents on QA, operating, and administrative procedures have been referenced, when possible. The QA program in operation at ORNL is best described in the program description (Sect. 1) of the ORNL Quality Assurance Manual.

It is the responsibility of the individual divisions of ORNL to ensure compliance with all QA plans that have been approved by the Quality Assurance Department. To this end, each division has appointed a Quality Assurance Coordinator (QAC) to ensure implementation of their divisional QA Plan. The QAC reports to the Division Director and is his direct representative in all matters pertaining to QA.

Table 3.1 is designed to show how the ORNL QA Program interfaces with 10 CFR 50, Appendix B. Section 3.3 provides the specific QA procedures in use to ensure compliance with the 18 requirements listed in WIPP-DOE-120, Rev. 1.⁴

3.3 QA PROGRAM ELEMENTS

This section attempts to define all those planned and systematic activities which will ensure that ORNL's TRU Waste Certification Program

Table 3.1. Cross references of QA standards

QA element	Paragraph reference in QA program description	Criteria reference in 10 CFR 50, ^a App. B
QA program	3.3.1	II
Organization and responsibilities	3.3.2	I
Design control	3.3.3	III
Procurement document control	3.3.4	IV
Instructions, procedures, and drawings	3.3.5	V
Document control	3.3.6	VI
Control of purchased material, equipment, and services	3.3.7	VII
Identification and control of items	3.3.8	VIII
Control of processes	3.3.9	IX
Inspection	3.3.10	X
Test control	3.3.11	XI
Control of measuring and test equipment	3.3.12	XII
Handling, storage, and shipping	3.3.13	XIII
Inspection, test, and operating status	3.3.14	XIV
Control of packages	3.3.15	XV
Action	3.3.16	XVI
Certification records	3.3.17	XVII
QA audits	3.3.18	XVIII

^aCode of Federal Regulations, Title 10, Part 50.

will perform satisfactorily. The waste is not the product, and QA/QC is not applied to the wastes as a product, but to the certification activities for shipment of waste to WIPP.

3.3.1 Organization

ORNL is operated for DOE by Union Carbide Corporation, Nuclear Division (UCC-ND), which provides the Laboratory as well as other Nuclear Division facilities with a centralized Office of Quality Assurance.

This office establishes and interprets the overall UCC-ND QA Program and coordinates its implementation. The office also serves as a focal point for UCC-ND communication with the Standards and Quality Assurance Division of the DOE Oak Ridge Operations Office (DOE-ORO). The organization chart detailing the responsibilities of this office is shown in Fig. 3.1.

Quality assurance activities at ORNL are coordinated by the Quality Assurance Program Director (QAD), who reports to the Director for Quality Assurance and Inspection. Quality Assurance and Inspection is under the Director for Administrative Services. The QAD staff consists of two QA Specialists and a Reports and Data Assistant responsible for QA audits, QA training and motivation, and QA procedures. Each research and development (R&D) division and each service division supporting such programs has one or more QACs appointed by its respective division director to coordinate the QA activities within the division. The ORNL organization is shown in Fig. 3.2 and the QA organization in Fig. 3.3.

The QAC interfaces directly with the various operating components of the division and with the Quality Assurance Department. It is the duty

Fig. 3.1. Organization chart of Union Carbide Corporation, Nuclear Division.

Fig. 3.2. Organization chart of Oak Ridge National Laboratory.

Fig. 3.3. Organization chart of ORNL Quality Assurance Program.

of the QAC to (1) review proposed additions or deletions to the QA plans, (2) schedule periodic formal reviews of existing QA plans, (3) conduct periodic audits and investigate any nonconformance items, and (4) review and approve divisional QA requirements on engineering documents. His reports are sent to the Division Director, operating components involved, and the Quality Assurance Department.

3.3.2 Quality Assurance Program Plan

This requirement is discussed in Sect. 3.2.

3.3.3 Design Control

At the present time, no design work relating to TRU waste certification is performed at ORNL, and thus no control of design is necessary. If such design work is initiated in the future, a revision of this plan conforming to ORNL QA Procedure QA-L-2-100 will be prepared and submitted for approval.

3.3.4 Procurement Document Control

ORNL ordering divisions are responsible for ensuring that documents necessary for procurement (such as plans, specifications, engineering drawings, instructions, procedures, codes, standards, requisitions, and purchase orders) are prepared and are made a part of the contract. Quality-related subjects that are covered by documents such as these are source selection and evaluation, supplier's QA program, material inspections, nondestructive examination, fabrication, processing, documented supplier reports and due dates, supplier data packages, supplier certifications, supplier nonconformances, supplier deviations, QA audits,

source surveillance and inspection, shipping, operating manuals, equipment acceptance tests, and quality records (see ORNL QA Procedure QA-L-9-100).

3.3.5 Instructions, Procedures, and Drawings

Activities affecting quality are controlled by procedures contained in the ORNL QA Manual or in division or program procedures manuals, which are approved by division or program directors. The ORNL Standard Practice Procedures Manual contains instructions and procedures that also are applicable to a QA program.

Operating procedures and/or work instructions are prepared by the line organization for predetermined conditions of start-up, normal, shutdown, and emergency operations. Operating logs and check lists are used to record actual operating events. Operational reviews are conducted periodically to evaluate the methods and procedures used in operating the project.

3.3.6 Document Control

Documents (such as plans, drawings, specifications, procedures, and instructions) that establish the item description and quality requirements or that prescribe inspections and tests to determine compliance of the completed item with technical requirements are defined as quality-related documents. Changes to these documents are reviewed and approved by the same organization that performed the original review and approval (see QA procedure QA-L-3-100).

Quality-related documents are approved by a designated individual and normally by the QAC. These approvals verify that particular control requirements applicable to the document have been satisfied and that the

designated individual certifies that the document is acceptable for its intended use. Understanding and acceptance are indicated by the signature and the date on the document.

The initial release and distribution of documents and changes thereto are the responsibility of a designated releasing authority. The releasing authority is also responsible for directing the user how to dispose of obsolete quality-related documents previously issued and for obtaining any necessary verification that such action has been taken, whenever required by the complexity of the project.

Controlled quality-related documents are uniquely numbered, and they are identified on a controlled master list so that the letter or number to designate the current issue can be quickly and easily checked to ensure that the most up-to-date version of a document is used. This list is updated on a periodic basis as documents are changed and reissued. Between updatings of the master list, document changes are permitted when supported by approved Deviation Notices (UCN Form 5458A). Documents that may be changed with such notices are Controlled Manufacturing Manual (CMM); Controlled Manufacturing Procedures (CMP); drawings, specifications, and procedures; and manufacturing and inspection plans.

