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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 662711

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2. ECN Category (mark one) Supplemental <input type="checkbox"/> Direct Revision <input checked="" type="checkbox"/> Change ECN <input type="checkbox"/> Temporary <input type="checkbox"/> Standby <input type="checkbox"/> Supersedure <input type="checkbox"/> Cancel/Void <input type="checkbox"/>		3. Originator's Name, Organization, MSIN, and Telephone No. TM Greager, TRU Waste Program T4-05, 376-4344		4. USQ Required? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		5. Date 11/17/00	
		6. Project Title/No./Work Order No. TRU Project		7. Bldg./Sys./Fac. No. N/A		8. Approval Designator Q	
		9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-2600, Rev. 2		10. Related ECN No(s). N/A		11. Related PO No. N/A	
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13a. Description of Change HNF-2600, Hanford Site Transuranic Waste Certification Plan is being revised in its entirety to incorporate the Plutonium Finishing Plant (PFP) requirements.				13b. Design Baseline Document? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
14a. Justification (mark one) Criteria Change <input checked="" type="checkbox"/> Design Improvement <input type="checkbox"/> Environmental <input type="checkbox"/> Facility Deactivation <input type="checkbox"/> As-Found <input type="checkbox"/> Facilitate Const. <input type="checkbox"/> Const. Error/Omission <input type="checkbox"/> Design Error/Omission <input type="checkbox"/>		14b. Justification Details Design verification not required Document is being revised in its entirety No USQ required					
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1. ECN (use no. from pg. 1)

662711

16. Design Verification Required

☐ Yes
☒ No

17. Cost Impact

ENGINEERING

Additional ☐ \$ N/A
Savings ☐ \$ N/A

CONSTRUCTION

Additional ☐ \$ N/A
Savings ☐ \$ N/A

18. Schedule Impact (days)

Improvement ☐ N/A
Delay ☐ N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	<input type="checkbox"/>	Seismic/Stress Analysis	<input type="checkbox"/>	Tank Calibration Manual	<input type="checkbox"/>
Functional Design Criteria	<input type="checkbox"/>	Stress/Design Report	<input type="checkbox"/>	Health Physics Procedure	<input type="checkbox"/>
Operating Specification	<input type="checkbox"/>	Interface Control Drawing	<input type="checkbox"/>	Spares Multiple Unit Listing	<input type="checkbox"/>
Criticality Specification	<input type="checkbox"/>	Calibration Procedure	<input type="checkbox"/>	Test Procedures/Specification	<input type="checkbox"/>
Conceptual Design Report	<input type="checkbox"/>	Installation Procedure	<input type="checkbox"/>	Component Index	<input type="checkbox"/>
Equipment Spec.	<input type="checkbox"/>	Maintenance Procedure	<input type="checkbox"/>	ASME Coded Item	<input type="checkbox"/>
Const. Spec.	<input type="checkbox"/>	Engineering Procedure	<input type="checkbox"/>	Human Factor Consideration	<input type="checkbox"/>
Procurement Spec.	<input type="checkbox"/>	Operating Instruction	<input type="checkbox"/>	Computer Software	<input type="checkbox"/>
Vendor Information	<input type="checkbox"/>	Operating Procedure	<input type="checkbox"/>	Electric Circuit Schedule	<input type="checkbox"/>
OM Manual	<input type="checkbox"/>	Operational Safety Requirement	<input type="checkbox"/>	ICRS Procedure	<input type="checkbox"/>
FSAR/SAR	<input type="checkbox"/>	IEFD Drawing	<input type="checkbox"/>	Process Control Manual/Plan	<input type="checkbox"/>
Safety Equipment List	<input type="checkbox"/>	Cell Arrangement Drawing	<input type="checkbox"/>	Process Flow Chart	<input type="checkbox"/>
Radiation Work Permit	<input type="checkbox"/>	Essential Material Specification	<input type="checkbox"/>	Purchase Requisition	<input type="checkbox"/>
Environmental Impact Statement	<input type="checkbox"/>	Fac. Proc. Samp. Schedule	<input type="checkbox"/>	Tickler File	<input type="checkbox"/>
Environmental Report	<input type="checkbox"/>	Inspection Plan	<input type="checkbox"/>	N/A	<input checked="" type="checkbox"/>
Environmental Permit	<input type="checkbox"/>	Inventory Adjustment Request	<input type="checkbox"/>		<input type="checkbox"/>

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number/Revision

None

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. TM Greager	11/20/00	PE	
Cog. Mgr. PJ Crane	11/21/00	QA	
QA JL Maupin	11/20/00	Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

HNF-2600
Revision 3

Copy No. ____

Hanford Site Transuranic Waste Certification Plan

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Fluor Hanford

P.O. Box 1000

Richland, Washington

HNF-2600
Revision 3
ECN 662711
Copy No. ____

Hanford Site Transuranic Waste Certification Plan

Document Type: RPT

Division: WM

TM Greager
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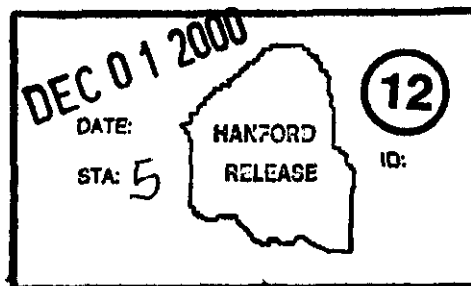
Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Release Approval

11/30/00
Date



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**HANFORD SITE
TRANSURANIC WASTE CERTIFICATION PLAN**

HNF-2600 / Revision 3

August 17, 2000

**HANFORD SITE TRANSURANIC
WASTE CERTIFICATION PLAN**

Revision 3

August 17, 2000

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HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

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ACRONYMS AND ABBREVIATIONS

AK	Acceptable Knowledge
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
C of C	Certificate of Compliance
CAO	Carlsbad Area Office
CAR	corrective action report
Certification Plan	<i>Hanford Site Transuranic Waste Certification Plan</i>
CFR	<i>Code of Federal Regulations</i>
CH	contact-handled
CH TRU	contact-handled transuranic
CIN	container identification number
CWC	Central Waste Complex
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DOT	U.S. Department of Transportation
dpm	disintegration(s) per minute
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FDH	Fluor Daniel Hanford
FGE	fissile gram equivalent
FGE/g	mass values by ^{239}Pu FGE conversion factors
ICV	inner containment vessel
LDR	land disposal restriction
M&O	management and operating
mrem/hr	milliroentgen(s) equivalent man per hour
MS	mass spectrometry
NIST	National Institute of Standards and Technology
nCi/g	nanocurie(s) per gram
NCR	nonconformance report
NDA	nondestructive assay
NDE	nondestructive examination
NFT	Nuclear Filter Technology
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
NTWP	National TRU Waste Program
OCA	Outer Containment Assembly
OCV	Outer Containment Vessel
ONTWP	Office of the National TRU Waste Program
PATCD	<i>Payload Assembly Transportation Certification Document</i>
PCB	polychlorinated biphenyl
PCTCD	<i>Payload Container Transportation Certification Document</i>
PDP	Performance Demonstration Program
PE-CI	plutonium-239 (^{239}Pu) equivalent-curie(s)

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PFP	Plutonium Finishing Plant
Project	Hanford Site Transuranic Waste Certification Project
QA	quality assurance
QAO	quality assurance objective
QAPD	<i>Quality Assurance Program Document</i>
QAPD Procedures Matrix	<i>Hanford Site TRU Waste Project Quality Assurance Program Document Procedures Matrix</i>
QAPjP	<i>Hanford Site Transuranic Waste Characterization Quality Assurance Project Plan</i>
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RH	remote-handled
RMS	root mean square
RTR	real-time radiography
SAR	safety analysis report
SPM	site project manager
SQAO	site quality assurance officer
SVOC	semivolatile organic compound
SW-846	<i>Test Methods for Evaluating Solid Waste, Physical/Chemical Methods</i>
SWB	standard waste box
SWD	Solid Waste Disposal
TC	toxicity characteristic
TCO	transportation certification official
TDOP	ten-drum overpack
TIC	tentatively identified compound
TRAMPAC	<i>TRUPACT-II Authorized Methods for Payload Control (Appendix 1.3.7 of TRUPACT-II SARP)</i>
TRU	transuranic
TRUCON	<i>TRUPACT-II Content Codes</i>
TRUPACT-II	Transuranic Package Transporter-II
TRUPACT-II SARP	<i>Safety Analysis Report for the TRUPACT-II Shipping Package</i>
TWBIR	<i>Transuranic Waste Baseline Inventory Report</i>
VOC	volatile organic compound
WAC	waste acceptance criteria
WAP	<i>Waste Analysis Plan (Attachment B of WIPP Hazardous Waste Facility Permit)</i>
WCO	Waste Certification Official
WIPP	Waste Isolation Pilot Plant
WIPP SAR	<i>Waste Isolation Pilot Plant Safety Analysis Report</i>
WIPP-WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant</i>
WRAP	Waste Receiving and Processing
WSPF	<i>Waste Stream Profile Form</i>
WWIS	Waste Isolation Pilot Plant Waste Information System

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

DEFINITIONS

Acceptable Knowledge (AK). An EPA term, which includes process knowledge and results from previous testing, sampling, and analysis, associated with the waste. AK includes information regarding the raw materials used in a process or operation, process description, products produced, and associated wastes. AK documentation includes the site history and mission, site-specific processes or operations, administrative building controls, and all previous and current activities that generate a specific waste.

Aluminum Honeycomb Spacer Assembly. An assembly that is located within each end of the inner containment vessel (ICV) to provide:

1. A generous void volume to accommodate payload gas generation.
2. An energy-absorbing barrier between the payload and the ICV dished heads.

Assay. The observation of spontaneous or stimulated nuclear radiations, interpreted to estimate the content of one or more radionuclides in a material.

Assessment. Evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection, or surveillance.

Audit. Planned and documented independent assessment to determine by investigation, examination, or evaluation of objective evidence, the adequacy of and compliance with established procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

Carbon Composite Filter. See filter vent.

Certification Authority. Authorization to certify TRU waste to the WIPP Waste Acceptance Criteria (WAC) that is granted by the CAO to those TRU waste generator/storage sites whose TRU waste programs have been evaluated and found to be acceptable.

Certified Waste. Payload containers loaded with waste that have been verified to meet the criteria of the WIPP-WAC (DOE/WIPP-069).

Chemical Compatibility. Assessing the properties of all potential chemicals (>1 weight percent) in a payload container. There must be no adverse safety or health hazards produced as a result of any mixtures that could occur.

Combustible Materials. Organic materials that are dominantly cellulosic (e.g., cotton, paper, cloth, wood, etc.), and including plastics.

Compressed Gas. Compressed gases are those materials defined as such by 49 CFR 173, Subpart G.

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Contact-Handled TRU Waste. Transuranic waste packages that have a surface dose rate not greater than 200 mrem/hr.

Content Code. A uniform system applied to waste forms to group those with similar characteristics for purposes of shipment in TRUPACT-II.

Corrosive Materials. Corrosive materials are those defined as such by 40 CFR 261.22 (a)(1).

Decay Heat. Heat produced by radioactive emissions that are absorbed in the surrounding material.

Defense TRU Waste. Nuclear waste derived from the manufacture of nuclear weapons and operation of naval reactors. Associated activities include (a) naval reactors development, (b) weapons activities, including defense inertial confinement fusion, (c) verification and control technology, (d) defense nuclear materials production, (e) defense nuclear waste materials and by-products management, (f) nuclear waste and materials security and investigations, and (g) research and development. See *CAO Interim Guidance on Ensuring Waste Qualifies for Disposal at the Waste Isolation Pilot Plant* (DOE 1997)

DOE Field Element. The first line DOE field element that carries the organizational responsibility for (1) managing and executing assigned projects, (2) directing contractors who conduct the projects, and (3) ensuring that environment, safety, and health are integral parts of each project.

Explosive Materials. Explosive materials are those defined as such by 49 CFR 173, Subpart C.

Filter Vent. A filter vent is defined as filter media manufactured of carbon composite, Kevlar, stainless steel, or any material that enables the filter to meet the minimum performance specifications stipulated in Appendix 1.3.5, "Specification for Filter Vents," of the TRUPACT-II SARP.

Fissile Gram Equivalent (FGE). An isotopic mass of radionuclide normalized to ^{239}Pu .

Flammable Volatile Organic Compound (VOC). A headspace gas VOC that has a National Fire Protection Association Flammability Hazard Degree of 3 or 4 and a flash point of less than 100°F or considered by EPA to be a significant fire hazard under WIPP repository conditions. Flammable headspace gas VOCs that are evaluated for the TRU waste project are listed in Table 5-8 of the TRAMPAC (Appendix 1.3.7 of the TRUPACT-II SARP).

Free Liquid. Liquid that is not sorbed on or in a host material such that it could spill or drain from its container.

G Value. The number of molecules of gas species produced per 100 electron volts of decay energy absorbed by the waste.

Germanium Counter. An assay device with high purity germanium as the detection element.

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

Glovebox. A sealed box with windows and rubber gloves attached to ports such that an operator may work inside the box without risk of contamination.

Headspace. That volume of any containment that is not occupied by the volume of waste material. Headspace is also used to refer to the gases contained in this volume. Headspace gas volume in a drum is defined as the volume between the outer drum liner and the drum.

Immobilized Materials. Materials that are fixed in a solidified matrix (e.g., glass, ceramic, cement, concrete).

Inner Containment Vessel (ICV). The assembly (comprised of a lid and body) providing a secondary level of containment for the payload. Within each end of the ICV is an aluminum honeycomb spacer assembly.

NaI Drum Counter. Assay performed on drums using sodium iodide crystals as the measurement device in the detector.

Newly Generated TRU Waste. Waste generated after the development, approval, and implementation of a TRU waste characterization program that has been granted certification authority by the CAO. Newly generated TRU waste also includes any previously generated waste (see also retrievably stored waste) that undergoes any form of treatment, processing, or repackaging in accordance with an approved quality assurance project plan.

Nondestructive Assay. Assay methods for waste items that do not affect the physical or chemical form of the material.

Nondestructive Examination. Methods that allow examination of the contents of payload containers without affecting the chemical or physical forms of these items. See also radiography.

Oil-Dri. A trade name for a basically clay material absorbent.

Outer Containment Assembly. The assembly (comprised of a lid and body) providing a primary level of containment for the payload. The outer containment assembly (OCA) completely surrounds the inner containment vessel and consists of an exterior stainless steel shell, a relatively thick layer of polyurethane foam, and an inner stainless steel boundary, which forms the outer containment vessel (OCV).

Outer Containment Vessel. The innermost boundary of the OCA.

Overpack. A payload container placed around another container to control contamination or enclose a damaged container.

Package. See shipping package.

Packaging Quality Assurance Plan. A site-specific document that defines the quality assurance (QA) and quality control (QC) activities applicable to usage of the NRC-approved packaging. This plan shall meet the requirements of 10 CFR Part 71, Subpart H. (The Hanford Site Packaging QA Plan is addressed in Section 5.0 of the Certification Plan.)

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Packaging. The packaging is the container the waste is placed into for shipment that meets the requirements of 49 CFR 173, Subpart I and 10 CFR 71.4. For TRU waste, the packaging is the reusable Type B shipping container for transport of TRU waste payload containers (e.g., TRUPACT-II or RH-TRU 72-B cask).

Passive-Active Neutron Counter. A device that measures radiations that occur spontaneously or naturally (passive) and those induced by external irradiation (active) and compares the results of both.

Payload Container Assembly. An assembly of payload containers, such as a seven-pack of drums, that is intended to be handled and emplaced as a single unit.

Payload Container. The outermost container (e.g., 55-gal. drum, standard waste boxes [SWB]) for TRU waste material that is placed in a reusable Type B shipping container (e.g., TRUPACT-II or RH-TRU 72-B cask) for transport.

Payload Pallet. A lightweight pallet with an aluminum honeycomb core used for loading and unloading fourteen 55-gal. drums of CH TRU waste at one time.

Payload. CH TRU waste contained within fourteen 55-gal. drums or two SWBs. The payload is considered to include a lift pallet if SWBs are not used. Any dunnage used external to the 55-gal. drums or SWBs is also considered to be part of the payload.

Pipe Component. A stainless steel container used for packaging specific waste forms within a 55-gal. drum. The pipe component is exclusively used as part of the pipe overpack.

Pipe Overpack. A payload container consisting of a pipe component positioned by dunnage within a 55-gal. drum with a rigid, polyethylene liner and lid. Fourteen pipe overpacks will fit within the TRUPACT-II packaging.

Plutonium Equivalent Curie (PE-Ci). An equivalent radiotoxic hazard of a radionuclide normalized to ^{239}Pu .

Polyethylene Liners. Rigid drum liners molded from high-density polyethylene, typically with a wall thickness of about 0.09 inches (90 mils). The liner generally has a snap-on cover of the same material.

Pressurized Containers. Smaller containers within the payload container (e.g., aerosol cans), which may hold compressed gas.

^{239}Pu Fissile Gram Equivalent. The amount of ^{239}Pu that would produce the equivalent K_{eff} as that determined for the fissile material in the container (assuming all containers are in an optimally moderated infinite array). ^{235}U and ^{233}U and other isotopes shall be calculated as ^{239}Pu fissile equivalents using ANSI/ANS-8.15-1981.

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Pyrophoric. 49 CFR 173.150 defines a pyrophoric as “a flammable solid which, under transport conditions, might cause fires through friction or retained heat, or, which can be ignited readily, and when ignited, burns vigorously and persistently so as to create a serious transportation hazard.” This includes spontaneously combustible materials, water reactive materials, and oxidizers. Examples of pyrophoric radionuclides are metallic plutonium and americium. Examples of nonradioactive pyrophorics are organic peroxides, sodium metal, and chlorates.

Quality Assurance Project Plan (QAPjP). A site-specific document that describes the methods used by TRU waste generator/storage sites to comply with the applicable requirements for TRU waste characterization specified in the Waste Isolation Pilot Plant (WIPP) Waste Analysis Plan (WAP). The QAPjP incorporates qualitative or quantitative criteria for determining whether the waste characterization activities are being satisfactorily performed, describes all activities pertaining to TRU waste characterization required by the WAP, references site-specific procedural and administrative controls, and identifies organizations and positions responsible for implementing waste characterization and certification activities.

Radioassay. All types of nondestructive or destructive assay techniques used to identify and quantify radionuclides in TRU waste. See also nondestructive assay and radiochemical assay.

Radiochemical Assay. Destructive assay methods performed with wet samples in a radiochemical laboratory using separation techniques.

Radiography. A nondestructive testing method, also referred to as nondestructive examination (NDE), that uses X-rays, gamma rays, or neutrons to inspect and determine the physical form of waste.

Remote-Handled Transuranic Waste. Packaged TRU waste whose external surface dose rate exceeds 200 mrem per hour. For the WIPP, there is an upper limit of 1000 rem per hour.

Residual Liquid. Liquids in quantities less than 1 volume percent of the external waste container and less than 1-in. in any internal container that result from liquid residues remaining in well-drained internal containers, condensation of moisture, and liquid separation from sludge/resin setting.

Retrievably Stored TRU Waste. Waste generated after 1970 and before the development, approval, and implementation of a TRU waste characterization program that meets the requirements for certification authority. TRU waste that is generated outside the umbrella of the approved Hanford Site TRU Project may be managed as retrievably stored TRU waste to demonstrate compliance with applicable characterization and certification requirements.

Shipper. A TRU waste generator/storage site that releases a TRUPACT-II or RH-TRU 72-B cask to a carrier for shipment.

Shipping Category. A grouping system for the transport of TRU waste payload containers that quantifies gas generation parameters for transport using the TRUPACT-II.

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Shipping Package. The packaging with its radioactive contents, or payload, as presented for transportation (10 CFR 71.4). The package is denoted as the TRUPACT-II CH TRU waste shipping package, or equivalently, the TRUPACT-II shipping package, or TRUPACT-II package.

Standard Waste Box (SWB). A payload container authorized for use with TRUPACT-II transportation packages that meets Department of Transportation (DOT) Specification 7A packaging, or equivalent, requirements. The SWB was designed specifically to fit TRUPACT-II. Two SWBs (one on top of another) can fit within the TRUPACT-II packaging.

Ten-Drum Overpack. A specialized payload container authorized for use within the TRUPACT-II packaging. One SWB, six 85-gal. drums, or ten 55-gal. drums can fit inside a ten-drum overpack (TDOP). One TDOP will fit within the TRUPACT-II packaging.

Tentatively Identified Compounds (TICs). Nontarget compounds identified using GC/MS. The reported concentrations for TICs will have a higher uncertainty associated with them than the reported target analyte concentrations.

Test Category. Decay heat determination from testing of individual waste packages for hydrogen generation prior to placement in a TRUPACT-II.

TRAMPAC. *TRUPACT-II Authorized Methods for Payload Control* document developed to show how all waste parameters are controlled to ensure TRUPACT-II payloads meet all of the TRUPACT-II shipping requirements and limits. The TRAMPAC is Appendix 1.3.7 of the TRUPACT-II SARP.

Transportation Authority. Authorization for use of the TRUPACT-II or RH-TRU 72-B cask for transportation of TRU waste, which is granted by the CAO to those TRU waste generator/storage sites whose TRU waste programs have been evaluated and found to be acceptable.

Transuranic (TRU) Wastes. Wastes contaminated with alpha-emitting radionuclides of atomic number greater than 92 (e.g., the radioactive isotopes of plutonium), having half-lives greater than 20 years, and present in concentrations greater than 100 nanocuries per gram of waste.

TRU Mixed Waste. TRU waste that is co-contaminated with hazardous constituents as identified in 40 CFR Part 261, Subparts C and D.

TRU Waste Certification Plan. A site-specific document that describes the methods used by TRU waste generator/storage sites to comply with each TRU waste acceptance criterion and requirement established in the WIP WAC. The Certification Plan shall include procedural and administrative controls and must describe all activities pertaining to TRU waste certification, including the required QA and QC activities applicable to the certification of TRU waste.

TRUPACT-II. An NRC-certified Type B transportation packaging used for transportation of CH TRU wastes.

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TRUPACT-II Content Codes (TRUCON). (1) A document containing a description of the waste stream, waste form, and packaging configuration for each waste content code authorized for shipment in a TRUPACT-II. (2) TRUCON codes are a shorthand representation of the chemical content and physical waste form of waste streams for use in the transportation safety analysis.

TRUPACT-II Packaging. The packaging consisting of an OCA, ICV, and two aluminum honeycomb spacer assemblies.

TRUPACT-II User. Organizations or facilities that prepare a TRUPACT-II for release to a carrier for shipment. Users ensure, via their TRUPACT-II user program, that the payload, inspection, testing, closing, and release for shipment of the TRUPACT-II meets the requirements of the TRUPACT-II chain of custody (COC). Users may also perform minor maintenance on the TRUPACT-II.

Twist and Tape. A method of bag closure for waste consisting of gathering the neck of the bag, twisting tightly, and wrapping tightly with plastic tape. Often called "horsetail."

Validation. An activity that demonstrates or confirms that a process, item, data set, or service satisfies the requirements defined by the user. Data validation requirements for the TRU waste project are described in the QAPjP.

Verification. The act of authenticating or formally asserting the truth that a process, item, data set, or service is (in fact) that which is claimed. Data verification is the process used to confirm that all review and validation procedures have been completed. Data verification requirements for the TRU waste project are described in the QAPjP.

VE Technique. A process of verification for newly generated waste involving two independent verifications of the physical form of the waste container contents. The process consists of the first operator confirming and documenting the contents (e.g., inventory) of the container at the time of packaging. A second operator documents concurrence of the waste container contents. Corrective actions are taken if either the first or the second operator cannot confirm the waste contents (e.g., inventory).

Volatile Organic Compounds. For the purposes of the TRU waste project, those gas VOCs listed in the *WIPP Hazardous Waste Facility Permit Waste Analysis Plan (WAP)* Table B-1 and any additional compounds tentatively identified by the VOC analytical procedures used to satisfy TRU waste characterization requirements specified in the WAP.

Waste Acceptance Criteria. Criteria developed for the safe disposal of TRU waste in the WIPP, meeting the very long-term disposal requirements of the WIPP underground salt bed.

Waste Certification. Formal and documented activities associated with waste processing and records required to certify that the waste has been characterized and meets the requirements of the WIPP-WAC.

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Waste Characterization. The process of determining that TRU waste meets the requirements of the WAP by the acceptable performance of the activities defined by site-specific, CAO-approved TRU waste project documents.

Waste Form. The physical form of the waste (e.g., sludge, combustibles, metals, etc.).

Waste Material Type. Further divisions of waste types based on gas generation potential expressed as the G value for hydrogen.

Waste Matrix Code Group. A term used in the WIPP-WAP, which has the same meaning as waste matrix parameter category.

Waste Matrix Parameter Category. A method for assigning a treatability parameter that addresses the overall bulk physical/chemical form of the waste. Parameters are defined in DOE/LLW-217, *DOE Waste Treatability Group Guidance*.

Waste Package Assembly. An assembly of waste packages, such as a seven-pack of drums that is intended to be handled and emplaced in a single unit by the WIPP waste handling system.

Waste Packaging. The process of filling a payload container with waste and remaining within the controls applied to layers of confinement.

Waste Stream. Waste material generated from a single process or from an activity that is similar in material, physical form, and hazardous constituents.

Waste Type. Waste type refers to physical types of waste such as solidified inorganics, solid inorganics, solidified organics, and solid organics.

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1.0 INTRODUCTION

As a generator of transuranic (TRU) and TRU mixed waste destined for disposal at the Waste Isolation Pilot Plant (WIPP), the Hanford Site must ensure that its TRU waste meets the requirements of U.S. Department of Energy (DOE) O 435.1, "Radioactive Waste Management," and the *Contact-Handled (CH) Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant (WIPP-WAC)*. WIPP-WAC requirements are derived from the *WIPP Technical Safety Requirements*, *WIPP Safety Analysis Report*, *TRUPACT-II SARP*, *WIPP Land Withdrawal Act*, *WIPP Hazardous Waste Facility Permit*, and Title 40 *Code of Federal Regulations (CFR) 191/194 Compliance Certification Decision*. The WIPP-WAC establishes the specific physical, chemical, radiological, and packaging criteria for acceptance of defense TRU waste shipments at WIPP. The WIPP-WAC also requires that participating DOE TRU waste generator/treatment/storage sites produce site-specific documents, including a certification plan, that describe their program for managing TRU waste and TRU waste shipments before transferring waste to WIPP. Waste characterization activities provide much of the data upon which certification decisions are based. Waste characterization requirements for TRU waste and TRU mixed waste that contains constituents regulated under the Resource Conservation and Recovery Act (RCRA) are established in the WIPP Hazardous Waste Facility Permit Waste Analysis Plan (WAP). The *Hanford Site Quality Assurance Project Plan (QAPjP)* (HNF-2599) implements the applicable requirements in the WAP and includes the qualitative and quantitative criteria for making hazardous waste determinations. The Hanford Site must also ensure that its TRU waste destined for disposal at WIPP meets requirements for transport in the Transuranic Package Transporter-II (TRUPACT-II). The U.S. Nuclear Regulatory Commission (NRC) establishes the TRUPACT-II requirements in the *Safety Analysis Report for the TRUPACT-II Shipping Package (TRUPACT-II SARP)*.

In addition, a TRU waste is eligible for disposal at WIPP only if it has been generated in whole or in part by one or more of the activities listed in Section 10101(3) of the Nuclear Waste Policy Act. DOE sites must determine that each waste stream to be disposed of at WIPP is "defense" TRU waste. (See also the definition of "defense" TRU waste.). Only CH TRU wastes meeting the requirements of the QAPjP, WIPP-WAP, WIPP-WAC, and other requirements documents described above will be accepted for transportation and disposal at WIPP.

Figure 1-1 illustrates the hierarchy of regulatory requirements for TRU waste certification and reflects the flow-down of requirements from higher-level documents to site-level program documents and implementing procedures. To ensure that future changes to the WIPP-WAC and other relevant requirements documents are appropriately reflected, this *Hanford Site Transuranic Waste Certification Plan* (hereinafter referred to as the Certification Plan) will be reviewed at least annually and updated as necessary.

This Certification Plan establishes the programmatic framework and criteria within which the Hanford Site ensures that CH TRU wastes can be certified as compliant with the WIPP-WAC and *TRUPACT-II Authorized Methods for Payload Control TRAMPAC* (Appendix 1.3.7 of the TRUPACT-II SARP). This Certification Plan does not address remote-handled (RH) defense TRU forms. RH TRU waste will not be shipped or accepted at WIPP until it has been addressed. This Certification Plan includes the following sections:

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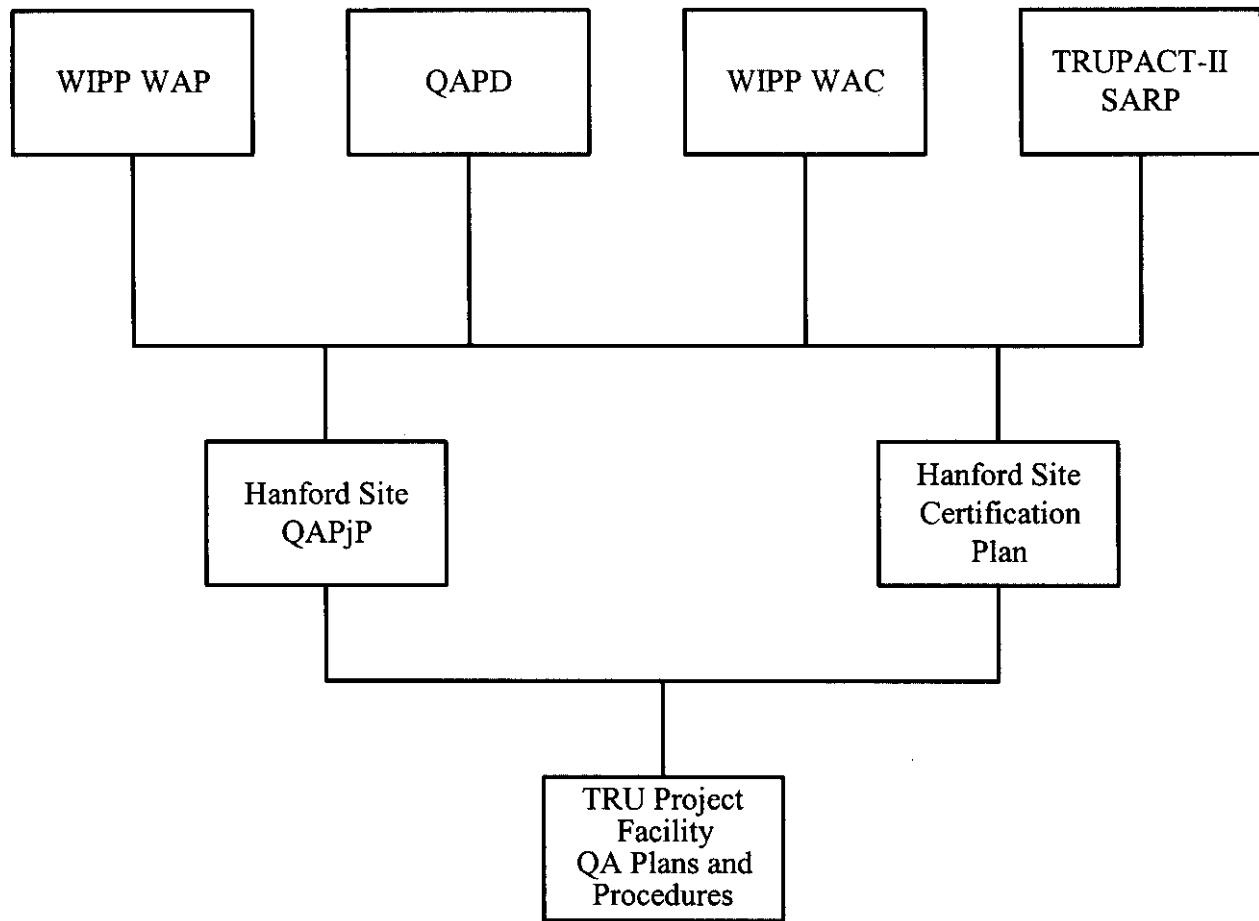


Figure 1-1. Hanford Site TRU Waste Certification Document Hierarchy

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- Section 2.0, "Certification Project Organization at the Hanford Site," identifies Hanford Site organizations involved in the TRU Waste Certification Project (the Project), describes the interaction between the characterization, certification, and transportation personnel, and lists the responsibilities of key Project officials.
- Section 3.0, "Compliance Plan for WIPP-WAC," summarizes the WIPP-WAC requirements and describes Hanford Site TRU Project activities and specific documents that implement and verify compliance with each requirement.
- Section 4.0, "Compliance Plan for TRAMPAC," summarizes the TRAMPAC requirements and describes Hanford Site TRU Project activities and practices that demonstrate compliance with the TRUPACT-II SARP.
- Section 5.0, "Quality Assurance Plan," describes how the Hanford Site TRU Project complies with the *Quality Assurance Program Document (QAPD)*, WIPP-WAC, and 10 Code of Federal Regulations (CFR) Part 71, Subpart H quality assurance (QA) requirements for TRU waste certification and use, maintenance, and control of packages used to store and transport waste to WIPP in compliance with U.S. Department of Transportation (DOT) and NRC requirements.

This Certification Plan, which includes the Compliance Plan for TRAMPAC and associated QA Plan, together with the QAPjP, establishes the basis for the Hanford Site's waste characterization, certification, and transportation packaging operations. These documents are submitted to the Carlsbad Area Office (CAO) for review and approval.

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2.0 CERTIFICATION PROJECT ORGANIZATION AT THE HANFORD SITE

The responsibilities for TRU waste management at the Hanford Site are distributed within various organizations. This section identifies the Hanford Site organizations involved in the Project and describes the responsibilities of and interactions between these organizations. Delegation of authority for decision making will be designated to the lowest appropriate level within the various organizations. This section also contains generalized process flow diagrams for TRU waste certification activities associated with newly generated and retrievably stored TRU waste, summarizes the use of acceptable knowledge (AK) in the certification project, and describes the document control and records management process.

2.1 ORGANIZATION AND RESPONSIBILITIES

Figure 2-1 is a functional organization chart pertaining to TRU waste characterization, certification, and payload assembly activities at the Hanford Site. The following subsections identify the organizations that oversee the Project and describe the roles and responsibilities of key positions within the Project charged with implementing the requirements defined in this Certification Plan.

2.1.1 Manager, CAO Office of the National TRU Waste Program

The manager of the Office of the National TRU Waste Program (ONTWP) executes program functions related to characterization of waste for disposal at the WIPP. The ONTWP manages the National TRU Waste Program (NTWP) team, which is responsible for TRU waste characterization.

