Date Received for Clearance Process (MM/YY/DD)
2/6/04

INFORMATION CLEARANCE FORM

A. Information Category

- ☐ Abstract
- ☐ Journal Article
- ☐ Summary
- ☐ Internet
- ☐ Visual Aid
- ☐ Software
- ☐ Full Paper
- ☐ Report
- ☐ Other _____

B. Document Number HNF-EP-0063, Revision 10

C. Title
Hanford Site Solid Waste Acceptance Criteria

D. Internet Address

E. Required Information

1. Is document potentially Classified? ☒ No ☐ Yes (MANDATORY)

Judith A. Nielsen
Manager's Signature Required

If Yes _____ ☐ No ☐ Yes Classified
ADC Signature Required

2. References in the Information are Applied Technology ☒ No ☐ Yes
Export Controlled Information ☒ No ☐ Yes

3. Does Information Contain the Following: (MANDATORY)

a. New or Novel (Patentable) Subject Matter? ☒ No ☐ Yes
If "Yes", Disclosure No.: _____

b. Information Received in Confidence, Such as Proprietary and/or Inventions?
☒ No ☐ Yes If "Yes", Affix Appropriate Legends/Notices.

c. Copyrights? ☒ No ☐ Yes If "Yes", Attach Permission.

d. Trademarks? ☒ No ☐ Yes If "Yes", Identify in Document.

4. Is Information requiring submission to OSTI? ☒ No ☐ Yes

5. Release Level? ☒ Public ☐ Limited

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting _____
2. Group Sponsoring _____
3. Date of Conference _____ 4. City/State _____
5. Will Information be Published in Proceedings? ☐ No ☐ Yes 6. Will Material be Handed Out? ☐ No ☐ Yes

H. Author/Requestor
C. K. Girres CK Girres
(Print and Sign)

Responsible Manager
Judith A. Nielsen Judith A Nielsen
(Print and Sign)

I. Reviewers

	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☒	See Attached Approval	Page 2	(Y) / N
Office of External Affairs	☐			Y / N
DOE-RL	☒	See Attached Approval	Page 3	(Y) / N
Other	☐			Y / N
Other	☐			Y / N

J. If Information Includes Sensitive Information and is not to be released to the Public indicate category below.

- ☐ Applied Technology
- ☐ Personal/Private
- ☐ Proprietary
- ☐ Business-Sensitive
- ☐ Predecisional
- ☐ UCNI
- ☐ Protected CRADA
- ☐ Export Controlled
- ☐ Procurement-Sensitive
- ☐ Patentable
- ☐ Other (Specify) _____

Information Clearance Approval

APPROVED FOR RELEASE
OFFICIAL DOCUMENT
CW
Date 2/17/04

K. If Additional Comments, Please Attach Separate Sheet Page 1 of 3

A-6001-401 (12/00)

Girres, Cynthia K

From: Norris, Kenneth M (Ken)
Sent: Friday, February 06, 2004 12:08 PM
To: Girres, Cynthia K
Subject: RE: Review and Approval Requested for Information Clearance

Looks fine, Cindy. Use this e-mail as authorization to clear for Legal Services/General Counsel.

Thanks for your patience.

Ken Norris

-----Original Message-----
From: Girres, Cynthia K
Sent: Thursday, February 05, 2004 9:44 AM
To: Norris, Kenneth M (Ken)
Subject: Review and Approval Requested for Information Clearance

Attached is a copy of HNF-EP-0063, Rev. 10, Hanford Site Solid Waste Acceptance Criteria. This document is over 100 pages. Your review and approval for the information clearance form is requested. Please provide me your e-mail approval or let me know when you are ready to sign.

Thank you,

Cindy Girres
on behalf of Fluor Hanford
373-1381
308-0109

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

04-AMCP-0164

FEB 3 2004

Mr. R. G. Gallagher, President
and Chief Executive Officer
Fluor Hanford, Inc.
Richland, Washington 99352

Dear Mr. Gallagher:

CONTRACT NO. DE-AC06-96RL13200 – SUBMITTAL OF HANFORD SITE SOLID WASTE ACCEPTANCE CRITERIA, HNF-EP-0063, REVISION 10

This is in response to your letter to me, same subject, dated January 20, 2004, FH-0400163. RL has reviewed HNF-EP-0063 (Attached). The document is approved as submitted.

The Government considers this action to be within the scope of the existing contract and therefore, the action does not involve or authorize any delay in delivery or additional cost to the Government, either direct or indirect.

If you have questions, please contact me, or your staff may contact Owen Robertson, Office of the Assistant Manager for the Central Plateau, on (509) 373-6295.

Sincerely,

Keith A. Klein
Manager

WMD:OR

Attachment

cc w/attach:
H. Hermanas, FHI

HNF-EP-0063
Revision 10

Hanford Site Solid Waste Acceptance Criteria

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

Fluor Hanford
P.O. Box 1000
Richland, Washington

Contractor for the U.S. Department of Energy
Richland Operations Office under Contract DE-AC06-96RL13200

HNF-EP-0063
Revision 10

Hanford Site Solid Waste Acceptance Criteria

C. K. Girres

February 2004

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

Fluor Hanford
P.O. Box 1000
Richland, Washington

Contractor for the U.S. Department of Energy
Richland Operations Office under Contract DE-AC06-96RL13200

Chris Willingham 2/17/04
Clearance Approval Date

N/A
Release Approval (stamp)

Approved for Public Release
(Upon receipt of Clearance approval)
Further Dissemination Unlimited

For use with Technical Documents (when appropriate)	
EDC- 04-19710	FMP-
EDT-	ECN-
Project No.:	Division:
Document Type: Rpt.	Page Count: 115

For use with Speeches, Articles, or Presentations (when appropriate)							
Abstract		Summary		Full Paper		Visual Aid	
Conference Name:							
Conference Date:							
Conference Location:							
Conference Sponsor:							
Published in:							
Publication Date:							

HANFORD SITE SOLID WASTE ACCEPTANCE CRITERIA
HNF-EP-0063, Revision 10

CONTENTS

CONTENTS, continued

CONTENTS, continued

TABLES

This page intentionally left blank.

GLOSSARY

ACRONYMS

AK	acceptable knowledge
ALARA	as low as reasonably achievable
ASTM	American Society for Testing of Materials
CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act of 1980*
CFR	Code of Federal Regulations
CH TRU	contact-handled transuranic
CIN	container identification number
CSER	criticality safety evaluation report
CWC	Central Waste Complex
DE-Ci	dose equivalent curie
DOE	U.S. Department of Energy
RL	U.S. Department of Energy, Richland Operations Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FGE	fissile gram equivalent
GEA	gamma energy analysis
HDPE	high-density polyethylene
HEPA	high-efficiency particulate air
HIC	high-integrity container
HNF	Hanford Nuclear Facility (document identifier)
HPC	high performance coating
ICRP	International Commission of Radiological Protection
LDR	land disposal restrictions
LLBG	Low-Level Burial Grounds
LLD	lower limit of detection
LPC	low performance coating
MPC	medium performance coating
NDA	nondestructive assay
NDE	nondestructive examination
NLF	nonuranium limit fraction
NORM	naturally occurring radioactive material
NPIC	no potential for internal contamination
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
PE-Ci	plutonium equivalent curie
PHMC	Project Hanford Management Contract
PSSD	Package-specific safety document
QAP	quality assurance program
RCRA	*Resource Conservation and Recovery Act of 1976*
RMA	radioactive material area

SWB	standard waste box
TRAMPAC	transuranic package transporter-model II-authorized methods for payload control
TRU	transuranic
TRUPACT	transuranic package transporter
TSCA	*Toxic Substances Control Act of 1976*
TSD	treatment, storage, and/or disposal
WAC	*Washington Administrative Code*
WIPP	Waste Isolation Pilot Plant
WD/GR	Waste Disposal/Groundwater Remediation
WRAP	Waste Receiving and Processing Facility
WSRd	waste specification record

DEFINITIONS

Acceptable knowledge. Characterization information collected by a generator to meet waste management requirements and determined to be adequate by the treatment, storage and/or disposal (TSD) unit.

Asbestos-containing waste material. Mill tailings or any waste that contains commercial asbestos and is generated by a source subject to Title 40, *Code of Federal Regulations* (CFR) 61 Subpart M. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and waste materials contaminated with asbestos including disposable equipment and clothing. (40 CFR 61.141)

Bulk waste. Waste that is not containerized for disposal and contains potentially dispersible radiological contamination, such as soil and rubble.

Byproduct material. (1) Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. (DOE M 435.1-1)

Chelating agent. Amine polycarboxylic acids (e.g., Ethylenediamine Tetraacetic Acid, Diethylenetriaminepentaacetic Acid), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid). (10 CFR 61.2)

Class IV oxidizer. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. In addition, the oxidizer will enhance the burning rate and could cause spontaneous ignition of combustible materials. (UFC 1997)

Combustible waste. Any waste that does not meet the definition of non-combustible waste.

Contact handled. Packaged waste whose external surface dose rate does not exceed 2 milliSieverts per hour (200 millirem per hour) per hour, except that packages larger than 208 liters (55 gallons) could have a marked point on the bottom or side with a surface dose rate up to 10 milliSieverts per hour (1,000 millirem per hour).

Container. Any portable device in which a material is stored, transported, treated, disposed, or otherwise handled. (*Washington Administration Code* [WAC] 173-303-040)

Corrosive material. (Class 8) means a liquid or solid that causes full thickness destruction of human skin at the site of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum based on the criteria in 49 CFR 173.137(c)(2) is also a corrosive material. (49 CFR 173.136)

Corrosive waste. A dangerous waste that exhibits the characteristic of corrosivity defined in WAC 173-303-090(6).

Dangerous waste. Solid waste designated in WAC 173-303-070 through -100 as dangerous or extremely hazardous waste, or mixed waste. (WAC 173-303-040)

Dangerous waste constituents. Those constituents listed in WAC 173-303-9905 and any other constituents that have caused a waste to be a dangerous waste under WAC 173-303.

Decontamination. The removal of radioactive material from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Disposal facility. The land, structures, and equipment comprising a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

Dose-equivalent curie (DE-Ci). A method of normalizing the radiotoxicity of various radionuclides to plutonium-239 for use in establishing that operations remain within approved safety bases at certain Hanford Site waste management units. The normalization is based on the relative committed effective dose equivalent from inhalation of each radionuclide to that of plutonium-239 using the conversion factors from the International Commission of Radiological Protection (ICRP) Publication 71, "*Age-dependent doses to members of the public from intake of radionuclides: Part 4, Inhalation dose coefficients*."

U.S. Environmental Protection Agency (EPA) hazardous waste numbers. The number assigned by the EPA to each hazardous waste listed in 40 CFR 261, Subpart D, and to each characteristic identified in 40 CFR 261, Subpart C.

Explosive waste. A waste that meets the definition of WAC 173-303-090 (7)(a)(vi), (vii) or (viii).

Extremely hazardous waste. Dangerous waste and mixed waste designated in WAC 173-303-100 as extremely hazardous. (WAC 173-303-040)

Facility. All contiguous land, structures, other appurtenances, and improvements on the land, used for recycling, reusing, reclaiming, transferring, treating, storing, or disposing of dangerous waste. The Hanford facility consists of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of these). (WAC 173 303-040)

Fissile material. Material made up of radionuclides that will sustain a chain reaction by thermal (slow) neutron induced fission. For the Hanford Site criticality safety program, uranium-233, uranium-235, plutonium-239, and plutonium-241 are the primary radionuclides of interest. In addition, plutonium-238 is considered fissile material for transportation under 49 CFR 173.

Fissionable materials. Substances containing radionuclides capable of sustaining a nuclear fission chain reaction (regardless of neutron energy). Such material could be fissionable only by nature of its form, configuration or environment. This includes, but is not limited to, uranium-233, uranium-235, plutonium-238, plutonium-239, plutonium-240, plutonium-241, neptunium-237, americium-241, and curium-244.

Flammable liquid. A liquid having a flash point of not more than 60.5 degrees Celsius (141 Fahrenheit), or any material in a liquid phase with a flash point at or above 37.8 Celsius (100 degrees Fahrenheit) that is intentionally heated and offered for transportation at or above its flash point in a bulk packaging. (49 CFR 173)

Flammable solid. Any of the following types of materials: wetted explosives, self-reactive materials that are liable to undergo a strongly exothermal decomposition caused by excessively high temperatures or contamination, or readily combustible solids that might cause a fire through friction. (49 CFR 173)

Free liquids. Those liquids determined to be present in a waste as defined by the *Paint Filter Liquids Test, Method 9095 of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846).

Generator. Any person, by site, whose act or process produces radioactive or mixed waste or whose act first causes a waste to become subject to regulation under WAC 173-303. The term generator also includes any person or organization that manages a dangerous waste at the generating site on behalf of the generator.

Gross weight. The tare weight of a container plus the weight of its contents.

Hanford Site Treatment, Storage, and/or Disposal Unit or Hanford Site TSD Unit. Any one of the operational treatment, storage, or disposal units having acceptance criteria defined by this document. This specifically excludes all other TSD units identified on the Hanford Site.

Hazardous waste. Solid waste designated by 40 CFR 261 and regulated as a hazardous waste and/or mixed waste by the EPA.

High-level waste. The highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. (DOE M 435.1-1)

Ignitable waste. A dangerous waste that exhibits the characteristic of ignitability as described in WAC 173-303-090(5).

Incompatible waste. A dangerous waste that is unsuitable for placement in a particular device or facility because it might corrode or decay the containment materials or is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure, fire or

explosion, violent reaction, toxic dusts, fumes, mists, or gases, or flammable fumes or gases. (WAC 173-303-040)

Infectious waste. Any waste that contains or is suspected to contain pathogenic microorganisms infectious to humans, including: cultures and stocks of infectious agents, human blood and body fluids, contaminated animal carcasses, body parts, bedding exposed to infectious agents, and human pathological waste. Waste that has been treated by heat (e.g., incineration, autoclaving) or chemical disinfectants to destroy pathogenic organisms is not considered infectious waste.

Inner liner. A continuous layer of material placed inside a tank or container that protects the construction materials of the tank or container from the contained waste or reagents used to treat the waste. (WAC 173-303-040)

Lab pack. A packaging method where a number of inner containers of waste are packaged into an outer drum as specified in 49 CFR 173.12(b). For this document, the term also could be used for U.S. Department of Transportation (DOT) Class 7 materials packaged in the same manner.

Land disposal restrictions. The restrictions and requirements for land disposal of hazardous or dangerous waste as specified in 40 CFR 268 and WAC 173-303-140. (Refer to definitions for *Resource Conservation and Recovery Act of 1976* [RCRA] Land Disposal Restrictions and Washington State Land Disposal Restrictions.)

Low-level mixed waste. Waste that meets both the definition of low-level waste and mixed waste.

Low-level waste. Radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the *Atomic Energy Act of 1954* (42 USC 2011 et seq.), or naturally occurring radioactive material. (DOE M 435.1-1)

Mixed waste. A dangerous, extremely hazardous, or acutely hazardous waste that contains both a nonradioactive hazardous component and, as defined by 10 CFR 20.1003, source, special nuclear, or by-product material subject to the *Atomic Energy Act of 1954* (42 USC 2011 et seq.). (WAC 173-303-040)

Major radionuclides. Those radionuclides in a waste that contribute significantly to the overall hazards of the waste, including criticality and human exposure by various pathways, as the waste is managed.

Mobile radionuclides. Radionuclides that tend to migrate readily through Hanford soil and pose the highest risk of impact to groundwater resources: tritium (hydrogen-3), carbon-14, chlorine-36, selenium-79, molybdenum-93, technecium-99, iodine-129, rhenium-187, uranium (all isotopes), and neptunium-237.

Non-biodegradable sorbent. A sorbent material meeting the requirements of 40 CFR 264.314(c).

Noncombustible waste. Containerized waste that shows no evidence of combustion or decomposition on exposure to 538 degrees Celsius (1,000 degrees Fahrenheit) for 10 minutes as specified by NUREG-0782, or waste that has been stabilized by grouting or disposal in a high-integrity container (HIC).

Organic peroxide. Any organic compound containing oxygen (O) in the bivalent -O-O- structure and that might be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Onsite. Any property within the Hanford Site boundary. (NOTE: DOT and RCRA regulations have varying definitions of onsite; the precise DOT and RCRA meanings of the term are not implied in the use of the term in this document.)

Operational safety requirements or technical safety requirements. Those requirements that define the conditions, safe boundaries, and bases thereof and the management or administrative controls required to ensure the safe operation of a nuclear facility.

Organic liquid. A chemical compound having carbon-carbon chemical bonds and that is a liquid at standard temperature and pressure. Typical organic liquids include organic solvents, petroleum oils, and synthetic oils.

Outer packaging. The outermost enclosure of a composite or combination packaging together with any absorbent materials, cushioning, and any other components necessary to contain and protect inner receptacles or inner packagings. (49 CFR 171)

Package-specific safety document (PSSD). A safety document prepared to demonstrate the safety associated with a specific package. PSSDs include existing U.S. Department of Energy, Richland Operations Office approved onsite safety analysis reports for packaging (SARP), onsite safety evaluations for packaging (SEP), Certificate of Compliance (CoC) or Certificate of Competent Authority for the U.S. Nuclear Regulatory Commission (NRC), U.S. Department of Transportation (DOT), U.S. Department of Defense (DOD), and U.S. Department of Energy (DOE) packaging systems. For onsite packages, the PSSDs are evaluations that demonstrate how the criteria of the TSD are met.

Performance assessment. An analysis of a radioactive waste disposal facility conducted to demonstrate there is a reasonable expectation that performance objectives established for the long-term protection of the public and the environment will not be exceeded following closure of the facility. (DOE M 435.1-1)

Project Hanford Management Contract. The current contract with the U.S. Department of Energy to operate portions of the Hanford Site, including the facilities described in this document. Fluor Hanford, Inc. is the Project Hanford Management Contract contractor.

Plutonium-equivalent curie (PE-Ci). A method of normalizing the radiotoxicity in transuranic waste to plutonium-239 for use in establishing the approved safety limits at the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico. The normalization is based on the

relative committed effective dose equivalent from inhalation of a radionuclide to that of plutonium-239 using the conversion factors from DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," as described in Appendix B of DOE/WIPP-02-3122.

Plutonium-239 fissile gram equivalent. A method of normalizing fissile and fissionable isotopes to plutonium-239 for use in establishing criticality safety limits for the Hanford Site Solid Waste Program. This is consistent with the method found in the safety analysis reports for the transuranic package transporter-II and 72-B casks for plutonium-239, uranium-233, and uranium-235 and in ANSI/ANS 8.15 for other fissile, fissionable, and special actinide elements.

Polychlorinated biphenyl (PCB). Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contains such substance (40 CFR 761.3).

Process knowledge. Knowledge the generator applies to a solid waste to determine if it is a dangerous or mixed waste in light of the materials or the processes used, when such knowledge can be demonstrated to be sufficient for determining whether a solid waste is designated properly. Process knowledge includes information on waste obtained from existing published or documented waste analysis data or studies conducted on mixed waste from processes similar to that which generated the waste. Process knowledge for mixed waste also could include information obtained from surrogate material.

Pyrophoric material. A liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air when tested as specified by 49 CFR 173.124.

Qualified analytical data. Data from waste analysis that is not fully compliant with an approved sampling and/or analysis method (e.g., where quality assurance/quality control deficiencies were identified from the sampling and/or analysis of the waste).

Radioactive waste. Any garbage, refuse, sludges, and other discarded material, including solid, liquid, semisolid, or contained gaseous material that must be managed for its radioactive content. (DOE M 435.1-1)

RCRA land disposal restrictions. The requirements and restrictions for land disposal of hazardous waste codified in 40 CFR 268.

Reactive waste. A dangerous waste that exhibits the characteristic of reactivity as described in WAC 173-303-090(7).

Remote handled. Packaged waste whose external surface dose rate exceeds the limits for contact-handled waste.

Remote-handled transuranic waste. Packaged transuranic waste whose unshielded payload container external surface dose rate exceeds 2 milliSieverts per hour (200 millirem per hour),

unless the shielding is part of a Waste Isolation Pilot Plant approved pipe overpack configuration.

Secular equilibrium. Equilibrium that occurs between a parent radionuclide and daughter radionuclide where the half-life of the parent is significantly longer than the daughter.

Shock-sensitive waste. Reactive waste meeting the definition of WAC 173-303-090(7)(a)(vii) (waste is readily capable of detonation or explosive composition or reaction at standard temperature and pressure).

Solidification. Any technique that reduces the solubility and mobility of dangerous waste constituents and/or radionuclides by physical means rather than by bonding or chemically reacting with the stabilizing material.

Sorb. To absorb or adsorb.

Sorbent. A material used to soak up free liquids by either adsorption or absorption, or both.

Specific activity. The radiological activity (disintegrations per unit of time) of a radionuclide per unit mass of that radionuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the radiological activity per unit mass of the material.

Spent nuclear fuel. Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. Test specimens of fissionable material irradiated for research and development only, and not production of power or plutonium, may be classified as waste, and managed in accordance with the requirements of DOE 435.1 when it is technically infeasible, cost prohibitive, or would increase worker exposure to separate the remaining test specimens from other contaminated material. (DOE M 435.1-1)

Spontaneously combustible material. A pyrophoric or self-heating material. (49 CFR 171)

Stabilization. Any technique that reduces the solubility and mobility of dangerous waste constituents and/or radionuclides by bonding or chemically reacting with the stabilizing material. The term stabilization to meet LDR is used when the specific definition of 40 CFR 268.42, Table 1, is implied.

Standard waste box. A payload container authorized for use with TRUPACT-II transportation packages for packaging of transuranic waste (NRC 1996).

State-only dangerous waste. Any waste that is regulated as a dangerous waste under WAC 173-303 but is not regulated as a hazardous waste under 40 CFR 261. (WAC 173-303-040)

Storage. The holding of radioactive waste for a temporary period, at the end of which the waste is treated, disposed of, or stored elsewhere. (DOE M 435.1-1)

Toxic. Having the properties to cause or to significantly contribute to death, injury, or illness of humans or wildlife. (WAC 173-303-040)

Toxic Substances Control Act of 1976 PCB waste. Any PCB-containing waste that is regulated under the TSCA requirements codified in 40 CFR 761.

Transuranic mixed waste, or TRU-mixed waste. Waste that meets both the definitions of transuranic waste and mixed waste.

Transuranic waste. Radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the U.S. Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61 (DOE M 435.1-1).

Treatment. The physical, chemical, or biological processing of dangerous waste to make such waste nondangerous or less dangerous, safer for transport, amenable for energy or material resource recovery, amenable for storage, or reduced in volume, with the exception of compacting, repackaging, and sorting as allowed under WAC 173-303-400(2) and 173-303-600(3). (WAC 173-303-040)

Treatment, storage, and/or disposal unit manager or TSD unit manager. The individual, or delegate, having responsibility for the operation of a given TSD unit within the limits of the TSD unit RCRA Permit, safety basis, performance assessment, and/or other environmental requirements.