3.3.7 Control of Purchased Materials, Equipment, and Services

When requested by project management, source surveillance of suppliers and manufacturers is performed during the course of a procurement by designated ORNL personnel. In such events, inspection personnel are periodically sent to a supplier's plant or may be called upon by

project management. Inspection personnel include in their reports recommendations for any required corrective action (see QA Procedure QA-L-9-100).

Any proposed changes to design documents, standards, specifications, manufacturing procedures, inspection and test procedures, QA programs, or other documents forming a part of procurement contracts must meet the requirements of WIPP-DOE-114, Rev. 1.⁵

Data packages on completed items are submitted to the using division after being reviewed for compliance with technical and quality-related requirements. The Materials Department in the receiving plant performs routine receiving inspection and ensures that the agency designated to perform special inspections, as indicated on the purchase requisition, is notified. Receiving-inspection results and all quality-verification documentation submitted by the supplier are transmitted to the ordering division. Nonconformances are transmitted to the Contract Administrator of the UCC-ND Purchasing Division so that contracts will not be closed out until corrective measures are taken and the item is fit for intended use.

3.3.8 Identification and Control of Items

Special high-quality items (including instruments, materials, parts, components, and subassemblies) are identified in a manner which provides direct traceability to the documentation that verifies the acceptability of the items. This means of control was established to ensure that non-conforming materials, parts, and components that have been rejected will not be used. Supplier-provided items are identified and documented by

the supplier in a manner consistent with applicable codes or in the manner specified in the procurement documents.

Upon the user division's receipt of materials, parts, and components, inspections are made according to preplanned procedures and test specifications. If the items are incorrectly identified or incorrectly documented, they are not accepted until the condition is resolved.

Incorrect or defective material, parts, and components are identified with "hold tags" and are handled in accordance with the ORNL QA manual, "Nonconforming Items" (QA Procedure QA-L-6-100).

3.3.9 Control of Processes

The use of welded containers and nondestructive testing techniques (e.g., drum and x-ray scanners) makes process control necessary. These processes are controlled by procedures that conform to ASME Code Sect. III, VIII, or IX or by other requirements determined during the design phase. The application of a special process is specified on the applicable drawing of the component, system, or structure. Special processes are performed in accordance with written procedures or instructions, and means are provided for recording evidence of verification of the processes.

Personnel, procedures, and equipment associated with metal joining and nondestructive examination (NDE) are qualified, and the results are documented in accordance with the requirements of ASME Code, Sect. IX, ASNT SNT-TC-1A, or specially developed procedures. Qualification of other procedures and equipment is based on previous successful operation.

Welder qualification records are stored in a computer data base which is readily accessible to inspectors and welding supervisors. Records include welder's name, weld procedure, position, date of last weld, and expiration date of his qualification. The supervisor of special processes is responsible for ensuring that personnel under his/her supervision are qualified to perform a particular process. When qualification records are required, they are maintained by the cognizant supervisor of the particular special process.

3.3.10 Inspection

Quality Assurance and Inspection (QA&I) is an independent inspection group. QA&I performs source surveillance, special receiving inspections, and ASME code inspection activities. When requested by the user, QA&I also monitors inspection activities in supplier's facilities.

All material received from suppliers is routinely inspected by ORNL Materials Department personnel for damage, quality, and item descriptions. Special inspections are performed, when required, in accordance with requirements contained on purchase requisitions.

Mandatory hold points are identified on the manufacturing plan by QA&I to satisfy the requirements of the user, the ASME Code Inspector, and the QAC.

The neutron interrogation assay system identifies the isotopic composition and quantities, and the x-ray scanner verifies the conformance of the waste form to the requirements. The ORNL Analytical Chemistry Division performs chemical analyses of materials in support of procurement, manufacturing, and construction activities. These analyses are

normally performed to verify the chemical composition of various metal products.

3.3.11 Test Control

Test control consists of NDE of the waste package prior to certification. The NDE methods include x-ray examination to ensure compliance with waste form criteria and neutron interrogation assaying to ensure compliance with radioactivity criteria. The records generated in these tests are retained onsite for 25 years after shipment to WIPP.

3.3.12 Control of Measuring and Test Equipment

For a systematic approach to proper calibration, all measuring and test equipment (M&TE) at ORNL is categorized according to one of the following application categories (see QA Procedure QA-L-14-100): (1) "casual" devices and systems that are not to be calibrated in service, (2) "routine" devices and systems that are to be included in a calibration recall program on a regular cycle, and (3) "experimental" devices and systems that are to be calibrated by, or at the direction of, the user.

Calibration control is achieved by following procedures that describe calibration techniques and requirements for the frequency of calibration of the operating instruments. This control ensures that all instruments, gauges, and other M&TE are calibrated to the required accuracies. The supervisor responsible for operations ensures enforcement of the calibration controls. The requirements for the control and calibration of M&TE are found in QA Procedure QA-L-14-100.

3.3.13 Handling, Storage, and Shipping

Special requirements for handling, storage, shipping, cleaning, and preservation are specified on drawings, specifications, instructions, and work-authorizing documents. These documents are verified by review and approval by qualified project and QA personnel.

Hoisting equipment and accessories are routinely inspected and tested in accordance with written procedures (Sect. 14, ORNL Quality Assurance and Inspection Manual) and at specified intervals. Special handling tools and equipment are inspected and tested in accordance with requirements on drawings, specifications, and work-authorizing documents.

The storage facility for contact-handled TRU waste is detailed in the Appendix.

3.3.14 Inspection, Test, and Operating Status

Each package shall be subjected to inspection and testing by the neutron interrogation assay system and by x-ray examination. The status of each package shall be plainly marked on check sheets or on tags attached to the package. Any package that fails to meet the requirements of WIPP-DOE-114 shall be returned to the waste generator for rework. Approved packages shall be identified and segregated in preparation for shipment.

3.3.15 Control of Packages

Written procedures govern the action that should be taken upon discovery of nonconforming items and also govern their control, identification, reporting, and disposition. The control actions specified in these procedures are applied through tests and inspections during in-plant or vendor manufacture, receiving of purchased items, installation, and preoperational evaluation (see QA Procedure QA-L-6-100).

When inspection, testing, analyses, or other QA actions indicate a nonconforming item, a HOLD tag or REJECT tag is attached to the item, and the questionable piece is physically segregated from other like items whenever possible. All packages of waste for shipment to WIPP shall be analyzed by the neutron interrogation assay system and the x-ray scanner. They shall also be surveyed for radiation and contamination levels and weighed. Any package that contains less than the TRU lower level (100 $\mu\text{Ci/kg}$) will be disposed of onsite, and any that are over the set upper limit for CH waste will be returned to the generator for repackaging or reworking.