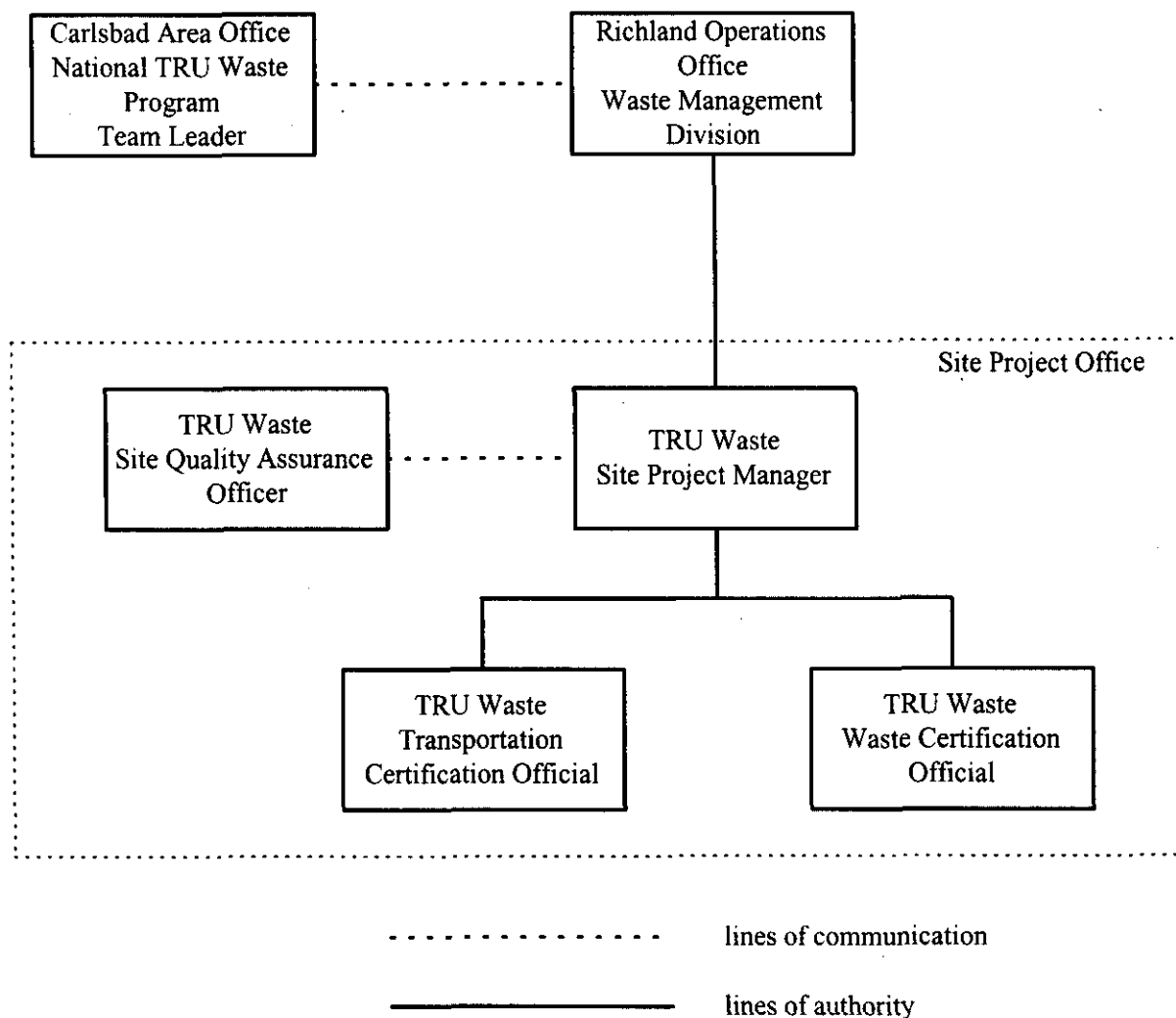
2.1.2 Team Leader, National TRU Waste Program (NTWP)

The NTWP team leader reports to the ONTWP and assists sites in preparing their waste for shipment to WIPP for disposal. The NTWP team leader develops options, recommendations, and guidelines for program activities and provides overall technical oversight of the TRU waste program activities at participating DOE sites. The NTWP team leader, in conjunction with the CAO QA manager, is responsible for conducting audits of all activities associated with TRU waste characterization and certification described in the WIPP Hazardous Waste Facility Permit and associated Waste Analysis Plan (WAP) and QAPD. The NTWP team leader reviews and approves this Certification Plan before its implementation. The CAO QA manager also reviews and approves this Certification Plan.

2.1.3 DOE-Richland Waste Management Division

The U.S. DOE-Richland Operations Office (RL) Waste Management Division is responsible for Project execution and oversight and serves as an interface between CAO and the Hanford Site. The RL TRU waste program manager ensures that Certification Plan activities comply with applicable DOE orders, the WAP, QAPD, WAC, TRUPACT-II SARP, and all applicable federal and state regulations. The RL TRU waste program manager also ensures that resources and funding are available to accomplish TRU waste certification activities.

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**Figure 2-1 Hanford Site TRU Waste Certification Project Functional Organization Chart**

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2.1.4 Site Project Manager

The Site Project Manager (SPM) is the principal point of contact with DOE (including CAO, NTWP, and RL) for technical activities associated with TRU waste. The SPM provides programmatic support for Hanford Site TRU waste organizations involved in TRU waste storage, characterization, certification, and transportation activities. The SPM coordinates with the Hanford Site Waste Certification Official (WCO) and transportation certification official (TCO) and oversees Project activities to ensure that Hanford Site TRU waste is characterized and certified compliant with WIPP requirements. Specific Project responsibilities assigned to the SPM include the following:

- Reviewing and approving the Hanford Site QAPjP and Certification Plan.
- Ensuring that the Hanford Site compliance plan for TRAMPAC and associated documents are revised, reviewed, approved, and implemented as necessary to maintain authorization for shipping TRU waste to WIPP.
- Ensuring Project personnel receive appropriate training and orientation.
- Selecting, prioritizing, and tracking waste to be sampled and analyzed.
- Validating and verifying project-level analytical data.
- Reconciling analytical data with data quality objectives (DQOs).
- Certifying Waste Stream Profile Forms (WSPF) data.
- Obtaining AK information from waste generators regarding U.S. Environmental Protection Agency (EPA) hazardous waste numbers.
- Submitting quality assurance/quality control (QA/QC) reports to DOE field offices.
- Transmitting testing, sampling, and analytical data to CAO.
- Assisting the Hanford Site QA Officer (SQA) in defining and standardizing Project assessment criteria and preparing responses to deficiency reports, such as corrective action reports (CARs), generated by CAO internal or other external assessment organizations.
- Halting certification activities if problems affecting the quality of certification processes or work products exist.
- Notifying personnel of nonconformances in accordance with WMH-400, Section 1.3.2, "TRU Nonconforming Item Reporting and Control."

The SPM may delegate any of these activities to another individual; however, the SPM retains responsibility for ensuring that Project requirements are met.

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2.1.5 Hanford Site Quality Assurance Officer (SQAQO)

The SQAQO provides QA oversight and planning for TRU waste characterization and certification and oversees the implementation of the QAPjP and the QA requirements of the Certification Plan. The SQAQO's general responsibilities include the following:

- Scheduling and conducting QA assessments.
- Reviewing and approving the QAPjP, Certification Plan, and implementing procedures.
- Coordinating internal and external audits and assessments to verify compliance.
- Reviewing and approving supplier and subcontractor QA plans as appropriate.
- Tracking and evaluating trends in compliance with QA objectives (QAOs) established in the QAPjP by performing the following:
 - ensuring that testing, sampling, and analytical facilities are assessed.
 - ensuring that nonconformance reports (NCRs) or CARs that affect Project activities are prepared, when appropriate.
 - tracking and trending nonconformances.
 - verifying corrective actions have been taken to resolve nonconformances.
 - validating and verifying data at the project level.
 - submitting QA/QC reports to the SPM, as needed.
 - preparing and submitting semiannual QA summary reports to the SPM.
- Coordinating responses to deficiency reports (e.g., CARs) generated by CAO or other external assessment organizations.
- Providing QA oversight for data package assembly and interface with the WIPP Waste Information System (WWIS).
- Stopping certification activities if problems affecting the quality of certification processes or work products exist.
- Having direct access to responsible management at a level where appropriate action can be affected.
- Being sufficiently independent from cost and schedule considerations.

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- Having the organizational freedom to communicate with management.
- Having no assigned responsibilities unrelated to the QA program that would prevent appropriate attention to QA matters.
- Developing, establishing, and interpreting QA policy and ensuring effective implementation.
- Interfacing, as appropriate, with the CAO staff, participants, and other stakeholders on QA matters.
- Assisting subordinate organizations with quality planning, documentation, quality measurements, and problem identification and resolution.
- Providing guidance to all applicable subordinate organizations concerning identification, control, and protection of QA records.

The SQAQO may designate one or more individuals to perform the above functional responsibilities, but retains ultimate responsibility for assuring compliance with Project requirements.

2.1.6 Hanford Site Waste Certification Official (WCO)

The Hanford Site WCO is responsible for certifying all data and information necessary to document that all TRU waste payload containers prepared for shipment to WIPP meet all specified criteria. The WCO coordinates activities related to waste characterization and works closely with the SQAQO to effect QC of the Project. Specific duties and responsibilities of the WCO include the following:

- Certifying that waste packages and waste shipments meet WIPP-WAC requirements.
- Interfacing with the SPM, TCO, and SQAQO on matters related to waste characterization and certification.
- Implementing the following Project QA activities:
 - reviewing and approving this Certification Plan.
 - ensuring that waste characterization and certification documents are managed as QA records in the designated repository.
 - preparing NCRs, CARs, and documenting corrective actions.
 - coordinating with the SQAQO to analyze trends in project nonconformances for waste characterization-related activities.
 - assisting the SQAQO in preparing responses to deficiency reports (e.g., CARs) generated by CAO or other external assessment organizations.

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- Stopping waste characterization activities if problems affecting the quality of certification processes or work products exist.
- Ensuring that all data entered into the WWIS is accurate and demonstrates the acceptability of the waste for transport to and disposal at the WIPP.

The WCO may designate one or more individuals to perform these responsibilities, but retains ultimate responsibility for ensuring that Project requirements are met.

2.1.7 Hanford Site Transportation Certification Official (TCO)

The Hanford Site TCO ensures that the site-specific TRU waste packaging and transportation activities comply with the TRAMPAC and DOT requirements specified in 49 CFR 173 and NRC requirements in 10 CFR 71. The TCO verifies payload containers and payload assemblies and ensures compliance with all packaging and records requirements. The TCO obtains WIPP authority to ship and ensures that all requirements are met before the transportation packaging is released to a carrier for transport. Specific TCO responsibilities include the following:

- Ensuring that the Hanford Site compliance plan for TRAMPAC and associated documents are revised, reviewed, approved, and implemented, as necessary, for the Hanford Site to maintain authorization for off-site shipments of TRU waste.
- Interfacing with the originating facility to develop and maintain procedures to load the TRUPACT-II in accordance with the TRUPACT-II SARP and WIPP-WAC to ensure that all payloads meet all applicable requirements.
- Maintaining Hanford Site TRUPACT-II Content Codes (TRUCON) in accordance with the TRUCON document and requesting revisions from CAO, as necessary.
- Interfacing with the SPM, WCO, and SQAQO on matters related to payload certification and offsite transportation of TRU waste.
- Reviewing and approving this Certification Plan.
- Reviewing all payload data sheets and documenting compliance with all packaging and shipping requirements described in this Certification Plan.
- Preparing and signing bills of lading, uniform hazardous waste manifests (UHWI), and land disposal restriction (LDR) notifications, as appropriate.

Shipping activities related to the TRUPACT-II and WIPP acceptance include the following:

- Ensuring compliance with applicable DOT and NRC regulations.

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- Providing guidance to waste generators to assist their efforts to comply with the TRAMPAC and WIPP-WAC criteria and requirements in implementing procedures affecting characterization, QA, and waste certification.
- Ensuring that the proper shipping category, TRUCON codes, and Hanford Site waste form number are assigned to each container and shipment.
- Reviewing all payload data sheets and Hanford Site records to guarantee and document compliance with all packaging and shipping requirements.
- In conjunction with the WCO, ensuring that all waste containers and shipments are certifiable for transport and that all documentation packages are complete and accurate.
- Interfacing with the WWIS and the SPM to obtain approval to ship.

The TCO may designate one or more individuals to perform these responsibilities, but retains ultimate responsibility for ensuring that certification-related Project requirements are met.

2.2 WASTE CHARACTERIZATION/CERTIFICATION PROCESS

The Hanford Site TRU waste process for characterizing and certifying waste and preparing it for transport to WIPP involves a series of operations based on whether the waste is retrievably stored or newly generated and the physical form of the waste. Newly generated TRU waste is defined as TRU waste generated after the New Mexico Environment Department (NMED) notifies WIPP, by approval of the final audit report, that the Hanford Site has satisfactorily implemented the characterization requirements of the WAP. However, TRU waste that is generated outside the umbrella of the authorized and approved Hanford Site TRU Project may be managed as retrievably stored waste at such time as the waste stream is identified for processing to meet the TRU Project characterization and certification criteria and requirements.

Initially, AK is used to delineate all TRU waste containers into waste streams and assign an appropriate waste matrix code group category based on the physical form of the waste and the waste contents. AK is also used to make determinations regarding EPA hazardous waste numbers, radionuclide composition, and prohibited item restrictions. AK information for each waste stream is assessed and verified through evaluation of results from applicable testing, sampling, and analytical activities.

Waste characterization requirements for retrievably stored and newly generated wastes differ, as summarized below. For more details on these waste characterization activities and requirements, refer to the QAPjP, Section B-3d.

- Radiography and/or visual examination (VE) is used to identify and/or confirm the waste matrix code group category and waste material parameter designations and identify prohibited items. All retrievably stored waste containers undergo radiography. Radiography is confirmed by VE on a randomly selected number of **containers** in each retrievably stored waste stream. For newly generated waste, **physical** form and prohibited items are verified during **packaging using the VE**

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technique. The VE technique is not the same process as VE that is performed to verify radiography. The VE technique involves two independent verifications of the physical form of the waste and contents at the time of packaging. The first operator documents the content of the waste container providing a written inventory of actual or estimated weights of each item placed in the container. The operator also documents that prohibited article(s) are not present. A second, independent operator provides additional verification by reviewing the waste contents and ensuring correct reporting of the waste container content. Corrective actions are taken if either the first or second operator cannot independently confirm the waste designations.

- Radioassay data identify and quantify radionuclide composition and concentration. All TRU waste containers from newly generated and retrievably stored waste streams undergo radioassay.
- Headspace gas sampling and analysis provide data to determine potential flammability, and confirm EPA hazardous waste numbers. All TRU waste containers from newly generated and retrievably stored waste streams undergo headspace gas sampling and analysis.
- Sampling and analysis of homogeneous wastes provide data to confirm listed and toxicity characteristic EPA hazardous waste numbers and quantify hazardous constituent concentration. The RCRA-regulated constituents in newly generated homogeneous solid waste streams are documented and verified at the time of generation based on AK and sampling and analysis. For continuous processes that result in newly generated homogeneous wastes (except soil/gravel waste streams), initial sampling is conducted and process control parameters are established to develop a baseline control chart for the process. The parameter limits for a waste generating process are established in specific written procedures for the process. Process performance relative to the established parameter limits is determined through annual sampling of the process, which is conducted on a random basis. If the parameter limits are exceeded, the waste stream is recharacterized according to procedures and methods specified for retrievably stored waste. In cases where control charting is not useful in controlling hazardous waste constituents, homogeneous wastes are characterized in process batches as described in the QAPjP, Section B-3d(1)(a). The number of newly generated soil/gravel waste containers to be randomly sampled and analyzed is determined through a statistical selection process. Using a similar approach, a statistically selected portion of retrievably stored homogeneous solids and soil/gravel wastes are sampled and analyzed to confirm waste constituents.

Radioassay and analytical facilities (i.e., headspace gas and homogeneous waste stream analysis) are qualified through participation in the applicable Performance Demonstration Program (PDP). The PDP program supports the determination of a facility to meet QA objectives.

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The SPM reconciles waste characterization data against applicable data quality objectives (DQOs). Data quality objectives are qualitative and quantitative statements that specify WIPP program technical and quality objectives. DQOs are determined through the data quality objective process (EPA 1994a). The data quality objectives for the waste characterization activities are contained in the WAP, Attachment B3.

Figures 2-2 and 2-3 illustrate the typical process flow for retrievably stored and newly generated TRU waste, respectively. Certain characterization activities identified for retrievably stored waste may be applied to newly generated waste and vice versa provided that compliance with waste characterization requirements can be adequately demonstrated. In addition, variance from the depicted flow path within each process may be necessary to address technical or operational needs. Sections 3.0 and 4.0 detail the methods of compliance and verification for each certification-related process and identify applicable implementing procedures.

2.2.1 Waste Stream Documentation

Hanford Site waste generators produce waste stream documentation to meet Hanford Site waste acceptance criteria and support the waste stream approval process. Waste stream information is supplied on site-specific forms and attachments. At a minimum, generators provide the following waste stream information:

- Generator information
- Waste stream name
- Waste generating process description
- Radiological information (e.g., classification, reportable radionuclides, characterization method)
- Chemical constituent information (e.g., chemicals present, concentration ranges, characterization methods)
- LDR information, including identification of underlying hazardous constituents, if applicable
- Waste type information (e.g., physical state, inert materials, and stabilizing agents and/or absorbents used)
- Packaging information (e.g., container type and size, maximum weight)
- Additional attachments, including process flow information, analytical data, container drawings, or other waste acceptance information.

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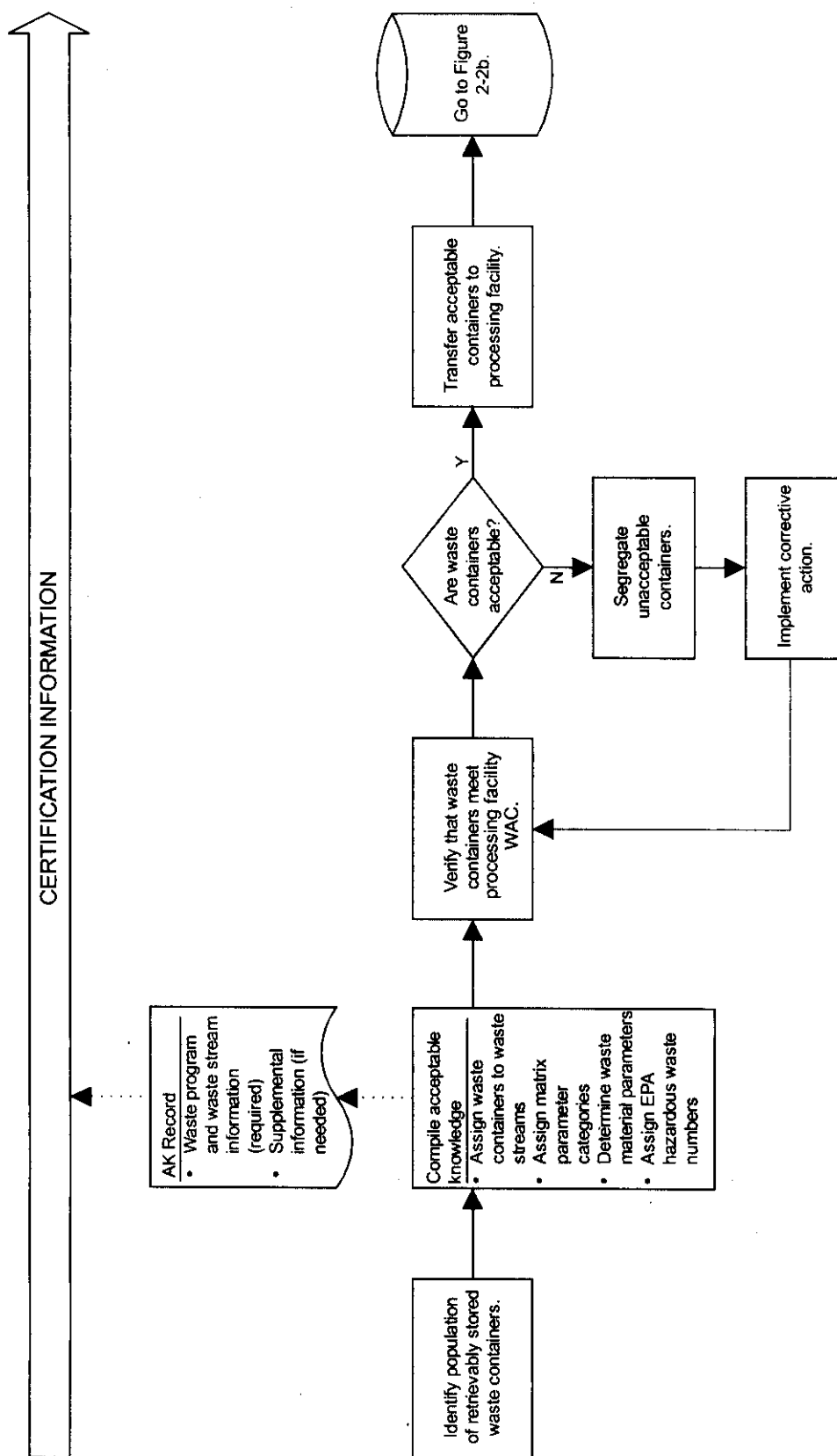


Figure 2-2a. Certification Flow for Retrievably Stored TRU Waste.

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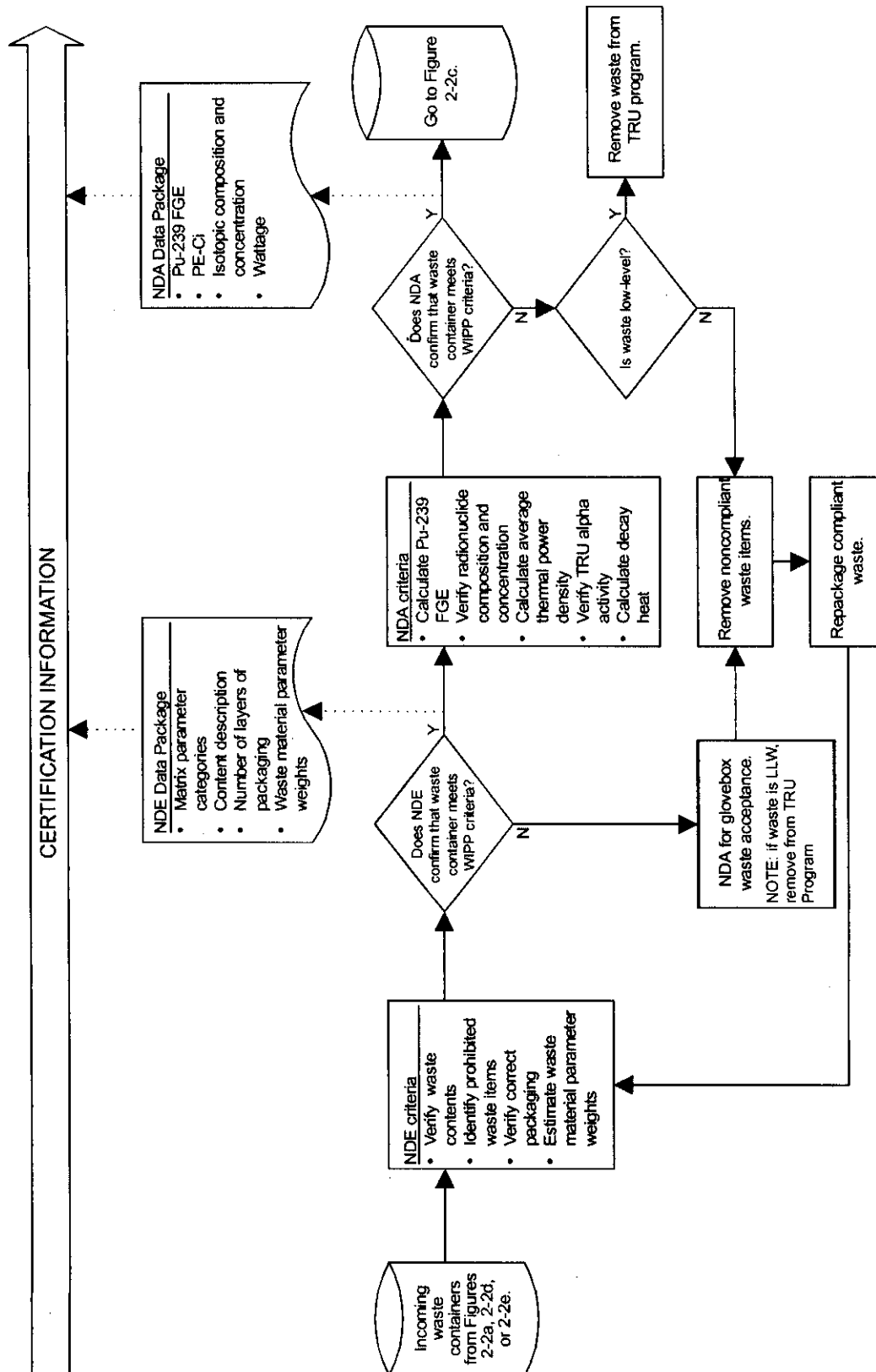


Figure 2-2b. Certification Flow for Retrievably Stored TRU Waste. (continued)

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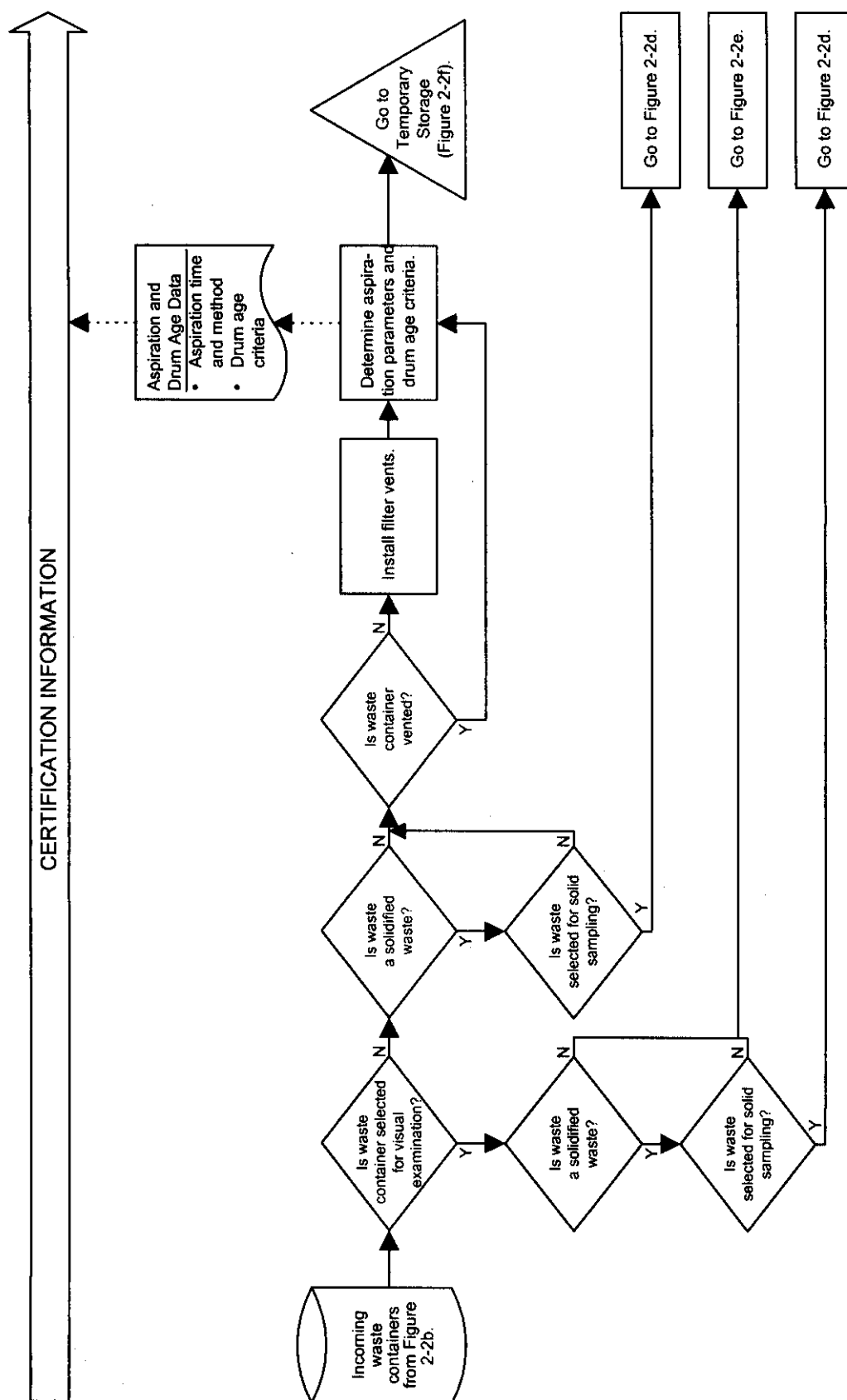


Figure 2-2c. Certification Flow for Retrievably Stored TRU Waste. (continued)

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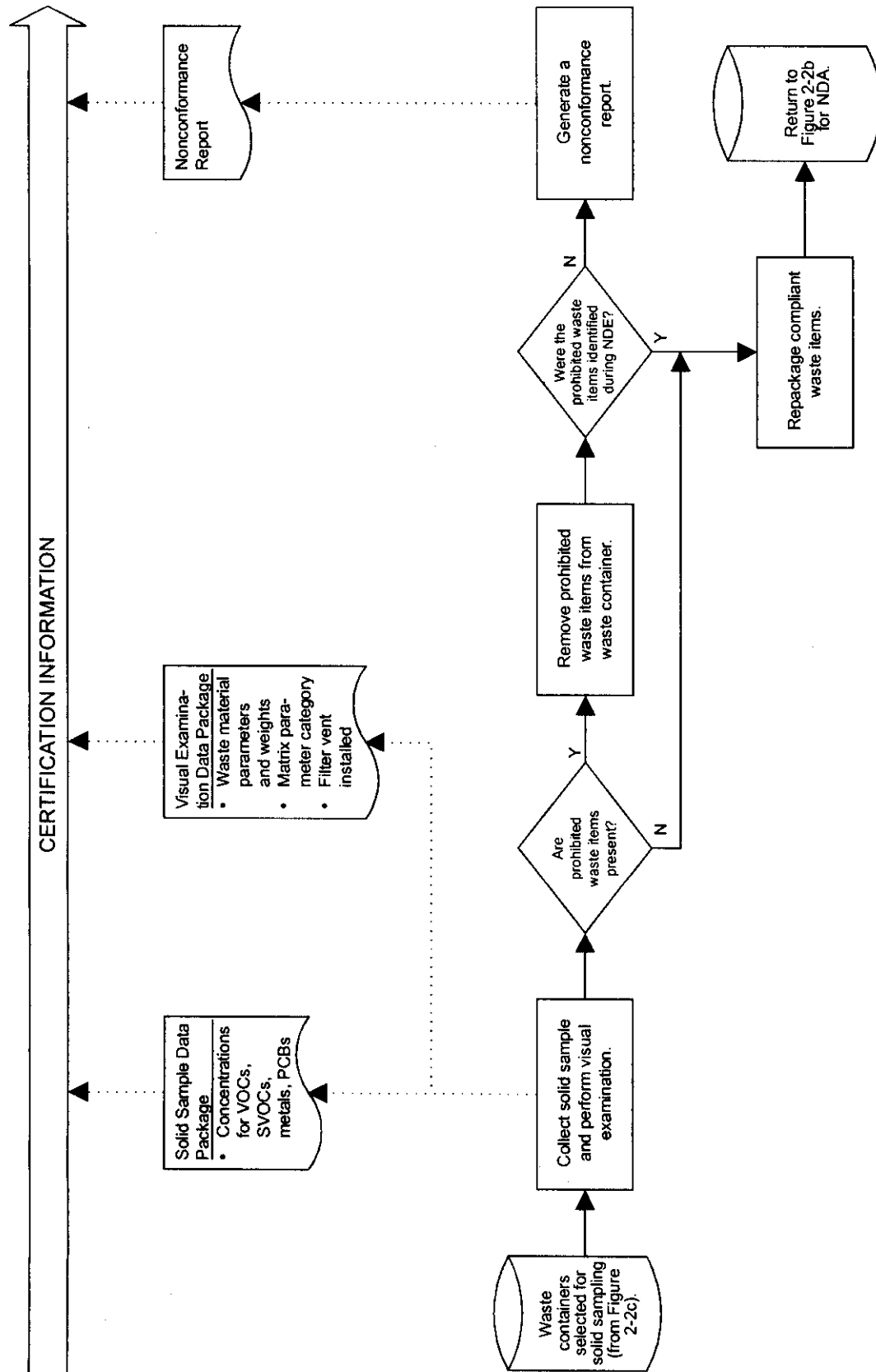


Figure 2-2d. Certification Flow for Retrievably Stored TRU Waste. (continued)

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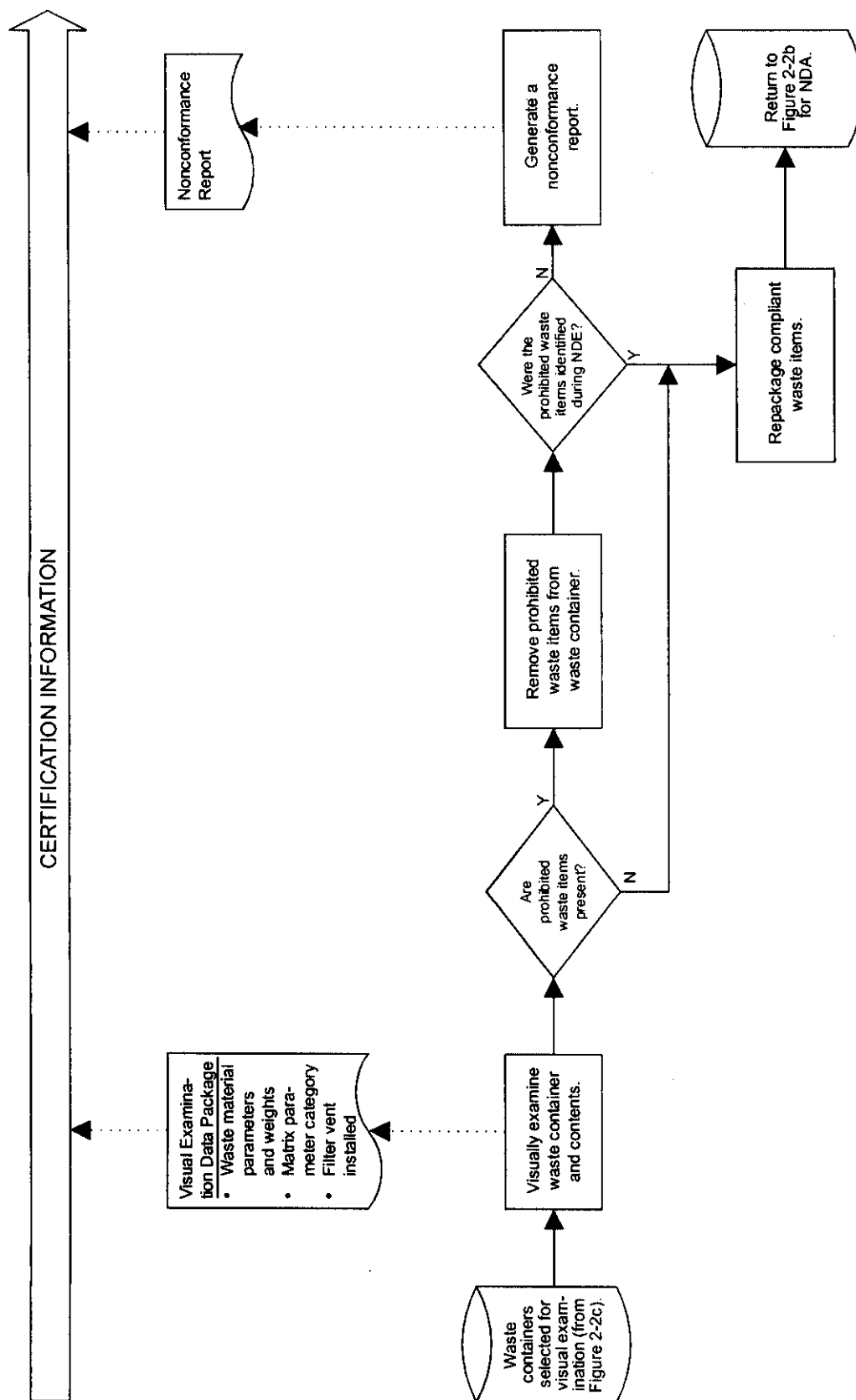


