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Terms

AEA	*Atomic Energy Act of 1954*
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CHPRC	CH2M HILL Plateau Remediation Company
CWC	Central Waste Complex
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HIC	high-integrity container
HLW	high-level waste
ICRP	International Commission of Radiological Protection
LDR	land disposal restrictions
LLBG	Low-Level Burial Grounds
LLW	low-level waste
MLLW	mixed low-level waste
NDA	nondestructive assay
NDE	nondestructive examination
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
QA	quality assurance
QAP	quality assurance program
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
SWIFT	Solid Waste Integrated Forecast Technical
SWOC	Solid Waste Operations Complex
TRU	transuranic
TRUM	transuranic mixed

TSCA	*Toxic Substances Control Act of 1976*
TSD	treatment, storage, and/or disposal
WAC	*Washington Administrative Code*
WFMP	Waste & Fuels Management Project
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing
WSRd	waste specification record

Definitions

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

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

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

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

Certifiable form. The waste is in a form capable of being certified for shipment to and disposal at the Waste Isolation Pilot Plant.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Fissile material. Material made up of radionuclides that will sustain a chain reaction by thermal (slow) neutron-induced fission. For the Hanford Site criticality safety program, uranium-233, uranium-235, plutonium-239, and plutonium-241 are the primary radionuclides of interest.

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

Flammable liquid. A liquid having a flash point of not more than 60.5°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 (49 CFR 173).

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

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

Generator. Any person, by site, whose act or process produces radioactive or mixed waste or whose act first causes a waste to become subject to regulation under WAC 173-303. The term generator also

includes any person or organization that manages a dangerous waste at the generating site on behalf of the generator.

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

Hanford Site Treatment, Storage, and/or Disposal Unit or Hanford Site TSD Unit. Any one of the operational TSD 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 EPA.

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

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

Incompatible waste. A dangerous waste that is unsuitable for placement in a particular device or facility because it might corrode or decay the containment materials or is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, fumes, mists, or gases, or flammable fumes or gases (WAC 173-303-040).

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

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

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

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

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

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

Mixed waste. A dangerous, extremely hazardous, or acutely hazardous waste that contains both a nonradioactive hazardous component and, as defined by 10 CFR 20.1003, source, special nuclear, or byproduct material subject to the AEA (WAC 173-303-040).

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

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

Newly Generated Waste. Waste from ongoing processes including secondary waste or repackaged waste that has not been previously accepted by SWOC and is not retrieved or previously stored waste.

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

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

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

Onsite. Any property within the Hanford Site boundary. (NOTE: DOT, *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [CERCLA], and RCRA regulations have varying definitions of onsite; the precise DOT, CERCLA, and RCRA meanings of the term are not implied in the use of the term in this document.)

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

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

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

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

Plateau Remediation Company. The current contract with the DOE to operate portions of the Hanford Site, including the facilities described in this document. CH2M HILL is the Plateau Remediation Company contractor.

Plutonium-equivalent curie (PE-Ci). A method of normalizing the radiotoxicity in transuranic waste to plutonium-239 for use in establishing the approved safety limits at the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico. The normalization is based on the relative committed effective dose equivalent from inhalation of a radionuclide to that of plutonium-239 using the conversion factors from DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," as described in Appendix B of DOE/WIPP-02-3122.

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

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

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

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

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

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

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

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

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

Remote-handled transuranic waste. Packaged transuranic waste whose unshielded payload container external surface dose rate exceeds 2 milliSieverts/hr (200 millirem/hr), unless the shielding is part of a WIPP-approved pipe overpack configuration.

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

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

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

Sorb. To absorb or adsorb.

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

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

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

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

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

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

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

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

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

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

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

Transuranic waste. Radioactive waste containing more than 100 nanocuries (3,700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission (NRC) has approved for disposal on a case-by-case basis in accordance with 10 CFR 61 (DOE M 435.1-1).

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

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

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

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

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

Waste Specification Record. A document that identifies the anticipated TSD methods to be applied to a given class of waste managed at Hanford Site TSD units.

