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Revision 5

Hanford Site Solid Waste Acceptance Criteria

Prepared for the U.S. Department of Energy

FLUOR DANIEL HANFORD, INC.
Richland, Washington

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

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GLOSSARY

Acronyms

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
CIN	container identification number
CWC	Central Waste Complex
DE-Ci	dose equivalent curie
DOE	U. S. Department of Energy
DOE-RL	U. S. Department of Energy, Richland Operations Office
DOT	U. S. Department of Transportation
DW	dangerous waste
EHW	extremely hazardous waste
EPA	U. S. Environmental Protection Agency
FDH	Fluor-Daniel Hanford Company
FGE	fissile gram equivalent
FSAR	final safety analysis report
GEA	gamma energy analysis
HDPE	high-density polyethylene
HEPA	high-efficiency particulate air
HIC	high-integrity container
HNF	Hanford Nuclear Facility (document identifier)
ISB	interim safety basis
LDR	land disposal restrictions
LLBG	Low-Level Burial Grounds
LLD	lower limit of detection
LLMW	Low-Level Mixed Waste
LLW	low-level waste
MSDS	material safety data sheet
MW	mixed waste
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
OSR	operational safety requirements
PCB	polychlorinated biphenyls
PE-Ci	plutonium equivalent curie
PHMC	Project Hanford Management Contract
QA	quality assurance
QAP	quality assurance program
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
RMA	radioactive material area
SWB	standard waste box
TRU	transuranic
TRUPACT	transuranic package transporter
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage, and/or disposal
TSR	technical safety requirements
ULF	uranium limit fraction
WAC	Washington Administrative Code
WIPP	Waste Isolation Pilot Plant
WMH	Waste Management Federal Services of Hanford, Inc.
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 TSD unit.

Accountable nuclear material. Any material that contains 0.5 times or more of the reporting unit of any one or more of the materials, elements, or isotopes listed in Figure I-1 of DOE Order 5633.3B.

Asbestos containing waste material. Any waste that contains more than 1 percent asbestos by weight and that can be crumbled, pulverized, or reduced by hand pressure to powder when dry.

Bulk waste. Waste that is not containerized for disposal.

Byproduct material. Either (a) any radioactive material (except special nuclear material) yielded from, or made radioactive by, exposure to the radiation incident to the process of producing special nuclear material or (b) the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

Chelating agent. Chelating agents are the following classes of compounds: amine polycarboxylic acids (e.g., ethylenediamine tetraacetic 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 combustibles. Examples include ammonium perchlorate, ammonium permanaganate, guanidine nitrate, hydrogen peroxide solutions greater than 91%, and tetranitromethane (UFC 1994).

Combustible waste. Containerized waste forms that show evidence of combustion or decomposition upon exposure to 538° C (1,000° F) for 10 minutes.

Contact handled. Packaged waste whose external surface dose rate does not exceed 200 millirem 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 1,000 millirem per hour.

Container. Any portable device in which a material is stored, transported, treated, disposed, or otherwise handled.

Corrosive material. A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.

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

Cylinder. A pressure vessel designed for pressures higher than 276 kilopascals (40 pounds per square inch atmosphere) and having a circular cross section. A cylinder does not include a portable tank, multi-unit tank car tank, cargo tank, or tank car.

Dangerous waste. Solid waste designated in WAC 173-303-070 through 100 as dangerous or extremely hazardous waste.

Dangerous waste constituents. Dangerous waste constituents means 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.

Department of Energy, Richland Operations Office (DOE-RL). The field office of the U.S. Department of Energy that operates the Hanford Site.

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. A method of normalizing the radiotoxicity of various radionuclides to plutonium-239 for use in establishing the safety basis for certain Hanford Site waste management units.

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)(vi), (vii) or (viii).

Extremely hazardous waste. Extremely hazardous waste means dangerous waste designated in WAC 173-303-100 as extremely hazardous.

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).

Fissile material. Material made up of nuclides 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 nuclides of interest. In addition, plutonium-238 is considered fissile material for transportation under 49 CFR 173.

Fissionable materials. Substances containing nuclides 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° C (141° F), or any material in a liquid phase with a flash point at or above 37.8° C (100° F) that is intentionally heated and offered for transportation at or above its flash point in a bulk packaging.

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.

Free liquids. Free liquids are 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. Generator means 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 that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

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

Incompatible waste. Incompatible waste means 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.

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 and 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.

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 could also be used for Department of Transportation 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 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 (LLW). Waste that contains radioactivity and is not classified as high-level waste, transuranic (TRU) waste, or spent nuclear fuel or 11e(2) byproduct material as defined by DOE Order 5820.2A. A test specimen of fissionable material irradiated for research and development only, and not for the production of power or plutonium, could be classified as LLW provided the concentration of transuranic materials is less than 100 nanocuries per gram.

Mixed waste. "Mixed waste" means a dangerous, extremely hazardous, or acutely hazardous waste that contains both a radioactive 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 U.S.C. 2011 et seq.).

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 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(e).

Noncombustible waste. Containerized waste forms that show no evidence of combustion or decomposition on exposure to 538° C (1,000° F) for 10 minutes.

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. Onsite means any property within the Hanford Site boundary. (Note: DOT and RCRA 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 (OSR) or technical safety requirements (TSR). 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 sorbent materials, cushioning, and any other components necessary to contain and protect inner receptacles or inner packagings.

Packaging safety analysis. A formal risk assessment process to evaluate the suitability of a container or packaging system for transportation of radioactive materials. For transport of radioactive materials on the Hanford Site, a safety analysis report for packaging (SARP), safety evaluation for packaging (SEP), or documentation and analysis of packaging (DAP) is required. For offsite transportation, the safety requirements are defined in 49 CFR 173 and 10 CFR 71.

Performance assessment. A systematic analysis of the potential risks posed by waste management systems to the public and environment, and a comparison of those risks to established performance objectives.

PHMC. Project Hanford Management Contract. The current contract with the U.S. Department of Energy to operate portions of the Hanford Site. Fluor-Daniel Hanford, Inc. (FDH) is the management contractor. The Waste Management Project is the responsibility of Waste Management Federal Services of Hanford, Inc.

Plutonium-equivalent curie (PE-Ci). A method of normalizing the radiotoxicity of transuranic radionuclides to plutonium-239 for use in establishing the safety limits for the Waste Isolation Pilot Plant, which is located near Carlsbad, New Mexico.

Plutonium-239 fissile gram equivalent (FGE). A method of normalizing fissile and fissionable isotopes to plutonium-239 for use in establishing criticality safety limits for the Hanford Site Solid Waste Project. This is consistent with the method found in the safety analysis reports for the TRUPACT-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 or 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 760.3).

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. Solid material that contains 1 percent or less pyrophoric metal generally distributed throughout the material is not considered pyrophoric (DOE Order 5820.2A).

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

Radioactive waste. Solid, liquid, or gaseous material that contains radionuclides regulated under the AEA, as amended, and of negligible economic value considering costs of recovery.

RCRA land disposal restrictions or RCRA LDR. 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 external surface dose rate exceeds 200 millirem per hour. Test specimens of fissionable material irradiated for research and development purposes only and not for the production of power or plutonium could be classified as remote-handled transuranic waste.

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)(i) (waste that normally is unstable and readily undergoes violent change without detonating).

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 that is 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 nuclide. 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, but that has not been reprocessed to remove its constituent elements.

Spontaneously combustible material. A pyrophoric or self-heating material.

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 (SWB). 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.

Storage. The holding of waste for a temporary period, at the end of which the waste is treated, disposed, or stored elsewhere. (40 CFR 260.10) (DOE Order 5820.2A, Attachment 2).

Toxic. Having the properties to cause or to significantly contribute to death, injury, or illness of humans or wildlife.

Toxic Substances Control Act PCB waste or TSCA PCB waste. Any PCB-containing waste that is regulated under the TSCA requirements codified in 40 CFR 761.60.

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

Transuranic waste or TRU waste. Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level waste; (2) waste that the Secretary (of Energy) has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation required by the 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 (Public Law 102-579: Waste Isolation Pilot Plant Land Withdrawal Act).

Treatment. "Treatment" means 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).

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 TSDunit RCRA Permit, safety basis, performance assessment, and/or other environmental requirements.

TRUPACT. A transuranic package transporter.

U.S. Department of Energy (DOE) Waste. Radioactive waste generated by activities of the DOE (or its predecessors), waste for which the DOE is responsible under law or contract, or other waste for which the DOE is responsible. Such waste could be referred to as DOE waste (DOE Order 5820.2A).

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

Washington State-Only Dangerous Waste. Refer to state-only dangerous waste.

Waste Specification Record, or WSRd. 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 stream is a set of wastes generated from the same process or similar processes that possess similar physical, chemical, and radiological characteristics and are managed by the same TSD methods.

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

WMH. Waste Management Federal Services of Hanford, Inc. is responsible for the Waste Management Project under the PHMC.

WMH acceptance organization. The organization within WMH 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

DOE Order 5820.2A requires that each treatment, storage, and/or disposal facility (referred to in this document as TSD unit) that manages low-level or transuranic waste (including mixed waste and TSCA PCB waste) maintain waste acceptance criteria. These criteria must address the various requirements to operate the TSD unit in compliance with applicable safety and environmental requirements.

1.1 PURPOSE AND SCOPE

This document sets forth the baseline criteria for acceptance of radioactive waste at TSD units operated by WMH. The criteria for each TSD unit have been established to ensure that waste accepted can be managed in a manner that is within the operating requirements of the unit, including environmental regulations, DOE Orders, permits, technical safety requirements, waste analysis plans, performance assessments, and other applicable requirements.

Acceptance criteria apply to the following TSD units: the Low-Level Burial Grounds (LLBG) including both the nonregulated portions of the LLBG and trenches 31 and 34 of the 218-W-5 Burial Ground for mixed waste disposal; Central Waste Complex (CWC); Waste Receiving and Processing Facility (WRAP); and T Plant Complex. Waste from all generators, both from the Hanford Site and from 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 (WSRds).

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.

1.2 ROADMAP TO THE WASTE ACCEPTANCE CRITERIA

This chapter describes general administrative requirements applicable to generators, along with introductory information.

Chapter 2.0 identifies requirements that generally are applicable to waste sent to any of the TSD units. These criteria relate primarily to overall characterization and segregation methods used by generators.

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 are as follows.

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

- Chapter 4.0: The lined portion (trenches 31 and 34) of the 218-W-5 Burial Ground is a RCRA-permitted disposal unit for certain mixed waste that meets federal and state LDR requirements.

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

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

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

- Chapter 8.0 lists references used throughout the document.

- 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.

- Appendix E describes selection of sorbents.

- Appendix F describes Hanford Site radiological release of waste.

- Appendix G provides interim requirements for TRU waste.

1.3 WASTE ACCEPTANCE PROCESS

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

The process for obtaining approval to ship waste to the Hanford Site TSD units is described on the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/index.htm).

1.4 GENERATOR RESPONSIBILITIES

Generators of radioactive waste have certain general responsibilities under DOE Order 5820.2A. Acceptance of waste at Hanford Site TSD units is contingent on effective implementation of 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. Generators are responsible financially for costs incurred by Hanford Site TSD units as a result of nonconformance with the acceptance criteria.

1.4.2 Quality Assurance Program

Each generator shall have a QAP as part of their overall waste certification program. The QAP shall implement the requirements of DOE Order 5700.6C (DOE Order 5820.2A). The generator QAP shall be subject to evaluation in accordance with 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 Order 5820.2A). For Hanford Site generators, the Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan (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 (DOE Order 5820.2A). The timing and format of the waste forecast will be provided by WMH.

1.5 EVALUATION OF GENERATOR WASTE CERTIFICATION PROGRAM

Under DOE Order 5820.2A, receiving TSD units retain joint responsibility with the generator for ensuring that the waste received 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 WMH 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.

WMH 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 WMH, or whether DOE-RL and/or regulatory agency approvals are required. On completion of this review, the WMH acceptance organization will respond in writing, identifying whether the exception is granted, rejected, or requires further evaluation or clarification.

1.6.1 WMH-Approved Exceptions

An exception can be granted to these acceptance criteria when the WMH acceptance organization demonstrates that the exception does not affect compliance with (1) any applicable regulations and (2) any DOE-RL and/or regulatory agency-approved requirements documents. 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, WMH can grant an exception to the container size requirement.

The WMH 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 requirement documents of the TSD units.

1.6.2 DOE-Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with a DOE-approved requirement documents (e.g., safety basis, performance assessment) or DOE Orders will require a DOE-RL waiver, DOE-RL approval of a safety document revision, or other DOE-RL approval. For this type of exception, the appropriate waiver request, document revision, or other applicable request for approval will be submitted by WMH, in coordination with FDH to DOE-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 DOE-RL to the affected regulatory agency(s).

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 CLASSES OF WASTE MANAGED AT HANFORD SITE TSD UNITS

The TSD units covered by these acceptance criteria manage low-level and transuranic 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 Order 5820.2A).

For containerized waste, the container type, weight, internal and external volume, any shielding provided, and the date packaged must be recorded (DOE Order 5820.2A).

