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TRANSURANIC (TRU)
WASTE MANAGEMENT PROGRAM

Guidelines For Developing Certification Programs For Newly Generated TRU Waste

May 1983

Rockwell International
Energy Systems Group
Rocky Flats Plant

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GUIDELINES FOR DEVELOPING CERTIFICATION PROGRAMS FOR NEWLY GENERATED TRU WASTE

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GLOSSARY

AL	Albuquerque Operations Office
DOE	Department of Energy
DOT	Department of Transportation
ERDA	Energy Research and Development Administration
FRP	fiber-glass-reinforced polyester
FUETAP	formed under elevated temperature and pressure
ORNL	Oak Ridge National Laboratory
QA	quality assurance
QC	quality control
RFP	Rocky Flats Plant
TA	technical area
TRU	transuranic
TWSO	Transuranic Waste Systems Office
WIPP	Waste Isolation Pilot Plant

GUIDELINES FOR DEVELOPING CERTIFICATION PROGRAMS FOR NEWLY GENERATED TRU WASTE

by

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ABSTRACT

These guidelines were prepared with direction from the US Department of Energy (DOE) Transuranic (TRU) Waste Management Program in support of the DOE effort to certify that newly generated TRU wastes meet the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria. The guidelines provide instructions for generic Certification Program preparation for TRU-waste generators preparing site-specific Certification Programs in response to WIPP requirements. The guidelines address all major aspects of a Certification Program that are necessary to satisfy the WIPP Waste Acceptance Criteria and their associated Compliance Requirements and Certification Quality Assurance Requirements.

The details of the major element of a Certification Program, namely, the Certification Plan, are described. The Certification Plan relies on supporting data and control documentation to provide a traceable, auditable account of certification activities. Examples of specific parts of the Certification Plan illustrate the recommended degree of detail. Also, a brief description of generic waste processes related to certification activities is included.

I. INTRODUCTION

The US Transuranic (TRU) Waste Management Program is developing procedures for the certification and future shipment of unclassified, defense TRU wastes to the Waste Isolation Pilot Plant (WIPP) under development in southeast New Mexico. In May 1980, the US Department of Energy (DOE) released a report that presented DOE-approved Criteria for developing a TRU-waste Certification Program. The DOE report, referred to as the WIPP Waste Acceptance Criteria, identifies and discusses the technical bases of the Criteria for the acceptance of TRU waste at WIPP. Minor changes to this document, which are included in a formal revision[2] to the WIPP Waste Acceptance Criteria, resulted from consultations with personnel from DOE TRU-waste-generating and storage facilities, the Transuranic Waste Systems Office (TWSO), the State of New Mexico Environmental Evaluation Group, and the Westinghouse Electric Corporation, WIPP Technical Support Contractor (Westinghouse-WIPP).

The primary objective of the WIPP Waste Acceptance Criteria is to provide guidelines, in the form of criteria, for TRU-waste generators to produce TRU-waste forms acceptable for handling and disposal at WIPP. These Criteria represent limits, rather than specifications, that allow individual sites to develop their own specifications for both newly generated and stored, contact- and remote-handled, unclassified, defense TRU waste. In July 1981, TWSO, in consultation with personnel from waste-generating and storage facilities, the DOE Albuquerque Operations Office (AL), and Westinghouse-WIPP, interpreted and clarified, in operational terms, the WIPP Waste Acceptance Criteria and prepared a document[3] detailing the Compliance Requirements for meeting the Criteria. This document was published after review by personnel from waste-generating and storage sites. Certification that the WIPP Waste Acceptance Criteria specified in these DOE documents are satisfied will be required before shipment of TRU waste to WIPP.

Because TRU wastes are generated and stored in various forms and modes at several sites, site-specific Certification Programs are necessary. Here, the term "certification" is understood to mean that some qualified authority at each site determines, verifies, and attests in writing that the processes, procedures, personnel qualifications, and related operations produce waste packages that satisfy the WIPP Waste Acceptance Criteria.

Plans for waste acceptance at WIPP were first focused on newly generated TRU waste and then on stored waste. TWSO requested the Los Alamos National Laboratory Safeguards Systems Group to prepare a general framework for a generic Certification Program for TRU wastes so that the waste-generating facilities would have some guidelines for preparing site-specific Certification Programs. In the following sections, we discuss some general features of the major element of a Certification Program, namely, the Certification Plan. Specific aspects of the Plan also are addressed and examples are presented. A brief description of generic waste processes related to certification activities is included in the Appendix.

The near-term goal of this report is to assist waste-generating facilities and shippers in developing Certification Programs that meet the WIPP Waste Acceptance Criteria,[2] supplemented by their Compliance[3] and Quality Assurance (QA) Requirements,[4] thereby enabling the continued generation, interim storage, and eventual shipment of TRU waste to WIPP.

II. ELEMENTS OF A CERTIFICATION PLAN

A Certification Program comprises all the activities within a facility generating TRU waste that satisfy the WIPP requirements. The Certification Plan describes the overall strategy of the Certification Program, including the identification of all activities, with their controls and supporting data, performed for the generation, processing, and certification of TRU waste.

Thus, the Certification Plan forms the major element of a Certification Program and relies on documented controls and supporting data to provide a traceable, auditable account of certification activities.

Controls are the specific process and procedural operations that implement the preparation of certifiable waste packages. Controls for each waste type should be described briefly, step-by-step, in the individual Attachments to the Certification Plan (see Sec. II.F). Moreover, the Attachments should reference documents containing additional detail on each control. Some examples of types of documents detailing controls are procedures manuals for process operation, administration, nondestructive measurement, and laboratory testing. This documentation is important for QA activities, such as surveillance and audits, and probably exists at most sites. Process and QA-related controls include procedures for

- waste generation,
- waste classification/segregation,
- waste treatment,
- container preparation,
- packaging,
- color coding and labeling,
- data package preparation,
- certification,
- interim storage/shipment,
- corrective actions,
- records management,
- personnel training,
- inspection and testing,
- procurement,
- nonconforming item disposition,
- design, and
- measurement control.