U.S. Department of Energy, Richland Operations Office (RL). The field element of the U.S. Department of Energy that is responsible for the storage and disposal facilities listed in this document.

Washington State Land Disposal Restrictions or Washington State LDR. The land disposal restrictions of WAC 173-303-140(4).

Washington State-Only Dangerous Waste. State-only dangerous waste.

Waste Specification Record. A document that identifies the anticipated treatment, storage, and/or disposal methods to be applied to a given class of waste managed at Hanford Site TSD units.

Waste stream. A waste or group of wastes from a process or a facility with similar physical, chemical, or radiological properties. (DOE M 435.1-1)

Water-reactive waste. Waste that meets the definition of WAC 173-303-090(7)(a)(ii), (iii) or (iv).

WD/GR Project acceptance organization. The organization within the Waste Disposal/Groundwater Remediation Project that is responsible for waste acceptance, including approval of waste stream profiles and approval of individual waste packages and shipments, and for coordinating the approval of case-by-case evaluations for specific criteria and exceptions to the acceptance criteria.

1.0 INTRODUCTION

U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*, requires that each treatment, storage, and/or disposal facility (referred to in this document as a treatment, storage and/or disposal [TSD] unit) that manages low-level or transuranic (TRU) waste (including mixed waste and *Toxic Substances Control Act of 1976* [TSCA] polychlorinated biphenyl [PCB] waste) maintain waste acceptance criteria. This requirement is implemented through DOE/RL-2000-25. The waste acceptance criteria for U.S. Department of Energy, Richland Operations Office (RL) TSD units are provided, including criteria for the Low-Level Burial Grounds (LLBG), the Central Waste Complex (CWC), the T Plant, and the Waste Receiving and Processing (WRAP).

1.1 PURPOSE AND SCOPE

The criteria for each TSD unit are established in this document to ensure that waste accepted can be managed within the operating requirements of the unit, including, but not limited to, environmental regulations, DOE Orders, permits, technical safety requirements, waste analysis plans, and performance assessments. The requirements of DOE O 435.1 and DOE M 435.1-1 are implemented through DOE/RL-2000-25. Revisions to the acceptance criteria document require an Unreviewed Safety Question review to document that the changes are consistent with current applicable safety analyses.

Acceptance criteria apply to the following RL TSD units.

- The LLBG including the low-level waste disposal portions of the LLBG and trenches 31 and 34 of the 218-W-5 Burial Ground for certain mixed waste disposal
- The CWC
- The WRAP Facility
- The T Plant Complex

Waste from all generators, including Hanford Site and offsite facilities, must comply with these criteria. Exceptions can be granted as provided in Section 1.6.

Specific waste streams could have additional requirements based on the identified TSD pathway. These requirements are communicated in the waste specification records (WSRd) and/or waste stream profile sheet approvals.

The Hanford Site manages nonradioactive waste through direct shipments to offsite contractors. The waste acceptance requirements of the offsite TSD facility must be met for these nonradioactive wastes. This document does not address the acceptance requirements of these offsite facilities.

Selection of specific storage locations and container movements within a TSD unit are outside the scope of these acceptance criteria.

1.2 ROADMAP TO THE WASTE ACCEPTANCE CRITERIA

Chapter 1.0 provides introductory information and describes general administrative requirements that apply to generators.

Chapter 2.0 identifies requirements that generally apply to waste sent to any of the TSD units. These criteria relate primarily to overall characterization and segregation methods used by generators. In addition, acceptance criteria that are the same for all units are provided in this chapter.

Chapters 3.0 through 7.0 communicate the unit-based criteria for acceptance of waste. Each of these chapters contains a general description of the unit functions followed by identification of prohibited waste, physical/chemical acceptance criteria, radiological acceptance criteria, and packaging criteria. These TSD units and the general functions follow.

- Chapter 3.0: The low-level waste disposal portion of the LLBG is for disposal of low-level radioactive waste not regulated as hazardous waste, dangerous waste, or TSCA PCB disposal-prohibited waste.

- Chapter 4.0: The mixed waste trench portion (trenches 31 and 34) of the 218-W-5 Burial Ground is a *Resource Conservation and Recovery Act of 1976* (RCRA-) permitted disposal unit for certain mixed waste that meets federal and state land disposal restrictions (LDR). The unit may also dispose of certain types of TSCA PCB waste.

- Chapter 5.0: The CWC is a storage unit for low-level mixed waste, low-level TSCA PCB waste, TRU waste, TRU mixed waste, TRU TSCA PCB waste, and other waste types that must be stored pending treatment and/or disposal.

- Chapter 6.0: The T Plant Complex is a multipurpose unit for storage, repackaging, treatment, and decontamination of radioactive waste. The T Plant Complex can accept low-level and TRU waste, including mixed and TSCA PCB waste.

- Chapter 7.0: The WRAP is a multipurpose unit for processing and treating low-level and TRU waste, including mixed and TSCA PCB waste. The WRAP can perform nondestructive assay (NDA) and nondestructive examination (NDE) of waste containers. The WRAP is the primary unit for repackaging and processing TRU waste for certification for disposal at the Waste Isolation Pilot Plant (WIPP).

Chapter 8.0 lists references for all chapters except the appendices. Each appendix has its own reference section.

Appendix A provides radiological calculation methods.

Appendix B provides fissionable material content limits.

Appendix C describes labeling of containers.

Appendix D describes selection of containers, coatings, and liners.

Appendix E describes selection of sorbents, stabilizing materials, and void fillers.

Appendix F describes Hanford Site radiological release of waste.

Appendix G provides TRU waste acceptance criteria and certification requirements.

Appendix H provides a listing of approved vents.

1.3 WASTE ACCEPTANCE PROCESS

All non-Hanford Site waste generators must receive approval from the RL before acceptance and shipment of waste to Hanford Site TSD units.

The process for obtaining approval to ship waste to the Hanford Site Waste Disposal/ Groundwater Remediation (WD/GR) Project's TSD units is described on the *Hanford Site Solid Waste Acceptance Program* Internet web site (http://www.hanford.gov/wastemgt/wac/). Use of the waste acceptance process is mandatory.

1.4 GENERATOR RESPONSIBILITIES

Generators of radioactive waste have certain general responsibilities under DOE O 435.1. Acceptance of waste at Hanford Site TSD units is contingent on effectively fulfilling these responsibilities.

1.4.1 Waste Certification Program

Generators must implement and maintain a waste certification program to ensure that any waste sent to a Hanford Site TSD unit meets the acceptance criteria of that unit (Sections III.J. and IV.J of DOE M 435.1-1). Generators are responsible financially for costs incurred by Hanford Site TSD units as a result of nonconformance with the acceptance criteria. All non-conforming containers can be returned to the generator for resolution. There is no obligation for WD/GR Project TSD units to correct generator nonconformances.

1.4.2 Quality Assurance Program

Each generator shall have a Quality Assurance Program (QAP) as part of its overall waste certification program. The QAP shall implement the requirements of 10 CFR 830, "Subpart A—

Quality Assurance Requirements," and DOE O 414.1A (DOE M 435.1-1). The generator QAP shall be subject to evaluation according to the requirements of Section 1.5.

1.4.3 Waste Minimization Program

Generators shall establish and maintain an auditable waste minimization program, including goals, incentives, procedures, and reports, to ensure that the amount of radioactive waste generated and/or shipped for disposal is minimized (DOE M 435.1-1). For Hanford Site generators, the most current version of DOE/RL-91-31 defines the methods for meeting this requirement.

1.4.4 Waste Forecast

Generators that wish to ship waste to Hanford Site TSD units shall provide an annual waste forecast. The timing and format of the waste forecast will be provided by the WD/GR Project.

1.5 EVALUATION OF GENERATOR WASTE CERTIFICATION PROGRAM

Under DOE M 435.1-1, receiving TSD units must evaluate waste to ensure the waste meets the acceptance criteria of the unit. This requirement is implemented through review of information submitted by the generator and verification and confirmation inspections performed on waste containers. When repeated or serious nonconformances are found, additional evaluations will be performed as defined in the waste analysis plan for that TSD unit. When necessary, an onsite audit of the waste certification program of the generator, including applicable portions of the QAP, will be required.

1.6 EXCEPTIONS TO THE WASTE ACCEPTANCE CRITERIA

Exceptions to these acceptance criteria may be granted in certain cases. The process to obtain approval of an exception is determined by the source and type of the requirements from which the specific acceptance criterion is derived. These requirements fall into three categories, each having a specific approval process, as described in the following sections.

A generator can request an exception from one or more of the criteria in this document. The request should be in writing to the WD/GR Project acceptance organization. The request must identify the specific requirement(s) in this document for which an exception is desired, the reason an exception is needed, and any proposed alternative methods to meet the general intent of the requirement.

The WD/GR Project acceptance organization will review the exception request and determine the appropriate category and approval process, based on the background documentation for these acceptance criteria. This documentation identifies the source(s) of each requirement so a

determination can be made whether an exception could be approved by the WD/GR Project acceptance organization, or whether RL and/or regulatory agency approvals are required. On completion of this review, the WD/GR Project acceptance organization will respond in writing, identifying whether the exception is granted, rejected, or requires further evaluation or clarification.

1.6.1 WD/GR Project-Approved Exceptions

An exception to these acceptance criteria can be granted when the WD/GR Project acceptance organization demonstrates that the exception does not affect compliance with (1) any applicable regulations and (2) any RL and/or regulatory agency-approved requirements. For example, a TSD unit's container size limits are operational requirements not related to any regulation or externally-approved document. If a larger container could be managed at that TSD unit with special handling provisions, the WD/GR Project acceptance organization can grant an exception to the container size requirement.

The WD/GR Project acceptance organization, in conjunction with the TSD operations organization, documents and certifies that the exception being granted does not affect compliance with any applicable regulations or any of the externally-approved requirements of the TSD units.

1.6.2 DOE-Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with DOE-approved requirements documents (e.g., safety basis, performance assessment) or DOE Orders will require a RL waiver, RL approval of a safety document revision, or other RL approval. For this type of exception, the appropriate waiver request, document revision, or other applicable request for approval will be submitted by Fluor Hanford, Inc. to the RL.

1.6.3 Regulatory Agency-Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with regulations, permit conditions, compliance orders, or other requirements imposed by a regulatory agency must be submitted by the RL to the affected regulatory agency(ies).

1.7 PRECEDENCE OF REQUIREMENTS

Cases might arise where two or more similar requirements or limits occur in the acceptance criteria. All requirements and limits must be met. If it appears that one requirement or limit is less restrictive than others, the more restrictive one must be met.

2.0 GENERAL REQUIREMENTS

Certain general requirements apply to acceptance of all waste at Hanford Site TSD units. These requirements are described as follows.

2.1 GENERAL RADIOACTIVE CLASSES OF WASTE MANAGED AT HANFORD SITE TSD UNITS

The TSD units covered by these acceptance criteria manage low-level and TRU waste. This generally excludes acceptance of waste classified as high-level waste, spent nuclear fuel, and/or byproduct material.

2.2 COMPOSITION OF WASTE AND CONTAINERS

For all waste, a detailed record must be kept of the contents, volume, and weight, as well as any added void fillers, sorbents, stabilization agents, or solidification agents (DOE M 435.1-1).

For containerized waste, the container type, weight, internal and external volume, any shielding provided, and the date packaged must be recorded (DOE M 435.1-1). In the case of labpacks, the record shall include the exact number, type, and volume of inner containers.

2.3 PROHIBITED WASTE

The following waste types are not accepted.

- Dangerous waste not having dangerous waste numbers listed on the TSD unit's approved Part A, Form 3, permit application (DOE/RL-88-21).
- Explosive waste (HNF-1886, HNF-2165, HNF-5841, WHC-SD-EN-WAP-005).
- Shock sensitive waste (HNF-1886, HNF-2165, HNF-5841, WHC-SD-EN-WAP-005).
- Pyrophoric waste (HNF-1886 HNF-2165, HNF-5841, WHC-SD-EN-WAP-005,).
- Class IV oxidizer (see definitions) waste (HNF-1886, HNF-2165, HNF-5841, WHC-SD-EN-WAP-005).
- Waste that is readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable (DOE M 435.1-1, Chapters III and IV, N.1).

- Containers packaged such that toxic air pollutants exceed small quantity emission rates in WAC 173-460.
- Infectious waste.

2.4 PHYSICAL AND CHEMICAL CHARACTERIZATION

The waste generator must determine the physical and chemical characteristics of the waste with sufficient accuracy and detail to properly designate and manage the waste in accordance with the unit-specific acceptance criteria and all applicable regulations (i.e., acceptable knowledge) (e.g., HNF-5841, WHC-SD-EN-WAP-005, HNF-1886, HNF-2165, 40 CFR 264.13, WAC 173-303-300, 40 CFR 761).

The following sections describe the physical/chemical characterization requirements for waste acceptance.

2.4.1 Types of Acceptable Knowledge

The types of information that can be used for physical/chemical characterization include data from analysis of the waste and knowledge of the materials and/or processes that generate the waste. Acceptable knowledge can be obtained using the following types of information.

- Analysis data from a representative sample of the waste or for a waste generated by a similar process.
- Test data from a nonradioactive surrogate sample that is chemically representative of a radioactive waste stream.
- Material Safety Data Sheets for commercial chemical products.
- Mass balance data for the waste generating process, to the extent that such data provides a sufficient understanding of the characteristics of and constituents in the waste stream.
- Interview information.
- Logbooks.
- Procurement records.
- Qualified analytical data.
- Radiation work packages.
- Procedures and/or methods.
- Process flow charts.

- Inventory sheets.
- Vendor information.

The following sections describe how this information may be used to meet acceptable knowledge requirements and when analysis of a representative sample is required.

2.4.2 General Waste Knowledge Requirements

General waste knowledge must be sufficient to determine the waste stream designation and to manage the waste in accordance with TSD unit-specific acceptance criteria necessary for proper management of the waste.

Analytical data and/or knowledge of the waste must be sufficient to determine whether the waste is regulated under 40 CFR 261, or 40 CFR 761, and/or WAC 173-303, and to assign correct waste numbers. Knowledge of the waste generating process alone is used to determine whether a waste stream is a listed waste identified in WAC 173-303-080 through WAC-173-303-082. For other waste numbers and for classification under 40 CFR 761, if the available process knowledge is not sufficient to determine whether the waste is regulated and to assign waste numbers, analysis of a representative sample must be performed. The sampling and testing methods outlined in WAC 173-303-110 must be used for the toxicity characteristics, corrosivity, and free liquids. For other characteristic and state criteria designations, when testing is needed, an appropriate method must be used. Appropriate test methods can include SW-846 test methods or any other methods with proper quality assurance and quality control.

In cases where one or more constituents are input into a process, but are not expected to be in the waste in concentrations that would cause the waste to be regulated, and when process knowledge is questionable, sampling and analysis should be performed to demonstrate that the constituents are below regulated limits. This analysis could be met through chemical screening and considered process knowledge.

NOTE: If sampling and analysis were performed, it would only be needed for initial characterization of the waste stream.

All waste must be characterized in a manner sufficient to ensure that the waste can be managed in accordance with the unit-specific waste management requirements set forth in this document. This includes (but is not limited to) sufficient knowledge to demonstrate that the waste is not prohibited from management at that unit, to segregate waste containers for compatibility, to ensure compatibility of waste with containers, to ensure that the waste can be safely managed, and to segregate waste for treatment, storage and/or disposal in accordance with the WSRds.

2.4.3 Land Disposal Restrictions Waste Knowledge

For waste that is a hazardous waste as defined in 40 CFR 261, waste characterization must be sufficient to establish whether the waste is a restricted waste under the LDR provisions of 40 CFR 268 and, if so, to determine the applicable LDR subcategories and treatment standard(s)

for that waste. Testing of a representative sample at a Hanford Site laboratory or another independent laboratory is required when a generator or treatment facility certifies that a waste stream meets a concentration-based treatment standard of 40 CFR 268. To certify that a waste stream meets a specified technology treatment standard in 40 CFR 268, the generator or treatment facility must provide data that demonstrates that the waste was properly treated by that treatment technology.

In addition, for waste that is a dangerous waste as defined in WAC 173-303, characterization must be sufficient to establish which, if any, of the Washington State LDR requirements of WAC 173-303-140 apply.

2.4.4 Exceptions to Physical and Chemical Characterization Requirements

The following exceptions can be made to the physical/chemical characterization requirements stated previously.

- Hazardous debris that is managed in accordance with the alternative treatment standards for hazardous debris (40 CFR 268.45) does not require sampling and analysis for adequate physical/chemical characterization.

- Hanford Site generators can transfer waste for storage at an onsite TSD unit without full characterization for designation and LDR status, provided the characterization is sufficient to demonstrate that the waste can be managed in accordance with the unit-specific acceptance criteria and provided a representative sample (or samples) has been obtained or will be obtained at the TSD unit to fully characterize the waste.

- An alternative management path negotiated by the RL with the appropriate regulatory agency can characterize waste that cannot be characterized in accordance with the requirements stated previously because of factors such as unique chemical or radiological hazards of the waste. This type of exception will be handled by the method outlined in Section 1.6.3.

2.4.5 Recertification

Physical/chemical characterization data for a waste stream must be recertified annually, and whenever the waste generating process changes. Recertification shall, at a minimum, identify changes to the generating process and any additional analytical data obtained from the waste stream. Sampling and analysis of the waste stream is not required to be performed more frequently than required by the regulations.

2.5 RADIOLOGICAL CHARACTERIZATION

The major radionuclides in the waste and the concentration of each major radionuclide must be established with sufficient sensitivity and accuracy to properly classify and manage the waste in accordance with the TSD unit-specific radiological limits (DOE M 435.1-1).

2.5.1 Identification of Major Radionuclides

For the purposes of the radiological criteria in this document, major radionuclides are defined as those radionuclides that meet any of the following conditions. Calculational methods for determining these limits are described in Appendix A.

- Any TRU radionuclide present in the waste in concentration exceeding 1 nanocurie per gram.
- Any fissionable radionuclide present in the waste in a quantity exceeding 0.1 fissile gram equivalent per container.
- Any radionuclide present in concentration exceeding 1 percent of its respective Category 1 limit (Appendix A, Table A-2).

  NOTE: This reporting limit does not apply to TRU waste.
- Any mobile radionuclide present in concentration that exceeds its reporting limit (Appendix A, Table A-2).

  NOTE: This reporting limit does not apply to TRU waste.
- For waste that has no detectable radiological activity but cannot be radiologically released, major radionuclides are those radionuclides believed to contribute more than 1 percent each to the radiological activity based on available process knowledge. The estimated concentration of the radionuclides should be based on the limit of detection of the analysis method used.
- The amount of uranium-235 and uranium-238 in each waste container must be reported if there is at least 0.1 gram of uranium-235 in the container, or if either isotope is a major radionuclide. The amount of uranium-233 in each waste container must be reported if it contains at least 0.1 gram of uranium-233.
- Any radionuclide that accounts for more than 1 percent of the total radiological activity of the waste must be reported. However, a radionuclide in concentration less than 1.0 E-6 curie per cubic meter, and not otherwise reportable, is exempt from reporting.

2.5.2 Methods for Establishing Radionuclide Inventory

The radionuclide inventory of a waste must be established using a method or combination of methods capable of identifying and quantifying the major radionuclides present. The methods chosen must provide adequate sensitivity and accuracy to ensure that the waste is categorized correctly (e.g., Category 1 and 3 limits for the LLBG, correct TRU determination). A graded approach (DOE M 435.1-1) should be applied when planning radiological characterization of waste streams. Using the graded approach, more frequent and detailed analysis is performed when a waste approaches one or more of the limits of these criteria. Conversely, waste that is far below applicable limits of these criteria would not require as extensive or frequent analysis. Use of the data quality objectives process (or an equivalent process) in accordance with

DOE M 435.1-1, should help ensure that the appropriate type, quantity, and quality of radiological characterization data are obtained.

Both direct and indirect methods can be used for characterization (DOE M 435.1-1). When indirect methods are used, these methods must be corroborated periodically with direct measurements. The frequency of corroborative analysis should be based on the variability of the waste generating process, and the extent and consistency of previous analytical data. A graded approach should be applied when determining the appropriate type and frequency of corroborative analysis.

The following characterization methods can be used individually or in combination to establish the radionuclide inventory of the waste.

- Process knowledge—Process knowledge includes documented knowledge of the radioactive materials used and the processes that contributed to the radiological content of the waste, along with historical analysis of waste and radiological contamination from the process. Process knowledge can be used to establish the suspected major radionuclides in a waste stream. In addition, process knowledge can be used to eliminate from further consideration those radionuclides not present in sufficient concentration to be major radionuclides as defined in Section 2.5.1, as long as the basis of this determination is documented.

- Radionuclide material accountability—The content of a given radionuclide in a waste can be determined by documented logs detailing the mass or activity of that radionuclide added to and leaving the waste in a controlled process. In addition, data relating the total inventory of a radionuclide in a process or facility can be used to determine the radionuclide inventory, but must be corroborated periodically with direct measurement methods.

- Field and laboratory analysis methods—Field and laboratory analysis methods, such as NDA, radiochemical analysis, and surveys with field instruments, must be selected as appropriate to detect and quantify the major radionuclides with adequate sensitivity and accuracy for waste classification. Analysis methods that measure gross activity (i.e., not radionuclide specific) must be used in conjunction with other methods to determine the relative concentration (scaling factors) of each suspected radionuclide, and must be corroborated periodically with radionuclide-specific analysis.

- Computer modeling—Computer modeling, applied appropriately, could be used in conjunction with other methods for radiological characterization. An individual who is knowledgeable and experienced in the use and limitations of the model must perform the modeling. The assumptions and measurements used as inputs to computer modeling must be documented. The computer software must be controlled in a manner that meets conventional quality assurance requirements. Computer models must be corroborated periodically with direct measurement methods.

- Scaling factors—Scaling factors can be used to relate the concentration of a readily measured radionuclide to more difficult-to-measure radionuclides. Scaling factors must be developed from one of the previous methods, and must be corroborated periodically with radionuclide-specific analysis.

Other methods of radiological characterization could be used, but must be documented clearly and approved by the WD/GR Project acceptance organization. Documentation of the method must include a detailed description of the method, the radionuclides identifiable by the method, and a discussion of precision, accuracy, quality assurance and quality control methods.

2.5.3 Additional Detail on Mobile Radionuclide Characterization

For low-level and low-level mixed waste, mobile radionuclide reporting is critical for compliance with the LLBG performance assessments (WHC-EP-0645 and WHC-SD-WM-TI-730). Because of the low reporting limits and difficulty of analysis of certain mobile radionuclides, this section provides additional detail concerning acceptable knowledge and characterization.