Figure 2-2e. Certification Flow for Retrievably Stored TRU Waste. (continued)

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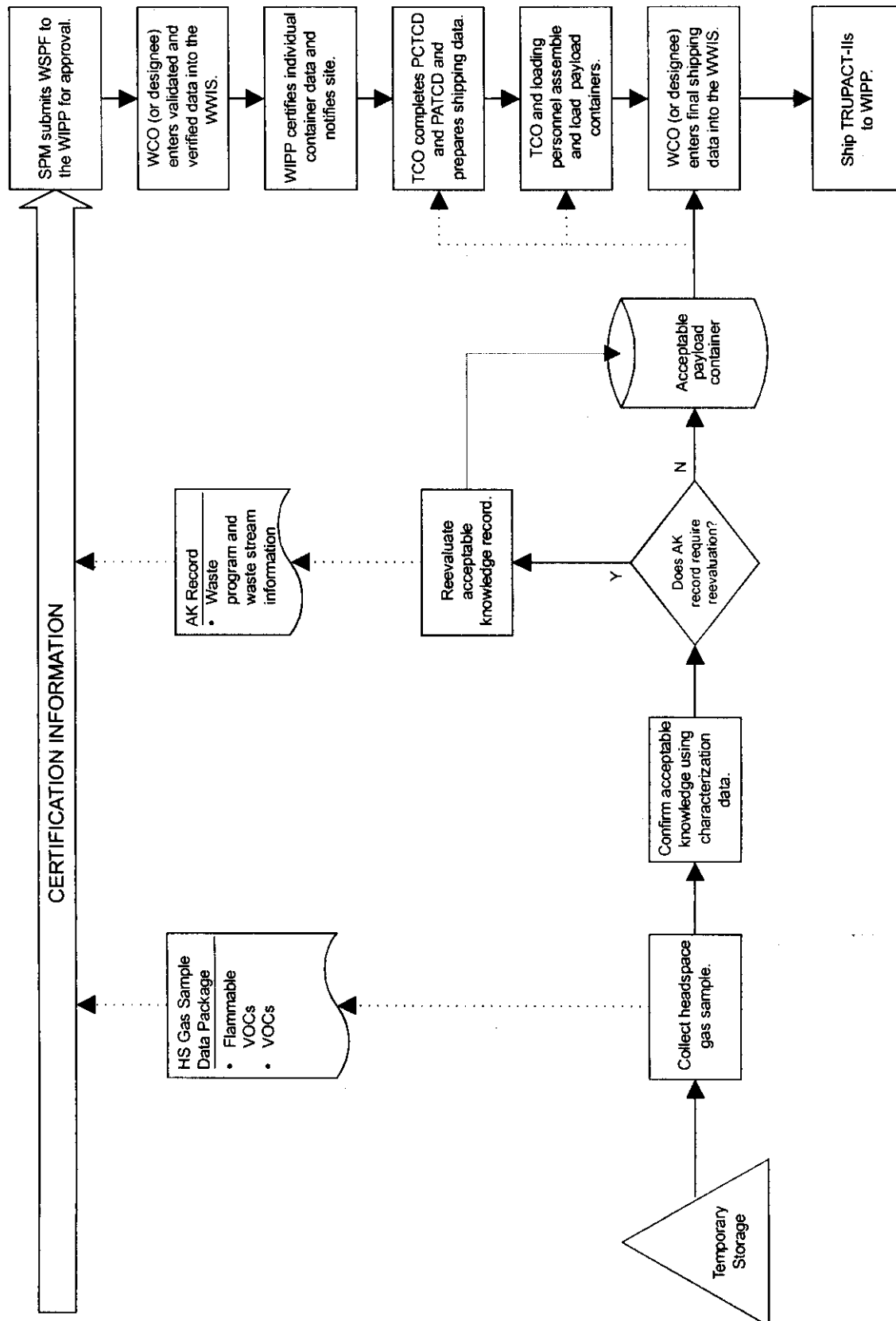


Figure 2-2f. Certification Flow for Retrievably Stored TRU Waste (concluded)

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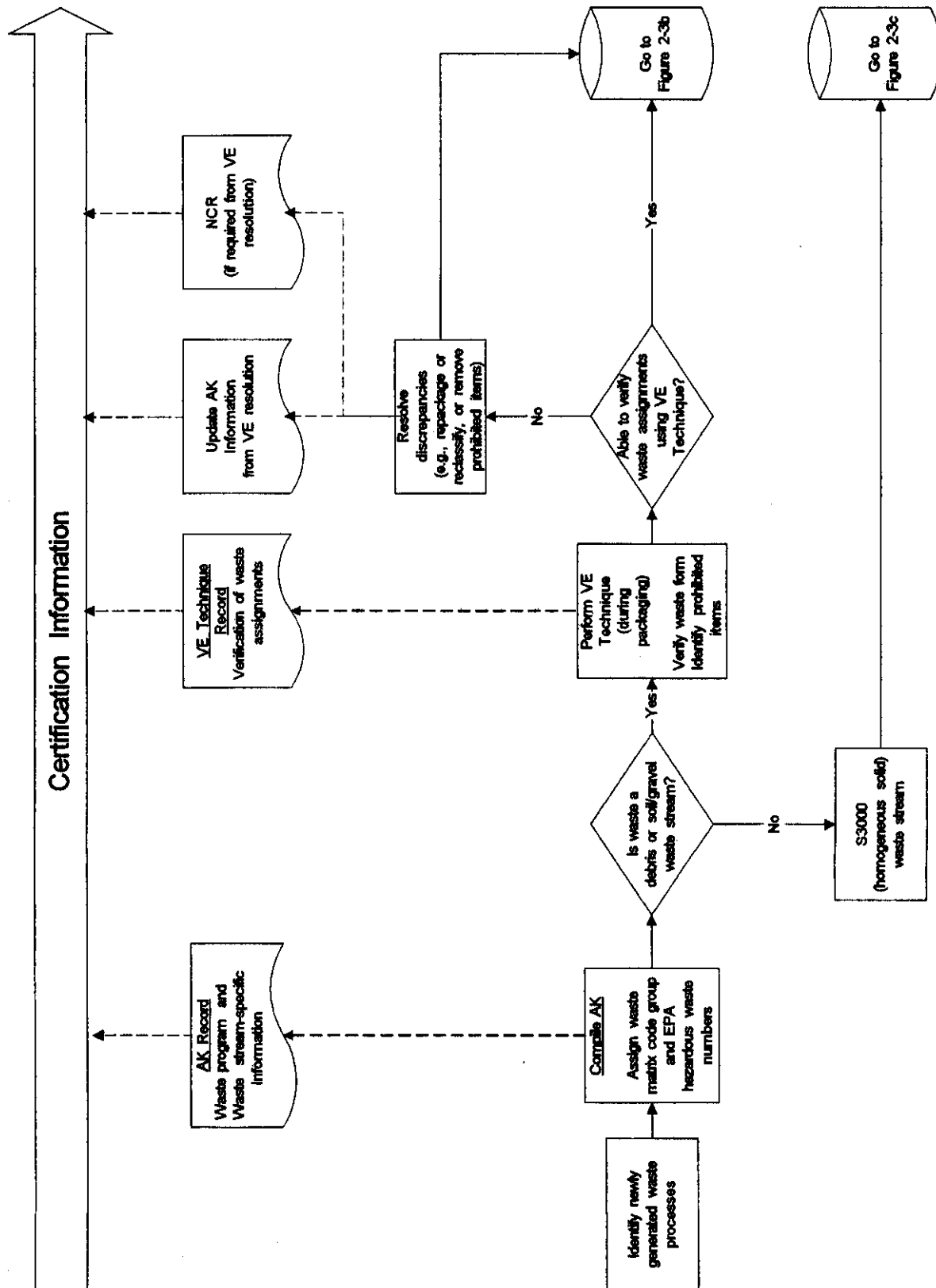


Figure 2-3a. Certification Flow for Newly Generated TRU Waste

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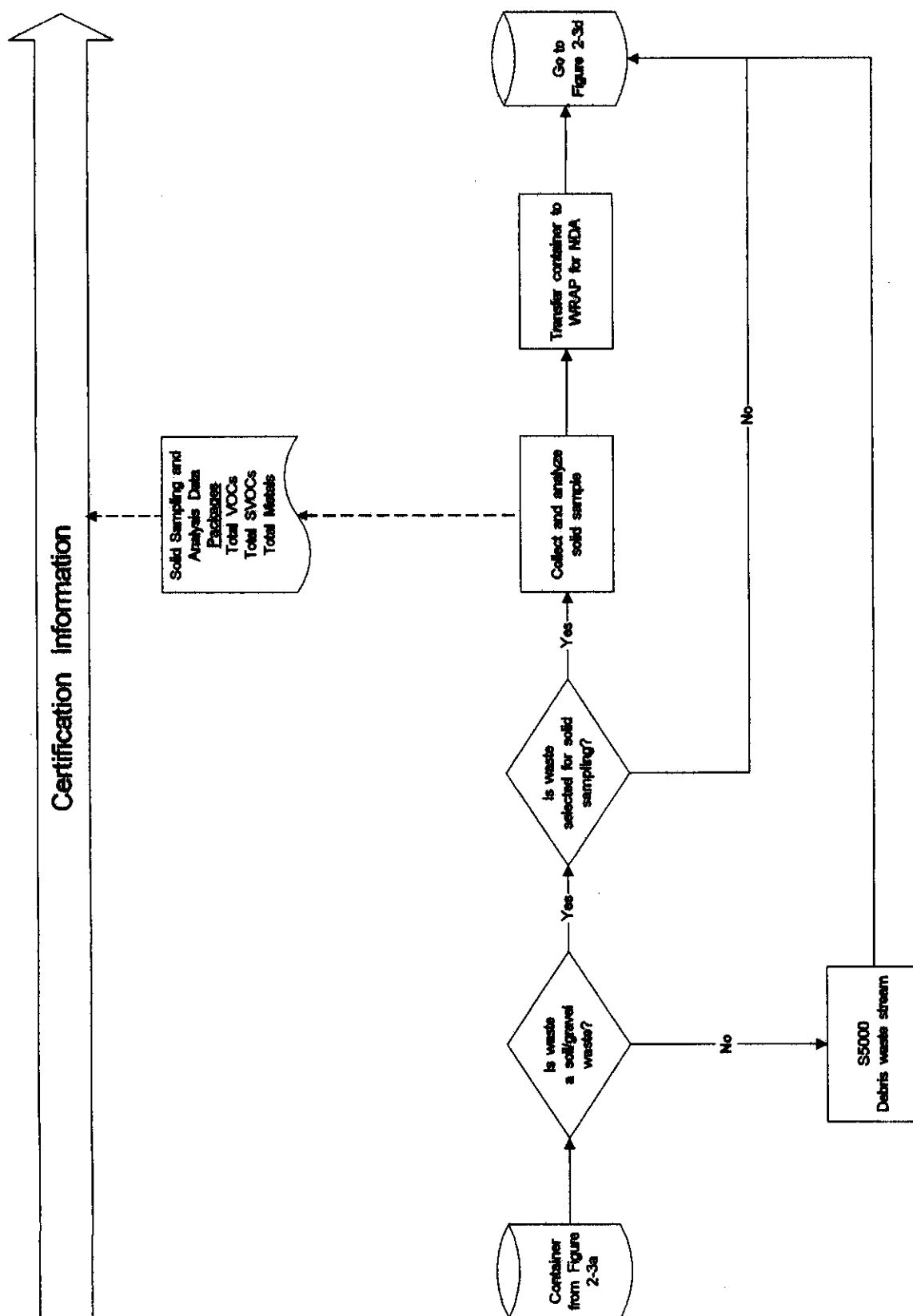


Figure 2-3b. Certification Flow for Newly Generated TRU Waste (Continued)

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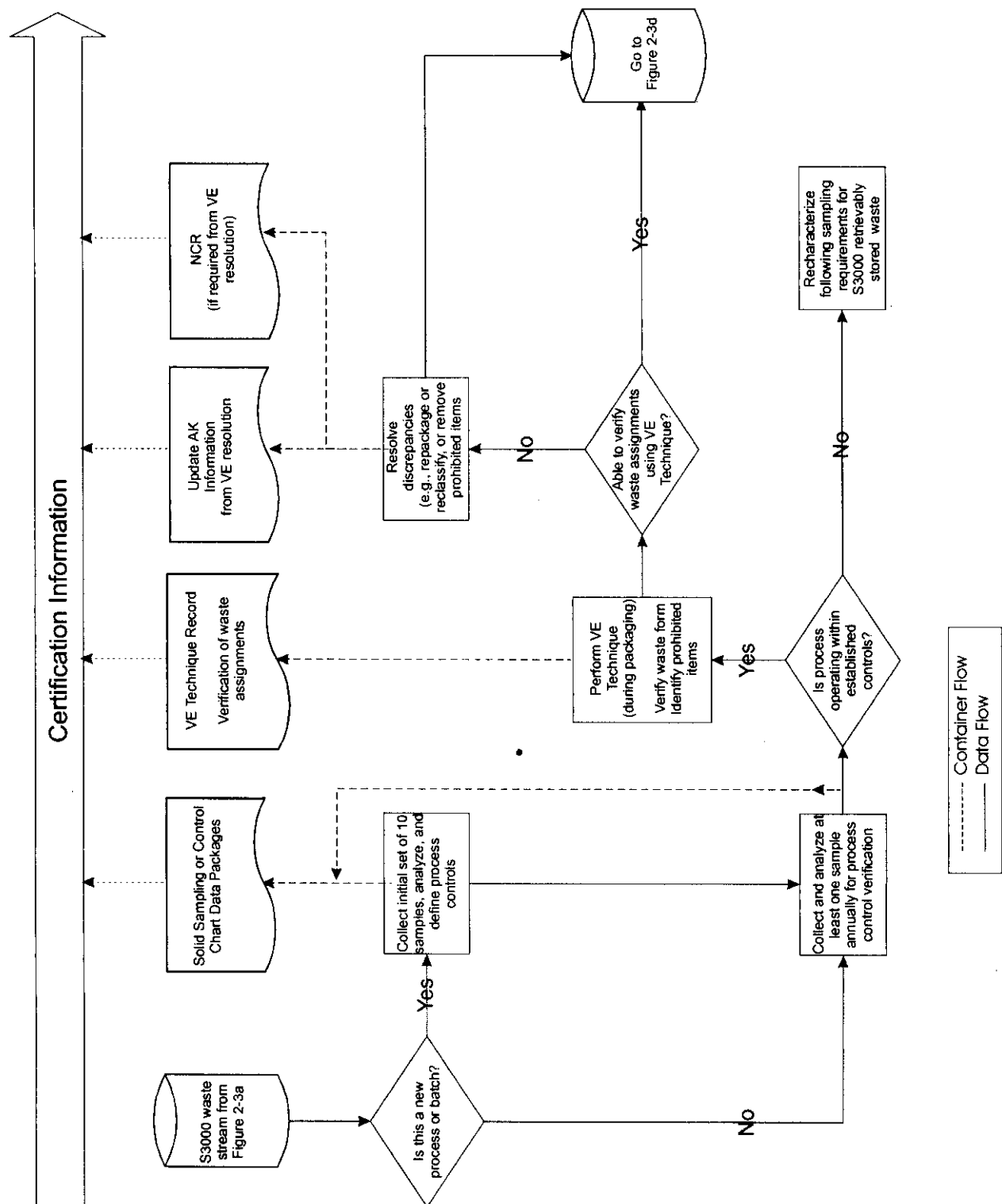


Figure 2-3c. Certification Flow for Newly Generated TRU Waste (Continued)

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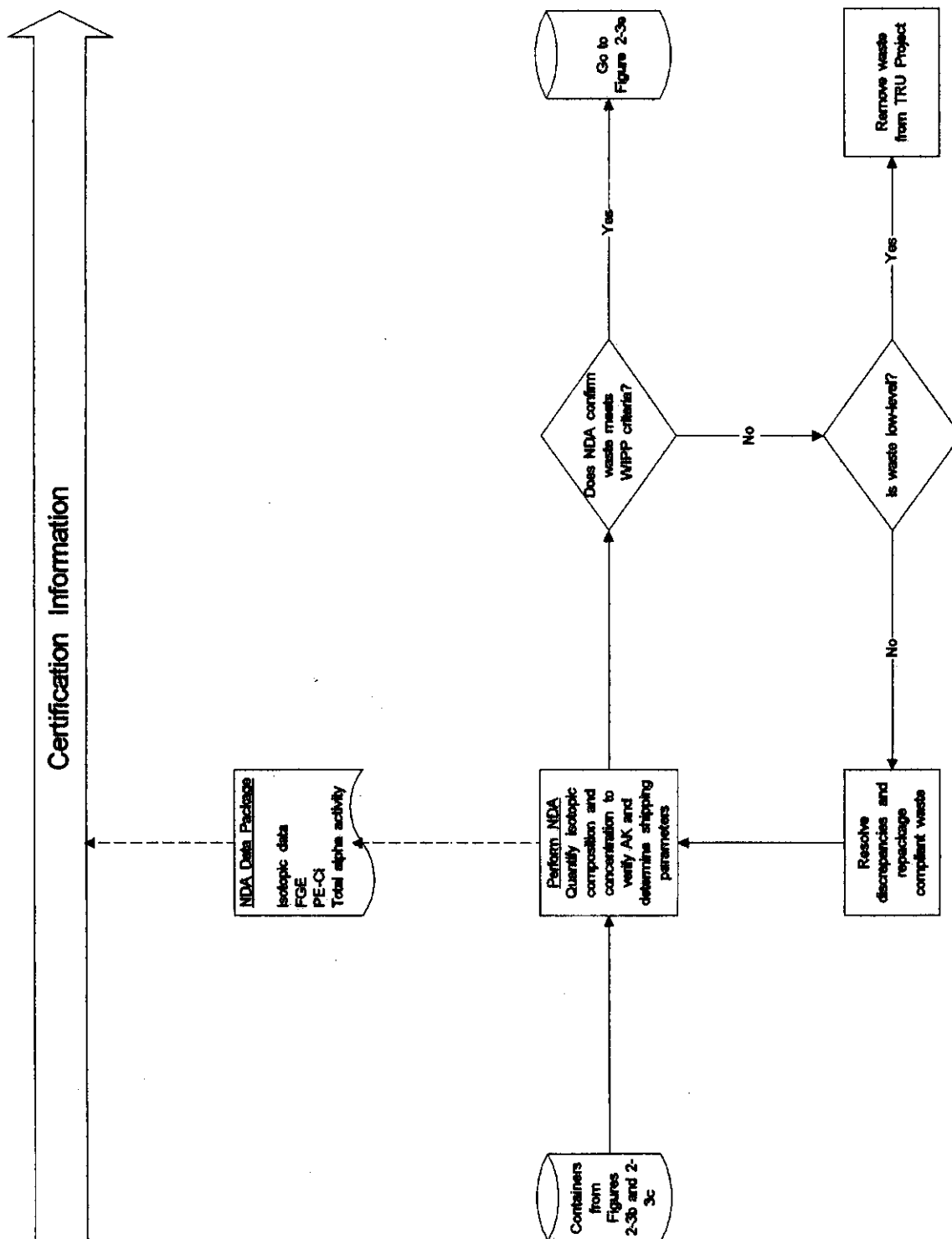


Figure 2-3d. Certification Flow for Newly Generated TRU Waste (Continued)

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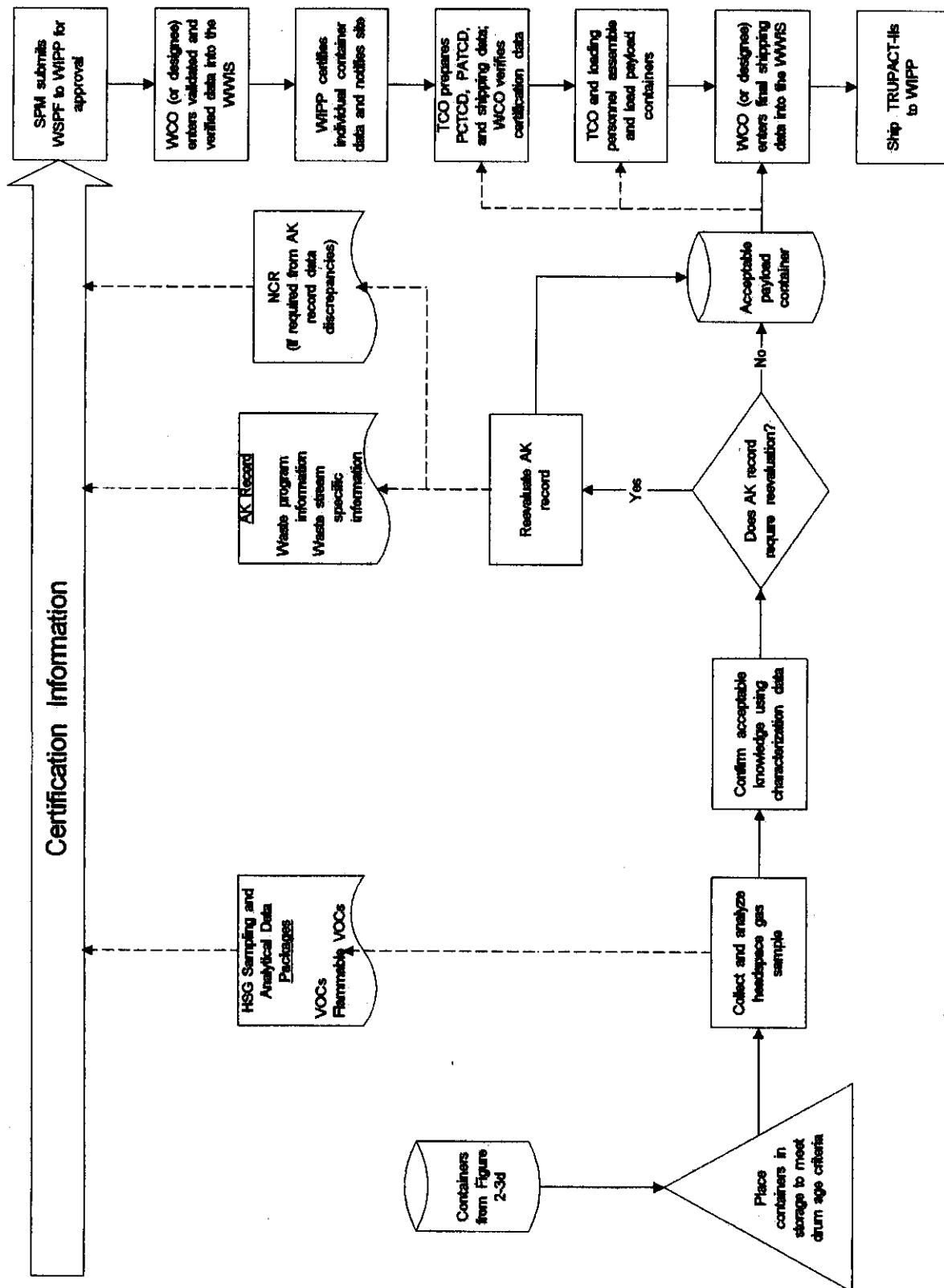


Figure 2-3e. Certification Flow for Newly Generated TRU Waste (Concluded)

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In addition to waste stream information, generators submit the following waste container documentation:

- Container identification number
- Waste profile number (This is a Hanford Site requirement not to be confused with the Waste Stream Profile transmitted to the WIPP for approval as required by the WIPP-WAP.)
- Waste description
- Generator information
- Waste contents inventory
- EPA hazardous waste numbers
- Waste classifications or designations (e.g., Washington State hazardous waste codes)
- Dose rate information
- Reportable radionuclides and quantities
- Waste composition
- Packaging materials and quantities.

Information supplied by waste generators is supplemented with information gathered during TRU Project characterization and certification activities to meet data requirements for completing the WIPP WSPF and WWIS submittals.

2.2.2 Acceptable Knowledge Documentation

The Hanford Site uses AK to assign waste matrix code groups, TRUCON codes, and EPA hazardous waste numbers and to determine the waste material parameters and radionuclides present in waste streams. For each TRU waste stream (and/or waste stream lot), AK information is compiled in an auditable record; confirmed through radiography, VE, radiological assay, headspace gas sampling and analysis, and homogenous waste sampling and analysis (applicable to homogenous solids and soil/gravel waste streams only); and audited periodically to ensure adequacy of the information.

Information compiled to document AK on a site-wide and facility-specific basis includes TRU waste management project information, waste stream information, and supplemental documentation (including reference lists), as needed. The SPM (or designee) reviews waste stream documentation and data packages resulting from radiography, VE, headspace gas sampling and analysis, and solidified waste sampling and analysis (as appropriate) to confirm waste matrix code group designations, EPA hazardous waste numbers, and waste material parameter designations using AK. Changes to EPA hazardous waste numbers are identified and

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justified based on confirmatory testing data. AK information is reevaluated if discrepancies are identified between AK documentation and data from confirmatory testing.

2.2.3 Waste Characterization and Certification Data Reporting

The SPM (or designee) reconciles TRU waste characterization data with DQOs and completes a WIPP WSPF for each Hanford Site TRU waste stream to be disposed at the WIPP. Summaries of waste stream information and reconciliation of DQOs comprise WSPF attachments. WMH-400, Section 7.1.1, "Transuranic Waste Characterization Data Quality Objectives Reconciliation and Reporting," specifies the information required to complete the WSPF and describes the process for reconciling waste characterization data with Project-required parameters, preparing data summary reports, and correlating container identification to data packages.

Before shipping TRU waste containers from a WIPP-accepted and approved waste stream, the SPM transmits waste characterization, certification, and shipment data to WIPP using the WWIS. The WWIS has electronic and edit/limit checks to ensure that the data representing the waste containers are in compliance with the applicable characterization and certification criteria. WMH-400, Section 7.1.5, "WIPP Waste Information System Data Entry and Reporting," describes the process for entering and reporting required data on payload containers and assemblies into the WWIS. WIPP will only accept waste container shipments for disposal if the waste container information has been correctly submitted to the WWIS and approved for shipment by the WIPP Data Administrator.

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2.3 CERTIFICATION PROJECT DOCUMENT CONTROL AND RECORDS MANAGEMENT

This Certification Plan, which includes the Compliance Plan for TRAMPAC and associated QA plans, together with the Hanford Site QAPjP, establishes the basis for the Hanford Site's TRU waste characterization, certification, and transportation packaging operations. These documents are submitted to CAO for review and approval. The individuals identified in Table 2-1 reviews and/or approve this Certification Plan and any revisions. The SPM (or designee) reviews this Certification Plan at least annually and schedules revisions, reviews, approvals, and distribution.

Table 2-1. Review, Approval, and Control Requirements for the Hanford Site Certification Plan.

Organization/Reviewer	Review and approval	Change approval	Change control
National TRU Waste Program Team Leader	X	X ^a	—
Carlsbad Area Office Quality Assurance Manager	X	X	—
Site Project Manager	X	X	X ^b
Site Quality Assurance Officer	X	X	—
Waste Certification Official	X	X	—
Transportation Certification Official	X	X	—

Note: — = not required.

^aChanges affecting performance criteria or data quality only.

^bEnsures compliance with records management requirements.

Project personnel develop, maintain, and control this Certification Plan in accordance with WMH-400, Section 1.4.1, "TRU Document Control." Project personnel generate records of characterization, certification, packaging, and transportation activities and review these records to ensure compliance with Project requirements. Approved records are collected, processed, stored, and maintained in accordance with records management requirements established in WMH-400, Section 1.5.1, "TRU Records Management."

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3.0 COMPLIANCE PLAN FOR WIPP-WAC

This section describes how the Hanford Site complies with the requirements and associated criteria for WIPP acceptance of contact-handled (CH) TRU waste, including transportation safety requirements (e.g., acceptable methods for payload compliance) defined in the TRUPACT-II SARP, WIPP Hazardous Waste Facility Permit requirements for TRU mixed waste established in the WAP, and EPA environmental compliance requirements established in the 40 CFR 191/194 Compliance Certification Application.

3.1 REQUIREMENT ORGANIZATION

WIPP-WAC requirements are organized under six major categories: 1) container properties, 2) radiological properties, 3) physical properties, 4) chemical properties, 5) gas generation properties, and 6) data package contents. Sections 3.2 through 3.7 correlate with the organization in the WIPP-WAC for CH TRU waste requirements and identify methods of compliance to meet each requirement. Procedures that implement the process controls, techniques, tests, and other actions to be applied to each TRU payload container, waste stream, and shipment are also identified. Appendix A summarizes the WIPP-WAC and TRAMPAC requirements and identifies the Hanford Site documents and procedures that implement each requirement. The numbering of WIPP-WAC requirements in Appendix A correlates with the numbering system in the following subsections. Waste shipped to WIPP must comply with the most restrictive of the CH TRU requirements established in the WIPP-WAC and TRAMPAC. Therefore, only the most restrictive requirements are described in this section. In addition, because many WIPP-WAC and TRAMPAC requirements overlap, this section refers to Section 4.0 of this document, where appropriate, for applicable methods of compliance and verification.

Revisions of requirements in referenced documents controlled by agencies or organizations other than DOE (e.g., EPA, NMED, NRC) shall have precedence over values quoted in this Certification Plan. Changes incorporated in future revisions of the WIPP-WAC will be reflected in future revisions of this Certification Plan. Requests for exceptions (variances) to requirements must be submitted formally to the CAO for approval. The CAO cannot approve exceptions (variances) to external requirements that are controlled by organizations other than DOE without first obtaining changes to the controlling authorizations.

Only wastes from a properly characterized and approved waste stream can be certified as meeting the requirements and associated criteria in this Certification Plan. Any payload containers with unresolved discrepancies associated with hazardous waste characterization will not be managed or disposed at WIPP until the discrepancies are in accordance with requirements established in the WAP. Corrective action reports applicable to WAP requirements shall be resolved prior to waste shipment. Throughout this section and the discussions of compliance and verification methods, it can be assumed, unless otherwise noted, that if a requirement is not met, Project personnel will segregate the nonconforming item and initiate an NCR or CAR in accordance with WMH-400, Section 1.3.2, "TRU Nonconforming Item Reporting and Control," or WMH-400, Section 1.3.3, "TRU Corrective Action Reporting and Control." Corrective action will be taken in accordance with WMH-400, Section 1.3.1, "TRU Corrective Action Management," to resolve nonconformances. See also Section 5.3 of this Certification Plan for more details about the NCR/CAR process.

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3.2 CONTAINER PROPERTIES CRITERIA AND REQUIREMENTS**3.2.1 Payload Container Description****3.2.1.1 Requirements**

CH TRU waste shall only be shipped in noncombustible DOT Type A or equivalent 55-gal. drums, pipe overpacks in 55-gal. drums, 85-gal. drum overpacks, standard waste boxes (SWBs), and ten-drum overpacks (TDOPs) in the TRUPACT-II. Containers shall comply with the specifications in the TRUPACT-II SARP, Appendix 1.3.3, and Section 2.0 of the TRAMPAC. All payload containers shall be inspected to ensure they are in good condition prior to shipment. Table 3-1 provides the maximum number of containers in accordance with TRUPACT-II and the authorized packaging configurations.

Table 3-1. Maximum Number of Containers per TRUPACT-II and Authorized Packaging Configurations.

Maximum Number of Containers	Authorized Packaging
14	55-gal. Drum
14	55-gal. drums, each containing one pipe component
2	SWBs
2	SWBs, each containing one bin
2	SWBs, each containing up to four 55-gal. drums
1	TDOP
1	TDOP, containing up to ten 55-gal. drums
1	TDOP, containing up to six 85-gal. drums
1	TDOP, containing one SWB
1	TDOP, containing one bin within an SWB
1	TDOP, containing up to four 55-gal. drums within an SWB

Source: TRAMPAC, Section 2.1.1 and WIPP-WAC, Table 3.2.1.

3.2.1.2 Compliance and Verification

See Section 4.1.1.2

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3.2.2 Container Weight and Center of Gravity**3.2.2.1 Requirements**

Individual payload container weights shall be limited to the weight capacities that meet DOT Type A requirements or the weight limits specified by TRUPACT-II restrictions, whichever is less.

Table 3-2 defines the weight limits that apply to CH TRU waste payload containers, loaded TRUPACT-IIs, and TRUPACT-II shipments. Because all weight criteria must be met, different payload configurations are restricted by different requirements. For example, a payload assembly of fourteen 55-gal. drums may not be greater than 7,265 lbs., even though the maximum weight of a single 55-gal. drum may be 1,000 lbs. Although the maximum weight of the payload assembly must not exceed 7,265 lbs., the weight available for the CH TRU waste payload assembly will be less, depending on the as-built weight of the TRUPACT-II to be used (the average as-built weight of a production TRUPACT-II is 12,705 lbs.). The weight available for the CH TRU waste payload assembly is obtained by subtracting the as-built weight of a TRUPACT-II from the maximum gross weight of 19,250 lbs. The maximum gross weight per TRUPACT-II is specified based on an approximate as-built weight of 13,050 lbs. and an average payload weight of 6,200 lbs. This is usually the limiting weight for two TRUPACT-IIs per shipment. The DOT limit of 80,000-lbs. gross vehicle weight rating must also be met. This is the limiting weight for three TRUPACT-IIs per shipment.

Table 3-2. Container and Assembly Weight Criteria

Component	Maximum Gross Weight (lbs.)
<i>Individual Payload Container--Required for Certification</i>	
55-gal. Steel drum (must also meet restrictions in DOT Specification 7A)	≤1,000
55-gal. Drum overpacked in SWB	≤1,450
SWB	≤4,000
TDOP	≤6,700
<i>Pipe Overpack Payload Container--Required for Certification</i>	
Pipe Overpack 6-in. diameter, in a 55-gal. drum	≤328
Pipe Overpack 12-in. diameter, in a 55-gal. drum	≤547
<i>Payload Container Assembly--After Waste is Certified</i>	
Payload Container Assembly (14 55-gal. drums or 2 SWBs)	≤7,265
TRUPACT-II	≤19,250
Truck (Tractor/Trailer)	≤80,000

Source: TRAMPAC, Section 2.3.1.1 and WIPP-WAC, Table 3.2.2.

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The center of gravity of a loaded TRUPACT-II shall be determined by the weights and locations of the individual CH TRU waste payload containers. The total weight of the top seven-pack of drums or an SWB shall be less than or equal to the total weight of the lower seven-pack of drums or an SWB. The total weight of the top five drums in a TDOP shall be less than or equal to the total weight of the bottom five drums. The scale calibration shall be in accordance with the National Institute of Standards and Technology (NIST) Handbook 44 or equivalent.

3.2.2.2 Compliance and Verification

See Section 4.1.3.2

3.2.3 Removable Surface Contamination (Payload Containers)**3.2.3.1 Requirements**

The degree of removable surface contamination for each CH TRU waste payload container or payload container assembly must be measured and documented prior to shipment. Removable surface contamination on CH TRU waste payload containers or container assemblies shall not be greater than 20 disintegrations per minute (dpm) per 100 cm² for alpha-emitting radionuclides or 200 dpm per 100 cm² for beta-gamma-emitting radionuclides. Beta-gamma contamination may be less than or equal to 1,000 dpm per 100 cm² if it meets the requirements of 10 CFR 835 (*DOE Radiological Control Manual*, Table 2-2). Fixing surface contamination to meet the above criterion is not permitted.