Supporting data comprise all those documents and records that justify and support the controls or operations that implement the

certification of waste packages. Some examples of such data are formal topical reports on waste form characteristics, procurement specifications, waste-packaging logs, and calibration records. These data, in addition to the control documentation, are important for QA activities and generally are available at each site.

Process- and QA-related supporting data include data or technical information related to

- certifiable waste forms,
- waste generation processes,
- waste treatment processes,
- procurement,
- container design/fabrication,
- operations,
- calibration records,
- surveillance/audit results,
- personnel qualifications, and
- measurement control records.

In the following sections, the examples presented for specific segments of the Certification Plan may not illustrate the most practical approach to writing these sections at each site. A site should use whatever is appropriate and available for effecting certification and, based on its completeness, decide on the best way to augment existing valid procedures and prepare the necessary documentation. The important points that must be considered in all Certification Programs are that a waste package must satisfy the WIPP requirements and that a traceable, auditable account of certification activities showing how these requirements will be satisfied must be provided.

The WIPP requirements for a waste package, that is, the waste container and its contents, provide each site operator with guidance for developing detailed operating procedures for waste package preparation. The Certification Plan addresses, in one document with separate Attachments, all the activities of a site that relate to waste generation, waste operations, and certification. In the following pages, we outline a Certification Plan and discuss each section in detail.

CERTIFICATION PLAN

- PURPOSE AND FEATURES

  Purpose and Requirements for Certification

  Overview of Waste-Generating Operations

  Scope and Organization of the Certification Plan

- WASTE GENERATION AND MANAGEMENT: ORGANIZATIONAL STRUCTURES AND INTERFACES

  General Organization Chart

  Infrastructure of the Organization Chart

- DATA COLLECTION AND ARCHIVING

- CONTAINER PROCUREMENT AND HANDLING

  Description of Waste Containers

  Control Methods

- WASTE GENERATION AND TREATMENT

  General Description of Primary Waste Generation and Treatment

  List of Certifiable and Noncertifiable Waste Forms

- SPECIFIC CERTIFICATION PROCEDURES: ATTACHMENTS TO THE PLAN

  Introduction

  Waste Form Description

  Waste Form and Packaging Control Methods

  Data Package

A. Purpose and Features

1. Purpose and Requirements for Certification. This section should state briefly the purpose and requirements for certifying TRU waste as given in DOE and site documents. The requirements include many or all of the following:

- WIPP Waste Acceptance Criteria,
- Criteria Compliance Requirements,
- national and local DOE orders,
- Energy Research and Development Administration (ERDA) manual chapters, and
- site health and safety, and operational requirements.

This section might be written for the Los Alamos National Laboratory as follows:

> This document describes a Certification Plan that specifies the methods used for certifying newly generated TRU waste at the Los Alamos National Laboratory. This Certification Plan satisfies the requirements detailed in the WIPP Waste Acceptance Criteria, their associated Compliance Requirements and Quality Assurance Requirements, and ERDA Manual Chapters 0511 and 0529. The following sections describe a Certification Plan, which specifies how newly generated, contact-handled, unclassified, defense TRU waste will be certified at the Los Alamos National Laboratory.

2. Overview of Waste-Generating Operations. This section should provide an overview of the site's waste-generating operations and, in general, of the TRU-waste forms that they produce. The following is an example of the level of detail that might be written about TRU-waste-generating operations for the Rocky Flats Plant (RFP).

RFP processes large quantities of plutonium, significant amounts of depleted uranium, and small amounts of enriched uranium, ^{233}U, ^{241}Am, and ^{237}Np. By volume, ~95% of the wastes generated result from plutonium processing and most of the remaining 5% result from processing of depleted uranium. Some americium is discarded through the various waste streams sent to waste treatment. Less than 1% of the wastes contain enriched uranium and ^{233}U, which are packaged as plutonium waste. In terms of radioactivity, the uranium wastes represent ~5% of the total.

RFP generates both solid and liquid TRU waste. Solid TRU waste includes (1) line-generated waste from the process lines and gloveboxes that process ^{239}Pu, ^{241}Am, and ^{233}U; (2) waste generated by decontamination of equipment and facilities used to process ^{239}Pu, ^{241}Am, and ^{233}U; and (3) non-line-generated waste contaminated, or potentially contaminated, by secondary contact with ^{239}Pu, ^{241}Am, or ^{233}U. Liquid TRU wastes generated at RFP are treated and reduced to solid form to permit shipment. The major waste streams are (1) organic coolants and solvents from TRU process areas, (2) plutonium recovery process wastes, and (3) other TRU aqueous wastes.

3. Scope and Organization of the Certification Plan. This section should summarize the scope and organization or format of the contents presented next in the Certification Plan. This section might be written as follows:

The following sections of the Certification Plan describe, with appropriate reference to documented controls and supporting data, various site-specific activities relating to the TRU-waste Certification Program. Specifically, the Certification Plan first

(1) 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; then (2) describes, in general, the data-collecting and archiving methods, and records control; (3) describes the procurement and handling of waste containers, and related control methods; and finally (4) describes, in general, the waste-generating and processing operations, and lists certifiable and noncertifiable waste forms. Note that for items (2) and (4) above, specific certification procedures, including data management, are prepared for each certifiable waste form as separate Attachments to the Certification Plan. The individual Attachments detail, for each certifiable waste form, the specific waste-generating, processing, packaging, and handling operations and their related technical and administrative controls, and describe the waste flow chart.

B. Waste Generation and Management: Organizational Structures and Interfaces

1. General Organization Chart. This section should outline and illustrate by organization chart the responsibilities and interfaces of the waste-generating, processing, managing, and supporting organizations that participate in the Certification Program. The level of detail of the organization chart should be sufficient to show the major lines of authority and communication that would exist during routine operations. Interfaces with the site's QA organization also should be identified. A sample organization chart for a hypothetical site is presented in Fig. 1.