The concentration of each mobile radionuclide must be established and compared to the Appendix A, Table A-2, reporting limit using process knowledge and/or analysis. If process knowledge alone is used to determine that a mobile radionuclide is not present in a waste stream at the reporting limit, the basis for this determination must be clearly documented. If available analysis techniques cannot detect a mobile radionuclide at its reporting limit, the concentration could be estimated using a combination of process knowledge, scaling factors, and analytical detection limits.

Mobile radionuclide reporting is intended to measure only the quantity of isotopes that exceeds Hanford Site natural background concentrations. For waste forms that contain uranium that originates from natural background on the Hanford Site, the background concentration of that radionuclide can be subtracted from the total concentration.

2.5.4 Recertification

The radiological characterization of waste streams must be recertified with sufficient frequency to account for changes in the generating process, radiological composition, and radiological decay.

2.5.5 Radioactive Material Shipments Less Than 70 Becquerels (0.002 microcuries) Per Gram

- All shipments of radioactive materials having specific activities less than 70 becquerels (0.002 microcuries) per gram shall be shipped in a container that ensures no loss of the radioactive material during loading, inspections, transportation, and unloading.

- The shipping documentation shall have the following statement placed on it. "The following Container(s) _____ Contain Radioactive Material at concentrations that are not regulated for transportation per 49 CFR 173.403 but are not releasable per DOE Order 5400.5 (1990/1993)."

- A radiological survey report shall identify the package radiation exposure rates (i.e., contact and 30 centimeter readings), the expected radionuclides, associated activity levels and package contamination levels, including an evaluation of hard-to-detect radionuclides (e.g., H-3), when necessary. The radiological survey report shall be sent with the shipment as part of the shipping documents.

2.6 WASTE SEGREGATION AND TREATMENT AND/OR DISPOSAL PATH

The following sections discuss waste segregation and the treatment and/or disposal path.

2.6.1 Segregation of Uncontaminated Waste from Radioactive Waste

Generators shall segregate uncontaminated waste from radioactive waste to minimize waste volume and the cost of waste treatment and disposal (DOE M 435.1-1).

2.6.2 Radiological Release of Waste

Generators shall attempt to obtain radiological release of dangerous waste and TSCA PCB waste generated from radioactive material areas in accordance with their site/facility radiological release criteria, unless one or more of the following conditions apply (for Hanford Site Project Hanford Management Contract [PHMC] generators, the Site release criteria are discussed in Appendix F).

- Radiological contamination in the waste is measurable using field instruments.
- Process knowledge clearly identifies that radiological contamination was introduced into the waste.
- The analytical limit of detection for the waste matrix is above the Site/facility radiological release limits (for Hanford Site PHMC generators, the limits of Appendix F, Table F-2).
- The waste is treated and directly disposed as radioactive waste at a cost that is lower than the cost of radiological release and disposal as nonradioactive waste.

The basis for use of these conditions must be documented as part of the radiological characterization record(s) for the waste.

2.6.3 Segregation for Treatment, Storage, and/or Disposal

All waste shall be segregated by the WSRds and waste stream profiles to facilitate proper treatment, storage, and/or disposal. The WSRds identify major waste streams, grouped in a manner that defines currently available storage and disposal methods and, for waste requiring treatment, the anticipated treatment and/or disposal methods. When it is not technically feasible or it is cost prohibitive to segregate a given waste stream by WSRd and profile, the generator

must document the basis for not segregating the waste. Acceptance of non-segregated waste is contingent on either (1) the WD/GR Project acceptance organization identifying a treatment/disposal pathway or (2) approval by the RL to receive the waste stream for storage.

WSRds will include certain waste stream-specific requirements to facilitate treatment, storage, and/or disposal. These criteria must be met in addition to the criteria identified in this document.

The current set of WSRds, along with instructions for selecting the appropriate WSRd, can be obtained from the *Hanford Site Solid Waste Acceptance Program* Internet web site (http://www.hanford.gov/wastemgt/wac/).

2.6.4 Waste Streams Having No Established Treatment/Disposal Path

Every effort shall be made to avoid the generation of waste for which no treatment/disposal path has been identified.

Written RL approval is required for acceptance of any waste stream that has no established treatment/disposal path.

2.6.5 Low-Level Mixed Waste From Non-PHMC Generators

Low-level mixed waste, for which an identified and available treatment capability exists, shall be delivered for disposal at Hanford Site TSD units in accordance with LDR requirements by non-PHMC generators. Non-LDR-compliant low-level mixed waste presented for storage will be considered on a case-by-case basis when no treatment path is available.

2.7 MANAGEMENT AND CERTIFICATION OF TRANSURANIC WASTE

Transuranic waste has a unique set of management and certification requirements based on DOE/WIPP-02-3122. The Hanford Site meets these requirements through implementation of HNF-2600 and HNF-2599. Requirements applicable to generators of transuranic waste are identified in Appendix G.

2.8 RECORDS

The generator must retain all record copy material used for waste characterization and designation in accordance with federal and state requirements and DOE Orders. These records include process knowledge, sampling information, analytical data, inventory records, and related information. The generator must transfer copies of certain records as requested by the WD/GR Project acceptance organization through the waste acceptance process described on the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/).

2.9 CLASSIFIED AND ACCOUNTABLE NUCLEAR MATERIAL

Radioactive waste to which access has been limited for national security reasons and which cannot be declassified shall be managed in accordance with the requirements of DOE O 5632.1C, and DOE O 474.1, (DOE M 435.1-1).

During the acceptance process, the generator shall notify the WD/GR Project acceptance organization of any classified waste. Classified waste is managed on a case-by-case basis.

A DOE/NRC 741 form must be completed for waste that contains accountable nuclear material (DOE O 474.1).

2.10 WASTE VERIFICATION

A portion of the waste containers sent to Hanford Site TSD units must be verified by physical inspection, nondestructive examination, and/or chemical screening as stated in waste analysis plans for the TSD units (e.g., HNF-1886). For most waste types, this verification can be performed at one of the Hanford Site TSD units. Certain types and configurations of waste, however, cannot be verified easily and could require verification at the generator's location before or during packaging. In these cases, generators must notify the Hanford Site acceptance organization and make verification arrangements before packaging the waste. This requirement applies to the following types of waste.

- Shielded waste.
- Remote-handled waste.
- Waste packaged in containers where the length is greater than or equal to 2.90 meters (9 feet 6 inches); width at bottom is greater than or equal to 1.61 meters (5 feet 3.5 inches); width (above 2 feet from bottom) is greater than or equal to 1.93 meters (6 feet 4 inches); and height is greater than or equal to 1.64 meters (5 feet 4.75 inches). These dimensions are absolute dimensions including any attachments such as lifting bails, lid flanges, etc.
- Waste containers weighing more than 3,175 kilograms (7,000 pounds).
- Mixed waste treated by macroencapsulation or microencapsulation.
- Highly compacted (supercompacted) waste.
- Waste packaged in plastic outer containers.
- Other waste that is to be treated or packaged in a form that cannot be inspected easily subsequent to treatment or packaging.

2.11 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical criteria for acceptance of all waste.

2.11.1 Chemical Compatibility

All waste placed in a given outer container shall be chemically compatible (WAC 173-303-630).

2.11.2 Asbestos Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as the liquid does not exceed applicable free liquid requirements.

2.11.3 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter (0.1 watt per cubic foot), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in storage. This evaluation must be provided to and approved by the WD/GR Project acceptance organization.

2.11.4 Gas Generation

Generators shall provide evidence of compliance with DOE M 435.1-1. When vents are required by this section, a certificate of conformance shall be provided stating the vent model number that has been installed on the waste container and that the waste packaging meets the requirements of this section.

When low-level waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container (DOE M 435.1-1, Chapter IV, L.1.b). Unless otherwise specified by the WD/GR Project acceptance organization, a minimum five-year time value shall be used to demonstrate compliance when performing gas generation calculations for low-level waste going directly to disposal.

When a container of newly generated transuranic waste is packaged, vents or other mechanisms shall be provided at the time the waste is packaged to prevent pressurization of the container or generation of flammable or explosive concentrations of gases. Containers of currently stored waste shall meet this requirement as soon as practical unless analyses demonstrate that the waste can otherwise be managed safely (DOE M 435.1-1, Chapter III, L.1.b).

If required, the following mitigating measures (or alternative measures approved by the WD/GR Project acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: Use an approved vent, as listed in Appendix H, or an approved alternative. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). When 90-mil liners are used, the hole size used to vent the liner shall be documented. In addition to filtering, palladium or platinum catalyst packs may be used to control hydrogen concentrations in the container.

- Control of hydrogen from biological decomposition: Waste containing readily biodegradable organic materials (e.g., animal waste, vegetation) must be vented with an approved vent, as listed in Appendix H, or an approved alternative. In addition, slaked lime shall be added to the waste to reduce biological decomposition if filtering alone is not sufficient to control combustible gas generations.

2.12 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste.

2.12.1 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B. Drums with non-exempt quantities of fissile materials must have a minimum steel mass of 23 kilograms (50.7 pounds) in accordance with Table B-2, Footnote 2. A certificate of conformance shall be provided stating the steel content of the drum meets this minimum steel mass.

2.12.2 Dose-Equivalent Curie Limits

Waste must meet the safety basis limit of 82.5 dose equivalent curies per container. Radionuclide quantities greater than 82.5 dose equivalent curies per container may be accepted based on specific container and waste forms but must be evaluated to ensure compliance with safety basis criteria (HNF-15280).

Additionally, each facility has inventory limits as described in HNF-15280. Waste receipts are controlled by each facility to maintain the inventory within these limits.

2.12.3 Package Removable Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of HNF-5173, Table 2-2. Use of fixatives is not allowed to meet the criteria. For returnable overpacks, the contamination limits and fixative prohibition also applies to the outside of the inner package.

2.12.4 Package Dose Rate Limits

Waste packages shall not exceed 1 milliSievert per hour (100 millirem per hour) at 30 centimeters (1 foot) from the waste package and 2 milliSieverts per hour (200 millirem per hour) at any point on the surface of the package. Contact handled containers (see definitions) and remote handled containers may be acceptable at the LLBG if the requirements of Section 3.4.2 are met.

2.13 PACKAGING CRITERIA

The following are the packaging criteria for acceptance of waste.

2.13.1 Container Selection

The packages for waste shall meet applicable 49 CFR container requirements for the hazard class/division of the waste, except that packaging for onsite transfers under an approved package-specific safety document might be allowed where cost or technical constraints make the use of a DOT-compliant package unfeasible. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.

2.13.2 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, dents, bulges, pit or scale corrosion, or other damage that could compromise container integrity (WAC 173-303-630). Minor external surface rust that can be sanded or brushed off will be acceptable. Containers having some pit or scale corrosion could be acceptable for storage provided the integrity of the container is confirmed.

2.13.3 Securing Waste and Shielding

For newly-generated waste, drums on pallets shall be strapped together prior to loading on the shipping transport vehicle. Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

2.13.4 Labeling

Packages shall be labeled according to the instructions in Appendix C.

3.0 ACCEPTANCE CRITERIA FOR THE LOW-LEVEL WASTE DISPOSAL PORTION OF THE LOW-LEVEL BURIAL GROUNDS

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements for the low-level waste disposal portions of the LLBG. For criteria relating to the mixed-waste disposal portions of the LLBG, refer to Chapter 4.0.

3.1 FACILITY DESCRIPTION AND FUNCTION

The LLBG are a land disposal unit for controlled burial of low-level radioactive waste. The LLBG includes a number of disposal trenches that accept only radioactive waste not regulated under 40 CFR 261, WAC 173-303, and waste that is not excluded from disposal under 40 CFR 761 (TSCA PCB waste). The LLBG also include two disposal trenches (trenches 31 and 34) for disposal of mixed waste. This chapter relates only to the acceptance criteria for the low-level waste disposal portions of the LLBG. Acceptance criteria for trenches 31 and 34 are provided in Chapter 4.0.

3.2 PROHIBITED WASTE

The following types of waste are not disposed in the low-level waste disposal portions of the LLBG:

- Waste that is dangerous or extremely hazardous as defined by WAC 173-303, or hazardous waste as defined by 40 CFR 261.

- TSCA-regulated PCB waste is prohibited except as specifically authorized under 40 CFR 761.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.1. Low-level waste must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and, if containers are used, between the waste and its container, shall be reduced to the extent practical (DOE M 435.1-1, Chapter IV, G.1.d.1). Additional requirements related to these criteria are listed in Section 3.5.3.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.2. Liquid low-level waste or low-level waste containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the low-level waste is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form (DOE M 435.1-1, Chapter IV, G.1.d.2). Additional requirements related to these criteria are listed in Section 3.3.1.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.3. Low-level waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable (DOE M 435.1-1).

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.4. Low-level waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or harmful to the long-term structural stability of the disposal site (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4 and Section 3.3.4.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.5. Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20 degrees Celsius (68 degrees Fahrenheit) (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4 and Section 3.3.4.

- Unstabilized organic liquids exceeding 1 percent of the waste by weight.

- Unstabilized chelating compounds exceeding 1 percent of the waste by weight.

- Transuranic waste and waste that exceeds other radiological limits of Section 3.4.1.

3.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical/chemical criteria for acceptance of waste at the LLBG.

3.3.1 Liquids and Liquid-Containing Waste

Liquids must be sorbed or stabilized in accordance with Appendix E.

3.3.2 Land Disposal Restrictions

Waste that is initially subject to regulation under the RCRA can be disposed in Hanford's low-level waste disposal units with a determination that the waste is no longer a dangerous waste, and that the waste meets the applicable treatment standards of 40 CFR 268 and WAC 173-303-140. These waste types normally include characteristic-only (D001–D043) waste and hazardous debris that exits RCRA regulation in accordance with 40 CFR 261.3(d) or (f).

For characteristic waste with concentration-based treatment standards, the generator/treater must obtain analytical data supporting the de-characterized waste determination, and the generator/treater must submit a notification and certification to their local U.S. Environmental Protection Agency (EPA) region administrator and/or authorized state program (40 CFR 268.9[d]).

For debris that is excluded from the definition of hazardous waste, the generator/treater must submit a notification to their EPA region administrator and/or authorized state program in accordance with 40 CFR 268.7(d)(1), and the generator/treater must complete a certification in accordance with 40 CFR 268.7(d)(3).

Hanford may request that the generator/treater provide copies of these notifications and certifications with the submittal of waste profiles and/or waste shipment.

Waste initially designated as state-only waste under WAC 173-303 can be disposed in the LLBG with a determination that the waste has been properly treated and redesignated as nondangerous waste following treatment.

3.3.3 Solidification or Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1 percent of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds. Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

3.3.4 Gas Generation

Radioactive animal carcasses must be packaged as follows.

- The waste must be packaged in an inner and outer metal package, where the outer package has a capacity at least 40 percent greater than that of the inner package. The outer package must be a metal container that meets applicable transportation requirements for shipment to the LLBG.
- The inner package shall be lined with a minimum 4 mil plastic liner. The animal carcass(es) in the inner package must be surrounded with slaked lime. The plastic liner and inner package must be sealed.
- A minimum of 7.6 centimeters (3 inches) of mineral sorbent must be placed in the bottom of the outer package. The inner package must be placed into the outer package, and the void space filled between the two packages with additional mineral sorbent.
- The outer package must be sealed.

3.4 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste at the LLBG.

3.4.1 Radiological Concentration Limits

The methodology for classification of the radionuclide content of waste according to the various limits listed in the following sections is provided in Appendix A. A waste must meet all of the following conditions to be disposed in the LLBG.

- TRU content limit—TRU content (as calculated by method A1.1 of Appendix A) shall not exceed 100 nanocuries (3,700 becquerels) per gram of waste (DOE M 435.1-1).

- Waste category (as calculated by methods A1.4 and A1.5 of Appendix A) shall not exceed Category 3, except with an analysis coordinated by the WD/GR Project acceptance organization demonstrating that the LLBG performance assessment conditions are met (WHC-EP-0645, WHC-SD-WM-TI-730).

- Category 3 waste (as calculated by methods A1.4 and A1.5 of Appendix A) can be disposed of only if the waste meets one of the following waste form stability criteria (WHC-EP-0645, WHC-SD-WM-TI-730).

  - Packaging in a high-integrity container (HIC) that is procured through WHC-S-0486 specification.

  - Packaging in a HIC approved by the WD/GR Project acceptance organization.

    NOTE: A list of approved HICs is available on the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/).

  - Placement in a monolith in the LLBG.

  - Stabilization in concrete or other stabilization agents. The stabilized waste must meet the leach index and compression strength criteria of the U.S. Nuclear Regulatory Commission (NRC) *Technical Position Paper on Waste Form*, Section C.2 and Appendix A (NRC 1991). Several Hanford-approved concrete mix formulas have been developed that can be used to meet the stabilization criteria. Contact the WD/GR Project acceptance organization for information on use of these formulas.

  - Inherently stable waste that meets the stability requirements of 10 CFR 61.56 and the NRC *Technical Position Paper on Waste Form* (NRC 1991).

- Mobile radionuclides—If the concentration of any mobile radionuclide exceeds the Mobile Radionuclide Reporting Limit of Appendix A, Table A-2, stabilization could be required (WHC-EP-0645, WHC-SD-WM-TI-730). The WD/GR Project acceptance organization will perform a case-by-case evaluation based on the LLBG performance assessment (WHC-EP-0645, WHC-SD-WM-TI-730) to determine whether the waste requires stabilization to meet the groundwater pathway dose criteria. Stabilization normally would consist of placing the waste container in a HIC, but additional stabilization might be required based on a number of factors such as waste form and radionuclide content. The WD/GR Project acceptance organization will coordinate this evaluation.

3.4.2 Package Dose Rate Limits

Containers with dose rates less than or equal to 2 milliSieverts per hour (200 millirem per hour) at contact and less than 1 milliSievert per hour (100 millirem per hour) at 30 centimeters (11.8 inches) are acceptable at the LLBG. Contact handled containers (see definitions) exceeding these limits require container-specific review and approval.

Remote-handled waste is acceptable at the LLBG if approved through both a waste stream profile sheet and a container-specific shipment. Remote-handled waste shall meet the applicable dose rate restrictions of U.S. Department of Transportation (DOT) or an approved package-specific safety document. Remote-handled waste shall be configured for unloading such that personnel exposures are maintained as low as reasonably achievable (ALARA).

3.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at the LLBG.

3.5.1 Package Construction

Containers must meet one of the following criteria to ensure compliance with the LLBG Fire Hazards Analysis.

- Constructed of metal, concrete, or masonry.
- Constructed of wood that is either (1) pre-treated wood having the Underwriters Laboratory FR-S stamp, or (2) painted with a fire-retardant paint that has been approved by Underwriters Laboratory or Factory Mutual.
- Constructed of rigid plastic that has a maximum flame spread rating of 25 when tested by a nationally recognized testing laboratory to American Society for Testing of Materials (ASTM) Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM E-84, most current version). These containers will only be accepted if approved by WD/GR Project Fire Protection Engineering.
- Constructed of flexible plastic packaging provided the waste matrix is limited to soils, metals, concrete, or masonry. Incidental amounts of organic material such as personal protective equipment are allowed in flexible packaging.
- Other containers as authorized under the LLBG Fire Hazards Analysis or as approved by WD/GR Project Fire Protection Engineering.

Sacrificial rigging shall not contain regulated materials, such as lead.

Containers shall be compatible with the waste and maintain containment during handling and storage before disposal. Where required, an appropriate combination of protective coatings and liners shall be used to prevent loss of container integrity.

3.5.2 Handling of Packages

All packages must be configured for safe unloading by forklift or crane. Alternate means of unloading could be allowed with approval from the TSD unit manager or designee. Packages that must be unloaded by crane shall be equipped with a lifting system designed to safely lift the fully loaded package. All slings and lifting devices shall meet the requirements of the most current version of DOE/RL-92-36. For packages that have special unloading requirements, information must be provided to the WD/GR Project acceptance organization concerning the methods for unloading before the shipment is scheduled. Sacrificial rigging shall be provided for remote-handled waste packages. Rigging shall not contain regulated materials, such as lead.

3.5.3 Minimization of Subsidence

All waste shall be in a form that minimizes settling and subsidence of the LLBG to the maximum extent feasible (DOE M 435.1-1, WHC-EP-0645, and WHC-SD-WM-TI-730). The following forms will be considered to meet these criteria.

- Containerized waste that fills at least 90 percent of the internal volume of the outer container. Void fillers must be selected and used in accordance with Appendix E.

- Waste compacted to a minimum of 1.41 kilogram-force per square centimeter (20 pounds per square inch), containerized soil and soil-like solids, and sorbed liquids, that fill at least 80 percent of the volume of the container.

- Non-containerized waste that will not subside in the disposal environment (e.g., rocks, soil, building rubble, activated metal).

- Packaging in a HIC or placement in a Hanford-provided HIC or monolith in the LLBG. If the applicable WSRd for the waste specifies that stabilization is required, this requirement will be met.

- Stabilization in concrete or other stabilization agents per Section 3.4.1.

3.5.4 Labeling

Bulk waste and remote-handled waste containers that are removed from reusable overpacks are exempt from labeling requirements at the LLBG. For unusual waste forms, special labeling provisions can be arranged with the WD/GR Project acceptance organization.

3.5.5 Bulk (Noncontainerized) Waste

Certain types of waste can be disposed in bulk rather than packaging in containers. This includes soil, vegetation, building rubble, and other homogeneous waste having relatively low concentrations of radionuclides and hazardous chemical constituents. To avoid unnecessary conservatism, universally applicable limits have not been developed for the LLBG acceptance criteria. Instead, a case-by-case evaluation will be performed on request to determine whether a given waste stream can be disposed in bulk. Any mitigating measures required to meet the conditions of the safety basis will also be determined on a case-by-case basis.

Waste types that are not surface contaminated with readily dispersible radiological or hazardous chemical contamination, such as activated metal or internally contaminated equipment, may be considered containerized. As such, they are subject to the radionuclide and chemical concentration requirements for containerized waste rather than the bulk waste requirements.

4.0 ACCEPTANCE CRITERIA FOR THE MIXED WASTE DISPOSAL PORTION OF THE LOW-LEVEL BURIAL GROUNDS

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements for the low-level waste disposal portions of the LLBG trenches 31 and 34.

4.1 FACILITY DESCRIPTION AND FUNCTION

Trenches 31 and 34 of the 218-W-5 Burial Ground are RCRA-compliant units for disposal of certain low-level mixed waste. Currently, only low-level waste originally designated with RCRA characteristic numbers D001 through D043, certain listed waste numbers (F001 through F005, and F039 derived from F001 through F005 waste), and Washington state-only dangerous waste (except waste number WSC2-acid) are accepted in trenches 31 and 34. All waste accepted at trenches 31 and 34 must meet the applicable LDR treatment standards of 40 CFR 268 and WAC 173-303-140. There also are safety-based and environmentally based limits on the radionuclide concentrations of waste received.

