NOTIFICATION OF PLANNED CHANGE TO THE EPA 40 CFR PART 194 CERTIFICATION OF THE WASTE ISOLATION PILOT PLANT

REMOTE-HANDLED TRANSURANIC WASTE CHARACTERIZATION PLAN

April 30, 2003

U.S. DEPARTMENT OF ENERGY
CARLSBAD FIELD OFFICE

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Acronyms and Abbreviations

AK	Acceptable Knowledge
CARD	Compliance Application Review Document
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CCDF	Complementary cumulative distribution function
CFR	Code of Federal Regulations
CH	Contact-Handled
CPR	Cellulose, Plastic, and Rubber
CRR	Characterization Reconciliation Report
D&D	Decontamination and Decommissioning
DA	Destructive Assay
DOE	U.S. Department of Energy
DQO	Data Quality Objective
DTC	Dose-to-Curie
EPA	U.S. Environmental Protection Agency
ETEC	Energy Technology Engineering Center
LWA	Land Withdrawal Act
NDA	Nondestructive Assay
PA	Performance Assessment
PAVT	Performance Assessment Verification Test
QA	Quality Assurance
QAO	Quality Assurance Objective
QAPD	Quality Assurance Program Document
R&D	Research and Development
RH	Remote-Handled
SCG	Summary Category Group
SNL	Sandia National Laboratory
SOP	Standard Operating Procedure
TRU	Transuranic
TWBIR	TRU Waste Baseline Inventory Report
VE	Visual Examination
WCPIP	Waste Characterization Program Implementation Plan
WIPP	Waste Isolation Pilot Plant
WMC	Waste Matrix Code
WMP	Waste Material Parameter
WSPF	Waste Stream Profile Form
WWIS	WIPP Waste Information System

1.0 Introduction

The U.S. Department of Energy/Carlsbad Field Office (**DOE/CBFO**) is providing the U.S. Environmental Protection Agency (**EPA**) this Notification of Planned Change (Notification) to accept remote-handled (**RH**) transuranic (**TRU**) waste at the Waste Isolation Pilot Plant (**WIPP**). RH TRU waste is defined in Section 2 of the WIPP Land Withdrawal Act (**LWA**) (Public Law 102-579, 1992) as TRU waste with a surface dose rate of 200 millirem per hour or greater. This Notification is being provided in accordance with Title 40 Code of Federal Regulations (**CFR**) §194.4 and the associated guidance in *Guidance to the U.S. Department of Energy on Preparation for Recertification of the Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194* (EPA, 2000). In the guidance, the EPA provided the following information on how the DOE/CBFO should submit potential changes to the EPA:

> "Throughout a given year, you must provide advance notice to EPA on intent to implement a significant change, pursuant to 194.4(b)(3)(i). Because we will determine the significance of a change relative to our own certification (see also Section 4.3.1 below) you are advised to regard any change under consideration as potentially significant and to provide due notice. For any proposed change, you should submit to us an information package supporting the change. The specific information we will need will vary according to the change, but we expect to receive first, at a minimum, a description of the nature and scope of the change, how it differs from the CCA, and the DOE's assessment of the consequences for compliance with our disposal regulations. Your assessment may consist of technical reports, performance calculations, laboratory results, or other materials, depending on the nature of the change."

In accordance with the requirements of EPA's certification, the EPA did not authorize emplacement in the repository of RH TRU waste from any generator site. In its response to comments, the EPA stated that the DOE must not dispose RH TRU waste "unless [DOE] demonstrates that such waste generator site can adequately characterize the RH TRU wastes to ensure that the RH-TRU waste inventory assumptions incorporated in the Performance Assessment (**PA**) and the PAVT are not violated." (Response to Comments 6.J.1 through 6.J.5.)

According to Compliance Application Review Document (**CARD**) Number 24, Waste Characterization, the EPA was not able to certify that the DOE demonstrated that the WIPP would comply with the radioactive waste disposal regulations for RH TRU waste. Specifically, the EPA determined that the DOE did not identify adequate waste characterization methods for RH TRU waste in the Compliance Certification Application (**CCA**).

This submittal provides the required information concerning DOE/CBFO's proposal for characterizing RH TRU waste. This submittal contains two volumes: the Notification of Planned Change and the RH TRU Waste Characterization Program Implementation Plan (**WCPIP**) applicable to RH TRU generator/storage sites. The WCPIP provides programmatic requirements to assure appropriate implementation of the characterization program for RH TRU waste.

The information included in this Notification represents updated RH TRU waste information. One significant aspect of this information is that over 95 percent of the RH TRU waste inventory

will undergo packaging or repackaging (see Supplement C for more information regarding the repackaging that will be performed). As with contact-handled (**CH**) TRU waste, the collection of characterization information for RH TRU waste during packaging uses visual examination (**VE**). The acceptable knowledge (**AK**) information collection processes are similar for RH TRU waste and CH TRU waste.

Section 2.0 of this Notification provides a summary description of the nature and scope of the proposed changes to the EPA's certification necessary to accommodate the RH TRU waste characterization program. Specifically, Section 2.0 includes a description of the proposed RH TRU waste characterization program and its implementation at the generator sites, including the specific methods to be used to obtain characterization information.

Section 3.0 provides information on how the proposed change differs from the information provided in the CCA. Section 3.0 also includes a description of the differences between the approved characterization process for CH TRU waste and the proposed characterization process for RH TRU waste. The section addresses the reasons for these departures, including a discussion of the capabilities of equipment that may be used to obtain qualified characterization information. Section 3 also includes a summary of how specific requirements in the WIPP LWA and specific criteria at 40 CFR §§194.22 and .24 are met. Section 3.0 concludes that no changes are needed to the Quality Assurance (**QA**) program in order to accommodate RH TRU waste characterization.

Section 4.0 explains in summary that implementation of the planned change will have no impact on the WIPP's ability to comply with the disposal and groundwater protection standards in 40 CFR Part 191, Subparts B and C.

This Notification is supported with the following supplemental information. The DOE/CBFO intends for this supplemental information to assist the EPA in understanding the RH TRU waste characterization program.

- Supplement A, *Dose Consequence Comparison for Characterizing RH TRU Waste as CH TRU Waste*, includes an estimate of potential exposure to workers due to RH TRU waste characterization activities being conducted in a manner identical to CH TRU waste characterization activities. This supplement concludes that characterization in this manner would exceed occupational radiological dose limits. As a result, it is necessary for operations to be performed in an alternative manner (such as in a shielded environment) with appropriate remote-operated waste handling, sampling, and analysis capability.
- Supplement B, *Capabilities of Radiography and Nondestructive Assay in Characterization of RH TRU Waste*, describes the technical capabilities of radiography and nondestructive assay (**NDA**) for RH TRU waste.
- Supplement C, *Remote Handled Transuranic (RH TRU) Waste Inventory Report and Site Descriptions*, updates the inventory estimates originally identified in the CCA. The inventory report shows that more than 95 percent of the RH TRU waste will either be packaged or repackaged prior to shipment to the WIPP.

2.0 Nature and Scope

This section provides an explanation of the nature and scope of the DOE's proposed RH TRU waste characterization program. Section 2.1 provides a general overview of the AK and radiological characterization processes. Section 2.2 identifies the specific methods that will be used to obtain the necessary characterization information.

2.1 Overview

The RH TRU waste characterization program will begin, as it does with CH TRU waste, with the compilation of AK information. This process is similar to the process used by DOE TRU generator sites to compile AK information for CH TRU waste. For RH TRU waste, there will be added interest in identifying and qualifying AK data (i.e., existing NDA measurements, radiological analyses, and radiography results) because of the relative difficulty in obtaining measurement information.

For over 95 percent of the RH TRU waste, AK qualification to satisfy data quality objectives (**DQOs**) related to the physical form of the waste will occur through VE during the packaging/repackaging step. During this VE process, the sites will also collect necessary information, such as samples for radioanalysis, to qualify radiological characterization information.