2. Infrastructure of the Organization Chart. This section list the formal offices and job titles of key personnel

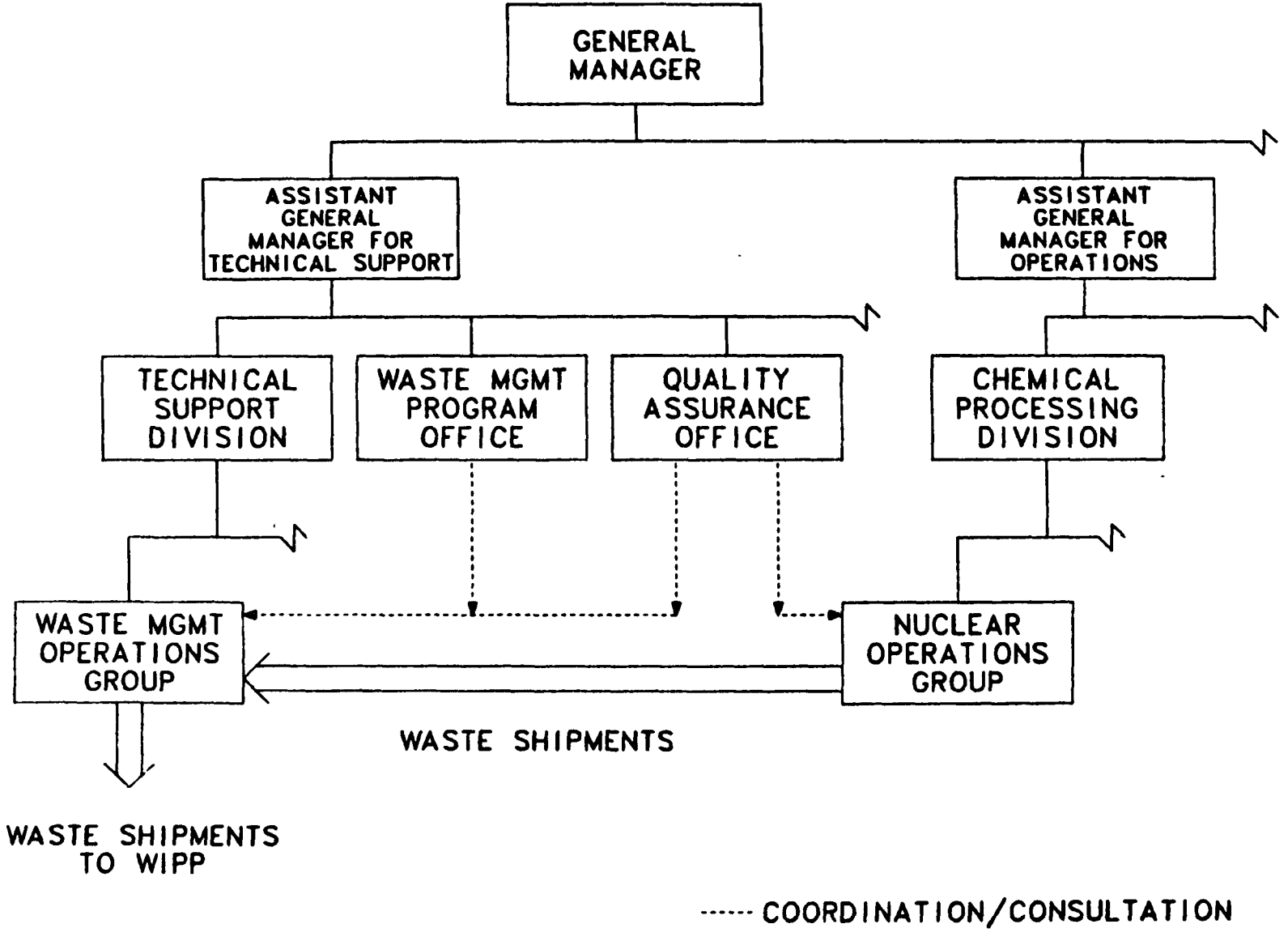

Fig. 1. Waste management and related organizational structure for a hypothetical site.

who are participating in the Certification Program. In general, these should coincide, one-for-one, with the blocks in the organization chart. As an example, the organizational listing below provides job titles of persons responsible for the Certification Program at the hypothetical site and corresponds to Fig. 1.

- General Manager
  - Assistant General Manager for Operations
    - Chemical-Processing Division Manager
      - Nuclear Operations Group Manager
  - Assistant General Manager for Technical Support
    - Technical Support Division Manager
      - Waste Management Operations Manager
  - Waste Management Program Manager
  - Quality Assurance Manager

C. Data Collection and Archiving

This section should describe briefly the data collection and archiving procedures related to the certification activities. In some cases, these procedures will be generic rather than tailored to their specific waste forms, containers, and packages. For example, all the records on quality control (QC) activities related to either drum or box acceptance after delivery may be documented and stored in a site-specific, standard manner in a particular location. This section also should state what data are collected, which organization is responsible for their collection, and where the data are stored. As a minimum, information and data should be collected and stored for those activities related to (1) instrument calibrations, (2) container-loading logs, (3) assay measurements for the contents and surface dose rate and

measurements for contamination surveys for the waste packages, (4) administrative control records, and (5) corrective action reports on damaged and repackaged waste packages. In general, describing the site's data operations in this section should help to eliminate duplication in the individual Attachments to the Certification Plan. Furthermore, it provides a concise and unified description of the site's records system(s) and helps document compliance with the WIPP requirements.

D. Container Procurement and Handling

For waste containers to satisfy the Compliance Requirements, they must be designed and fabricated to be noncombustible or to provide overpack capability to meet US Department of Transportation (DOT) Type A specifications. This section should describe the containers and the controls used to ensure that the Requirements are met, including procurement specifications and QA procedures. Vendor qualification documentation can be used to accomplish part of the control measures.

In some cases, fiber-glass-reinforced-polyester (FRP)-coated plywood boxes will be used by waste shippers until standard metal containers are available. These FRP-coated boxes are combustible and, therefore, render an otherwise certifiable waste package only partially certifiable until it is overpacked in a metal container.

1. Description of Waste Containers. This section should briefly describe the type of containers used. For example, the Oak Ridge National Laboratory (ORNL) uses 208-L (55-gal.) stainless-steel drums. Therefore, a description of ORNL's waste containers could be as follows:

> Waste containers are 208-L (55-gal.) stainless-steel drums that comply with DOT requirements for Type A packaging as stated in the US Code of Federal Regulations [49 CFR 173.398(b)].