3.3.16 Corrective Action

Unusual or unplanned events that have an adverse effect on quality (such as malfunctions, unapproved deviations, and other quality problems) are noted in nonconformance reports, unusual occurrence reports, or quality investigation reports. Where such conditions indicate that the quality system requires improvement or modification, actions are taken to identify the particular problem and to determine appropriate measures that will correct the condition and preclude a recurrence (see QA Procedure QA-L-6-101).

3.3.17 Certification Records

All records pertinent to the certification process shall be stored at ORNL for 25 years. These records shall include the following:

1. Records pertaining to the purchase, fabrication, and approval of waste containers to be used for shipment of waste to WIPP shall be maintained by UCC-ND Purchasing.

2. Records pertaining to the loading of the waste into containers for shipment shall be maintained by the waste generator.
3. Records pertaining to the testing, approval, storage, and shipment of packages to WIPP shall be maintained by Solid Waste Storage Area (SWSA) management.

3.3.18 Audits

A series of internal audits and reviews is performed by the ORNL QA Lead Auditor and the QACs to verify compliance with all aspects of the ORNL QA Program. These audits are conducted in accordance with ORNL QA Procedure QA-L-8-100. DOE-ORO performs annual QA Appraisals of the ORNL QA Program.

Quality assurance and QC audits of suppliers are normally conducted by QA&I and/or by qualified personnel from the ORNL user divisions and/or by other experts selected by the user divisions. These audits are scheduled by the user divisions on the basis of quality requirements.

4. WASTE GENERATION AND MANAGEMENT: ORGANIZATIONAL STRUCTURES AND INTERFACES

4.1 ORGANIZATIONAL STRUCTURE

Management at ORNL utilizes the matrix management theory (Fig. 4.1). The solid waste storage operation reports to the Waste Management Operations Program Manager, who in turn is accountable to the Nuclear Waste Program Director. This director then reports to an Associate Director of the Laboratory. Some of the TRU waste generators report to this same associate director, but other waste generators (as well as the QA personnel) report to other associate directors.

Fig. 4.1. Waste management structure at ORNL.

The individual waste generators are responsible for ensuring that the waste will be acceptable to WIPP. The Waste Management Operations Program Manager will give the final signature for shipment to WIPP.

The overall WIPP-Waste Acceptance Criteria Program has been coordinated under the guidance of the Nuclear Waste Program Director in conjunction and cooperation with the individual divisions at ORNL.

4.2 INFRASTRUCTURE OF THE ORGANIZATION CHART

Figure 4.2 lists the formal offices and job titles of key personnel who participate in the Certification Program. In general, they coincide with the blocks in the organization chart detailed in Fig. 4.1.

5. DATA COLLECTION AND ARCHIVING

Data concerning the certification and storage of TRU waste are summarized on a Waste Storage Data Sheet and transmitted to the Solid Waste Storage Group along with the waste. This information is placed in computer storage for retrieval as needed. The individual waste-generating divisions are responsible for maintaining backup records for the Waste Storage Data Sheet in the form of log books, runsheets, transfer forms, etc. Each package is surveyed by a representative of the Industrial Safety and Applied Health Physics Division (IS&AHP), who certifies the radiation and contamination level on the Waste Storage Data Sheet. All data are kept at least 25 years.

Fig. 4.2. Abridged organizational listing of the ORNL Certification Program.

6. CONTAINER PROCUREMENT AND HANDLING

6.1 DRUMS

6.1.1 Description of Acceptable Drums

The standard, acceptable drums used for storage and shipment of CH TRU waste are 30- and 55-gal stainless steel drums, which meet the requirements of the Department of Transportation (DOT) Specification 17C. The drums must meet all applicable requirements for Type A packaging of radioactive material and must have a design life of 25 years after emplacement. The earliest date for emplacement is assumed to be 1989, so the package must also have sufficient design life to cover the period from time of generation to time of emplacement.

The 30- and 55-gal stainless steel drums are provided at the user's expense by the Solid Waste Storage Area (SWSA) operating staff, using UCC-ND purchasing procedures; the drums purchased must meet the required specification. No other drums are to be used for this purpose.

6.1.2 Combustibility of Drums

Combustible TRU waste material must be packaged in noncombustible containers. The use of stainless steel 30- and 55-gal drums meets the requirements.

6.1.3 Waste Drum Size

Because of the limitations of handling equipment both at the waste-generating site and the receiving site, it is necessary that the drum size be limited. At the same time, handling very small containers can also pose problems. For this reason, the drums are limited to 55- and 30-gal sizes.

6.1.4 Waste Drum Handling

The waste drums are fitted with full removable gasketed drum heads closed by means of a bolted ring. The drums may be handled by drum slings or lifters. Since it will be necessary that several drums be packaged in drum assemblies prior to shipment to WIPP, no welded lifting lugs or rings are allowed on the drums themselves.

6.1.5 Procurement Procedures

As mentioned in Sect. 6.1.1, the drums used for the storage and shipment of CH TRU waste have been procured through the UCC-ND purchasing procedure and have been purchased to the required specifications. Since the drums are to meet a DOT specification (17C), they are considered "standard items." The term "standard items" has the following meaning:

Those items procured according to the seller's description or national consensus standards and normally delivered from the seller's stock (off the shelf).

This definition is taken from the Procurement Control Procedure (QA-L-9-100) of the ORNL Quality Assurance Procedures Manual (see Appendix Q of the manual). The requirements for purchase requisition, bidding, receiving, and inspecting are included in this procedure.

6.2 OTHER CONTAINERS

6.2.1 Introduction

As can be readily seen, the use of 30- and 55-gal drums for the storage and transportation of CH TRU waste has its limitations. Some waste is too bulky to fit into such containers, and the problems of contamination control, radiation exposure, and standardization of operations

are the same as were encountered with drum-loadable waste; thus, it is necessary that other containers be considered. This section describes the sizes, types, and limitations of containers other than drums.

6.2.2 Description of Acceptable Containers

In lieu of drums, metal boxes are acceptable containers. These metal boxes must (1) meet all acceptable requirements for Type A packaging and (2) have a design life of 25 years after emplacement. Testing of containers to meet Type A criteria must be performed and documented prior to using a container type.

Standardized containers (WIPP-approved DOT Type A) for use where the waste is too bulky to be placed in drums are obtained at the user's expense from the SWSA operating staff. These containers have been procured through UCC-ND purchasing procedures and have been purchased to the required specifications. All containers used for CH TRU waste must have the approval of the SWSA management [see Radioactive Solid Waste Operations Manual,³ Procedure 3.3, Sect. 3.3.1 (to be revised)].

6.2.3 Combustibility of Containers

The use of metal boxes meets the requirement that combustible TRU waste be packaged in noncombustible containers.