4.2 PROHIBITED WASTE

The following types of waste are not disposed in trenches 31 and 34.

- Waste designated with any RCRA U, P, or K waste numbers, any F-listed waste (other than F001, F002, F003, F004, F005, or F039), and WSC2-acid (DOE/RL-88-21). F039 waste is limited to waste derived from F001, F002, F003, F004, and/or F005 waste.

- TSCA-regulated PCB waste except as specifically authorized by 40 CFR 761.

- *CERCLA* waste shipped directly from the generator, unless the EPA has specifically approved (e.g., a Record of Decision) management of the waste at the LLBG.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.1. Low-level waste must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical (DOE M 435.1-1, Chapter IV, G.1.d.1). Additional requirements related to these criteria are listed in Section 4.5.3.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.2. Liquid low-level waste or low-level waste containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the low-level waste is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form

(DOE M 435.1-1, Chapter IV, G.1.d.2). Additional requirements related to these criteria are listed in Section 4.3.1.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.3. Low-level waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable (DOE M 435.1-1).

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.4. Low-level waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or harmful to the long-term structural stability of the disposal site (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4 and Section 4.3.4.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.5. Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20 degrees Celsius (68 degrees Fahrenheit) (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4 and Section 4.3.4.

- Waste that does not meet all applicable treatment standards of 40 CFR 268 and WAC 173-303-140.

- Unstabilized chelating compounds exceeding 1 percent of the waste by weight.

- Transuranic waste and waste that exceeds other radiological limits of Section 4.4.1.

- Waste that is incompatible with the trench liner, as defined in Section 4.3.3 (40 CFR 264.301; WAC 173-303-665; HNF-5841).

4.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical/chemical criteria for acceptance of waste at trenches 31 and 34.

4.3.1 Liquids and Liquid-Containing Waste

All free liquids must be absorbed or stabilized in accordance with Appendix E, or otherwise removed from the waste, except when specifically allowed as follows.

- Containerized free liquids are allowed in the following situations, but cannot exceed 1 percent of the volume of the waste (40 CFR 264.314, HNF-5841).

  – Free liquids in a very small container, such as an ampule.

  - Small articles that contain free liquids required for the article to function (e.g., batteries or capacitors).

- For liquid-containing waste where condensate could form in inner plastic packaging (e.g., bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbents within the inner plastic packaging (HNF-5841). The type and amount of sorbent required shall be in accordance with Appendix E. In any case, the amount of liquid may not exceed 1 percent of the volume of the waste or 0.5 percent of waste processed to a stable form (DOE M 435.1-1).

- Residual liquids in large debris items shall be sorbed or removed. In cases where it is not practical to remove suspected liquids and it is impossible to sample to determine if liquids are present, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item (HNF-5841). In any case, the amount of liquid cannot exceed 1 percent of the volume of the waste (DOE M 435.1-1).

4.3.2 Land Disposal Restrictions

All waste subject to RCRA LDR (40 CFR 268) and/or the Washington State LDR (WAC 173-303-140) must be demonstrated to meet all applicable treatment standards and requirements. For waste that has concentration-based treatment standards for specific hazardous constituents under 40 CFR 268, the waste must be tested at a Hanford Site laboratory or another independent laboratory in accordance with 40 CFR 268. For waste that has treatment standards that are not concentration-based, the generator and/or treatment facility must demonstrate that the waste meets the applicable treatment standards using process knowledge and/or by waste analysis, as required by the applicable sections of 40 CFR 268 and WAC 173-303-140 (HNF-5841).

4.3.3 Compatibility of Waste With Liner

All waste disposed in trenches 31 and 34 must be compatible with the landfill liner system (HNF-5841). A variety of chemical constituents have been evaluated for compatibility with the liner system, and it is believed that waste that meets LDR requirements and the other acceptance criteria of this chapter will be compatible (HNF-5841, WHC-SD-WM-TI-714). An assessment will be performed by the WD/GR Project acceptance organization on each waste stream to confirm the compatibility of the waste with the liner. In cases where a waste contains constituents that have not been evaluated previously for liner compatibility, testing by Method 9090 of SW-846 could be required.

NOTE: Table 4-1 lists certain chemical constituents, in concentrated form, that have been evaluated and determined to be incompatible with the liner.

4.3.4 Gas Generation

The requirements are identical to those in Chapter 3.0, Section 3.3.4.

4.3.5 Solidification and Stabilization of Chelating Compounds

Chelating compounds exceeding 1 percent of the waste by weight must be solidified or stabilized to a form that immobilizes chelating compounds. Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

4.4 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste in trenches 31 and 34.

4.4.1 Radiological Concentration Limits

The requirements are identical to those in Chapter 3.0, Section 3.4.1.

4.4.2 Criticality Safety Limits

The fissile and fissionable material limits are provided in Appendix B. Note that for trenches 31 and 34, non-exempt quantities of uranium-bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation (refer to Footnote 1 of Table B-3 in Appendix B). Drums with non-exempt quantities of fissile materials must have a minimum steel mass of 23 kilograms (50.7 pounds) in accordance with Table B-2, Footnote 2. A certificate of conformance shall be provided stating the steel content of the drum meets this minimum steel mass.

4.4.3 Package Dose Rate Limits

The requirements are identical to those in Chapter 3.0, Section 3.4.2.

4.5 PACKAGING CRITERIA

The following are packaging criteria for acceptance in trenches 31 and 34.

4.5.1 Package Construction

The requirements are identical to those in Chapter 3.0, Section 3.5.1.

4.5.2 Handling of Packages

Handling requirements are the same as shown in Chapter 3.0, Section 3.5.2.

4.5.3 Minimization of Subsidence

All waste shall be packaged in a form that minimizes settling and subsidence in trenches 31 and 34 to the maximum extent feasible (DOE M 435.1-1, WHC-EP-0645, and WHC-SD-WM-TI-730). Containerized waste must be at least 90 percent full when placed in the disposal unit (WAC 173-303-665).

4.5.4 Labeling

The requirements are identical to those in Chapter 3.0, Section 3.5.4.

4.5.5 Bulk (Noncontainerized) Waste

The requirements are identical to those in Chapter 3.0, Section 3.5.5.

Table 4-1. Chemical Constituents Known to be Incompatible With Liner System.

Chemical Constituent	Chemical Abstract Service Number(s)
Aqua regia	8007-56-5
Bromic acid	7789-31-3
Bromine (elemental)	7726-95-6
Bromobenzene	108-86-1
Bromoform	75-25-2
Calcium bisulfite	13780-03-5
Calcium sulfide	20548-54-3
Chlorine (elemental)	7782-50-5
1-Chloropentane (amyl chloride)	543-59-9
1,1-Dichloroethylene (vinylidene chloride)	75-35-4
1,2-Dichloropropane (propylene dichloride)	78-87-5
Diethyl benzene	105-05-5, 135-01-3, 141-93-5
Diethyl ether	60-29-7
Chloroethane (ethyl chloride)	75-00-3
Fluorine (elemental)	7782-41-4
Nitrobenzene	98-95-3
Sulfur trioxide	7446-11-9
Sulfuric acid, fuming	8014-95-7
Tetrachloroethylene	127-18-4
Thionyl chloride	7719-09-7
Trichloroethylene	79-01-6, 52037-46-4

Source: WHC-SD-WM-TI-714, 1995, *High-Density Polyethylene Liner Chemical Compatibility for Radioactive Mixed Waste Trenches*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

5.0 ACCEPTANCE CRITERIA FOR THE CENTRAL WASTE COMPLEX

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements at the CWC.

5.1 FACILITY DESCRIPTION AND FUNCTION

The CWC is a storage unit for low-level mixed, TRU, TRU mixed, TSCA PCB waste, and other waste types requiring treatment before disposal. Waste stored at the CWC will be treated and repackaged as required for disposal as treatment capabilities become available.

The CWC manages waste having characteristic waste numbers D001 through D043, certain listed, discarded chemical product waste numbers (U- and P- listed waste), certain F-listed waste (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste numbers. Table 5-1 lists the acceptable dangerous waste numbers from the approved CWC Part A, Form 3 (DOE/RL-88-21). In addition, the CWC manages TSCA PCB waste from Hanford Site generators in accordance with 40 CFR 761. The CWC also can store waste from *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) cleanup activities..

Table 5-1. CWC Dangerous Waste Numbers.

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001 thru D043	F001 F002 F003 F004 F005 F020 F021 F022 F023 F026 F027 F028 F039	U001 thru U012 U014 thru U039 U041 thru U053 U055 thru U064 U066 thru U099 U101 U102 U103 U105 thru U194 U196 U197 U200 thru U223 U225 thru U228 U232 thru U240 U243 thru U249 U328 U353 U359	P001 thru P018 P020 thru P024 P026 thru P031 P033 P034 P036 thru P051 P054 P056 thru P060 P062 thru P078 P081 P082 P084 P085 P087 P088 P089 P092 thru P099 P101 thru P116 P118 thru P123	WT01 WT02 WP01 WP02 WP03 WCS2 W001

5.2 PROHIBITED WASTE

The following wastes are not accepted for storage at the CWC.

- Liquid waste, except if packaged in labpacks or overpacks in quantities less than or equal to 57 liters (15 gallons) per outer container.

5.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical criteria for acceptance of waste at the CWC.

5.3.1 Liquids and Liquid-Containing Waste

Sorbtion of liquids is allowed, but must be compatible with the treatment methods anticipated for disposal. Liquids must be sorbed or stabilized in accordance with Appendix E.

For waste that could form condensate during storage, sufficient sorbent shall be added to the container to sorb any condensate formed.

5.4 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at the CWC.

5.4.1 Container Selection

Outer containers shall be constructed of noncombustible materials. Wood, fiberboard, and plastic outer containers are prohibited (HNF-15280).

5.4.2 Protective Coatings and Liners

The packaging for stored waste shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste, as follows.

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.

- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WD/GR Project acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

5.4.3 Packaging of Liquid Waste

The following are requirements for packaging of liquid waste as lab packs and overpacked liquids.

- Up to 57 liters (15 gallons) of liquid can be packaged in inner glass, metal, or plastic containers. Glass containers shall not exceed 4 liters (1.1-gallon) capacity each. Sufficient head space must be left in the inner containers to prevent breakage because of expansion in temperatures up to 55 degrees Celsius (131 degrees Fahrenheit) and freezing conditions.

- Inner containers shall be securely closed. The lids of glass containers shall be sealed with Teflon1™ or equivalent lid seals (gaskets). After closure, glass lids shall be taped.

- All inner containers shall be compatible with the waste contents over the anticipated storage life of the waste.

- Each inner container shall be labeled with its contents.

- A sufficient quantity of polymer sorbent (selected in accordance with Appendix E) shall be packaged around the inner containers to sorb twice the volume of the liquid in the inner containers. The sorbent shall be placed around the inner containers in a manner that prevents shifting and breakage.

5.4.4 Package Size and Weight Limits

The following are the baseline size limits for the CWC storage modules. Larger containers could be accepted into specific storage modules with special loading procedures. Drums smaller than 208 liters (55 gallons) are not accepted on a routine basis, but could be approved on a case-by-case evaluation.

1 Teflon is a registered trademark of E. I. DuPont de Nemours & Company, Wilmington, Delaware.

Table 5-2. Central Waste Complex Container Size and Floor Loading Limits.

Storage Units	Package Size Limit	Floor Loading Limit
Alkali metal modules	321 liter (85-gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
Low-flashpoint modules	321 liter (85-gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
2401-W Building	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	2,200 kilograms per square meter (450 pounds per square foot)
2402-W Building	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	3,430 kilograms per square meter (700 pounds per square foot)
2402-WB through WL Buildings, 2403-W and 2404-W facilities	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	9,800 kilograms per square meter (2,000 pounds per square foot)

5.4.5 Stacking

Packages must be designed to withstand the weight of two layers of 208 liter (55-gallon) drums weighing 454 kilograms (1,000 pounds) each stacked on top.

5.4.6 Waste Pallets

Newly generated waste shall be stored on non-combustible pallets (HNF-12206). For this section, newly generated waste is defined as waste received at the CWC after October 1, 2002. Metal pallets will be used for any waste received after this date. Wood pallets will only be accepted at the facility on a case-by-case basis to support transportation and/or special handling requirements (an exception to this criteria will be required).

6.0 ACCEPTANCE CRITERIA FOR THE T PLANT COMPLEX

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements at the T Plant Complex.

6.1 FACILITY DESCRIPTION AND FUNCTION

T Plant Complex is a treatment and storage unit having a number of functions, including equipment decontamination, waste treatment, storage, sampling, NDE, repackaging. The 221-T Building is being prepared for the storage of K Basin sludge. In addition, this building can be used for decontamination, treatment, and storage of equipment and waste. The 2706-T Building is used for the decontamination, treatment, storage, etc., of equipment and waste having relatively low levels of radiological contamination. The 214-T Building is for storage purposes.

Waste that can be managed at the T Plant Complex includes TRU, TRU-mixed, low-level waste, hazardous/dangerous low-level mixed, and TSCA PCB waste. Table 6-1 lists the acceptable dangerous waste numbers from the approved T Plant Complex, Part A, Form 3 (DOE/RL-88-21). The T Plant Complex can also manage TSCA PCB (40 CFR 761) waste.

Table 6-1. T Plant Complex Dangerous Waste Numbers.

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001 thru D043	F001 thru F012 F019 thru F023 F026 thru F028 F039	U001 thru U012 U014 thru U039 U041 thru U053 U055 thru U064 U066 thru U099 U101 thru U103 U105 thru U138 U140 thru U174 U176 thru U194 U196 U200 thru U211 U213 thru U223 U225 thru U228 U234 thru U240 U243 U244 U246 thru U249 U271 U278 thru U280 U328 U353 U359 U364 U367 U372 U373 U387 U389 U394 U395 U404 U409 thru U411	P001 thru P018 P020 thru P024 P026 thru P031 P033 P034 P036 thru P051 P054 P056 thru P060 P062 thru P078 P081 P082 P084 P085 P087 thru P089 P092 thru P099 P101 thru P116 P118 thru P123 P127 P128 P185 P188 thru P192 P194 P196 thru P199 P201 thru P205	WT01 WT02 WP01 WP02 WP03 WCS2 W001

Waste managed at the T Plant Complex could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing at the T Plant Complex.

6.2 PROHIBITED WASTE

The following waste types are not accepted at the T Plant Complex:

- *CERCLA* waste shipped directly from the generator to the T Plant Complex, unless the EPA has specifically approved (e.g., a Record of Decision) management of the waste at the T Plant Complex.

- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20 degrees Celsius (68 degrees Fahrenheit), except that pressurized aerosol cans can be accepted (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.

6.3 RADIOLOGICAL CRITERIA

The following are the radiological acceptance criteria specific to the T Plant Complex.

6.3.1 Package External Dose Rate Limits

Waste packages that exceed 1 milliSievert per hour (100 millirem per hour) at 30 centimeters (1 foot) from the waste package or 2 milliSieverts per hour (200 millirem per hour) at any point on the surface of the package require case-by-case evaluation for acceptance. When these dose rates are exceeded, the generator must provide detailed radiological survey data.

6.3.2 Internal Dose Rate and Contamination Limits for Decontamination and Processing

The contact dose rate for equipment and waste to be decontaminated or processed will be determined on a case-by-case basis during acceptance review. When internal contact dose rates exceed 1 milliSievert per hour (100 millirem per hour), the generator must provide detailed radiological survey information.

In addition, items with detectable alpha contamination may not be acceptable for decontamination or processing at 2706-T Building. If the waste contains detectable alpha contamination, the generator must provide detailed radiological survey information to determine whether the waste can be processed.

6.4 PACKAGING CRITERIA

The following are the packaging criteria for acceptance of waste at the T Plant Complex.

6.4.1 Container Selection

Outer containers shall be constructed of metal or concrete, except that fire-retardant wood boxes can be used.

6.4.2 Protective Coatings and Liners for Stored Waste

The packaging for waste to be stored shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste as follows.

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.

- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WD/GR Project acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

6.4.3 Container Size Limits

Container size limits are as follows.

- 2706-T: 12.2 meters (40 feet) long by 4.3 meters (14 feet) high by 3.7 meters (12 feet) wide
- 221-T: 6.7 meters (22 feet) long by 4.0 meters (13 feet) high by 5.5 meters (18 feet) wide
- 214-T: 6.0 meters (20 feet) long by 3.0 meters (10 feet) high by 3 meters (10 feet) wide.

These size limits may be exceeded on a case-by-case basis with approval from facility operations via a waste profile.

6.4.4 Container Weight Limits

General container weight limits are as follows. Heavier containers can be accepted on a case-by-case basis with T Plant Complex operations' approval.

- Drums shall not exceed 454 kilograms (1,000 pounds)
- Boxes shall not exceed their rated weight capacity

- Large equipment or packages shall not exceed the following limits.
  - 2706-T: 5,400 kilograms (11,900 pounds) (small vehicles); 9,100 kilograms (20,000 pounds) per axle or 36,000 kilograms (80,000 pounds) gross (heavy equipment); or 110,000 kilograms (243,000 pounds) (rail rolling stock). All limits except rail rolling stock can be exceeded on a case-by-case basis.
  - 221-T: 41,000 kilograms (90,000 pounds).

7.0 ACCEPTANCE CRITERIA FOR THE WASTE RECEIVING AND PROCESSING FACILITY

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements at the WRAP.

The following acceptance criteria apply to newly generated waste sent to the WRAP. Newly generated TRU waste shall be managed in accordance with Section 2.7. Acceptance criteria for retrieved waste containers in the LLBG will be established through project-specific acceptance procedures.

7.1 FACILITY DESCRIPTION AND FUNCTION

The WRAP is a treatment and storage unit. The WRAP receives waste containers for verification, sampling, NDA, NDE, treatment, and repackaging.

Waste that can be managed at the WRAP includes TRU waste, TRU mixed waste, low-level waste, low-level mixed, and TSCA PCB waste. Table 7-1 lists the acceptable dangerous waste numbers from the approved WRAP Part A, Form 3 (DOE/RL-88-21). In addition, the WRAP manages TSCA PCB waste.

Table 7-1. The WRAP Dangerous Waste Numbers.

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001 thru D012 D016 D018 thru D043	F001 F002 F003 F004 F005 F020 F021 F022 F023 F026 F027 F028 F039	U001 thru U012 U014 thru U039 U041 thru U053 U055 thru U064 U066 thru U099 U101 U102 U103 U105 U132 U133 U134 U135 thru U197 U200 U222 U223 U225 thru U228 U232 thru U240 U243 thru U249 U328 U353 U359	P001 thru P018 P020 thru P024 P026 thru P031 P033 P034 P036 thru P051 P054 P056 thru P060 P062 thru P078 P081 P082 P084 P085 P087 P088 P089 P092 thru P099 P101 thru P116 P118 thru P123	WT01 WT02 WP01 WP02 WP03 WCS2 W001

Waste managed at the WRAP could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these TSD units must be met subsequent to reprocessing waste at the WRAP.

7.2 PROHIBITED WASTE

The following waste types are not accepted at the WRAP.

- *CERCLA* waste shipped directly from the generator to the WRAP, unless the EPA has specifically approved (e.g., a Record of Decision) management of the waste at the WRAP facility.

- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20 degrees Celsius (68 degrees Fahrenheit), except that pressurized aerosol cans can be accepted (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.

- Liquid waste, except if packaged in labpacks or overpacks in quantities less than or equal to 57 liters (15 gallons) per outer container.

7.3 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at the WRAP.

7.3.1 Protective Coatings and Liners for Stored Waste

The packaging for mixed waste to be stored shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste.

- The exterior coating of metal containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.

- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WD/GR Project acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

7.3.2 Noncombustible Containers

Outer containers shall be constructed of metal, except that fire-retardant wood boxes can be used for low-level waste only. Additionally, wood boxes must be overpacked in a metal box for NDA at the WRAP.

7.3.3 Package Size Limits

The container sizes that can be handled at the WRAP are as follows.

- Drums not exceeding 321 liters (85 gallons).
- Boxes less than the following dimensions can be received for NDE.

  Length must be less than 2.90 meters (9 feet 6 inches); width at bottom must be less than 1.61 meters (5 feet 3.5 inches); width above 2 feet from bottom must be less than 1.93 meters (6 feet 4 inches); and height must be less than 1.64 meters (5 feet 4.75 inches). These dimensions are absolute dimensions including any attachments such as lifting bails or lid flanges.

7.3.4 Package Weight Limits

The maximum weight for containers handled at the WRAP is as follows.

- Drums: 450 kilograms (990 pounds)
- Standard Waste Box: 1,800 kilograms (3,970 pounds)
- Other Boxes: 3,175 kilograms (7,000 pounds)

7.3.5 Labeling

Packages shall be labeled as described in Appendix C.

8.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

10 CFR 830, "Nuclear Safety Management," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

49 CFR, "Transportation," *Code of Federal Regulations*, as amended.

49 CFR 173, "Shippers—General Requirements for Shipments and Packagings," *Code of Federal Regulations*, as amended.

ANSI/ANS 8.15, 1981, *Nuclear Criticality Control of Special Actinide Elements*, American National Standards Institute/American Nuclear Society, New York, New York.

ASTM Standard E-84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, American Society for Testing of Materials, Philadelphia, Pennsylvania. (Use most current version.)

Atomic Energy Act of 1954, 42 USC 2011 et seq.

Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC 9601 et seq.

DOE M 435.1-1, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

DOE O 474.1, *Control and Accountability of Nuclear Materials*, U.S. Department of Energy, Washington, D.C.

DOE O 5632.1C, *Protection and Control of Safeguards and Security Interests*, U.S. Department of Energy, Washington, D.C.

DOE/RL-88-21, 2002, *Hanford Facility Dangerous Waste Permit, Part A Permit Application*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-31, 2001, *Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. (Use most current version.)

DOE/RL-92-36, 2003, *Hanford Site Hoisting and Rigging Manual*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. (Use most current version.)

DOE/RL-2000-25, 2003, *Contracts Requirement Document 435.1, Radioactive Waste Management Plan,* Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/WIPP-02-3122, 2002, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Rev. 0.1, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.

HNF-1886, 2000, *Central Waste Complex Waste Analysis Plan*, Rev. 1, Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-2165, 1999, *WRAP Facility Waste Analysis Plan*, Rev. 1, Waste Management Federal Services of Hanford, Inc., Richland, Washington.

HNF-2599, *Hanford Site Transuranic Waste Characterization Quality Assurance Project Plan*, Fluor Hanford, Inc., Richland, Washington.

HNF-2600, *Hanford Site Transuranic Waste Certification Plan*, Fluor Hanford, Inc., Richland, Washington.

HNF-5173, 2002, *Project Hanford Radiological Control Manual,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-5841, 2000, *Low-Level Burial Grounds Waste Analysis Plan,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-12206, 2003, *Central Waste Complex (CWC) Fire Hazard Analysis (FHA),* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-15280, 2003, *Technical Safety Requirements for the Solid Waste Operations Complex*, Rev. 1, Fluor Hanford, Inc., Richland, Washington.