For the Los Alamos National Laboratory, a description could be as follows.

> The only drum approved for TRU waste at the Los Alamos National Laboratory is the white-painted, unlined, DOT 17-C, 208-L (55-gal.) drum.

2. Control Methods. In most cases, controls on waste containers must ensure that they (1) meet the WIPP requirements at the design and fabrication stages, (2) are undamaged on delivery to the facility, and (3) are still undamaged before and after waste-packaging operations. Items (2) and (3) involve visual inspections of the containers following receipt and before and after waste-packaging operations.

The following is a sample statement for drum procurement and handling at the Los Alamos National Laboratory.

> White-painted, unlined, DOT 17-C, 208-L (55-gal.) drums are purchased from RFP on a standing order of ~850 drums per year. RFP purchases large quantities of these drums on low bid in accordance with specifications that satisfy the WIPP requirements. All potential RFP vendors must be certified as "qualified vendors." The RFP qualifying procedure includes inspection of a 50-drum sample size at RFP by the inspection department. If it appears that the drums are in compliance, RFP quality personnel then perform a vendor audit on quality procedures at the manufacturing site.
>
> Each shipment of drums received at RFP undergoes inspection, sampling, and testing as part of RFP's QC program. The drums purchased by the Los Alamos National Laboratory are from this stock pool. Drums are ordered from RFP by the Chemical Stock Group when the inventory level indicates that restocking is necessary. When the drums arrive at Los Alamos, a Waste

Management Group employee observes their unloading to detect damaged drums. Damaged drums are segregated and disposed of by Chemical Stock personnel. Other drums, identical except for having rigid polyethylene liners, are used for packaging sludge. They are ordered from RFP and handled in the same manner. As a drum is required, it is delivered by Chemical Stock and inspected by the waste generator before use.

E. Waste Generation and Treatment

This section should provide a general description of waste generation, treatment, packaging, and handling operations that render wastes certifiable and ultimately certified. A list of the certifiable and currently noncertifiable waste forms that the site produces should be included, as well as the treatment processes necessary to meet the WIPP Waste Acceptance Criteria. Specific waste generation, treatment, packaging, and handling operations for each waste form should be described, where necessary, in the individual Attachments to the Certification Plan (see Sec. II.F).

1. General Description of Primary Waste Generation and Treatment. This section should present a general description of the site's waste generation and treatment operations that yield certifiable waste forms. The following is an example for the Los Alamos National Laboratory.

Significant solid and liquid TRU-waste-generating processes are located in 10 Laboratory areas. Figure 2 is a flow diagram showing the origin and disposition of the solid and solidified liquid wastes.

The Laboratory's main plutonium facilities are located at Technical Area (TA)-55. Plutonium operations involve research and development, oxide production, and metal preparation and fabrication work with

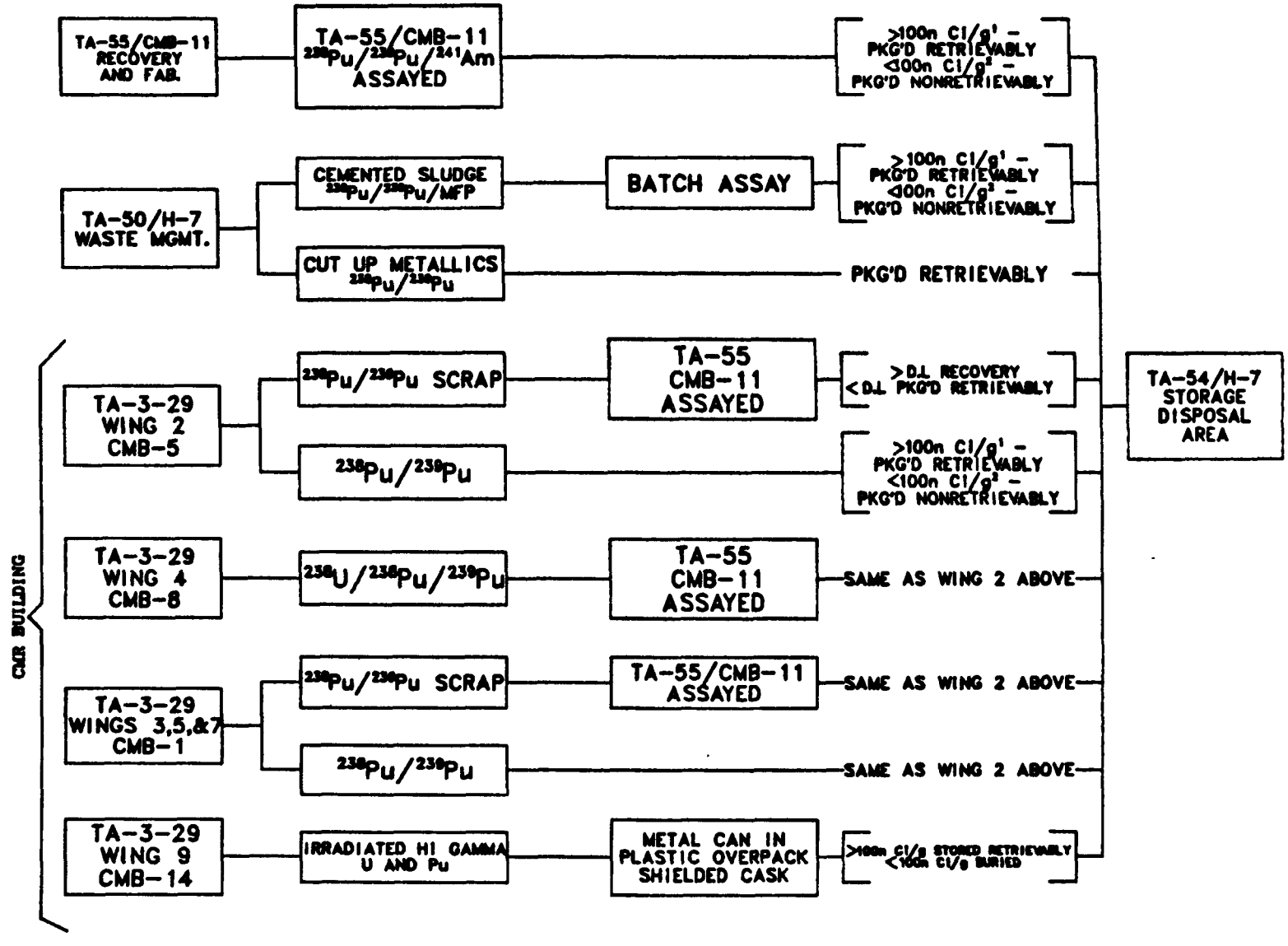

Fig. 2. Flow diagram of the generation and disposition of the solid TRU waste at the Los Alamos National Laboratory. TA stands for technical area; MFP for mixed fission products; and D.L. for discard limit. The superscript 1 indicates >100 nCi/g ^{238}Pu; the superscript 2, <100 nCi/g ^{238}Pu.