3.2.3.2 Compliance and Verification

A Hanford Site radiological control technician (RCT) surveys TRU waste containers and container assemblies for removable surface contamination before the containers are loaded for shipment. The RCT assesses removable contamination and documents the results in accordance with WRP1-OP-1225, "Radiological Support of TRUPACT-II Shipping and Receiving." If the RCT determines that removable contamination exceeds 20 dpm per 100 cm² for alpha-emitting radionuclides or 200 dpm per 100 cm² for beta-gamma-emitting radionuclides, Project personnel determine whether surface contamination can be removed to meet established limits. If compliance with removable surface contamination limits cannot be achieved, project personnel segregate and disposition noncompliant container(s) in accordance with nonconformance and corrective action procedures. The survey results are added to the container data package as described in WMH-400, Section 7.1.8. The WCO confirms removable surface contamination survey results in accordance with WMH-400, Section 7.1.8.

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3.2.4 Container Identification/Labeling**3.2.4.1 Requirements**

Each CH TRU waste payload container shall be uniquely identified by means of labels permanently attached in conspicuous locations. The labels shall contain a unique container identification number consisting of site and container information. The container identification number shall be in medium- to low-density Code 39 bar code symbology (per MIL-STD-1189B) in characters at least 1-in. high, and alphanumeric characters at least 0.5-in. high. The bar code identification labels shall be placed at three locations about 120 degrees apart so that at least one label is clearly visible when drums are assembled into a seven-pack (e.g., a label must be visible after slip sheets and wrapping are applied). Labels are required on the flat sides of SWBs. Each CH TRU waste payload container shall be marked with the shipping category after verification of all payload parameters. Containers shall be marked in accordance with 10 CFR 835 and/or 40 CFR 262.32, as applicable. See section 3.2.5 for dunnage container labeling requirements.

3.2.4.2 Compliance and Verification

All waste containers currently in the Central Waste Complex (CWC) have a bar code label containing a unique identification number. Generators procure waste containers with bar code labels affixed in accordance with the Hanford Site's container management program. Prior to loading containers in the TRUPACT-II, two additional bar code labels will be added to each drum such that each bar code label is approximately 120 degrees apart around the drum.

After verifying all payload parameters, Project personnel mark each container with the appropriate site and container information and shipping category description (see Section 4.4.1). The TCO verifies compliance with container marking requirements by visually inspecting all TRU waste containers and their labels and comparing them to the container data package prior to shipment in accordance with WMH-400, Section 7.1.8. The TCO confirms the appropriate shipping category and documents compliance on the PCTCD and the WCO verifies the container marking as described in WMH-400, Section 7.1.8.

3.2.5 Dunnage**3.2.5.1 Requirements**

If too few payload containers meeting all payload container and transportation requirements are available, dunnage must complete one of the configurations specified in Table 3-1. Empty 55-gal. drum(s) or an empty SWB may be used as dunnage, as specified in Section 2.2 of the TRAMPAC. If an empty drum is used as dunnage to complete a seven-pack in a shipment to WIPP, the drum shall be labeled "EMPTY" or "DUNNAGE" and have a container marking in accordance with Section 3.2.4 of this Certification Plan, as appropriate. Dunnage containers shall have open vent ports (e.g., vent ports shall not be plugged or filtered). The empty drum shall be reported by container identification number (CIN) in the data package. Actual data (e.g., zeros, weights) shall be reported in the WWIS data fields for a dunnage drum that is part of a payload assembly. If a seven-pack of empty drums or an SWB is shipped as dunnage to fill a TRUPACT-II, the drums or SWB will be labeled as "EMPTY" or "DUNNAGE" but will not be labeled with container identification numbers or included in WWIS data.

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3.2.5.2 Compliance and Verification

See Section 4.1.4.2.

3.2.6 Filter Vents**3.2.6.1 Requirements**

All payload containers (including overpacks, but not dunnage containers) shall be vented with one or more filters to control gas concentration and pressure and to preclude conditions within the container that would lead to development of ignitable, corrosive, reactive, or other characteristic wastes. Filters shall meet the specifications described in Appendix 1.3.5 of the TRUPACT-II SARP for minimum hydrogen diffusivity and RCRA requirements for VOC dispersion.

3.2.6.2 Compliance and Verification

See Section 4.1.5.2

3.3 RADIOLOGICAL PROPERTIES CRITERIA AND REQUIREMENTS**3.3.1 Radionuclide Composition****3.3.1.1 Requirements**

The radionuclide composition comprising at least 95 percent of the activity of each waste container must be quantified and reported using the WWIS. For purposes of tracking the inventory curie content, the following radionuclides must be quantified and reported: ^{241}Am , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{242}Pu , ^{233}U , ^{234}U , ^{238}U , ^{90}Sr , and ^{137}Cs .

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3.3.1.2 Compliance and Verification

Nondestructive assay (NDA) personnel perform measurements of each TRU waste container using gamma energy assay (GEA) and, if necessary, imaging passive/active neutron (IPAN) systems to determine the radioactive material composition and quantify radionuclide masses. The requirements for NDA are presented in Appendix E of this Certification Plan. NDA personnel at WRAP follow NDA procedures described in WRP1-OP-0906, "Gamma Energy Assay Operations," and WRP1-OP-0905, "Imaging Passive/Active Neutron Assay Operations." NDA personnel at WRAP quantify radionuclide values in accordance with WMP-350, Section 2.2, "Calculation of Assay Results." NDA personnel at WRAP use acceptable knowledge (AK) data and assay measurements and calculations to create an isotopic profile of each waste container, which is reported in batch data reports in accordance with WMP-350, Section 2.3, "Data Management of NDE/NDA Results."

NDA personnel at PFP follow NDA procedures described in ZA-948-385, "Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS)." NDA personnel at PFP calibrate the assay system in accordance with ZA-400-301, "SAS Energy and Efficiency Setup and Baseline Determination," and quantitate radionuclide values in accordance with ZA-400-302, "Calculation of Assay Results." NDA personnel at PFP use AK data and assay measurements and calculations to create an isotopic profile of each waste container, which is reported in batch data reports in accordance with FSP-PFP-5-8, *Plutonium Finishing Plant Administration*, Section 16.1, "Quality Assurance Objectives for Nondestructive Assay at PFP," and FSP-PFP-5-8, Section 16.2, "Data Management for NDA Results."

3.3.2 Fissile Material Quantity (^{239}Pu Fissile Gram Equivalents)**3.3.2.1 Requirements**

The fissile or fissionable radionuclide content, expressed in terms of ^{239}Pu fissile gram equivalent (FGE) plus two times the measurement error, of CH TRU waste payload containers shall be no greater than 200 g per 55-gal. drum or pipe overpack, or 325 g per SWB or TDOP. A TRUPACT-II shall be acceptable for transport only if the ^{239}Pu FGE plus two times the measurement error is no greater than 325 g for a payload of fourteen 55-gal. drums, two SWBs, or one TDOP, or 2,800 g for a payload of 14 pipe overpacks. The ^{239}Pu FGE shall be calculated using the methods detailed in Section 3.1.2 of the TRAMPAC (Rev 17). Table 3-1 of the TRAMPAC lists the ^{239}Pu FGE of many radionuclides. Table 3-3 (below) defines the maximum allowable quantity of fissile material, expressed as ^{239}Pu FGE, for CH TRU waste in the TRUPACT-II. The ^{239}Pu FGE of the radionuclides in each waste container shall be reported to WIPP using the WWIS. Payload containers must meet both the TRUPACT-II and WIPP repository requirements for criticality. The total ^{239}Pu FGE for a TRUPACT-II shall be calculated and recorded in the PATCD.

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Table 3-3. Nuclear Criticality Criteria

Payload Container	²³⁹ Pu FGE Limit (grams)
55-gal. drum	≤200
SWB	≤325
TDOP	≤325
Pipe component overpacked in 55-gal. drum	≤200
TRUPACT-II (14 55-gal. drums, 2 SWBs, 1 TDOP)	≤325
TRUPACT-II (14 pipe overpacks)	≤2800

Source: WIPP-WAC, Table 3.3.2 and TRAMPAC, Section 3.1.1.

3.3.2.2 Compliance and Verification

NDA personnel obtain the CH TRU waste fissile content in accordance with the NDA process described in Appendix E. All radioassay equipment is qualified under the corresponding Performance Demonstration Program (PDP) requirements. NDA personnel calculate the fissile or fissionable radionuclide content of the CH TRU waste container as ²³⁹Pu FGEs according to approved calculation methods described in Section 3.1.2 of the TRAMPAC. See Section 4.2.1.2 for additional requirements.

3.3.3 TRU Alpha Activity Concentration

3.3.3.1 Requirements

TRU waste containers to be disposed of at WIPP shall contain > 100 nanocuries (nCi) of alpha-emitting TRU isotopes, with half-lives greater than 20 years per gram of waste matrix. The tare weight of the payload containers (including any rigid liners and any added shielding) shall be subtracted prior to performing the calculation to obtain TRU alpha activity concentration. The TRU alpha concentration and total activity from all radionuclides (TRU and non-TRU) reported on the bill of lading or the Uniform Hazardous Waste Manifest, including measurement uncertainty shall be reported to WIPP using the WWIS.

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3.3.3.2 Compliance and Verification

NDA personnel measure TRU alpha activity concentration in accordance with the NDA process described in Appendix E. NDA personnel calculate the TRU alpha activity concentration of the CH TRU waste container manually or using computational algorithms. NDA personnel validate and verify calculation programs in accordance with WMH-400, Section 6.1.1, before the data are used as part of the Project. Assay data are validated and verified at WRAP in accordance with WMP-350, Section 2.3, or at PFP in accordance with FSP-PFP-5-8, Section 16.2, and submitted in batch data reports to the site project office (SPO). The WCO confirms TRU alpha activity in accordance with WMH-400, Section 7.1.8. Project personnel manage waste containers with TRU alpha activity concentrations that do not exceed 100 nCi/g as low-level waste.

3.3.4 ²³⁹Pu Equivalent Activity**3.3.4.1 Requirements**

In accordance with limits stated in Table 3.3.4 of the WIPP-WAC, untreated CH TRU waste shall not exceed 80 Plutonium equivalent-curies (PE-Ci) of activity per 55-gal. drum (direct packaged), or 130 PE-Ci of activity per SWB (direct packaged). Untreated CH TRU waste in 55-gal. drums may contain up to 1100 PE-Ci of activity if overpacked in SWBs or TDOPs. A 55-gal. drum containing a pipe component may not exceed 1800 PE-Ci of activity. Solidified/vitrified CH TRU waste shall not exceed 1800 PE-Ci of activity per 55-gal. drum. Appendix B of the WIPP-WAC details the methods used to calculate PE-Ci.

3.3.4.2 Compliance and Verification

NDA personnel calculate the activity of the CH TRU waste container as PE-Ci according to the methodology in Appendix B of the WIPP-WAC. NDA personnel validate and verify the computational algorithms in the software in accordance with WMH-400, Section 6.1.1, before the data are used as part of the Project. Project personnel identify payload containers exceeding limits stated in Table 3.3.4 of the WIPP-WAC, segregate them, and disposition them in accordance with approved nonconformance and corrective action management. The WCO verifies compliance of the PE-Ci limits in accordance with WMH-400, Section 7.1.8.

3.3.5 Radiation Dose Rate**3.3.5.1 Requirements**

The external radiation dose rates of individual payload containers and the loaded TRUPACT-II shall be limited to ≤ 200 mrem/hr at contact and ≤ 10 mrem/hr at 2 meters, as specified in Section 3.2 of the TRAMPAC. Payload containers that meet the radiation dose rate requirements may be shielded as low as reasonably achievable (ALARA). Internal payload container shielding shall not be used to meet these requirements, except for the pipe component configuration. Neutron contributions to the total payload container dose rate shall be reported separately in the data package.

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3.3.5.2 Compliance and Verification

See Section 4.2.2.2.

3.4 PHYSICAL PROPERTIES CRITERIA AND REQUIREMENTS**3.4.1 Liquids****3.4.1.1 Requirements**

CH TRU waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping, or aspirating. Internal containers (e.g., bottles, cans) shall contain less than 1 in. (2.5 cm) of liquid in the bottom of the container. The aggregate volume of residual liquid in a payload container shall be less than one volume percent of the payload container. For sites that choose to use visual examination in lieu of NDE, the detection of any liquid waste in nontransparent inner containers, detected from shaking the container, will be handled by assuming that the container is filled with liquid and adding this volume to the total liquid volume for the payload container.

3.4.1.2 Compliance and Verification

See Section 4.1.6.2.

3.4.2 Sealed Containers**3.4.2.1 Requirements**

Payload containers shall be verified to be free of unvented sealed containers greater than 4 liters (L), except for Waste Material Type II.2 packaged in a metal container. A rigid 55-gal. drum liner, if present, shall be punctured by a ≥ 0.3 -in. diameter hole or fitted with a filter. Twist-and-tape closure, fold-and-tape closure, and heat-seal closure (with a minimum of one filter vent) are allowable methods for closing plastic bags used for waste confinement.

3.4.2.2 Compliance and Verification

See Section 4.1.8.2

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3.5 CHEMICAL PROPERTIES CRITERIA AND REQUIREMENTS**3.5.1 Pyrophoric Materials****3.5.1.1 Requirements**

Pyrophoric materials other than radionuclides shall be rendered safe prior to placement in the CH TRU waste payload container by mixing them with chemically stable materials (e.g., concrete, glass) or shall be processed to remove their hazardous properties. Not more than 1 percent by weight of the CH TRU waste payload in each payload container shall be pyrophoric forms of radionuclides, and these shall be generally dispersed in the payload. Nonradionuclide pyrophorics are not allowed.

The 1 percent limitation on radionuclides is to allow for any minor residues of uranium or plutonium that may remain in an unoxidized state in the payload. The CH TRU wastes expected to contain metallic radionuclides are to be treated (oxidized) to eliminate as much of the potential pyrophorics as possible prior to placement in payload containers. A validated process that converts radionuclide pyrophoric compounds to a nonpyrophoric form may be used to meet this requirement.

3.5.1.2 Compliance and Verification

See Section 4.3.1.2.

3.5.2 Hazardous Waste**3.5.2.1 Requirements**

TRU mixed waste shall be managed in accordance with the applicable requirements of the WAP. Hazardous waste not occurring as co-contaminants with TRU wastes are prohibited at WIPP. Wastes exhibiting the RCRA characteristics of ignitability, corrosivity, or reactivity (D001, D002, or D003, respectively) are prohibited. Each TRU waste container will be characterized in accordance with AK protocols and applicable sampling and analytical requirements specified in the WAP for purposes of making hazardous waste determinations. Each individual payload container must come from a waste stream documented using an approved WSPF, which identifies the appropriate hazardous waste codes associated with the waste constituents as well as the absence of prohibited hazardous wastes. Only EPA hazardous waste numbers listed in the WIPP Hazardous Waste Facility Permit may be managed at WIPP. Table 3-4 lists the WIPP acceptable EPA hazardous waste numbers.

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Table 3-4. EPA Hazardous Waste Numbers Acceptable at WIPP

F001	D008	D030
F002	D009	D032
F003	D010	D034
F004	D011	D035
F005	D018	D036
F006	D019	D037
F007	D021	D038
F009	D022	D039
D004	D026	D040
D005	D027	D043
D006	D028	P015
D007	D029	

Source: WIPP-WAC, Table 3.5.2.

3.5.2.2 Compliance and Verification

Project personnel review AK information and implement one or more of the procedures identified in Appendix A to characterize waste streams through headspace gas sampling and analysis on all waste containers and homogeneous waste sampling and analysis for nondebris waste streams. For homogeneous waste streams, toxicity characteristic and spent solvent EPA hazardous waste numbers are assigned based upon the analytical results and AK. For debris waste, EPA hazardous waste numbers are assigned based on AK. Toxicity characteristic (TC) and spent solvent EPA hazardous waste numbers are assigned to debris waste streams based on headspace gas sampling and analytical results if AK indicates the waste might contain a constituent in excess of the regulatory level. If data are insufficient to demonstrate that the concentration of the constituent is less than the regulatory level, the EPA hazardous waste number for the identified constituent is applied to the waste stream. The SPM (or designee) reviews the analytical data to ensure that chemical constituents in the waste are allowable according to the chemical lists in the TRAMPAC (Appendix 1.3.7, Tables 4-1 through 4-6). At the discretion of the SPM, additional sampling of the waste stream from which any nonconforming container originated may be performed to determine whether the container is anomalous or is representative of the entire waste stream.

Project personnel identify hazardous constituents in CH TRU wastes and record the data in accordance with applicable data management procedures. The TCO or WCO verifies that data are entered in the WWIS. The TCO ensures the Uniform Hazardous Waste Manifest (UHWI) reflects the hazardous waste codes as described in WMH-400, Section 2.1.5, "TRU Transportation Logistics." The WCO confirms the hazardous waste criteria in accordance with WMH-400, Section 7.1.8.

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3.5.3 Chemical Compatibility**3.5.3.1 Requirements**

CH TRU mixed waste must not contain chemicals that would cause adverse reactions with other payload containers during handling or disposal. The CH TRU mixed waste must be compatible with backfill, seal, and panel closure materials at the WIPP facility; container and packaging material, and other waste. Only wastes that have been shown to meet the approved Chemical Lists for the TRAMPAC (Appendix 1.3.7, Tables 4-1 through 4-6) are acceptable at WIPP.

3.5.3.2 Compliance and Verification

See Section 4.3.4.2.

3.5.4 Explosives, Corrosives, and Compressed Gases**3.5.4.1 Requirements**

The CH TRU waste payload shall contain no explosives (49 CFR 173.50), corrosives (49 CFR 173.136), compressed gases (49 CFR 173.115), or pressurized containers and no ignitable, corrosive, or reactive wastes (as defined by 40 CFR 261.21, 261.22, and 261.23, respectively). If corrosives, pressurized containers, or explosive materials are found to be present, they must be physically removed, neutralized, or treated to render them inert such that a violent reaction is not possible. Documented procedures, NDE, or VE shall be used to ensure that pressurized containers are not present within CH TRU waste containers. AK and the chemical compatibility evaluation may be used to demonstrate that corrosives, explosive items, compounds, or combinations of materials that could result in a violent reaction within payload containers are not present.

3.5.4.2 Compliance and Verification

See Section 4.3.2.2.

3.5.5 Headspace Gas VOC Concentrations**3.5.5.1 Requirements**

Averaged headspace gas concentrations in a WIPP disposal room are limited for the compounds listed in Table 3-5. The average measured concentration of VOCs in the headspace gas of all containers in any single room shall not exceed the limits specified in Table 3-5. All TRU waste containers must undergo headspace gas sampling and analysis in accordance with the WAP characterization requirements and methods to determine headspace VOC concentrations. Required QAOs for headspace gas analysis are established in the WAP. The VOC concentration levels, as reported to the WIPP via the WWIS, will be evaluated by the WIPP to ensure that VOC room concentrations do not exceed the limits depicted in Table 3-5.

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3.5.5.2 Compliance and Verification

Project personnel sample headspace gases and have them analyzed for target analytes listed in Table 3-5 in accordance with methods specified in the QAPjP. Analytical personnel determine VOC concentrations for target analytes in the headspace gas samples in accordance with one or more analytical procedures specified in the QAPjP and listed in Appendix A. Project personnel ensure that the required quality assurance objectives (QAOs) meet the requirements specified for headspace gas VOCs in the QAPjP. Project personnel ensure that headspace gas sampling is conducted in accordance with approved procedures. See also Section 4.4.4 for flammable VOC requirements. In accordance with WMH-400, Section 7.1.8, the WCO verifies compliance with the headspace gas sampling and analysis requirement and VOC limits. TRUPACT-II loading personnel accept and load containers that have undergone headspace gas sampling and analysis for VOC concentrations and meet acceptable concentration limits. Hydrogen sampling and analysis may also be required to meet aspiration criteria for unvented containers as described in Section 4.4.5.

**Table 3-5. Maximum Allowable Volatile Organic Compound
Room-Averaged Headspace Concentration Limits**

Compound	Limits (ppmv)
Carbon tetrachloride	9,625
Chlorobenzene*	13,000*
Chloroform	9,930
1,1-Dichloroethene*	5,490*
1,2-Dichloroethane*	2,400*
Methylene chloride	100,000
1,1,2,2-Tetrachloroethane	2,960
Toluene*	11,000*
1,1,1-Trichloroethane	33,700

Note: There are no maximum concentration limits for the other RCRA target VOCs required to be included in sampling programs.

* = These compounds are also subject to a 500 ppm limit on total flammable VOCs per payload container by the TRUPACT-II SARP.

Source: WIPP-WAC, Table 3.5.5

3.5.6 Polychlorinated Biphenyl Concentration**3.5.6.1 Requirements**

TRU waste with polychlorinated biphenyl (PCB) concentrations equal to or greater than 50 ppm (as determined by AK or sampling and analysis) is not allowed for disposal in the WIPP.

3.5.6.2 Compliance and Verification

Project personnel use AK and/or verification, testing, sampling, and analysis to demonstrate compliance with the PCB requirement. Waste generators use the VE technique during packaging of newly generated waste to verify that there is no indication that the waste

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materials may contain PCBs greater than 50 ppm. Project personnel sample and analyze solidified organic sludge (S3220) waste streams for PCBs. For retrievably stored homogeneous waste streams other than S3220, Project personnel use AK and randomly sample a statistically selected portion of each waste stream for VOCs, SVOCs, (including PCBs) and metals analyses. Field screening may be used to confirm AK for soils. Sampling and analysis is conducted in accordance with applicable procedures specified in the QAPjP. For retrievably stored debris waste, Project personnel compile, record, and evaluate AK in accordance with WMH-400, Section 7.1.9, to demonstrate compliance with the PCB requirement. The WCO verifies compliance with the PCB requirements in accordance with WMH-400, Section 7.1.8.

3.5.7 Asbestos**3.5.7.1 Requirements**

The NMED regards asbestos-contaminated TRU waste as a special waste for which the WIPP must be designated as a special waste disposal facility (under New Mexico Administrative Code, Chapter 20, Section 9.1.700). Currently, asbestos is prohibited from disposal at the WIPP.

3.5.7.2 Compliance and Verification

Project personnel review and evaluate AK information for retrievably stored waste and waste generators use AK and the VE technique during packaging of newly generated waste to determine if TRU waste contains asbestos-containing materials. Waste generators and/or Project personnel identify payload containers with asbestos-contaminated waste and repackage them or segregate the payload containers and store them until such time that asbestos-containing TRU waste is acceptable for disposal at WIPP. The WCO verifies compliance with the asbestos-containing material restriction in accordance with WMH-400, Section 7.1.8.

3.6 GAS GENERATION PROPERTIES CRITERIA AND REQUIREMENTS

For any package that could radiolytically generate combustible gases, a determination must be made by tests and measurements or by analysis of a representative package such that the following criterion is met over a period of time that is twice the expected shipment time (60 days total): the hydrogen generated must be limited to a molar quantity that would be no more than 5 percent by volume of the innermost layer of confinement (or equivalent limits for other flammable gases) if present at standard temperature and pressure (i.e., no more than 0.063 gram-moles/cubic ft. at 14.7 pounds per square inch absolute [psia] and 70 degrees F).

The gases generated in the payload and released into the packaging inner containment vessel cavity shall be controlled to maintain the pressure within the TRUPACT-II inner containment vessel cavity below the acceptable design pressure of 50 pounds per square inch gauge.

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3.6.1 Payload Shipping Category**3.6.1.1 Requirements**

Each payload container shall have an assigned shipping category that is included in an approved content code in the TRUCON document. Two payload shipping category notations are available. Shipping sites may use either the alpha-numeric or numeric notation.

All CH TRU waste payload containers shipped in a single TRUPACT-II shall be assembled with containers belonging to the same shipping category or payload containers in the same waste type but different bounding G values and resistance, provided the decay heat limit for all payload containers within the payload is conservatively assumed to be the same as that of the payload container with the lowest decay heat limit. This is consistent with the TRAMPAC (Rev. 17).

3.6.1.2 Compliance and Verification

See Section 4.4.1.2.

3.6.2 Decay Heat**3.6.2.1 Requirements**

Because of gas generation concerns, there is a wattage limit for individual payload containers and a wattage limit for the TRUPACT-II payload assembly. The decay heat within each payload container plus the measurement error shall be less than or equal to the decay heat limit specified in the TRAMPAC, Table 5-6, for each authorized shipping category. The total decay heat from all containers in a TRUPACT-II shall be less than 40W. If individual payload containers exceed the limit, these containers must be tested in accordance with Attachment 2.0 of the TRAMPAC, "Gas Generation Test Plan to Qualify Test Category Waste for Shipment in the TRUPACT-II."

Calculations shall be performed as specified in Section 3.1 of the TRAMPAC. Documented evidence shall exist to show that individual CH TRU waste payload containers and the total payload assembly to be transported meet the decay heat limits specified in the TRUCON for the appropriate shipping category.

3.6.2.2 Compliance and Verification

See Section 4.4.2.2.

3.6.3 Test Category Waste**3.6.3.1 Requirements**

A payload container can be qualified for shipment only if it can be demonstrated (either by analysis or testing) that the molar quantity of hydrogen is maintained at or below the 5 percent limit in all confinement layers and the limits for flammable organics in the headspace

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are met. A payload container may be placed in the test category when the decay heat loading of the waste in the container exceeds the limit set for the shipping category (specified in the TRAMPAC, Table 5-6) or when a content code does not have a characterized bounding G value. Data from the testing shall be recorded on the PCTCD for test category waste and reported to WIPP using the WWIS.

For a payload container in the test category to be qualified for shipment, its steady-state hydrogen gas generation release rate must be equivalent to the rate for the analytical categories and shall not exceed the limit specified in the TRAMPAC, Tables 5-6 and 5-7. Testing data shall be documented in the PCTCD for test category waste.

3.6.3.2 Compliance and Verification

See Section 4.4.3.2.

3.6.4 Flammable Volatile Organic Compounds**3.6.4.1 Requirements**

The total concentration of potentially flammable volatile organic compounds (VOCs) is limited to 500 ppm in the headspace of a CH TRU waste payload container, as specified in Section 5.4 of the TRAMPAC. Table 3-6 provides the list of flammable VOCs.

For content codes that identify potentially flammable VOCs as part of the waste, approved waste generation procedures shall be used to ensure that the total concentration is no greater than 500 ppm in the headspace of each payload container. If an upper limit cannot be established for the amount of potentially flammable VOCs in a content code or if the limit of 500 ppm is exceeded, a gas sampling program shall be implemented. For content codes that do not contain any of the flammable VOCs in the chemical lists, no additional controls to meet this requirement need to be implemented (i.e., sampling and analysis to demonstrate compliance does not need to be conducted).

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Table 3-6. Flammable Volatile Organic Compounds

Flammable VOCs
Acetone
Benzene
Butanol
Chlorobenzene
Cyclohexane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
cis-1,2-Dichloroethylene
Ethyl benzene
Ethyl ether
Methanol
Methyl ethyl ketone
Methyl isobutyl ketone
Toluene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Xylenes

Source: TRAMPAC, Table 5-8

3.6.4.2 Compliance and Verification

See Section 4.4.4.2.

3.6.5 Venting and Aspiration**3.6.5.1 Requirements**

TRU waste drums and containers that have been stored in an unvented condition (e.g., no filter installed and/or rigid liners not punctured) shall be aspirated for a specific length of time in accordance with the TRAMPAC, Section 5.5, to ensure equilibration of any gases that may have accumulated in closed containers. Required aspiration times are listed in the TRAMPAC Tables 5-9 through 5-17. Options for determining aspiration time include determination based on the date of drum closure and headspace gas sampling at the time of venting or during aspiration.

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3.6.5.2 Compliance and Verification

See Section 4.4.5.2.

3.7 DATA PACKAGES CRITERIA AND REQUIREMENTS**3.7.1 Characterization and Certification Data****3.7.1.1 Requirements**

Only those waste containers that pass all Phase II waste screening determinations will be emplaced at WIPP. Waste characterization and waste certification data records shall be maintained at the generator site. WWIS data shall be entered and transmitted to WIPP in accordance with the WWIS User's Manual.

3.7.1.2 Compliance and Verification

Project personnel verify compliance with the data package requirements by reviewing data packages in accordance with WMH-400, Section 7.1.6, "Transuranic Waste Project level Data Validation and Verification." The TCO and WCO ensure that the WWIS data are entered into the system and transmitted to the CAO for approval before waste shipment in accordance with WMH-400, Section 7.1.5, "WIPP Waste Information System Data Entry and Reporting."

3.7.2 Shipping Data**3.7.2.1 Requirements**

The TCO shall complete PCTCDs and authorize the TRUPACT-II package for shipment by completing and signing the PATCD. Sites shall also prepare a bill of lading for CH TRU waste shipments in accordance with 49 CFR 172, Subpart C, or UHWM in accordance with 40 CFR 262.23 and a Land Disposal Restriction (LDR) notification in accordance with the State of New Mexico Hazardous Waste Management regulations. The LDR notification for CH TRU waste shipments shall state that the waste is not prohibited from land disposal. For each waste container, the radionuclide composition comprising at least 95 percent of the activity shall be reported to WIPP. Shipping papers shall be maintained by the shipper for a minimum period of 3 years.

3.7.2.2 Compliance and Verification

The WCO confirms that the auditable data package is complete in accordance with WMH-400, Section 7.1.8. (If the WCO prepares the data package, another qualified individual reviews it.) If deficiencies are identified, the WCO and SPM resolve any deficiencies, and the data package is reviewed again. The TCO completes the data package, adding the shipment, payload, and dose rate information.

The TCO prepares a TRUPACT-II PCTCD in accordance with the TRAMPAC for each payload container prior to loading the container into a TRUPACT-II. The TCO completes the PCTCD (Section 4.7) to certify an individual payload container and a PATCD to certify the

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payload assembly for shipping in accordance with WRP1-OP-0521, "Receive and Load TRUPACT Containers," which is based on Section 6.0 of the TRAMPAC. Transportation logistics personnel prepare a bill of lading or UHWM at the direction of the TCO. For nonmixed waste shipments, a bill of lading is prepared in accordance with the requirements of 49 CFR 172, Subpart C. A UHWM is prepared for mixed waste shipments in accordance with 40 CFR 262.23. For TRU mixed waste shipments, a UHWM may be used in place of a bill of lading, as specified in 40 CFR 262.23. Shipping data are prepared in accordance with WMH-400, Section 7.1.8.

The SPM reviews the manifest and LDR notification for accuracy and completeness. If the SPM identifies a deficiency in the manifest or notification, the SPM returns the paperwork to the WCO and TCO for resolution. If the manifest and LDR notification are accurate and complete, the TCO signs them and removes the generator copy of the manifest. The Project records custodian maintains the generator copy of the UHWM on file along with a copy of the LDR notification in accordance with WMH-400, Section 1.5.1.

Transportation packaging personnel perform final inspection and approval of the payload assembly and shipping documents. Transportation procedures are included in WMH-400, Section 2.1.5, "TRU Transportation Logistics."

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4.0 HANFORD COMPLIANCE PLAN FOR TRAMPAC

This section describes CH TRU waste management practices and procedures used at the Hanford Site to demonstrate compliance with the TRAMPAC. The Hanford Site must demonstrate compliance with TRAMPAC transportation requirements before TRU wastes can be shipped from the Hanford Site in the TRUPACT-II, a Type B package certified for transporting CH TRU wastes.

This section is organized to correlate with the organization of the TRAMPAC (Rev. 17), which defines payload requirements under the following categories:

- Container and physical properties
- Nuclear properties
- Chemical properties
- Gas generation
- Payload assembly
- Quality Assurance.

Each TRAMPAC requirement is summarized followed by descriptions of the Hanford Site methods of compliance and verification. Each generator or storage site shall select and implement a single method, or a combination of methods, to ensure the payload is compliant with each requirement and is qualified for shipment. Because many of the TRAMPAC requirements overlap WIPP-WAC requirements, this section will refer to applicable sections and tables in Section 3.0, where appropriate. QA is addressed in Section 5.0 of this Certification Plan. Appendix A lists the WIPP-WAC and TRAMPAC requirements and identifies applicable Hanford Site documents and procedures that implement each requirement. Appendix A is organized to correlate with section numbering for WIPP-WAC requirements; therefore, the equivalent compliance and verification subsections of Section 4.0 are cross-referenced in column two of Appendix A to the applicable WIPP-WAC requirement(s) listed in column one of Appendix A. Radiography requirements are addressed in the QAPjP. Radioassay requirements are included in Appendix E of this Certification Plan.

Only wastes from a properly characterized and approved waste stream can be certified as meeting the requirements and associated criteria in this Certification Plan. Any payload containers with unresolved discrepancies associated with hazardous waste characterization will not be managed or disposed at WIPP until the discrepancies are in accordance with requirements established in the WAP. Corrective action reports applicable to WAP requirements shall be resolved prior to waste shipment. Throughout this section and the discussion of compliance and verification methods, it can be assumed, unless otherwise noted, that if a requirement is not met, Project personnel segregate the noncompliant item and initiate an NCR or CAR in accordance with WMH-400, Section 1.3.2, "TRU Nonconforming Item Reporting and Control," or WMH-400, Section 1.3.3, "TRU Corrective Action Reporting and Control." Corrective action will be taken in accordance with WMH-400, Section 1.3.1, "TRU Corrective Action Management," to resolve nonconformances. (See Section 5.3 for more information about the NCR/CAR process.)

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4.1 CONTAINER AND PHYSICAL PROPERTIES REQUIREMENTS**4.1.1 Container Descriptions****4.1.1.1 Requirements**

Only the following payload containers, which must comply with the specifications in Appendix 1.3.3 of the TRUPACT-II SARP, are authorized for shipment in the TRUPACT-II:

- 55-gal. drum (including pipe overpack)
- Standard Waste Box (SWB)
- Ten-Drum Overpack (TDOP).

The maximum number of containers per TRUPACT-II and authorized packaging configurations are shown in Section 3.2.1.1, Table 3-1.

4.1.1.2 Compliance and Verification

The Hanford Site procures payload containers (e.g., 55-gal. drums, SWBs, and TDOPs) that meet the following requirements:

- SWBs and TDOPs are procured to the same standards and specifications as the containers used in Type A testing.
- New 55-gal. drums are procured as UN1A2 reusable drums, in accordance with applicable requirements of 49 CFR 173, which is allowable per CAO memo CAO:NTP:JFS97-1144UFC5822. Drums may also be procured to the same standards and specifications as the drums used in Type A testing.

Recovered drums are inspected to ensure that they are DOT Specification 17C or 17H or meet UN1A2 requirements for reusable drums. Permanent markings embossed on the bottom of the drums are used to verify the drum type if procurement records are not available. Alternatively, if the markings are not visible (e.g., drums that are galvanized through a dipping process, which obscures the embossing), the drums are inspected and inspection results compared to requirements for 17C, 17H, or UN1A2 drums. Project personnel examine retrievably stored containers for compliance with the applicable requirements and verify that the containers are in good condition in accordance WMH-400, Section 7.1.8. Project personnel document their procurement acceptance and/or visual inspections. If packages cannot be shown to meet the above requirements by procurement records and/or physical examination, Project personnel take corrective action (e.g., accept as is or repackage the waste into a certifiable container) to resolve the nonconformance. The TCO verifies that the packaging meets applicable requirements and that the TRUPACT-II is assembled in an authorized packaging configuration, in accordance with WRP1-OP-0521, "Receive and Load TRUPACT Containers" and WMH-400, Section 7.1.8.