NRC, 1991, *Technical Position Paper on Waste Form*, Rev. 1, U.S. Nuclear Regulatory Commission Office of Nuclear Material Safety and Safeguards, Washington, D.C.

NRC, 1996, *Safety Analysis Report for the TRUPACT II Shipping Package (SARP),* NRC Docket No. 71-9218, Revision 19a, U.S. Department of Energy, Washington, D.C.

NUREG-0782, "Licensing Requirements for Land Disposal of Radioactive Waste," Draft Environmental Impact Statement on 10 CFR Part 61, U.S. Nuclear Regulatory Commission, September 1981.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, 3rd ed., Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C.

Toxic Substances Control Act of 1976, 15 USC 2601 et seq.

UFC, 1997, *Uniform Fire Code*, 1997 Edition, International Fire Code Institute, Austin, Texas.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

WHC-EP-0645, 1995, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington.

WHC-S-0486, 1998, *Specification for High Integrity Container, 300 Year*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-WAP-005, 1999, *Waste Analysis Plan for T Plant Complex*, Rev. 0, Waste Management Federal Services of Hanford, Inc., Richland, Washington.

WHC-SD-WM-TI-714, 1995, *High-Density Polyethylene Liner Chemical Compatibility for Radioactive Mixed Waste Trenches*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-TI-730, 1996, *Performance Assessment for the Disposal of Low-Level Waste in the 200 East Area Burial Grounds*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A
A1.0 RADIOLOGICAL CALCULATION METHODS

A variety of radiological calculations are required to determine whether a waste can be managed at Hanford Site treatment, storage, and/or disposal (TSD) units. The following sections describe the methodology for performing these calculations. For each calculation, the following assumptions shall be used.

- All major radionuclides in the waste, as defined in Section 2.5.1, must be considered in the calculations. If there is a major radionuclide in the waste that is not listed in Table A-1 and Table A-2, the generator must notify the Waste Disposal/Groundwater Remediation Project acceptance organization to calculate the applicable limits and conversion factors.

- If a daughter radionuclide has a half-life less than 10 days and the parent radionuclide has a half-life greater than the daughter, the activity of the daughter should not be considered in the calculations.

- The volume of the outer waste container shall be used when limits are expressed in volume concentration. For example, a generator packaging a 1 liter jar (0.001 cubic meters) inside of a 208 liter (55-gallon) drum (0.208 cubic meters) would use the 0.208 cubic meter volume for radiological calculation purposes. An additional example is a concrete lined 208 liter (55-gallon) drum (0.208 cubic meters) having a 0.15 cubic meter waste capacity. The generator would again use 0.208 cubic meter for the radiological calculation volume. If the waste is not containerized, the volume is the anticipated volume the waste will occupy in the TSD unit.

A1.1 TRANSURANIC WASTE DETERMINATION

To determine whether a waste is transuranic (TRU), compute the sum of the specific activity of the alpha-emitting radionuclides having half-lives greater than 20 years. These radionuclides are identified by footnote b in Table A-2. If the total alpha activity exceeds 100 nanocuries (3,700 becquerels) per gram, the waste is TRU. (DOE M 435.1-1)

For the mass of the waste matrix used in the TRU determination, the following direction will be used.

- The mass of added shielding, the container, and any rigid liners is excluded.

- The mass of stabilization media and similar materials added to meet waste acceptance criteria is used in accordance with DOE G 435.1-1, Chapter III.A.

A1.2 CALCULATION OF PLUTONIUM-239 FISSILE GRAM EQUIVALENTS

Fissile gram equivalent (FGE) is defined as the amount of plutonium-239 (in grams) that will produce the equivalent reactivity as another isotope at optimal shape, moderation, and reflection. FGE normally is calculated using the following steps.

1. Multiply the grams of each fissionable isotope by the FGE conversion factor (FGE per gram) in Appendix B, Table B-1, to yield the FGE for the isotope.

   Isotope mass (grams) x isotope conversion factor (FGE per gram) = Isotope FGE.

2. Sum the FGE for each fissionable isotope to a total FGE for all isotopes. If there is more than one gram of uranium-235, the Waste Disposal/Groundwater Remediation Project facility criticality safety representative could use an alternate method for determining the FGE for uranium-235 as discussed in Appendix B. Natural uranium (i.e., 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent) is always exempt for criticality purposes at Waste Disposal/Groundwater Remediation Project TSD units.

A1.3 CALCULATION OF THERMAL POWER

The thermal power of the waste in a container is calculated from the concentration of radionuclides in the waste and the heat of decay from Table A-1. The thermal power calculation is performed using the following steps.

1. The concentration of each isotope is multiplied by the heat of decay for that isotope from the value in Table A-1, yielding the thermal power for each isotope.

   Isotope concentration (curies per cubic meter) x decay heat (watts/curie)
   = decay heat (watts per cubic meter)

2. Thermal power is the sum of the thermal power of all isotopes in the waste.

A1.4 CATEGORY 1 DETERMINATION

Classification of waste as Category 1 or greater than Category 1 is a sum-of-fractions calculation, performed using the following steps.

1. The concentration of each isotope (expressed in curies per cubic meter) is divided by its respective Category 1 limit from Table A-2.

2. The category is the sum of the fractions for all isotopes in the waste package.

If the sum of the fractions is less-than-or-equal-to 1, the waste is Category 1. If the sum of fractions exceeds 1, the waste is greater than Category 1, and the Category 3 determination described in A1.5 must be performed to classify the waste package.

A1.5 CATEGORY 3 DETERMINATION

Category 3 determination is performed in the same way as the Category 1 calculation, only using the Category 3 limits from Table A-2 using the following steps.

1. The concentration of each isotope (expressed in curies per cubic meter) is divided by its respective Category 3 limit from Table A-2.

2. The category is the sum of the fractions for all isotopes in the waste..

If the sum of the fractions is less than or equal to 1, the waste is Category 3. If the sum of fractions exceeds 1, the waste is greater than Category 3.

A1.6 MOBILE RADIONUCLIDE REPORTING

This is a simple comparison of the concentration of each mobile isotope (hydrogen-3, carbon-14, chlorine-36, selenium-79, molybdenum-93, technetium-99, iodine-129, rhenium-187, total uranium, and neptunium-237) against its respective reporting value from Table A-2.

A1.7 CALCULATING DOSE-EQUIVALENT CURIES

Calculation of dose equivalent curies (DE-Ci) is a method of normalizing the exposure risk of various isotopes. Calculation of the DE-Ci of a waste container is performed using the following steps.

1. Multiply the activity (in curies) of each isotope in a given container by its respective ICRP 71 Correction Factor from Table A-1.

2. The total DE-Ci of the waste package is the sum of the DE-Ci values for all isotopes in the waste.

A1.8 CALCULATING PLUTONIUM-239 EQUIVALENT CURIES

The plutonium equivalent curie calculation is required for TRU waste to be shipped to the Waste Isolation Pilot Plant (WIPP). The plutonium equivalent curie calculation is performed as specified in the WIPP waste acceptance criteria (DOE/WIPP-02-3122).

A2.0 REFERENCES

DFSNW-ECAL-043, *Calculations for Table A-1 of HNF-EP-0063*, Rev. 0, Duratek Federal Services, Inc., Northwest Operations, Richland, Washington.

DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*, U.S. Department of Energy, Washington, D.C.

DOE M 435.1-1, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

DOE/WIPP-02-3122, 2002, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Rev. 0.1, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.

Firestone, R. B., S. Y. F. Chu, and L. P. Ekstrom, 1999, *Table of Isotopes*, 8th ed., John Wiley & Sons, Inc., New York, New York. (*The Lund / LBNL Nuclear Data Search Database*, version 2.0 is available at http://Nucleardata.nuclear.lu.se/nucleardata/toi).

HNF-14741, 2003, *Waste Management Project (WMP) Master Documented Safety Analysis (MDSA) for the Solid Waste Operations Complex (SWOC),* Rev. 1A, Fluor Hanford, Inc., Richland, Washington.

WHC-EP-0645, 1995, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-TI-730, 1996, *Performance Assessment for the Disposal of Low-Level Waste in the 200 East Area Burial Grounds*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Table A-1. Conversion Factors for General Radiological Calculations. (5 sheets total)

Isotope	Half-Life (second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[d]
H-3	3.891 E+08	9.613 E+03	3.383 E-05	5.20 E-06
Be-7	4.605 E+06	3.491 E+05	1.996 E-03	1.00 E-06
Be-10	5.049 E+13	2.231 E-02	1.495 E-03	1.92 E-04
C-14	1.808 E+11	4.455 E+00	2.933 E-04	1.16 E-04
Na-22	8.214 E+07	6.244 E+03	1.420 E-02	2.60 E-05
P-32	1.232 E+06	2.864 E+05	4.119 E-03	1.54 E-05
Si-32	5.428 E+09	6.500 E+01	4.079 E-04	2.20 E-03
P-33	2.195 E+06	1.559 E+05	4.539 E-04	1.84 E-06
S-35	7.560 E+06	4.267 E+04	2.895 E-04	2.80 E-05
Cl-36	9.530 E+12	3.291 E-02	1.622 E-03	1.46 E-04
Ar-39	8.489 E+09	3.411 E+01	1.296 E-03	0.00 E+00
K-40	4.039 E+16	6.989 E-06	4.025 E-03	4.20 E-05
Ca-41	3.249 E+12	8.500 E-02	1.408 E-02	1.90 E-06
Ar-42	1.041 E+09	2.582 E+02	1.381 E-03	0.00 E+00
Ti-44*	1.490 E+09	1.722 E+02	1.708 E-02	1.22 E-03
Ca-45	1.406 E+07	1.785 E+04	4.577 E-04	5.40 E-05
Sc-46	7.242 E+06	3.390 E+04	1.258 E-02	1.36 E-04
V-49	2.851 E+07	8.084 E+03	2.685 E-05	4.20 E-07
Cr-51	2.394 E+06	9.251 E+04	2.170 E-04	4.00 E-07
Mn-54	2.698 E+07	7.751 E+03	4.981 E-03	1.70 E-05
Fe-55	8.631 E+07	2.379 E+03	3.492 E-05	1.54 E-05
Co-56	6.679 E+06	3.020 E+04	2.200 E-02	9.60 E-05
Co-57	2.348 E+07	8.438 E+03	8.536 E-04	1.10 E-05
Co-58	6.122 E+06	3.181 E+04	5.990 E-03	3.20 E-05
Fe-59	3.845 E+06	4.979 E+04	7.749 E-03	4.40 E-05
Fe-60	4.752 E+13	1.300 E-04	2.900 E-02	5.60 E-03
Ni-59	2.398 E+12	7.982 E-02	4.248 E-05	3.60 E-06
Co-60	1.664 E+08	1.131 E+03	1.542 E-02	2.00 E-04
Ni-63	3.124 E+09	5.738 E+01	1.016 E-04	8.80 E-06
Zn-65	2.110 E+07	8.233 E+03	3.495 E-03	4.00 E-05
Ge-68	2.340 E+07	7.098 E+03	5.264 E-05	1.04 E-05
Se-75	1.034 E+07	1.457 E+04	2.400 E-03	2.00 E-05
Se-79	2.051 E+12	6.969 E-02	6.019 E-04	2.20 E-05
Sr-82	2.208 E+06	6.237 E+04	7.665 E-05	4.20 E-05

Table A-1. Conversion Factors for General Radiological Calculations. (5 sheets total)

Isotope	Half-Life (second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[d]
Rb-83	7.448 E+06	1.827 E+04	2.934 E-03	1.38 E-05
Rb-84	2.831 E+06	4.749 E+04	6.236 E-03	2.00 E-05
Kr-85	3.383 E+08	3.927 E+02	1.498 E-03	0.00 E+00
Sr-85	5.603 E+06	2.371 E+04	3.128 E-03	7.60 E-06
Rb-86	1.612 E+06	8.145 E+04	4.518 E-03	1.86 E-05
Y-88	9.213 E+06	1.393 E+04	1.603 E-02	8.20 E-05
Sr-89	4.365 E+06	2.907 E+04	3.460 E-03	2.00 E-05
Sr-90*	9.037 E+08	1.388 E+02	6.695 E-03	4.80 E-04
Nb-91	2.146 E+10	5.783 E+00	1.021 E-04	2.20 E-04
Mo-93	9.504 E+10	1.278 E+00	9.834 E-05	2.00 E-05
Nb-93m	5.089 E+08	2.386 E+02	1.834 E-04	1.02 E-05
Zr-93	4.828 E+13	2.515 E-03	1.130 E-04	5.00 E-04
Nb-94	6.307 E+11	1.905 E-01	1.031 E-02	2.20 E-04
Nb-95	3.022 E+06	3.934 E+04	4.795 E-03	3.00 E-05
Zr-95*	5.532 E+06	2.149 E+04	5.047 E-03	5.00 E-05
Tc-99	6.668 E+12	1.711 E-02	5.986 E-04	5.80 E-06
Ru-103*	3.392 E+06	3.232 E+04	3.578 E-03	9.60 E-06
Ru-106*	3.181 E+07	3.349 E+03	9.670 E-03	1.58 E-04
Pd-107	2.050 E+14	5.148 E-04	5.513 E-05	5.00 E-07
Ag-108m*	1.319 E+10	7.926 E+00	1.008 E-02	1.22 E-04
Cd-109	3.997 E+07	2.592 E+03	1.237 E-04	1.62 E-04
Ag-110m*	2.158 E+07	4.756 E+03	1.687 E-02	1.10 E-04
Cd-113m	4.323 E+08	2.311 E+02	1.086 E-03	2.20 E-03
Sn-113*	9.944 E+06	1.005 E+04	2.498 E-03	1.08 E-05
Sn-119m	2.532 E+07	3.748 E+03	5.313 E-04	5.60 E-06
Sn-121m	1.736 E+09	5.376 E+01	2.396 E-04	1.60 E-05
Te-121	1.450 E+06	6.435 E+04	3.471 E-03	4.80 E-06
Te-123	3.154 E+20	2.911 E-10	1.342 E-05	7.80 E-05
Sb-124	5.205 E+06	1.749 E+04	1.331 E-02	2.60 E-05
I-125	5.135 E+06	1.759 E+04	3.655 E-04	1.02 E-04
Sb-125	8.707 E+07	1.037 E+03	3.150 E-03	2.80 E-05
Te-125m	5.011 E+06	1.802 E+04	8.582 E-04	1.02 E-05
Sb-126	1.071 E+06	8.363 E+04	1.847 E-02	2.00 E-05
Sn-126*	3.156 E+12	2.839 E-02	1.056 E-03	2.20 E-04

Table A-1. Conversion Factors for General Radiological Calculations. (5 sheets total)

Isotope	Half-Life (second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[d]
Te-127m*	9.418 E+06	9.440 E+03	1.870 E-03	3.00 E-05
I-129	4.951 E+14	1.768 E-04	4.633 E-04	7.20 E-04
Te-129m*	2.920 E+06	2.997 E+04	4.127 E-03	2.60 E-05
Xe-131m	1.028 E+06	8.382 E+04	9.622 E-04	0.00 E+00
Ba-133	3.337 E+08	2.544 E+02	2.705 E-03	3.00 E-05
Cs-134	6.517 E+07	1.293 E+03	1.018 E-02	1.32 E-04
Cs-135	7.574 E+13	1.104 E-03	3.964 E-04	1.38 E-05
Cs-136	1.137 E+06	7.300 E+04	2.326 E-03	2.40 E-05
Cs-137*	9.521 E+08	8.655 E+01	4.816 E-03	9.20 E-05
Ba-140*	1.101 E+06	7.326 E+04	2.236 E-02	2.00 E-05
Ce-141	2.808 E+06	2.851 E+04	1.467 E-03	6.40 E-05
Ce-144*	2.462 E+07	3.185 E+03	7.996 E-03	7.20 E-04
Nd-147	9.487 E+05	8.094 E+04	2.432 E-03	4.80 E-05
Pm-147	8.278 E+07	9.277 E+02	3.676 E-04	1.00 E-04
Sm-147	3.343 E+18	2.297 E-08	1.361 E-02	1.92 E-01
Eu-150	1.079 E+09	6.977 E+01	9.532 E-03	3.80 E-06
Sm-151	2.840 E+09	2.632 E+01	1.179 E-04	8.00 E-05
Eu-152	4.267 E+08	1.740 E+02	7.667 E-03	8.40 E-04
Gd-152	3.406 E+21	2.180 E-11	1.303 E-02	3.80 E-01
Gd-153	2.091 E+07	3.528 E+03	8.622 E-04	4.20 E-05
Eu-154	2.712 E+08	2.703 E+02	9.009 E-03	1.06 E-03
Eu-155	1.529 E+08	4.762 E+02	7.749 E-04	1.38 E-04
Tm-170	1.111 E+07	5.975 E+03	1.982 E-03	1.40 E-04
Hf-175	6.048 E+06	1.066 E+04	2.422 E-03	1.44 E-05
Hf-181	3.662 E+06	1.703 E+04	4.357 E-03	2.80 E-05
Ta-182	9.910 E+06	6.257 E+03	8.890 E-03	1.52 E-04
W-185	6.489 E+06	9.401 E+03	7.520 E-04	2.40 E-06
Re-187	1.577 E+18	3.827 E-08	3.913 E-06	4.00 E-08
Au-195	1.608 E+07	3.599 E+03	7.629 E-04	1.32 E-06
Hg-203	4.026 E+06	1.381 E+04	1.997 E-03	1.12 E-05
Tl-204	1.196 E+08	4.624 E+02	1.407 E-03	7.80 E-06
Bi-207	1.002 E+09	5.438 E+01	9.829 E-03	1.12 E-04
Pb-210	7.037 E+08	7.634 E+01	2.661 E-04	1.80 E-02
Po-210	1.196 E+07	4.493 E+03	3.206 E-02	1.22 E-02

Table A-1. Conversion Factors for General Radiological Calculations. (5 sheets total)

Isotope	Half-Life (second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[d]
Ra-226	5.049 E+10	9.885 E-01	2.888 E-02	7.00 E-02
Ac-227	6.871 E+08	7.232 E+01	5.021 E-04	1.10 E+01
Ra-228	1.815 E+08	2.727 E+02	1.391 E-04	5.20 E-02
Th-228	6.037 E+07	8.195 E+02	3.272 E-02	6.40 E-01
Th-229	2.316 E+11	2.127 E-01	3.055 E-02	2.20 E+00
Th-230	2.379 E+12	2.061 E-02	2.822 E-02	8.60 E-01
Pa-231	1.034 E+12	4.723 E-02	3.054 E-02	2.80 E+00
Th-232	4.434 E+17	1.097 E-07	2.426 E-02	9.00 E-01
U-232	2.203 E+09	2.207 E+01	3.210 E-02	7.40 E-01
U-233	5.026 E+12	9.633 E-03	2.912 E-02	1.92 E-01
Th-234	2.082 E+06	2.315 E+04	4.268 E-04	1.32 E-04
U-234	7.754 E+12	6.217 E-03	2.880 E-02	1.88 E-01
U-235	2.221 E+16	2.161 E-06	2.773 E-02	1.70 E-01
Pu-236	9.152 E+07	5.222 E+02	3.478 E-02	4.00 E-01
U-236	7.390 E+14	6.468 E-05	2.712 E-02	1.74 E-01
Np-237	6.753 E+13	7.047 E-04	2.944 E-02	4.60 E-01
Pu-238	2.768 E+09	1.712 E+01	3.315 E-02	9.20 E-01
U-238	1.410 E+17	3.361 E-07	2.532 E-02	1.60 E-01
Pu-239	7.609 E+11	6.202 E-02	3.109 E-02	1.00 E+00
Pu-240	2.071 E+11	2.269 E-01	3.115 E-02	1.00 E+00
Am-241	1.366 E+10	3.427 E+00	3.343 E-02	8.40 E-01
Pu-241	4.544 E+08	1.030 E+02	3.177 E-05	1.80 E-02
Am-242m	4.450 E+09	1.047 E+01	4.288 E-04	7.40 E-01
Cm-242	1.408 E+07	3.311 E+03	3.682 E-02	1.04 E-01
Pu-242	1.179 E+13	3.954 E-03	2.955 E-02	9.60 E-01
Am-243	2.324 E+11	1.997 E-01	3.225 E-02	8.20 E-01
Cm-243	9.467 E+08	4.903 E+01	3.683 E-02	6.20 E-01
Cm-244	5.712 E+08	8.093 E+01	3.499 E-02	5.40 E-01
Pu-244	2.525 E+15	1.831 E-05	2.909 E-02	9.40 E-01
Cm-245	2.682 E+11	1.716 E-01	3.334 E-02	8.40 E-01
Cm-246	1.493 E+11	3.072 E-01	3.282 E-02	8.40 E-01
Bk-247	4.352 E+10	1.049 E+00	3.425 E-02	1.38 E+00
Cm-247	5.049 E+14	9.043 E-05	3.174 E-02	7.80 E-01
Cm-248	1.073 E+13	4.239 E-03	1.244 E-01	3.00 E+00

Table A-1. Conversion Factors for General Radiological Calculations. (5 sheets total)

Isotope	Half-Life (second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[d]
Cf-249	1.108 E+10	4.089 E+00	3.945 E-02	1.40 E+00
Cf-250	4.128 E+08	1.093 E+02	3.727 E-02	6.80 E-01
Cm-250	2.525 E+11	1.787 E-01	8.263 E-01	1.68 E+01
Cf-251	2.834 E+10	1.586 E+00	3.663 E-02	1.42 E+00
Cf-252	8.347 E+07	5.362 E+02	7.258 E-02	4.00 E-01
Es-254	2.380 E+07	1.865 E+03	5.779 E-02	1.72 E-01

[a]Daughters with half-life less than 10 days (8.64×10^5 sec) and with parent radionuclide half-life greater than the daughter are not reportable as separate isotopes. Contributions from nonreportable daughters have been included in the decay heat and dose-equivalence factors.

[b]Firestone, R. B., S. Y. F. Chu, and L. P. Ekstrom, 1999, *Table of Isotopes*, 8th ed., John Wiley & Sons, Inc., New York, New York. (*The Lund / LBNL Nuclear Data Search Database*, version 2.0 is available at http://Nucleardata.nuclear.lu.se/nucleardata/toi).

Specific activity data: DFSNW-ECAL-043, *Calculations for Table A-1 of HNF-EP-0063*, Rev. 0, Duratek Federal Services, Inc., Northwest Operations, Richland, Washington.

[c]Decay heat: ORIGEN database.

[d]ICRP 71 Factor: HNF-14741, 2003, *Waste Management Project (WMP) Master Documented Safety Analysis (MDSA) for the Solid Waste Operations Complex (SWOC)*, Rev. 1, Fluor Hanford, Inc., Richland, Washington.