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

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

Waste & Fuels Management Project (WFMP) acceptance organization. The organization within the Waste & Fuels Management Project that is responsible for waste acceptance, including approval of waste stream profiles and approval of individual waste packages and shipments, and for coordinating the approval of case-by-case evaluations for specific criteria and exceptions to the acceptance criteria.

1 Introduction

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

1.1 Purpose and Scope

The criteria for each TSD unit are established in this document to ensure that newly generated waste accepted can be managed within the operating requirements of the unit, including, but not limited to, environmental regulations, DOE Orders, permits, technical safety requirements (HNF-11724, Section 9.1; HNF-15280, Section 5.6.12), waste analysis plans, and performance assessments. The requirements of DOE O 435.1 and DOE M 435.1-1 are implemented through DOE/RL-2000-25. Revisions to the acceptance criteria document require an Unreviewed Safety Question review to document that the changes are consistent with current applicable safety analyses.

All waste received for acceptance at the Solid Waste Operations Complex (SWOC) facilities will be disposal ready, meeting all applicable federal and state land disposal restrictions (LDR) requirements, radiological stabilization requirements (Greater Than Category 1 wastes and mobile radionuclides), 90 percent full requirements, and meeting the 50 per square inch (psi) compaction criteria for the disposal trenches. It is expected that all low-level waste (LLW) and mixed low-level waste (MLLW) with a disposition path will have received treatment if required and shipped for final disposition. CWC will accept LLW/MLLW with no identifiable disposition path using the exception process in Section 1.6. CWC will accept TRU and transuranic mixed (TRUM) wastes in certifiable form with no identifiable disposition path.

Acceptance criteria apply to the following RL TSD units:

- Lined trenches in the LLBG
- CWC
- WRAP Facility
- T Plant Complex

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

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

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

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

1.2 Roadmap to the Waste Acceptance Criteria

Chapter 1 provides introductory information and describes general administrative requirements that apply to generators.

Chapter 2 identifies requirements that generally apply to waste sent to any of the TSD units. These criteria relate primarily to overall characterization and segregation methods used by generators. In addition, acceptance criteria that are the same for all units are provided in this chapter.

Chapter 3 through Chapter 6 communicate the unit-based criteria for acceptance of waste. Each of these chapters contains a general description of the unit functions followed by identification of prohibited waste, physical/chemical acceptance criteria, radiological acceptance criteria, and packaging criteria. These TSD units and the general functions follow:

- Chapter 3: The lined trench portion (Trench 31 and Trench 34) of the 218-W-5 Burial Ground is a *Resource Conservation and Recovery Act of 1976* (RCRA) permitted disposal unit for certain MLLW and LLW that meet federal and state LDR. The unit may also dispose of certain types of TSCA PCB waste.

- Chapter 4: The CWC is a storage unit for LLMW, low-level TSCA PCB waste, TRU waste, TRUM waste, TRU TSCA PCB waste, and other waste types that must be stored pending treatment and/or disposal.

- Chapter 5: The T Plant Complex is a multipurpose unit for storage, repackaging, treatment, and decontamination of radioactive waste. The T Plant Complex can accept LLW and TRU waste, including mixed and TSCA PCB waste.

- Chapter 6: The WRAP facility is a multipurpose unit for processing and treating LLW and TRU waste, including mixed and TSCA PCB waste. The WRAP facility can perform nondestructive assay (NDA) and nondestructive examination (NDE) of waste containers. The WRAP facility is the primary unit for repackaging and processing TRU waste for certification and disposal at the Waste Isolation Pilot Plant (WIPP).

Chapter 7 lists references for all chapters except the appendices. Each appendix has its own reference section.

Appendix A provides radiological calculation methods.

Appendix B provides fissionable material content limits.

Appendix C describes the labeling of containers.

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

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

Appendix F, "Radiological Release of Waste," has been retired.

Appendix G provides contact-handled TRU waste acceptance criteria and certification requirements.

Appendix H provides a listing of approved vents.

Appendix I provides remote-handled TRU waste acceptance criteria.