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Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.2.1, which contains the titles of applicable procedures that implement the requirements of this section.

4.1.2 Dunnage**4.1.2.1 Requirements**

A shipper shall use empty drums or SWBs as dunnage to complete a 14-drum or 2-SWB payload configuration if too few payload containers are available that meet transportation requirements. Dunnage containers shall meet the specifications of Appendix 1.3.3 of the TRUPACT-II SARP except that dunnage containers shall have open vent ports (e.g., not filtered or plugged). Dunnage containers shall be marked in accordance with 4.1.4 of this section.

4.1.2.2 Compliance and Verification

Loading personnel can use empty 55-gal. drums or SWBs as dunnage. Dunnage drums may be assembled into a seven-pack of only dunnage drums or may be assembled into a seven-pack with drums of waste that meet all applicable requirements. Refer to Section 4.1.4 for requirements for labeling dunnage containers. Loading personnel ensure that dunnage containers have open vent ports (e.g., vent ports shall not be plugged or filtered). Shoring, including empty drums, is provided as necessary inside a TDOP. The TCO ensures that dunnage drums meet all applicable requirements (e.g., through visual inspection and documentation prior to shipment) following the procedures WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.2.5, which contains the titles of applicable procedures that implement the requirements of this section.

4.1.3 Contain/Assembly Weight and Center of Gravity**4.1.3.1 Requirements**

The TRUPACT-II SARP restricts the weight of individual payload containers, the payload assembly, loaded TRUPACT-IIs, and the center of gravity of each payload assembly. The weight limits are as follows:

- 1,000 lbs per 55-gal. drum (these drums must also meet restrictions in DOT Specification 7A).
- 1,450 lbs per 55-gal. drum overpacked in an SWB.
- 4,000 lbs per SWB.
- 6,700 lbs per TDOP.
- 328 lbs per pipe overpack with 6-in. pipe component.

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- 547 lbs per pipe overpack with 12-in. pipe component.
- 7,265 lbs per payload assembly of 14 55-gal. drums (including pallet, guide tubes, slip sheets [optional], reinforcing plates, and banding material).
- 7,265 lbs per payload assembly of two SWBs, including adjustable sling (optional).
- 19,250 lbs per loaded TRUPACT-II.

NOTE - Actual payload assembly weights are limited by "as-built" TRUPACT-II weights and DOT requirements for a loaded tractor/trailer.

The center of gravity requirements are as follows:

- The total weight of the top seven drums or SWB must be less than or equal to the total weight of the bottom seven drums or SWB.
- The total weight of the top five drums in a TDOP must be less than or equal to the total weight of the bottom five drums.

Each payload container (or dunnage) shall be weighed on a calibrated scale. Scale calibrations shall be in accordance with the National Institute for Standards and Testing (NIST) Handbook 44 or an equivalent standard. The weight of each payload container and measurement error must be recorded on the PCTCD. The weight and error of the total TRUPACT-II payload is calculated and reported in the PATCD.

4.1.3.2 Compliance and Verification

Loading personnel weigh individual payload containers in accordance with WRP1-OP-0503, "Move Waste Drums Throughout the WRAP Facility," to ensure that payload containers do not exceed maximum allowable weights determined from Type A testing and evaluation, those shown above, or Table 3-2, whichever is less. Loading personnel calibrate and maintain the scale in accordance with NIST Handbook 44, calculate the error, and record the calibration results. If the waste container meets applicable weight limits, loading personnel record the weight of the container for each payload container. The TCO enters this weight information on the Payload Container Transportation Certification Document (PCTCD) (described in Section 4.6 and Appendix C). The TCO reviews loading data and the PCTCD to verify compliance with the individual payload container weight requirement and signs the PCTCD. If the measured weight of the payload container (including the error) exceeds applicable weight limits, the containers are repackaged and reweighed.

The TRUPACT-II payload weight limit of 7,265 lbs includes a payload of 14 drums and the payload pallet, optional slip sheets, reinforcing plates, guide tubes, and banding material; or a payload of two SWBs and optional nylon strap assemblies; or one TDOP. The total payload weight is obtained either from the weights and associated errors of the individual components or by weighing the complete assembly. If total payload weight is obtained by summing the weights of individual payload containers or dunnage (plus the weight of pallets, reinforcing plates, slip sheets, guide tubes, and banding material) the measurement includes the square root of the sum

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of the squares of the individual measurement errors. If total payload is weighed as an assembly, the measurement includes the error. The TCO plans the load using the Payload Assembly Transportation Certification Document (PATCD) (see Section 4.6 and Appendix D.). The load is planned to ensure compliance with the center-of-gravity requirements by placing the heavier seven-pack of drums or the heavier SWB at the bottom of the TRUPACT-II. The TCO also takes the actual as-built weight of the TRUPACT-II and the weight of the payload pallet, optional slip sheets, reinforcing plates, guide tubes, and banding material into account as necessary during load planning. The loading personnel load the TRUPACT-II in accordance with the requirements of the PATCD and the *TRUPACT-II Operating and Maintenance Instructions* (DOE 1997b).

The TCO reviews the data and information, approves the weight of the total payload, verifies compliance with the TRUPACT-II payload weight and center-of-gravity requirements, and signs the PATCD (described in Section 4.6). The TCO also verifies that TRUPACT-II trailer loads meet all DOT weight restrictions. The WCO verifies container and assembly weights in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.2.2, which contains the titles of applicable procedures that implement the requirements of this section.

4.1.4 Container Marking

4.1.4.1 Requirements

Each payload container and dunnage shall be labeled with the following information:

- Unique container identification number (CIN)
- Shipping category (not applicable for dunnage).

The CIN and the shipping category may be on the same label(s). If an empty 55-gal. drum or SWB is used as dunnage to complete a 14-drum or 2-SWB payload configuration, the dunnage container shall be labeled with the following information:

- Unique CIN
- "EMPTY" or "DUNNAGE."

If a seven-pack of only dunnage drums or a dunnage SWB is used in the TRUPACT-II, the container(s) shall be labeled "EMPTY" or "DUNNAGE." The unique CIN and shipping category labels are not required for a seven-pack of dunnage drums or a dunnage SWB.

4.1.4.2 Compliance and Verification

In accordance with WRP1-OP-0521, loading facility personnel load the TRUPACT-II in one of the configurations identified in Table 3-1. If dunnage containers are used to complete a seven-pack assembly, loading personnel mark each dunnage container with a unique identification number, label the containers "EMPTY" or "DUNNAGE," and document this action. Dunnage drums in a seven-pack assembly are reported by CIN and reported in the

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WWIS. If a seven-pack of empty drums is shipped as dunnage, each dunnage container is labeled "EMPTY" or "DUNNAGE," but the containers are not marked with an identification number and not reported in the WWIS. The TCO performs a visual inspection to verify whether dunnage containers are used, whether the containers are marked and labeled as required, and documents the information on the PCTCD and PATCD (see WMH-400, Section 7.1.8). The WCO confirms the use and marking of dunnage containers in accordance with WMH-400, Section 7.1.8

4.1.5 Filter Vents**4.1.5.1 Requirements**

Each payload container (except dunnage containers) to be transported in the TRUPACT-II must have one or more filter vents as specified below. Appendix 1.3.5 of the TRUPACT-II SARP specifies the flow and hydrogen diffusion requirements for these filters.

- 1 per 55-gal. drum
- 1 per 85-gal. drum
- 1 per pipe component overpacked in a drum
- 1 per filtered metal can (not applicable to waste type II.2)
- 2 per SWB
- 2 per bin overpacked in a SWB
- 9 per TDOP
- 1 per filtered bag.

4.1.5.2 Compliance and Verification

The Hanford Site procures Nuclear Filter Technology (NFT)-012, NFT-013, and NFT-020 (or equivalent) carbon composite filters for use on TRU waste containers. Filters meet the specifications described in Appendix 1.3.5 of the TRUPACT-II SARP and are procured in accordance with the Hanford Site's procurement process identified in Section 5.7.

Project personnel visually verify that filter vents, if present, have been installed properly as shown in DO-080-009, "Obtain Headspace Gas Samples of TRU Waste Container." If filter vents are not installed, Project personnel procure filter vents that meet specifications and install the correct number of filter vents. The TCO verifies and records this information on the PCTCD, and the WCO confirms payload venting in accordance with WMH-400, Section 7.1.8. When a payload container does not meet the payload container filter requirements, an NCR is initiated. Nonconforming filters are replaced as necessary.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.2.6, which contains the titles of applicable procedures that implement the requirements of this section.

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4.1.6 Liquids**4.1.6.1 Requirements**

Liquid waste is prohibited in the payload containers, except for residual amounts in well-drained containers. The total volume of residual liquid in a payload container shall be less than 1 percent (volume) of the payload container.

4.1.6.2 Compliance and Verification

Generators ensure that TRU waste is not in free-liquid form, that minor residual liquids remaining in well-drained internal containers (e.g., bottles, cans), do not exceed 1-in. (2.5 cm) in the bottom of any container, and that the total liquid in the waste package does not exceed 1 volume percent.

Initially, AK is used to determine container contents. AK is confirmed through radiography and/or VE for retrievably stored waste. AK is verified through the VE technique at the time of packaging for newly generated waste. Waste generators ensure that the contents of newly generated waste containers comply with the free liquids restriction. For retrievably stored waste, Project personnel estimate liquid volume by radiography and/or VE, in accordance WMH-400, Section 7.1.3, and WRP1-OP-0908, "Operation of the Drum Nondestructive Examination System," and applicable procedures listed in Appendix A, and record the location of any liquid detected in a CH TRU waste container. NDE and/or VE personnel reject payload containers found to have greater than 1 volume percent liquid or greater than 1-in. of liquid in the bottom of an internal container and segregate them. If necessary, repackaging personnel repackage noncompliant waste containers in accordance with WMH-400, Section 7.1.3. The TCO verifies compliance on the PCTCD.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.4.1, which contains the titles of applicable procedures that implement the requirements of this section.

4.1.7 Sharp or Heavy Objects**4.1.7.1 Requirements**

Sharp or heavy objects in the waste shall be blocked, braced, or suitably packaged as necessary to provide puncture protection for the payload containers packaging these objects.

4.1.7.2 Compliance and Verification

For retrievably stored waste, AK initially is used to determine container contents. AK is confirmed by radiography and/or VE of the payload container contents prior to certification. For newly generated waste, the VE technique is used during packaging to verify compliance. As appropriate, noncompliant items are removed or repackaging of sharp or heavy objects is conducted in a manner to preclude puncturing the payload container.

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Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.4.1, which contains the titles of applicable procedures that implement the requirements of this section.

4.1.8 Sealed Containers**4.1.8.1 Requirements**

Sealed containers greater than 4 L are prohibited, except for Waste Material Type II.2 packaged in a metal container or those containers fitted with an appropriate filter vent (see Section 3.2.). Friction-fit or slip-top containers are not considered to be sealed unless the lid is completely taped around its edge to the container body. A rigid 55-gal. drum liner, if present, shall be punctured by a ≥ 0.3 -in. diameter hole or fitted with a filter. Twist-and-tape closure, fold-and-tape closure, and heat-seal closure (with a minimum of one filter vent) are allowable methods for closing plastic bags used for waste confinement.

4.1.8.2 Compliance and Verification

For newly generated waste, the waste generators use the VE technique during packaging to ensure prohibited physical waste forms are not present in waste containers. Waste generators process items such as pressurized or sealed containers to eliminate any condition that may result in rejection of the payload container. The generator verifies that the waste placed in the container meets the physical form requirements. For retrievably stored waste, Project personnel ensure compliance with the physical form requirements through AK verified by radiography and/or VE of the payload container contents. A payload container rejected for noncompliance with the physical form requirements is marked and segregated, or the noncompliant item is removed and the container is repackaged and reprocessed to verify remaining certification requirements. The TCO verifies compliance on the PCTCD and the WCO confirms the sealed container criteria in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.4.1 and 3.5.4, which contain the titles of applicable procedures that implement the requirements of this section.

4.2 NUCLEAR PROPERTIES REQUIREMENTS**4.2.1 Nuclear Criticality****4.2.1.1 Requirements**

A payload container shall be acceptable for transport only if the ^{239}Pu fissile gram equivalent (FGE) plus two times the measurement error is less than 200 grams for a drum or pipe overpack, or 325 grams for an SWB or TDOP.

A TRUPACT-II shall be acceptable for transport only if the ^{239}Pu FGE plus two times the measurement error (2 sigma) is less than 325 grams for a payload of fourteen 55-gal. drums, two SWBs, or one TDOP; or 2,800 grams for a payload of 14-pipe overpacks.

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There are two allowable methods for determining isotopic composition. Mass spectrometry (MS) is a primary method for determining radioisotopic composition of plutonium product material. Gamma ray pulse height analysis is the other method used to determine isotopic composition for gamma-emitting radionuclides. When MS is used to determine isotopic composition, the analyses must be performed in accordance with American Society for Testing and Materials (ASTM) methods [e.g., ASTM C 696-80, ASTM C 697-86, ASTM C 759-79, and ASTM C 853-82 (References 8.5, 8.6, 8.7, and 8.8)], or equivalent. Sites that produce or utilize special (non plutonium) TRU radionuclides have more variability in the isotopic composition of individual payload containers.

Pu-239 FGE for other fissile or fissionable isotopes, including special actinide elements, shall be obtained using the American National Standards Institute (ANSI)/American Nuclear Society (ANS) method ANSI/ANS-8.15-1981 (Reference 8.4), or an equivalent method. Table 3-1 (at the end of Section 3.1) lists the ^{239}Pu FGE, as well as the decay heat and specific activity of many radionuclides.

The quantity of the radionuclides in each payload container shall be estimated by either a direct measurement or records of the individual payload container, summation of assay results from individual packages in a payload container, or by direct measurement on a representative sample of a waste stream. The measured quantity of radiation is used to calculate the quantity of other radionuclides and the total quantity of ^{239}Pu FGE.

The isotopic inventory for each payload container shall include the identity, total quantity, and measurement error for all radionuclides in the waste container. In addition, the total fissile loading in ^{239}Pu FGE and its measurement error must be determined for each payload container. The ^{239}Pu FGE for each payload container is summed to compute the total measured ^{239}Pu FGE for the proposed TRUPACT-II payload. The total ^{239}Pu FGE error is the square root of the sum of the squares of the individual ^{239}Pu FGE errors. The total shipment ^{239}Pu FGE (measured value plus two times the total error) is compared to the TRUPACT-II limit for ^{239}Pu FGE.

4.2.1.2 Compliance and Verification

Project personnel compile and review AK to make initial determinations about radionuclide content and concentrations. NDA personnel at WRAP confirm AK by obtaining information on the isotopic composition of the waste through radioassay of the filled payload container following WRP1-OP-0906, "Transuranic Waste Certification - Gamma Energy Assay Operations," and, if necessary, WRP1-OP-0905, "Transuranic Waste Certification - Imaging Passive/Active Neutron Assay Operation." NDA personnel at PFP confirm AK by obtaining information on the isotopic composition of the waste through radioassay of the storage cans that are packaged into the payload container following ZA-948-385. The NDA requirements are specified in Appendix E of this Certification Plan.

NDA personnel compute the container ^{239}Pu FGE and container ^{239}Pu FGE error manually or using a computational algorithm. Software is designed and maintained in accordance with WMH-400, Section 6.1.1, "TRU Software Quality Assurance." Individual radionuclide mass quantities and errors are converted to ^{239}Pu FGE by multiplying the mass values (g) by ^{239}Pu FGE conversion factors (FGE/g) listed in the TRAMPAC. The container

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^{239}Pu FGE is determined by summing the ^{239}Pu FGE for each radionuclide in the container. The container ^{239}Pu FGE error is determined by taking the square root of the sum of the squares of the individual ^{239}Pu FGE errors.

The TCO verifies the container FGE data and records them on the PCTCD in accordance with WMH-400, Section 7.1.8. The TCO sums the container ^{239}Pu FGE and two times the container ^{239}Pu FGE error and compares the result to the limits of 200 FGE per drum and 325 FGE per SWB. If the container does not meet the criterion, Project personnel at WRAP repackage it in accordance with WRP1-OP-0725, "TRU Waste Certification - TRU Sorting Glovebox Operation." Project personnel at PFP would repackage the container in accordance with ZO-160-080, "Pipe-and-Go Operations."

To assess compliance with the payload ^{239}Pu FGE requirements, the TCO computes the payload ^{239}Pu FGE and the payload ^{239}Pu FGE error. The payload ^{239}Pu FGE is computed as the sum of the container ^{239}Pu FGE values for all containers in the proposed payload. The payload ^{239}Pu FGE error is computed by taking the square root of the sum of the squares of two times the container ^{239}Pu FGE error values for all containers in the payload. Finally, the payload ^{239}Pu FGE and the payload ^{239}Pu FGE error are summed and compared to the limit of 325 ^{239}Pu FGE. If the payload does not meet the criterion, a different combination of payload containers is identified that meets the TRUPACT-II ^{239}Pu FGE limit. Once a compliant payload is identified, the TCO records the sum of the payload ^{239}Pu FGE and payload ^{239}Pu FGE error on the PATCD and the WCO confirms nuclear criticality criteria in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.3.1 and 3.3.2, which contain the titles of applicable procedures that implement the requirements of this section.

4.2.2 Radiation Dose Rates

4.2.2.1 Requirements

The external radiation dose rates of individual payload containers and the three loaded TRUPACT-II payloads to be shipped on a trailer must be less than or equal to 200 mrem/hr at the surface and 10 mrem/hr at a 2-m distance, as specified in the TRAMPAC. The radiation dose rates for the TRUPACT-II must also comply with 10 CFR 71.47.

NOTE - Any payload container that exceeds the 200 mrem/hr surface reading or 10 mrem/hr at 2 meters without shielding shall not be transported.

Occasionally, drums of CH TRU waste that meet the surface dose radiation limits require shielding to meet DOE site requirements. The radiation levels at the surface and at a 2-m distance from the unshielded payload container are measured to ensure compliance with the 200 mrem/hr and 10 mrem/hr limits, respectively. If the measured radiation levels are below the specified levels but do not meet site ALARA criteria, shielding may be added to the drum. Drums that exceed the 200 mrem/hr surface reading or 10 mrem/hr at 2-m without shielding may not be transported in a TRUPACT-II.

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4.2.2.2 Compliance and Verification

A Hanford Site RCT measures surface dose rates of the individual payload containers in accordance with WRP1-OP-1225 using the beta-gamma and neutron dose rates for each container at the surface and at 2 m, and records the results for each payload container. If the combined beta-gamma and neutron dose rate exceeds 200 mrem/hr at the surface or 10 mrem/hr at 2-m for any container, the container is rejected, marked, and segregated. Corrective action is taken to resolve the noncompliant condition. The payload container and the TRUPACT-II surface dose rate and the dose rate at 2-m shall be measured with instruments traceable to a national standard. The dose rates shall be recorded prior to each shipment.

The RCT also surveys the loaded TRUPACT-II surface before shipping and records the highest combined gamma and neutron reading on the PATCD. If this reading exceeds 200 mrem/hr combined gamma and neutron, the TRUPACT-II is rejected from shipment. Additionally, the reading from a TRUPACT-II at a 2-m distance from any side of the TRUPACT-II (excluding the top and bottom) is recorded on the PATCD. If this reading exceeds 10 mrem/hr, the TCO rejects the TRUPACT-II from shipment. If the TRUPACT-II is rejected from shipment, corrective action is taken to resolve the noncompliant condition.

After the payload assemblies are loaded into the TRUPACT-II, the RCT surveys the vehicle's driver and passenger space to ensure the dose rate does not exceed 2 mrem/hr. The TCO reviews the radiation dose rates and records the results of the RCT survey of the TRUPACT-II and transport vehicle on the PATCD for the payload assembly. Project personnel submit radiation dose rate measurement reports to the Project records custodian. The TCO verifies compliance with the radiation dose rate requirements by signing the PATCD, and the WCO confirms the contact dose rate in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.3.5, which contains the titles of applicable procedures that implement the requirements of this section.

4.3 CHEMICAL PROPERTIES REQUIREMENTS**4.3.1 Pyrophorics****4.3.1.1 Requirements**

A pyrophoric is defined as "a flammable solid which, under transport conditions, might cause fires through friction or retained heat, or, which can be ignited readily, and when ignited, burns vigorously and persistently so as to create a serious transportation hazard." This includes spontaneously combustible materials, water reactive materials, and oxidizers. Examples of pyrophoric radionuclides are metallic plutonium and americium. Examples of nonradioactive pyrophorics are organic peroxides, sodium metal, and chlorates.

Pyrophoric radioactive materials may be present only in a small residual amount (e.g., less than 1 weight percent) in payload containers. Radioactive pyrophorics in concentrations greater than 1 percent by weight and all nonradioactive pyrophorics shall be

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reacted (or oxidized) and/or otherwise rendered nonreactive prior to placement in the payload container.

4.3.1.2 Compliance and Verification

Nonradionuclide pyrophoric materials at the Hanford Site are subject to procurement controls and safety assessments. In general, the Hanford Site does not permit pyrophoric materials in TRU waste process areas. If a process requires the use of pyrophoric materials, the quantity of pyrophoric materials that enters the process is limited and controlled, and the waste must be treated to render it chemically safe prior to placement in a waste container.

For newly generated waste, waste generators use AK and the VE technique during packaging to ensure prohibited items are not present in waste containers. Waste generators process items to eliminate any condition that may result in rejection of the payload container. VE personnel verify that the waste placed in the container meets the pyrophoric restriction. For retrievably stored waste, Project personnel verify compliance with the pyrophorics restriction by obtaining information (e.g., administrative, operating, and QA procedures and safety assessments) documenting that waste does not contain pyrophorics or other prohibited materials. Project personnel review and evaluate AK to verify that waste-producing processes included no pyrophorics or other prohibited materials. AK includes sampling and analysis data, documentation of waste stream descriptions, or actions to treat or stabilize the waste to eliminate specific characteristics. Project personnel verify AK through radiography and VE of randomly selected waste containers. The TCO documents compliance on the PCTCD, and the WCO confirms the pyrophorics criteria in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.5.1, which contains the titles of applicable procedures that implement the requirements of this section.

4.3.2 Explosives, Corrosives, and Compressed Gases

4.3.2.1 Requirements

An explosive is defined as "any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion (e.g., with substantial instantaneous release of gas and heat)." Examples of explosives are ammunition, dynamite, black powder, detonators, nitroglycerin, urea nitrate, and picric acid.

A corrosive is defined as an aqueous material that has a pH less than 2 or more than 12.5.

Explosives, corrosives, and pressurized containers are prohibited from the payload.

4.3.2.2 Compliance and Verification

The Hanford Site prohibits explosives, compressed gases, and corrosive liquids in payload containers. Chemicals (e.g., oxidizers) capable of forming explosive mixtures under some conditions are also prohibited from the waste. The Hanford Site administratively controls and monitors the procurement, distribution, use, and disposal of explosive materials through site-

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specific operating and QA procedures. Additionally, waste-generating processes must be assessed for safety hazards such as potential explosion hazards and potential inadvertent production of explosive materials. Corrosives must be either excluded from the payload container or processed to neutralize the corrosive material or otherwise render it noncorrosive. Process-specific operating procedures describe the specific actions taken to ensure compliance with the corrosive material prohibition.

For newly generated waste, waste generators use AK and the VE technique during packaging to ensure that there is no indication of the presence of waste materials that may contain explosives, compressed gases, and corrosives in waste containers. Waste generators process items to eliminate any condition that may result in rejection of the payload container. For retrievably stored waste, Project personnel verify compliance with the prohibited items requirement by obtaining information (e.g., administrative, operating, and QA procedures and safety assessments) documenting that waste does not contain explosives, corrosives, or pressurized containers. Project personnel review and evaluate AK to verify that waste-producing processes included no prohibited or restricted materials. AK includes sampling and analysis data, documentation of waste stream descriptions, or actions to treat or stabilize the waste to eliminate specific characteristics. Project personnel verify that prohibited materials are not in the waste container through radiography. Radiography is verified through VE of randomly selected waste containers. The TCO documents compliance on the PCTCD and the WCO verifies this information in accordance with WMH-400, Section 7.1.8.

See also Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.5.4, which contains the titles of applicable procedures that implement the requirements of this section.

4.3.3 Chemical Composition

4.3.3.1 Requirements

The chemical constituents allowed within a given waste material type are restricted so that a conservative bounding G-value can be established for the gas-generation potential in each waste material type. (Presently, an effective G-value cannot be assigned to Waste Type IV, and this waste type has been assigned to the test category. Waste Type IV can be qualified for shipment only by gas generation testing of each individual payload container. The test procedures and controls for test category waste are discussed in the TRAMPAC and Section 4.5 of this Certification Plan).

Chemical constituents in a payload shall conform to the allowable chemical lists in Tables 4-1 through 4-6 of the TRAMPAC. The total quantity of the trace chemicals/materials (e.g., materials that occur in the waste in quantities less than 1 percent [by weight]) in any payload container is restricted to less than 5 percent (weight) for Waste Types I, II, and III.

4.3.3.2 Compliance and Verification

Waste generators and/or Project personnel initially review AK information to identify chemical constituents in the waste. AK is verified based on the results of sampling and analysis activities. The TCO compares the payload container inventory with the allowable

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material/chemical lists in the TRAMPAC. If a TRUCON code has not been assigned to the waste in the container, Project personnel assign the appropriate TRUCON code based on the waste stream characterization information as described in the TRUCON. If the waste is not listed in the correlation tables of the TRUCON or if there is no corresponding TRUCON code listed in the TRUCON, the payload container is not eligible for shipment. The TCO requests TRUCON code changes or additions from the CAO as necessary. The TCO verifies the TRUCON code assignment of each payload container before certification for shipment to WIPP and documents this on the PCTCD and PATCD in accordance with WMH-400, Section 7.1.8.

See also Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.5.3 and 3.6.1, which contain the titles of applicable procedures that implement the requirements of this section.

4.3.4 Chemical Compatibility

4.3.4.1 Requirements

The allowable chemical lists in Tables 4-1 through 4-6 of the TRAMPAC restrict the chemical composition of the TRUPACT-II payload. Chemical compatibility of a waste with its packaging ensures that chemical processes will not occur that might pose a threat to the safe transport of a payload in the TRUPACT-II. A chemical compatibility study is specifically required to determine the following:

- Chemical compatibility of the waste form within each individual payload container
- Chemical compatibility between contents of payload containers during hypothetical accident conditions
- Chemical compatibility of waste forms within the TRUPACT-II inner containment vessel (ICV)
- Chemical compatibility of the waste form with the TRUPACT-II O-ring seals.

Chemical compatibility is evaluated in accordance with *A Method for Determining the Compatibility of Hazardous Wastes* (EPA-600/2-80-076)(EPA 1980). Any incompatibilities between the payload and the package must be evaluated separately if not covered by the EPA method.

4.3.4.2 Compliance and Verification

Project personnel ensure compliance with the chemical compatibility requirements based on AK and analytical data. The TCO verifies chemical compatibility by comparing payload container inventory with approved TRUCON codes using the chemical lists in the TRAMPAC. The WCO confirms chemical compatibility criteria in accordance with WMH-400, Section 7.1.8. If necessary, Project personnel repackage CH TRU waste containers not meeting the chemical compatibility requirement.

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Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.5.3, which contains the titles of applicable procedures that implement the requirements of this section.

4.4 GAS GENERATION REQUIREMENTS

4.4.1 Payload Shipping Category

4.4.1.1 Requirements

Gas generation, concentrations, and pressures during transport of CH-TRU wastes in a TRUPACT-II payload are restricted as follows:

- For any package containing water and/or organic substances that could radiolytically generate combustible gases, determination must be made by tests and measurements or by analysis of a representative package such that the following criterion is met over a period of time that is twice the expected shipment time. The hydrogen generated must be limited to no more than 5 percent by volume of the innermost layer of confinement (or equivalent limits for other inflammable gases) if present at standard temperature and pressure (STP) (i.e., no more than 0.063 gram-moles/cubic foot at 14.7 pounds per square inch absolute and 70° F).
- The gases generated in the payload and released into the ICB cavity shall be controlled to maintain the pressure within the TRUPACT-II ICB cavity below the acceptable design pressure of 50 pounds per square inch gauge (psig).

CH TRU waste is classified into payload shipping categories to evaluate and ensure compliance with the gas generation requirements. The thermal wattage (decay heat) allowed in each payload shipping category is restricted such that the hydrogen generated during twice the expected shipment time results in a molar quantity of not more than 5 volume percent in any layer of confinement in the payload container or packaging. A shipping category is defined by the following parameters:

- Chemical composition of the waste (waste type)
- Gas generation potential of the waste material type (quantified by the G value for hydrogen)
- Gas release resistance (type of payload container and type and maximum number of confinement layers used).

Each payload container shall be assigned to an approved payload shipping category. Each payload shipping category shall have information on the following components:

- Waste type shall match the content code description from the TRUCON.
- **Waste material type** defines the gas generation potential and shall **match the content code description** from the TRUCON.

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- Total resistance to gas release by the packaging confinement layers. Total resistance has specific requirements associated with:
 - Confinement Layers: The inner layers of confinement around the waste materials in the payload containers shall be plastic bags and/or metal cans that meet the specifications outlined in Appendix 1.3.6 of the SAR. For waste within a given content code, the maximum number of layers of confinement shall comply with that specified in the TRUCON.
 - Rigid Liners: The rigid liner, if present, in a payload container shall be punctured by a >0.3-inch diameter hole, or fitted with an equivalent filter vent, before the container is transported in the TRUPACT-II (see appendix 1.3.3 of the SAR).
- Each payload container shall have an assigned shipping category that is included in an approved content code in the TRUCON document. Table 2 of the TRUCON document lists all approved content codes and the corresponding assigned shipping categories. Complete descriptions of all content codes listed are categorized in the TRUCON document.

For any given payload container, the shipping category provides a basis to determine the gas generation potential of the contents and the resistance to gas release of the packaging configuration. This enables evaluation of compliance with the gas generation requirements (5 percent limit on hydrogen concentration). Two payload shipping category notations are available. Either notation may be used by a shipping site. Descriptions of the two notations are presented below.

Numeric Shipping Category Notation

The numeric shipping category notation (initiated in Rev. 17 of the TRAMPAC) is a ten-digit code, in the form, XX YYYY ZZZZ, where,

XX	=	the waste type, which indicates the chemical composition of the waste
YYYY	=	the G value, or gas generation potential, of the waste material type multiplied by 10^2
ZZZZ	=	the resistance to hydrogen release of the packaging configuration multiplied by 10^{-4}

A description of the parameters follows.

Waste Type

Payloads for the TRUPACT-II package are subdivided into four waste types based on physical and chemical form as shown in Table 4-1. Table 4-1 also shows the shipping category notation denoting each waste type.

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Waste Material Type

The four waste types can be further subdivided into waste material types. The waste material types define the gas generation potential of the waste. A listing of the chemicals/materials allowed in each waste material type is presented in the TRAMPAC, Tables 4-1 through 4-6. An effective G value quantifying the gas generation potential of each waste material type is assigned based on the chemicals allowed. Table 4-2 (of this Certification Plan) lists the waste material types and their respective bounding G values, along with the shipping category denoting the bounding G value.

Total Resistance

The determination of the total resistance to gas release of a payload container requires knowledge of the type and maximum number of layers of confinement used to package waste. Allowable closure methods for confinement layers are specified in Appendix 1.3.6 of the TRUPACT-II SARP. The plastic layers of confinement in payload containers are of three types—liner bags, inner bags, and filtered bags. Appendices 3.6.9 through 3.6.14 of the TRUPACT-II SARP present the release rates for these three types of bags.

The shipping category notation used to denote the total resistance to hydrogen release of the packaging configuration of a payload container is the sum of all the resistances from all confinement layers (seconds/mole) multiplied by 10^{-4} , rounded up, and reported as digits (ZZZZ). For example, the shipping category notation for a total resistance of 1,395,163 seconds/mole is "0140."

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The shipping category assignment for a 55-gal. drum containing solid inorganic waste packaged within two filtered, plastic liner bag layers is:

20 0170 0140

where,

20 = Waste Type II

0170 = G value ($\times 10^2$) of Waste Material Type II.1

0140 = Total resistance to hydrogen release ($\times 10^{-4}$) of the two filtered bags

Alphanumeric Shipping Category Notation

This shipping category notation (used through Rev. 16 of the TRAMPAC) was based on the same parameters as the numeric notation, but conveyed the information through a different set of notations. Verification of the shipping category requirements shall be by comparison of the payload shipping category level with the allowable shipping categories from the content code information in the TRUCON. The shipping category information is also recorded in Tables 6-1 or 6-2, as applicable.

The alphanumeric shipping category is based on type of waste, type of container used to package the waste, and the number and type of confinement layers present in the payload container. The shipping category designation is in the form, $N.n1Xn2$, where

N = A Roman numeral (I to IV) that describes the physical form of the waste and is termed the "Waste Type" (see Table 4-2)

n1 = A number (1, 2, or 3) denoting cases where further division of the waste type has been made based on the gas-generating potential of the waste (these subcategories of the waste type are termed "Waste Material Types") (see Table 4-1)

X = A capital letter (A, B, C, or D) that designates the payload container and, if applicable, the overpacking configuration (see Table 4-3)

n2 = An alpha or numeric character that denotes the number of bag layers or type of containment of the waste. The number of plastic layers is indicated by a numeral (0 through 6). The letter M is used when the waste is placed directly in a metal can as the innermost layer of confinement (See Table 4-4)

A "T" (for "Test Category") placed at the end of a shipping category indicates a shipping category that cannot be shipped without first performing a test to verify a container's actual gas generation rate. The required testing is described in the TRAMPAC. All other shipping categories are referred to as analytical shipping categories.

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Table 4-1 Summary of Payload Waste Types

Waste Type ^a	Waste Type ^b	Description of Examples
I	10	Solidified Aqueous or Homogenous Inorganic Solids (<1% organics – not including packaging) absorbed, adsorbed or solidified inorganic liquid soils, solidified particulates, or sludges formed from precipitates
II	20	Solid Inorganics Glass, metals, crucibles Other solid inorganics
III	30	Solid Organics Plastics (e.g., polyethylene, polyvinyl chloride) Cellulose (e.g., paper, cloth, wood) Cemented organic solids Other solid organics
IV	40	Solidified Organics Cemented or immobilized organic liquids and solids

^aPayload shipping category notation used through TRUPACT-II SAR, Rev. 16^bPayload shipping category notation used through TRUPACT-II SAR, Rev. 17

Source: TRAMPAC, Table 5-1

Table 4-2 CH TRU Waste Material Types and G Values

Waste Material Type ^a	Typical Material Description	G Value	Numeric Shipping Category Notation ^b (G value x 10 ²)
I.1	Absorbed, adsorbed, or solidified inorganic liquid	1.6	0160
I.2	Soils, solidified particulates, or sludges formed from precipitation	1.3	0130
I.3	Concreted inorganic particulate waste	0.4	0040
II.1	Solid inorganic materials in plastic bags	1.7	0170
II.2	Solid inorganic materials in metal cans	0	0000
III.1	Solid organic materials	3.4	0340
III.2	Homogenous mixed organic (10% by weight) and inorganic (90% by weight) materials in metal cans	0.34	0034
III.3	Homogenous mixed organic (10% by weight) and inorganic (90% by weight) materials in plastic bags	1.85	0185
IV.1	Solidified organics	Unknown (test)	9999

^aPayload shipping category notation used through TRUPACT-II SAR, Rev. 16^bPayload shipping category notation used through TRUPACT-II SAR, Rev. 17

Source: TRAMPAC, Table 5-2

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Table 4-3
Alpha-numeric Shipping Category Notation for Payload Container Configurations

Notation	Description
A	55-gal. drums with materials in additional layers of confinement (such as rigid liners[s], bag[s], and can[s])
B	Overpack of four 55-gal. drums in an SWB (SWB overpack)
C	SWB with materials in additional layers of confinement (such as bag[s] and can[s])
D	Overpack of one experimental bin in an SWB
E	Overpack of one pipe component in a 55-gal. drum (pipe overpack)

Source: TRAMPAC, Table 5-3

Table 4-4
Alpha-numeric Shipping Category Notation for
Layers of Confinement in Payload Containers

Notation	Description
0	No closed bags around waste
1	Up to a maximum of 1 closed bag around waste
2	Up to a maximum of 2 closed layers of bags around waste
3	Up to a maximum of 3 closed layers of bags around waste
4	Up to a maximum of 4 closed layers of bags around waste
5	Up to a maximum of 5 closed layers of bags around waste
6	Up to a maximum of 6 closed layers of bags around waste
M	Metal container(s) as the innermost layer of confinement
a	For Waste Types II and III packaged in drums, denotes a minimum of 2 liner bags
b	For all waste types packaged in SWBs, denotes a minimum of 1 SWB liner bag
f	All layers of bags around waste are vented with a minimum of 1 filter vent

Source: TRAMPAC, Table 5-4

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The shipping category assignment for a 55-gal. drum containing solid inorganic waste packaged within two filtered, plastic liner bag layers is:

II.1A2af

where,

II.1 = the waste material type (solid inorganic materials in plastic bags)

A = the type of payload container (55-gal. drum)

2 = the number of confinement layers (2 bag layers)

af = the type of confinement layers (filtered drum liner bags)

Confinement Layers

See confinement layer compliance under the numeric shipping category notation above.