NOTE: The conversion factor from seconds to years is 3.155 E+07 s/yr.

DE-Ci = dose equivalent curie.
ICRP = International Commission of Radiological Protection.

Table A-2. Low-Level Burial Grounds Radiological Content Limits. (5 sheets total)

Isotope	Mobile Radionuclide Reporting Limit (Curies per Cubic Meter)	Category 1 Waste Limit (Curies per Cubic Meter)	Category 3 Waste Limit (Curies per Cubic Meter)
H-3	4.4 E+00	9.9 E+04	NL
Be-7	NL	NL	NL
Be-10	NL	1.1 E+00	2.4 E+02
C-14	1.3 E-04	9.1 E-02	2.1 E+01
C-14 activated metal[a]	NL	9.1 E-01	2.1 E+02
Na-22	NL	NL	NL
P-32	NL	NL	NL
Si-32	NL	7.3 E-01	3.6 E+02
P-33	NL	NL	NL
S-35	NL	NL	NL
Cl-36	3.1 E-05	6.4 E-05	1.4 E-01
Ar-39	NL	NL	NL
K-40	NL	1.8 E-03	3.8 E-01
Ca-41	NL	1.9 E-01	4.1 E+01
Ar-42	NL	NL	NL
Ti-44	NL	6.3 E-03	4.7 E+02
Ca-45	NL	NL	NL
Sc-46	NL	NL	NL
V-49	NL	NL	NL
Cr-51	NL	NL	NL
Mn-54	NL	NL	NL
Fe-55	NL	NL	NL
Co-56	NL	NL	NL
Co-57	NL	NL	NL
Co-58	NL	NL	NL
Fe-59	NL	NL	NL
Ni-59	NL	3.9 E+00	8.5 E+02
Fe-60	NL	NL	NL
Ni-59 activated metal[a]	NL	3.9 E+01	8.5 E+03
Co-60	NL	7.5 E+01	NL
Co-60 activated metal[a]	NL	7.5 E+02	NL
Ni-63	NL	5.9 E+00	2.0 E+04
Ni-63 activated metal[a]	NL	5.9 E+01	2.0 E+05
Zn-65	NL	NL	NL
Ge-68	NL	NL	NL

Table A-2. Low-Level Burial Grounds Radiological Content Limits. (5 sheets total)

Isotope	Mobile Radionuclide Reporting Limit (Curies per Cubic Meter)	Category 1 Waste Limit (Curies per Cubic Meter)	Category 3 Waste Limit (Curies per Cubic Meter)
Sc-75	NL	NL	NL
Sc-79	3.4 E-05	5.1 E-01	1.1 E+02
Sr-82	NL	NL	NL
Rb-83	NL	NL	NL
Rb-84	NL	NL	NL
Kr-85	NL	NL	NL
Sr-85	NL	NL	NL
Rb-86	NL	NL	NL
Y-88	NL	NL	NL
Sr-89	NL	NL	NL
Sr-90[c]	NL	1.6 E-02	5.4 E+04
Nb-91	NL	2.0 E+00	6.3 E+02
Mo-93	2.1 E-04	8.7 E-01	2.0 E+02
Nb-93m	NL	NL	NL
Zr-93	NL	2.50 E+00	5.40 E+02
Nb-94	NL	2.2 E-04	4.8 E-02
Nb-94 activated metal[a]	NL	2.2 E-03	4.8 E-01
Nb-95	NL	NL	NL
Zr-95[c]	NL	NL	NL
Tc-99	2.1 E-04	2.3 E-02	5.0 E+00
Ru-103[c]	NL	NL	NL
Ru-106[c]	NL	NL	NL
Pd-107	NL	1.5 E+01	3.3 E+03
Ag-108m	NL	NL	NL
Cd-109	NL	NL	NL
Ag-110m[c]	NL	NL	NL
Cd-113m	NL	7.6 E-01	NL
Sn-113[c]	NL	NL	NL
Sn-119m	NL	NL	NL
Sn-121m	NL	6.7 E-01	2.2 E+04
Te-121	NL	NL	NL
Te-123	NL	NL	NL
Sb-124	NL	NL	NL
I-125	NL	NL	NL
Te-125m	NL	NL	NL

Table A-2. Low-Level Burial Grounds Radiological Content Limits. (5 sheets total)

Isotope	Mobile Radionuclide Reporting Limit (Curies per Cubic Meter)	Category 1 Waste Limit (Curies per Cubic Meter)	Category 3 Waste Limit (Curies per Cubic Meter)
Sb-125	NL	NL	NL
Sb-126	NL	NL	NL
Sn-126[c]	NL	1.6 E-04	3.4 E-02
Te-127m[c]	NL	NL	NL
I-129	1.0 E-06	8.5 E-03	1.8 E+00
Te-129m[c]	NL	NL	NL
Xe-131m	NL	NL	NL
Ba-133	NL	7.1 E-01	NL
Cs-134	NL	NL	NL
Cs-135	NL	1.6 E-01	3.5 E+01
Cs-136	NL	NL	NL
Cs-137[c]	NL	5.5 E-03	1.2 E+04
Ba-140[c]	NL	NL	NL
Ce-141	NL	NL	NL
Ce-144[c]	NL	NL	NL
Nd-147	NL	NL	NL
Pm-147	NL	NL	NL
Sm-147	NL	1.7 E-02	3.7 E+00
Eu-150	NL	1.4 E-03	6.7 E+02
Sm-151	NL	4.6 E+01	2.1 E+05
Eu-152	NL	4.8 E-02	NL
Gd-152	NL	6.4 E-03	1.4 E+00
Gd-153	NL	NL	NL
Eu-154	NL	7.5 E-01	NL
Eu-155	NL	NL	NL
Tm-170	NL	NL	NL
Hf-175	NL	NL	NL
Hf-181	NL	NL	NL
Ta-182	NL	NL	NL
W-185	NL	NL	NL
Re-187	3.3 E-02	3.6 E+01	7.8 E+03
Au-195	NL	NL	NL
Hg-203	NL	NL	NL
Tl-204	NL	NL	NL
Bi-207	NL	1.7 E-03	1.44 E+03

Table A-2. Low-Level Burial Grounds Radiological Content Limits. (5 sheets total)

Isotope	Mobile Radionuclide Reporting Limit (Curies per Cubic Meter)	Category 1 Waste Limit (Curies per Cubic Meter)	Category 3 Waste Limit (Curies per Cubic Meter)
Pb-210	NL	3.7 E-02	2.1 E+06
Po-210	NL	NL	NL
Ra-226	NL	1.7 E-04	4.3 E-02
Ac-227	NL	4.2 E-03	3.0 E+05
Ra-228	NL	1.7 E+01	NL
Th-228	NL	NL	NL
Th-229	NL	4.4 E-04	9.8 E-02
Th-230	NL	2.1 E-03	1.5 E-01
Pa-231	NL	1.4 E-04	3.0 E-02
Th-232	NL	1.1 E-04	2.3 E-02
Total U	1.4 E-05	NL	NL
U-232	See Total U	4.6 E-04	4.6 E+00
U-233	See Total U	7.4 E-03	9.7 E-01
Th-234	NL	NL	NL
U-234	See Total U	8.9 E-03	1.9 E+00
U-235	See Total U	2.8 E-03	5.0 E-01
Pu-236	NL	NL	NL
U-236	See Total U	9.5 E-03	2.0 E+00
Np-237[b]	1.1 E-05	6.8 E-04	1.5 E-01
Pu-238[b]	NL	4.7 E-03	2.4 E+01
U-238	See Total U	5.7 E-03	1.2 E+00
Pu-239[b]	NL	1.9 E-03	4.2 E-01
Pu-240[b]	NL	1.9 E-03	4.3 E-01
Am-241[b]	NL	2.1 E-03	8.5 E-01
Pu-241	NL	6.1 E-02	2.5 E+01
Am-242m[b]	NL	1.9 E-03	1.6 E+00
Cm-242	NL	NL	NL
Pu-242[b]	NL	2.0 E-03	4.3 E-01
Am-243[b]	NL	1.0 E-03	2.3 E-01
Cm-243[b]	NL	1.8 E-02	3.4 E+02
Cm-244	NL	1.4 E-01	1.6 E+02
Pu-244[b]	NL	6.1 E-04	1.3 E-01
Cm-245[b]	NL	1.3 E-03	2.2 E-01
Cm-246[b]	NL	1.8 E-03	4.2 E-01
Bk-247[b]	NL	1.5 E-03	3.8 E-01

Table A-2. Low-Level Burial Grounds Radiological Content Limits. (5 sheets total)

Isotope	Mobile Radionuclide Reporting Limit (Curies per Cubic Meter)	Category 1 Waste Limit (Curies per Cubic Meter)	Category 3 Waste Limit (Curies per Cubic Meter)
Cm-247[b]	NL	5.6 E-04	1.2 E-01
Cm-248[b]	NL	5.1 E-04	1.1 E-01
Cf-249[b]	NL	7.8 E-04	3.6 E-01
Cf-250	NL	3.8 E-01	1.5 E+02
Cm-250[b]	NL	9.3 E-05	2.1 E-02
Cf-251[b]	NL	1.3 E-03	3.8 E-01
Cf-252	NL	NL	NL
Es-254	NL	NL	NL

[a]Limit for isotope in activated metal.
[b]TRU isotope (half-life >20 years).
[c]Daughters with half-life less than 10 days and with parent radionuclide half-life greater than the daughter are not reportable.

Ci/m^3 = curies per cubic meter.
NL = no applicable limit.

Sources: WHC-EP-0645, 1995, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington, and WHC-SD-WM-TI-730, 1996, *Performance Assessment for the Disposal of Low-Level Waste in the 200 East Area Burial Grounds*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX B
B1.0 FISSIONABLE MATERIAL CONTENT LIMITS

The following describes the limits for fissionable material content in waste packages or bulk waste sent to treatment, storage, and/or disposal units covered by the criteria provided in this document. Fissionable material inventories for a given container shall be restricted to ensure they do not exceed the applicable fissionable material limit, including measurement uncertainty. For some waste packages, the generator must provide distribution of the fissionable material or moderating materials in the container to determine the applicable specification and whether criticality limits are met.

B1.1 EXEMPT MATERIALS

Waste packages or bulk waste shipments are exempt from criticality safety controls and fissile labeling at all treatment, storage, and/or disposal units if the fissile gram equivalence for the contained fissionable material is less than 1 fissile gram equivalent (FGE). Natural uranium (i.e., 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent) is always exempt for criticality purposes at the treatment, storage, and/or disposal units.

B1.2 MEASUREMENT UNCERTAINTY FOR NONEXEMPT MATERIALS

Measured values of operating parameters subject to criticality safety limits (e.g., the mass of a given isotope) shall conservatively account for assessed biases and uncertainties for the measurement methods.

The measurement uncertainty will be accounted for in the following ways.

1. For transuranic waste destined for the Waste Isolation Pilot Plant, the sum of the measured mass and the mass corresponding to the 2 sigma total measurement uncertainty shall be less than the fissile material quantity limits in Table G-2.

2. For measurements of fissionable material under a critical mass limit, where the accuracy of the fissile mass measurement method is controlled to within ±5 percent at the 95 percent confidence limit, the reported mass may be used as the mass limit control value. If the method's accuracy is outside ±5 percent (at the 95 percent confidence limit), as it is for certain nondestructive assay methods, then allowance for a potentially higher mass due to inaccuracy shall be accounted for in one of these ways:

    - The sum of the measured mass and the mass corresponding to the 2 sigma uncertainty in the measurement method shall be less than the criticality prevention specification (CPS) mass limit (i.e., the limits of this Appendix).

- The Waste Disposal/Groundwater Remediation Project criticality safety representative shall give a written exemption to the requirement for considering the uncertainties in the measurement method at a given location, or for a given type of fissionable unit (HNF-7098). Such exemptions shall be obtained in accordance with Section 1.6 of these acceptance criteria.

B1.3 NON-EXEMPT MATERIALS IN STANDARD CONTAINERS

Certain non-exempt materials in standard packaging configurations (per Table B-2) are acceptable at the Low-Level Burial Grounds (LLBG) (except greater than 1 percent enriched uranium in trenches 31 and 34), the Central Waste Complex (CWC), the T Plant Complex, and the Waste Receiving and Processing Facility (WRAP). The fissionable material limits are expressed in plutonium-239 FGE as defined in HNF-5134, *CSER 00-005, Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, and described in Section A1.2. Table B-1 is used to determine the total fissile gram equivalence of fissionable material in a waste container by multiplying the gram quantity of each listed isotope by the correction factor and summing the results. Note that when waste contains a significant quantity of non-exempt uranium-235, the FGE calculation will be conservative, as it does not account for the poisoning effect of uranium-238 in the mixture. If a container approaches or exceeds a limit of Table B-2, due in part to the uranium-235 content, the method provided in Section B.6 can be used to lower the contribution of uranium-235 to the total FGE.

Specific container limits are shown in Table B-2, which addresses the most common containers and CPSs. Other container limits may be available through other CPSs. Exceptions can be requested as specified in Section 1.6. If a new criticality safety evaluation report (CSER) is required for a new waste stream, the generator will need to provide funding for performing the evaluation.

Note that for trenches 31 and 34, non-exempt quantities of uranium-bearing waste exceeding 1 percent enrichment cannot be accepted until issuance of a new criticality safety evaluation.

Liquids and absorbed liquids with non-exempt quantities of fissionable material must be packaged in 3.8 liter (1-gallon) containers. Specific Plutonium Finishing Plant waste streams, however, are allowed for direct disposal into absorbent in 208 liter (55-gallon) drums with 90 mil liners at up to 200 FGE (CPS-SW-006).

B1.4 NON-EXEMPT MATERIALS IN NON-STANDARD CONTAINERS OR BULK WASTE

Waste packages that have non-exempt quantities of fissionable material but are not in Table B-2 standard containers (e.g., in 114 liter [30-gallon] drums, concrete or wood boxes, small boxes, ion exchange modules, or bulk waste shipments) may still be received for storage and disposal. Waste packages of this type may be arrayed together up to a maximum total of 119 FGE, corresponding to 22.5 percent of a minimum critical mass. A 3-feet separation from other fissile

material is required while in storage or for disposal. Other transportation limits might apply to the entire shipment. Note that for trenches 31 and 34, non-exempt quantities of uranium-bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation.

B1.5 NON-EXEMPT QUANTITIES OF FISSIONABLE RADIONUCLIDES IN OTHER CONFIGURATIONS

Limits for configurations other than those shown in Sections B1.3 and B1.4 may be requested as described in Section 1.6. If a new CSER is required for a new waste stream the generator will need to provide funding for performing the evaluation.

B1.6 CALCULATION OF URANIUM-235 FGE

HNF-5134 provides a detailed method for calculating FGE that takes into account the poisoning effect of uranium-238. The maximum enrichment, or actual distribution for a mixture of enrichments, is required to perform this calculation. If uranium is not a significant factor, FGE may be calculated as shown in Section A1.2. The uranium-235 FGE value for the uranium in a waste package is calculated by one of the following methods.

1. FGE for uranium-235 may be calculated using the conversion factor in Table B-1. Uranium-235 also may be excluded in calculating FGE if it is in natural or depleted uranium (less than or equal to 0.72 weight percent uranium-235 in uranium). The Waste Disposal/Groundwater Remediation Project facility criticality safety representative may also exempt homogeneous uranium solutions in solid or liquid form up to 1.0 weight percent enrichment of uranium-235.

2. The FGE for uranium-235 may be conservatively calculated by including all uranium-235 present with no exemptions on a 1 gram = 1 FGE basis. This conservative method of conversion is currently required for waste acceptance at the Waste Isolation Pilot Plant.

3. If a bounding value or specific distribution is known for the uranium-235 enrichment (e.g., based on analytical data or process knowledge), the facility criticality safety representative may use the alternate FGE method specified below. If the enrichment of a batch of uranium is not known, the enrichment value is treated as 100 percent uranium-235 and method 1 or 2, above, is used.

The first two methods above result in over counting the contribution of uranium-235 to the fission process by neglecting the effects of uranium-238 in reducing the neutron population available for fission (i.e., poisoning). These methods are adequate (safe) for accepting waste containers if the amount of uranium-235 is less than the criticality mass limit, but such usage may unnecessarily restrict shipping of containers with greater than 1 gram of uranium-235. Uranium FGE may be determined by summing the FGEs of uranium-235 at each distinct homogeneous enrichment. Each FGE is the ratio of the uranium mass at an enrichment

divided by the minimum critical mass at that enrichment from Table B-3, multiplied by the minimum critical mass for plutonium-239 (531 FGE). If the mass at each enrichment is not known or it is desirable to group several enrichments together, the highest enrichment is to be used for the entire mass of that group. The details of this calculation are specified below.

Calculate a fraction for each mass **A** (grams) of uranium-235 with a distinct enrichment **B**, determine the uranium-235 mass limit **D** for the enrichment **C** from Table B-3 which is greater than or equal to enrichment **B.** Calculate the sum-of-the-fractions using these fractions as follows.

Uranium FGE = Sum of (**A** ÷ **D**) for each distinct enrichment (**B**) x 531

B2.0 REFERENCES

CPS-D-001, *Criticality Prevention Specification: T Plant Complex,* Fluor Hanford Inc., Richland, Washington.

CPS-SW-002, *Criticality Prevention Specification: Waste Storage - Central Waste Complex*, Fluor Hanford, Inc., Richland, Washington.

CPS-SW-003, *Criticality Prevention Specification: Waste Storage - 200 Area Low-Level Burial Grounds*, Fluor Hanford, Inc., Richland, Washington.

CPS-SW-006, *Criticality Prevention Specification: Absorbed Plutonium Nitrate Solutions in Lined Drums,* Fluor Hanford, Inc., Richland, Washington.

HNF-5134, 2000, *CSER 00-005: Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-7098, 2003, *Criticality Safety Program,* Rev. 2, Fluor Hanford, Inc., Richland, Washington.

WRP1-CPS-001, *Criticality Prevention Specification for the Waste Receiving and Processing Facility*, Fluor Hanford, Inc., Richland, Washington.

Table B-1. Fissile Gram Equivalent Conversion Factors
(Fissile Gram Equivalent per Gram).

Isotope	Conversion Factor	Isotope	Conversion Factor
U-233	1.0 E+0*	Am-242m	3.46 E+1
U-235	6.43 E-1	Am-243	1.29 E-2
Np-237	1.5 E-2	Cm-243	5.0 E+0
Pu-238	1.13 E-1	Cm-244	9.0 E-2
Pu-239	1.0 E+0	Cm-245	1.5 E+1
Pu-240	2.25 E-2	Cm-247	5.0 E-1
Pu-241	2.25 E+0	Cf-249	4.5 E+1
Pu-242	7.5 E-3	Cf-251	9.0 E+1
Am-241	1.88 E-2	—	—

*Actual value for U233 is 9.0 E-1, but normally taken as 1.

Source: Table 4-2 in HNF-5134, 2000, *CSER 00-005: Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Table B-2. Fissionable Material Content Limits for Certain Standard Containers.
(2 sheets total)

Container Type	Fissionable Material Content[a]
208-liter (55-gallon) or larger steel drum, where fissile material is contained in 20 percent or more of the container volume, unless a specific CSER allows a lesser volume.	200 FGE[b]
208-liter (55-gallon) or larger steel drum, where fissile material is contained in less than 20 percent of the container volume	100 FGE[b]
208-liter (55-gallon) lead- or concrete-lined steel drum	100 FGE[b]
208-liter (55-gallon) or larger drum with 90 mil liner and liquids in 3.8 liter (1-gallon) containers, or sorbed liquids in 3.8 liter (1-gallon) containers with sufficient sorbent material to sorb twice the liquid volume	100 FGE[b]

Table B-2. Fissionable Material Content Limits for Certain Standard Containers.
(2 sheets total)

Container Type	Fissionable Material Content[a]
DOT- or NRC-Approved Containers (e.g., DOT Specification 6M)	Maximum fissile content may not exceed that which is acceptable for transportation as specified in the DOT regulations or the NRC Certificate of Compliance
Steel box containing flushed and drained equipment and/or HEPA filters -- all of the following limits shall apply:	• 350 FGE per piece of equipment • 353 FGE per cubic meter (10 FGE per cubic foot) on HEPA filters • 15 FGE in waste other than equipment or HEPA filters • 250 FGE total in box greater than or equal to 0.76 x 0.76 x 0.7 meters (2.5 x 2.5 x 2.5 feet) • 350 FGE total in box greater than or equal to 0.9 x 1.4 x 1.5 meters (3 x 4 x 5 feet) (Includes SWB) (Note: Limit for WRAP/WIPP is 325 FGE) • 1,000 FGE total in box greater than or equal to 1.2 x 1.2 x 2.1 meters (4 x 4 x 7 feet)

[a]Non-TRU drums or bulk waste accepted for burial are limited to 119 FGE (and up to 128.6 FGE in special configurations) .
[b]This limit assumes that the steel drum weighs a minimum of 23 kilograms (50.7 pounds) excluding the liner. Steel (non-waste) may be added to the drum to meet the 23 kilogram (50.7 pounds) minimum mass. Any drum that weighs less than 23 kilograms (50.7 pounds) requires overpacking, addition of steel, or completion of a criticality safety evaluation.

DOT = U.S. Department of Transportation.
FGE = fissile gram equivalent.
HEPA = high-efficiency particulate air.
NRC = U.S. Nuclear Regulatory Commission.

Table B-3. Minimum Critical Mass and Maximum Uranium-235 for Various Enrichments.

(C)[a] Maximum Enrichment (Weight Percent U-235)	Minimum Critical Mass for U (kilogram) (U-235 Plus U-238) at This Maximum Enrichment	(D)[a] Maximum U-235 (gram) at This Enrichment
0.72	Unlimited	Unlimited
0.80	10,000	80,000
0.85	7,000	60,000
0.90	3,800	35,000
0.95	2,600	25,000
1.00	2,000	20,000
1.15	889	10,222
1.25	627	7,836
1.50	375	5,628
1.70	270	4,590
1.80	231	4,160
2.00	180	3,606
2.50	109	2,730
3.00	78.0	2,340
3.50	62.1	2,172
4.0	48.9	1,956
4.5	40.8	1,830
5.0	34.8	1,740
8.0	17.5	1,404
10.0	13.0	1,300
20.0	5.52	1,104
30.0	3.33	1,000
40.0	2.376	951
50.0	1.835	918
75.0	1.116	837
100.0	0.819	819

[a]These columns are used in calculations described in Section B1.6.

NOTE: For trenches 31 and 34, non-exempt quantities of uranium bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation.

Source: HNF-5134, 2000, *CSER 00-005: Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

APPENDIX C
C1.0 LABELING OF WASTE CONTAINERS

Containers sent to Hanford Site treatment, storage, and/or disposal units must be labeled for identification and to communicate information needed for proper waste management. Table C-1 shows the standard labeling required on containerized waste. The following sections provide general requirements for labels and markings.