6.2.4 Waste Package Size

Rectangular metal boxes that have the following nominal outside dimensions are acceptable:

1. 74.5 in. long x 50.5 in. wide x 38.5 in. high,
2. 68 in. long x 56 in. wide x 38.5 in. high,
3. 88 in. long x 54 in. wide x 54 in. high, and
4. 112 in. long x 68 in. wide x 77 in. high.

These dimensions have been set because of (1) the limitations of handling equipment both at the generating site and at WIPP, (2) the need

for overpacking existing containers, and (3) the need for interfacing with the TRUPACT shipping system.

6.2.5 Waste Package Handling

All packages other than drums must be provided with cleats, off-sets, chins, or skids for handling by means of fork trucks, cranes, or similar devices. Any lifting rings or other auxiliary lifting device shall be recessed, offset, or hinged in a manner that does not inhibit stacking.

6.2.6 Procurement Procedures

As mentioned in Sect. 6.2.2, containers other than drums used for the storage and shipment of CH TRU waste must be procured through the UCC-ND purchasing procedure and must be purchased to the required specifications. These metal boxes do not at the present time meet a standard DOT specification and are considered "special items" by ORNL. The term "special items" has the following meaning at ORNL:

Those items procured according to special descriptions and requirements provided by UCC-ND (Company). They are normally based on performance specifications or detail design drawings and/or specifications provided by the Company.

This definition is taken from the Procurement Control Procedure (QA-L-9-100) of the ORNL Quality Assurance Procedures Manual. The requirements for purchase requisition, bidding, receiving, and inspection are included in this procedure.

If, in the future, the DOT issues standard specifications concerning these containers, all procurement will be made to these specifications.

7. WASTE GENERATION AND TREATMENT

7.1 INTRODUCTION

TRU waste is generated by many of the programs at ORNL. This diversity explains the rationale for giving the individual divisions the responsibility of ensuring that the waste for WIPP meets the criteria, rather than forming one organization that would lack the authority to cross divisional lines.

After the individual generator has filled, sealed, and identified the waste container, Health Physics personnel smear and survey the drum before shipment to the drum assayer (see description in Appendix). An assay is performed in the drum counter, and the data package is assembled. The drum is then certified and sent to interim storage.

7.2 GENERAL WASTE STREAMS/CONTROL MATRIX

7.2.1 Standard Drums

Most of the TRU waste generated at ORNL results from hot-cell glove box operations in which R&D experiments are carried out (Fig. 7.1). These wastes consist of ion-exchange resins, tools and machinery, glassware, plasticware, rubber gloves, gaskets and other rubber parts, wipes (paper and cloth), ventilation filters, metal parts, electrical equipment, and general waste generated during the operation of the glove boxes.

Methods of waste preparation, layers of containment, and waste forms generated from various facilities at ORNL are noted in Sect. 7.3.1 and tabulated in Table 7.1.

Fig. 7.1. Flow diagram of waste at ORNL.

Table 7.1. Divisional waste preparation methods

Waste form	Div. ^a /Bldg. or Dept. ^b	Method of waste preparation ^c for shipment	Remarks
Ion-exchange resin	CT/7920, 7930	1, 3, 5, 6, 7, 8	
	CT/3508	1, 3, 5, 6, 7, 8	
	OP/3038-3028	1, 3, 5, 7	
	CH/5500	1, 3, 5, 6, 7, 8	
	AC/2026	1, 3, 5, 6, 7	
Tools, machinery, and structural materials	CT/7920, 7930	4, 5, 6, 7	
	CT/3508	3, 5, 6, 7, 8	(3) if sharp edges present
	CT/3019	3, 5, 7	Bagged in 6-mil plastic prior to bag-out from glove box
	OP/Proc	3, 5, 7	
	OP/IRML	5, 7	(3) and (4) if sharp edges present
	OP/Iso-Tech	4, 5, 7	(3) if sharp edges present
	CH/5500	5, 6, 7, 8	(3) if sharp edges present
	MC/4508	3, 5, 6, 7	
	AC/2026	5, 6, 7	(3) if sharp edges present
Glassware	CT/7920, 7930	1, 3 (or 4), 5, 6, 7	
	CT/3508	1, 3, 4, 6, 7, 8	
	CT/3019	1, 3, 5, 6, 7	
	OP/Proc	1, 3, 5, 7	
	OP/IRML	1, 3, 5, 7	
	OP/Iso-Tech	1, 3, 5, 7	Bagged in heavy plastic prior to bag-out from glove box
	CH/5500	1, 3, 4, 6, 7, 8	
	AC/2026	1, 3, 5, 6, 7	

Table 7.1 (continued)

Waste form	Div. ^a /Bldg. or Dept. ^b	Method of waste preparation ^c for shipment	Remarks
Plasticware	CT/7920, 7930	1, 5, 6, 7	Bagged in 6-mil plastic prior to bag-out from glove box Some materials canned
	CT/3508	1, 5, 6, 7, 8	
	CT/3019	1, 5, 7	
	OP/Proc	1, 5, 7	
	OP/IRML	1, 5, 7	
	OP/Iso-Tech	1, 5, 7	
	CH/5500	1, 5, 6, 7, 8	
	MC/4508	1, 5, 6, 7	
	AC/2026	1, 5, 6, 7	
Rubber gloves, gaskets, and other rubber parts	CT/7920, 7930	5, 6, 7	Bagged in 6-mil plastic prior to bag-out from glove box
	CT/3508	5, 6, 7, 8	
	CT/3019	5, 7	
	OP/Proc	3, 5, 7	
	OP/IRML	5, 7	
	OP/Iso-Tech	5, 7	
	CH/5500	3, 5, 6, 7, 8	
	MC/4508	3, 5, 6, 7	
	AC/2026	5, 6, 7	
Wipes (paper, cloth)	CT/7920, 7930	2, 5, 6, 7	Dry overnight
	CT/3508	2, 5, 6, 7	
	CT/3019	2, 5, 7	
	OP/Proc	2, 3, 5, 7	
	OP/IRML	2, 5, 7	
	OP/Iso-Tech	2, 5, 7	

Table 7.1 (continued)