Rigid Liner

See rigid liner compliance under the numeric shipping category notation above.

Addition of New Shipping Categories

Any proposed change in payload packaging configuration or addition of a new payload shipping category at a generator site for a given content code shall be evaluated by the TRUPACT-II cognizant engineer for compliance with existing waste packaging restrictions and submitted to the NRC for review and approval. Changes to the number of layers of confinement, layer types, or filter types shall be recorded and submitted to the TRUPACT-II cognizant engineer along with a completed Numeric Payload Shipping Category Worksheet (Table 5-5) for the new packaging configuration.

Transport of the waste under a more conservative approved shipping category for the content code (listed in the TRUCON document) may be allowed if none of the packaging restrictions are violated. If the TRUPACT-II cognizant engineer determines that the new packaging configurations should be added to the content code, and the payload shipping category and associated decay heat limit are listed in Table 5-6, the TRUCON is revised to reflect the change and is submitted to the NRC for review and approval.

If the payload shipping category for the new packaging configuration is not listed in Table 5-6, or the packaging configuration includes layers of confinement that have not been previously approved by the NRC, approval by the NRC in the form of an amendment to the SAR is required prior to the revision of the TRUCON.

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4.4.1.2 Compliance and Verification

Wastes generated at the Hanford Site will be categorized into several waste streams. The TRUCON generally lists Hanford Site waste streams and their associated waste material types and transportation parameters. The TRUCON describes how a waste complies with the TRAMPAC. The TCO requests updates to the TRUCON from the CAO as necessary when additional waste types are identified. As waste is selected for processing, the shipping category is assigned based on AK and/or visual inspection. For retrievably stored waste, AK is verified by radiography. Prior to the completion of waste certification and transport, the assigned shipping category must match a TRUCON code for Hanford. The TCO verifies the shipping category of each payload container before certification for shipment to WIPP and documents this according to the instructions for completing the PCTCD and PATCD. The WCO confirms the shipping category in accordance with WMH-400, Section 7.1.8.

See also Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.6.2, which contains the titles of applicable procedures that implement the requirements of this section.

4.4.2 Decay Heat

4.4.2.1 Requirements

The decay heat within each payload container plus the measurement error shall be less than or equal to the decay heat limit shown in Table 5-6 of the TRAMPAC for each authorized payload shipping category. The total decay heat from all payload containers in a TRUPACT-II shall be less than 40 watts.

4.4.2.2 Compliance and Verification

NDA personnel compute the container decay heat and container decay heat error manually or using a computational algorithm. Software is designed and maintained in accordance with WMH-400, Section 6.1.1. Individual radionuclide mass quantities and errors are converted to decay heat by multiplying the mass values (g) by decay heat conversion factors (w/g). Table 3-1 in the TRAMPAC lists ²³⁹Pu FGE, decay heat, and specific activity for many radionuclides. The container decay heat is computed by summing the decay heat for all radionuclides in the container. The container decay heat error is computed by taking the square root of the sum of the squares of the decay heat errors for individual radionuclides.

The TCO sums the container decay heat and container decay heat error and compares the result to the limit for individual containers for the applicable shipping category. The TCO verifies the container decay heat data and records it on the PCTCD (described in Section 4.6). If the container does not meet the criterion, it is segregated and returned to storage to be dispositioned at a later date.

To assess compliance with the payload decay heat requirements, the TCO computes the payload decay heat and payload decay heat error. The payload decay heat is computed as the sum of the container decay heat values for all containers in the proposed payload. The payload decay heat error is computed by taking the square root of the sum of the squares of the container

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decay heat error values for all containers in the payload. Finally, the payload decay heat and payload decay heat error are summed and compared to the limit for the applicable shipping category. If the payload does not meet the criterion, a different combination of payload containers is identified that meets the TRUPACT-II decay heat limit. Once a compliant payload is identified, the TCO records the sum of the payload decay heat and payload decay heat error on the PATCD and the WCO confirms decay heat criteria in accordance with WMH-400, Section 7.1.8.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.6.2, which contains the titles of applicable procedures that implement the requirements of this section.

4.4.3 Test Category Requirements

4.4.3.1 Requirements

A payload container can be qualified for shipment only if it can be demonstrated (either by analysis or testing) that the molar quantity of hydrogen is maintained at or below the 5 percent limit in all confinement layers. A payload container may be placed in a test category under one of two conditions:

- The decay heat loading of the waste in a payload container exceeds the limit set for the shipping category. Payload containers in Waste Types I, II, and III belong in this class.
- A content code that does not have a characterized bounding G value. Payload containers in Waste Type IV belong to this class.

The containers classified as test category must meet all other restrictions for analytical category waste.

The following criteria (discussed in Chapter 3.0 of the TRUPACT-II SARP) shall be used to qualify a payload container in the test category for transport:

- The steady-state hydrogen gas generation rate for the test categories is equivalent to the rate for the analytical categories and shall not exceed the limit specified in Table 5-6 of the TRAMPAC. This limit is necessary to ensure that the molar quantity of hydrogen in any confinement layer is not more than 5 percent (volume) at STP.
- The steady-state gas release rate shall not exceed the limit specified in Table 5-7 of the TRAMPAC. This limit is necessary to ensure that the design pressure of 50 psig is not exceeded.

4.4.3.2 Compliance and Verification

With the exception of Waste Type IV (solidified organics), which currently is test category waste by definition, the Hanford Site may repackage test category waste into an acceptable configuration to qualify as analytical category waste. For type IV waste or test

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category waste that cannot be repackaged, the Hanford Site will segregate and store this waste until compliance can be demonstrated in accordance with the test category requirements provided in Attachment 2.0 of the TRAMPAC.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.6.2, 3.6.4, and 3.7.1, which contain the titles of applicable procedures that implement the requirements of this section.

4.4.4 Flammable Volatile Organic Compounds

4.4.4.1 Requirements

The total amount of potentially flammable VOCs that can occur in the headspace of a payload container shall be limited to 500 ppm. The limit on flammable VOCs will be met either by means of process controls or by suitable sampling programs. A list of flammable VOCs is presented in Section 3.6.4, Table 3-5, of this Certification Plan.

4.4.4.2 Compliance and Verification

Project personnel verify that wastes are in compliance with the 500-ppm flammable VOC limit through review of documentation of the chemical inputs and outputs. Project personnel obtain headspace gas samples from all containers, and analytical laboratory personnel analyze headspace gas samples to verify that wastes are in compliance with the 500-ppm flammable VOC limit. Analytical laboratory personnel determine VOCs, SVOCs, and metals in the waste matrix according to approved procedures.

The SPM or designee reviews the analytical data to ensure that chemical constituents in the waste are allowable in accordance with the Chemical Lists and that flammable VOCs in the headspace of the payload containers are less than 500 ppm. At the discretion of the SPM, additional sampling of the waste stream from which nonconforming containers originated will be performed to determine whether the container is anomalous or is representative of the entire waste stream. The TCO documents compliance on the PCTCD and the WCO confirms the flammable VOC criteria in accordance with WMH-400, Section 7.1.8. Project personnel identify containers that exceed VOC requirements, segregate them, and ensure that the noncompliant containers are dispositioned, which may include repackaging in accordance with WMH-400, Section 7.1.3.

For content codes that identify flammable VOCs as part of the waste, the following options exist to comply with the above transportation requirement:

- Specify, from waste generation procedures, what the maximum amount of flammable VOCs in the waste can be if all the potentially flammable VOCs vaporized into the headspace of the drum. If this is less than 500 ppm, the content code meets the above limit. A margin of safety is provided because not all the potentially flammable VOCs would vaporize in a drum. Verification for this shall be from process records and random sampling.

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- If an upper limit cannot be established on the amount of flammable VOCs in a content code or if the limit exceeds 500 ppm, a sampling program needs to be implemented to verify compliance with the requirements.
- For retrievably stored waste, headspace sampling for potentially flammable VOCs shall be an added parameter for waste sampling programs. Newly generated waste sites shall meet compliance for content codes by establishment of sampling programs for waste streams and/or payload containers. By content code, at the 95 percent confidence limits.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.6.4, which contains the titles of applicable procedures that implement the requirements of this section.

4.4.5 Venting and Aspiration

4.4.5.1 Requirements

Drums that have been stored in an unvented condition (e.g., no filter and punctured liner) shall be aspirated for a sufficient period of time to equilibrate gases that may have accumulated in the closed containers prior to transport. The following three options are provided for showing compliance with aspiration requirements, any one of which may be implemented:

- Option 1 - Aspiration Time Based on Date of Drum Closure: This option determines aspiration time based on the closure date of the payload container and the TRUCON code. This method does not require sampling of headspace gases.
- Option 2 - Headspace Gas Sampling at the Time of Venting: This option determines aspiration time based on the measured concentration of hydrogen in the headspace of the drum (between the drum lid and the rigid liner) at the time of venting.
- Option 3 - Headspace Gas Sampling During Aspiration: This option utilizes the measured headspace concentration of hydrogen two or more weeks after venting to determine aspiration time.

4.4.5.2 Compliance and Verification

Project personnel ensure that all containers are properly vented or repackage CH TRU waste into vented containers. Unvented containers will be allowed to aspirate for a period of time determined using one of the options and applicable aspiration tables presented in the TRAMPAC. If option 2 or 3 is used to determine aspiration time, Project personnel follow headspace gas sampling requirements identified in the QAPjP and analyze the headspace gas samples in accordance with Appendix F of this Certification Plan. Analytical personnel determine the concentration of hydrogen in the headspace gas samples in accordance with the requirements established in Appendix F of the Certification Plan. The TCO enters the aspiration option used and the information required to compute the aspiration time on the PCTCD, and the WCO confirms the aspiration time in accordance with WMH-400, Section 7.1.8.

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Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," row 3.6.5, which contains the titles of applicable procedures that implement the requirements of this section.

4.5 PAYLOAD ASSEMBLY REQUIREMENTS

This section describes the procedures that must be followed to assemble a payload approved and qualified for transport in the TRUPACT-II in accordance with the TRAMPAC.

The parameters described in previous sections shall be evaluated for selection of a payload.

The container identification (ID) number shall uniquely identify the payload container. The content code identifies a payload shipping category per the TRUCON. Whenever applicable, the measured parameters (weight, fissile material, and the decay heat) shall be checked against the limits after addition of the measurement error, as detailed in previous sections.

If any of the limits are not met by the container, it shall be rejected from transport, marked, and segregated. If all requirements are satisfied except for the decay heat limit, the container shall be assigned to a test category, and can be qualified for transport only by the procedure outlined in section 4.5.2.

Only waste with content codes described in the TRUCON may be transported in the TRUPACT-II. Shipping categories impose restrictions and requirements on the manner in which a payload can be assembled as follows:

- Payload selection shall be made from only those payload containers that have been approved for shipment.
- After all the payload parameters have been quantified and verified and the transport requirements are satisfied, the shipping category must be confirmed and clearly marked (e.g., labeled) on the payload container to provide a visual verification that the container is authorized for shipment.
- Individual containers forming a payload within each TRUPACT-II shall belong to the same shipping category or equivalent categories allowed by the TRUPACT-II SARP (e.g., such that weight, center of gravity, dose rate, fissile quantity limits, and decay heat limits of the payload are met). This permits the management of different waste material types, different payload containers, and different internal packaging configurations. This requirement applies to drums, SWBs, and TDOPs.
- Payload containers qualified for transport in the analytical and test categories cannot be mixed in a TRUPACT-II.
- Transportation parameters of individual payload containers are recorded on the PCTCD. Separate PCTCD forms are used for the analytical payload shipping category and the test payload shipping category. (Examples of these forms are

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provided in Appendices B and C, respectively.) Information on these forms should be available for each payload container, even if the format is not identical to that shown in Appendices B and C (e.g., use of a computer-generated form is acceptable provided all required information is included). A payload container may be certified for transport only if all transportation parameters are in compliance. The TCO verifies compliance before containers are authorized for transport.

- A TRUPACT-II shipment is authorized only if all the transportation requirements are met and verified by the TCO. The transportation parameters of every TRUPACT-II shipment are then recorded on the PATCD (shown in Appendix D). The information on this form must be available for each payload assembly, even if the format is not identical to that shown in Appendix E (e.g., use of a computer-generated form is acceptable provided all required information is included). The shipping records shall be maintained by the shipper for a minimum period of 3 years.

All authorized payloads must meet the requirements set forth in the TRAMPAC. Data on the parameters for specific payloads are obtained by the methods outlined in this document in accordance with the specific limits of the TRUCON. The following sections describe methods for evaluating the payload container and shipment data against TRUPACT-II limits and restrictions.

4.5.1 Certification of Individual Payload Containers for Transport in the TRUPACT-II (Analytical Payload Shipping Category)

4.5.1.1 Requirements

Generating and storage sites shall qualify an individual payload container for transport in a TRUPACT-II under the analytical category by verifying that the container meets the parameter requirements/limits listed in previous sections of this certification plan. All parameters noted on the PCTCD shall be included in any modified version. Data on the parameters for specific payloads shall be obtained by the methods outlined in this document and the TRAMPAC and shall be consistent with the information for each parameter provided in the TRUCON.

Individual payload containers must be qualified for transport in a TRUPACT-II by verifying that each container meets the requirements and limits for the parameters listed on the PCTCD for the analytical payload shipping category.

4.5.1.2 Compliance and Verification

The TCO completes a PCTCD for analytical category waste in accordance with WMH-400, Section 7.1.8, to qualify an individual payload container for shipping. The TCO signs and dates the PCTCD after verifying that each container meets the following transportation parameter requirements:

- Container ID and Container Bar Code Numbers--identification numbers unique to each container and used to track process data and package history.

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- Shipping Category and TRUCON Code--assigned using the corresponding tables in the TRUCON.
- Content Code--acquired either from the data package (preassigned) or by correlating the waste description with the applicable contents code list in the TRUCON.
- Decay Heat Limit--when the shipping category is determined, the allowable decay heat for that category is recorded from Table 5-6 in the TRAMPAC.
- Container Type--obtained by visual inspection.
- Certification Site--the location at which transportation takes place (e.g., the generating site for newly generated waste; the generating or storage site for retrievably stored waste).
- WIPP-WAC/Transportation Parameters--for each payload container, the following criteria must be met:
 - free liquids limited to residual amounts less than 1 percent of container volume
 - nonradioactive pyrophorics are prohibited
 - explosives are prohibited
 - corrosives are prohibited
 - pressurized containers are prohibited
 - sealed containers greater than 4 L are prohibited, except for Waste Material Type II.2 packaged in metal cans
 - drum liner (if present) is punctured/filtered
 - flammable VOCs are limited to not more than 500 ppm
 - radiation dose rates are limited to not more than 200 mrem/hr at the surface of the payload container.
- Filter Identification--information obtained by visual inspection includes filter vent identification of both supplier and date of manufacture, lot number, or unique serial number.
- Weight Limit -- the maximum weight limit for the appropriate payload container type shall be recorded.
- Weight--loaded weight of each payload container obtained from the data package.
- Decay Heat--obtained from NDA data report (calculated by combining isotopic inventory data and calculated decay heat for each radionuclide in the waste).
- Container Weight (Plus Error)--obtained from the data package (an error is assigned to the container weight in accordance with methods listed in the TRAMPAC and compared against the limits listed in the TRAMPAC).

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- Decay Heat (Plus Error)--obtained from the data package (decay heat plus error is compared against the limits listed in the TRAMPAC).
- Fissile Mass (Plus Two Times the Error)--obtained from NDA data report (fissile mass calculated by combining isotopic inventory data and ^{239}Pu FGE for each radionuclide in the waste, plus an error is assigned to the fissile mass in accordance with methods listed in the TRAMPAC and compared against the transport limits listed in the TRAMPAC).
- Aspiration Method--confirms that the requirements on aspiration time for containers that have been closed (i.e., not vented with an approved filter vent) for a period of time are met, and addresses the following:
 - identifies the method for determination of the aspiration period
 - indicates the period of time the payload container has been unvented (for option 1 only)
 - indicates the concentration of hydrogen measured in the headspace (for options 2 and 3)
 - indicates the aspiration time for the option chosen and the aspiration table that the value was derived from in the TRUPACT-II SARP
 - indicates if the payload container has been vented for the prescribed period of time.
- Approved for Transport--The TCO signs and dates the PCTCD certifying that the requirements for the transportation parameters are met. If the requirements are not met, the payload container is rejected (nonconformance disposition) and not qualified for shipment.

After the TCO has verified and documented that all parameters are met, loading personnel clearly mark the individual payload containers with the appropriate shipping category designator. Payload containers that do not comply with parameter limits are not qualified for shipment. These containers are segregated and corrective action is taken to resolve the noncompliant condition.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.2.4 and 3.7.1, which contain the titles of applicable procedures that implement the requirements of this section.

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4.5.2 Certification of Individual Payload Containers for Transport in the TRUPACT-II (Test Payload Shipping Category)**4.5.2.1 Requirements**

In accordance with the TRAMPAC, payload containers assigned to the test category must meet additional criteria for certification. The generating and storage sites shall qualify an individual payload container for transport in a TRUPACT-II under the test category by verifying the container meets the parameter requirements/limits in this section and in Table 6-2 of the TRAMPAC. These criteria evaluations shall be made once the "TRUPACT-II Gas Generation Test Plan to Qualify Test Category Waste for Shipment in the TRUPACT-II" has been instituted at the site. The test plan and criteria that must be followed for this project is presented in Attachment 2.0 of the TRAMPAC.

Complete the PCTCD for the Test Payload Shipping Category as outlined in Table 6-2 of the TRAMPAC.

Additional requirements for the Test payload shipping category include the following:

- Limit/Measurement for Total Gas Release is defined for each shipping category in table 5-6 of the TRAMPAC. Record the measured value under the measurement column. This value shall be less than the limit to be approved for shipment.
- Limit/Measurement for Hydrogen Gas Generation is defined for each shipping category in Table 5-7 of the TRAMPAC. Record the measured value under the measurement column. This value shall be less than the limit to be approved for shipment.
- Limit/Measurement for Potentially Flammable VOCs (section 5.4 of the TRAMPAC and 4.4 of this document) shall be the measured value and recorded under the measurement column. This value shall be less than the 500 ppm limit to be approved for shipment.
- The date the test is completed shall be the date the test is terminated as outlined in Attachment 2.0 of the TRAMPAC.

4.5.2.2 Compliance and Verification

With the exception of Waste Type IV (solidified organics), which currently is test category waste by definition, the Hanford Site will repackage test category waste into an acceptable configuration to qualify as analytical category waste. For type IV waste or test category waste that cannot be repackaged, the Hanford Site will segregate and store this waste until testing and/or repackaging can be performed.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.5.1, 3.5.2, and 3.6.3, which contain the titles of applicable procedures that implement the requirements of this section.

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4.5.3 Assembly of a TRUPACT-II Payload**4.5.3.1 Requirements**

In accordance with the TRAMPAC, certified payload containers of the same type and shipping category shall be assembled into acceptable TRUPACT-II payloads. Total TRUPACT-II package limits must be met by ensuring the TRUPACT-II SARP restrictions and requirements are met, and by evaluating the data from the individual PCTCDs.

The first two digits (representing the waste type) of the ten-digit payload shipping category notation shall be the same for all payload containers making up a payload. If using the alpha-numeric shipping category notation used through Revision 16 of the TRUPACT-II SAR (see Section 5.1), the first digit (i.e., I, II, III, or IV) and container code (i.e., A, B, C, D, or E) shall be the same for all payload containers making up a payload.

The value of the other digits of the shipping category (representing the bounding G value and the total resistance) for each payload container may differ provided the decay heat limit for all payload containers within the payload is conservatively assumed to be the same as that of the payload container with the lowest decay heat limit. Visual inspection of the affixed shipping category labels on each payload container or the respective PCTCD shall ensure the appropriate shipping category assignment to the payload.

Weight of pallets, reinforcing plates, slip sheets, guide tubes, banding material, etc shall be measured for total weight (or 265 lbs) and recorded.

4.5.3.2 Compliance and Verification

The TCO combines data from the individual PCTCDs and completes a PATCD upon verifying the applicable transportation parameters are met. The parameters listed below correspond with data fields on the PATCD:

- Shipment No.--the shipment number of the trailer of TRUPACT-IIs.
- TRUPACT-II OCA Body/Lid Nos.--the identification numbers on the TRUPACT-II OCA body and lid.
- Payload Shipping Category--the payload shipping category shall be recorded and verified through visual inspection of the affixed shipping category labels on each payload container.
- Category Decay Heat Limit--the design decay heat limit for the TRUPACT-II is 40 watts.
- Type of Payload--identifies the approved payload configuration (verified by visual inspection).
- Date ICV Closed--identifies the data the inner containment vessel is **closed**.

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- Payload Composition--identifies the following container parameters:
 - payload container identification number (or "DUNNAGE" or "EMPTY")
 - weight and measurement error
 - decay heat and measurement error
 - FGE and two times the measurement error.

Weights, decay heats, and FGEs of individual containers are summed for both top and bottom layers of the assembly, and the total error for each parameter is calculated as indicated on the PATCD.

- The total weight of pallets, reinforcing plates, slip Sheets, guide tubes, banding material, etc (or 265 pounds) shall be measured and recorded.
- Total Weight (Plus Error) of Payload and Package--indicates that the total weight of the payload and package does not exceed limits established in the TRAMPAC; the total error can be determined by weighing the entire payload assembly.
- Bottom Layer (Plus Error) \geq Top Layer (Plus Error)--the total weight of the bottom layer of seven drums, seven pipe overpacks, SWB, or five drums in a TDOP must be verified to be greater than or equal to the top layer.
- Total Weight (Plus Error) $\leq 7,265$ lbs--the total weight plus error must be verified to be less than or equal to 7,265 lbs.
- Total Decay Heat (Plus Error) of all Containers--indicates that the total decay heat plus error for all containers comprising the shipment does not exceed limits set in the TRAMPAC.
- Total ^{239}Pu FGE (Plus Error) of all Containers--indicates that the calculated total fissile quantity plus two times the error for all containers comprising the shipment does not exceed limits set in the TRAMPAC.
- TRUPACT-II Dose Rates--indicates that dose rate measurements do not exceed limits set in the TRAMPAC.

The TCO completes the PATCD, except for dose rate information, and provides the PATCD to loading personnel. Loading personnel load the TRUPACT-II in accordance with the PATCD and WRP1-OP-0522, "Assemble and Stretch Wrap TRUPACT Payload." The TCO signs and dates the PATCD upon verifying the TRUPACT-II transportation requirements are met and the payload is certified for transport.

Refer to Appendix A, column "WIPP-WAC and Certification Plan Section," rows 3.2.1 and 3.7.1, which contain the titles of applicable procedures that implement the requirements of this section.

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5.0 QUALITY ASSURANCE PLAN

Each site must develop and implement QA plans for TRU waste characterization, certification, and packaging. QA plans are submitted to CAO for approval before TRU wastes are characterized, certified, and transported to WIPP. No waste may be certified unless it is a product of a waste stream evaluated and approved by the CAO. The TRUPACT-II is not used without CAO granting authority.

The QAPD establishes QA program requirements for all programs, projects, and activities sponsored by CAO. The QA plan associated with the Certification Plan must apply QAPD requirements. The QA requirements for compliance with TRUPACT-II loading and usage are derived from 10 CFR 71, Subpart H, "Packaging and Transportation of Radioactive Materials;" 49 CFR 173, "Shippers-General Requirements for Shipments and Packagings;" TRUPACT-II Certificate of Compliance; DOE O 460.1 and 460.2; and the CAO *TRUPACT-II Operating and Maintenance Instructions* manual. The QA plan for packaging must address DOT and NRC requirements applicable to the use, maintenance, and control of packages used to transport TRU waste to WIPP, including the criteria addressed in 10 CFR 71, Subpart H; 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," Subpart G, "Quality Assurance;" and 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

This QA Plan implements the combined QA requirements for certification, transportation, and packaging established in the documents identified above. The QAPjP implements the QA/QC activities and requirements specified in the WAP. Activities included in the scope of this QA Plan are those related to certifying that waste containers and payload assemblies meet the criteria and requirements specified in the WIPP-WAC and TRUPACT-II SARP, operation and maintenance of transport containers, waste transportation services, and the criteria specific to the packaging and transportation of radioactive materials. This QA plan ensures that all activities that are governed by the *Code of Federal Regulations*, certificates of compliance, or other regulatory requirements are conducted in accordance with written, approved procedures or instructions that incorporate the applicable regulatory requirements. Activities that are important to safety are performed with specified equipment under suitable conditions, and prerequisites are satisfied prior to inspection, testing, or operation. This QA plan takes precedence over any other Hanford Site QA plans related to characterization and certification of TRU wastes destined for WIPP, and transportation and packaging applicable to the TRUPACT-II. This plan does not apply to the procurement, inspection, or testing of payload containers except as those activities apply to verification that the payload containers meet the requirements of the TRUPACT-II SARP.

The organization of this QA Plan is based on the QAPD elements outlined below. Table 5-1 provides a cross-reference of identical or related QA requirement elements from 10 CFR 830.120 and 10 CFR 71.

- **Organization and QA Program** documents the organizational structure, primary interfaces functional responsibilities, levels of authority, and lines of communication for activities affecting quality, and identifies the activities and items to which the QA program applies.

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Table 5-1. Cross-Reference of Quality Assurance Requirements

QAPD and QA Plan Section	Equivalent Section in 10 CFR 830.120	Equivalent Section in 10 CFR Part 71, Subpart H
Organization and QA Program	Program	QA Organization QA Program
Personnel Qualification and Training	Personnel Training and Qualification	QA Program
Quality Improvement	Quality Improvement	Corrective Action Nonconforming Materials, Parts, or Components
Documents Records	Documents and Records	Document Control QA Records
Work Processes	Work Processes	Instructions, Procedures, and Drawings Identification and Control of Materials, Parts, and Components Control of Special Processes
Procurement	Procurement	Procurement Document Control Control of Purchased Material, Equipment, and Services
Inspection and Testing	Work Process and Acceptance Testing	Internal Inspection Test Control Control of Measuring and Test Equipment Inspection, Test, and Operating Status Handling, Storage, and Shipping
Assessment Requirements	Management Assessment Independent Assessment	Audits
Sample Control Requirements	Work Processes	Not applicable
Scientific Investigation Requirements	Work Processes Design	Identification and Control of Materials, Parts, and Components
Software Requirements	Not applicable	Not applicable

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- **Personnel Qualification and Training** identifies the Hanford Site qualification and training programs and plans established to ensure personnel are provided training to perform their assignments and maintain job proficiency.
- **Quality Improvement** describes the processes to detect and prevent conditions adverse to quality, pursue continuous quality improvement, and control and correct nonconforming items.
- **Documents and Records** describes the processes for preparation, review, approval, issue, use, revision, and control of Project documents and records.
- **Work Processes** identifies the processes by which work conditions, equipment, and special processes are controlled to ensure quality.
- **Procurement** identifies the technical and QA requirements for procured items and services.
- **Inspection and Testing** identifies the processes for inspection and testing.
- **Assessment Requirements** describes the requirements for conducting management and independent assessments to measure management effectiveness, item quality, and process effectiveness and to promote improvement.
- **Sample Control Requirements** identifies the requirements for the control of waste samples, including identification, handling, storing, shipping, and archiving.
- **Scientific Investigation Requirements** describes the requirements for defining, controlling, verifying, and documenting scientific investigations.
- **Software Requirements** specifies the requirements for developing, procuring, maintaining, and using software.

5.1 ORGANIZATION AND QA PROGRAM

This QA program applies to items and activities affecting Project quality. The QA activities are integrated into the Project through reviews, assessments, inspections, and approval and control of records and documents. The Hanford Site has identified the SPM, SQAQO, WCO, and TCO as being responsible for ensuring QA within the Project. The responsibilities of each of these positions, as well as other personnel involved with TRU waste characterization, certification, packaging, and transportation, are summarized in this Certification Plan (Section 2.1).

All personnel involved with TRU waste certification, packaging, and transportation ensure the quality of their activities and products. If work is delegated, the individual making the delegation retains responsibility for the delegated work. Disputes related to QA program requirements will be resolved by the SQAQO and cognizant Project personnel.

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TRU project management at all levels have established communication channels that provide timely and wide dissemination of information related to the TRU Project quality performance which includes:

- QA program status
- Lessons learned
- Quality improvement
- Results of trend analysis.

The program interfaces are described and defined in section 2.0 of this certification plan.

Figure 1-1 (see Section 1.0) illustrates the hierarchy and interrelationships of QA documents governing the QA program. Quality management documents are audited and/or assessed to ensure they meet Project requirements.

The TRU Project QA organization has the authority, access to work, and organizational freedom to identify quality problems, make recommendations for resolution, and verify implementation of corrective actions. In addition, the QA organization will ensure that unsatisfactory conditions are controlled until proper corrective actions have been completed.

Project personnel plan certification activities and document the planning process. Planning documentation is subject to review by facility managers and subject matter experts (SMEs). Project planning documentation consists of this Certification Plan, the QAPjP, implementing procedures, QA plans, training plans, and facility and certification process designs. These documents establish performance criteria and methods to measure performance relevant to the Project. All Project personnel are accountable for ensuring quality within their assigned areas of responsibility; however, the SQAQO is responsible for determining the effectiveness of this QA Plan, which is accomplished through internal reporting procedures, audits, and assessments (see Section 5.3).

A procedure matrix has been developed and will be maintained. The procedure matrix identifies TRU Project documents that implement QAPD requirements. When the QAPD is revised, the TRU Project will be evaluated for changes to requirements and revisions to this certification plan will be initiated and implemented as appropriate.

5.2 PERSONNEL QUALIFICATION AND TRAINING

Personnel performing work in support of the Project receive QA indoctrination and are qualified and trained to ensure that suitable proficiency is achieved and maintained in the performance of their assigned tasks. Records documenting qualifications and completed training programs are maintained and controlled as described in Sections 5.4 and 5.5.

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5.2.1 Qualification

Facility managers, the SPM, and Training manager determine qualification standards for each job category relevant to the Project and ensure that qualifications of Project personnel, including minimum education and experience, have been verified. Project personnel maintain minimum qualifications in accordance with WMH-400, Section 1.2.1, "TRU Training and Qualification Plan." The SPM assists facility managers in determining which positions relevant to the Project require minimum qualifications. The period of effectiveness for qualification associated with special processes and operations that require special skills and the requalification criteria are specified or referenced in WMH-400, Section 1.2.1. Facility managers ensure that auditable records documenting personnel qualifications are maintained as described in WMH-400, Section 1.5.1, "TRU Records Management." Records of qualified personnel, their areas of qualification, and qualification periods (as appropriate) are retained in the TRU Project records files.

5.2.2 Training

The SPM and facility managers ensure that all Project personnel receive indoctrination and training on the scope, purpose, and objectives of the Project and the specific QAOs of the tasks being performed. Facility personnel performing activities affecting quality are trained according to facility training plans to ensure they achieve and maintain proficiency. Personnel receive initial and continuing training requisite with their activities and level of responsibility, as described in WMH-400, Section 1.2.1.

Training is designed, developed, conducted, and evaluated in accordance with Hanford Site requirements described in WMH-400, Section 1.2.1. Training programs may include classroom instruction; practical hands-on experience; supervised on-the-job training; self-paced individual study; and written, oral, or practical demonstration of worker competence. Facility managers (or designees) analyze job positions and determine task responsibilities for Project personnel to ensure education, experience, and training is commensurate with minimum requirements specified. Facility managers are responsible for ensuring that auditable records documenting the required training and qualifications are maintained in accordance with WMH-400, Section 1.5.1.

5.3 QUALITY IMPROVEMENT

Project personnel continually evaluate and improve project activities. The SQAQO ensures that quality improvement in the Project is achieved by identifying and controlling conditions adverse to quality, analyzing trends, reporting and tracking nonconformances, and implementing corrective actions. These quality improvement activities detect and prevent unacceptable quality problems and thereby increase accuracy and reliability, and reduce variability.

A condition adverse to quality is an all-inclusive term used in reference to failures; malfunctions; deficiencies; and nonconforming items, materials, parts, or components, and processes. Project personnel ensure that nonconforming items, materials, parts, or components are adequately identified and segregated from acceptable items and materials to preclude their inadvertent use. The SQAQO, the SPM, facility managers, and facility QA officers have the authority to stop certification, packaging, and transportation activities and/or refuse to accept

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work products or services (e.g., procured items, documentation, packaging, and waste shipments) that do not conform to Project requirements. All Hanford Site employees have the responsibility to stop work that poses a clear and imminent danger to the safety and health of employees, subcontractors, visitors, or the environment. Project personnel report conditions adverse to quality to facility QA officers and/or the SQAQO, who ensure that the condition adverse to quality is investigated and that corrective action is taken as described in this section.

All violations of the WIPP Hazardous Waste Facility Permit must be managed as a significant condition adverse to quality. Project personnel notify CAO of all conditions adverse to quality affecting waste to be shipped to WIPP and forward all CARs related to violations of the WIPP Hazardous Waste Facility Permit to CAO for tracking.

Deficiencies are uncontrolled and unapproved deviations from an approved plan, procedure, or expected result. Deficiencies specific to the Project also include documentation or management practices that do not meet the requirements related to waste certification, packaging, and transportation which are identified in the WAP, TRAMPAC, WIPP-WAC, QAPD, DOE orders, and applicable federal and state regulations. Project personnel are responsible for identifying any condition that affects the Project's compliance with these requirements. Assessments may often identify systems, processes, products, or services that do not meet performance criteria established in planning documents. When deficiencies are found, Project personnel take prompt action to rectify the situation.

Any individual who identifies a condition adverse to quality initiates an NCR or CAR in accordance with WMH-400, Sections 1.3.2 or 1.3.3. If the safety or quality of the certification process could be compromised by continued use of a nonconforming item, the item is taken out of service and tagged or otherwise identified to prevent reuse or acceptance until the nonconformance is corrected. The facility manager of the facility where the nonconformance is identified ensures that an NCR is initiated and that corrective action is taken to resolve the nonconformance. WMH-400, Section 1.3.1, guides the corrective action process.