C1.1 BAR CODE

Each container shall be labeled with a bar code showing the unique container identification number (CIN). Bar-coded CINs will be assigned as follows.

- For containers purchased through the Hanford Site procurement system, the bar code will be attached to the containers when the containers are received at the Central Stores warehouse. The CIN is a unique seven-digit number beginning with the last two digits of the year the container was purchased.

- For containers not purchased through the Hanford Site procurement system, Hanford Site generators will assign a CIN. The CIN must be a unique number. The suggested format to ensure that the CIN is unique is: "Facility ID-Year-Sequential #," where the Facility ID is the generating facility's unique 4-character (letter and/or number) identifier, "Year" is the last two digits of the year the CIN was assigned, and "Sequential #" is the generator's sequential numbering of containers for that year.

- For offsite generators, a bar code will be attached when the container is received on the Hanford Site. The CIN will be the unique container identification number provided by the waste generator. (NOTE: Offsite generators should contact the Waste Disposal/ Groundwater Remediation Project acceptance organization for guidance on assigning a unique identification number.)

C1.2 DURABILITY

Labels and markings must be durable, fade-resistant, water-resistant paints, vinyl stickers, or another system that is sufficiently durable to remain intact and legible during management of the waste before disposal. For waste placed into storage, labels must remain intact and legible for 20 years.

C1.3 PLACEMENT OF LABELS

Labels and markings shall be positioned so that all required information is visible on the same side of the container as the bar code. If drums are destined for storage, the bolt on the drum ring must be placed at a 90-degree angle to the drum labels. If drums are palletized, the drums must be oriented on the pallet such that a complete set of labels is visible.

C1.4 SIZE OF LABELS

Standard labels defined by regulations (e.g., U.S. Department of Transportation [DOT] label, hazardous waste label, polychlorinated biphenyl [PCB] label, asbestos label) should be the conventional size specified by the regulations. Characters on other labels (e.g., gross weight, major risk label) must be a minimum of 2.54 centimeters (1 inch) high.

C1.5 LABELING INNER CONTAINERS IN LAB PACKS

Each inner container in a lab pack must be labeled with an identification number or waste name cross-referenced against the contents inventory sheet. These labels must be sufficiently durable to remain legible for 20 years.

Table C-1. Required Labeling for Waste Containers.[d]

Label	When Required	Location on Drum	Location on Box
Bar code with container identification number	All containers	Bottom third of drum	Short side of box
Gross weight in kilograms (Kilogram units must appear on label)	All containers	Same side as bar code	Same side as bar code
Applicable DOT labeling	All containers	As specified in 49 CFR	As specified in 49 CFR
Hazardous waste label	Mixed waste containers	Same side as bar code	Same side as bar code
Major risk label(s)[a]	Mixed waste containers	Same side as bar code	Same side as bar code
PCB label[b]	Waste that is regulated for PCB content under 40 CFR 761	Same side as bar code	Same side as bar code
Asbestos label	As required per 40 CFR 61 Subpart M	Same side as bar code	Same side as bar code
SWITS-generated fissile label (printed with a barcode printer) and fissile trefoil label (or symbol)[c]	Containers with 1 fissile gram equivalent or more fissionable material	Same side as bar code	Same side as bar code

[a]Refer to Table C-2 for major risk labeling of mixed and TRU-mixed waste.
[b]Label in accordance with 40 CFR 761.40. The label placed on containers holding PCB items must include the date the item was removed from service. For PCB articles and containers, the label must include the date the waste was placed into storage, including 30-day temporary storage areas.
[c]These labels might conflict with the DOT fissile label; for shipments of waste from offsite, these labels should be placed on the containers at the time the waste arrives on the Hanford Site.
[d]For packages shipped within a Special Packaging Zone as allowed by DOE/RL-2001-36, the minimum marking and labeling requirements are the bar code with container identification number and gross weight in kilograms.

DOT = U.S. Department of Transportation.
PCB = polychlorinated biphenyl.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.
40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.
49 CFR, "Transportation," *Code of Federal Regulations*, as amended.

Table C-2. Selection of Major Risk Labeling.

Hazard or Risk	Acceptable Labels and Markings
Flammable liquid	DOT Class 3 label (Flammable Liquid) FLAMMABLE LIQUID COMBUSTIBLE LIQUID
Flammable solid	DOT Division 4.1 label (Flammable Solid) FLAMMABLE SOLID
Water-reactive	DOT Division 4.3 label (Dangerous When Wet) DANGEROUS WHEN WET WATER-REACTIVE
Oxidizer	DOT Division 5.1 label (Oxidizer) OXIDIZER
Organic peroxide	DOT Division 5.2 label (Organic Peroxide) ORGANIC PEROXIDE
Poison or Toxic	DOT Division 6.1 label (Poison) or (Inhalation Hazard) POISON or TOXIC POISON—INHALATION HAZARD or TOXIC—INHALATION HAZARD
Corrosive	DOT Class 8 label (Corrosive) CORROSIVE
Hazardous Wastes—DOT Class 9 only	DOT Class 9 label (Miscellaneous) and "Hazardous Waste" or "Dangerous Waste" marking
WA State Only Dangerous Wastes—Non DOT	"Hazardous Waste" or "Dangerous Waste" marking

NOTE: Choose the label or marking, or combination of labels or markings that most clearly communicates the major risk(s) associated with the waste. Markings in Table C-2 must be applied for dangerous waste major risk(s) regardless of the DOT radioactive labeling status. DOT labels must be used when required by the DOT.

DOT = U.S. Department of Transportation

Prior to DOT transportation and during dangerous waste accumulation in Washington State, DOT markings can be used instead of DOT labels to communicate dangerous waste major risk(s), (e.g., if the major risk of a dangerous waste is flammability, the container may be marked "Flammable" as opposed to being labeled with the Class 3 Flammable label). However, at the point of transportation, the waste must be labeled with the applicable DOT hazard class label Major risk markings requirements are as follows (HNF-PRO-15333).

- State-only/Non-DOT dangerous waste: The words "hazardous waste" or "dangerous waste" are sufficient.

- State-only/DOT and federal hazardous waste: The words "hazardous waste" or "dangerous waste" and the DOT hazard class label or mark are sufficient.

C2.0 REFERENCES

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

DOE/RL-2000-36, *Hanford Sitewide Transportation Safety Document,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

HNF-PRO-15333, *Environmental Protection Processes*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

APPENDIX D
D1.0 SELECTION OF COMPATIBLE CONTAINERS, COATINGS, AND LINERS

WAC 173-303-630 (4) requires that containers used for storage of dangerous waste be made of, or lined with, materials that are compatible with the waste and will not react with the waste such that the ability of the container to contain the waste is not impaired. A variety of factors affect the compatibility of a container/liner combination, including the properties of chemical constituents in the waste, the physical form of the waste (e.g., free liquid, sorbed liquid, dry waste), and the anticipated length of storage.

The compatibility of the container/liner and the waste is determined using chemical compatibility charts, manufacturer's compatibility data, and/or other applicable data. Any combination of container(s) and/or liner(s) can be used that is compatible with the waste.

Hanford Site procurement specifications for metal drums (HNF-7403) and boxes (HNF-7656) identify several options for container coatings, with varying degrees of chemical resistance. The document WHC-SD-TP-ES-002, *Justification for Packaging Acceptance Criteria* describes a set of standard packages from the Hanford Site that generally will be compatible with the types of waste generated on the Hanford Site. Table D-1 provides baseline coating and liner combinations for metal containers based on WHC-SD-TP-ES-002. These container/liner combinations generally provide a compatible container, although compatibility data must demonstrate that the container is compatible with the waste. (NOTE: The Hanford Site specifications and Table D-1 are provided for information purposes only. It is not necessary to select packaging according to Hanford Site specifications.)

D2.0 REFERENCES

HNF-7403, 2003, *Specification for Packaging of Hanford Site Performance-Based Drums,* Rev. 0, Duratek Federal Services, Inc., Northwest Operations, Richland, Washington.

HNF-7656, 2001, *Specification for Packaging of Hanford Site Performance-Based Steel Boxes,* Rev. 0, Duratek Federal Services, Inc., Northwest Operations, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WHC-SD-TP-ES-002, 1996, *Justification for Packaging Acceptance Criteria*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Table D-1. Standard Container/Liner Combinations.

WSRd Series	SubGroup[a]	Minimum Coatings/Liners[b]
100—Low-level waste	Low-level dry waste for disposal	LPC/no liner
	Low-level absorbed liquids	LPC/10 mil liner
200—TRU waste	Dry debris and soil	LPC/10 mil liner MPC/no liner
	Sorbed or solidified corrosive (acid or caustic) liquids	LPC/90 mil liner HPC/no liner
	Sorbed or solidified noncorrosive liquids, sludges, and wet soil	MPC/10 mil liner LPC/90 mil liner
400—Mixed waste overpacked and lab packed liquids	Organic liquids (noncorrosive)	MPC/10 mil liner LPC/90 mil liner
	Corrosive (acidic or caustic) or oxidizing liquids	HPC/no liner LPC/90 mil liner
	Other noncorrosive waste	MPC/10 mil liner LPC/90 mil liner
500—Mixed waste solids, sorbed liquids, and soils	Sorbed organic liquids or sludges (noncorrosive)	MPC/10 mil liner LPC/90 mil liner
	Corrosive (acidic or caustic) or oxidizing waste	HPC/no liner LPC/90 mil liner
	Noncorrosive sorbed liquid, sludges, or wet soils	MPC/10 mil liner LPC/90 mil liner
	Noncorrosive dry solids or dry soils	MPC/no liner LPC/10 mil liner
600—Mixed debris waste	Corrosive (acidic or caustic) or oxidizing debris	HPC/no liner LPC/90 mil liner
	Other noncorrosive debris	MPC/no liner LPC/10 mil liner
800—Mixed waste with specific treatment standards	Lead solids, beryllium powder	LPC/no liner
	Elemental mercury	LPC/10 mil liner
	Batteries containing acids or caustics	HPC/no liner LPC/90 mil liner
	Other	Case-by-case evaluation
900—State-only mixed waste and LDR-compliant mixed waste	Solid corrosive waste	HPC/no liner LPC/90 mil liner
	Other	MPC/no liner LPC/10 mil liner

[a]For mixed hazards, the most protective combination of coatings/liners should be chosen.
[b]Container coating/liner abbreviations are as follows.
10-mil liner—10 mil or thicker nylon-reinforced polyethylene liner.
90-mil liner—90 mil or thicker high-density polyethylene rigid liner.

HPC = high performance coating.
LDR = land disposal restrictions.
LPC = low performance coating.
MPC = medium performance coating.
TRU = transuranic.
WSRd = waste specification record.

APPENDIX E
E1.0 SELECTION AND USE OF VOID FILLERS, SORBENTS AND STABILIZING MATERIALS

A variety of materials can be added as void filler to meet the void space requirements of Chapters 3.0 and 4.0.

Sorbents and stabilizing materials can be used to meet free liquid requirements or to provide a safer waste form for handling and storage. All sorbents and stabilizing materials must be nonhazardous, compatible with the waste being sorbed or stabilized, and nonbiodegradable as defined in 40 CFR 264.314(e). Table E-1 lists the general types of sorbents and stabilizing materials that can be used for major Hanford Site waste streams. Specific products used must meet the definitions of Section E1.0 that have been listed on an approved Waste Profile Sheet.

Note that use of these materials to meet radiological stabilization (i.e., to meet Category 3 or mobile radionuclide stabilization requirements) or *Resource Conservation and Recovery Act of 1976* land disposal restrictions treatment standards is not addressed in this appendix. More specific evaluation must be performed as specified previously in this document to demonstrate radiological stabilization or land disposal restrictions compliance.

E1.1 GENERAL TYPES OF SORBENTS AND STABILIZING MATERIALS POTENTIALLY ALLOWED

The general types of sorbents and stabilizing materials potentially allowed include the following.

- Inorganic mineral sorbents including aluminosilicates, clays, vermiculite, zeolites, lime, silica, diatomaceous earth, perlite, fly ash and other inorganic materials used for absorption.

- High molecular weight synthetic polymers (polymer sorbents) including polyethylene, high-density polyethylene, polypropylene, polyacrylate, and other synthetic polymers. This excludes polymers derived from biological material (e.g., cellulose-based materials), and polymers specifically designed to be degradable.

- Stabilizing materials including concrete, portland cement, lime/pozzolans, and a variety of other inorganic materials.

NOTE: Selection of specific materials must be in accordance with Section E1.2.

Specialty stabilization agents for organic liquids include certain products that stabilize organic liquids. These products chemically react with organic liquids to prevent their release in the disposal environment.

E1.2 SELECTION AND USE OF SORBENTS AND STABILIZING MATERIALS

Selection and use of a specific product for sorbtion of a given waste must address the following.

- Determine from Table E-1 what general classes of materials can be used and the conditions for use. The allowable types of sorbents for various waste streams are based on the anticipated treatment/disposal methods.

- Select a product that is appropriate for the material to be treated. Generators can request approval of products in the waste stream profile sheet by providing data to support the intended use. Approval of the profile constitutes approval of the product.

- Obtain manufacturer's instructions and limitations for use of the product. It is critical to use sorbents and stabilizing materials in accordance with the manufacturer's instructions. Information required includes the following.

  - Compatibility of the sorbent or stabilizing material with the waste.

  - The recommended ratio of sorbent to waste for the liquid being sorbed.

  - For stabilizing materials, the exact ratio of liquid to stabilizing materials and methods of mixing.

It might be necessary to run a test of the waste or a surrogate to ensure that the product works adequately with the waste requiring sorption or stabilization.

E1.3 HANFORD SITE REQUIREMENTS FOR USE OF SORBENTS

Sorbents used for Hanford Site treatment, storage, and/or disposal units must be used in sufficient quantity to meet the following requirement.

> Use twice the minimum amount of sorbent. Based on data from the manufacturer or testing, the minimum ratio of sorbent to liquid is determined. For all Hanford Site applications, a minimum of twice the minimum amount of sorbent shall be used.

E2.0 REFERENCES

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," *Code of Federal Regulations*, as amended.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

Table E-1. Sorbent Selection Based on Waste Specification Records.

WSRd Series	Subgroup	Allowable Sorbents/Stabilizing Materials
100—Low-level waste	Low-level liquids for disposal	Mineral sorbents Polymer sorbents Stabilizing materials
	Low-level organic liquids and chelating agents for disposal	Stabilizing materials
200—TRU waste	TRU-mixed waste	Mineral sorbents Polymer sorbents Stabilizing materials
	TRU waste (not mixed)	Mineral sorbents Polymer sorbents Stabilizing materials
400—Mixed waste overpacked and lab packed liquids[a]	All types	Mineral sorbents Polymer sorbents
500—Mixed waste solids, sorbed liquids and soils	Non-thermal treatment WSRds (520 series)	Mineral sorbents Polymer sorbents
	Thermal treatment WSRds (500 series)	Mineral sorbents Polymer sorbents
600—Mixed debris waste	Thermal treatment WSRds (620 series)	Mineral sorbents Polymer sorbents
	Non-thermal treatment WSRds (640 series)	Mineral sorbents Polymer sorbents
800—Other mixed waste with specific treatment standards	All types	Polymer sorbents (or as specified in waste stream profile)
900—State-only mixed waste and LDR-compliant mixed waste	Thermal treatment WSRds (920 series)	Mineral sorbents Polymer sorbents
	Other WSRds	Mineral sorbents Polymer sorbents

[a]Sorbent for lab packs is placed around containers, not mixed with liquids.

LDR = land disposal restrictions.
TRU = transuranic.
WSRd = waste specification record.

APPENDIX F
F1.0 RADIOLOGICAL RELEASE OF WASTE

This appendix establishes the method for radiological release of waste generated by Project Hanford Management Contract waste generators. The method is intended primarily for release of dangerous waste, *Toxic Substances Control Act of 1976* polychlorinated biphenyl waste, and nonregulated waste to offsite treatment, storage, and/or disposal facilities, but also could be used for waste that is not a regulated dangerous waste or *Toxic Substances Control Act of 1976* polychlorinated biphenyl waste shipped to *Resource Conservation and Recovery Act of 1976* Subtitle D facilities. (U.S. Department of Energy, Richland Field Office correspondence 9308117; Westinghouse Hanford Company correspondence 9355777; Westinghouse Hanford Company correspondence 9600740B R1; U.S. Department of Energy, Richland Operations Office correspondence 9600740 B.)

F1.1 DEFINITIONS

The following definitions and abbreviations apply specifically to this appendix.

No radiation added. Any waste material that meets these criteria:

- Contains no measurable increase in bulk or volume radioactivity (at a 95 percent confidence level above background) resulting from U.S. Department of Energy Operations except for waste specifically exempted by U.S. Environmental Protection Agency, U.S. Department of Energy, or U.S. Nuclear Regulatory Commission regulations.

- Contains no surface radioactivity above limits established in HNF-5173 .

No potential for internal contamination (NPIC) waste. A waste generated in a listed Radioactive Material Area (RMA), but for which there is no potential for volumetric contamination. NPIC waste can be one, or both, of these:

- In a form that could not be internally contaminated (aerosol cans, sealed containers, fluorescent light tubes, etc.).

- Known through process knowledge to have no potential to be volume contaminated.

NPIC waste must meet the surface contamination release requirements of HNF-5173.

Naturally occurring radioactive material (NORM) waste. A NORM waste is a waste for which the only radioactive component is a naturally occurring isotope. An example of a NORM waste is water with potassium chloride (containing a percentage of potassium-40).

Other matrix. Waste comprised of any materials not meeting the definitions of water or soil matrices.

Process knowledge. Specific knowledge on the origin, storage, use, and potential exposure of a waste to radiological contamination. Process knowledge is used to determine if a waste has the potential to be radiologically contaminated. If the waste has the potential to be radiologically contaminated, process knowledge is used to identify the radionuclides of concern. Process knowledge must be formally certified by the waste generator. If a generator does not have process knowledge of a waste stream, the waste will be managed as if it is potentially both internally and externally contaminated.

Radioactive material area. An RMA is an area in which the potential exists for contamination because of the presence of unencapsulated or unconfined radioactive material or an area that is exposed to beams or other sources of particles (neutrons, protons, etc.) capable of causing activation.

Radioactive waste. Any waste managed or regulated for its radioactive content.

Soil matrix. Waste comprised of soil or earthen materials.

Volumetric contamination. Radiological contamination that is distributed throughout a solid or liquid matrix, as opposed to surface contamination.

Water matrix. Waste comprised primarily of water that could be contaminated with organic or inorganic contaminants that do not interfere with obtaining the lower limits of detection (LLD) for the water matrix listed in Table F-2.

F1.2 RADIOLOGICAL RELEASE PROCEDURE

This section defines the method by which a generator determines that no radiation was added to the waste. The generator follows each step in succession until a determination is made that the waste can be released as nonradioactive or that the waste must be managed as a radioactive waste. The procedure follows the decision tree illustrated on Figure F-1.

1. When a waste is identified that requires disposal, the generator determines through process knowledge whether the waste was generated or stored in an RMA. If the waste was not generated/stored in an RMA, the generator proceeds to Step 2. If the waste was generated or stored in an RMA, or if the generator does not believe that process knowledge is adequate, the generator proceeds to Step 3.

2. The generator completes the Radiological Release Certification for Waste form, Figure F-2, checking the box corresponding to the 'Non-RMA Waste Certification,' and proceeds to Step 12.

3. The generator determines whether the RMA waste has NPIC. An RMA waste qualifies as NPIC if the waste is in a form that could not be internally contaminated (e.g., aerosol cans, sealed containers, fluorescent light tubes), or if, through process knowledge, it is known that there is no potential for the waste to be volumetrically contaminated. If the waste has no potential for internal contamination, the generator proceeds to Step 4. If the waste does not qualify as NPIC, the generator proceeds to Step 8.

4. To be released, NPIC waste must meet the surface contamination release requirements of HNF-5173. If there is no surface contamination, the generator proceeds to Step 7. If there is surface contamination, the generator proceeds to Step 5.

5. If the container holding a NPIC waste has surface contamination, the generator attempts to decontaminate the exterior of the container. If decontamination is possible, the generator proceeds to Step 7. If decontamination is not possible, the generator proceeds to Step 6.

6. If the NPIC waste can be transferred from the contaminated exterior container into another container without contaminating the NPIC waste, the waste is transferred and the generator proceeds to Step 7. If it is not possible to repackage without the risk of contaminating the NPIC waste, the waste is transferred out of its contaminated packaging and the generator proceeds to Step 8.

7. The generator completes the Radiological Release Certification for Waste form, Figure F-2, checking the box corresponding to the 'NPIC Waste Certification,' and proceeds to Step 12.

8. When a potential for radioactive contamination of the waste exists, which cannot adequately be resolved by process knowledge, certification of the absence of radioactive material is based on radiological survey, sampling, and analytical data. The generator, following SW-846 methods, obtains a representative sample of the waste. Samples of compatible waste having the same radiological process knowledge can be composited for more cost-efficient analysis.

   Radionuclide analysis is performed using the appropriate methods, selected from Table F-1, to measure the radionuclides of concern identified from process knowledge. Gross methods (e.g., gross alpha, gross beta, total uranium) from Table F-1 can be used as long as the method is capable of detecting all radionuclides in the waste at or below the LLDs in Table F-2. Alternate radioanalytical methods having LLDs equal to or less than those listed in Table F-2 could be used.

   Analytical results less than or equal to the LLD listed in Table F-2 for the isotopes of concern will demonstrate that no radioactivity has been added. If a gross analytical method is used, the analytical result must be less than or equal to the lowest LLD among the radionuclides of concern measured by that method. If the analytical results meet the Table F-2 limits, the generator performs an external survey to release the container and proceeds to Step 9.

   If the measurements are greater than the Table F-2 limits, the generator could proceed to Step 10 (optional), or could proceed directly to Step 13.

9. The generator completes the Radiological Release Certification for Waste form, Figure F-2, checking the box corresponding to the 'RMA Waste Certification,' and proceeds to Step 12.

10. This step provides the option to demonstrate that radiological contamination exceeding LLDs (Step 8) is due to NORM.

A comparison sample is prepared using virgin (non-RMA) materials in the same concentrations as the waste and analyzed by the same radioanalytical method as the sample in Step 9. If the concentration of radionuclides in the waste is less than or equal to the concentration in the virgin sample, the waste will be considered NORM waste. The generator performs an external survey to release the container and proceeds to Step 11.

If the waste stream does not meet this criterion, the generator proceeds to Step 13.

It should be noted that because of the complexity of some waste streams, performing comparison sample analysis to release the waste might not be possible.

11. The generator completes "Radiological Release Certification" form, Figure F-2, checking the box corresponding to the 'NORM Waste Certification,' and proceeds to Step 12.

12. The waste is shipped to the offsite facility. The completed Radiological Release Certification is maintained in the generator's files.