As described in Supplement C, *Remote Handled Transuranic (RH TRU) Waste Inventory Report and Site Descriptions,* less than five percent of the RH TRU waste inventory is already in approved payload containers. Characterization of this waste will be accomplished by compiling and examining the AK record and determining to what extent the AK information must be supplemented. AK information used to establish compliance with the RH TRU waste DQOs, with the exception of the defense waste determination, will be qualified using one of the four processes described in 40 CFR §194.22(b). Any waste that cannot meet the RH TRU waste DQOs will not be shipped to the WIPP as RH TRU waste.

The RH TRU waste characterization process is shown in Figure 1, RH TRU Waste Characterization Process. As with CH TRU waste, AK source document summaries are developed, a source document reference list is prepared, discrepancies in the AK record are resolved, and an AK summary report is prepared for each waste stream, representing a compilation of AK information supporting the required DQOs. This AK information is then reconciled with qualification process information that has gone through the requisite verification and validation steps. Once data are validated, the site prepares a waste stream profile form (**WSPF**) and enters data into the WIPP Waste Information System (**WWIS**). Quality assurance objectives (**QAOs**) for AK relevant to the collection and confirmation of the RH TRU DQOs include accuracy, completeness, representativeness, and comparability. The steps shown in Figure 1 are discussed below.

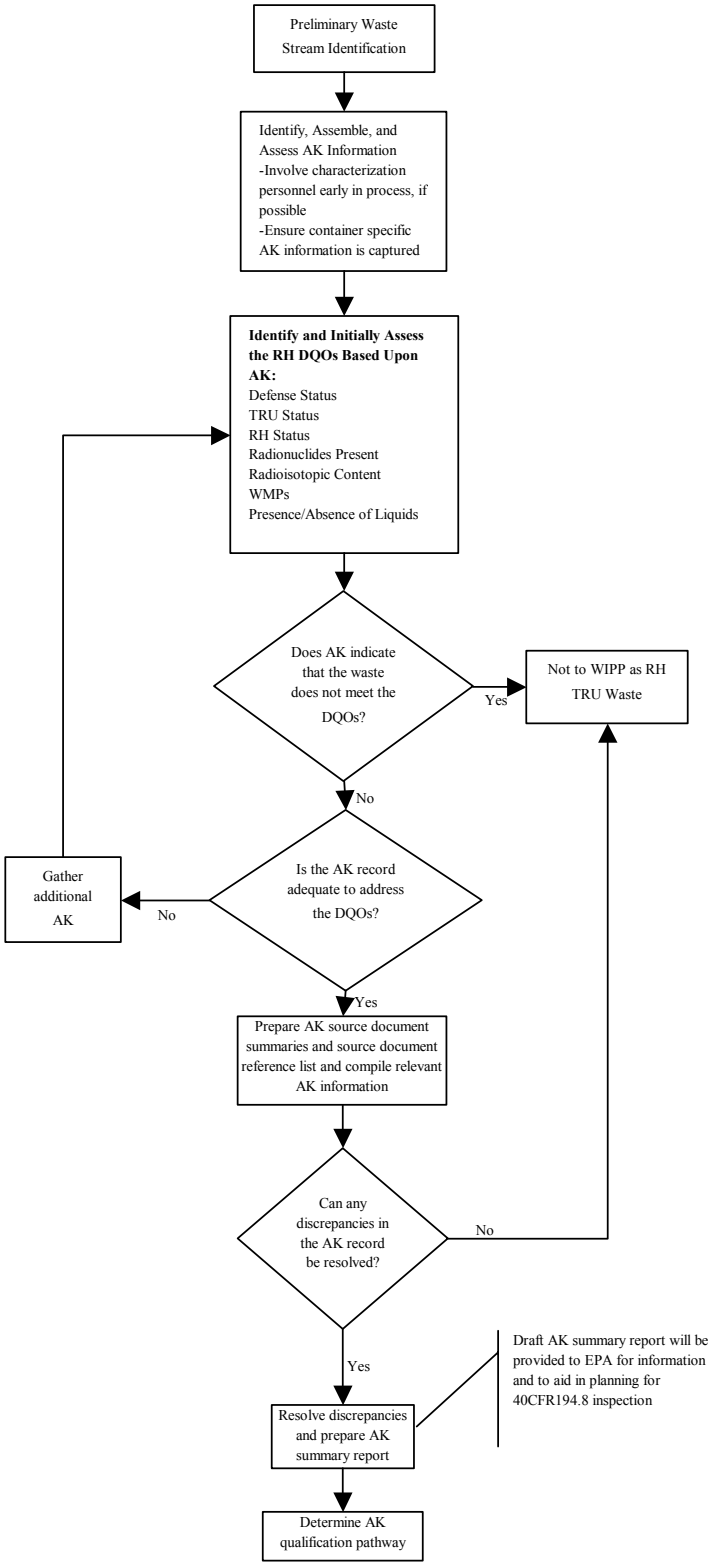

Figure 1. RH TRU Waste Characterization Process

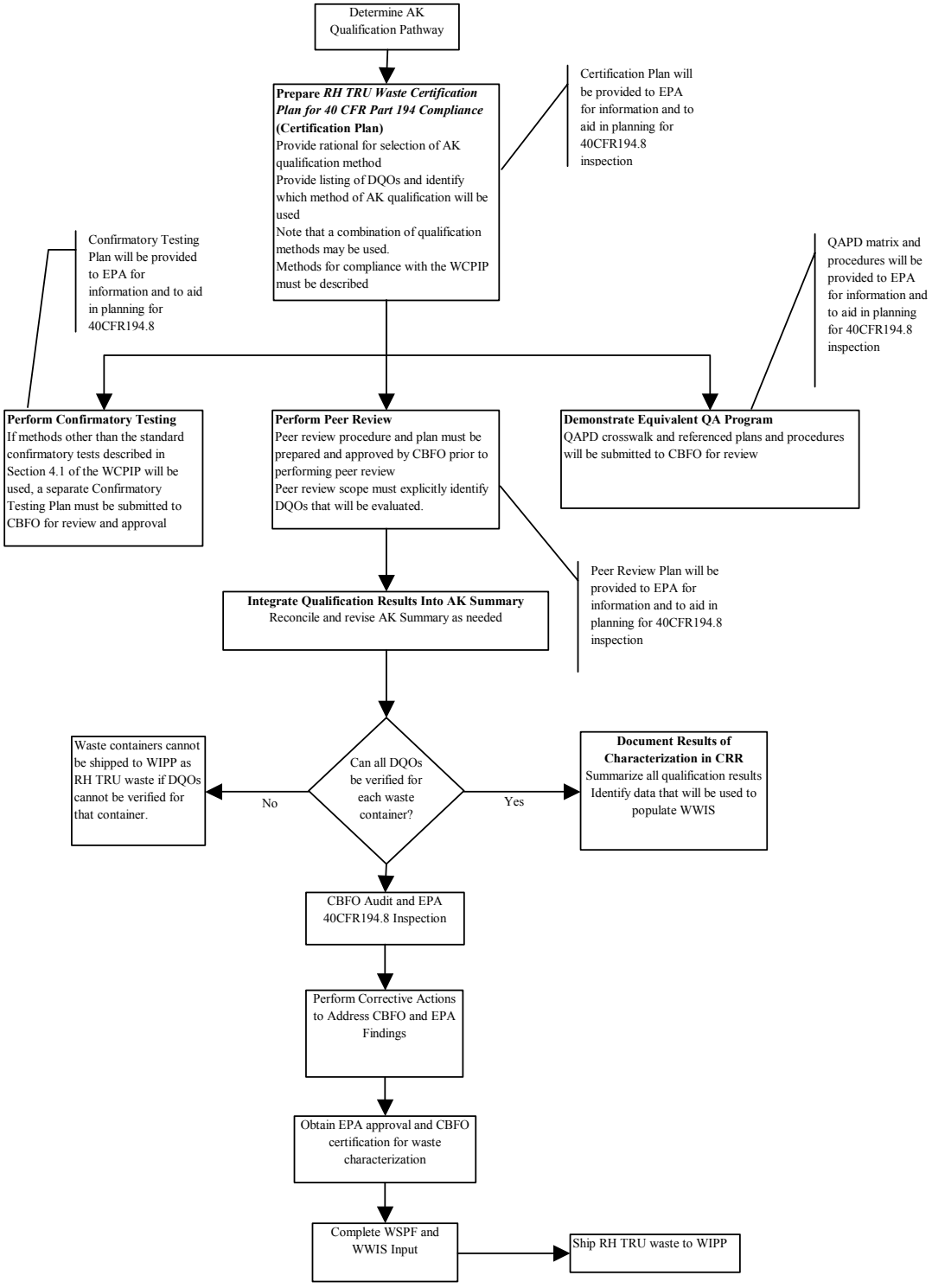

Figure 1. RH TRU Waste Characterization Process (continued)

Preliminary Waste Stream Identification – Identification of the RH TRU waste stream for which the AK information is being compiled.