2.3 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). The following sections describe the physical/chemical characterization requirements for waste acceptance (HNF-SD-EN-WAP-002, WHC-SD-EN-WAP-005, HNF-1886, HNF-2165, 40 CFR 264.13, WAC 173-303-300, 40 CFR 761).

2.3.1 Types of Acceptable Knowledge

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 used to generate the waste. Acceptable knowledge requirements can be met using one or more of the following:

- Mass balance from a controlled process that has a specified output for a specified input
- MSDS on unused chemical products
- Analytical data on the waste or a waste from a similar process
- Test data from a surrogate sample

In addition, acceptable knowledge requirements can be met using a combination of analytical data or screening results and one or more of the following:

- Interview information
- Logbooks
- Procurement records
- Qualified analytical data
- Radiation work packages

- Procedures and/or methods
- Process flow charts
- Inventory sheets
- Vendor information
- Mass balance from an uncontrolled process (e.g., spill cleanup)
- Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods).

If the information is sufficient to quantify constituents and characteristics, as required by the regulations and unit-specific acceptance criteria, the information is considered acceptable knowledge.

2.3.2 General Waste Knowledge Requirements

The minimum level of acceptable knowledge must include designation data where the constituents causing a waste number to be assigned are quantified, and data that address any 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 760, and/or WAC 173-303, and to assign correct waste numbers. Where the available information does not qualify as acceptable knowledge or is not sufficient to characterize a waste for management, the sampling and testing methods outlined in WAC 173-303-110 must be used to determine whether a waste designates as toxic characteristic, corrosive, and/or contains free liquids.

In cases where constituents that could cause a waste to be regulated are input into a process, but are not expected to be in the waste in concentrations causing the waste to be regulated, sampling and analysis must be performed to demonstrate that the constituents are below regulated limits. This requirement can be met through chemical screening. This sampling and analysis is required only 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.

2.3.3 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 treatment standard(s) for that waste. Testing of a representative sample at a Hanford Site laboratory or an other independent laboratory is required to demonstrate that a waste stream meets a concentration-based treatment standard of 40 CFR 268.

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 are applicable.

2.3.4 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 that: (1) characterization is sufficient to demonstrate that the waste can be managed in accordance with the unit-specific acceptance criteria and (2) a representative sample (or samples) has been obtained or will be obtained at the TSD unit to fully characterize the waste.

- 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 can be characterized by an alternative management path negotiated through DOE-RL with the appropriate regulatory agency. This type of exception will be handled by the method outlined in Section 1.6.3.

2.3.5 Recertification

Physical/chemical characterization data for a waste stream must be recertified annually, or 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. This does not require sampling and analysis of the waste stream more frequently than required by the regulations.

2.4 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 Order 5820.2A).

2.4.1 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 FGE per container.

- Any radionuclide that accounts for more than 1% of the total radiological activity of the waste.

- Any radionuclide present in concentration exceeding 1% 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% each of 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.

2.4.2 Acceptable Knowledge 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 correctly categorized (e.g., Category 1 and 3 limits for the LLBG, correct TRU determination). A graded approach should be applied to radiological characterization, in which more detailed analysis and a higher level of statistical confidence are applied when the concentration of radionuclides in a waste approaches one or more of the limits of these criteria.

Indirect methods (i.e., methods other than direct measurement of a given radionuclide) are acceptable as long as the methods are 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 where more frequent analysis is performed when the concentration of radionuclides in a waste approaches one or more of the limits of these criteria.

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 contributing 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 2.4.1, as long as the basis of this determination is documented. Process knowledge alone generally is not sufficient to quantify the radionuclide inventory of a waste.

- 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.

- Direct measurement methods - Direct measurement 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. The modeling must be performed by an individual who is knowledgeable and experienced in the use and limitations of the model. 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 QA 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 clearly documented and approved by the WMH 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.

2.4.3 Additional Detail on Mobile Radionuclide Characterization

For low-level and low-level mixed waste, mobile radionuclide reporting is particularly 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 with respect 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 a mobile radionuclide that originates from natural background on the Hanford Site, the background concentration of that radionuclide can be subtracted from the total concentration. Typical radionuclides found in Hanford Site soils include uranium isotopes, thorium-232, and potassium-40.

2.4.4 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 WASTE SEGREGATION AND TREATMENT AND/OR DISPOSAL PATH

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

2.5.1 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 Order 5820.2A).

2.5.2 Radiological Release of Mixed 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 FDH subcontractor generators, the site release criteria are provided 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 subcontractor 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 records for the waste.

2.5.3 Segregation for Treatment, Storage, and/or Disposal

All waste shall be segregated by the Waste Specification Records (WSRds) 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, the generator must document the basis for not segregating the waste and acceptance is contingent on either (1) the WMH acceptance organization identifying a treatment/disposal pathway or (2) approval by DOE-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 requirements identified in this document.

The current set of WSRds can be obtained from the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/index.htm).

2.5.4 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 (e.g., greater than Class C low-level waste).

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

2.6 MANAGEMENT AND CERTIFICATION OF NEWLY-GENERATED TRANSURANIC WASTE

Transuranic waste has a unique set of management and certification requirements based on the Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069). The Hanford Site meets these requirements through the Hanford Site Transuranic Waste Certification Plan and companion documents, currently in draft form. In the interim, the applicable transuranic waste requirements are identified in Appendix G.

2.7 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 WMH 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/index.htm).

2.8 CLASSIFIED AND ACCOUNTABLE NUCLEAR MATERIAL

- Transuranic waste that is classified for security reasons must be declassified by the generator for acceptance at Hanford Site TSD units (DOE Order 5820.2A). The generator shall notify the WMH acceptance organization of any classified low-level waste during the acceptance process.

- A DOE/NRC 741 form must be completed for waste that contains accountable nuclear material (DOE Order 5633.3B). Forms are available from the WMH acceptance organization.

3.0 ACCEPTANCE CRITERIA FOR THE UNLINED PORTIONS OF THE LOW-LEVEL BURIAL GROUNDS

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements for the unlined portions of the LLBG. For criteria relating to the lined 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 unlined disposal trenches that accept only radioactive waste not regulated under 40 CFR 261, WAC 173-303, or 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 unlined portions of 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 unlined portions of the LLBG:

- Waste that is dangerous or extremely hazardous as defined by WAC 173-303, or as hazardous waste as defined by 40 CFR 261 (HNF-SD-EN-WAP-002)
- TSCA-regulated PCB waste (HNF-SD-EN-WAP-002)
- Waste generated from CERCLA cleanup activities, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site.
- Waste containing free liquids, except as allowed in Section 3.3.1 (HNF-SD-EN-WAP-002)
- Gaseous waste packaged at pressures exceeding 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F) (DOE Order 5820.2A)
- Unstabilized organic liquids (including sorbed organic liquids) exceeding 1% of the waste by weight
- Unstabilized chelating compounds exceeding 1% of the waste by weight (DOE Order 5820.2A)
- Infectious waste
- Transuranic waste and waste that exceeds Class C, and other radiological limits of Section 3.4.1
- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards before disposal (DOE Order 5820.2A)

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

All free liquids must be sorbed or stabilized in accordance with Appendix E, or otherwise removed from the waste, except as specifically allowed as follows (HNF-SD-EN-WAP-002).

- Containerized free liquids are allowed in the following situations, but cannot exceed 1% of the volume of the waste (HNF-SD-EN-WAP-002, DOE Order 5820.2A):
  - Free liquids in a very small container, such as an ampule
  - Small articles that contain free liquids required for the article to function
- 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-SD-EN-WAP-002). The type and amount of sorbent required shall be in accordance with Appendix E. In any case, the amount of liquid cannot exceed 1% of the volume of the waste or 0.5% of waste processed to a stable form (DOE Order 5820.2A).
- 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-SD-EN-WAP-002). In any case, the amount of liquid cannot exceed 1% of the volume of the waste (DOE Order 5820.2A).

3.3.2 Land Disposal Restrictions

Waste that is initially subject to regulation under RCRA can be disposed in the LLBG with a determination that the waste is no longer dangerous waste and the waste meets the applicable treatment standards of 40 CFR 268. These waste types include the following.

- Hazardous debris that is exempted from regulation under 40 CFR 261.3(f).
- Waste that originally was designated only with characteristic waste numbers D001 through D043 that is no longer hazardous, and that meets all of the applicable treatment standards of 40 CFR 268.

A copy of the applicable notification to the EPA Regional Administrator, as specified in 40 CFR 268.7, and data supporting this notification must be provided to the WMH acceptance organization.

3.3.3 Solidification or Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1% of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds (DOE Order 5820.2A). Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

3.3.4 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 it does not exceed applicable free liquid requirements.

3.3.5 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 the LLBG. This evaluation must be approved by the WMH acceptance organization.

3.3.6 Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure), and combustible gas (e.g., hydrogen, methane) concentrations exceeding the lower explosive limit during handling before disposal. If a waste generates sufficient gas to exceed these limits, the following mitigating measures (or alternative measures approved by the WMH acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. 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). In addition to filtering, palladium or platinum catalyst packs could be used to control hydrogen concentrations in the container.

- Control of gases from biological decomposition: waste containing readily biodegradable organic materials (e.g., animal waste, vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition, a mixture of 10% by weight slaked lime in 90% inorganic sorbent shall be added to the waste to reduce biological decomposition if filtering alone is not sufficient to control combustible gas concentrations.

- Packaging of animal carcasses: Radioactive animal carcasses must be packaged as follows (Ecology 1989).

  - 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 a mixture of 10 parts mineral sorbent to 1 part slaked lime. The plastic liner and inner package must be sealed.

™ Nucfil is a registered trademark of Nuclear Filter Technology Incorporated, 5161 Ward Rd., Wheat Ridge, CO 80033.

- A minimum of 7.6 centimeters (3 inches) of mineral sorbent must be placed in the bottom of the outer package, the inner package 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 against the various limits listed in the following sections are 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 A.1 of Appendix A) shall not exceed 100 nanocuries per gram of waste (DOE Order 5820.2A)

- Waste category (as calculated by methods A.4 and A.5 of Appendix A) shall not exceed Category 3, except with an analysis coordinated by the WMH acceptance organization demonstrating that the LLBG Performance Assessment conditions are met (WHG-EP-0645, WHC-SD-WM-TI-730).

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

  - Packaging in a HIC that meets the testing requirements of the Hanford High Integrity Container, 300 Year specification (WHC-S-0486)

  - Packaging in a HIC approved by the WMH 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/index.htm).

  - Stabilization in concrete or other stabilization agents. The stabilized waste must meet the leach index and compression strength criteria of the NRC Technical Position Paper on Waste Form, Section C.2 and Appendix A (NRC 1991).

  - 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). WMH will perform a case-by-case evaluation against the LLBG performance assessment (WHG-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 placement of 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 WMH acceptance organization will coordinate this evaluation.

- NRC Class C limit - Waste shall not exceed the NRC Class C limits (as calculated by method A.6 of Appendix A) (DOE Order 5820.2A).

- ISB limits - Waste must meet the applicable ISB limits for the LLBG (as calculated by method A.7 of Appendix A), with the following exception: if a combustible waste exceeds the combustible waste limit, but does not exceed the noncombustible waste limit, the WMH acceptance organization can coordinate an evaluation to determine whether segregation or stabilization can be used to mitigate the combustibility hazard (HNF-SD-WM-ISB-002).

3.4.2 Criticality Safety Limits

The limits for fissile and fissionable material are provided in Appendix B (CPS-SW-149-00003).

3.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of the Hanford Site Radiological Control Manual (HSRCM-1), Table 2-2.

3.4.4 Package Dose Rate Limits

Contact-handled waste 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) on the surface of the package, except that a package larger than 208 liters may have a marked point on the bottom or side with a surface dose rate of up to 10 milliSieverts per hour (1,000 millirem per hour) as long as the 30 centimeter dose rate limit is not exceeded (DOE Order 5820.2A, HSCRM-1).

Remote-handled waste shall meet the applicable dose rate restrictions of DOT or an approved packaging safety analysis. Remote-handled waste shall be configured for unloading such that personnel exposures are maintained as low as reasonably achievable (ALARA), and in no case shall exceed 100 millirem per hour exposure rate.

3.5 PACKAGING CRITERIA

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

3.5.1 Outer Packages

Outer packages that meet one of the following criteria will provide adequate containment for disposal.

- Packages that meet the applicable DOT requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a strong tight container is adequate.

- Packages that have been evaluated through an approved packaging safety analysis.

Drums or boxes not exceeding 2.74 meters long by 1.6 meters wide by 1.7 meters high (nominally 9 feet long by 5.25 feet wide by 5.5 feet high) should be used whenever possible to facilitate receipt verification. When a larger container is required, the WMH acceptance organization must be notified before packaging.

3.5.2 Package Construction

All outer packages shall be nonflammable or constructed of fire-retardant materials. All exterior surfaces of wooden packages shall be treated with a fire-retardant material having a maximum flame-spread index of 25 when tested to ASTM Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM E-84-96). Cardboard containers are not acceptable for disposal (DOE Order 5820.2A). Packages and sacrificial rigging shall not contain regulated materials, such as lead.

3.5.3 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, bulges, substantial corrosion, or other damage that could compromise integrity.