Waste form	Div. ^a /Bldg. or Dept. ^b	Method of waste preparation ^c for shipment	Remarks
Wipes (cont'd)	CH/5500	2, 3, 5, 6, 7	
	MC/4508	2, 3, 5, 6, 7	
	AC/2026	2, 5, 6, 7	Dry overnight
Ventilation filters	CT/7920, 7930	4, 5, 6, 7	
	CT/3508	4, 5, 6, 7, 8	
	CT/3019	5, 7	Bagged in 6-mil plastic prior to bag-out from glove box. Placed in plywood box after removal from system.
	OP/Proc	3, 5, 7	
	OP/IRML	3 (or 4), 5, 7	
	OP/Iso-Tech	4, 6, 7	All filters exterior to glove box
	CH/5500	5, 6, 7	
	MC/4508	3, 5, 6, 7	
	CT/7920, 7930	3 (or 4), 5, 6, 7	
	CT/3508	3, 5, 6, 7, 8	
Metal parts	CT/3019	5, 7	Bagged in 6-mil plastic prior to bag-out from glove box. (3) if sharp edges present.
	OP/Proc	3, 5, 7	
	OP/IRML	3 (or 4), 5, 7	
	OP/Iso-Tech	5, 7	(3) if sharp edges present
	CH/5500	3, 5, 6, 7, 8	
	MC/4508	3 (or 4), 5, 6, 7	
	AC/2026	5, 6, 7	(3) if sharp edges present

Table 7.1 (continued)

Waste form	Div. ^a /Bldg. or Dept. ^b	Method of waste preparation ^c for shipment	Remarks
Electrical equipment	CT/7920, 7930	3 (or 4), 5, 6, 7	Bagged in 6-mil plastic prior to bag-out from glove box. (3) if sharp edges present
	CT/3508	4, 5, 7, 8	
	CT/3019	5, 7	
	OP/Proc	3, 5, 7	(3) if sharp edges present
	OP/IRML	3 (or 4), 5, 7	
	OP/Iso-Tech	4, 5, 7	
	CH/500	3 (or 4), 5, 6, 7, 8	
	AC/2026	5, 6, 7	(3) if sharp edges present

^aDivision abbreviations

CT - Chemical Technology
 OP - Operations
 AC - Analytical Chemistry
 MC - Metals and Ceramics
 CH - Chemistry

^bDepartment abbreviations

Proc - Process Department
 IRML - Isotope Research Materials Laboratory
 Iso-Tech - Isotope Technology

^cMethod of preparation for shipment

1. Drain dry.
2. Squeeze dry.
3. Place in secondary container (plastic paper container, bucket, metal can, etc.).
4. Wrap and tape sharp edges.
5. Bag out of glove box (heat seal or tape and cut).
6. Overbag (heat seal or tape and cut).
7. Transfer to a stainless steel drum.
8. Stainless steel drum is lined with a polyethylene bag but upon closure is not necessarily sealed.

7.2.2 Other Containers

Occasionally the need arises to dispose of a contaminated glove box. When disposal becomes necessary, as much of the equipment as possible is removed, and the inside is cleaned to remove as much loose contamination as is practicable. The building services are then severed, and the glove box is placed into a metal container (see Sect. 6.2). The top is secured in place either by welding or by bolting/gasket. At the present time, assay techniques are limited to estimates based on historical data for TRU isotopes present and to material balances for maximum quantities. At a later date when a box scanner becomes available, its use will then be initiated to update present procedures.

7.3 CERTIFIABLE AND NONCERTIFIABLE WASTE FORMS

7.3.1 Certifiable Waste

TRU waste generated at ORNL can be categorized into the following forms:

1. ion-exchange resins;
2. tools, machinery, and structural materials;
3. glassware;
4. plasticware;
5. elastomeric gloves, gaskets, and other rubber parts;
6. wipes (paper and cloth);
7. ventilation filters;
8. small metal parts; and
9. electrical equipment.

These nine waste forms, their points of generation, and methods of waste preparation are shown in Table 7.1.

7.3.2 Noncertifiable Waste

Any waste that does not comply with the certification compliance requirements set forth in WIPP-DOE-114 will be processed by the waste generator to meet these standards. Shipment of noncertifiable waste will not be considered.

8. SPECIFIC CERTIFICATION PROCEDURE

Specific certification procedures that include step-by-step actions to ensure that a single waste form and package meet the WIPP requirements are a necessary part of this plan. The various divisions in ORNL produce more than one waste form, and the specific problems and processes vary from building to building. Therefore, it is necessary that each facility produce referenceable and auditable documents describing the steps taken to certify that their waste satisfies the requirements listed in WIPP-DOE-114.

8.1 CERTIFICATION METHODS

The methods and procedures^{2,3,5-9} used at ORNL to satisfy the 19 requirements delineated in WIPP-DOE-114 are described in the following sections and are summarized in Tables 8.1-8.3 (pp. 44-47).

8.1.1 Waste Container

The certification procedure for waste containers applies to the procurement of standard and special items by ORNL divisions and programs. Interfacing activities are defined between ORNL divisions/programs and the Materials Department of the ORNL Finance and Materials Division, the Y-12 Plant Materials and Services Division, and the UCC-ND Purchasing Division. This procedure covers procurement of items through direct charge requisitioning and procurement through stores.

8.1.2 Combustibility

This procedure specifies that, whenever feasible, the burnable and nonburnable wastes shall be segregated; if segregation is impossible, the percentage of burnable waste shall be estimated. The drum shall then be color coded as specified in WIPP-DOE-114.

8.1.3 Waste Package Size

This procedure delineates the sizes of containers acceptable for use at ORNL for TRU waste and addresses the QA program that deals with the purchase and testing of these containers.

8.1.4 Waste Package Handling

All containers used at ORNL for TRU waste shall be WIPP approved and shall thus comply with these requirements. The requirements for the safe transfer of materials from glove boxes, hot cells, and other radioactive processing areas to shipping containers are outlined in the ORNL Health Physics Manual,¹⁰ Appendix A-9 ("Guide for the Transfer of Materials Between Contaminated Enclosure Systems and Non-contaminated Areas"). Thus, requirements are supplemented by detailed procedures specific to the individual facilities at ORNL.

8.1.5 Immobilization

All waste generated at ORNL shall meet the immobilization requirements by one of the following methods.

Ion exchange resins - all ion exchange resins shall be placed in a suitable metal container resistive to attack before removal from the working environment.

Ventilation filters - analytical data have shown that most of the ventilation filters contain less than 100 $\mu\text{Ci/kg}$ TRU material. Those

that are classified as in the TRU range will be immobilized with rigid foam, concrete, or other acceptable immobilizing agent before loading into the shipping container.

Glove box sweepings - the use of assay drum counters, real time radiography, as well as accountability methods shall be utilized to determine that quantities of fine powder will not exceed the requirements. To date, these methods have shown that the powders contained in the waste drums have been <0.2% of the total package weight.

A check list (see Fig. 8.1) must be signed by operators at the time of removal operations. The QA representative shall make periodic inspection of TRU waste drums for conformance of check list usage.

8.1.6 Free Liquid

This requirement shall be verified as described in Sect. 8.1.5.

8.1.7 Sludges

This requirement shall be verified as described in Sect. 8.1.5.

8.1.8 Pyrophoric Material

This requirement shall be verified as described in Sect. 8.1.5.