NCRs and CARs are forwarded to the SQAQO. The SQAQO is responsible for validating and tracking Project-related deficiencies to ensure that corrective action is implemented and that the corrective action resolves the nonconformance. Project personnel notify CAO within 5 calendar days of identification of any nonadministrative nonconformance related to applicable requirements specified in the WIPP Hazardous Waste Facility Permit WAP, which are first identified at the SPM's signature release level. Project personnel submit the NCR to CAO within 30 calendar days of identification of the deficiency. WMH-400, Section 1.3.1, guides the corrective action process. The SQAQO ensures dissemination of information that may prevent problems or help improve parallel processes in other waste generator or Project activities and reevaluates system performance after corrective actions have been implemented. The facility manager provides the resources necessary to accomplish corrective actions.

The SQAQO, facility managers, and facility QA officers are jointly responsible for identifying the following:

- Trends in nonconformances
- Root causes of nonconformances
- Specific, measurable corrective actions to resolve current problems and prevent recurrence

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- Personnel responsible for implementing corrective actions
- Schedules for completing corrective actions.

5.4 DOCUMENTS

Documents that specify quality requirements or establish activities affecting quality are controlled to ensure that accurate and current documents are used. Document control ensures that documents have gone through the designated review and approval process and are distributed to the appropriate personnel.

Project personnel prepare and control documents supporting the quality of the Project in compliance with WMH-400, Section 1.4.1, "TRU Document Control." Document control coordinators ensure that documents are developed as prescribed by current procedures; reviewed for adequacy, correctness, and completeness; approved; revised; and distributed to the appropriate personnel. Documents developed specifically for the Project are distributed through a document control process. These documents include:

- Certification Plan
- QAPjP
- QAPD Procedures Matrix
- Plans and procedures implementing the TRU waste characterization, certification, packaging, and transportation requirements.

5.5 RECORDS

A QA record is an authenticated record that furnishes evidence of the quality of items and/or activities. The minimum lifetime and nonpermanent QA Project records are identified in the QAPjP. QA records are controlled and maintained to certify compliance with requirements and to reflect completed work. QA records are indexed, classified, controlled, and maintained by records management personnel as described in WMH-400, Section 1.5.1.

5.6 WORK PROCESSES

The work processes and items supporting and affecting Project quality are controlled through plans and procedures identified in this Certification Plan, the QAPjP, and the QAPD Procedures Matrix. Procedures and plans are developed, reviewed, approved, revised, and distributed in accordance with WMH-400, Section 1.4.1; WMH-400, Section 2.1.2, "TRU Operating Procedure Preparation and Approval"; and WMH-400, Section 2.1.3, "TRU Administrative Procedure Preparation and Approval." Project technical and QA personnel comply with the applicable technical standards and administrative controls described in procedures, which are reviewed and approved by the SPM (or designee), the SQAQO (or designee), and cognizant facility manager in accordance with WMH-400, Section 2.1.2, and WMH-400, Section 2.1.3, as appropriate. Facility managers ensure personnel perform work following established procedures.

The procedures identified in this Certification Plan, the QAPjP, and the QAPD Procedures Matrix provide the following information:

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- organizational and individual responsibilities
- training and qualification requirements
- technical, regulatory, and QA requirements
- step-by-step instructions for the process (prepared by a subject matter expert of the cognizant organization)
- equipment specifications
- methods and criteria for ensuring and verifying the acceptability of equipment and materials used in the process (e.g., calibration)
- prerequisites, precautions, process parameters, and other limiting conditions
- products of the process
- quantitative and/or qualitative criteria for determining that prescribed process activities have been performed satisfactorily
- records generated by the process
- package and design control of equipment and materials.

The SPM and facility managers ensure that Project activities are controlled and conducted in accordance with WMH-400, Section 2.1.1, "TRU Process Control," and facility-specific procedures that describe and control work processes applicable to TRU waste characterization, certification, packaging, or transportation. If equipment is designed for TRU Project activities, site personnel comply with QAPD design control. Inspection and testing is addressed in Section 5.8.

Each individual performing the work is responsible for ensuring that work processes are controlled and comply with established criteria. Facility managers are responsible for ensuring that workers have the correct procedures, materials, and training to perform quality work. All instructions and procedures are maintained current with a documented and controlled method of revision (see Section 5.4). Instructions, procedures, and drawings are readily available to Project personnel at locations requiring their use.

Fabrication, installation, and inspection processes that have an effect upon the quality of items or services important to safety shall be controlled by process procedures. Special processes controlled under this QA Plan are nondestructive testing (NDA, NDE, and VE), helium leak testing, and limited maintenance of the TRUPACT-II and associated components. These processes are controlled by the following written procedures:

- WRP1-OP-0906, "Gamma Energy Assay Operation"
- WRP1-OP-0905, "Imaging Passive/Active Neutron Assay Operation"
- **ZA-948-385, "Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS)"**
- WRP1-OP-0908, "Operation of the Drum NDE"
- WRP1-OP-0729, "Visual Examination"
- WRP1-OP-0522, "Assemble and Stretch Wrap TRUPACT"
- WRP1-OP-0521, "Receive and Load TRUPACT Containers"
- WRP1-OP-0524, "Helium Leak Test Operation"
- WRP1-OP-1225, "Radiological Support of TRUPACT-II Shipping and Receiving"
- WMH-400, Section 1.2.2, "Qualification of NDA, NDE, VE, and Inspection and Test Personnel"

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5.7 PROCUREMENT

All Hanford Site TRU Project facilities implement procedures to ensure that procurement of items and services important to safety and quality meet requirements and perform as intended. Procurement controls are also applicable to equipment and services that directly affect testing, sampling, and analytical data quality. Project personnel adhere to procurement and recordkeeping practices established in written procedures. The procurement criteria are implemented according to WMH-400, Section 2.3.1, "TRU Procurement Planning," and the procedures specified in the following subsections.

5.7.1 Procurement Document Control

The SPM and facility managers ensure that Project personnel control procurement documents in accordance with WMH-400, Section 2.3.2, "TRU Procurement Document Control." Procurement documents supporting waste management and packaging and transportation activities must include required specifications and acceptance criteria. Procurement documents are reviewed by appropriate organizations and engineering disciplines to ensure that they contain adequate scope of work, technical requirements, supplier QA program requirements, and provisions for acceptance. The procurement document control system is also defined in WMH-400, Section 2.3.2.

5.7.2 Control of Purchased Items and Services

The SPM and facility managers ensure that Project personnel control items and services purchased (including supplier evaluations and inspections) in accordance with WMH-400, Section 2.3.3, "TRU Control of Purchased Items and Services," and WMH-400, Section 2.4.1, "TRU Inspection Control." Documentary evidence that items, material, and equipment conform to the procurement specifications is provided before installation or use of the item, material, and equipment, and is retained in accordance with WMH-400, Section 2.3.2. Potential suppliers of goods and services to the TRU Project will have their own QA program or will comply with applicable TRU Project requirements.

Measures are established in WMH-400, Section 2.1.4, "TRU Handling and Storage," and WMH-400, Section 2.4.1, "TRU Inspection Control" to ensure that materials, parts, and components used for repair work for maintenance purposes or packaging and transportation purposes are adequately identified to preclude the use of incorrect or defective items. Also, where replacement of limited-life items is specified, measures are established to preclude use of items whose shelf life or time in operation has expired (see Section 5.8).

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5.7.3 Control of Subcontractors

Section 5.7.2 also applies to subcontractors who perform work that directly affects the quality of characterization and certification data. WMH-400, Section 2.3.3, describes how Project personnel control subcontractor services. Subcontractors may support TRU Project activities under a "staff augmentation" role or for procurement of products and services. TRU Project staff augmentation subcontractors operate under the umbrella of the TRU Project QA program and are subject to all applicable requirements for TRU Project-related functions they perform. All subcontractors who support the TRU Project will be informed of the need to perform operations in compliance with TRU Project requirements. Subcontractors are required to establish procurement controls and a QA program to ensure that purchased materials, equipment, and services conform to the TRU Project procurement and QA program documents. The controls must include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products on delivery. Subcontractors are subject to periodic assessments and audits at intervals consistent with the importance, complexity, and quantity of the product or services provided to ensure compliance with procurement requirements. Subcontractor personnel must meet applicable Project training and qualification requirements. Subcontractors shall submit copies of all Project-related, quality-affecting documents to the SPM.

5.8 INSPECTION AND TESTING

Equipment is tested, inspected, and maintained in accordance with WMH-400, Section 2.4.1, "TRU Inspection Control"; WMH-400, Section 2.4.2, "TRU Test Control"; and WMH-400, Section 2.4.4, "TRU Control of Measuring, Test, and Data Collection Equipment." Status tagging based on inspections and/or tests done in accordance with WMH-400, Section 2.4.5, "TRU Identification and Control of Items." Project personnel identify and control items (e.g., items with limited shelf or operating lives, materials, equipment, samples) and ensure that only correct and accepted items are used according to WMH-400, Section 2.4.1. These procedures and documents address planning, parameters for evaluation, techniques to be used, qualification of inspection and test personnel, hold points, documentation, acceptance criteria, and organizational responsibilities.

Project personnel routinely test and inspect items and processes and control, calibrate, and maintain equipment to ensure proper operation and data quality. Procedures identified above implement an inspection program that establishes criteria for inspection of activities affecting quality by, or for, the organization performing the activity, and to verify conformance with the requirements for accomplishing the activity. The verification is performed in accordance with written procedures, instructions, or drawings. Personnel performing the inspections are independent from the individuals performing the activity being inspected. Equipment modifications, repairs, and replacement are inspected in accordance with the original design and inspection requirements unless an approved alternative exists. The inspection program also provides for identification and documentation of deficiencies discovered during the inspection. Measures are established to indicate, by the use of markings, tags, stamps, labels, routing cards, or other suitable means, the status of inspections and tests performed. These measures provide for the identification of items that have satisfactorily passed required inspections and tests, where necessary, to preclude inadvertent bypassing of the inspections and tests.

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Measuring and test equipment with the necessary range and accuracy is provided to qualified personnel for the inspection, test, and acceptance of material, parts, components, and systems. Equipment accuracy is ensured by periodic calibration that is traceable to national standards or a documented equivalent basis for calibration.

The test control program is established for items and services important to safety. No testing requiring a test control program relative to waste payload containers or the TRUPACT-II will be performed under this program. All TRUPACT-II repair parts that may be replaced by the operator are supplied by the CAO or a designated contractor and are tested, inspected, accepted, and tagged in accordance with the CAO *TRUPACT-II Operating and Maintenance Instructions* manual prior to delivery to the user. Leak testing is a special process discussed in Section 5.6.

Specific measures to control packaging, shipping, storage, preservation, handling of components, material, and packaging to prevent damage, loss, deterioration, or substitution are established in WRP1-OP-0521, WRP1-OP-0522, WRP1-OP-0524, and WMH-400, Section 2.1.5, "TRU Transportation Logistics." These procedures address the following requirements:

- Transport cask handling and operation shall conform to written handling and operating procedures for each licensed.
- Prior to shipment of a transport cask, conditions of the NRC's certificate of compliance (e.g., specifications, tests, inspections) shall be satisfied. Required shipping papers shall be prepared and shall accompany the shipment.
- Established safety restrictions concerning handling, storage, and shipping shall be included in the handling and operating procedures for transport casks.

5.9 ASSESSMENT REQUIREMENTS

The Hanford Site participates in an assessments program to ensure that the Project is in compliance with applicable requirements. Management assessments are conducted by Hanford Site Project management and independent assessments by site personnel independent of the Project. CAO and external regulatory agencies also conduct assessments of the TRU Project. The SQAQ tracks deficiencies identified during assessments; identifies corrective actions to resolve deficiencies according to WMH-400, Sections 1.3.1, 1.3.2 and 1.3.3; and ensures the resolutions are reported to the SPM, RL, and CAO as described in Section 5.3.

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5.9.1 Management Assessments

Project managers periodically assess the performance of their organization to determine the effectiveness of QA Program provisions that enable the organization to comply with requirements of the WAP, QAPD, WIPP-WAC, TRAMPAC, and applicable procedures and documents. Managers evaluate QA Program effectiveness by focusing on the identification and resolution of both systemic and management issues and problems, and identifying strengths and weaknesses to facilitate actions to improve quality efficiency and cost-effectiveness. The management assessment should include an introspective evaluation to determine whether the entire integrated management system effectively focuses on meeting strategic goals. Management assessments are conducted as described in WMH-400, Section 3.1.1. Project managers are responsible for the conduct of these assessments and report at least annually on relevant findings.

5.9.2 Independent Assessments

Documented independent assessments, also referred to as audits and surveillances, are used to measure item service and quality, process adequacy and effectiveness, and to promote improvement. Independent assessments are conducted in accordance with WMH-400, Section 3.2.1. Project personnel and facilities are subject to periodic independent assessments performed by teams assembled by the SQAQ. The SQAQ ensures that characterization facilities and analytical laboratories are assessed and determines whether the independent assessment is an audit or process surveillance (see below). In addition, facility QA officers may perform independent assessments (audits or surveillances) of Project activities at their facilities. Audit teams include one or more qualified auditors, one of whom must be a certified lead auditor. Audit and surveillance personnel qualifications are addressed in WMH-400, Sections 1.2.1 and 1.2.3, and are in accordance with the QAPD.

The independent assessment team is made up of a team leader appointed by the SQAQ and team members and technical specialists selected by the team leader in conjunction with the SQAQ. The team leader provides indoctrination and supervision of the team, organizes and directs the assessment, establishes the scope of the assessment, prepares a plan for conducting the assessment, and prepares and issues an assessment report to the management of the assessed organization and any affected organizations. The assessment team members and technical specialists prepare the assessment checklist, conduct the assessment, brief the management of the assessed organization on a daily basis, and prepare a draft report for presentation at the exit conference for the assessment. Assessments are performed in accordance with WMH-400, Sections 3.2.1 and 3.2.2.

5.9.3 Audits

Facilities participating in the Project are subject to CAO audits. A CAO audit of the Project is conducted before waste is shipped to WIPP and annually thereafter. These audits are the responsibility of the CAO QA manager, who coordinates these audits through the SPM and SQAQ.

The TRU Project also participates in an internal audits and surveillance program. The SQAQ ensures that all conditions adverse to quality are resolved and that **appropriate corrective actions are implemented** in a timely manner. The SQAQ develops a schedule, **in association with**

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Project facility managers, that details follow-up activities and final resolution of all corrective actions. The SQAQO tracks corrective actions to completion and monitors the status of the corrective actions to ensure timely closure of deficient conditions.

5.9.4 Surveillances

The Surveillance Program is conducted primarily to monitor work in progress and to follow up on corrective actions. Surveillance results are reported and monitored similar to other assessment activities. Surveillances are performed in accordance with WMH-400, Section 3.2.2, "TRU Surveillance Program."

5.9.5 Reports to Management

The SQAQO provides the QA interface between facilities and the SPM. The SQAQO oversees the NCR/CAR process for Project-related deficiencies and coordinates with facility managers to track nonconformances and verify corrective action completion according to WMH-400, Sections 1.3.2 and 1.3.3. Facility QA officers report the results of their independent assessments to the SQAQO, and together they track assessment results and corrective actions. The SQAQO reports these independent assessment results to the SPM in accordance with WMH-400, Section 3.1.2, "Quality Assurance Reports to Management." Also, the SQAQO prepares and transmits a semiannual QA report to the SPM and the DOE. The semiannual QA report includes the following information, as appropriate:

- Any QAPjP changes
- Identification of any significant QA/QC problems, recommended solutions, and corrective actions
- An assessment of QC data collected during the period, including the frequency of repeated analyses, reasons they were repeated, and corrective actions
- Discussions of whether QAOs have been met and any resulting impact on decision making
- Limitations on the use of measurement data
- Status of PDP sample results
- Results of audits, assessments, and surveillances conducted during the period.

5.9.6 Performance Demonstration Program

The Hanford Site TRU Project facilities participate in the Performance Demonstration Program (PDP) as summarized in the QAPjP. PDP samples are processed according to the facility procedures applicable to the specific testing or analytical characterization activity being assessed.

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5.10 SAMPLE CONTROL REQUIREMENTS

Project personnel use procedures to ensure proper documentation and tracking of sample possession from the time of collection/identification, through handling, preservation, shipment, transfer, analysis, storage, and final disposition. Sample control procedures used by Project personnel are described in WMH-400, Section 7.1.7, "Transuranic Waste Sample and Waste Container Management Activities." Project personnel ship samples in compliance with DOT regulations and Project QA requirements.

5.11 SCIENTIFIC INVESTIGATION REQUIREMENTS

The plans and procedures developed and implemented to support the Project define, control, verify, and document data collection activities related to TRU waste management.

5.12 SOFTWARE REQUIREMENTS

Computer software and hardware/software configurations used in Project activities are developed, documented, verified, validated, and tested prior to use in compliance with requirements contained in the QAPD, QAPjP, and NQA-1, Subpart 2.7, "Quality Assurance Requirements of Computer Software for Nuclear Facility Applications" (ASME 1989). WMH-400, Section 6.1.1, describes the processes for computer software development, validation, and verification.

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6.0 REFERENCES

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- 40 CFR Part 194, "Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 "Disposal Regulations," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.
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APPENDIX A

SUMMARY OF CH TRU WASTE ACCEPTANCE CRITERIA,
REQUIREMENTS, AND COMPLIANCE AND VERIFICATION
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WPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
<i>Container Properties Criteria and Requirements</i>				
3.2.1	2.1 (4.1.1)	<ul style="list-style-type: none"> • Payload Container description 	<ul style="list-style-type: none"> • DOT Type A (or equivalent) 55-gal. drums, pipe overpacks, SWBs, and TDOPs • Maximum number of containers and authorized packaging configurations shown in Table 3-1 	TRU Control of Purchased Items and Services (WMH-400, Section 2.3.3) TRU Procurement Document Control (WMH-400, Section 2.3.2) Transuranic Waste Sample and Waste Container Management Activities (WMH-400, Section 7.1.7) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Receive and Load TRUPACT Containers (WRP1-OP-0521)
3.2.2	2.3 (4.1.3)	<ul style="list-style-type: none"> • Container/assembly weight and center of gravity • ≤ 1000 lbs/55-gal. drum • \leq certified weight. Limits for Type A equivalent drums • ≤ 4000 lbs/SWB • $\leq 6,7000$ lbs/TDOP • \leq TRUPACT-II configuration limits shown in Table 3-2 		Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Move Waste Drums Throughout the WRAP Facility (WRP1-OP-0503)
3.2.3	NA	<ul style="list-style-type: none"> • Removable surface contamination • ≤ 20 disintegrations per minute (dpm)/100 cm² alpha • ≤ 200 dpm/100 cm² beta/gamma • $\leq 1,000$ dpm per 100 cm² beta/gamma if meets requirements of 10 CFR 835 		Radiological Support of TRUPACT-II Shipping and Receiving (WRP1-OP-1225) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)
3.2.4	2.4 (4.1.4)	<ul style="list-style-type: none"> • Container identification / labeling • Bar code with unique CIN and site identification • Shipping category 		Transuranic Waste Sample and Waste Container Management Activities (WMH-400, Section 7.1.7) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)

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WPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.2.5	2.2 (4.1.2)	Dunnage	<ul style="list-style-type: none"> Empty 55-gal. drums Empty SWBs 	Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Assemble and Stretch Wrap TRUPACT Payload (WRP1-OP-0522) Receive and Load TRUPACT Containers (WRP1-OP-0521)
3.2.6	2.5 (4.1.5)	Filter vents	<ul style="list-style-type: none"> Payload containers vented with filters that meet WAP and TRUPACT-II SARP specifications 	TRU Control of Purchased Items and Services (WMH-400, Section 2.3.3) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Obtain Headspace Gas Samples of TRU Waste Containers (DO-080-009)
<i>Physical Properties Criteria and Requirements</i>				
3.4.1	2.6 (4.1.6)	Liquids	<ul style="list-style-type: none"> <1 in. (2.5 cm) in the bottom of any container <1 volume percent in any payload container 	AK Documentation Management (WMH-400, Section 7.1.9) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Waste Certification - Operation of the Drum Nondestructive Examination System (WRP1-OP-0908) TRU Waste Certification - Operation of the Box Nondestructive Examination System (WRP1-OP-0909) TRU Waste Certification - Glovebox Waste Sampling (WRP1-OP-0710) TRU Waste Certification - TRU Sorting Glovebox Operation (WRP1-OP-0725) Pipe-and-Go Operations (ZO-160-080)

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.4.2	2.8 (4.1.8)	Sealed containers	<ul style="list-style-type: none"> Sealed containers >4 L prohibited (except for waste material Type II.2 packaged in a metal container) 	AK Documentation Management (WMH-400, Section 7.1.9) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Waste Certification - Operation of the Drum Nondestructive Examination System (WRP1-OP-0908) TRU Waste Certification - Operation of the Box Nondestructive Examination System (WRP1-OP-0909) TRU Waste Certification - Glovebox Waste Sampling (WRP1-OP-0710) TRU Waste Certification - TRU Sorting Glovebox Operation (WRP1-OP-0725) Pipe-and-Go Operations (ZO-160-080)
<i>Radiological Properties Criteria and Requirements</i>				
3.3.2	3.1 (4.2.1)	Fissile material quantity (Plutonium- 239 fissile gram equivalent [FGE])	<ul style="list-style-type: none"> ≤200 g/55-gal. drum (including pipe overpacks) ≤325 g/SWB or TDOP ≤325 g/TRUPACT-II ≤2,800 g/TRUPACT-II (14 pipe overpacks) 	TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation (WRP1-OP-0905) TRU Waste Certification - Gamma Energy Assay Operations (WRP1-OP-0906) Calculation of Assay Results (WMP-350, Section 2.2) TRU Software Quality Assurance (WMH-400, Section 6.1.1) Data Management for NDE/NDA Results (WMP-350, Section 2.3) Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS) (ZA-948-385) SAS Energy and Efficiency Setup and Baseline Determination (ZA-400-301) Calculation of Assay Results (ZA-400-302) Quality Assurance Objectives for Nondestructive Assay at

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.3.1	3.1 (4.2.1)	Radionuclide Composition	<ul style="list-style-type: none"> Assay measurements Quantification of : ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs 	<p>PFP (FSP-PFP-5-8, Section 16.1) Data Management for NDA Results (FSP-PFP-5-8, Section 16.2)</p> <p>Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation (WRP1-OP-0905) TRU Waste Certification - Gamma Energy Assay Operations (WRP1-OP-0906) Calculation of Assay Results (WMP 350, Section 2.2)</p> <p>Data Management for NDE/NDA Results (WMP-350, Section 2.3) Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS) (ZA-948-385) SAS Energy and Efficiency Setup and Baseline Determination (ZA-400-301) Calculation of Assay Results (ZA-400-302) Quality Assurance Objectives for Nondestructive Assay at PFP (FSP-PFP-5-8, Section 16.1) Data Management for NDA Results (FSP-PFP-5-8, Section 16.2)</p> <p>Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Software Quality Assurance (WMH-400, Section 6.1.1) TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation (WRP1-OP-0905) TRU Waste Certification - Gamma Energy Assay Operations (WRP1-OP-0906) Calculation of Assay Results (WMP-350, Section 2.2)</p>
3.3.4	NA	^{239}Pu equivalent activity (^{239}Pu equivalent-curies [PE-Ci])	<p>Untreated Waste</p> <ul style="list-style-type: none"> ≤ 80 PE-Ci/55-gal. Drum ≤ 130 PE-Ci/SWB ≤ 1100 PE-Ci/55-gal. drum overpacked 	

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
			in SWB or TDOP Solidified/Vitrified Waste	TRU Software Quality Assurance (WMH-400, Section 6.1.1) Data Management for NDE/NDA Results (WMP-350, Section 2.3)
			<ul style="list-style-type: none"> • ≤ 1800 PE-Ci/55-gal. drum (including a drum containing a pipe component) 	Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS) (ZA-948-385) SAS Energy and Efficiency Setup and Baseline Determination (ZA-400-301) Calculation of Assay Results (ZA-400-302) Quality Assurance Objectives for Nondestructive Assay at PFP (FSP-PFP-5-8, Section 16.1) Data Management for NDA Results (FSP-PFP-5-8, Section 16.2)
				Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)
3.3.5	3.2 (4.2.2)	Radiation dose rate	<ul style="list-style-type: none"> • ≤ 200 mrem/hr (at surface for payload containers and TRUPACT-II) • ≤ 10 mrem/hr at 2 meters 	Radiological Support of TRUPACT-II Shipping and Receiving (WRP1-OP-1225) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Receive and Load TRUPACT Containers (WRP1-OP-0521) Transuranic Waste Repackaging Visual Examination and Sampling (WMH-400, Section 7.1.3)
3.3.3	NA	TRU alpha activity	<ul style="list-style-type: none"> • > 100 nCi of alpha-emitting TRU isotopes per gram of waste matrix 	TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation (WRP1-OP-0905) TRU Waste Certification - Gamma Energy Assay Operations (WRP1-OP-0906) Calculation of Assay Results (WMP-350, Section 2.2) Data Management for NDE/NDA Results (WMP-350, Section 2.3) Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS) (ZA-948-385)

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
				<p>SAS Energy and Efficiency Setup and Baseline Determination (ZA-400-301)</p> <p>Calculation of Assay Results (ZA-400-302)</p> <p>Quality Assurance Objectives for Nondestructive Assay at PFP (FSP-PFP-5-8, Section 16.1)</p> <p>Data Management for NDA Results (FSP-PFP-5-8, Section 16.2)</p> <p>Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)</p> <p>TRU Software Quality Assurance (WMH-400, Section 6.1.1)</p>
<i>Chemical Properties Criteria and Requirements</i>				
3.5.1	4.1 (4.3.1)	<ul style="list-style-type: none"> Pyrophoric materials • <1 weight percent radionuclide pyrophorics • No nonradionuclide pyrophorics 	<ul style="list-style-type: none"> Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) 	
3.5.2	NA	<ul style="list-style-type: none"> Hazardous wastes • Characterization per QAPjP (as defined in WAP) • Limited to EPA hazardous waste numbers listed in Table 3-4 	<ul style="list-style-type: none"> Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) TRU Transportation Logistics (WMH-400, Section 2.1.5) Determination of Volatile Organic Compounds in TRU Waste Container Headspace (LA-523-410) Determination of Total Nonmethane Organic Compounds in TRU Waste Container Headspace (LA-523-425) Volatile Sample Analysis by SSW-846 (LA-523-455) Semivolatile Sample Analysis by SW-846, Method 8270B1 (LA-523-456) 	

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
				Mercury Analysis by Cold Vapor Atomic Absorption (LA-325-104)
				Acid Digestion of Solid and Liquid Samples for Graphite Furnace Atomic Absorption Analysis (GFAA) (LA-505-100)
				Metal Analysis by Graphite Furnace Atomic Absorption (GFAA) using the Perkin-Elmer 5100 PC (LA-505-102)
				Acid Digestion/Dilution of Aqueous Samples and Extracts (LA-505-158)
				Acid Digestion of Sediments, Sludges, and Soils for Inductively Coupled Plasma (ICP) and Atomic Absorption (AA) Analysis (LA-505-159)
				Inductively Coupled Plasma (ICP) Emission Spectrometric Method for the Applied Research Laboratories (LA-505-151)
				Inductively Coupled Plasma (ICP) Emission Spectrometric Method for Jarrel Ash Type 61E (LA-505-161)
				Determination of Trace Elements and Radionuclides by Inductively Coupled Plasma-Mass Spectrometry using TJA Pions (LA-506-101)
				ACE Program Implementation and Operation of Spreadsheet Interface (WMH-310, Section 9.1)
				Polychlorinated Biphenyls (PCBs) by Gas Chromatography (LA-523-427)
				WIPP Waste Information System Data Entry and Reporting (WMH-400, Section 7.1.5)
				Data Management for WIPP Headspace Gas Samples (WMH-400, Section 8.1.8)
				Transuranic Waste Characterization Data Quality Objectives Reconciliation and Reporting (WMH-400, Section 7.1.1)
				Transuranic Waste Transportation and Disposal Certification

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.5.3	4.4 (4.3.4)	Chemical compatibility	All chemicals must be allowable per the TRAMPAC	(WMH-400, Section 7.1.8) Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)
3.5.4	4.2 (4.3.2)	Explosives, corrosives, and compressed gases	<ul style="list-style-type: none"> No explosives, compressed gases, or pressurized containers No ignitable, reactive, or corrosive wastes 	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) TRU Waste Certification - Operation of the Drum NDE System (WRP1-OP-0908) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) TRU Waste Certification - TRU Sorting Glovebox Operation (WRP1-OP-0725) Pipe-and-Go Operations (ZO-160-080) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)
3.5.6	NA	PCB concentration	• <50 ppm	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Polychlorinated Biphenyls (PCBs) by Gas Chromatography (LA-523-427)
3.5.7	N/A	Asbestos	• Sites shall identify wastes containing asbestos	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8)

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
<i>Gas Generation Properties Criteria and Requirements</i>				
3.6.2	5.2 (4.4.2)	Decay heat	<ul style="list-style-type: none"> • \leq Decay heat limit for the authorized shipping category • ≤ 40 W per TRUPACT-II 	TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation (WRP1-OP-0905) TRU Waste Certification - Gamma Energy Assay Operations (WRP1-OP-0906) Calculation of Assay Results (WMP-350, Section 2.2) Data Management for NDE/NDA Results (WMP-350, Section 2.3) Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS) (ZA-948-385) SAS Energy and Efficiency Setup and Baseline Determination (ZA-400-301) Calculation of Assay Results (ZA-400-302) Data Management for NDA Results (FSP-PFP-5-8, Section 16.2)
3.6.3	5.3 (4.4.3)	Test category waste	Steady-state hydrogen gas generation release rate is less than or equal to the rate specified in the TRAMPAC	Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Software Quality Assurance (WMH-400, Section 6.1.1)
3.6.4	5.4 (4.4.4)	Flammable VOCs	• ≤ 500 ppm in container headspace	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Obtain Headspace Gas Samples of TRU Waste Containers (DO-080-009) Determination of Volatile Organic Compounds in TRU Waste Container Headspace (LA-523-510)

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.5.5	4.3, 4.5 (4.3.3, 4.4.4)	Headspace has VOC • concentration	Every container will be headspace gas sampled per the QAPJP as defined in the WAP	Volatile Organics by Gas Chromatography/Mass Spectrometry Using SW-846 (LA-523-134) WIPP Waste Information System and Reporting (WMH-400, Section 7.1.5) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Data Management for WIPP Headspace Gas Samples (WMH-400, Section 8.1.8)
3.6.5	5.5 (4.4.5)	Venting and aspiration	• \geq Times shown in TRUCON tables • Options for determining aspiration time based on date of drum closure	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Obtain Headspace Gas Samples of TRU Waste Containers (DO-080-009) Determination of Volatile Organic Compounds in TRU Waste Container Headspace (LA-523-510) Volatile Organics by Gas Chromatography/Mass Spectrometry Using SW-846 (LA-523-134) Mercury Analysis by Cold Vapor Atomic Absorption (LA-325-104) WIPP Waste Information System and Reporting (WMH-400, Section 7.1.5) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) Data Management for WIPP Headspace Gas Samples (WMH-400, Section 8.1.8) Sampling Design and Data Analysis for RCRA Characterization and Visual Examination of Retrievably Stored Transuranic Waste (WMH-400, Section 7.1.4) Transuranic Waste Transportation and Disposal Certification

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WIPP-WAC and Certification Plan Section	TRAMPAC (and Certification Plan Section, if applicable)	Criteria	Requirements	Compliance and Verification Procedures
3.6.1	5.1 (4.4.1)	Payload shipping category <ul style="list-style-type: none"> Approved content codes listed in TRUCON tables Assigned shipping category Same shipping category or same waste type in a single TRUPACT-II 	(WMH-400, Section 7.1.8) TRU Waste Container and Sample Management Activities (WMH-400, Section 7.1.7)	Acceptable Knowledge Documentation Management (WMH-400, Section 7.1.9) TRU Waste Certification - Operation of the Drum Nondestructive Examination System (WRP1-OP-0908) Transuranic Waste Repackaging, Visual Examination, and Sampling (WMH-400, Section 7.1.3) Transuranic Waste Transportation and Disposal Certification (WMH-400, Section 7.1.8) TRU Waste Certification - TRU Sorting Glovebox Operation (WRP1-OP-0725) Pipe-and-Go Operations (ZO-160-080) Receive and Load TRUPACT Containers (WRP1-OP-0521)
3.7.1	6.0 (4.6)	Shipping data	<i>Data Packages Criteria and Requirements</i> <ul style="list-style-type: none"> <i>Payload Container Transportation Certification Document</i> <i>Payload Assembly Transportation Certification Document</i> <i>Bill of lading^b</i> <i>Land disposal restriction notification^a</i> 	TRU Transportation Logistics (WMH-400, Section 2.1.5) Receive and Load TRUPACT Containers (WRP1-OP-0521)

^a Applies to mixed wastes only.^b A Uniform Hazardous Waste Manifest may be substituted

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APPENDIX B

**PAYLOAD CONTAINER TRANSPORTATION CERTIFICATION DOCUMENT:
ANALYTICAL PAYLOAD SHIPPING CATEGORY**

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

TRUPACT-II PAYLOAD CONTAINER TRANSPORTATION CERTIFICATION DOCUMENT (PCTCD)
(ANALYTICAL PAYLOAD SHIPPING CATEGORY)

IDENTIFICATION PARAMETERS			
Container ID No.: _____		Container Bar Code No.: _____	
Shipping Category: _____		Content Code: _____	
<input type="checkbox"/> SWB <input type="checkbox"/> DRUM <input type="checkbox"/> TDOP <input type="checkbox"/> PIPE OVERPACK		Decay Heat Limit: _____	
Weight Limit: _____		Certification Site: _____	
		Fissile Mass Limit: _____	
WIPP-WAC/TRAMPAC TRANSPORTATION PARAMETERS			
Parameter	Initials	Filter(s) Identification	
Free liquids are \leq 1% of container volume	_____	1. _____	2. _____
Nonradionuclide pyrophorics are not present		3. _____	4. _____
Explosives are not present		5. _____	6. _____
Corrosives are not present		7. _____	8. _____
Pressurized containers are not present		9. _____	10. _____
Sealed containers > 4 liters are not present			
Drum liner (if present) is punctured/filtered			
Flammable VOCs are \leq 500 ppm			
Radiation dose rates (mrem/hr): Contact _____			
MEASURED PARAMETERS		RETRIEVABLY STORED WASTE PARAMETERS ONLY	
Container Parameter	Value	Error	Aspiration Method: <input type="checkbox"/> Option 1 <input type="checkbox"/> Option 2 <input type="checkbox"/> Option 3
Weight			Container closed time: _____ (Option 1 only)
Decay Heat			Headspace H ₂ Concentration: _____ (Option 2 or 3)
Fissile Mass (FGE)			Aspiration Period (if applicable): _____
Weight (plus Error): _____			Aspiration Table (if applicable): _____
Decay Heat (plus Error): _____			Time container vented: _____
Fissile Mass (plus two times the Error): _____			

I certify that the above container meets all the requirements for shipment as stated in Appendix 1.3.7 of the *Safety Analysis Report for the TRUPACT-II Shipping Package* (current revision). The container is approved for shipment.