13. If none of these release methods is successful, the waste is designated and managed as radioactive waste.

F2.0 REFERENCES

9308117, 1993, *Authorization to Resume Offsite Shipment of RCRA/TSCA Wastes* (letter to President, Westinghouse Hanford Company, Richland, Washington, October 12), Department of Energy, Richland Field Office, Richland, Washington.

9355777, 1993, *Westinghouse Hanford Company Hazardous Waste Radiation Release Protocol* (letter to J. M. Hennig, U.S. Department of Energy, Richland Field Office, Richland, Washington, July 9), Westinghouse Hanford Company, Richland, Washington.

9600740 B, 1996, *RL Site Controls of Potentially Radioactive Waste* (letter to President, Westinghouse Hanford Company, Richland, Washington, March 20), Department of Energy, Richland Operations Office, Richland, Washington.

9600740B R1, 1996, *Westinghouse Hanford Company Site Controls of Potentially Radioactive Waste* (letter to T. K. Teynor, U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 28), Westinghouse Hanford Company, Richland, Washington.

HNF-5173, 2002, *Project Hanford Radiological Control Manual,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, 3rd ed., Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C.

Toxic Substances Control Act of 1976, 15 USC 2601 et seq.

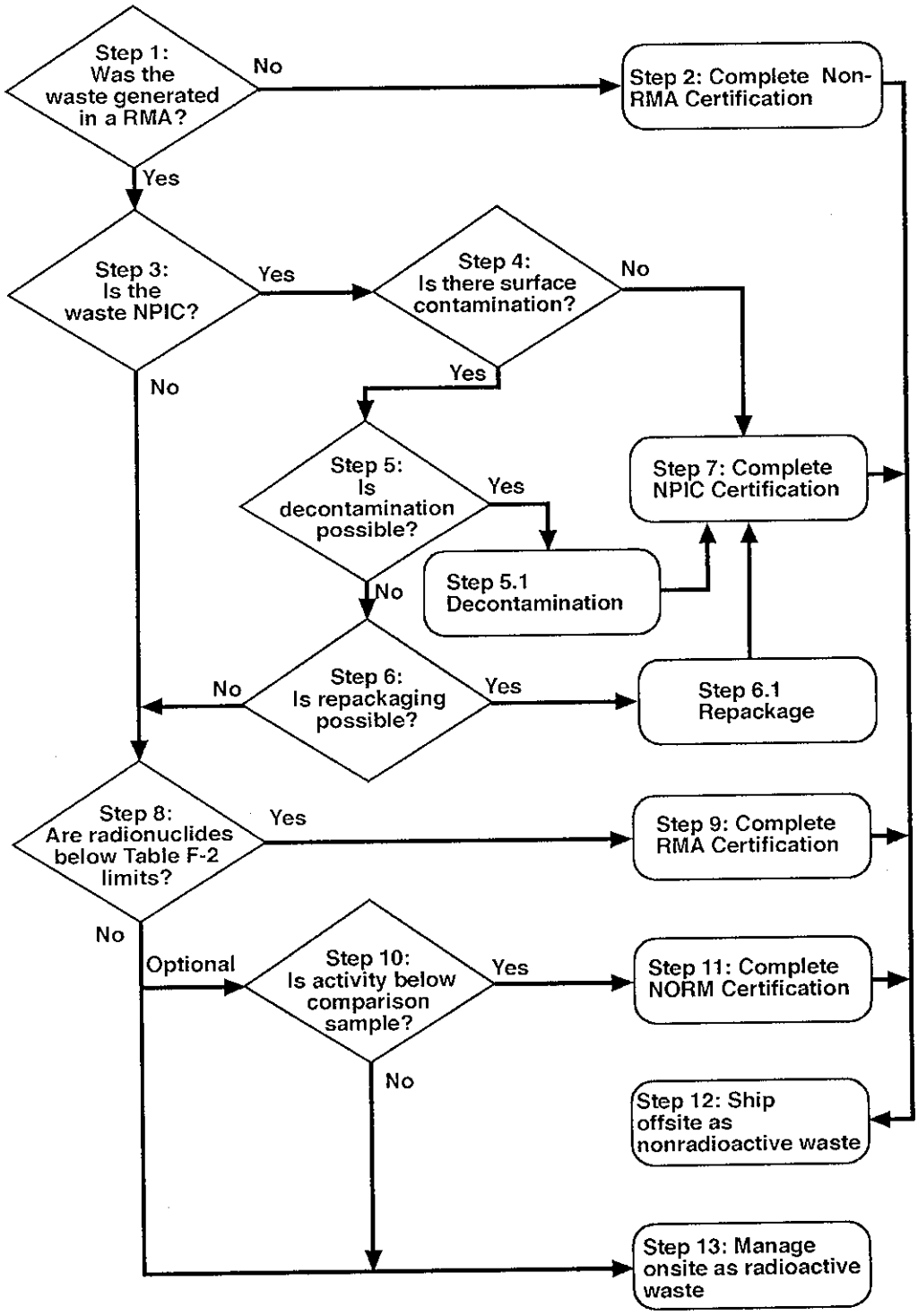

Figure F-1. Decision Tree for Radiological Release.

Radiological Release Certification Form

Package identification number(s): _____

Check the applicable box or boxes:

☐ Non-RMA Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was not generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). The waste's container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual.

☐ NPIC Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material. It is additionally certified that while the waste was in this area, the waste was in a form or location, which could not be internally contaminated (aerosol cans, sealed containers, fluorescent light tubes, etc.). The waste's exterior and/or container have met all of the external radiation release requirements of the Hanford Site Radiological Control Manual.

☐ RMA Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). It is additionally certified that all of the activity levels for the radionuclides of concern are less than the LLD's specified in Table F-2. The waste container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual. A copy of the laboratory analytical data is attached.

☐ NORM Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or, an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). It is additionally certified that all of the activity levels for the NORM constituents in the waste were less than or equal to the activity levels in a virgin comparison sample of NORM waste. The waste container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual. A copy of the laboratory analytical data for both the waste sample and the comparison sample are attached.

Describe process knowledge leading to the classification chosen above:

_____

_____

_____

_____

List the radionuclides potentially present in the waste and describe why these are the only radionuclides of concern (applicable only to RMA and NORM certifications):

_____

_____

_____

Radiological release survey number(s) (applicable to NPIC, RMA, and NORM certifications):

_____

Certification:

Name (print) _____ Signature _____ Date _____

Title _____ Company _____

Figure F-2. Radiological Release Certification.

Table F-1. Radioanalysis Techniques Used for Release.

Matrix	Analysis Group	Technique
Water	Gross alpha/beta activity	proportional counting liquid scintillation
	Gamma emitters	gamma energy analysis
	Beta specific emitters	proportional counting[a] liquid scintillation[a] low energy photon spectrometer. (I-129)[a]
	Radium alpha emitters	alpha scintillation[a] proportional counting[a]
	Specific actinide emitters	alpha energy analysis[a] laser kinetic phpos. (U chem)[a]
Soil/Other	Gross alpha/beta activity[b]	proportional counting liquid scintillation
	Gamma emitters	gamma energy analysis
	Beta specific emitters[b]	proportional counting[a] liquid scintillation[a] low energy photon spec. (I-129)[a]
	Radium alpha emitters[b]	alpha scintillation[a] proportional counting[a]
	Specific actinide emitters[b]	alpha energy analysis[a] laser kinetic phpos. (U chem)[a]

[a]Specific radionuclide analysis requiring chemical separation procedure processing.
[b]Soil/other matrix samples requiring chemical dissolution before chemical separation/counting.

Table F-2. Required Lower Limits of Detection for Radionuclides.

Analysis/Isotope		Water Matrix		Soil or Other Matrix	
		Limit	Units	Limit	Units
Gross alpha		3[a]	pCi/L	5[a]	pCi/g
Gross beta		4[b]	pCi/L	10[b]	pCi/g
Gamma emitters (using GEA)	Co-60	50		10	pCi/g
	Cs-137	50		10	
	Eu-152	50		10	
	Eu-154	50		10	
	Eu-155	50		10	
	Ra-226	NA		2	
	Ra-228	NA		2	
	Na-22	50		10	
	Na-24	50		10	
Report any detectable isotope					
Specific beta emitters					
Tritium		400	pCi/L	400	pCi/g
C-14		200	pCi/L	50	pCi/g
Ni-59		30	pCi/L	30	pCi/g
Ni-63		30	pCi/L	30	pCi/g
Se-79		Refer to footnote c		Refer to footnote c	
Sr-89		5	pCi/L	10	pCi/g
Sr-90		2	pCi/L	10	pCi/g
Tc-99		30	pCi/L	30	pCi/g
I-129		25	pCi/L	25	pCi/g
Ra-228 (via Ac-228 daughter)		3	pCi/L	GEA	pCi/g
Radium alpha emitters					
Ra-226 (via Rn-222 daughter)		2	pCi/L	GEA	pCi/g
Gross Radium		2	pCi/L	5	pCi/g
Specific actinides					
Isotopic thorium (Th-228, 230, 232)		2[d]	pCi/L	2[d]	pCi/g
Isotopic uranium (U-234, 235, 238)		2[d]	pCi/L	2[d]	pCi/g
Total uranium using chemical analysis		0.2	µg/L	2	µg/g
Np-237		2	pCi/L	2	pCi/g
Pu-238		2	pCi/L	2	pCi/g
Pu-239/240 (sum)		2		2	
Pu-241		20		20	
Am-241		2	pCi/L	2	pCi/g
Cm-244		2	pCi/L	2	pCi/g

[a]Applies only if the absence of alpha emitting radionuclides with LLDs is known.
[b]Applies only if the absence of beta emitting radionuclides with LLDs is known.
[c]If fission products (e.g., Cs-137 and Sr-90) are below their LLD values the Se-79 will also be below detectable limits.
[d]Signifies 2 pCi/L (or 2 pCi/g respectively) for each isotope. It should be noted that the analysis will not differentiate between some isotopes (i.e., analysis will not differentiate between U-235 and U-236).

GEA = gamma energy analysis
LLD = lower limit of detection.
pCi/L = picocuries per liter.
pCi/g = picocuries per gram.
µg/L = microgram per liter.

APPENDIX G
G1.0 TRANSURANIC WASTE CERTIFICATION REQUIRMENTS

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 contact-handled (CH) TRU waste meets the requirements of U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*, and DOE/WIPP-02-3122. DOE/WIPP-02-3122 establishes the specific physical, chemical, radiological, and packaging criteria for acceptance of defense TRU waste shipments at the WIPP as required depending upon waste material form and packaging configurations.

In addition to meeting the general requirements of this document, the following are the specific TRU waste acceptance criteria.

G1.1 REMOTE-HANDLED TRANSURANIC CRITERIA

The WIPP is currently unable to accept remote-handled (RH) TRU waste; hence, RH TRU waste currently has no path to disposal. Acceptance of RH TRU by Hanford treatment, storage, and/or disposal units is, therefore, evaluated on a case-by-case basis. Requirements for RH TRU acceptance are established as part of the waste stream profile approval and will not be identified in this document. Generators must obtain waste stream profile approval prior to generating and/or packaging their RH TRU waste. RH TRU is defined as packaged TRU with an unshielded external surface dose rate exceeding 2 milliSieverts (200 millirem) per hour at contact.

G1.2 CONTACT-HANDLED TRANSURANIC CRITERIA

1. Waste must be segregated by waste specification record, including segregation of defense from non-defense waste. Non-defense waste is prohibited.

   Defense waste is waste generated, in whole or in part, by the Secretary of Energy (and predecessor agencies) while carrying out any of these functions: naval reactors development; weapons activities, including defense inertial confinement fusion; verification and control technology; defense nuclear material production; defense nuclear waste and materials by-product management; defense nuclear materials security investigations; and defense research and development.

2. Waste must meet all requirements in Tables G-1 through G-6 except as allowed with profile sheet approval.

3. Newly generated waste may require packaging using the visual examination technique. This requirement, if applicable, will be communicated to the generator as a waste stream profile condition of approval.

4. Newly generated waste may require that the Waste Disposal/Groundwater Remediation Project WIPP Certification Program certify the nondestructive assay equipment used to quantify the radiological properties. This requirement, if applicable, will be communicated to the generator as a waste stream profile condition of approval.

5. Acceptable Knowledge data must be provided through use of a waste stream profile sheet from the *Hanford Site Solid Waste Acceptance Program* Internet web page. The profile sheet is located at http://www.hanford.gov/wastemgt/wac/.

6. Packaging requirements will be established by the Hanford TRU Project Group and communicated to the generator as a waste stream profile condition of approval. Generators must obtain waste stream profile approval prior to generating and/or packaging their CH TRU waste.

Generators unable to meet the above CH TRU criteria may request an exception to the waste acceptance criteria per Section 1.6 of this document.

G2.0 REFERENCES

49 CFR, "Transportation," *Code of Federal Regulations*, as amended.

49 CFR 173, "Shippers—General Requirements for Shipments and Packagings," *Code of Federal Regulations*, as amended.

DOE/WIPP-02-3122, 2002, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Rev. 0.1, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.

Table G-1. Container Properties.

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Payload container description	DOT Type A or equivalent • 55-gallon drums (direct fill or containing a pipe component) • 55-gallon drums are <24 inches in diameter (including gasket, locking ring, and torqued accordingly) and <34 - 15/16 inches tall (fully assembled) • SWBs (standard waste box) • Ten-drum overpacks • 85-gallon drum overpacking a 55-gallon drum (no direct fill)	Site procurement specifications and quality assurance acceptance reports, or manufacturer's fabrication documentation and records demonstrating equivalency with DOT Type A requirements, or testing records showing compliance with 49 CFR 173.461, or comparison to technical criteria/industry standards. Pipe overpack containers', SWB's, and ten-drum overpack's specifications procured consistent with TRAMPAC requirements. Visual inspection to verify container integrity.'
Container weights	• WIPP waste acceptance criteria Table 3.2.2	Records of loaded container weights.
Removable surface contamination	For individual containers and payload assemblies: • $\leq$20 dpm/100 cm^2 for alpha • $\leq$200 dpm/100 cm^2 for beta-gamma The fixing of surface contamination to meet these limits is not allowed.	Records of surface contamination surveys taken on individual containers prior to release from a radiological contamination area.
Container identification and marking	• Bar code label consisting of a unique container identification number • Shipping category • Yellow and Magenta – "Caution Radioactive Material" sticker.	Visual inspection at time of shipment.
Confinement Requirements	• Maximum layers of confinement allowed is 6, including the liner. Smaller number of confinement layer may be required as a waste stream profile condition of approval. • Newly generated waste must be packaged with filtered bags or be horsetailed. Filtered bags are considered layers of confinement.	Contents inventory records, which clearly indicate the number of confinement layers.
Filter vents	Payload containers vented using 1 or more filter(s) that meet the WIPP Hazardous Waste Facility Permit and the TRAMPAC Appendix 2.5 specification. Drums with vent clips are not considered vented.	Site procurement specifications and quality assurance acceptance reports, manufacturer's fabrication documentation, and records of visual inspection.

DOT = U.S. Department of Transportation.
SWB = standard waste box.
TRAMPAC = transuranic package transporter-model II-authorized methods for payload control.
WIPP = Waste Isolation Pilot Plant.

Table G-2. Radiological Properties.

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Radionuclide composition	• Assay measurements • Quantification of Am-241, Pu-238, Pu-239, Pu-240, Pu-242, U-233, U-234, U-238, Sr-90, and Cs-137	Records of assay data and acceptable knowledge (AK) documentation.
Fissile material quantity (Pu-239 fissile gram equivalent)	• ≤200 g/55-gallon drum (direct fill or containing a pipe component) • ≤325 g/SWB • ≤325 g/TDOP • Note that uncertainty must be accounted for in accordance with Appendix B, Section B.2	Records of assay data and AK documentation and calculations using isotopic composition, specific activity of the isotopes, and measured assay values to calculate Pu-239 fissile gram equivalent.
TRU alpha activity concentration	>100 nCi of alpha-emitting TRU isotopes with half lives greater than 20 years per gram of waste	Records of assay data and AK documentation and records of calculations showing concentrations of the total TRU radionuclides in the waste matrix.
Pu-239 equivalent activity (PE-Ci)	Untreated waste: • ≤80 PE-Ci/55-gallon drum • ≤130 PE-Ci/SWB • ≤130 PE-Ci/TDOP • ≤1100 PE-Ci/55-gallon drum overpacked in a SWB or TDOP or 85 gallon drum • ≤1100 PE-Ci/SWB overpacked in TDOP • ≤1800 PE-Ci/55-gallon drum containing a pipe component Solidified/vitrified waste: • ≤1800 PE-Ci/55-gallon drum	Records of assay data and AK documentation and records of conversion and calculations using Appendix B of the WIPP waste acceptance criteria.
Radiation dose rate	• ≤200 mrem/h at the surface of the payload (waste) container and the TRUPACT-II • ≤10 mrem/h at 2 meters	Measurements shall be made on each CH TRU waste container with instruments calibrated using sources traceable to a national standard. Internal payload container shielding cannot be used to meet dose rate requirements except for the approved pipe component configuration.
Decay heat	• ≤ limit established per TRUCON.[a]	Records of assay methods and AK documentation.

[a]TRUCON assignment can be obtained from the Hanford TRU project group.

AK = acceptable knowledge.
CH TRU = contact-handled transuranic.
g/SWB = gram per standard waste box.
g/TDOP = gram per ten-drum overpack.
mrem/h = millirem per hour.
nCi = nanocurie.
PE-Ci =. plutonium equivalent curie.
TRU = transuranic.
TRUCON = TRUPACT-II Content Code
TRUPACT = transuranic package transporter.
WIPP =Waste Isolation Pilot Project.

Table G-3. Physical Properties.

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Liquids	Liquid waste is prohibited in payload containers except for residual amounts as follows. Free liquid: • <1 volume percent of external container • <1 inch or 2.5 centimeter in bottom of internal containers Liquid identification: • Generators must specify the quantity and location of all liquids in the container.	AK, radiography, visual examination, and/or packaging records will be used to determine the presence of free liquids and to ensure the quantity of liquid satisfies the acceptance criteria. The waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping, and/or aspirating.
Sealed containers	No sealed containers greater than 4 liters except for waste material type II.2 packaged in metal containers. Sealed containers greater than 4 liters, including rigid liners, shall be vented. Heat-sealed plastic bags must have at least one filter vent. NOTE: See TRAMPAC (Section 4.0, Table 4-4) for waste material type II.2 definition.	AK, radiography, visual examination, and/or packaging records. Taping a lid around the edges to secure it without venting the lid is considered a sealed container. Cross-taping across the lid, puncturing the lid, or crimping the container are acceptable methods for securing materials in internal containers.

AK = acceptable knowledge.
TRAMPAC = transuranic package transporter-model II-authorized methods for payload control.

Table G-4. Chemical Properties.

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Pyrophoric materials	• <1 percent radionuclide pyrophorics • No nonradionuclide pyrophorics	AK documentation and records of procedures, processes, or evidence that shows no presence of pyrophorics or treatment to eliminate the characteristic.
Hazardous waste	• Limited to EPA hazardous waste numbers identified as allowable in the Hazardous Waste Facility Permit and all Washington State waste codes	Approved Fluor Hanford Waste Profile Sheet. AK documentation and records of procedures, processes, or evidence that shows hazardous waste codes as listed in Table G-6.
Chemical compatibility	No chemicals or materials that are incompatible	AK and/or records of sampling and analysis.
Explosives, corrosives, and compressed gases	No explosives, corrosives, or compressed gases	Radiography records, visual examination records, or AK documentation, and site policies/procedures prohibiting these items.
Polychlorinated biphenyl concentration	<50 parts per million	AK and/or records of sampling and analysis.

AK = acceptable knowledge.
EPA = U.S. Environmental Protection Agency.

Table G-5. Data Package Contents.

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Shipping data	Hazardous waste shipments: • Uniform hazardous waste manifest or bill of lading • Land disposal restriction notification	Uniform hazardous waste manifest and land disposal restriction notification generated

Table G-6. WIPP-Acceptable RCRA Hazardous Waste Codes.

"D" Series	"F" Series	"P" Series	"U" Series
D004	F001	P015	U002
D005	F002	P030	U003
D006	F003	P098	U019
D007	F004	P099	U037
D008	F005	P106	U043
D009	F006	P120	U044
D010	F007		U052
D011	F009		U070
D018			U072
D019			U078
D021			U079
D022			U103
D026			U105
D027			U108
D028			U122
D029			U133
D030			U134
D032			U151
D033			U154
D034			U159
D035			U196
D036			U209
D037			U210
D038			U220
D039			U226
D040			U228
D043			U239

This page intentionally left blank.

APPENDIX H
H1.0 APPROVED VENTS

Containers requiring a vent shall have a vent installed. Table H-1 provides a list of the approved vents. The NucFil-019 DS is the preferred vent for newly generated TRU waste packages; other vents will be approved on a case-by-case basis in the waste profile.

Table H-1. Approved Vents.[a]

Manufacturer	Model Number
Fairey[a]	98867[b]
Fairey	99421
Nuclear Filter Technology	NucFil[c]-012
Nuclear Filter Technology	NucFil-013
Nuclear Filter Technology	NucFil-013 GorTex
Nuclear Filter Technology	NucFil-013 SSS
Nuclear Filter Technology	NucFil-016
Nuclear Filter Technology	NucFil-019
Nuclear Filter Technology	NucFil-019 DS
Nuclear Filter Technology	NucFil-019-EPD
Nuclear Filter Technology	NucFil-019-HCR
Nuclear Filter Technology	NucFil-020
Nuclear Filter Technology	NucFil-049
Nuclear Filter Technology	NucFil-049LS
Nuclear Filter Technology	NucFil-049S
Nuclear Filter Technology	NucFil-050[d]
Nuclear Filter Technology	NucFil-007
Nuclear Filter Technology	NucFil-007LS
Nuclear Filter Technology	NucFil-007S
Nuclear Filter Technology	NucFil-072
Nuclear Filter Technology	NucFil-072 SSS
Nuclear Filter Technology	NucFil-073
Nuclear Filter Technology	NucFil-074
Nuclear Filter Technology	NucFil-075
Nuclear Filter Technology	NucFil-DVS3
Nuclear Filter Technology	NucFil-DVS3 IP
Nuclear Filter Technology	NucFil-DVS307
UltraTech	9400
UltraTech	9402
UltraTech	9408
UltraTech	9414
UltraTech	9415
UltraTech	9416
UltraTech	9450
UltraTech	9460
UltraTech	9500
UltraTech	9550

[a]Fairey is a registered trademark of the Fairey Holdings Limited Company, Middlesex, England.
[b]Wildcard designator used by manufacturer.
[c]NucFil is a registered trademark of the Nuclear Filter Technology Corporation, Lakewood, Colorado.
[d]Not approved for transuranic package transporter-model II-authorized methods for payload control applications.