8.1.9 Explosives and Compressed Gases

This requirement shall be verified as described in Sect. 8.1.5.

8.1.10 Toxic and Corrosion Materials

This requirement shall be verified as described in Sect. 8.1.5.

8.1.11 Waste Package Weight

The weight of the waste container is recorded on Form UCN-2822-Rev. 1 (Fig. 8.2), and the scales are maintained and calibrated by the Plant Metrology Department on a quarterly basis.

[illegible]

Fig. 8.1. Waste form check list.

REQUEST FOR STORAGE OR DISPOSAL OF RADIOACTIVE SOLID WASTE OR SPECIAL MATERIALS

REQUESTER: EXECUTES THIS SECTION BEFORE ARRANGING MATERIAL TRANSFER						
DATE	ORIGIN OF WASTE BLOG IF ORNL	REQUESTER'S SIGNATURE	EMPLOYEE NO.	PHONE NO.	OFFICE AND BLOG NO.	CHARGE NO.
TOTAL VOLUME (CU. FT.)	COMBUSTIBLE VOL. (CU. FT.)	WEIGHT (LBS.)	ACCOUNTABILITY MW NUMBER	TOTAL CURIES IN WASTE (BEST ESTIMATE)		
WASTE CLASSIFICATION (CHECK ONE) ☐ TEMPORARY STORAGE ☐ TRU OR ²³³ U (>100 µ Ci/Kg)-Retrievable Storage ☐ URANIUM/THORIUM ☐ FISSION PRODUCT ☐ INDUCED ACTIVITY ☐ TRITIUM ☐ BETA-GAMMA TRU OR ²³³ U (>100 µ Ci/Kg)-Retrievable Storage ☐ ALPHA TRU OR ²³³ U (>100 µ Ci/Kg) BETA-GAMMA TRU OR ²³³ U (>100 µ Ci/Kg) ☐ OTHER _____ ☐ LANDFILL		TYPE OF WASTE (CHECK ONE) ☐ BIOLOGICAL (BW) ☐ CONTAMINATED EQUIPT. (CE) ☐ DECONTAMINATION DEBRIS (DD) ☐ DRY SOLIDS (DS) ☐ SOLIDIFIED SLUDGE (SS) ☐ NOT CLASSIFIED (NC) BRIEF DESCRIPTION _____ <div style="border: 1px solid black; padding: 2px; margin-top: 5px;"> CONSTRUCTION RENOVATION DECONTAMINATION & DECOMMISSIONING (DD) </div>		CONTAINER(S) IDENTIFICATION (INDICATE NUMBER OF EACH) 1. ☐ 55 GAL. SS DRUM 2. ☐ 30 GAL. SS DRUM 3. ☐ 4-1/2" WALL CONCRETE CASK 4. ☐ 6 IN. WALL CONCRETE CASK 5. ☐ 12 IN. WALL CONCRETE CASK 6. ☐ 55 GAL. BI DRUM 7. ☐ 30 GAL. BI DRUM 8. ☐ WOOD 11. ☐ PLASTIC 9. ☐ OTHER 12. ☐ DUMPSTER 10. ☐ GI CAN 13. ☐ NONE 14. ☐ CASK NO. _____ WALL THICKNESS _____ IN. SHIELDED MATERIAL _____ METAL BOX 15. ☐ 74.5"L x 50.5"W x 38.5"H 16. ☐ 68"L x 54"W x 38.5"H 17. ☐ 88"L x 54"W x 54"H 18. ☐ 112"L x 68"W x 77"H		
PRINCIPAL ISOTOPE(S): (BEST ESTIMATE) 1. QUANTITY _____ GRAM(S) _____ CURIE(S) _____ IDENTITY _____ 2. QUANTITY _____ GRAM(S) _____ CURIE(S) _____ IDENTITY _____ 3. QUANTITY _____ GRAM(S) _____ CURIE(S) _____ IDENTITY _____ 4. QUANTITY _____ GRAM(S) _____ CURIE(S) _____ IDENTITY _____		REQUESTER'S COMMENTS FOR THOSE HANDLING WASTE IN FIELD _____ <div style="text-align: right;"> QUANTITY _____ WATTS/H TOTAL </div>				
HEALTH PHYSICIST: EXECUTES THIS SECTION BEFORE MATERIAL TRANSFER						
RADIATION DATA BETA-GAMMA FOR PACKAGE _____ mrem/hr @ _____ IN. OR FOR SHIELDED CASK _____ mrem/hr @ _____ IN. SURFACE CONT. _____ dpm(3-γ), _____ dpm(α), NEUTRON READING _____ mrem/hr. HP SURVEYOR'S COMMENTS FOR THOSE HANDLING WASTE IN FIELD _____						
				HP'S SIGNATURE		PHONE NO.
STORAGE AREA FOREMAN: COMPLETES AND SENDS COPY TO ORIGINATOR AFTER HANDLING WASTE						
ACTION TAKEN (CHECK ONE) WASTE WAS ☐ STORED, ☐ BURIED, ☐ COMPACTED, ☐ OTHER _____ FACILITY ☐ BUILDING ☐ WELL ☐ Ravine (Check One) ☐ TRENCH ☐ ON GROUND ☐ OTHER _____				LOCATION SWSA NO. _____ FACILITY NUMBER _____ SWSA ATN _____		DATE _____
LOCATION WITHIN FACILITY FFO FFT COMP. NO. _____		LAYER _____		FILE _____		RANK _____
FISSION WASTE DATA WELL FULL ☐ YES ☐ NO		CRITICALITY COMMITTEE APPROVAL FOR _____		SCALE NO. _____		
COMMENTS FROM SWSA FOREMAN REGARDING WASTE AND/OR OPERATION _____ <div style="text-align: right;">FOREMAN'S SIGNATURE _____</div>						

Fig. 8.2. Form UCN-2822-Rev. 1.

8.1.12 Nuclear Criticality

This requirement shall be verified by the listing of the nuclear material contained in the waste package on Form UCN-2822-Rev. 1. This quantity is then checked by nondestructive testing (NDT) on the ORNL drum scanner and on a box scanner.

8.1.13 Surface Dose Rate

The surface dose rates of all waste containers shall be recorded on Form UCN-2822-Rev. 1, and the equipment used shall be maintained in accordance with ORNL/TM-8405.¹¹

8.1.14 Surface Contamination

The surface contamination shall be recorded on Form UCN-2822-Rev. 1, and the equipment used shall be maintained in accordance with ORNL/TM-8405.

8.1.15 Thermal Power

A calculation shall be made of the thermal power of each isotope present in the waste package and shall be recorded on Form UCN-2822-Rev. 1.