3.5.4 Securing Waste and Shielding

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.

3.5.5 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 Hanford Site Rigging Manual (DOE-RL-92-36). For packages that have special unloading requirements, information must be provided to the WMH 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.

3.5.6 Minimization of Subsidence

All waste shall be packaged in a form that minimizes settling and subsidence of the LLBG to the maximum extent feasible (DOE Order 5820.2A, WHC-EP-0645, WHC-SD-WM-TI-730). The following forms will be considered to meet these criteria.

- Inherently stable waste that will not subside in the disposal environment.
- Waste stabilized by grouting or packaging in a HIC.

- Containerized waste that fills at least 90% of the internal volume of the container. To calculate the volume of void spaces in the waste, only voids exceeding 5.1 centimeters (2 inches) in all dimensions need be considered. Any void fillers must be selected and used in accordance with Appendix E.

3.5.7 Labeling

Waste containers shall be labeled in accordance with Appendix C. 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 WMH acceptance organization.

3.5.8 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. The Solid Waste Burial Grounds Interim Safety Basis (HNF-SD-WM-ISB-002) identifies the radiological and chemical conditions under which bulk waste may be disposed. 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, including any mitigating measures required to meet the conditions of the ISB.

4.0 ACCEPTANCE CRITERIA FOR THE LINED PORTIONS OF THE LOW-LEVEL BURIAL GROUNDS

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements 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 lined, 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) 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 (DOE/RL-88-21). F039 waste is limited to waste derived from F001, F002, F003, F004, and/or F005 waste
- TSCA-regulated PCB waste (HNF-SD-EN-WAP-002)
- Waste generated from CERCLA cleanup activities conducted, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Waste that does not meet all applicable treatment standards of 40 CFR 268 and WAC 173-303-140
- Free liquids, as determined by the Paint Filter Liquids Test (Method 9095 of SW-846), except as allowed by Section 4.3.1 of this document (40 CFR 264.314, HNF-SD-EN-WAP-002)
- Gaseous waste packaged at pressures exceeding 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F) (DOE Order 5820.2A)
- Unstabilized chelating compounds exceeding 1% of the waste by weight (DOE Order 5820.2A)
- Infectious waste
- Transuranic waste and waste that exceeds Class C, and other radiological limits of Section 4.4.1

- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards before disposal (DOE Order 5820.2A)

- Waste that poses substantial hazards because of formation of excessive heat generation from radiological decay (Section 4.3.6) (DOE Order 5820.2A)

- Waste that is incompatible with the trench liner, as defined in Section 4.3.3 (40 CFR 264.301; WAC 173-303-665; HNF-SD-EN-WAP-002).

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 as specifically allowed as follows.

- Containerized free liquids are allowed in the following situations, but cannot exceed 1% of the volume of the waste (40 CFR 264.314, HNF-SD-EN-WAP-002):

  - 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-SD-EN-WAP-002). 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% of the volume of the waste or 0.5% of waste processed to a stable form (DOE Order 5820.2A).

- 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-SD-EN-WAP-002). In any case, the amount of liquid cannot exceed 1% of the volume of the waste (DOE Order 5820.2A).

4.3.2 Land Disposal Restrictions

All waste subject to RCRA LDR (40 CFR 268) and/or the Washington State LDR (WAC 173303-140) 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 an other 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-SD-EN-WAP-002).

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-SD-EN-WAP-002). 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-SD-EN-WAP-002, WHC-SD-WM-TI-714). An assessment will be performed by the WMH 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 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Method 9090 (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 Solidification and Stabilization of Chelating Compounds

Chelating compounds exceeding 1% of the waste by weight must be solidified or stabilized to a form that immobilizes chelating compounds (DOE Order 5820.2A). Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

4.3.5 Asbestos-Containing Waste

Requirements are identical to those in Chapter 3.0, Section 3.3.4.

4.3.6 Heat Generation

The requirements are identical to those found in Chapter 3.0, Section 3.3.5.

4.3.7 Gas Generation

The requirements are identical to those found in Chapter 3.0, Section 3.3.6.

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 found 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% enrichment can be accepted only with a case-by-case evaluation demonstrating that the uranium is in an insoluble or stabilized form (refer to Footnote 1 of Table B-3 in Appendix B) (HNF-SD-WM-SARR-028).

4.4.3 Package External Contamination Limits

The requirements are identical to those found in Chapter 3.0, Section 3.4.3.

4.4.4 Package Dose Rate Limits

The requirements are identical to those found in Chapter 3.0, Section 3.4.4.

4.5 PACKAGING CRITERIA

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

4.5.1 Outer Packages

Metal drums and HICs are acceptable for disposal in trenches 31 and 34. Other containers must be evaluated by the WMH acceptance organization for structural stability and containment on a case-by-case basis. Outer packages that meet one of the following criteria will provide adequate containment for disposal.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a strong tight container is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

Drums or boxes not exceeding 2.74 meters long by 1.6 meters wide by 1.7 meters high (nominally 9feet long by 5.25 feet wide by 5.5 feet high) should be used whenever possible to facilitate receipt verification. When a larger container is required, the WMH acceptance organization must be notified before packaging.

4.5.2 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, bulges, substantial corrosion, or other damage that could compromise integrity.

4.5.3 Package Construction

All outer packages shall be nonflammable or constructed of fire-retardant materials. Cardboard containers are not acceptable for disposal (DOE Order 5820.2A). Packages and 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. Packages and sacrificial rigging shall not contain regulated materials, such as lead.

4.5.4 Securing Waste and Shielding

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.

4.5.5 Handling of Packages

Handling requirements are the same as shown in Chapter 3.0, Section 3.5.5.

4.5.6 Minimization of Subsidence

The requirements for minimization of subsidence are the same as those shown in Chapter 3.0, Section 3.5.6.

4.5.7 Labeling

Waste containers shall be labeled in accordance with Appendix C. Bulk waste and remote-handled waste containers that are removed from reusable overpacks are exempt from labeling requirements at trenches 31 and 34.

4.5.8 Bulk (Noncontainerized) Waste

Bulk waste requirements are the same as shown in Chapter 3.0, Section 3.5.8.

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.

5.0 ACCEPTANCE CRITERIA FOR THE CENTRAL WASTE COMPLEX

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements of 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 (e.g., nonregulated low-level organic liquids, unstabilized chelating compounds, and contact-handled low-level waste that exceeds radiological disposal criteria). Waste stored at 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, all 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. 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 CERCLA cleanup activities.

5.2 PROHIBITED WASTE

The following waste types are not accepted for storage at the CWC:

- Waste having dangerous waste numbers other than those listed on the CWC Part A, Form 3, permit application (DOE-RL-88-21). The prohibited waste numbers are F006 through F019, F024, F025, F032 through F038, and all K waste numbers
- Explosive waste (HNF-1886)
- Shock sensitive waste (HNF-1886)
- Pyrophoric waste (HNF-1886)
- Class IV oxidizer waste (HNF-1886)
- Waste that reasonably might be expected to become unstable, to be explosive, to generate excessive heat or toxic gases, or for any other reason cannot be stored safely over a 20-year period (DOE Order 5820.2A)
- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards during storage (DOE Order 5820.2A; HNF-SD-WM-ISB-007).
- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F) or waste that might pressurize to exceed 1.5 atmospheres (152 kilopascals absolute pressure) over a 20-year storage life (DOE Order 5820.2A; HNF-SD-WM-ISB-007).

- Waste that exceeds any of the radiological limits of Section 5.4.
- Liquid waste, except that lab packed and overpacked liquids could be accepted in quantities of 57 liters (15 gallons) per outer container (HNF-SD-WM-ISB-007).
- Infectious waste.

5.3 PHYSICAL/CHEMICAL CRITERIA

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

5.3.1 Chemical Compatibility

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

5.3.2 Liquids and Liquid-Containing Waste

Sorbtion of liquids is allowed, but must be compatible with the treatment methods anticipated for disposal. Appendix E and the applicable WSRd specify the appropriate sorbents to be used for various waste streams.

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

5.3.3 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.

5.3.4 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 approved by the WMH acceptance organization.

5.3.5 Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure) and combustible gas (e.g., hydrogen, methane) concentrations exceeding the lower explosive limit for up to 20 years of storage before disposal. If a waste generates sufficient gas to exceed these limits, the following mitigating measures (or alternative measures approved by the WMH acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. 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). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic absorbent could be required for waste that is expected to decompose rapidly.

5.4 RADIOLOGICAL CRITERIA

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

5.4.1 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B (CPS-SW-149-00002).

5.4.2 Container Dose-Equivalent Curie Limits

Up to 35 DE-Ci per container are acceptable at the CWC as a routine shipment. Quantities up to 150 DE-Ci per container can be evaluated on a case-by-case basis for acceptability at the CWC (HNF-SD-WM-ISB-007).

5.4.3 Waste Exceeding Class C or Category 3

Waste having radionuclide concentrations exceeding Class C or Category 3 (except TRU waste) requires DOE-RL approval for acceptance.

5.4.4 Package Removable Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of the HSRCM-1, Table 2-2.

5.4.5 Package Dose Rate Limits

Waste containers 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 (DOE Order 5820.2A; HSCRM-1).

5.5 PACKAGING CRITERIA

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

5.5.1 Container Selection

The packages for stored 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 packaging safety analysis 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 strong tight container will be adequate.

Outer containers shall be constructed of noncombustible materials. Wood, fiberboard, and plastic outer containers are prohibited (HNF-SD-WM-ISB-007).

5.5.2 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 WMH 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.

5.5.3 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° C (131° F) and freezing conditions.

- Inner containers shall be securely closed. The lids of glass containers shall be sealed with Teflon™tape or equivalent.

- 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 containers in a manner that prevents shifting and breakage.

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5.5.4 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 by NDE.

5.5.5 Securing Waste and Shielding

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.

5.5.6 Package Size and Weight Limits

Drums or boxes not exceeding 2.74 meters long by 1.6 meters wide by 1.7 meters high (nominally 9 feet long by 5.25 feet wide by 5.5 feet high) should be used whenever possible to facilitate receipt verification. When a larger container is required, the WMH acceptance organization must be notified before packaging.

The following are the baseline size limits for CWC storage modules. Larger containers could be accepted into specific storage modules with special loading procedures.

Table 5-1. Central Waste Complex Container Size and Floor Loading Limits.

Storage units	Package size limit	Floor loading limit
Alkali metal modules	320 liter (85 gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
Low-flashpoint modules	320 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)
Other storage buildings (2402-W, 2403-W and 2404-W)	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	3,430 – 9,800 kilograms per square meter (700 – 2,000 pounds per square foot)

5.5.7 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.

5.5.8 Labeling

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

6.0 ACCEPTANCE CRITERIA FOR THE T PLANT COMPLEX

This chapter defines the baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements at 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, and repackaging. The 221-T Building is used primarily for highly contaminated equipment decontamination. The 2706-T and 214-T Buildings are used for storage, decontamination, treatment, and processing of equipment and waste having relatively lower levels of radiological contamination.

Waste that can be managed at the T Plant Complex includes TRU, TRU-mixed, LLW, low-level mixed, and TSCA PCB waste. The T Plant Complex Part A, Form 3, permit application includes characteristic waste numbers D001 through D043, all listed discarded chemical product waste numbers (U- and P- listed waste), F-listed waste having waste numbers F001 through F005, F020 through F023, F026 through F028, and F039, and all Washington state-only waste numbers (DOE/RL-88-21). The T Plant Complex also can manage TSCA PCB (40 CFR 761) waste generated on the Hanford Site.

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:

- Waste having dangerous waste numbers other than those listed on the T Plant Complex Part A, Form 3, permit application. The prohibited waste numbers are F006 through F019, F024, F025, F032 through F038, and all K waste numbers (DOE-RL-88-21)
- Waste generated from CERCLA cleanup activities, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Explosive waste
- Shock sensitive waste
- Pyrophoric waste
- Class IV oxidizer waste
- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards during storage (DOE Order 5820.2A).

- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F), except that pressurized aerosol cans can be accepted
- Waste that exceeds any of the radiological limits of Section 6.4
- Infectious waste.

6.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical acceptance criteria for T Plant Complex.

6.3.1 Chemical Compatibility

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

6.3.2 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.

6.3.3 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. This evaluation must be approved by the WMH acceptance organization.

6.3.4 Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure) and combustible gas (e.g., hydrogen, methane) concentrations exceeding the lower explosive limit for up to 20 years of storage before disposal. If a waste generates sufficient gas to exceed these limits, the following mitigating measures (or alternative measures approved by the WMH acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. 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). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.
- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic sorbent could be required for waste that is expected to decompose rapidly.

6.4 RADIOLOGICAL CRITERIA

The following are the radiological acceptance criteria for the T Plant Complex.

6.4.1 Total Dose Equivalent Curie Limits

T Plant Complex has a total inventory limit of 19.5 DE-Ci of radioactive material (HNF-SD-WM-ISB-006). Waste receipts will be controlled as needed to maintain the inventory within this limit.

6.4.2 Criticality Safety Limits

Individual buildings within the T Plant Complex have total fissile material limits. Waste receipts will be controlled as needed to maintain the inventory within the following limits (CPS-D-149-00001, CSAR-86-007).