^{238}Pu and ^{239}Pu materials. Most of these operations generate residues and waste materials that are sent (along with residues from other Laboratory plutonium operations) to the chemical processing section.

Materials containing ^{238}Pu are assayed and are either sent to Savannah River Plant for recovery, placed into the appropriate Laboratory retrievable-storage facility, or buried when the ^{238}Pu content of the waste is <100 nCi/g.

All containers of ^{239}Pu material are measured for plutonium content by one or more nondestructive assay techniques. Materials that contain more plutonium than the AL-approved discard limit are processed through scrap recovery. Process waste with lower plutonium concentrations is sent to retrievable storage. Leached process solids are sent to retrievable storage when the plutonium concentration is <4 g/kg of the total waste.

Room-trash boxes are monitored by a neutron counter or a low-energy gamma scanner. Those found to have >100 nCi/g plutonium are repackaged and placed into retrievable storage. The room trash that is <100 nCi/g plutonium is sent to the disposal area for burial. Liquid discard streams from TA-55 are transferred through special stainless-steel waste lines to the Liquid Waste Treatment Facilities (TA-50) for solidification.

The TA-50 facilities produce a sludge that is dewatered by vacuum filtration. To insure the absence of free water, about 9 kg (20 lbs) of Portland cement are mixed with the sludge in a drum that includes a 2.3-mm (90-mil) liner.

2. List of Certifiable and Noncertifiable Waste Forms. This section should list the site's certifiable and currently noncertifiable waste forms, as well as the treatment processes and

resultant suitable waste forms for the latter. In particular, the attributes of the acceptable waste forms should be described to substantiate the claim that they are certifiable. Treatment processes to meet the WIPP Waste Acceptance Criteria should be stated.

F. Specific Certification Procedures: Attachments to the Plan

Specific certification procedures include step-by-step actions taken to ensure that a single waste form and package meet the WIPP requirements. Because sites usually produce more than one waste form, a stand-alone document is needed to describe the steps taken to produce a specific category of waste package that satisfies the WIPP requirements. Therefore, the waste-form-specific parts of the Certification Plan should be written as Attachments to the Plan. However, if a site produces only one or a few waste forms, they could be discussed in the main body of the Plan. The advantage of Attachments is that the Certification Plan can be easily updated with the addition of Attachments for any new certifiable waste forms.

An example of an Attachment outline for a waste-form-specific certification procedure is given below. Then each of the outline sections is discussed.

ATTACHMENT 1

WASTE-FORM-SPECIFIC
CERTIFICATION PROCEDURE

- INTRODUCTION
- WASTE FORM DESCRIPTION
- WASTE FORM AND PACKAGING CONTROL METHODS
  Flow Diagram and Identification of Controls
  Description of Control Methods
- DATA PACKAGE

1. Introduction. This section should identify the type of waste package that is addressed by the certification Attachment.

2. Waste Form Description. This section should briefly describe the waste form being certified and can include references to more detailed documentation.

3. Waste Form and Packaging Control Methods. This section should include a waste stream flow diagram that illustrates the progression of the specific waste form from generation through packaging and certification, including related control methods. Also, the specific control methods, including those instituted to ensure certification, should be described for this progression. The references for these control methods should be listed.

4. Data Package. The Compliance Requirements state: "The documentation referred to in the compliance requirements (i.e., documented procedures, etc.) will form the bases to establish the adequacy of certification procedures or specific waste certifications." This documentation shall also support the required data package for each waste package. The preparation of the data package, including the certification statement, is the culmination of the efforts to produce a certified waste package for interim certified storage and for eventual shipment to WIPP.

Before the certification statement is prepared, the individual(s) responsible for all phases of the certification activities must have confidence that those activities have been performed properly. Furthermore, each site's certifying authority must review the information in the data package and have confidence that all data are correct and recorded properly. A dated, signed Certificate of Compliance to this effect will be maintained by the shipper. Thus, the data collection and reporting activities required for the preparation of the data package are critical to the success of the Certification Program.

A data package format for submission to WIPP was developed by MRC-Mound personnel with input from DOE and its contractor personnel. This format is strictly for electronic transmission to WIPP; sites can produce this format by electronic data-handling techniques regardless of their local storage format. Detailed instructions for completing the data package are found in Ref. 5.

III. CERTIFICATION QA REQUIREMENTS

As defined in DOE Order 5700.6A,[6] and "Quality Assurance Program Requirements for Nuclear Power Plants" [ANSI/ASME NQA-1-1979 (NQA-1)],[7] 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. QA includes QC, which comprises all those actions necessary to control and verify that the features and characteristics of a material, process, product, or service conform to specified requirements.[6] If the QA activities are effective, the documentation related to waste certification will be valid and adequate for performing the waste package certification activities.

A. Purpose and Scope

DOE Order 5700.6A requires all DOE programs and their contractors to have QA programs. 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 met QA requirements.[2-4] As the basis for the certification-related QA activities of the waste generators, DOE issued "Quality Assurance Requirements for Certification of TRU Waste for Shipment to the WIPP."[4] This report was adapted from the basic requirements of NQA-1. If personnel at a site decide that any of the Certification QA Requirements are not applicable to the site's activities, they must justify this briefly in their Certification Plan. When addressing

these Requirements, the following principles, some adapted from Ref. 6, should be 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.
- A site's QA activities should be identified after determining the extent to which the Certification QA Requirements should be applied.
- Organizational responsibility and authority for activities affecting waste processing and certification should provide for the effective implementation of the Certification Program and for effective management support when necessary.
- Maximum use should be made of existing QA practices.
- The Certification Plan must be amenable to internal and external audits and surveillance.