8.1.16 Gas Generation

Tests conducted on typical drums of waste from Bldg. 3019 at ORNL revealed that the "average" waste drum contained ~15 plastic packages. The combined weight of the polyethylene making up these packages is 1 kg. Other cellulosic material contained in the packages weighed ~0.4 kg. If all of this organic material is converted to gas, then the pressure generated would be ~100 lb/in.².

Tests performed on 17C stainless steel waste drums indicate that the closure seal vents air from the drum whenever the internal pressure reaches 10-15 lb/in.². These tests were conducted on 10 drums where air was used to pressurize the drum in increments of 10 lb/in.² and the

resulting pressure was recorded at intervals of 1 hr until the internal pressure stabilized.

8.1.17 Color Coding

Whenever the materials contained in the waste package exceed the limits of WIPP-DOE-114 Sects. 3.2, 4.6, and 5.3, the package shall be color coded as described in Sect. 5.7 of WIPP-DOE-114.

8.1.18 Labeling

The waste package shall be labeled in accordance with Sect. 5.8 of WIPP-DOE-114 in addition to the labeling requirements of DOT.¹²

8.1.19 Data Package

The data package shall be in accordance with the Data Package Format, WIPP-DOE-157,⁹ for "Shipping Certified TRU Waste to the WIPP" as prepared by the MRC-Mound Laboratory. All check lists and pertinent forms shall be maintained onsite for 25 years.

8.2 PROCEDURES FOR WASTE CONTAINER REQUIREMENTS

The manner in which the four waste container compliance requirements are met at ORNL is shown in Table 8.1.

8.3 PROCEDURES FOR WASTE FORM REQUIREMENTS

The manner in which the six waste form compliance requirements are met at ORNL is shown in Table 8.2.

8.4 PROCEDURES FOR WASTE PACKAGE REQUIREMENTS

The manner in which the eight waste package compliance requirements are met at ORNL is shown in Table 8.3.

Table 8.1. Procedures for waste container requirements

WIPP criteria	WIPP specification	ORNL procedure	Compliance method
Waste container	49 CFR 773.398(B)	ORNL QA Manual ⁶ QA-L-9-100 Rev. 2 (purchase of container)	Administrative control of purchase orders
Combustibility	Containers with >25 vol % combustible material to be color coded with 1 red band. (49 CFR 172, Table 1, App. A)	ORNL Health Physics Manual, ² Procedure 5.1 [Procedures Sect. 2.c-(3)]	Administrative control by individual facility procedures
Waste package size	Maximum allowable size (l x w x h): 12 x 5.7 x 6.5 ft (truck transport); 12 x 7 x 7.7 ft (train transport); 12 x 8 x 8.5 ft (special shipment)	(1) ORNL Health Physics Manual, ² Procedure 5.1 [Procedures Sect. 2.c(1) (d)] (2) ORNL QA Manual, ⁶ QA-L-9-100 Rev. 2	(1) Administrative control (2) Administrative control of purchase orders
Waste package handling	All waste packages to be equipped for handling by lift trucks, cranes, etc. (SAND 81-0141)	(1) ORNL Health Physics Manual, ² Procedure 5.1 [Procedures Sect. 2.c(1)] (2) ORNL QA Manual, ² QA-L-9-100 Rev. 2 (3) Radioactive Solid Waste Operations Manual, ³ Sect. 3.3.3.5	(1) Administrative control (2) Administrative control of purchase orders (3) Documented check sheets

Table 8.2. Procedures for waste form requirements

WIPP criteria	WIPP specification	Procedure	Compliance method
Immobilization	<1% of waste <10 μm ; <15% of waste <200 μm	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Administrative control, check list, assay and accountability (verification)
Free liquid	No free liquids	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Administrative control, check list, assay, real time radiography
Sludges	Packaged to prevent corrosion of internal containers	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Check list, assay, real time radiography, visual inspection, administrative control
Pyrophoric material	<1 wt % is allowed to be pyrophoric [49 CFR 173(e)]	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Check list, administrative control, visual inspection
Explosives and compressed gases	None allowed as defined in 49 CFR 173(c) and (g)	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Check list, real time radiography, administrative control, visual inspection
Toxic and corrosive materials	None allowed as defined in 49 CFR 173(h) Tables (A) and (B)	ORNL Health Physics Manual, ² Procedure 5.1 and pertinent building operating manuals	Check list, administrative control, visual inspection

Table 8.3. Procedures for waste package requirements

WIPP criteria	WIPP specification	ORNL procedure	Compliance method
Waste package weight	<25,000 lb	ORNL HPP ² 5.1, Sect. 2.5.5; UCC-SPP ⁷ D-2-7; UCC-SPP ⁷ D-2-7-S; Radioisotope Shipping Procedure 1	Administrative control Check sheet
Nuclear criticality	<200 g fissile isotope/55-gal drum <100 g fissile isotope/30-gal drum <500 g fissile isotope/4 ^m container <350 g fissile isotope/4 x 4 x 7-ft 7A box <5 g/ft ³ in other boxes	UCC-SPP ⁷ 31-B; UCC-SPP ⁷ D-2-7 UCC-SPP ⁷ D-2-7S Radioactive Solids Waste Operations Manual, ³ Sect 3.0; ORNL Health Physics Manual, ² Procedure 5.1 ORNL Health Physics Manual, ² Procedures 2.4, 4.1, 4.3	Administrative control NDT check and adminis- trative control
Surface dose rate	<200 mrem/h	UCC-SPP ⁷ 31-B; UCC-SPP ⁷ D-2-7; UCC-SPP ⁷ D-2-7S; Radioactive Solid Waste Operations Manual, ³ Sect. 3.0; ORNL Health Physics Manual, ² Procedure 5.1; ORNL Health Physics Manual, ² Procedures 2.4, 4.1, 4.3; IS&AHP IP No. 201	Administrative control, NDT check ORNL/TM-8405 ¹¹
Surface contamination	<50 pCi/100 cm ² , α <450 pCi/100 cm ² , β	49 CFR 173-397(a); UCC-SPP ⁷ 31B; UCC-SPP ⁷ D-2-7; UCC-SPP ⁷ D-2-7S; Radioactive Solid Waste Operations Manual, ³ Sect. 3.6; ORNL Health Physics Manual, ² Procedures 2.4, 4.1, 4.3, 5.1; IS&AHP IP No. 201	Administrative control, NDT check ORNL/TM-8405 ¹¹
Thermal power	>0.1 W/ft ³ must have thermal power recorded in data package	49 CFR 17.3-393 ⁸	Check sheet (calculation)
Gas generation	Organic content <220 kg/m ³ (<14 lb/ft ³) in 55-gal drum; <100 kg/m ³ (<6 lb/ft ³) in other containers	Organic content listed on Form UCN-2822-Rev. 1	Administrative control (check sheet)