Identify, Assemble, and Assess AK Information – AK personnel assisted by personnel who were involved in previous characterization of the waste collect documentation in the form of published and unpublished reports, correspondence, waste packaging logs, databases, procedures, and other data used to compile RH TRU waste AK information.

Identify and Initially Assess the RH TRU DQOs Based Upon AK– If the waste does not meet any of the RH DQOs, it is eliminated from further consideration under this program. The AK personnel compile information from the AK documentation to support each of these primary DQOs. If there is not enough information to assess compliance with the DQOs, AK personnel gather additional AK information.

Prepare AK Source Document Summaries and AK Source Document Reference List and Compile Relevant AK Information – AK personnel prepare AK source document summaries that identify the relevant information from the source documents supporting one or more of the characterization DQOs. Limitations of the AK source documents are noted and each document is assigned a unique number. A reference list is compiled and maintained in the AK record.

Resolve Discrepancies and Prepare AK Summary Report – AK personnel prepare an AK summary report for the RH TRU waste stream. The report provides a narrative description of the waste stream, process source of generation, inventory figures, and AK information that address the required DQOs for RH TRU waste. The summary report will identify additional information required to meet the DQOs, such as container weight, and will also document the process used to qualify or confirm the relevant AK information. The summary report will also identify how AK discrepancies were resolved.

Determine AK Qualification Pathway – Site personnel determine the methods that will be used to qualify the AK data relied upon to meet the RH TRU waste DQOs.

Prepare RH TRU Certification Plan for 40 CFR 194 Compliance (Certification Plan) – Site personnel prepare a Certification Plan that describes the rationale for selection of the AK qualification methods that will be used, a listing of the DQOs and identification of AK qualification methods that will be used to comply with the DQOs, and a description of the methods that will be used to comply with the requirements of the WCPIP. The TRU waste sites may use a combination of methods to demonstrate compliance with the DQOs.

Perform Confirmatory Testing – TRU waste sites perform confirmatory testing, as described in their Certification Plans. The WCPIP, in Section 4.1, describes standard confirmatory testing methods for characterizing RH TRU waste. These include:

- Visual examination of 100% of waste requiring packaging or repackaging
- Visual examination or radiography of 10% of waste already packaged in payload containers
- Dose-to-curie conversion
- Destructive assay
- Nondestructive assay

These standard methods are discussed in more detail in Section 3.3.3 of this Notification and Section 4.1 of the WCPIP. If TRU waste sites propose to use confirmatory testing by means other than the standard methods, they must submit a confirmatory testing plan for CBFO approval.

Perform Peer Review – TRU waste sites may perform peer reviews to qualify AK information. If this option is selected, the site must submit the peer review plan and procedures to CBFO for approval prior to performing the peer review.

Demonstrate Equivalent QA Program – If AK information was collected under a QA program equivalent in effect to the current QA program required by 40 CFR 194, TRU waste sites may choose this option to qualify AK information. The TRU waste sites are required to submit documentation of equivalency to CBFO for review and approval.

Integrate Qualification Results Into AK Summary – After the AK qualification information is verified and validated, AK personnel reconcile the data with the AK record in the AK summary report. Discrepancies are identified and resolved. Significant and/or numerous discrepancies may require a reevaluation of the AK record. If AK discrepancies cannot be resolved, the waste will not be shipped to the WIPP as RH TRU waste.

Document Results of Characterization in Characterization Reconciliation Report (CRR) With qualified AK information to support the DQOs, generator site personnel will prepare the CRR. The qualified AK information must demonstrate compliance with the DQOs for each container that will be shipped to WIPP.

CBFO Audit and EPA 40 CFR 194.8 Inspection – The EPA will perform an inspection of the waste characterization and QA program at the TRU waste site. The CBFO will also perform an audit of these activities.

Obtain EPA Approval and CBFO Certification for Waste Characterization – Upon completion of any corrective actions performed to address EPA or CBFO concerns, the EPA will approve and the CBFO will certify the TRU waste site to perform waste characterization for a waste stream or group of waste streams.

Complete Waste Stream Profile Form - The generator site personnel will complete a WSPF for the RH TRU waste stream of interest and enter this data into the WWIS.

2.2 Characterization Methods

The DOE has identified waste characterization objectives that each site must satisfy. These are specific characteristics of the waste that need to be determined in order to track the significant waste components and to control the inventory of RH TRU waste in the repository so as to ensure compliance with the requirements of the LWA and the PA. These are grouped by DQO. Specific QAOs for the methods are described in Section 3. Table 2-1 depicts the methods for obtaining the needed information and the corresponding characterization objective being met. More detail regarding implementation of the characterization methods is provided in Section 3.3.3.

Table 2-1. Characterization Methods and Characterization Objectives

Characterization Methods	Characterization Objectives
Acceptable Knowledge	TRU Waste Determination, Total Activity, Activity per Canister, Defense Determination, Physical Form, Residual Liquid
Dose-to-curie	TRU Waste Determination, Total Activity, Activity per Canister
Visual Examination	Physical Form, Residual Liquid
Radiography	Physical Form, Residual Liquid
Radioassay	TRU Waste Determination, Total Activity, Activity per Canister
Surface Dose Rate	Surface Dose Rate
Count Containers	Metals

2.2.1 TRU Activity Determination

An assessment of the TRU curie-per-gram (Ci/g) concentration of waste in each waste stream is necessary to demonstrate the waste contains greater than 100 nanocuries per gram (nCi/g) of alpha-emitting TRU radionuclides with half-lives greater than 20 years.

In addition, the radionuclide activity (including ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) must be reported in the WWIS in order to track the radionuclides of interest. The reported value will indicate the related uncertainty of the measurements. The quantification will include documentation that establishes the basis for the calculation of isotopic distributions. The following methods will be used to obtain the required information for this DQO:

- AK
- Qualification of AK information using:
  - Radioassay
  - Dose-to-curie (**DTC**) conversion
  - Peer review
  - Demonstration of equivalent QA program
  - Other confirmatory testing

2.2.2 Total Activity

An estimate of the total curie content of the waste in each waste stream is necessary to comply with the LWA limit of 5.1 million curies of RH TRU waste. The following methods will be used to obtain the required information for this DQO:

- AK
- Qualification of AK information using
  - Radioassay
  - DTC conversion
  - Peer review
  - Demonstration of equivalent QA program
  - Other confirmatory testing

2.2.3 Activity Limit Per Canister

An estimate of the activity of the waste in each container is determined. That value will then be averaged over the volume of the RH TRU canister to ensure compliance with the LWA limit of 23 curies per liter (Ci/l). The following methods will be used to obtain the required information for this DQO:

- AK
- Qualification of AK information using
  - Radioassay
  - DTC conversion
  - Peer review
  - Demonstration of equivalent QA program
  - Other confirmatory testing

2.2.4 Surface Dose Rate

The dose rate from the waste package must be known to demonstrate that the waste is RH, to comply with the disposal limitations, and to allow the WIPP to track the dose rates to ensure that less than five percent of the containers have dose rates greater than 100 rem/hr. Waste package dose rates must be measured and reported using measurements with calibrated field instruments that meet calibration tolerances defined by the manufacturer.