- 221-T canyon and tunnel: 200 grams fissile material per piece of equipment and 900 grams total fissile material in these areas.
- 2706-T and adjacent areas may be established as up to three isolated areas with a 177 FGE limit each (WHC-SD-SQA-CSA-502).
- All other areas of the T Plant Complex: an exempt quantity of fissionable material must be maintained as defined in Appendix B, Section B.1.

Individual waste containers must additionally meet the limits of Appendix B.

6.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall meet the limits of Table 2-2 of HSRCM-1.

6.4.4 Package External Dose Rate Limits

Waste containers that exceed 1 milliSievert per hour (100 millirem) per hour at 30 centimeters 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, detailed radiological survey data must be provided by the generator.

6.4.5 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), detailed radiological survey information must be provided by the generator.

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.

6.5 PACKAGING CRITERIA

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

6.5.1 Container Selection

Waste packages that meet one of the following criteria will provide adequate containment.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a strong tight container is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

6.5.2 Noncombustible Containers

Outer containers shall be constructed of noncombustible or fire-retardant materials. Fire-retardant wood boxes are acceptable at T Plant Complex.

6.5.3 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 WMH 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.

6.5.4 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 integrity (WAC-173-303-630). Minor external surface rust that could 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 by NDE.

6.5.5 Securing Waste and Shielding

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.

6.5.6 Container Size Limits

Drums or boxes not exceeding 2.74 meters long by 1.6 meters wide by 1.7 meters high (nominally 9 feet long by 5.25 feet wide by 5.5 feet high) should be used whenever possible to facilitate receipt verification. When a larger container is required, the WMH acceptance organization must be notified before packaging.

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.

6.5.7 Container Weight Limits

General container weight limits are as follows. Heavier containers can be accepted on a case-by case basis.

- Drums shall not exceed 454 kilograms (1,000 pounds)
- Plywood boxes shall not exceed 2,270 kilograms (5,000 pounds)
- 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).

6.5.8 Labeling

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

7.0 ACCEPTANCE CRITERIA FOR THE WASTE RECEIVING AND PROCESSING FACILITY

The following acceptance criteria apply to newly generated waste sent to WRAP. Acceptance criteria for retrieved waste containers in the LLBG will be established through project-specific acceptance procedures.

7.1 FACILITY DESCRIPTION AND FUNCTION

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

Waste that can be managed at WRAP includes TRU waste, TRU mixed waste, low-level waste, low-level mixed, and TSCA PCB waste. WRAP manages waste having characteristic waste numbers D001 through D043, all listed discarded chemical product waste numbers (U- and P- listed wastes), certain F-listed waste numbers (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste numbers (DOE/RL-88-21). In addition, WRAP manages TSCA PCB waste generated on the Hanford Site.

Waste managed at 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 WRAP.

7.2 PROHIBITED WASTE

The following wastes types are not be accepted at WRAP:

- Waste having dangerous waste numbers other than those listed on the WRAP Part A, Form 3, permit application (DOE-RL-88-21). The prohibited waste numbers are F006 through F019, F024, F025, F032 through F038, and all K waste numbers)
- Waste generated from CLERCLA cleanup activities, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Explosive waste (HNF-2165)
- Shock sensitive waste (HNF-2165)
- Pyrophoric waste (HNF-2165)
- Class IV oxidizer waste (HNF-2165)
- Liquid waste, except that inner containers having less than 57 liters (15 gallons) of liquid are acceptable (HNF-2165)
- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F), except that aerosol cans can be accepted as long as the

total quantity of propane in an outer container does not exceed 900 grams (2 pounds) (HNF-SD-W026-SAR-002)

- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards during storage (DOE Order 5820.2A).
- Waste that exceeds any of the radiological limits of Section 7.4
- Infectious waste.

7.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical acceptance criteria for WRAP.

7.3.1 Chemical Compatibility

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

7.3.2 Hazardous Material Limits

The WRAP safety basis has a method for determining limits on the quantity of hazardous material in each container (HNF-SD-W026-SAR-002). Generators should contact the WMH acceptance organization for any waste containing hazardous chemical constituents to determine the quantity per container allowed at WRAP.

7.3.3 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.

7.3.4 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. This evaluation must be approved by the WMH acceptance organization.

7.3.5 Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure) and combustible gas (e.g., hydrogen, methane) concentrations exceeding the lower explosive limit for up to 20 years of storage before disposal. If a waste generates sufficient gas to exceed these limits, the following mitigating measures (or alternative measures approved by the WMH acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. 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). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic sorbent could be required for waste that is expected to decompose rapidly.

7.4 RADIOLOGICAL CRITERIA

The following are the radiological acceptance criteria for WRAP.

7.4.1 Container Dose-Equivalent Curie Limits

The maximum DE-Ci content per container is as follows. Other container types and sizes must be evaluated for acceptance (HNF-SD-W026-SAR-002).

- 35 DE-Ci per drum
- 35 DE-Ci per wood waste box
- 56.9 DE-Ci per standard waste box.

7.4.2 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B (WRP1-CPS-001).

7.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of Table 2-2 of HSRCM-1.

7.4.4 Package External Dose Rate Limits

Waste containers 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 (HSRCM-1).

7.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at WRAP.

7.5.1 Container Selection

Waste packages must meet one of the following criteria to provide adequate containment.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a noncombustible strong tight container is adequate.
- Strong, tight packages that have been evaluated through an approved packaging safety analysis.

7.5.2 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 WMH 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.

7.5.3 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 WRAP (HNF-SD-W026-SAR-002).

7.5.4 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 integrity. Minor external surface rust that could 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 by NDE.

7.5.5 Securing Waste and Shielding

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.

7.5.6 Package Size Limits

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

- 208 liter (55 gallon) drums
- 321 liter (85 gallon) drums
- Boxes not exceeding the following dimensions can be received for NDE and/or NDA:
  - NDE: 2.74 meters long by 1.6 meter wide by 1.7 meter high (nominally 9 feet long by 5.25 feet wide by 5.5 feet high)
  - NDA: 2.43 meters long by 1.5 meter wide by 1.5 meter high (nominally 8 feet long by 5 feet wide by 5 feet high).

7.5.7 Package Weight Limits

The maximum weight for containers handled at WRAP is as follows:

- Drums: 454 kilograms (1,000 pounds)
- SWB: 1,800 kilograms (3,970 pounds)
- Other Boxes: 3,180 kilograms (7,000 pounds).

7.5.8 Labeling

Packages shall be labeled as described in Appendix C.

8.0 REFERENCES

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APPENDIX A

RADIOLOGICAL CALCULATION METHODS

A variety of radiological calculations are required to determine whether a waste can be managed at Hanford Site 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 2.4.1, must be considered in the calculations. If there is a major radionuclide in the waste that is not listed in Tables A-1 and A-2, the generator must notify the WMH 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.

- Except for the NRC Class C calculation, the internal volume of the waste container should be used when limits are expressed in volume concentration (refer to Section A.6 regarding the NRC Class C calculation). If the waste is not containerized, the volume is the anticipated volume the waste will occupy in the LLBG.

A.1. TRANSURANIC WASTE DETERMINATION

To determine whether a waste is 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 d in Table A-2. If the total alpha specific activity exceeds 100 nanocuries per gram, the waste is TRU.

The following are conventions regarding concentration averaging that shall apply to the TRU determination:

- The concentration applies to the contents of a single waste package at the time of assay (DOE Order 5820.2A).

- The mass of the waste container and any shielding shall not be used in calculating the TRU concentration of the waste (DOE Order 5820.2A).

- The mass of liners, void fillers, sorbents or stabilizing agents added subsequent to generation of the waste generally should not be used in calculating the TRU concentration of the waste. There are, however, certain cases in which these materials are implicitly part of the waste generating process (e.g., liners used in hot cells for packaging before load-out, grouting of waste for reduction of dispersible contamination, sorbents added to aid in removal of sludges from pits or sumps). In such cases, the mass of these materials can be considered in the TRU determination. When it is unclear whether the mass of a material can be considered in the TRU determination, the *NRC Branch Technical Position on Concentration Averaging and Encapsulation* (NRC 1995) should be used as guidance.

A.2. CALCULATION OF PLUTONIUM-239 FISSILE GRAM EQUIVALENTS

The plutonium-239 FGE calculation is performed by completing the following steps:

1. Multiply the gram quantity of each isotope listed in Appendix B, Table B-1, by its respective FGE conversion factor

2. Sum each of the resulting values to obtain the total FGE.

A.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 in the following steps:

1. The concentration of each radionuclide (expressed in curies per cubic meter) is multiplied by the heat of decay for that nuclide from Table A-1, yielding the heat of decay for each in units of watts per cubic meter

2. Thermal power is the sum of the heat of decay of all radionuclides in the waste.

A.4. CATEGORY 1 DETERMINATION

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

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

2. The resulting values are added to form the sum of fractions.

3. If the sum of 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 must be performed to classify the waste.

A.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 as follows.

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

2. The resulting values are added to form a sum of fractions.

3. If the sum of 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.

A.6. NRC CLASS C CALCULATION

NRC Class C calculation shall be performed as specified in 10 CFR 61.55.

Note that the NRC calculations have different assumptions regarding volume and weight concentration averaging than those required by Hanford Site performance assessments and safety bases. NRC guidance on waste classification (NRC 1983) and concentration averaging (NRC 1995) shall be applied in making the Class C determination.

A.7. INTERIM SAFETY BASIS CALCULATIONS FOR LOW-LEVEL BURIAL GROUNDS

The ISB calculations are sum of fractions calculations, performed in the following steps:

1. Determine the appropriate set of limits from Table A-2 (i.e., noncombustible containerized waste or combustible containerized waste)

2. Divide the concentration of each radionuclide by its respective limit

3. Add the resulting values to form a sum of fractions

4. If the sum of fractions is less than or equal to 1, the waste lies within the ISB limits. If combustible waste exceeds the combustible waste limit, but does not exceed the noncombustible waste limit, the WMH acceptance organization can perform an evaluation to determine whether segregation or stabilization can be used to mitigate the combustibility hazard. The noncombustible waste limit cannot be exceeded.

A.8. MOBILE RADIONUCLIDE REPORTING

This is a simple comparison of the concentration of each mobile radionuclide (^{3}H, ^{14}C, ^{36}Cl, ^{79}Se, ^{93}Mo, ^{99}Tc, ^{129}I, ^{187}Re, Total U, and ^{237}Np) against its respective reporting value from Table A-2.

A.9. CALCULATING DOSE-EQUIVALENT CURIES

Calculation of DE-Ci is a method of normalizing the exposure risk of various radionuclides. DE-Ci limits are established for certain TSD units as part of the safety basis. Calculation of the DE-Ci of a waste container is performed in the following steps:

1. Multiply the activity (in Ci) of each isotope in a given container by its respective DE-Ci correction factor from Table A-1

2. Add the resulting values to obtain the total DE-Ci of the package.

A.10. CALCULATING PLUTONIUM-239 EQUIVALENT CURIES

The PE-Ci calculation is required for TRU waste to be shipped to WIPP. The PE-Ci calculation is performed as specified in the WIPP waste acceptance criteria (DOE/WIPP-069, Appendix A).

Table A-1. Conversion Factors for General Radiological Calculations.

Isotope	Half-life (days)	Specific activity (curies per gram)	Heat of decay (watts per curie)	Dose equivalent curie correction factor
^{3}H	4.5034 E+03	9.66 E+03	3.38 E-05	1.49 E-07
^{7}Be	5.3920 E+01	3.50 E+05	2.94 E-04	7.47 E-07
^{10}Be	5.8439 E+08	2.23 E-02	1.20 E-03	8.25 E-04
^{14}C	2.0928 E+06	4.46 E+00	2.93 E-04	4.86 E-06
^{22}Na	9.5032 E+02	6.25 E+03	8.71 E-03	1.78 E-05
^{32}P	1.4262 E+01	2.86 E+05	4.12 E-03	3.61 E-05
^{35}S	8.7510 E+01	4.26 E+04	2.88 E-04	5.76 E-06
^{36}Cl	1.0994 E+08	3.30 E-02	1.43 E-03	5.11 E-05
^{40}K	4.6641 E+11	7.00 E-06	3.33 E-03	2.87 E-05
^{45}Ca	1.6380 E+02	1.77 E+04	4.56 E-04	1.54 E-05
^{46}Sc	8.3790 E+01	3.39 E+04	1.26 E-02	6.90 E-05
^{49}V	3.3000 E+02	8.08 E+03	5.16 E-06	8.04 E-07
^{51}Cr	2.7702 E+01	9.24 E+04	1.93 E-04	7.78 E-07
^{54}Mn	3.1210 E+02	7.75 E+03	4.96 E-03	1.56 E-05
^{55}Fe	9.9711 E+02	2.38 E+03	9.66 E-06	6.25 E-06
^{56}Co	7.7270 E+01	3.02 E+04	2.02 E-02	9.22 E-05
^{57}Co	2.7179 E+02	8.43 E+03	7.42 E-04	2.11 E-05
^{58}Co	7.0820 E+01	3.12 E+04	4.91 E-03	2.53 E-05
^{59}Fe	4.4503 E+01	4.97 E+04	7.74 E-03	3.44 E-05
^{59}Ni	2.7758 E+07	7.97 E-02	1.36 E-05	3.08 E-06
^{60}Co	1.9253 E+03	1.13 E+03	1.54 E-02	5.09 E-04
^{63}Ni	3.6561 E+04	5.67 E+01	1.01 E-04	7.23 E-06
^{65}Zn	2.4426 E+02	8.22 E+03	3.38 E-03	4.75 E-05
^{68}Ge	2.7082 E+02	7.09 E+03	2.44 E-05	1.20 E-04
^{75}Se	1.1978 E+02	1.45 E+04	2.32 E-03	1.97 E-05
^{79}Se	2.3741 E+07	6.96 E-02	3.14 E-04	2.29 E-05
^{82}Sr	2.5550 E+01	6.23 E+04	4.65 E-05	1.43 E-04
^{85}Kr	3.9285 E+03	3.91 E+02	1.50 E-03	1.64 E-14
^{85}Sr	6.4840 E+01	2.37 E+04	3.07 E-03	1.17 E-05
^{86}Rb	1.8631 E+01	8.15 E+04	4.51 E-03	1.54 E-05
^{88}Y	1.0665 E+02	1.39 E+04	1.59 E-02	6.54 E-05
^{89}Sr	5.0530 E+01	2.90 E+04	3.46 E-03	9.65 E-05
^{90}Sr - ^{90}Y *	1.0512 E+04	2.76 E+02	5.54 E-03	3.04 E-03
^{93}Mo	1.4610 E+06	9.61 E-01	7.41 E-05	6.62 E-05

Table A-1. Conversion Factors for General Radiological Calculations.