The use of "shall" in this document provides an accurate example of the formal WIPP QA Requirements and does not change this document from a guideline to an order.

B. QA Program Elements

1. Organization.

- An organization for the TRU-Waste Certification Program shall be identified and described. The size of the organization shall be consistent with the scope of work. As a minimum, the QA organization requirement can be satisfied by an individual who has no responsibility for the certification activities being performed. The QA organization shall have authority, organizational freedom, and access to relevant site management at a level where appropriate action can be effected.
- Authorities and responsibilities within the Certification Program shall be defined in writing in the QA Plan.

2. QA Program Plan. A QA Plan for the Certification Program must be prepared and maintained at each site. This section should describe the content of the QA Plan. In this document the QA Plan is called a "Certification Plan." The term "QA Plan" in this section provides consistency with the terminology used in the Certification QA Requirements. In developing a site-specific QA Plan, maximum use of existing QA personnel, policies, and practices is recommended. Also, where possible, existing site documents on QA, operating, and administrative procedures should be referenced.

The QA Plan describes a program for planning work, writing and approving procedures, performing work according to those procedures, recording results, and reporting variances. Activities requiring independent verification shall be identified. The QA Plan shall identify the items and activities necessary to assure certification. The QA Plan shall be approved by the facility TRU-waste management, waste generation, and QA organizations, and it shall be maintained on a routine basis. The documents to be used in program activities shall be described. The QA Plan shall identify where specially trained personnel are needed and the minimum qualifications.

3. Design Control.

- Design control shall apply to waste containers, selected waste forms, packages, and processes. New container designs shall be subject to procedures for qualifying container designs to satisfy DOT specifications as outlined in the Compliance Requirements. Approved containers are covered under "Control of Purchased Items and Services" below. However, site and vendor or contractor contact personnel responsible for designs, as well as independent verification activities based on sampling by QA personnel, must be identified.

- Waste container design verification can be accomplished by design review, tests, or alternative calculation methods. Any method that is used shall be described in the QA Plan.

4. Procurement Document Control.

- The QA Plan shall identify those procured items that will require document control. Procurement Document Control requires that the purchasing methods be listed. Supplier QA activities must be available for inspection and must be documented at the supplier's site.
- Preparation of documents shall assure that subcontractor QA requirements are described, specifications with acceptance or rejection criteria are designated, tests are delineated, and records requirements are listed.

5. Instructions, Procedures, and Drawings. The QA Plan shall identify and describe activities affecting quality that require detailed written instructions, procedures, and drawings. These documents shall describe the work to be performed by a trained operator. Whenever appropriate, these documents shall also contain tolerances and acceptability limits.

6. Document Control.

- The QA Plan shall identify the documents that need to be controlled, their location, and the titles of the organizations responsible for their maintenance.
- A system(s) shall be established for the control of document preparation, review, approval, distribution, and revision. This system(s) shall include methods to prevent use of obsolete or superseded documents and to prepare, identify, and maintain distribution lists.

7. Control of Purchased Items and Services.

- Purchased Items and Services that significantly affect certification shall be identified in the QA Plan with the degree of control commensurate with their importance.
- Control of Purchased Items and Services shall apply to the procurement of waste containers, liners, materials, and equipment used in the processing, packaging, and inspection of waste.
- Procurement sources shall be selected by acceptable past performances or by documented assessment of technical and QA capabilities.
- Items or services shall be inspected at the source or upon receipt. The inspections shall be identified and documented.
- Documentation to be supplied to the site and documents to be retained at the source shall be identified.

8. Identification and Control of Items.

- Those items that need to be controlled shall be identified in the QA Plan. The degree of control shall be commensurate with their importance.
- A system shall be developed to assure that the flow of waste is identified from generation through certification and shipping. This should provide for the identification of waste streams and packages that contain toxics, pyrophorics, or corrosives.

9. Control of Processes.

- Control of processes that can significantly affect the characteristics of the waste form or waste package shall be identified and accomplished by the use of written procedures or instructions and by independent verification that these procedures are being followed.

- These procedures shall contain methods for qualifying personnel, procedures, and equipment. Storage requirements for qualification records shall also be identified.

10. Inspections.

- QC inspections shall be defined for waste containers, waste forms, and waste packages. All inspections shall be performed by independent inspectors using written procedures.
- If direct inspections are not possible, independent monitoring of processing methods, equipment, and personnel shall be described that will satisfy inspection requirements.

11. Test Control.

- Tests to assure that the waste containers, waste forms, and waste packages meet the Compliance Requirements shall be identified.
- Test results shall be documented and reviewed for product conformance.

12. Control of Measuring and Test Equipment.

- The QA Plan shall identify and control the use of measuring and test equipment.
- The Plan shall include methods for calibration, adjustment, and periodic recalibration.
- Calibration records shall be documented.

13. Handling, Storage, and Shipping.

- Waste-handling, packaging, storage, and shipping operations shall be identified and described in detail or by reference in written procedures.
- These procedures shall include cleaning, decontamination, and preservation requirements for stored waste packages.

14. Inspection, Test, and Operating Status. A system shall be developed to identify the status of waste flow and waste packages. The system shall also describe the identification of certifiable items. The status of in-process waste flow and packaging shall be identified by physical location, tags, markings, and/or attached inspection records.

15. Control of Nonconforming Items.

- Sites shall develop a system for the identification, documentation, segregation, and disposition of nonconforming materials or items.
- Items that do not conform to required specifications shall be documented, segregated, and evaluated. Provisions shall be made for disposition of nonconforming items, which shall be appropriately marked to ensure their proper disposition.

16. Corrective Action. A system shall be established to ensure that conditions adverse to certification are identified promptly. The cause of each condition shall be determined and corrective action taken to preclude recurrence. The identification, cause, and corrective action shall be documented and reported to appropriate levels of management. Follow-up action shall be taken to verify corrective action.