2.2.5 Waste Generated by Atomic Energy Defense Activities

Only AK can be used to determine this DQO. AK documentation describes the origin of the waste. Source documents will be included in the AK record which establish the defense-related activities performed at the site and how this work resulted in the generation of the waste. Documentation such as studies or reports generated as a result of the work, contracts or payment schedules that establish the nature of the work, correspondence concerning the work, interviews with personnel directly involved with the work, or material transfer records that establish the defense nature of the material, will be considered adequate documentation that the material was generated by defense-related activities.

If defense waste is co-mingled with non-defense waste, the description will explain how the wastes were co-mingled and why they cannot be segregated. If a non-defense waste has been mixed with a defense waste and it is not feasible to segregate it, it is considered defense waste.

2.2.6 Physical Form

AK information will be used to establish the physical form of waste and will be used as the basis to prepare the waste packaging procedures for waste not yet in containers. The Summary Category Groups (**SCGs**) are S3000 (solidified solids), S4000 (soil/gravel), and S5000 (debris). The SCG indicates the physical form of the waste. The identification of physical form applies to the entire waste stream and is based on the majority of the waste stream. That is to say, a stream that has mostly debris may also have homogeneous solids and soils/gravels. The following methods will be used to obtain the required information for this DQO:

- AK
- Qualification of AK information using:
  - VE
  - Radiography
  - Peer review
  - Demonstration of equivalent QA program
  - Other confirmatory testing

2.2.7 Residual Liquids

Residual liquids in excess of one percent are prohibited in RH TRU waste. By maintaining residual liquid content below the one percent limit, the waste remains consistent with an assumption made in the PA. The following methods will be used to obtain the required information for this DQO:

- AK
- Qualification of AK information using:
  - VE
  - Radiography
  - Peer review
  - Demonstration of equivalent QA program
  - Other confirmatory testing

2.2.8 Metals

The amount of ferrous and non-ferrous materials will be determined by counting the number of canisters disposed of multiplied by the construction weights of each type of material in RH TRU canisters. These parameters will be tracked by the WWIS.

2.2.9 Cellulose, Plastic, and Rubber (**CPR**)

Visual examination, radiography, and qualification of AK information are the primary methods for determining this parameter on a waste stream basis. Each is capable of determining the physical form of the waste and of assigning the SCG code. The amount of CPR for debris waste (S5000) will be determined by multiplying the volume of the waste container by the density of plastic (620 kg/m^3). This calculation will be performed by the WWIS. Weights up to the net weight of the waste will be assigned using this method. The derived weight will be entered into WWIS with a waste material parameter type of "plastic." For soils and gravel (S4000), the net weight of the waste will be entered into the WWIS with a waste material parameter type of "soil." For homogeneous solids (S3000), the net weight of the waste will be entered into the WWIS with the waste material parameter type appropriate to the waste (e.g., solidified inorganic material, solidified organic material, cement). For all summary category groups, weights for plastics in packaging (e.g., drum liners) will be entered into WWIS. The total CPR mass in RH TRU waste will be tracked and controlled through the WWIS such that the repository limit on CPR is not exceeded. The density of plastic at 50% porosity is 600 kg/m^3; this type of loading is very dense and normally requires deliberate packing. However, for bounding purposes, a density loading of 620 kg/m^3 will be used. This represents the maximum extreme case for an isolated drum identified in the Baseline Inventory Report 3 (**BIR**-3) used in the CCA, which is greater than the 50% of the maximum theoretical density of 1200 kg/m^3. The maximum theoretical density is the value if molten plastic were poured into the canisters with zero void volume or porosity.

Plastic was chosen to conservatively represent the RH CPR mass for RH debris waste because plastic produces 1.7 moles of gas per mole of plastic consumed versus 1.0 mole of gas per mole of cellulose, and 1.1 moles of gas per mole of rubber. This is consistent with the assumptions of Appendix WCA in the CCA.

This approach will conservatively overestimate the amount of plastics in the repository. This overestimation will serve to compensate for any CPR that might be present in S3000 and S4000 waste matrices.

2.3 Conclusion

The RH TRU waste characterization program described in this section was derived from the CH TRU waste characterization program. The following section provides an explanation of the RH TRU waste characterization program and explains the differences between this program and the CH TRU waste characterization program. Details for implementation of the RH TRU waste characterization program at the generator sites are contained in the RH TRU WCPIP.

3.0 Information Different from the Compliance Certification Application

This section explains the changes to the DOE/CBFO TRU waste program necessary for the disposal of RH TRU waste at the WIPP. These changes were identified after a systematic examination of the certification baseline. All of the changes are in the area of waste characterization (40 CFR §194.24). This section was organized and written using Chapter 4 of the WIPP CCA as a model. The text of the CCA was revised only to discuss RH TRU waste.

Implementation of the RH TRU waste characterization program will ensure sufficient data are obtained to demonstrate that the waste inventory assumptions in the PA and Performance Assessment Verification Test (**PAVT**) are maintained. Table 3-1 provides a quick reference guide comparing the CH TRU waste and the RH TRU waste characterization methods.

The WCPIP provides the programmatic detail and the methods that will be employed by the generator sites in collecting waste characterization data.

3.1 Differences Between CH TRU Waste and RH TRU Waste

In its certification decision, the EPA approved the characterization process for CH TRU waste, but deemed the same process inadequate for RH TRU waste. This Notification provides details of the proposed characterization process for the RH TRU waste. In addition, in a recent letter (EPA, 2002), the EPA stated: "In order for EPA to consider departures from the CH TRU program, DOE/CBFO must justify in its proposal why the CH TRU program cannot or should not be applied to the RH-TRU waste." This section describes the differences between CH TRU waste and RH TRU waste and provides the necessary justification.

There are two differences between RH TRU waste and CH TRU waste that drive the differences between the two waste characterization programs:

- Statutory: Unlike CH TRU waste, the LWA places specific limitations (dose rate and activity) on the subset of TRU waste that is defined as RH TRU waste.

- Radiological: The RH TRU waste has much higher radiation dose rates than the CH TRU waste. Remote handled TRU waste contains larger concentrations of strong gamma emitters (e.g., ^{60}Co and ^{137}Cs), which make determining the isotopic ratios of TRU radionuclides by nondestructive assay difficult. In addition, while operators can handle CH TRU waste containers by hand, the RH TRU waste canisters must be handled remotely, with sufficient shielding to preclude excessive doses to the operators. Supplement A, *Dose Consequence Comparison for Characterizing RH TRU Waste As CH TRU Waste,* provides information regarding the radiological impacts of RH TRU waste compared to CH TRU waste.