Isotope	Half-life (days)	Specific activity (curies per gram)	Heat of decay (watts per curie)	Dose equivalent curie correction factor
^{93m}Nb	5.8914 E+03	2.38 E+02	1.09 E-05	6.81 E-05
^{93}Zr	5.5882 E+08	2.51 E-03	1.24 E-04	7.47 E-04
^{94}Nb	7.4144 E+06	1.87 E-01	1.02 E-02	9.65 E-04
^{95}Nb	3.4975 E+01	3.93 E+05	4.68 E-03	1.35 E-05
^{95}Zr - ^{95m}Nb *	6.4020 E+01	4.42 E+04	4.24 E-04	6.09 E-05
^{99}Tc	7.7103 E+07	1.71 E-02	5.04 E-04	1.93 E-05
^{103}Ru - ^{103m}Rh *	3.6260 E+01	7.00 E+04	3.36 E-03	2.08 E-05
^{106}Ru - ^{106}Rh *	3.7359 E+02	6.59 E+03	3.99 E-04	1.11 E-03
^{107}Pd	2.3741 E+09	5.14 E-04	5.51 E-05	2.97 E-05
^{108m}Ag	4.6386 E+04	2.61 E+01	9.96 E-03	6.60 E-04
^{109}Cd	4.6260 E+02	2.59 E+03	1.54 E-04	2.66 E-04
^{110m}Ag - ^{110}Ag *	2.4979 E+02	9.50 E+03	7.19 E-03	1.87 E-04
^{113m}Cd	5.1499 E+03	2.24 E+02	1.08 E-03	3.56 E-03
^{113}Sn	1.1509 E+02	1.00 E+04	1.66 E-03	2.48 E-05
^{119m}Sn	2.9310 E+02	3.74 E+03	6.78 E-05	1.45 E-05
^{121m}Sn	2.0088 E+04	5.37 E+01	6.59 E-05	2.68 E-05
^{121}Te	1.6780 E+01	6.43 E+04	3.42 E-03	4.43 E-06
^{123}Te	3.6524 E+15	2.91 E-10	1.29 E-03	2.45 E-05
^{124}Sb	6.0200 E+01	1.75 E+04	1.33 E-02	5.86 E-05
^{125}I	5.9408 E+01	1.76 E+04	2.51 E-04	5.62 E-05
^{125}Sb	1.0074 E+03	1.04 E+03	3.14 E-03	2.84 E-05
^{125m}Te	5.7400 E+01	1.82 E+04	2.13 E-04	1.69 E-05
^{126}Sb	1.2460 E+01	8.32 E+04	1.83 E-02	2.73 E-05
^{126}Sn - ^{126m}Sb *	3.6524 E+07	5.68 E-02	1.23 E-02	2.31 E-04
^{127m}Te - ^{127}Te *	1.0900 E+02	1.89 E+04	1.36 E-03	5.07 E-05
^{129}I	5.7343 E+09	1.77 E-04	3.93 E-04	4.04 E-04
^{129m}Te	3.3600 E+01	3.01 E+04	1.44 E-03	5.57 E-05
^{131m}Xe	1.1840 E+01	8.42 E+04	1.19 E-04	6.07 E-12
^{133}Ba	3.8423 E+03	2.56 E+02	2.39 E-03	1.81 E-05
^{134}Cs	7.5313 E+02	1.29 E+03	1.02 E-02	1.08 E-04
^{135}Cs	8.4006 E+08	1.15 E-03	3.32 E-04	1.06 E-05
^{137}Cs - ^{137m}Ba *	1.0983 E+04	1.69 E+02	3.36 E-03	7.44 E-05
^{140}Ba	1.2752 E+01	7.31 E+04	2.72 E-03	8.70 E-06
^{141}Ce	3.2501 E+01	2.85 E+04	8.60 E-04	2.08 E-05

Table A-1. Conversion Factors for General Radiological Calculations.

Isotope	Half-life (days)	Specific activity (curies per gram)	Heat of decay (watts per curie)	Dose equivalent curie correction factor
^{144}Ce - ^{144}Pr *	2.8489 E+02	6.37 E+03	7.34 E-03	8.70 E-04
^{147}Nd	1.0980 E+01	8.09 E+04	2.22 E-03	1.59 E-05
^{147}Pm	9.5818 E+02	9.27 E+02	3.68 E-04	9.13 E-05
^{147}Sm	3.8716 E+13	2.29 E-08	1.37 E-02	1.74 E-01
^{150}Eu	1.3076 E+04	6.66 E+01	8.90 E-03	6.25 E-04
^{151}Sm	3.2872 E+04	2.63 E+01	7.41 E-04	6.98 E-05
^{152}Eu	4.9461 E+03	1.74 E+02	7.03 E-03	5.14 E-04
^{152}Gd	3.9446 E+16	2.18 E-11	1.31 E-02	5.67 E-01
^{153}Gd	2.4160 E+02	3.53 E+03	6.02 E-04	5.54 E-05
^{154}Eu	3.1385 E+03	2.70 E+02	8.77 E-03	6.66 E-04
^{155}Eu	1.7390 E+03	4.84 E+02	6.53 E-04	9.65 E-05
^{170}Tm	1.2860 E+02	5.97 E+03	1.90 E-03	6.12 E-05
^{175}Hf	7.0000 E+01	1.07 E+04	2.16 E-03	1.30 E-05
^{181}Hf	4.2390 E+01	1.70 E+04	3.85 E-03	3.59 E-05
^{182}Ta	1.1443 E+02	6.27 E+03	8.46 E-03	1.04 E-04
^{185}W	7.5100 E+01	9.40 E+03	7.53 E-04	1.75 E-06
^{187}Re	1.5888 E+13	4.39 E-08	3.91 E-06	1.26 E-07
^{195}Au	1.8609 E+02	3.60 E+03	5.10 E-04	3.01 E-05
^{203}Hg	4.6612 E+01	1.38 E+04	1.75 E-03	1.70 E-05
^{204}Tl	1.3806 E+03	4.64 E+02	1.38 E-03	5.60 E-06
^{207}Bi	1.1523 E+04	5.47 E+01	9.12 E-03	4.66 E-05
^{210}Pb	8.1449 E+03	7.63 E+01	6.62 E-05	3.16 E-02
^{210}Po	1.3838 E+02	4.49 E+03	3.26 E-02	2.18 E-02
^{226}Ra	5.8439 E+05	9.89 E-01	2.89 E-02	2.00 E-02
^{227}Ac	7.9524 E+03	7.23 E+01	1.46 E-03	4.00 E+00
^{228}Ra	2.1001 E+03	2.73 E+02	2.71 E-04	1.11 E-02
^{228}Th	6.9874 E+02	8.20 E+02	3.27 E-02	7.95 E-01
^{229}Th	2.6809 E+06	2.13 E-01	3.08 E-02	5.00 E+00
^{230}Th	2.7532 E+07	2.06 E-02	2.83 E-02	7.58 E-01
^{231}Pa	1.1965 E+07	4.72 E-02	3.08 E-02	2.99 E+00
^{232}Th	5.1317 E+12	1.10 E-07	2.42 E-02	3.81 E+00
^{232}U	2.5165 E+04	2.24 E+01	3.21 E-02	1.53 E+00
^{233}U	5.8147 E+07	9.64 E-03	2.91 E-02	3.15 E-01
^{234}Th	2.4100 E+01	2.32 E+04	1.49 E-04	8.16 E-05

Table A-1. Conversion Factors for General Radiological Calculations.

Isotope	Half-life (days)	Specific activity (curies per gram)	Heat of decay (watts per curie)	Dose equivalent curie correction factor
^{234}U	8.9667 E+07	6.26 E-03	2.88 E-02	3.08 E-01
^{235}U	2.5706 E+11	2.16 E-06	2.86 E-02	2.86 E-01
^{236}Pu	1.0439 E+03	5.30 E+02	3.48 E-02	3.37 E-01
^{236}U	8.5540 E+09	6.47 E-05	2.71 E-02	2.92 E-01
^{237}Np	7.8162 E+08	7.05 E-04	2.96 E-02	1.25 E+00
^{238}Pu	3.2032 E+04	1.71 E+01	3.31 E-02	9.13 E-01
^{238}U	1.6319 E+12	3.36 E-07	2.53 E-02	2.75 E-01
^{239}Pu	8.8060 E+06	6.21 E-02	3.11 E-02	1.00 E+00
^{240}Pu	2.3971 E+06	2.28 E-01	3.10 E-02	1.00 E+00
^{241}Am	1.5786 E+05	3.44 E+00	3.33 E-02	1.03 E+00
^{241}Pu	5.2412 E+03	1.03 E+02	3.30 E-05	1.92 E-02
^{242}mAm	5.1499 E+04	1.05 E+01	2.37 E-04	9.91 E-01
^{242}Cm	1.6280 E+02	3.31 E+03	3.68 E-02	4.02 E-02
^{242}Pu	1.3634 E+08	3.96 E-03	2.93 E-02	9.56 E-01
^{243}Am	2.6918 E+06	2.00 E-01	3.22 E-02	1.02 E+00
^{243}Cm	1.0629 E+04	5.16 E+01	3.73 E-02	7.15 E-01
^{244}Cm	6.6109 E+03	8.09 E+01	3.50 E-02	5.77 E-01
^{244}Pu	2.9512 E+10	1.83 E-05	2.77 E-02	9.39 E-01
^{245}Cm	3.1046 E+06	1.72 E-01	3.40 E-02	1.06 E+00
^{246}Cm	1.7276 E+06	3.07 E-01	3.25 E-02	1.05 E+00
^{247}Bk	5.0403 E+05	1.05 E+00	3.56 E-02	1.34 E+00
^{247}Cm	5.6978 E+09	9.29 E-05	3.36 E-02	9.65 E-01
^{248}Cm	1.2418 E+08	4.24 E-03	3.06 E-02	3.85 E+00
^{249}Cf	1.2820 E+05	4.09 E+00	3.93 E-02	1.34 E+00
^{250}Cf	4.7774 E+03	1.09 E+02	3.63 E-02	6.10 E-01
^{250}Cm	3.2872 E+06	2.07 E-01	2.19 E-04	2.18 E+01
^{251}Cf	3.2799 E+05	1.59 E+00	3.74 E-02	1.37 E+00
^{252}Cf	9.6607 E+02	5.38 E+02	3.69 E-02	3.65 E-01
^{254}Es	2.7570 E+02	1.86 E+03	3.92 E-02	9.56 E-02

* When this parent-daughter pair are in secular equilibrium, only the activity of the parent nuclide should be considered in performing the calculations. E.g., if ^{90}Sr-^{90}Y are in secular equilibrium in the waste, the thermal power for both nuclides would be determined by multiplying the ^{90}Sr activity by the heat of decay for the ^{90}Sr-^{90}Y pair.

Sources: NHC-9761979; HNF-SD-W026-SAR-002; Firestone 1996.