Transportation Certification Official Print/Sign _____

Date _____

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

APPENDIX C

**PAYLOAD CONTAINER TRANSPORTATION CERTIFICATION
DOCUMENT: TEST PAYLOAD SHIPPING CATEGORY**

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

TRUPACT-II PAYLOAD CONTAINER TRANSPORTATION CERTIFICATION DOCUMENT
(PCTCD) (TEST PAYLOAD SHIPPING CATEGORY)

IDENTIFICATION PARAMETERS			
Container ID No.: _____		Container Bar Code No.: _____	
Shipping Category: _____		Content Code: _____	
<input type="checkbox"/> SWB <input type="checkbox"/> DRUM <input type="checkbox"/> TDOP <input type="checkbox"/> PIPE OVERPACK		Certification Site: _____	
Weight Limit: _____		Fissile Mass Limit: _____	
WIPP-WAC/TRAMPAC TRANSPORTATION PARAMETERS			
Parameter	Initials	Filter(s) Identification	
Free liquids are \leq 1% of container volume	<div style="border: 1px solid black; width: 40px; height: 100px; margin: 0 auto;"></div>	1. _____	2. _____
Nonradionuclide pyrophorics are not present		3. _____	4. _____
Explosives are not present		5. _____	6. _____
Corrosives are not present		7. _____	8. _____
Pressurized containers are not present		9. _____	10. _____
Sealed containers > 4 liters are not present			
Drum Liner (if present) is punctured/filtered			
Flammable VOCs are \leq 500 ppm			
Radiation dose rates (mrem/hr): Contact _____			
MEASURED PARAMETERS		TEST CRITERIA	
Container Parameter	Value	Error	Parameter Limit / Measurement
Weight			Total Gas Gen. Rate _____ / _____
Decay Heat			H ₂ Gen. Rate _____ / _____
Fissile Mass (FGE)			Flam. VOC Conc. _____ / _____
Weight (plus Error): _____			Date Test Completed: _____
Decay Heat (plus Error): _____			
Fissile Mass (plus two times the Error): _____			

I certify that the above container meets all the requirements for shipment as stated in Appendix 1.3.7 of the *Safety Analysis Report for the TRUPACT-II Shipping Package* (current revision). The container is approved for shipment.

Transportation Certification Official Print/Sign

Date

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APPENDIX D
PAYLOAD ASSEMBLY TRANSPORTATION CERTIFICATION DOCUMENT

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TRUPACT-II PAYLOAD ASSEMBLY TRANSPORTATION CERTIFICATION DOCUMENT (PATCD)

IDENTIFICATION PARAMETERS						
Shipment No.: _____		TRUPACT-II OCA Body/Lid Nos.: _____ / _____				
Governing						
Payload Shipping Category: _____		TRUPACT-II Decay Heat Limit: 40 watts				
Type of Payload:	SWBs	DRUMS	TDOP	PIPE OVERPACKS		
Date ICV Closed: _____						
BOTTOM PAYLOAD ASSEMBLY COMPOSITION						
Container ID Number	Weight (lb)	Error (lb)	Decay Heat (W)	Error (W)	Fissile Mass (FGE)	Error (FGE)
Subtotal (A)						
Subtotal RMS Error ^a (C)						
TOP PAYLOAD ASSEMBLY COMPOSITION						
Container ID Number	Weight (lb)	Error (lb)	Decay Heat (W)	Error (W)	Fissile Mass (FGE)	Error (FGE)
Subtotal (B)						
Subtotal RMS Error ^a (D)						
Total RMS Error ^b						

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PAYLOAD TOTALS		
Weight of pallets, reinforcing plates, slip sheets, guide tubes, banding material, etc. (E) _____		
Total (A+B+E) Weight: _____	Total RMS Weight Error: _____	
Total (A+B) Decay Heat: _____	Total RMS Decay Heat Error: _____	
Total (A+B) Fissile Mass: _____	Total RMS Fissile Mass Error X 2: _____	
PAYLOAD CERTIFICATION PARAMETERS		
Bottom assembly weight plus subtotal RMS error (A+C) (lbs.): _____		
Top assembly weight plus subtotal RMS error (B+D) (lbs): _____		
Total weight plus RMS error ^c : _____ Fissile mass (FGE) plus 2X error: _____		
Decay heat plus error (watts) : _____		
TRUPACT-II Dose rates (mrem/hr): contact _____ @ 2 m _____ in cab _____		
Bottom weight \geq top weight _____		Total weight plus error \leq 7,265 lbs. ^d _____
Decay heat plus error \leq category limit _____		Fissile mass (FGE) plus 2X error \leq limit ^e _____
I certify that the above payload meets all the requirements for shipment as stated in Appendix 1.3.7 of the <i>Safety Analysis Report for the TRUPACT-II Shipping Package</i> (current revision). The container is approved for shipment.		
_____ Transportation Certification Official Print/Sign		_____ Date
<p>^a Error = root mean square error (square root of the sum of the squares of the individual errors)</p> <p>^b Total RMS error for the entire payload (Top and Bottom)</p> <p>^c Total weight error may be determined by weighing entire payload assembly.</p> <p>^d Total weight may be determined by one of the following methods: (1) sum of 14 individual drums plus error; (2) sum of two seven-packs or two SWBs plus error; or (3) single measurement of a total payload of 14 drums, two SWBs or one TDOP plus error.</p> <p>^e If the payload shipping category is a pipe overpack, the total Pu-239 FGE limit is 2,800 grams/TRUPACT-II. The total PU-239 FGE limit for all other payload shipping categories is 325 grams/TRUPACT-II.</p>		

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APPENDIX E
NONDESTRUCTIVE ASSAY

HANFORD SITE TRANSURANIC WASTE CERTIFICATION PLAN

NONDESTRUCTIVE ASSAY

E.1 INTRODUCTION

Radioassay techniques are used to determine the radionuclide content of waste. Radioassay methods include both nondestructive and destructive techniques. The term "radioassay" includes all types of assay techniques. Nondestructive assay (NDA) refers only to nonintrusive assay techniques. The WIPP-WAC identifies typical methods, QAOs, methods requirements, and applicable QA/QC requirements for NDA. This appendix describes the Hanford Site TRU Project process for TRU waste characterization and certification using NDA.

Project personnel use NDA to demonstrate compliance with the radiological requirements for contact-handled (CH) Transuranic (TRU) waste. NDA personnel perform measurements on each waste container using a gamma energy assay (GEA) system supplemented by an imaging passive/active neutron (IPAN) system, if necessary, to acquire radionuclide data to demonstrate compliance with the following radiological properties criteria and requirements:

- Identification and quantification of the following radionuclides: ^{241}Am , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{242}Pu , ^{233}U , ^{234}U , ^{238}U , ^{90}Sr , and ^{137}Cs , for purposes of tracking the Waste Isolation Pilot Plant (WIPP) emplacement inventory curie content. (Trace radionuclides [i.e., less than 5 percent of the total activity] need not be estimated, so long as 95 percent of the total container radioactivity is accounted for.)
- Activity concentration of TRU radionuclides (in nanocuries/gram [nCi/g]) present in every waste container to demonstrate that the waste meets the definition for TRU waste. Determination of LLW versus TRU waste is based on the nominal assay value without considering measurement error.
- Values for total alpha radioactivity and activities of individual radioisotopes for individual containers to determine FGEs, PE-Ci, and decay heat.

Facility-specific procedures listed at the end of this appendix describe the NDA processes and implementation of the requirements specified in Appendix A of the WIPP Waste Acceptance Criteria (WAC).

E.2 QUALITY ASSURANCE OBJECTIVES AND DATA QUALITY OBJECTIVES

Quality Assurance Objectives

NDA quality assurance objectives (QAOs) include precision, accuracy, minimum detectable concentration (MDC), and total uncertainty. Table A-1 summarizes the QAOs for precision and accuracy. The methods used for demonstrating compliance with the QAOs, as described in WRP1-OP-0905, "Imaging Passive/Active Neutron Assay Operations," WRP1-OP-0906, "Gamma Energy Assay Operations," WMP-350, Section 2.2, "Calculation of Assay Results," and WMP-350, Section 2.4, "Quality Assurance Objectives for Nondestructive Assay at WRAP," ZA-948-385, "Non-Destructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS)," ZA-400-301, "SAS Energy and Efficiency Setup and Baseline Determination," ZA-400-302, "Calculation of Assay Results," FSP-PTP-5-3, Section 16.1,

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“Quality Assurance Objectives for Nondestructive Assay at PFP,” and Section 16.2, “Data Management for NDA Results,” comply with the minimum QAOs established in the WIPP-WAC. To demonstrate compliance with the QAOs, NDA personnel perform the following:

1. Determine precision through replicate processing of a waste container containing known quantities of plutonium (Pu) sources in accordance with the nominal activity compliance points specified in Table E-1.
2. Determine accuracy through replicate processing of a waste container containing known quantities of Pu sources in accordance with the nominal activity compliance points specified in Table E-1. Accuracy is calculated from the ratio of the mean measured estimate to the known value for an accepted verification standard. Verification standards are used to test the validity of a calibration independently of the original calibration standards. Calibration standards are those used to determine the response characteristics of a measurement system. Whenever possible, both radioactive calibration and verification standards shall be obtained from NIST, the New Brunswick Laboratory, or from suppliers maintaining measurement systems traceable to NIST. Evidence of such traceability and certificates for individual standards shall be obtained from the standards suppliers.
3. Determine MDC from replicate processing of calibration waste containers with no radioactive sources added. The MDC is determined using calculations that set the risk for concluding falsely that activity is present above the critical level (α) and the predetermined degree of confidence for correctly detecting its presence above the critical level ($1-\beta$) at 5 percent and 95 percent, respectively. Wastes can only be sent to WIPP when the measured value of a waste container is greater than 100 nCi/g and when the measured value is greater than the MDC. To determine the MDC for the actual waste drums, the detection limit may need to be adjusted to account for interferences from different matrix conditions or radiation backgrounds that occur in the waste drums.
4. Determine total measurement uncertainty (TMU) for the assay measurement process on a waste form basis, and document the evaluation for review by an expert review team. TMU is determined in accordance with Section E-7 of this appendix.

Data quality objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that clarify Project technical and QAOs, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. The DQOs established for radioassay are summarized below:

- Determine total bias as part of the determination of total uncertainty, and document the evaluation for review by an expert review team.

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- Demonstrate completeness by obtaining acceptable NDA data for 100 percent of the waste containers characterized for disposal.
- To classify waste by activity as low-level waste (LLW) versus TRU waste by demonstrating that the total TRU activity is less than or equal to 100 nCi/g of waste. Only measured values greater than the MDC are valid for TRU waste determinations. Wastes can only be sent to WIPP when the measured TRU alpha activity concentration in the waste container is greater than 100 nCi/g and when the measured value is greater than the MDC. Effectively this means that instruments performing TRU/LLW discrimination measurements must have an MDC of 100 nCi/g or less.
- To identify and confirm the activities of each radionuclide of concern. The radionuclide inventory is established in 40 CFR Part 194.

E.3 METHODS REQUIREMENTS

The WIPP-WAC provides that any radioassay method may be used to assay TRU waste if it is demonstrated that the method meets the requirements of the applicable QAOs and the TRAMPAC, Attachment 3.0.

NDA personnel at WRAP assay all waste containers using a GEA system in accordance with WRP1-OP-0906. At PFP, NDA personnel assay all storage containers (that will eventually be packaged into waste containers) in accordance with ZA-948-385. The GEA methods are performed in accordance with ASTM C 1030-95. The GEA system establishes radionuclide ratios relative to a radionuclide whose mass is directly determined. The assay process utilizes GEA data to determine the radioactive material composition, quantify radionuclide masses, and compute associated derived quantities. When necessary (e.g., waste containers with low fissile gram quantities), waste containers are also assayed using an IPAN system in accordance with WRP1-OP-0905. When both systems are used, the results from both assays are evaluated to determine the best result for data reporting. Data generated from these assays are reported in the semiannual quality assurance (QA) report in accordance with WMH-400, Section 3.1.2, "Quality Assurance Reports to Management."

NDA personnel demonstrate and document the performance of software associated with NDA in accordance with the QAPD, ASME *Quality Assurance Program Requirements for Nuclear Facilities* (NQA-1) (ASME 1989), Element 11, Supplement IIS-2; and NQA-2a, Part 2.7, and ANSI 1987, "Standards for Software Documentation." They ensure that software testing covers the full range of expected system application.

NDA personnel also ensure that the methods and systems used for NDA meet the QAOs listed in Table E-1 for the applicable ranges in which they operate. The WRP1-OP-0905, WRP1-OP-0906, and ZA-948-385 procedures detail all aspects of NDA operation. These procedures instruct operators to perform all necessary background and performance checks before and after performing any waste container assays. NDA personnel check performance check data against predetermined acceptance criteria as documented in the procedures. They initiate corrective action if any acceptance criteria are not met. They document and justify the

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disposition and use of any assays performed during a period ending with a suspect performance check.

The isotopic ratios used for radioassay may be established by acceptable knowledge (AK) data when adequate data exist to support the isotopic information. For retrieved waste or new waste streams where isotopic ratios are not known, assay measurements may be used to confirm or establish isotopic ratios.

Table E-1. Quality Assurance Objectives for Nondestructive Assay

Range of waste activity in α -Curies ^a	Nominal Compliance Point		Accuracy ^d (%R)
	α -Curies ^a (g WG Pu) ^b	Precision ^c (%RSD)	
0 to 0.02	0.008 (0.1)	≤ 20	70-130
>0.02 to 0.2	0.08 (1.0)	≤ 15	70-130
>0.2 to 2.0	0.8 (10)	≤ 10	70-130
>2.0	12.8 (160)	≤ 5	70-130

^a Applicable range of TRU activity in a waste container to which the QAOs apply, units are Curies of alpha-emitting TRU isotopes with half-lives greater than 20 years.

^b The nominal activity (or weight of Pu) in a waste container used to demonstrate that QAOs can be achieved for the corresponding range in column 1, values in parentheses are the approximate equivalent weights of WG Pu, 15 years after purification; for purposes of demonstrating QAOs, "nominal" means within ± 50 percent, except for the highest range, where "nominal" means ± 25 percent.

^c \pm One standard deviation based on 15 replicate measurements of a noninterfering matrix. The calculated standard deviation is compared to the mean measured value of the QAO source to obtain the %RSD.

^d Ratio of measured to known values based on the average of 15 replicate measurements of a noninterfering matrix.

%R = percent recovery
 %RSD = percent relative standard deviation
 QAO = quality assurance objective
 TRU = transuranic
 WG Pu = weapons grade plutonium

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NDA procedures require the use of proper calibration standards, proper equipment and equipment setup, avoidance of practices known to result in inaccurate assays, attention to proper record keeping and equipment maintenance, and safe operation of equipment. These procedures contain all necessary instructions for the operation of computerized data acquisition systems. Instructions include explanations of required input, options, and prohibitions for operators when exercising any interactive portions of the software. NDA procedures have been internally demonstrated in the NDA facility with documented performance characteristics that meet the QAOs listed in Table E-1 for the waste activity ranges in which the systems are operated.

NDA personnel demonstrate acceptable performance through participation in the NDA performance demonstration program (PDP), as applicable, between the Hanford Site and NDA facilities at other DOE sites. Results of the NDA PDP are reported to CAO for evaluation.

E.4 QUALITY CONTROL

NDA personnel implement a documented QA program as described in the facility NDA procedures. This QA program specifies qualitative and quantitative acceptance criteria for QC checks and the corrective action necessary when acceptance criteria are not met. The facility QA officer is responsible for monitoring and documenting procedure performance, including analyzing QC samples. NDA personnel initiate and resolve a nonconformance report (NCR) if final reported QC measurements do not meet acceptance criteria. The facility QA officer and the facility manager are responsible for implementing corrective action when acceptable procedure performance is not met.

NDA personnel perform routine background measurements and instrument performance checks on the IPAN and GEA systems, as described in WRP1-OP-0905, WRP1-OP-0906, and ZA-948-385 and summarized below.

1. Background Measurements. Background Measurements: NDA personnel perform and document a background check at the beginning of each shift. Additional background checks during or at the end of the shift may be performed.
2. Instrument Performance Checks: Performance checks include efficiency checks, energy calibration checks, and energy resolution checks, as appropriate for NDA systems. System performance check implementation and documentation are described in the referenced NDA procedures. NDA personnel perform and document an efficiency check daily before making measurements on any waste drums. In addition, for the GEA system, NDA personnel perform and document energy calibration checks and energy resolution checks daily. Source checks are performed at least daily on calibrated and operable NDA systems when used for **assay operations**. Additional performance checks during or at the end of the shift may be performed on the systems. Sources are long-lived or corrected for decay, simple to reposition, of sufficiently high activity to obtain adequate counting statistics in short count times, and are relatively insensitive to handling.

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3. Control Charts: NDA personnel use control charts to track trends in the parameters measured in the performance checks. They log the data, plot the data on control charts, and compare the data to preset control limits. They operate the NDA systems in statistical control as determined by the control limits established in these procedures. They report these data with NDA results to the facility QA officer, who submits them to the SQAQO. If the performance checks result in data that are outside the acceptable range, the suspect NDA system is not used to generate NDA data and is evaluated for corrective action.
4. Replicate Assays: NDA personnel perform and document a duplicate measurement (e.g., replicate count) on one of every 20 waste containers (e.g., once per testing batch) or once per operating week, whichever is more frequent. NDA procedures detail duplicate measurement and documentation processes.
5. Comparison Programs: NDA personnel participate in the NDA PDP Plan to provide measurements for comparing performance with that of other DOE sites performing measurements for the same radionuclides under comparable conditions.
6. NDA Operator Training: NDA personnel who operate the assay equipment are trained according to Project and facility procedures. NDA operator training is based on existing industry standard training requirements. Requalification of operators is based on evidence of continued satisfactory performance and is done at least every 2 years. The Training manager ensures that training records are current, and unsatisfactory performance results in disqualification, retraining, and demonstration of satisfactory performance before allowing an operator to again operate NDA systems.

E.5 CALIBRATION PROCEDURES AND FREQUENCIES

NDA personnel perform calibrations on each NDA system following system-specific methods specified in vendor manuals. Initial calibration and setup of the assay equipment was documented in acceptance test procedures. Correction algorithms and the ranges and waste types are recorded in the calibration documentation. Calibrations are verified for at least one counting geometry/sample matrix combination on an annual basis. Additional calibrations of the GEA system are performed as necessary based on current operating conditions. Recalibrations occur after major repairs or if verification of the calibration demonstrates that it has significantly changed after relocation of the system. NDA personnel provide all equipment calibration records to the Project records custodian according to WMH-400, Section 1.5.1, "TRU Records Management."

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NDA personnel procure primary calibration standards from suppliers maintaining measurement systems traceable to the NIST whenever these standards are available. When these standards are not available, they calibrate standards against primary standards obtained from suppliers maintaining measurement systems traceable to the NIST. They document the cross-calibration and provide the documentation to the Project records custodian. They prepare standards using isotopes, geometries, and matrices that closely reflect those expected in the waste. PDP standards, sources and drums may not be used for calibrations since the calibration source must be independent from sources used for verification measurements.

The NDA procedures specify the range of applicability of system calibrations. Assay instruments will only be used to assay in the ranges for which they are calibrated. If assay measurement values fall outside of the applicable range for a particular instrument, the assay measurement will either be repeated on an alternate system covering the range, or NDA personnel will initiate and document corrective action. They determine and document the range of waste types to which any given calibration and set of correction factors apply.

E.6 SOFTWARE REQUIREMENTS

NDA personnel ensure that all computer programs (and any revisions) are documented, verified, and validated in accordance with WMH-400, Section 6.1.1, "TRU Software Quality Assurance." They ensure that verification includes both verification of the algorithm and test runs comparing program output to true values. They ensure that test runs exercise all default and boundary values of parameters and that programs are documented in accordance with *Standard for Software User Documentation* (American National Standards Institute [ANSI] 1987) and include the following minimum information:

- Program name
- Revision number
- Revision date
- Author(s)
- Program application
- Programming language (including version numbers of all compilers, linkers, etc.)
- Operating system
- Required hardware
- Descriptions of algorithms used
- User's manual
- Listing of code
- Examples of input and output forms
- Results of test cases
- Copies of external data files
- Lists of default parameters
- Records of review and approval.

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E.7 TOTAL MEASUREMENT UNCERTAINTY

NDA personnel at WRAP estimate total measurement uncertainty (TMU) as described in *Total Measurement Uncertainty for Nondestructive Assay of Transuranic Waste at the Waste Receiving and Processing Facility* (HNF-4050). A similar TMU document will be developed for use at PFP. These documents discuss the development of random error and bias components for verification (e.g., waste containers completing a process of waste characterization activities and not requiring repackaging) and process drums (e.g., waste containers that require repackaging into a new drum). The TMU determination includes sources of uncertainty for both the IPAN and GEA systems. The primary uncertainty components for the IPAN system include calibration uncertainty, counting statistics (random error), matrix effects, source distribution, gamma and neutron interferences, multiplication effects, and self-shielding. The primary uncertainty components for the GEA system include counting statistics (random error), matrix absorption, source self-absorption uncertainties, and source nonuniformities.

E.8 DATA MANAGEMENT

NDA personnel at WRAP collect and reduce NDA data in accordance with WMP-350, Section 2.2, "Calculation of Assay Results," using computer software designed for the IPAN and GEA systems. NDA personnel at PFP collect and reduce NDA data in accordance with ZA-400-302 using computer software designed for the GEA system. The computer software is controlled to comply with the QAPD and ANSI, as described in the NDA procedures and WMH-400, Section 6.1.1.

NDA personnel compile data reports on a testing batch basis assigning each testing batch data report a unique report number. Facility methods for validation, including verification that the QAOs have been met, and data reporting are described in WMP-350, Section 2.3, "Data Management for NDE/NDA Results," for WRAP NDA operations and FSP-PFP-5-8, Section 16.2, for NDA operations at PFP. An independent technical reviewer and a technical supervisor, who ensures that the data generation and reduction functions have been performed in a technically correct manner and that the QA documentation is complete, verify data at the facility level. The facility QA officer ensures that the independent technical and technical supervisory reviews have been completed, validates the data to ensure that the QAOs in Table E-1 have been met, and ensures the data necessary to complete the project-level review is complete.

The radioassay testing facility is required to submit testing batch data reports for each testing batch to the site project office on approved standard forms that consist of the following:

- Testing facility name, testing batch number, drum numbers included in that testing batch, and signature releases of radioassay testing personnel as described in Section B3-10 of the QAPjP
- Table of contents
- Background and performance check data or control charts for the relevant time period

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- Data review checklists for each testing batch verifying that the data generation level review as described in Section B3-10 of the QAPjP has taken place.
- Separate testing report sheet(s) for each sample in the testing batch that includes:
 - Title "Radioassay Data Sheet"
 - Method used for NDA (e.g., procedure identification)
 - TRUCON code, matrix parameter category, as applicable
 - Date of NDA examination
 - Total ^{239}Pu FGEs (g) and associated uncertainty
 - Total alpha activity and associated uncertainty (curies)
 - TRU activity and associated uncertainty (nCi/g)
 - Listing of individual radioisotopes present (curies) and associated uncertainty (curies)
 - Thermal power and associated uncertainty (W)
 - QC replicate (yes/no)
 - Operator signature/date
 - Reviewer signature/date.

NDA personnel record results of data review for each testing batch data report. Raw data and calibration reports shall be provided to the Project records custodian. Raw data are retained in sufficient detail to allow the calculations to be repeated. All uncertainties are made at the 95 percent confidence level using the terms derived for compliance with the TMUs described in Section E.7.

The facility records manager provides records to the Project records custodian. The Project records custodian maintains the records retrievable by testing batch number, in accordance with WMH-400, Section 1.5.1. These records include raw data, calibration reports, and data reports.

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E.9 PROCEDURES PERTINENT TO NDA

Table E-2 lists the implementing procedures for NDA.

Table E-2. NDA Implementing Procedures

Document number	Title
WMH-400, Section 1.2.1	<i>TRU Training and Qualification Plan</i>
WMH-400, Section 1.2.2	<i>Qualification of NDA, NDE, Visual Examination, and Inspection and Test Personnel</i>
WMH-400, Section 1.3.2	<i>TRU Nonconforming Item Reporting and Control</i>
WMH-400, Section 1.3.3	<i>TRU Corrective Action Reporting and Control</i>
WMH-400, Section 1.5.1	<i>TRU Records Management</i>
WMH-400, Section 3.1.2	<i>Quality Assurance Reports to Management</i>
WMH-400, Section 6.1.1	<i>TRU Software Quality Assurance</i>
WMP-350, Section 2.2	<i>Calculation of Assay Results</i>
WMP-350, Section 2.3	<i>Data Management for NDE/NDA Results</i>
WMP-350, Section 2.4	<i>Quality Assurance Objectives for NDA</i>
WMP-350, Section 2.5	<i>GEA Energy and Efficiency Setup and Baseline Establishment</i>
WRP1-OP-0905	<i>TRU Waste Certification - Imaging Passive/Active Neutron Assay Operation</i>
ZA-948-385	<i>Nondestructive Assay (NDA) Using the Segmented Gamma Scan Assay System (SGSAS)</i>
ZA-400-301	<i>SAS Energy and Efficiency Setup and Baseline Determination</i>
ZA-400-302	<i>Calculation of Assay Results</i>
FSP-PFP-5-8, Section 16.2	<i>Data Management for NDA Results</i>
FSP-PFP-5-8, Section 16.1	<i>Quality Assurance Objectives for Nondestructive Assay at PFP</i>

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**APPENDIX F
HYDROGEN SAMPLING AND ANALYSIS**

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HYDROGEN SAMPLING AND ANALYSIS

Headspace gas sampling and analysis may be used to determine the concentration of hydrogen in the void volume of a payload container for purposes of determining aspiration time. Sampling personnel collect headspace gas samples in SUMMA™, or equivalent, canisters in accordance with the requirements established in the QAPjP, Section B1-1. Analytical personnel receive samples from the headspace gas sampling operations or samples may be collected directly into an on-line integrated sampling/analysis system. Project personnel analyze the samples for hydrogen, as described in this section.

F.1 QUALITY ASSURANCE OBJECTIVES

Table F-1 lists the QAOs for hydrogen analysis. Key data quality indicators are defined below.

Table F-1. Hydrogen Analysis Quality Assurance Objectives.

Analyte	CAS Number	Precision ^a (%RSD or RPD)	Accuracy (%R)	PRQL (vol%)
Hydrogen	1333-74-0	*	*	0.1

* To be determined as part of initial Method Performance determination

%R = percent recovery

%RSD = percent relative standard deviation

CAS = Chemical Abstract Service

RPD = relative percent difference

PRQL = Program required quantitation limit

vol% = volume percent

To demonstrate compliance with the QAOs, analytical personnel perform the following:

- Measure precision by analyzing duplicate laboratory control samples, and calculate RPD based on the results.
- Measure accuracy by analyzing laboratory control samples and calculating %R based on the results.

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- Demonstrate the ability to quantitate at or below the PRQL given in Table F-1 by setting the concentration of at least one calibration standard below the PRQL.
- Achieve comparability by using standardized procedures and traceable standards for headspace gas analysis.
- Ensure representativeness through cleaning and certification of SUMMA™ canisters, or equivalent canisters, in accordance with the QAPjP.

In addition, sampling personnel ensure representativeness through the use of the standardized headspace gas sampling methods described in the QAPjP.

The facility QA officer is responsible for monitoring the results from these measurements and determining whether the precision and accuracy criteria listed in Table F-1 are met. The facility QA officer evaluates performance and decides whether corrective action should be initiated based on the results of the precision and accuracy calculations.

F.2 METHODS REQUIREMENTS

Analytical personnel analyze headspace gas samples for hydrogen using GC/thermal conductivity detection (TCD). The handling of headspace gas samples in SUMMA™ canisters requires samples to be equilibrated to ambient temperature conditions prior to measuring canister pressure and ambient pressure and temperature. Canister pressure and ambient temperature/pressure must be measured within 24 hours of sample receipt at the laboratory.

F.2.1 Standards

Analytical personnel purchase a manufacturer-certified primary hydrogen standard from commercial sources. The procedure LA-523-426, "Determination of Permanent Gases in Waste Container Headspace," identifies the purity requirements and describes the procedures for preparing the standard.

F.2.2 Qualitative and Quantitative Analysis

Analytical personnel quantitate hydrogen within the calibration range of the analytical instrument being used. They dilute samples with concentrations greater than the calibration range of the analytical instrument or the calibration curve.

Analytical personnel identify hydrogen by retention time (RT) using GC/TCD. They establish RT windows around the mean absolute RT of analyzed standards (calibration standards, continuing calibration verification standards, and/or laboratory control samples). They establish the RT windows so the occurrence of both false positive and false negative results are minimized. Analytical procedures describe RT window determination and quantitation of hydrogen based on signal response against a reference standard.

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F.3 QUALITY CONTROL

The facility manager and QA officer are responsible for monitoring and documenting procedure performance, including analyzing QC samples, and implementing corrective action when acceptable procedure performance is not met. The facility manager ensures that QC sample results are flagged as appropriate or an NCR is initiated if QC results associated with final reported sample data do not meet acceptance criteria. LA-523-426, "Determination of Permanent Gases in Headspace Gas Sampling," describes the procedures to ensure hydrogen analysis data quality. Analytical personnel perform operations in accordance with Project QA requirements and provide records to the site project office (SPO) documenting the quality of the data generated. Analytical procedures that describe the QC sample requirements and acceptance criteria are listed in Table F-2.

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Table F-2. Summary of Laboratory Quality Control Samples and Frequencies for Hydrogen Analysis

QC sample	Minimum frequency	Acceptance criteria	Corrective action
Method performance samples	Seven (7) LCS samples	Used to calculate accuracy and precision QAOs in Table F-1	
Laboratory blank or on-line blank	One (1) per analytical batch or on-line batch	Analyte concentrations <PRQL	Nonconformance required if minimum frequency exceeded. If analyte concentration \geq PRQL, flag as "B." NCR is not a requirement.
Laboratory control sample or on-line control sample	Two (2) per analytical batch or on-line batch	In-house limits for %R and RPD	Nonconformance if outside of calculated limits.

%R = percent recovery

PRQL = Program required quantitation limit

QAO = quality assurance objective

RPD = relative percent difference

Analytical personnel calculate control limits for accuracy and precision through the analysis of laboratory control samples before analyzing any headspace gas samples. They purchase or prepare LCSs that contain hydrogen at concentrations appropriate to calculate QAOs for accuracy and precision established in Table F-1. Initially, they analyze LCSs to calculate precision and accuracy for hydrogen. Control limits for LCS are updated semiannually.

Analytical personnel analyze headspace gas samples for hydrogen in analytical batches. Specific QC samples for each analytical batch include a laboratory blank or on-line blank and a laboratory control sample or on-line control sample, and a laboratory control sample duplicate or on-line control sample duplicate.

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Analytical personnel prepare laboratory blanks from high purity nitrogen (99.999 percent pure) using the same procedure used to prepare field samples for analysis.

Analytical personnel prepare laboratory or on-line control samples and duplicates using commercially purchased gas standards independent of those used for instrument calibration and ensure that control samples contain hydrogen at concentrations within the calibration range of the analytical instrument.

F.4 INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Analytical personnel test, inspect, and maintain analytical equipment according to the QAPD and applicable manufacturer's specifications. Analytical personnel test, inspect, and maintain analytical equipment to ensure that the QAOs in Table F-1 are met.

F.5 INSTRUMENT CALIBRATION AND FREQUENCY

Analytical personnel calibrate all instruments before use, verify calibration at routine intervals during analysis, maintain instrument run logs that permit the reconstruction of the calibration sequence and frequency, and ensure that all initial and continuing calibration requirements listed in Table F-3 are met.

Table F-3. Summary of GC/TCD Calibration Requirements for Hydrogen Analysis

Technique	Procedure	Frequency of procedure	Acceptance criteria
GC	3-pt initial calibration (3 standards)	Initially and as needed	To be determined as part of initial Method Performance determination
	Continuing calibration	Every 12 hours	%D \leq 30
<hr/>			
%D	=	percent difference	
%R	=	percent recovery	
%RSD	=	percent relative standard deviation	
GC	=	gas chromatography	

Analytical personnel obtain an initial GC/TCD multi-point calibration curve for hydrogen that consists of a minimum of three standards. They ensure that one standard is at a concentration less than the PRQL listed in Table F-1 and the high standard is at a concentration such that it brackets the expected sample concentrations, yet remains within the linear range of the instrument. Analytical personnel use average response factors to construct the calibration plot and ensure that initial calibrations meet the criteria listed in Table F-3.

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Analytical personnel analyze a continuing calibration verification standard at the beginning of each 12-hour shift, before sample analysis. They compare the known concentration of the continuing calibration verification standard to the corresponding concentration determined from the most recent valid initial calibration. If Table F-3 acceptance criteria are not met, analytical personnel either run another continuing calibration or generate a new calibration plot. They do not continue sample analysis until the criteria in Table F-3 are met.

F.6 DATA MANAGEMENT

Analytical personnel do not blank-correct hydrogen results, but report results from blank analysis separately from field sample results. The facility QA officer ensures that all analytical data are reviewed, validated, and verified, as described in the QAPjP, and reports all hydrogen results in units of volume percent.

WMH-400, Section 8.1.8, describes the data reduction, validation, and reporting processes and includes or references example forms to be used to record and report data. Analytical personnel reduce raw data to reportable results and report analytical results in units of volume percent, limited to two significant figures. Analytical personnel review, validate, and verify data, as described in the QAPjP.

Analytical personnel validate analytical data and submit batch data reports to the Project records custodian. Analytical or on-line batch data reports, which are described in WMH-400, Section 8.1.8, include the information required in the QAPjP, Section B3-12.

SPO personnel maintain records, documented and retrievable by analytical batch numbers, in accordance with WMH-400, Section 1.5.1. These records include the following:

- Original chain of custody (COC) records for analytical batches (not applicable when using on-line integrated sampling/analysis systems)
- All raw data, including original (or legible copy of) instrument readouts and/or bench reports, calculation records, and QC sample results. Duplicate results are recorded along with the LCS result, and the RPD between the two results are calculated. Control sample results are entered with the accepted value and the %R.
- A reference to instrument calibration reports that include the accepted and measured values of calibration verification for all analytes. The calibration reports also contain the facility name, initial and continuing calibration verification source, method identification, and calibration date and time.
- QC result summary, which includes true and found values for all QC samples plus associated result calculations. At a minimum, QC data include blanks, control samples, duplicates, initial calibration data, initial and continuing calibration verifications. The QC result summary includes the facility identifier, the batch number, and method names.

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- Original field sample canister tags (or equivalent documentation) for headspace gas samples.

F.7 PROCEDURES PERTINENT TO THIS APPENDIX

Table F-4 lists the implementing procedures pertinent to hydrogen sampling and analysis.

Table F-4. Hydrogen Sampling and Analysis Implementing Procedures.

Document number	Title
LA-523-426	<i>Determination of Permanent Gases in Waste Container Headspace Gas Sampling</i>
LO-090-450	<i>Sample Chain of Custody Acceptance and Disposal</i>
LO-080-407	<i>Cleaning SUMMA™ Canisters</i>
WMH-400, Section 1.3.2	<i>TRU Nonconforming Item Reporting and Control</i>
WMH-400, Section 1.3.3	<i>TRU Corrective Action Reporting and Control</i>
WMH-400, Section 1.5.1	<i>TRU Records Management</i>
WMH-400, Section 8.1.1	<i>Logkeeping Practices for Headspace Gas Sampling and Analysis</i>
WMH-400, Section 8.1.8	<i>Data Management for Headspace Gas Sampling and Analytical Results</i>