Table 3-1. Quick Reference Guide to RH TRU Waste and CH TRU Waste Characterization

CHARACTERIZATION OBJECTIVES	WASTE TYPE	PACKAGED WASTE		WASTE REQUIRING PACKAGING	
		CHARACTERIZATION METHOD	QUALIFICATION METHOD	CHARACTERIZATION METHOD	QUALIFICATION METHOD
DEFENSE DETERMINATION	RH TRU	AK	Approved AK Program	AK	Approved AK Program
	CH TRU	AK	Approved AK Program	AK	Approved AK Program
RADIOLOGICAL PROPERTIES					
RH vs. CH DETERMINATION	RH TRU	Surface Dose Rate under an EPA-approved program	None	Surface Dose Rate under an EPA-approved program	None
	CH TRU	Surface Dose Rate under an EPA-approved program	None	Surface Dose Rate under an EPA-approved program	None
ACTIVITY[1]	RH TRU	AK	AK used for activity determination must be qualified by confirmatory testing, peer review, or equivalent QA program	AK	AK used for activity determination must be qualified by confirmatory testing, peer review, or equivalent QA program
	CH TRU	AK	NDA used as a confirmatory test to qualify AK. Use of destructive assay (**DA**) as a confirmatory test is allowed under the current CH program, but has not been used to date.	AK	NDA used as a confirmatory test to qualify AK. Use of DA as a confirmatory test is allowed under the current CH program, but has not been used to date.
TRU WASTE DETERMINATION	RH TRU	AK	AK used for the TRU waste determination must be qualified by confirmatory testing, peer review, or equivalent QA program	AK	AK used for the TRU waste determination must be qualified by confirmatory testing, peer review, or equivalent QA program
	CH TRU	AK	NDA used as a confirmatory test to qualify. Use of DA as a confirmatory test is allowed under the current CH program, but has not been used to date.	AK	NDA used as a confirmatory test to qualify. Use of DA as a confirmatory test is allowed under the current CH program, but has not been used to date.

[1] Includes data to determine 10 tracked radionuclides, compliance with 23 Ci/l limit, and total RH Ci limits.

Table 3-1. Quick Reference Guide to RH TRU Waste and CH TRU Waste Characterization (continued)

CHARACTERIZATION OBJECTIVES	WASTE TYPE	PACKAGED WASTE		WASTE REQUIRING PACKAGING	
		CHARACTERIZATION METHOD	QUALIFICATION METHOD	CHARACTERIZATION METHOD	QUALIFICATION METHOD
PHYSICAL AND CHEMICAL PROPERTIES					
RESIDUAL LIQUIDS	RH TRU	AK	AK must be qualified by confirmatory testing using VE or radiography on 10% of the containers[2], peer review, or equivalent QA program	AK	AK must be qualified by confirmatory testing using VE on 100% of the waste
	CH TRU	AK	AK must be qualified using confirmatory testing by 100% radiography or VE	AK	AK must be qualified by confirmatory testing using VE or radiography on 100% of the waste
FERROUS METALS	RH TRU	None	None, count containers	None	None, count containers
	CH TRU	None	None, count containers	None	None, count containers
CPR[3]	RH TRU	AK	AK must be qualified by confirmatory testing by use of the 10-10-All method, peer review, or equivalent QA program	AK	AK must be qualified by confirmatory testing using VE on 100% of the waste.
	CH TRU	AK	AK must be qualified by 100% radiography or VE	AK	AK must be qualified by confirmatory testing using VE or radiography on 100% of the waste.

[2] Using the "10-10-All" approach described in Section 3.3.3.1 of this Notification

[3] For RH TRU waste, CPR is established using a bounding value for density and container volume based on SCG; CPR in packaging is accounted for as is done on CH TRU waste.

In addition to these differences, based on current inventory estimates, more than 95 percent of the RH TRU waste will either be packaged or repackaged because the configuration of the existing packaging is not appropriate for transport to and/or disposal in the WIPP. This unpackaged condition of RH TRU waste provides opportunities to the generator sites to visually examine the RH TRU waste during packaging to assure compliance with the EPA's disposal criteria. The proposed VE process to be used during packaging is described in the WCPIP.

3.1.1 RH TRU Waste Characteristics Defined by the Land Withdrawal Act

The LWA defines unique statutory characteristics that apply to RH TRU waste. The WIPP must operate within a specific total curie limit for RH TRU waste, maintain the RH TRU curie concentration in each canister below a specified limit, and assure that RH TRU surface dose rate limitations are met. The CH TRU waste characterization program does not have to address these requirements.

3.1.2 Management of Radiation Dose

Containers of RH TRU waste must be handled in a manner (i.e., remotely) that protects operators and others from exposure to penetrating radiation. Surface dose equivalent rates (dose rates) are equal to or greater than 200 millirem per hour (mrem/hr), which could lead to operators exceeding annual dose limits due to prolonged exposure. CH TRU waste has lower dose rates (typically less than 10 mrem/hr) and can be contact-handled. Because of this, some waste management techniques will vary from their application for CH TRU waste.

All TRU waste must be handled in a manner that protects operators and others from inhalation or ingestion of radionuclides. To do this, waste characterization activities are performed in facilities designed to contain airborne radionuclides that may result from sampling or testing. For CH TRU waste, these facilities can include gloveboxes that allow operators to use gloveports to access waste containers while viewing them through windows. For RH TRU waste, the testing or sampling may require hot cell facilities that provide remote-handling capability and extensive shielding. Supplement A illustrates the dose consequences if operators were to attempt to characterize RH TRU waste using the same methods and facilities that are currently used for CH TRU waste.

3.2 Differences Between the RH TRU Waste and the CH TRU Waste Characterization Programs

The RH TRU waste characterization program will include the quantification and tracking of unique waste properties that are required by the LWA. These include verification that surface dose rates are below 1,000 rem/hr for all containers, tracking of dose rate information to ensure that no more than five percent of the containers disposed exceed 100 rem/hr, determination of activity concentration in Ci/l, ensuring each container is less than or equal to 23 Ci/l, and verification that container dose rates are equal to or greater than 200 mrem/hr.

Due to the limitations imposed by the higher gamma radiation fields, NDA of waste containers will not be used as extensively in the RH TRU program as it is in the CH TRU waste characterization program. For the same reason, the usefulness of radiography will also be

limited. See Supplement B, *Capabilities of Radiography and Nondestructive Assay in Characterization of RH TRU Waste,* for a discussion of these limitations. Because of these limitations, the DOE/CBFO is proposing to determine and confirm the isotopic composition of RH TRU waste on a waste stream or waste stream lot basis. The DOE/CBFO is proposing to allow the use of the DTC method (see Section 3.3.3.2), in addition to destructive and nondestructive assay, as a technique for quantification of the radionuclide activities in the RH TRU waste and qualification of AK information.

For those RH TRU wastes that are already in acceptable payload containers, the DOE/CBFO is proposing, as a standard confirmatory method, that a subpopulation of this waste be subjected to either VE or radiography to confirm the absence of free liquids in excess of one percent and to confirm the physical form of the waste.

Qualification of AK information using the methods described in 40 CFR §194.22(b) will be used in the RH TRU waste characterization program. The CH program has relied on 100 percent confirmatory testing as the method for qualifying AK information related to the radiological and physical properties of the waste. The DOE/CBFO is proposing to use peer review, equivalent QA programs, and confirmatory testing of subpopulations of the waste to qualify AK information related to the properties of the waste. Although these methods are allowed under the CH program, and have been used to qualify AK information related to the radionuclide properties of certain CH TRU wastes at the Rocky Flats Environmental Technology Site (confirmatory testing of a subpopulation of the waste), AK information qualification using less than 100 percent confirmatory testing has not been extensively done in the CH TRU waste characterization program.

The DOE/CBFO is proposing to calculate the amount of CPR in containers of debris waste (S5000) by multiplying the volume of the waste container by the density of plastic (620 kg/m^3). This calculation will be performed by the WWIS and is a conservative estimation of the amount of CPR in the RH TRU inventory. Weights up to the net weight of the waste will be assigned using this method. The derived weight will be entered into WWIS with a waste material parameter type of "plastic."

For soils and gravel (S4000), the net weight of the waste will be entered into the WWIS with a waste material parameter type of "soil." For homogeneous solids (S3000), the net weight of the waste will be entered into the WWIS with the waste material parameter type appropriate to the waste (e.g., solidified inorganic material, solidified organic material, cement). For all summary category groups, weights for plastics in packaging (e.g., drum liners) will be entered into WWIS. The total CPR mass in RH TRU waste will be tracked and controlled through the WWIS such that the repository limit on CPR is not exceeded. Given the conservative assumptions with regard to CPR quantities, VE will not be used as a quality control check on radiography performed on RH TRU waste. The differences between the CH TRU and RH TRU waste characterization programs are summarized in Table 3-2.