17. Certification Records.

- Records to be stored shall be described. These include operating logs, design reviews, inspection data, test results, calibration documents, nonconformance reports, drawings, specifications, procurement documents, audit reports, and qualification records for procedures, personnel, and equipment. This description shall identify the individuals collecting the information and how it is collected and recorded.

- A system shall be established for the easy retrieval of pertinent records, and retention times shall be specified for each of these records.

18. Audits. An independent audit program shall be developed to determine effectiveness of the site's Certification Program. The audits should be performed by trained, independent auditors using written procedures or checklists. Audit findings shall be documented and distributed to the appropriate management. An independent check shall be made to assure correction of deficiencies.

IV. CONCLUSIONS AND RECOMMENDATIONS

The cornerstone of the TRU-waste Certification Program is the WIPP Waste Acceptance Criteria.[2] These criteria, developed over the past 6 years after considerable deliberation, are flexible enough to allow each site to develop its own specific program to achieve the goals of the waste Certification Program. The process of developing site-specific waste Certification Programs is still at an early stage. This effort is undergoing a necessary evolutionary process whereby the certification of less complex waste forms in early stages will provide adequate experience to approach the certification problems of more complex waste forms.

The waste Certification Program development is site-specific because of the diversity of the processes that generate the wastes and the diversity of the wastes thus generated. However, there are significant similarities in the waste management technologies that allow us to suggest a generic approach to waste Certification Program development, as detailed in Sec. II.

In developing a Program, the working groups at each site should recognize the WIPP requirements as well as the site-specific constraints. The procedures thus developed can be documented to become the site-specific Certification Plan. This Plan

and its supporting documents will form the bases for the WIPP Waste Acceptance Criteria Certification Committee to examine whether the proposed Plans are in conformance with established Criteria. The procedures approved by this Committee can be implemented to process the wastes to produce certifiable waste packages.

After examining the on-going efforts of developing site-specific waste Certification Programs, we recommend the following items to underscore some of the efforts required to achieve the objectives of the Certification Program.

(1) The process of identifying waste streams and evaluating the needs of waste processing should start at a time early enough to be included in early drafts of certification plans.

(2) A desirable near-term goal would be to select a few waste forms to initiate the certification efforts, with plans to incorporate other newly generated wastes in the Certification Program.

(3) After the specific methods for classifying, processing, and packaging the waste forms have been chosen, the details of the controls necessary to assure the quality of the processes and products should be coordinated with the appropriate QA group.

(4) The QC efforts should be coordinated with the waste management program, with the process objectives and operational safety as the guiding principles.

(5) Experts conversant with waste management science and technology should be identified to assist in the Committee's work of reviewing Certification Plans and to help the participants to resolve areas of conflict.

(6) Consultations among various sites participating in the waste Certification Program are helpful.

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APPENDIX

GENERIC WASTE PROCESSES RELATED TO CERTIFICATION

K. K. S. Pillay

The technologies necessary to accomplish the goal of the waste Certification Program for newly generated TRU wastes are fairly well developed. The bases for this conclusion are mentioned in this Appendix in a brief review of the salient, process-related technical considerations of waste certification. For this report, waste processes relevant to certification are considered in a sequence approximating the process steps involved in the preparation and packaging of waste. The need for site-specific waste Certification Programs is based on the recognition that normal plant operations often produce waste mixtures of varying composition; disparate process needs and operational philosophies, as well as differing equipment and facility designs, contribute to significant variations in waste lines from facility to facility. However, in spite of the differences in the generation rate and the characteristics of the wastes, the controls required to assure the quality of the processes that lead to certifiable waste packages at various sites can have many common features.

The following descriptions of processes related to certification are generic and adaptable to site-specific certification activities. Each of the process steps described below also identifies documentation required to develop a comprehensive Certification Plan. This document must lend itself to developing and instituting both technical and administrative controls to establish a credible QA effort for the waste Certification Program.

I. WASTE SOURCES

A waste Certification Program should (1) identify the main sources of wastes and (2) have a reasonable estimate of the quantities (volume, weight, activity, etc.) generated for each category of TRU waste. Because many unit operations are necessary to classify, treat, and package the various waste streams, it is equally important to have a knowledge of the processes that generate these radioactive wastes. Access to existing documentation on primary processes that generate the various waste streams can be beneficial in determining the physical and chemical characteristics of the wastes. In addition, this documentation can also be a valuable reference for review of a Certification Program and for performance of quality verification activities.

II. WASTE CLASSIFICATION

Although there are numerous classifications of radioactive wastes,[1-4] for the purposes of waste certification considered here, it is desirable to classify all primary and secondary TRU wastes into categories based on treatment. One reasonable classification is as follows:

- compactible and combustible solids,
- noncombustible solids,
- wet solids and sludges,
- liquids (aqueous and nonaqueous), and
- toxic, corrosive, explosive, or highly inflammable materials.

Most of the TRU wastes generated (except gaseous forms) can be grouped under one of the above categories. The development of treatment strategies may require further grouping depending on the quantities of wastes involved in each of the subgroups.

Combustible and compactible solids may include all types of cellulose, rubber, plastic, and other solid organic wastes. The

noncombustible category may include all types of TRU-contaminated material such as glassware, ceramics, insulators, metals, tools, and failed equipment. Wet solids may consist of sludges, slurries, ion-exchange media, filter aids, and biowastes. Liquids will include all aqueous wastes and contaminated organic liquids and semiliquids such as greases and lubricants. Once a detailed inventory of typical waste forms at a site is available, a practical grouping can be initiated. This site-specific classification, when properly documented, can be used to control the sorting and segregation of wastes for the Certification Program.

Many forms of contact-handled TRU wastes generated can be segregated and packaged without further treatment. However, those that need processing before packaging must be segregated. This effort can be minimized by keeping the wastes from major process lines separated from general trash. Under properly controlled conditions, contact-handled TRU wastes of mixed categories can be readily segregated by manual sorting. Sorting operations require protective clothing and radiation shielding. Gloveboxes and/or walk-in rooms requiring the use of pressurized suits generally are used for sorting and classification. Proper documentation of this classification procedure must include steps for the identification and exclusion of materials such as explosives, compressed gases, pyrophorics, toxics, and corrosives for special handling and treatment.