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m^3)	Category 1 waste limit (Ci/m^3)	Category 3 waste limit (Ci/m^3)	ISB Non-combustible waste limit[a] (Ci/m^3)	ISB Combustible waste limit[b] (Ci/m^3)
^{3}H	4.4 E+00	9.9 E+04	NL	4.00 E+07	5.00 E+02
^{7}Be	NL	NL	NL	2.64 E+07	6.59 E+05
^{10}Be	NL	1.1 E+00	2.4 E+02	1.00 E+04	2.50 E+02
^{14}C	1.3 E-04	9.1 E-02	2.1 E+01	1.76 E+06	4.41 E+04
^{14}C act. metal [c]	1.3 E-04	9.1 E-01	2.1 E+02	1.76 E+06	4.41 E+04
^{22}Na	NL	NL	NL	4.29 E+05	1.07 E+04
^{32}P	NL	NL	NL	2.31 E+05	5.77 E+03
^{35}S	NL	NL	NL	1.46 E+06	3.66 E+04
^{36}Cl	3.1 E-05	6.4 E-05	1.4 E-01	1.70 E+05	4.17 E+03
^{40}K	NL	1.8 E-03	3.8 E-01	3.00 E+05	7.50 E+03
^{45}Ca	NL	NL	NL	5.45 E+05	1.36 E+04
^{46}Sc	NL	NL	NL	1.22 E+05	3.06 E+03
^{49}V	NL	NL	NL	1.05 E+07	2.63 E+05
^{51}Cr	NL	NL	NL	1.00 E+07	2.50 E+05
^{54}Mn	NL	NL	NL	5.22 E+05	1.30 E+04
^{55}Fe	NL	NL	NL	1.33 E+06	3.33 E+04
^{56}Co	NL	NL	NL	9.16 E+04	2.29 E+03
^{57}Co	NL	NL	NL	4.29 E+05	1.07 E+04
^{58}Co	NL	NL	NL	3.24 E+05	8.11 E+03
^{59}Fe	NL	NL	NL	2.35 E+05	5.88 E+03
^{59}Ni	NL	3.9 E+00	8.5 E+02	2.86 E+06	7.14 E+04
^{59}Ni act. metal [c]	NL	3.9 E+01	8.5 E+03	2.86 E+06	7.14 E+04
^{60}Co	NL	7.5 E+01	NL	1.82 E+04	4.55 E+02
^{60}Co act. metal [c]	NL	7.5 E+02	NL	1.82 E+04	4.55 E+02
^{63}Ni	NL	5.9 E+00	2.0 E+04	1.20 E+06	3.00 E+04
^{63}Ni act. metal [c]	NL	5.9 E+01	2.0 E+05	1.20 E+06	3.00 E+04
^{65}Zn	NL	NL	NL	1.97 E+05	4.92 E+03
^{68}Ge	NL	NL	NL	7.02 E+04	1.75 E+03
^{75}Se	NL	NL	NL	4.29 E+05	1.07 E+04
^{79}Se	3.4 E-05	5.1 E-01	1.1 E+02	3.87 E+05	9.68 E+03
^{82}Sr	NL	NL	NL	5.91 E+04	1.48 E+03
^{85}Kr	NL	NL	NL	2.11 E+09	2.63 E+04
^{85}Sr	NL	NL	NL	1.97 E+06	4.92 E+04

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m^3)	Category 1 waste limit (Ci/m^3)	Category 3 waste limit (Ci/m^3)	ISB Non-combustible waste limit[a] (Ci/m^3)	ISB Combustible waste limit[b] (Ci/m^3)
^{86}Rb	NL	NL	NL	5.45 E+05	1.36 E+04
^{88}Y	NL	NL	NL	1.29 E+05	3.24 E+03
^{89}Sr	NL	NL	NL	6.67 E+05	1.67 E+04
^{90}Sr - ^{90}Y	NL	1.6 E-02	5.4 E+04	1.50 E+04	3.75 E+02
^{93}Mo	2.1 E-04	8.7 E-01	2.0 E+02	1.28 E+05	3.19 E+03
^{93m}Nb	NL	NL	NL	1.21 E+05	3.03 E+03
^{93}Zr	NL	2.50 E+00	5.40 E+02	4.62 E+03	1.15 E+02
^{94}Nb	NL	2.2 E-04	4.8 E-02	9.23 E+03	2.31 E+02
^{94}Nb act [c]	NL	2.2 E-03	4.8 E-01	9.23 E+03	2.31 E+02
^{95}Nb	NL	NL	NL	5.71 E+05	1.43 E+04
^{95}Zr - ^{95m}Nb	NL	NL	NL	9.23 E+04	2.31 E+03
^{99}Tc	2.1 E-04	2.3 E-02	5.0 E+00	4.00 E+05	1.00 E+04
^{103}Ru – ^{103m}Rh	NL	NL	NL	3.87 E+05	9.68 E+03
^{106}Ru – ^{106}Rh	NL	NL	NL	8.00 E+03	2.00 E+02
^{107}Pd	NL	1.5 E+01	3.3 E+03	2.86 E+05	7.14 E+03
^{108m}Ag	NL	NL	NL	2.15 E+04	5.39 E+02
^{109}Cd	NL	NL	NL	2.45 E+04	6.12 E+02
^{110m}Ag - ^{110}Ag	NL	NL	NL	1.00 E+04	2.50 E+02
^{113m}Cd	NL	7.6 E-01	NL	1.79 E+03	4.48 E+01
^{113}Sn	NL	NL	NL	3.24 E+05	8.11 E+03
^{119m}Sn	NL	NL	NL	6.00 E+05	1.50 E+04
^{121m}Sn	NL	6.7 E-01	2.2 E+04	3.08 E+05	7.69 E+03
^{121}Te	NL	NL	NL	1.91 E+06	4.77 E+04
^{123}Te	NL	NL	NL	1.38 E+05	3.44 E+03
^{124}Sb	NL	NL	NL	1.38 E+05	3.45 E+03
^{125}I	NL	NL	NL	5.00 E+04	1.25 E+00
^{126}Sn – ^{126m}Sb	NL	1.6 E-04	3.4 E-02	3.64 E+04	9.09 E+02
^{125m}Te	NL	NL	NL	2.18 E+06	5.45 E+04
^{125}Sb	NL	NL	NL	2.79 E+05	6.98 E+03
^{127m}Te – ^{127}Te	NL	NL	NL	1.67 E+05	4.17 E+03
^{129}I	1.0 E-06	8.5 E-03	1.8 E+00	7.06 E+03	1.76 E-01
^{129m}Te	NL	NL	NL	1.56 E+05	3.90 E+03
^{131m}Xe	NL	NL	NL	7.50 E+08	9.38 E+03

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m^3)	Category 1 waste limit (Ci/m^3)	Category 3 waste limit (Ci/m^3)	ISB Non-combustible waste limit[a] (Ci/m^3)	ISB Combustible waste limit[b] (Ci/m^3)
^{133}Ba	NL	7.1 E-01	NL	4.62 E+05	1.15 E+04
^{134}Cs	NL	NL	NL	8.57 E+04	2.14 E+03
^{135}Cs	NL	1.6 E-01	3.5 E+01	8.03 E+05	2.00 E+04
$^{137}Cs - ^{137m}Ba$	NL	5.5 E-03	1.2 E+04	1.20 E+05	3.00 E+03
^{140}Ba	NL	NL	NL	3.87 E+05	9.68 E+03
^{141}Ce	NL	NL	NL	4.14 E+05	1.03 E+04
$^{144}Ce - ^{144}Pr$	NL	NL	NL	1.00 E+04	2.50 E+02
^{147}Nd	NL	NL	NL	5.45 E+05	1.36 E+04
^{147}Pm	NL	NL	NL	9.23 E+04	2.31 E+03
^{147}Sm	NL	1.7 E-02	3.7 E+00	2.86 E+01	7.14 E-01
^{150}Eu	NL	1.4 E-03	6.7 E+02	1.38 E+04	3.45 E+02
^{151}Sm	NL	4.6 E+01	2.1 E+05	7.06 E+04	1.76 E+03
^{152}Eu	NL	4.8 E-02	NL	1.74 E+04	4.35 E+02
^{152}Gd	NL	6.4 E-03	1.4 E+00	3.64 E+00	9.09 E-02
^{153}Gd	NL	NL	NL	1.09 E+05	2.73 E+03
^{154}Eu	NL	7.5 E-01	NL	1.32 E+04	3.30 E+02
^{155}Eu	NL	NL	NL	6.67 E+04	1.67 E+03
^{170}Tm	NL	NL	NL	1.38 E+05	3.46 E+03
^{175}Hf	NL	NL	NL	6.52 E+05	1.63 E+04
^{181}Hf	NL	NL	NL	1.23 E+05	3.07 E+03
^{182}Ta	NL	NL	NL	8.00 E+04	2.00 E+03
^{185}W	NL	NL	NL	4.62 E+06	1.15 E+05
^{187}Re	3.3 E-02	3.6 E+01	7.8 E+03	6.32 E+07	1.58 E+06
^{195}Au	NL	NL	NL	2.81 E+05	7.03 E+03
^{203}Hg	NL	NL	NL	5.00 E+05	1.25 E+04
^{204}Tl	NL	NL	NL	1.51 E+06	3.78 E+04
^{207}Bi	NL	TBD	TBD	1.82 E+05	4.54 E+03
^{210}Pb	NL	3.7 E-02	2.1 E+06	1.82 E+02	4.55 E+00
^{210}Po	NL	NL	NL	1.82 E+02	4.55 E+00
^{226}Ra	NL	1.7 E-04	4.3 E-02	4.44 E+02	1.11 E+01
^{227}Ac	NL	4.2 E-03	3.0 E+05	3.08 E-01	7.69 E-03
^{228}Ra	NL	1.7 E+01	NL	8.57 E+02	2.14 E+01
^{228}Th	NL	NL	NL	7.06 E+00	1.76 E-01

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m^3)	Category 1 waste limit (Ci/m^3)	Category 3 waste limit (Ci/m^3)	ISB Non-combustible waste limit[a] (Ci/m^3)	ISB Combustible waste limit[b] (Ci/m^3)
^{229}Th	NL	4.4 E-04	9.8 E-02	7.06 E-01	1.76 E-02
^{230}Th	NL	2.1 E-03	1.5 E-01	4.62 E+00	1.15 E-01
^{231}Pa	NL	1.4 E-04	3.0 E-02	1.09 E+00	2.73 E-02
^{232}Th	NL	1.1 E-04	2.3 E-02	8.57 E-01	2.14 E-02
Total U	1.4 E-05	NL	NL	NL	NL
^{232}U	See Total U	4.6 E-04	4.6 E+00	5.45 E+00	1.36 E-01
^{233}U	See Total U	7.4 E-03	9.7 E-01	2.67 E+01	6.67 E-01
^{234}Th	NL	NL	NL	1.00 E+05	2.50 E+03
^{234}U	See Total U	8.9 E-03	1.9 E+00	2.73 E+01	6.82 E-01
^{235}U	See Total U	2.8 E-03	5.0 E-01	2.93 E+01	7.32 E-01
^{236}Pu	NL	NL	NL	1.40 E+01	3.49 E-01
^{236}U	See Total U	9.5 E-03	2.0 E+00	2.86 E+01	7.14 E-01
^{237}Np [d]	1.1 E-05	6.8 E-04	1.5 E-01	2.55 E+00	6.38 E-02
^{238}Pu [d]	NL	4.7 E-03	2.4 E+01	5.22 E+00	1.30 E-01
^{238}U	See Total U	5.7 E-03	1.2 E+00	3.08 E+01	7.69 E-01
^{239}Pu [d]	NL	1.9 E-03	4.2 E-01	4.62 E+00	1.15 E-01
^{240}Pu [d]	NL	1.9 E-03	4.3 E-01	4.62 E+00	1.15 E-01
^{241}Am [d]	NL	2.1 E-03	8.5 E-01	4.44 E+00	1.11 E-01
^{241}Pu	NL	6.1 E-02	2.5 E+01	2.35 E+02	5.88 E+00
^{242m}Am [d]	NL	1.9 E-03	1.6 E+00	4.62 E+00	1.15 E-01
^{242}Cm	NL	NL	NL	2.03 E+02	5.08 E+00
^{242}Pu [d]	NL	2.0 E-03	4.3 E-01	5.00 E+00	1.25 E-01
^{243}Am [d]	NL	1.0 E-03	2.3 E-01	4.44 E+00	1.11 E-01
^{243}Cm [d]	NL	1.8 E-02	3.4 E+02	6.67 E+00	1.67 E-01
^{244}Cm	NL	1.4 E-01	1.6 E+02	8.57 E+00	2.14 E-01
^{244}Pu [d]	NL	6.1 E-04	1.3 E-01	5.00 E+00	1.25 E-01
^{245}Cm [d]	NL	1.3 E-03	2.2 E-01	4.44 E+00	1.11 E-01
^{246}Cm [d]	NL	1.8 E-03	4.2 E-01	4.29 E+00	1.07 E-01
^{247}Bk [d]	NL	TBD	TBD	2.98 E+00	7.44 E-02
^{247}Cm [d]	NL	5.6 E-04	1.2 E-01	4.80 E+00	1.20 E-01
^{248}Cm [d]	NL	5.1 E-04	1.1 E-01	1.21 E+00	3.03 E-02
^{249}Cf [d]	NL	TBD	TBD	2.96 E+00	7.41 E-02
^{250}Cf	NL	TBD	TBD	6.74 E+00	1.69 E-01

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m^3)	Category 1 waste limit (Ci/m^3)	Category 3 waste limit (Ci/m^3)	ISB Non-combustible waste limit[a] (Ci/m^3)	ISB Combustible waste limit[b] (Ci/m^3)
^{250}Cm [d]	NL	TBD	TBD	2.13 E-01	5.33 E-03
^{251}Cf [d]	NL	TBD	TBD	2.91 E+00	7.26 E-02
^{252}Cf	NL	NL	NL	1.43 E+01	3.57 E-01
^{254}Es	NL	NL	NL	5.22 E+01	1.30 E+00

Ci/m^3 = curies per cubic meter.
NL means that there is no applicable limit for this isotope; TBD means that a limit is under development.
[a] Noncombustible waste means containerized waste forms that show no evidence of combustion or decomposition on exposure to 538° C (1,000 ° F) for 10 minutes.
[b] The combustible waste limit should be used for containerized waste forms that do not meet the definition of noncombustible waste.
[c] Limit for isotope in activated metal.
[d] TRU isotope (half-life >20 years).