Table 3-2. Summary of Differences Between the CH TRU and RH TRU Waste Characterization Programs

Process	Differences	Justification
AK	The CH program generally requires 100% confirmation of TRU isotopic ratios derived from AK. This confirmation is performed during NDA. The RH program will use sampling and analysis to confirm AK TRU isotopic ratios on a waste-stream basis.	Because of the higher dose rates associated with RH TRU waste, it will be difficult or impossible (see Supplement B) to measure TRU isotopics directly using gamma spectroscopy methods applied to containers of RH TRU waste.
	The CH program requires 100% VE or radiography of each waste container to confirm physical form and absence of residual liquids in excess of 1%. The RH program requires that 10% of waste that is already packaged in payload containers be subjected to VE or radiography. RH TRU waste requiring packaging will be subjected to 100% VE at the time of packaging.	Given the high dose rates associated with RH TRU waste and the cost associated with opening packaged waste, the DOE has proposed less than 100% VE or radiography for already packaged waste.
	The term "supplemental" AK information has been removed from the AK program for RH.	Based on experience with the CH program, required and "supplemental" AK information have been combined in the RH WCPIP.
	The CH program requires confirmation of the waste matrix code during radiography and VE. The RH program only requires confirmation of the Summary Category Group.	The RH TRU program requires that the waste stream description be confirmed. Because the waste stream description is confirmed, it is not necessary to confirm the waste matrix code. Confirmation of the waste stream description will include a description of the waste material parameters present in the waste.
VE	The CH program requires that weights of individual waste material parameters be estimated. The RH program will assign waste material parameter weights based on the SCG of the waste.	Due to the increased costs associated with estimating waste material parameter weights, the DOE has proposed to make a conservative assumption.
	There are no QAOs associated with VE on the CH program. QA objectives have been established for VE on the RH program.	QAOs were established to make the description of the RH characterization methods consistent.

Table 3-2. Summary of Differences Between the CH TRU and RH TRU Waste Characterization Programs (continued)

Process	Differences	Justification
Radiography	The CH program requires that weights of individual waste material parameters be estimated. The RH program will assign waste material parameter weights based on the SCG of the waste.	Due to the increased costs associated with estimating waste material parameter weights the DOE has proposed to make a conservative assumption.
	VE will not be used as a QC check on radiography.	Due to the small volume of RH waste that could be subject to radiography (less than 5% of the total RH inventory), the increased dose and costs associated with performing VE as a QC check on radiography is not justified.
Radioassay	The DOE/CBFO is not proposing to have a Performance Demonstration Program (**PDP**) for NDA performed on RH TRU waste.	The costs associated with developing a PDP program using high gamma dose rate sources is not justified.
	The volumetric activity in Ci/l will be determined for each RH TRU waste package.	Required to assure compliance with the limits in the LWA.
	The DTC method will be an allowable characterization method on RH TRU waste.	The DTC method is amenable to quantifying the activities of TRU waste containing significant quantities of gamma-emitting radionuclides.
Data Review	For VE and radiography, batch data reports require review by an independent technical reviewer, a technical supervisor, a facility QA officer, a site QA officer, and the site project manager. For the RH program, a review by an independent technical reviewer and the site project manager will be required.	This will make the batch data report review requirements for VE and radiography consistent with review requirements for NDA batch data reports as currently approved for CH TRU waste.

3.3 RH TRU Waste Characteristics

Chapter 4 of the CCA (DOE, 1996) provided a description of the waste included in the DOE's PA. The discussion focused on waste inventory, waste controls, and waste characterization.

This Notification discusses each of these three topics to the extent that new or different information is available for RH TRU waste. In some cases, where the information from the CCA has not changed, the RH TRU waste information is presented for completeness.

3.3.1 RH TRU Waste Inventory

This section responds to changes to the criteria in 40 CFR §194.24(a). Supplement C, *RH TRU Waste Inventory Report and Site Descriptions*, contains a summary of the quantity of stored and projected RH TRU waste and RH TRU waste components. Supplement C updates the

information used in the CCA based on the *TRU Waste Baseline Inventory Report* (**TWBIR**). Supplement C also documents the current estimated inventory of DOE RH TRU waste and includes both the RH TRU waste planned for disposal in the WIPP and the RH TRU waste for which a disposal decision has not yet been made. Updates to TWBIR information will be analyzed for submittal of the compliance recertification application and are not a part of this Notification.

Although updates are made to the inventory based on new information received from ongoing waste identification and characterization activities at the generator/storage sites, Supplement C is an inventory report and not a summary of RH TRU waste characterization data. For waste shipped to the WIPP, RH TRU waste characterization data associated with each container will be reported by entering the data into the WWIS for tracking purposes. A description of the WWIS is given in Section 4.3.2 of the CCA and changes are discussed subsequently in Section 3.3.2 of this Notification.

3.3.2 RH TRU Waste Controls

The following discussion is responsive to the criteria of 40 CFR §§194.24(c)(4), (c)(5), and (e).

The WWIS is used to track and control waste components to assure limits are not exceeded. A description of the WWIS can be found in the CCA. The WWIS will be used for tracking RH TRU waste in the same manner in which it is currently used for CH TRU waste, with the exceptions noted below.

The WWIS will calculate the appropriate waste material parameter weights for RH TRU waste containers. This will be done as follows:

- The amount of CPR in containers of debris waste (S5000) will be assigned by multiplying the volume of the waste container by the density of plastic (620 kg/m^3). This calculation will be performed by the WWIS and is a conservative estimation of the amount of CPR in the RH TRU inventory. Weights up to the net weight of the waste will be assigned using this method. The derived weight will be entered into WWIS with a waste material parameter type of "plastic."

- For soils and gravel (S4000), the net weight of the waste will be entered into the WWIS with a waste material parameter type of "soil." For homogeneous solids (S3000), the net weight of the waste will be entered into the WWIS with the waste material parameter type appropriate to the waste (e.g., solidified inorganic material, solidified organic material, cement). For all SCGs, weights for plastics in packaging (e.g., drum liners) will be entered into WWIS. The total CPR mass in RH TRU waste will be tracked and controlled through the WWIS such that the repository limit on CPR is not exceeded.

The WWIS will also be used to keep track of the RH TRU waste curies to assure compliance with the 5.1 million curie limit and the 23 Ci/l limit. Container dose rates will be tracked in the WWIS to assure compliance with the RH-specific dose rate limits. The volume of waste disposed will also be tracked to comply with the regulatory limit of 6.2 million cubic feet. The

WWIS will be revised to include:

- Calculation of CPR amounts for S5000 waste
- Edit/limit checks to verify containers disposed of in WIPP are less than 1000 rem/hr
- Edit/limit checks to verify no more than 5% of the total volume of RH waste disposed in WIPP is greater than 100 rem/hr
- Edit/limit checks to verify waste does not exceed 23 Ci/l

These changes will be made in accordance with the software QA plans and procedures that govern changes to the WWIS. The WWIS user's manual will also be revised to reflect these changes.

3.3.3 Waste Characterization

The process of waste characterization identifies the physical, chemical, and radiological properties of the waste using a variety of methodologies (DOE, 1995) including AK, waste sampling and analysis, VE, NDA, DA, DTC, and radiography. The measured waste properties obtained by the generator/storage sites are either on a waste container or waste stream basis and serve to demonstrate compliance with the waste component limits described in Appendix WCL of the CCA, which are repository limits that serve as upper and lower bounds for the cumulative waste inventory. As described in Section 3.3.2, the linkage between the collective waste inventory and the repository limits is provided by the WWIS.

The RH TRU WCPIP establishes the waste characterization requirements for RH TRU waste destined for disposal in the WIPP and includes requirements for the determination of the physical, chemical, and radiological properties of the RH TRU waste streams. The capabilities and applicability of these methods to RH TRU waste are discussed in detail in the RH TRU WCPIP.