Table 8.3 (continued)

WIPP criteria	WIPP specification	ORNL procedure	Compliance method
Color coding	Combustibles >25 vol %; toxics; radiation level 10-50 mrem/h = 1, 50-100 mrem/h = 2, 100-200 mrem/h = 3	As specified in WIPP-DOE-114 ⁵	Administrative control (check sheet)
Labeling	Package ID #; package weight	As specified in WIPP-DOE-114; ⁵ DOT Reg. 172.4 ¹²	Administrative control (check sheet)
Data package		Data package format for shipping certified transuranic waste to the WIPP ⁹	

9. REFERENCES

1. TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant, WIPP-DOE-069, Rev. 2, DOE, September 1981.
2. Health Physics Procedures Manual: Procedures and Practices for Radiation Protection, Oak Ridge National Laboratory (current revision, February 1983).
3. Radioactive Solid Waste Operations Manual, Oak Ridge National Laboratory, May 1979.
4. Quality Assurance Requirements for Certification of TRU Waste for Shipment to the WIPP, WIPP-DOE-120, Rev. 1, DOE, January 1983.
5. TRU Waste Certification Compliance Requirements for Newly-Generated Contact-Handled Wastes for Shipment to the WIPP, WIPP-DOE-114, Rev. 1, DOE, October 1981.
6. ORNL Quality Assurance Manual.
7. Union Carbide Corp. Standard Practice Procedures.
8. Code of Federal Regulations, Title 10, Part 17.3-393.
9. Data Package Format for Certified Transuranic Waste for the Waste Isolation Pilot Plant (WIPP), WIPP-DOE-157, DOE, March 1983.
10. Health Physics Procedures Manual: Procedures and Practices for Radiation Protection, Oak Ridge National Laboratory (current revision, February 1983), Appendix A-9.
11. C. D. Berger, E. D. Gupton, B. H. Lane, J. H. Miller, and S. W. Nichols, ORNL Calibrations Facility, ORNL/TM-8405, August 1982.
12. Hazardous Materials Regulations of the Department of Transportation, Subpart E, Sect. 172.4, U.S. DOT, Mar. 1, 1977.

APPENDIX

RETRIEVABLE SOLID WASTE STORAGE FACILITIES

A.1 INTRODUCTION

The Atomic Energy Commission Immediate Action Directive of October 1970 required that all radioactive waste contaminated above 10 $\mu\text{Ci/kg}$ (changed to 100 $\mu\text{Ci/kg}$ by DOE Order 5820.1) with transuranic isotopes be stored in a manner to allow future removal of the waste for subsequent processing or shipment for a period of 25 years. This requirement has been met at ORNL by a group of special facilities located in the security area of SWSA 5/north (Fig. A.1).

TRU wastes are packaged retrievably in 30- or 55-gal stainless steel drums. The low-level drums are stored in one of two storage facilities, Building 7826 or 7834.

A.2 STAGING FACILITY

The staging facility, Building 7823 (Fig. A.1), is a partially underground shed currently used for temporary storage of low-level transuranic waste, primarily drums, before it is placed in permanent storage facilities.

Building 7823 is approximately 15.3 m (50 ft) wide by 24.4 m (80 ft) long with an extension on the south side for a truck entrance. The total area of the building is about 390 m^2 (4200 ft^2). The facility is approximately two-thirds below grade and has a gable roof open at each end. The walls are curved, galvanized metal culvert sections of 12-gauge corrugated steel. The roof is 0.08-cm (0.032-in.) corrugated aluminum with four sections of plastic skylight. There is an interior

Fig. A.1. Location and alignment of trenches in S

and alignment of trenches in SWSA 5/north.

ceiling of 9-gauge galvanized steel wire fencing located 4.25 m (14 ft) above the floor to prevent removal of the waste containers during a tornado. The floor is a 0.3-m (12-in.)-deep bed of crushed rock. There are no utilities inside the building (Fig. A.2).

A.3 DRUM STORAGE FACILITY NO. 1

Building 7826 is a facility designed for retrievable storage of contact-handled transuranic waste in 55-gal drums (Fig. A.3). The building is a one-story concrete-block-and-reinforced-concrete structure approximately 11.6 x 17.4 x 4 m (38 x 57 x 13 ft) high. The structure is approximately 85% below grade (Fig. A.4). The facility is divided into 24 compartments or cells (Fig. A.5). Each cell will accommodate sixty-four 55-gal drums, stacked in four layers with 16 drums per layer. A thin sheet of plywood is placed between each layer. Each cell contains a floor drain and a sump to monitor for groundwater leakage and possible movement of radionuclides from the facility. Each sump can be sampled individually, and the drains can be monitored and sampled at external catch basins. The facility has no utilities.

Access to the cells is by removal of roof sections; each section accommodates two cells. The roof sections are composed of a structural steel framework covered with 22-gauge galvanized metal decking. The spacing on the roof framework is designed to prevent removal of the drums in the event of a tornado. When sufficient drums have accumulated in the staging facility, one of the roof panels is removed and the drums are placed in the cells with a crane, four at a time.

The structure is designed to satisfy the requirements of both the Uniform Building Code for Seismic Zone 2 and the DOE Design Basis

Fig. A.2. Interior of staging facility (Building 7823).

Fig. A.3. Stainless steel retrievable storage drum and closure hardware.

Fig. A.4. Drum storage buildings (7826 and 7834) and high-level storage wells (Buildings 7827 and 7829).

Tornado. Criticality control is accomplished through restrictions on the amount of fissionable material allowed in each drum, based on calculations assuming an infinite array of drums.

A.4 DRUM STORAGE FACILITY NO. 2

As Building 7826 approached its capacity of drums, a new storage facility was designed and constructed adjacent to it (Fig. A.4). This facility, Building 7834, was completed in early FY 1980 and is currently available for use as needed. It is expected to have sufficient capacity for approximately 8 years at current generation rates.

Building 7834 has the same basic design as Building 7826 with two exceptions. The roof of Building 7834 consists of removable concrete plugs with sufficient weight to prevent removal during a tornado. Each cell has one plug. The plugs contain a 10-cm (4-in.) pipe sleeve to allow the sumps in each cell to be sampled without removing the plug (Fig. A.4). Building 7834 contains 24 cells with a sump and drain arrangement similar to Building 7826. Building 7834, however, accommodates drums in five layers instead of four layers, which gives a capacity of 80 drums per cell.

Placement of drums is similar to the procedure for Building 7826. When sufficient drums have accumulated in the staging facility, one of the concrete cell plugs is removed, and the drums are placed in the cell four at a time. Plywood separates the layers. Building 7834 is designed to meet the requirements of the DOE Design Basis Tornado and Earthquake.

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