Sources: WHC-EP-0645; WHC-SD-WM-TI-730; HNF-SD-WM-ISB-002.

APPENDIX B

FISSIONABLE MATERIAL CONTENT LIMITS

The following describes the limits for fissionable material content in waste packages sent to TSD units covered by criteria provided in Chapters 3.0 through 7.0 (CPS-D-149-00001, CPS-SW-149-00002, CPS-SW-149-00003, WRP1-CPS-001).

B.1. EXEMPT MATERIALS

The following materials are exempt from criticality safety controls at all TSD units (HNF-PRO-537):

- 15 grams or less of any combination of ^{233}U, ^{235}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, and ^{241}Am
- 2 grams or less of any fissionable nuclide with atomic number greater than or equal to 95 (excluding ^{241}Am)
- Depleted or natural uranium in any amount (i.e., uranium containing less than 0.72 weight percent ^{235}U)

B.2. NON-EXEMPT MATERIALS IN STANDARD CONTAINERS APPLICABLE TO LLBG, CWC, AND WRAP

Certain non-exempt materials in standard packaging configurations are acceptable at the LLBG (except trenches 31 and 34), CWC, and WRAP.

The fissionable material limits shall be expressed in ^{239}Pu FGEs. Table B-1 is used to determine the total quantity of fissionable material in a waste container by multiplying the gram quantity of each listed isotope by the correction factor and summing the results.

Specific container limits are shown in Table B-2. Note that some of the limits in Table B-2 are based on WRAP criticality prevention requirements, which are slightly more restrictive than CWC and LLBG limits. Higher quantities of fissionable nuclides could be allowed on a case-by-case basis for containers that will not require reprocessing at WRAP. Exceptions can be requested as shown in text, Section 1.6.

B.3. NON-EXEMPT QUANTITIES OF URANIUM BEARING WASTE APPLICABLE TO CWC, LLBG, AND WRAP

This section only applies to uranium bearing waste where the uranium is enriched to 0.72% ^{235}U or greater and the total quantity of fissionable material per container exceeds that listed in Table B-2. Use of these limits for uranium bearing waste exceeding 1% enrichment at trenches 31 and 34 requires that the uranium be in an insoluble or stabilized form.

For uranium bearing waste that contains uranium in a single enrichment, but no other radioisotopes listed in Table B-1, the limits of Table B-3 shall apply to each container in a shipment. For criticality control, other transportation limits might apply to the entire shipment.

For uranium bearing waste containers that have uranium in a variety of different enrichments or contain any other isotopes listed in Table B-1, the fissionable material allowed shall be determined by the sum-of-fractions method as follows:

- The total U quantity present (grams) for each enrichment will be divided by the total quantity allowed (second column in Table B-3). Enrichments shall be conservatively rounded up to the next higher value listed. The result is the uranium limit fraction (ULF)
- A uranium limit fraction shall be determined for each enrichment
- All the uranium limit fractions are summed, the total must be less than or equal to 1.

The limit for all fissionable isotopes, other than 235U in the waste matrix, shall be determined if the total FGE (excluding ^{235}U) greater than 1 for these isotopes (it is neglected if the total FGE less than or equal to 1). This nonuranium limit fraction (NLF) shall be determined as follows:

$$NLF = \frac{FGE\,(without\ ^{235}U)}{100\ FGE}$$

The nonuranium limit fraction must be less than or equal to 1.

The container limit fraction is determined by adding the total uranium limit fraction and the nonuranium limit fraction. The container limit fraction must be less than or equal to 1.

B.4. NON-EXEMPT QUANTITIES OF FISSIONABLE RADIONUCLIDES IN OTHER CONFIGURATIONS.

Limits for other configurations than those shown in Section B.2 and B.3 may be requested as described in the text, Section 1.6.

Table B-1. Plutonium-239 Fissile Gram Equivalent Correction Factors.

Isotope	Correction factor	Isotope	Correction factor
^{233}U [a]	1.0 E+00	^{242m}Am	3.46 E+01
^{235}U [b]	1.0 E+00	^{243}Am	1.29 E-02
^{237}Np	1.5 E-02	^{243}Cm	5.0 E+00
^{238}Pu [c]	1.13 E-01	^{244}Cm	9.00 E-02
^{239}Pu [c]	1.0 E+00	^{245}Cm	1.50 E+01
^{240}Pu [c]	2.25 E-02	^{247}Cm	5.00 E-01
^{241}Pu [c]	2.25 E+00	^{249}Cf	4.50 E+01
^{242}Pu [c]	7.50 E-03	^{251}Cf	9.00 E+01
^{241}Am	1.87 E-02		

[a] ^{233}U is normally negligible unless the materials have been enriched in ^{233}U.

[b] ^{235}U is not included in calculating FGE unless it is enriched (greater than or equal to 0.72 wt % ^{235}U in Uranium).

[c] For conservatism, all plutonium is normally considered to be ^{239}Pu unless the isotopic composition is known.

Sources: DOE/WIPP 89-004 (1996) and ANSI/ANS 8.15.

Table B-2. Fissionable Material Content Limits for Certain Standard Containers.

Container type	Fissionable material content[1]
208-liter (55-gallon) or larger steel drum, where fissile material is contained in 20% or more of the container volume	177 FGE[2]
208-liter (55-gallon) or larger steel drum, where fissile material is contained in less than 20% of the container volume	100 FGE[2]
208-liter (55-gallon) lead-lined steel drum	100 FGE[2]
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:	• 325 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 larger than 0.76 x 0.76 x 0.7 meters (2.5 x 2.5 x 2.5 feet) • 325 FGE total in box larger than 0.9 x 1.4 x 1.5 meters (3 x 4 x 5 feet) • 1,000 FGE total in box larger than 1.2 x 1.2 x 2.1 meters (4 x 4 x 7 feet)

[1] Some of these limits are based on WRAP criticality prevention requirements, which are more restrictive than CWC and LLBG limits. Higher quantities of fissionable nuclides could be allowed on a case-by-case basis for containers that will not require reprocessing at WRAP.

[2] This limit assumes that the steel drum weighs a minimum of 23 kilograms (50.7 pounds) excluding the liner. Any drum that weighs less than 23 kilograms (50.7 pounds) requires overpacking or completion of a criticality safety evaluation.

Source: CPS-D-149-00001, CPS-SW-149-00002, CPS-SW-149-00003, WRP1-CPS-001.

Table B-3. Maximum Uranium Content of Containers with Uranium Bearing Waste.

Maximum Enrichment (weight percent ^{235}U)*	Maximum Total Uranium (kilogram)
0.71	Unlimited
1.00	450
1.15	200
1.25	141
1.50	84
1.70	61
1.80	52
2.00	40
2.50	25
3.00	18
3.50	14
4.0	11
5.0	7.8
8.0	4.0
10.0	2.9
20.0	1.2
30.0	0.75
50.0	0.41
75.0	0.25
Greater than 75.0	0.18

* Uranium bearing waste disposed at trenches 31 and 34 in the LLBG cannot exceed 1% enrichment unless it is shown to be in an insoluble or stabilized form. A case-by-case evaluation will be performed by WMH acceptance organization for non-exempt uranium bearing waste exceeding 1% enrichment for trenches 31 and 34.

Sources: CPS-D-149-00001, CPS-SW-149-00002, CPS-SW-149-00003, WRP1-CPS-001.

APPENDIX C

LABELING OF WASTE CONTAINERS

Containers sent to Hanford Site TSD 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:

C.1. BAR CODE

Each container shall be labeled with a bar code showing the unique container identification number (CIN#). Bar-coded CIN#s 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 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 WMH acceptance organization for guidance on assigning a unique identification number).

C.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.

C.3. PLACEMENT OF LABELS

Labels and markings shall be positioned so that all required information is visible on same side of the container as the bar code. If drums are palletized, the drums must be oriented on the pallet such that a complete set of labels are visible.

C.4. SIZE OF LABELS

Standard labels defined by regulations (e.g., DOT labels, hazardous waste label, 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.

C.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.

Label	When required	Location on drum	Location on box
Bar Code with CIN#	All containers	Bottom third of drum	Short side of box
Gross weight in kilograms	All containers	Same side as bar code	Same side as bar code
Caution - Radioactive Material/trefoil (dose rate, contamination level written in)	All containers	Same side as bar code	Same side as bar code
Segregation group from WSRd[1]	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)[2]	Mixed waste containers	Same side as bar code	Same side as bar code
PCB label[3]	Waste that is regulated for PCB content under 40 CFR 761	Same side as bar code	Same side as bar code
Asbestos label	Waste containing >1% asbestos	Same side as bar code	Same side as bar code
Hanford Site fissile material label and fissile gram label[4]	Containers with 1 gram or more fissile material	Same side as bar code	Same side as bar code

[1] Mark the container with the text from Section I of the WSRd (e.g., "Direct Disposal", "Acid Storage").
[2] Refer to Table C-2 for major risk labeling of mixed and TRU-mixed waste.
[3] Label in accordance with 40 CFR 761.65. 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.
[4] These labels might conflict with 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.

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
Oxidizer	DOT Division 5.1 label (Oxidizer) OXIDIZER
Corrosive	DOT Class 8 label (Corrosive) CORROSIVE – ACID CORROSIVE – CAUSTIC CORROSIVE
Water-reactive	DOT Division 4.3 label (Dangerous When Wet) WATER-REACTIVE
Reactive organic peroxide	DOT Division 5.2 label (Organic Peroxide) REACTIVE - ORGANIC PEROXIDE
Toxic (this hazard refers to DOT Division 6.1 materials and DOT Class 9 waste that is derived from listed waste and/or toxicity characteristic waste.	DOT Division 6.1 label (Poison) DOT "Poison - Inhalation Hazard" marking TOXIC

Note: Choose the combination of labels or markings that most clearly communicates the major risk(s) associated with the waste. DOT labels must be used when required by DOT; other markings can be used to communicate hazards for which DOT labels are not be applied [e.g., if a container has waste that is an oxidizer and toxic and the 49 CFR regulations prescribe that only the 5.1 (Oxidizer) label be applied, the container should be labeled with the DOT 5.1 label and with an additional marking with the word TOXIC]. If a given risk label conflicts with DOT transportation requirements, the label can be provided with the paperwork to be applied when the container reaches the TSD unit.

For Washington state-only dangerous waste, the words "hazardous waste" or "dangerous waste" on the hazardous waste label are sufficient to communicate the major risk (HNF-PRO-455).

APPENDIX D

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 generator must determine the compatibility of the container/liner and the waste based on chemical compatibility charts, manufacturer's compatibility data, and/or other applicable data. Any combination of containers and/or liners can be used that is compatible with the waste.

Hanford Site procurement specifications for metal drums and boxes identify several options for container coatings, with varying degrees of chemical resistance. The document *Justification for Packaging Acceptance Criteria* (WHC-SD-TP-ES-002) describes a set of standard packages from the Hanford Site procurement specifications 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. Packaging is not required to be selected from Hanford Site specifications.)

Table D-1. Standard Container/Liner Combinations.

WSRd Series	Subgroup[1]	Minimum Coatings/Liners[2]
100 – Low-level waste	Low-level dry waste for disposal	LPC / no liner
	Low-level absorbed liquids	LPC/10 mil liner
	Low-level dry waste for storage	LPC / 10 mil liner MPC / no liner
	Low-level sorbed liquids, sludges, and lab packs for storage	MPC / 10 mil liner LPC / 90 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 – Lab packs	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 sorbed liquids, sludges, and other homogeneous solids	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 waste debris	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 – Other mixed waste	Lead solids	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 – Mixed waste that does not require treatment before disposal	Solid corrosive (caustic) waste	HPC / no liner LPC / 90 mil liner
	Other	MPC / no liner LPC / 10 mil liner

[1] For mixed hazards, the most protective combination of coatings/liners should be chosen.

[2] Container coating/liner abbreviations are as follows:

LPC- Low-performance coating (epoxy-phenolic coating or galvanized drum)
MPC- Mid-performance coating (general protective coating)
HPC- High-performance coating (aqueous acids, bases and chlorinated solvents)
10 mil liner- 10 mil or thicker nylon-reinforced polyethylene liner
90 mil liner- 90 mil or thicker high-density polyethylene rigid liner.