Radiological characterization of TRU waste is needed to demonstrate compliance with 40 CFR Parts 191 and 194. A quantitative determination of the 10 WIPP-tracked radionuclides is driven by the need to remain within the envelope of the CCA with regard to compliance with the release limits as specified in 40 CFR Part 191, Subpart B, Appendix A, and the RH TRU waste curie limit established by the LWA.

Collectively, those elements of the waste characterization program that support long-term regulatory compliance include the determination of the radionuclide inventory, the identification of the physical and chemical waste form inventories (if applicable), and the verification that no waste is emplaced in the WIPP that exceeds the limits of the disposal system.

The WIPP RH TRU waste radiological characterization program is conducted by generator/storage site personnel and is implemented in accordance with the requirements of the DOE/CBFO QAPD. A description of the approved waste characterization methodologies and QAOs is provided in the RH TRU WCPIP.

Implementation of the RH TRU waste characterization program at DOE sites requires that all waste characterization activities be conducted in accordance with approved documentation that describes the management, operations, and QA aspects of the program. Conformance with applicable regulatory, programmatic, and operational requirements is monitored by the DOE/CBFO through audits and surveillances. The documentation requirements important to the implementation of the TRU Waste Characterization Program at each site are:

- QA requirements: Implementation of individual site-specific waste certification and characterization programs must meet the QA requirements contained in the QAPD, which are traceable to the applicable sections of ASME NQA-1 through NQA-3 (ASME 1989a, b, and c). The WCPIP describes the specific QAOs for the RH TRU Waste Characterization Program.

- RH TRU Waste Certification Plans: Generator sites prepare site-specific RH TRU certification plans that describe waste characterization activities which support the RH TRU waste characterization program. These documents, developed in accordance with the applicable requirements in the QAPD and the WCPIP, define QA management and program elements that provide for planning, implementation, and assessment of the RH TRU waste characterization data collection activities.

- Standard Operating Procedures (**SOPs**): The WCPIP requires that each DOE site develop, implement, and control written SOPs that provide detailed descriptions of waste characterization activities.

As the generator sites complete the necessary program documentation, they commence RH TRU waste characterization activities. Information derived from these activities is used in preparing the site's WSPF required for waste acceptance at the WIPP. The waste characterization data are downloaded into the WWIS database on a container basis.

In addition to approval of site-specific documentation, generator/storage sites must pass an initial site certification audit where adequacy, implementation, and effectiveness of these programs is assessed. Audits are performed at least annually thereafter, including the possibility of unannounced audits. These audits verify that the generator site has implemented a QA program for all certification activities. The accuracy of the physical waste description and the subsequent waste stream assignment are verified by a review of the AK documentation, radioassay, dose-to-curie, radiography data, and VE results (as applicable). Table 3-3 summarizes the characterization requirements, and the methods are detailed in the WCPIP.

Table 3-3. Applicable RH TRU Waste Component Characterization Methods

Waste Properties	Waste Components	Waste Characterization Methods
Nuclear	Radionuclides	AK qualified by: Radioassay or Dose-to-Curie or qualification of existing radiological data by peer review, equivalent QA program, or other confirmatory test.
Physical and Chemical	CPR, Residual Liquids	AK qualified by: VE or radiography or qualification of previous VE or radiography data by peer review, equivalent QA program, or other confirmatory test.

3.3.3.1 Qualitative Methodologies

The criteria of 40 CFR §194.24(a) require that a description be provided of the physical, chemical, and radiological composition of the TRU waste to be emplaced in the WIPP. With regard to the waste's physical and chemical components, there are three qualitative methodologies used either alone or in combination for verifying adherence to the compliance limits contained in the CCA, the final certification, and CCA Appendix WCL. These methodologies include AK, radiography, and VE.

Acceptable Knowledge

The following discussion is responsive to the criteria of 40 CFR §194.24(c)(3).

AK includes information regarding the physical form of the waste, the base materials composing the waste, and the process that generated the waste.

The WCPIP provides an overview of the process for assembling AK documentation into an auditable record, including identification of the AK information regarding the materials and processes that generate a specific waste stream.

To ensure that the AK process is consistently applied, sites must implement the Standard AK Procedure for RH TRU waste that is found in the WCPIP. The QAOs for the AK method are found in Table 3-4.

Table 3-4. RH TRU Waste Characterization Method Quality Assurance Objectives

METHOD	PRECISION	ACCURACY	REPRESENTATIVENESS	COMPLETENESS	COMPARABILITY
VE	Precision is maintained by reconciling any discrepancies between two operators (or between the operator and the independent technical reviewer) with regard to the identification of important waste characteristics (i.e., physical form of the waste and absence of residual liquid in excess of 1% by volume) within a single container. Any container with unreconciled discrepancies cannot be shipped to the WIPP.	Accuracy is maintained by requiring operators to successfully identify 100% of the items in a training container during their initial qualification and subsequent requalification.	The contents placed in a container selected for VE will be described.	The relevant waste information must be assembled. This information must be documented on audio/videotape, photograph, or other unalterable media.	Comparability is ensured through sites meeting the training requirements and complying with the minimum standards outlined for guidance used to implement this characterization process.
AK	The qualitative determinations, such as compiling and assessing AK documentation, do not lend themselves to statistical evaluations of precision, therefore, precision requirements are not established for AK.	The percentage of waste containers which require re-assignment to a new SCG or new waste stream based on the re-evaluation of AK or on obtaining testing, sampling, and/or analysis data, will be reported as a measure of AK accuracy. The sites shall, in addition, develop a methodology to compare radionuclide information from confirmation with the information in the AK record and address significant discrepancies.	Representativeness is a qualitative parameter that will be satisfied by ensuring that the process of obtaining, evaluating, and documenting AK information is performed in accordance with the minimum standards established in the WCPIP.	The AK record shall contain 100% of the information specified in the WCPIP. The usability of the AK information will be assessed for completeness during audits.	Comparability is ensured through sites meeting the training requirements and complying with the minimum standards outlined for guidance used to implement the AK process.
DTC	Precision shall be established and maintained within the recommendations of the manufacturer of the dose-rate instrument used.	Calibration shall be established and maintained within the recommendations of the manufacturer of the dose-rate instrument.	Representativeness of the isotopic distributions will be confirmed by taking a minimum of 10 samples from a population of RH TRU waste (e.g., waste stream, waste stream lot)	This will be ensured by measuring the dose rate for every container. The sites must verify that the measured dose rate is at least 10 times greater than background.	Standardized instructions must be used in designing and implementing the measurement program.

Table 3-4. RH TRU Waste Characterization Method Quality Assurance Objectives (continued)

METHOD	PRECISION	ACCURACY	REPRESENTATIVENESS	COMPLETENESS	COMPARABILITY
Radiography	Precision is maintained by reconciling any discrepancies between two operators with regard to the identification of important waste characteristics within a single container. Any container with unreconciled discrepancies cannot be shipped to the WIPP.	Accuracy is obtained by using a target to tune the image for maximum sharpness and by requiring operators to successfully identify 100% of the items in a training container during their initial qualification and subsequent requalification.	The relevant contents in a container selected for radiography will be described.	The relevant waste information must be assembled and must show that each of the containers in the waste stream belongs to the waste stream. This information must be documented on videotape, photograph, or other unalterable media and data form.	Comparability is ensured through sites meeting the training requirements and complying with the minimum standards outlined for guidance used to implement the characterization process.
NDA	Precision will be measured as the percent relative standard deviation (%**RSD**). The %RSD shall not exceed the values listed in Table 4.1 in the WCPIP.	Accuracy will be measured as the percent recovered (%**R**). The %R will not exceed ±30% on a non-interfering matrix	Representativeness is ensured through assay of each waste container when NDA is used to satisfy DQOs.	Required completeness is 100%. All NDA data used to satisfy a DQO must be valid and usable.	Comparability is ensured through a site meeting the training requirements and complying with the minimum standards used to implement the NDA process.
DA	Precision will be measured as the relative percent difference (**RPD**). The RPD is derived from analysis of laboratory duplicates as listed in Table 4.3 of the WCPIP.	Accuracy will be measured as the %R. The %R is derived from analysis of laboratory control samples and matrix spikes as listed in Table 4.3 of the WCPIP.	Representativeness is achieved by the collection of unbiased samples.	Completeness of DA data shall be expressed as the ratio of the number of samples that are analyzed with valid results to the total number of samples that are submitted for analysis, expressed as a percent. Acceptable DA data shall be obtained for 90% of the samples acquired for waste characterization. Valid results for radioassay data are those that were obtained when the laboratory or testing facility demonstrated that the instrumentation and method were in control.	Comparability is ensured through a site meeting the training requirements and complying with the minimum standards used to implement the DA process.