III. PRETREATMENT OF WASTES

Some wastes that need processing for stabilization may require certain pretreatment such as size and volume reduction. Pretreatment operations also are valuable to those forms of wastes that may not require any processing to conform to the Compliance Requirements.

Various pretreatment operations[4] that are useful to size and volume reduction of dry, solid TRU wastes are shredding, compaction, baling, disassembly, meltdown casting, and incineration.

Pretreatment operations that are generally used in the volume and size reduction of wet wastes include evaporation, drying, calcination, flocculation, coprecipitation, centrifugation, ion exchange, and reverse osmosis. The choice of a pretreatment method depends on the composition of the wastes and the overall waste generation rate at a site. The above-mentioned well-developed pretreatment technologies are in routine use in the nuclear and chemical industries.

Among pretreatment methods, combustion of radioactive wastes has been in use for a long time with varying degrees of success.[5] Recently, there has been large-scale support for incineration projects by DOE for TRU-waste management and plutonium recovery operations.[6,7] Several of these projects are either in final stages of demonstration or already in routine operation. Because incineration effectively eliminates organics, destroys toxic chemicals, significantly reduces both mass and volume of wastes, and produces a chemically inert waste form, there are many advantages to adopting incineration as part of the waste treatment, where such facilities are readily available.

When using any pretreatment method, one must consider any secondary wastes that may be generated, as well as any treatment that may be required to convert such wastes to a form suitable for storage and disposal. Successful integration of the pretreatment methods with the overall waste management system at a facility is critical in assuring the overall effectiveness of the waste management program.

IV. WASTE PROCESSING

The present version of the WIPP Waste Acceptance Criteria requires the processing of only limited categories of waste.[8] However, it will be necessary for most sites to process at least limited quantities of wastes before they can be certified.

Various waste-processing methods for the stabilization of radionuclides are now used in the nuclear industry,[1,9,10] primarily to control wet wastes and dispersible fines, and to retard the mobility of radionuclides in waste forms. In the area of cementitious materials,[11] hydraulic cement concrete, cements with additives (such as zeolites, sodium silicate, and plaster of Paris), formed under elevated temperature and pressure (FUETAP) concrete, and cold-pressed concrete cover a wide range of requirements for waste solidification. The last two forms, because of their limited moisture content, are considered especially useful in reducing gas generation caused by radiolysis. A variety of organic materials used in the solidification of radioactive wastes includes bitumen, urea-formaldehyde resin, and other synthetic polymers such as vinyl ester, styrene, and epoxy resins. More complex processing methods such as calcination, vitrification, tailored ceramics, and synthetic mineral preparations are useful to the stabilization of radioactive wastes. Although there is considerable available knowledge about all these technologies,[12] the processing of newly generated, contact-handled TRU wastes for certification probably will not require complex technologies. Simple process technologies such as cementing or cold-pressed sintered ceramic preparation may be quite adequate to meet the Compliance Requirements. When quantities of wet wastes are small, absorbents such as vermiculite and diatomite may serve the need to stabilize these waste forms.

The Certification Program should evaluate the processing needs carefully and document the procedures for the Certification Program review. Once the processing is approved, this documentation will form the basis for maintaining and evaluating the quality of the processes as well as the waste products.

V. WASTE PACKAGING

The WIPP Waste Acceptance Criteria require that all waste containers for placement in WIPP be noncombustible.[8,13] Because all shipments containing nonexempt quantities of radioactive materials are regulated by both the DOT and US Nuclear Regulatory Commission under Title 49 and Title 10, respectively, of the Code of Federal Regulations, the selection of the containers for waste packages must be evaluated on the bases of all three sets of criteria. These criteria in combination require that all packages be steel drums or steel boxes. It is reasonable to assume that all the packages will require shipment in casks or overpacks meeting Type B packaging standards.[14-16]

If packaging is implemented without the treatment option, steel drums or steel boxes can be used directly with minimal preconditioning of the waste forms. In this case, the documentation is simple, although it is important for the Certification Program to assure that the containers and packaging accessories were produced under an acceptable QA program. The packaging procedures for each waste form must be documented independently, and adequate controls must be included to ensure that the waste packages conform to the Compliance Requirements.

VI. PACKAGE ASSAY

The certification of each waste package requires both a qualitative and quantitative evaluation of the radionuclides, including a separate determination of the fissile contents within each package. A determination of the final weight of the package, radiological survey of the surface contamination, and an estimate of the heat generation capacity of each package are required for color coding as a prerequisite for certification. The instruments used for the isotopic assay, weighing, and radiological survey all need to be calibrated on a predetermined schedule to ensure

their reliability. Detailed documentation on instrument calibration and assay results is essential to maintaining a quality Certification Program.

VII. CERTIFICATION

Affixing certification signatures on documents pertaining to each package is the final step in preparing the wastes for shipment to WIPP. Before the certification, the person(s) responsible must be able to review all the data from various stages of the waste package-producing operation. Proper document control methods must be able to assist personnel in reviewing the documents necessary for certification. Such data and document verification are also part of audit procedures required for a Certification Program. Proper emphasis on QA at all processing steps is important in achieving the goal of routinely certifying waste packages.

VIII. STORAGE OF WASTE PACKAGES

Contact-handled TRU-waste packages can be stored indoors or outdoors without significant shielding requirements. Various interim storage modes now used at DOE sites[17] include

- surface storage,
- surface storage with mound earth cover,
- trench storage with weather protection,
- storage in precast-concrete or prefabricated metal buildings, and
- storage in air-supported buildings.

The WIPP Waste Acceptance Criteria require the integrity of the waste container, including labeling and color coding, for a period of at least 15 years after emplacement in WIPP. Considering the present schedule for opening WIPP, the waste packages that are prepared now for placement in WIPP in 1989 will have to retain

their integrity at least until the year 2004. Several precautions can be taken to ensure the longevity of waste packages during the interim storage period. Conversion of waste to a chemically inert form, protective coating for the surfaces of the package container, and weather protection during storage all can contribute to the long-term integrity of the waste package.

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