APPENDIX E

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 text Chapters 3.0 and 4.0. Approved void fillers are listed in the Approved Sorbents/Stabilizing Materials List on the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/index.htm)

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. Selection of specific products must be from the Approved Sorbents/Stabilizing Materials List on the *Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/index.htm) A generator or vendor can provide information to the WMH acceptance organization to have a product added to the Approved Sorbents/Stabilizing Materials List.

Note that use of these materials to meet radiological stabilization (i.e., to meet Category 3 or mobile radionuclide stabilization requirements) or RCRA LDR 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 LDR compliance.

E.1. TYPES OF SORBENTS AND STABILIZING MATERIALS

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

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

- High molecular weight synthetic polymers (polymer sorbents) allowed for sorption include polyethylene, HDPE, 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 include concrete, portland cement, lime/pozzolans, and a variety of other inorganic materials.

- 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.

E.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 approved and appropriate for the material to be treated. The Approved Sorbents/Stabilizing Materials List on *the Hanford Site Solid Waste Acceptance Program* Internet web page (http://www.hanford.gov/wastemgt/wac/index.htm) has a current list of approved sorbents and stabilizing materials. The manufacturer will be able to provide product use information to determine whether the product could be used with the liquids intended to be sorbed or stabilized. If generators want to use a product not on the Approved Sorbents/Stabilizing Materials List, information could be obtained from the manufacturer, submitted to the WMH acceptance organization for approval, and added to the list.

- 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.

E.3. HANFORD SITE REQUIREMENTS FOR USE OF SORBENTS.

Sorbents used for Hanford Site TSD units must be used in sufficient quantity to meet the following requirements.

- 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.

- Sorbed waste for disposal must not release liquid under 20 pounds per square inch (138 kilopascals) pressure. A determination whether the waste will release liquids at 20 pounds per square inch (138 kilopascals) can be made from manufacturer's data or by testing. The EPA Liquid Release Test Procedure, SW-846 Method 9090 can be modified to test at 20 pounds per square inch (138 kilopascals) . Other test methods can be approved by the WMH acceptance organization.

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

WSRd Series	Subgroup	Allowable sorbents/stabilizing materials	Use requirements
100 - Low-level waste	Low-level liquids for disposal	Mineral sorbents Polymer sorbents Stabilizing materials	Sorbents must not release liquids at 138 kilopascals (20 pounds per square inch) [1]
	Low-level organic liquids and chelating agents for disposal	Stabilizing materials	
	Low-level organic liquids for storage	Polymer sorbents	
200 - TRU waste	TRU-mixed waste	Mineral sorbents Polymer sorbents Stabilizing materials	
	TRU waste (not mixed)	Mineral sorbents Polymer sorbents Stabilizing materials	
400 - Lab packs [2]	All types	Polymer sorbents	
500 - Mixed waste sorbed liquids, sludges, and other homogeneous solids	Aqueous waste with only D004-D011 waste numbers	Mineral sorbents	
	Soils	Mineral sorbents	Use mineral sorbents for sorbtion of residual liquids in wet soils.
	All others	Polymer sorbents	
600 – Mixed waste debris	All types	Polymer sorbents	
800 – Other mixed waste	All types	Polymer sorbents	
900 – Mixed waste that does not require treatment prior to disposal	All types	Polymer sorbents Mineral sorbents Stabilizing materials	Sorbents must not release liquids at 138 kilopascals (20 pounds per square inch)

[1] The sorbent must not release liquids when compressed at 138 kilopascals (20 pounds per square inch).
[2] Sorbent for lab packs is placed around containers, not mixed with liquids.

APPENDIX F

RELEASE OF NONRADIOACTIVE WASTE FOR OFFSITE DISPOSAL

This appendix establishes the method for radiological release of waste generated by PHMC waste generators. The method is intended primarily for release of dangerous waste, TSCA PCB waste, and nonregulated waste to offsite TSD facilities, but also could be used for waste that is not a regulated dangerous waste or TSCA PCB waste shipped to RCRA Subtitle D facilities.

F.1. DEFINITIONS

The following definitions and abbreviations apply specifically to this appendix.

No radiation added: Any waste material that:

- Contains no measurable increase in bulk or volume radioactivity (at a 95% confidence level above background) resulting from DOE Operations except for waste specifically exempted by EPA, DOE, or NRC regulations
- Contains no surface radioactivity above limits established in the HSRCM-1.

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:

- In a form that could not be internally contaminated (aerosol cans, sealed containers, fluorescent light tubes, etc.)
- It is known through process knowledge that there is no potential for the waste to be volume contaminated.

NPIC waste must meet the surface contamination release requirements of HSRCM-1.

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 ^{40}K).

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 materials area: 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 (LLDs) for the water matrix listed in Table F-2.

F.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 mixed 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-1, checking the box corresponding to the 'Non-RMA Waste Certification', and proceeds to step 12.

3. The generator determines whether the RMA waste has no potential for internal contamination (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 HSRCM-1. 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 potentially contaminating the NPIC waste, the waste 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 nuclides 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 for Waste' 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 for Waste is maintained in the generator's files.

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

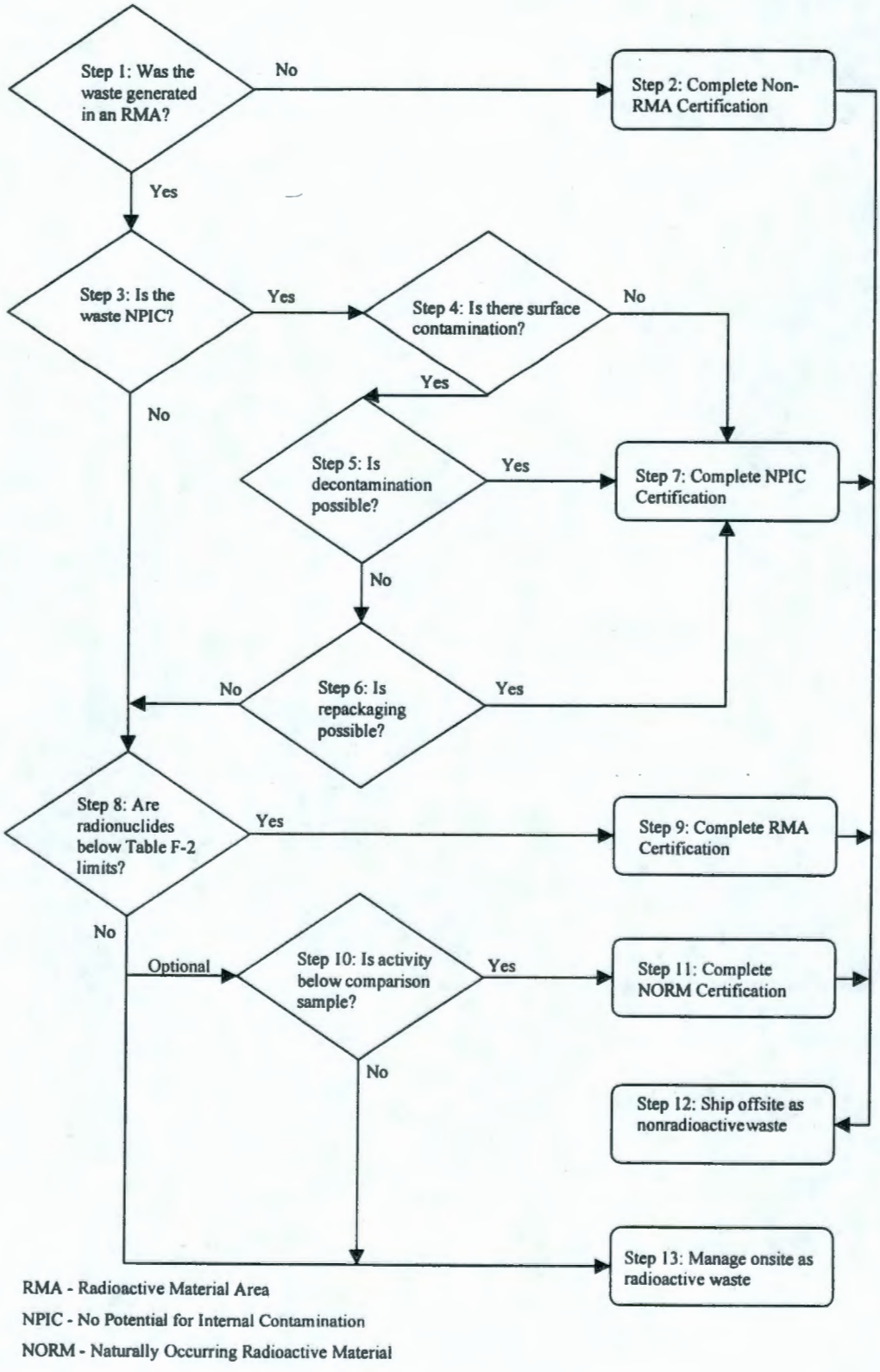

Figure F-1. Decision Tree for Radiological Release.

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 for Waste.

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[1] liquid scintillation[1] low energy photon spec. (I-129)1
	Radium alpha emitters	alpha scintillation[1] proportional counting[1]
	Specific actinide emitters	alpha energy analysis[1] laser kinetic phpos. (U chem)[1]
soil/other	Gross alpha/beta activity[2]	proportional counting liquid scintillation
	Gamma emitters	gamma energy analysis
	Beta specific emitters[2]	proportional counting[1] liquid scintillation[1] low energy photon spec. (I-129)[1]
	Radium alpha emitters[2]	alpha scintillation[1] proportional counting[1]
	Specific actinide emitters[2]	alpha energy analysis[1] laser kinetic phpos. (U chem)[1]

[1] Specific radionuclide analysis requiring chemical separation procedure processing.
[2] 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 (GEA)	Co-60	50	pCi/L	10	pCi/g
	Cs-137	50		10	
	Eu-152	50		10	
	Eu-154	50		10	
	Eu-155	NA		2	
	Ra-226	NA		2	
	Ra-228	50		10	
	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 (Chemical Analysis)		0.2	ug/L	2	ug/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 lower LLDs is known.
[b] Applies only if the absence of beta emitting radionuclides with lower 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).
LLD = lower limit of detection; pCi/L = picocuries per liter; pCi/g = picocuries per gram; ug/L = microgram per liter.

APPENDIX G

INTERIM TRANSURANIC WASTE CERTIFICATION REQUIREMENTS

WIPP is the disposal facility identified for TRU waste from the Hanford Site. At the time of writing, the Hanford Site TRU waste certification program currently is being developed to meet various requirements to ship and dispose of waste at WIPP. The TRU waste certification program will identify portions of the certification process that are the responsibility of the waste generator, while other portions will be performed at WRAP. Until completion and approval of the TRU waste certification program, this appendix identifies the interim requirements applicable to generators.

It is understood that certain TRU waste might require extensive processing and/or treatment before disposal at WIPP. As a policy, however, generators of newly generated TRU waste shall generate, segregate, and package the waste to minimize the need for additional processing at WRAP. More specifically, generators shall segregate their waste by TRUCON code (DOE/WIPP-89-004) and shall attempt to meet those requirements of the Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069) identified in Table G-1. The following is the order of priority for TRU waste.

Group 1. Contact-handled TRU certified to meet all Table G-1 requirements.
Group 2. Remote-handled TRU shielded to contact-handled and certified to meet all Table G-1 requirements.
Group 3. Contact-handled TRU requiring additional processing.
Group 4. Remote-handled TRU requiring additional processing.

If a generator is unable to prepare their waste to meet group 1 or 2, a written explanation must be provided to the WMH acceptance organization.

Table G-1. Matrix of WIPP Waste Acceptance Requirements Applicable to Generators.

DOE-WIPP-069 Requirement	Exceptions or Explanation
Section 3.2.1, Container Description	Only the limits for 208 liter (55 gallon) drums and SWBs apply to generators.
Section 3.2.2, Container/Assembly Weight and Center of Gravity	Only the limits for 208 liter (55 gallon) drums and SWBs apply to generators.
Section 3.2.3, Removable Surface Contamination.	
Section 3.2.6, Filter Vents	
Section 3.2.7, Liquids	
Section 3.3.1, Nuclear Criticality (Pu-239 FGE)	
Section 3.3.2, Pu-239 Equivalent Activity	
Section 3.3.3, Contact Dose Rate	
Section 3.3.4, Thermal Power	
Section 3.3.5, TRU Alpha Activity Concentration	
Section 3.4.1, Pyrophoric Materials	
Section 3.4.2, Mixed Waste	Generators are not responsible for the Hanford Site quality assurance project plan. Acceptable knowledge for TRU waste must meet the requirements of Section 2.3 of this document (HNF-EP-0063)..
Section 3.4.3, Chemical Compatibility	Generators are not responsible for subsection 3.4.3.4, Compliance.
Section 3.4.5, Explosives, Corrosives, and Compressed Gases	
Section 3.4.6, PCBs Concentration	
Section 3.5.1, Decay Heat	
Section 3.5.2, Flammable VOCs	The generator is required only to limit the amount of flammable volatile organic compounds in TRU waste to the extent possible and package in a form that minimizes dissipation into the headspace.
Section 3.5.3, VOC Concentrations	The generator is required only to limit the amount of flammable volatile organic compounds in TRU waste to the extent possible and package in a form that minimizes dissipation into the headspace.
Section 3.5.6, Confinement Layers	