Radiography

Radiography is a nondestructive qualitative technique that involves X-ray interrogation of waste containers to identify and verify the contents. Radiography may be used to confirm AK with regard to the waste's physical properties and the absence of residual liquids in excess of one percent. A discussion of radiography technology and its limitations for RH TRU waste can be found in Supplement B. Data acquired by radiography are documented as required by the WCPIP. The QAOs for radiography are given in Table 3-4.

Radiography may also be used to collect information about a waste stream when the AK information about a waste stream cannot be qualified in accordance with 40 CFR §194.22(b). A subpopulation of RH TRU waste that is already packaged in payload containers may be subjected to radiography if the AK information on the waste is incomplete, unusable, or cannot be qualified in accordance with 40 CFR §194.22(b). If radiography is used to characterize this waste, a minimum of 10 percent of the packaged waste will be subjected to radiography. If residual liquids in excess of one percent are identified or the physical form of the waste does not match the waste stream description in this subpopulation, an additional 10 percent of the packaged waste will be subject to radiography. If additional residual liquids in excess of one percent or additional waste is identified that does not match the waste stream description in this second subpopulation, the entire waste stream must be subjected to radiography (or VE). This is referred to as 10-10-All.

Visual Examination

Visual examination may be used to establish the physical form and the absence of residual liquids in excess of one percent. Visual examination involves the inspection and identification of waste items. The examination will be recorded on a signed data form accompanied by visual evidence such as video/audiotapes, photographs, or some other form of unalterable media. Alternatively, two trained operators may perform the VE and document their examination on a signed data form.

Visual examination may be used for unsegregated or unsorted waste to assign waste to an appropriate waste stream as it is retrieved from RH TRU storage areas. At this time, prohibited items will be removed and other needed information collected. In this manner, VE is used to characterize the waste at the time it is packaged. During this process, VE may also be used to confirm AK information that may be available regarding the waste.

Visual examination may also be used to collect information about a waste stream when AK information cannot be qualified in accordance with 40 CFR §194.22(b). For RH TRU waste that requires packaging or repackaging, 100 percent of the waste will be subjected to VE. A subpopulation of RH TRU waste that is already packaged in payload containers may be subjected to VE if the AK information cannot be qualified in accordance with 40 CFR §194.22(b). If VE is used to characterize this waste, a minimum of 10 percent of the packaged waste will be subjected to VE. If residual liquids in excess of one percent are identified or the physical form of the waste does not match the waste stream description in this subpopulation, an additional 10 percent of the packaged waste will be subject to VE. If additional residual liquids

in excess of one percent or additional waste is identified that does not match the waste stream description in this second subpopulation, the entire waste stream must be subjected to VE (or radiography). This is referred to as 10-10-All. The QAOs for VE are listed in Table 3-4.

3.3.3.2 Quantitative Methodologies

The primary quantitative methodology used to determine the radionuclide inventory of RH TRU waste is the DTC method. The DTC method correlates the physical measurements with container contents through reactor physics and shielding modeling to determine the radionuclide content of the waste. The radioassay results will be used to demonstrate that the inventory assumptions used in the PA and the PAVT are maintained. They will also furnish radionuclide information on a container basis to assure compliance with the RH TRU waste limits in the LWA. Limitations regarding performing radioassay of RH TRU waste are found in Supplement B.

Dose-to-Curie Conversion Method

The DTC conversion method uses a standard profile of the waste to relate the quantity of gamma-emitting radionuclides to the curie content in the waste. DTC conversions are based on a dose rate measurement taken with calibrated instrumentation. The measurement is associated with documented isotopic distributions within the waste through the use of empirically developed conversion factors. Sites will confirm AK information related to radionuclide distribution by sampling and analysis.

The requirements for implementing the DTC method are contained in the WCPIP. Attachment B of the WCPIP, *Dose-to-Curie Survey Procedure,* provides detailed instructions for performing and documenting dose measurements and the conversion of those measurements to values for the activities in the container. Attachment C of the WCPIP, *General Procedure for Dose-to-Curie Estimation for Remote Handled TRU Waste*, describes the methodologies that the generator sites must use to develop the standard isotopic mixes used for DTC method. The DOE/CBFO is proposing to develop and control the computer software used to implement the DTC conversion. The generator sites will be required to use the software provided by the DOE/CBFO.

The QAOs that are applied to DTC method are given in Table 3-4.

Nondestructive Assay

Nondestructive assay can be used to establish RH TRU waste activity, total activity, isotopic activity and activity per canister. If a generator site has a radioassay system that is capable of performing measurements on containers of CH TRU waste and that system is capable of meeting the RH TRU waste characterization program requirements, a site may make measurements with this equipment. The site must demonstrate to the DOE/CBFO the ability of the system to meet the criteria in the WCPIP. The QAOs that are applied to NDA methodologies are given in Table 3-4.

Destructive Assay (Radiochemistry)

Sampling and analysis of radioactive materials are commonly referred to collectively as destructive assay. A variety of methods are used to measure individual radionuclide quantities in a sample collected from the waste. Depending on the type of sample (e.g., solids, smears) and analysis, sample digestion, dissolution, or leaching may be required. The prepared samples are measured using standard radiation counting equipment. The QAOs that are applied to DA methodologies are given in Table 3-4.

3.4 Quality Assurance

The QA requirements for RH TRU waste characterization are the same as those for the CH TRU waste program and are imposed through the QAPD. The QAPD meets the requirements of 40 CFR §194.22.

4.0 Consequences for Compliance with Disposal Regulations

In the final certification (EPA, 1998), the EPA concluded that "WIPP will comply with the 40 CFR Part 191 containment requirements to the extent that emplaced waste falls within the waste envelope limits that were shown by the PA, and confirmed by the PAVT, to be compliant with the 40 CFR Part 191 standards." The waste inventory assumed for the CCA (DOE 1996) PA and the PAVT included both CH TRU and RH TRU waste. As such, the current certification applies to the emplacement of RH TRU waste.

4.1 LWA Consequences

As discussed in Section 3.1, there are multiple limits identified in the LWA that pertain to RH TRU waste. The limits address dose rate and curie contribution of RH TRU waste and the total curie limit of the repository. The RH TRU waste characterization program proposed by the DOE/CBFO is capable of identifying, tracking, and controlling the waste components identified in the LWA and therefore present no adverse consequences to compliance with the LWA.

4.2 40 CFR Parts 191 and 194 Consequences

The RH TRU waste characterization program described in this Notification provides the necessary waste characterization methods for RH TRU waste, and describes how the DOE/CBFO will quantify RH TRU waste components to ensure that the inventory assumptions incorporated in the PA and PAVT are maintained. The RH TRU characterization methods proposed in the Section 3 of this Notification and discussed in detail in the WCPIP satisfy the requirements of 40 CFR §194.24 to identify and describe the methods used to quantify the limits of the waste components important to repository performance. The QA program established for collecting RH TRU waste characterization data is the same as the QA program described in the CCA, which satisfies the requirements of 40 CFR §194.22.

5.0 References

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