1.3 Waste Acceptance Process

The process for obtaining approval to ship waste to the Hanford Site Waste & Fuels Management Project (WFMP) TSD units is described on the *Hanford Site Solid Waste Acceptance Program* Internet Web site (available at: http://www.hanford.gov/?page=577). Use of the waste acceptance process is mandatory.

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

1.4 Generator Responsibilities

Generators of radioactive waste have certain general responsibilities under DOE O 435.1. Acceptance of waste at Hanford Site TSD units is contingent on effectively fulfilling these responsibilities. The generator is responsible for all costs associated with the storage, treatment, disposition, and associated transportation for disposal-ready waste as stated in Section 1.1 of these acceptance criteria.

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 (Section III.J. and Section IV.J of DOE M 435.1-1). Generators are financially responsible for costs incurred by Hanford Site TSD units resulting from nonconformance with the acceptance criteria. All non-conforming containers can be returned to the generator for resolution. There is no obligation for WFMP TSD units to correct generator nonconformances.

1.4.2 Quality Assurance Program

Each generator shall have a quality assurance program (QAP) as part of its overall waste certification program. The QAP shall implement requirements of the *Code of Federal Regulations* (CFR) 10 CFR 830, "Subpart A—Quality Assurance Requirements," and DOE O 414.1C (DOE M 435.1-1). The generator QAP shall be subject to evaluation according to the requirements of Section 1.5.

1.4.3 Waste Minimization Program

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

1.4.4 Waste Forecast

Generators that wish to ship waste to the Hanford Site TSD unit shall provide an annual waste forecast. This input is done through the Solid Waste Integrated Forecast Technical (SWIFT) tool. Integration of this data is summarized in the SWIFT report and provides up-to-date life cycle information about radioactive solid waste that is expected to be managed by Hanford's WFMP Organization from onsite and offsite generators. The data contained in this report are the official data for solid waste forecasting. Requests to update this forecast are sent out semi-annually, in conjunction with the budget cycle.

The SWIFT report contains two volumes. Volume I provides waste metrics in several forms (e.g., volume, containers, radionuclides, etc.). Volume II gives detailed history and analyzes any changes to the metrics.

Customized data reports or analyses may be requested by contacting Ms. Linda Maiden:

E-mail: Linda_E_Maiden@rl.gov
Phone: (509) 376-9126

This report and more information are also available at the following Web site address: http://www.hanford.gov/swift.

1.5 Evaluation of Generator Waste Certification Program

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

1.6 Exceptions to the Waste Acceptance Criteria

Exceptions to these acceptance criteria may be granted in certain cases. The process to obtain approval of an exception is determined by the source and type of the requirements from which the specific acceptance criterion is derived. These requirements fall into three categories, each having a specific approval process, as described in Sections 1.6.1, 1.6.2, and 1.6.3.

A generator can request an exception from one or more of the criteria in this document. The request should be a written letter to the WFMP acceptance organization. The request must include the following:

- Specific requirement(s) in this document for which an exception is desired
- Waste type (e.g., TRU, TRUM, LLW, and MLLW)
- Waste characteristics (e.g., physical descriptions, dose rates, radiological constituents, and hazardous waste constituents)
- Packaging information (e.g., volume, weight, dimensions, internal configuration, and materials)
- Identification of the waste in SWIFT
- Efforts made to comply with the requirements of this document
- How the generator complied with the waste generation/life cycle planning requirements of DOE M 435.1-1
- Alternative analyses (including life cycle estimates) showing that acceptance of waste that is not compliant with requirement(s) of this document is the most cost effective solution for DOE

The WFMP acceptance organization will review the exception request and determine the appropriate category and approval process, based on the background documentation for these acceptance criteria. This documentation identifies the source(s) of each requirement in order for a determination to be made on whether an exception could be approved by the WFMP acceptance organization, or whether DOE-RL and/or regulatory agency approvals are required. On completion of this review, the WFMP acceptance organization will respond in writing, identifying whether the exception is granted, rejected, or requires further evaluation or clarification.

1.6.1 Waste & Fuels Management Project Approved Exceptions

An exception to these acceptance criteria can be granted when the WFMP 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. For example, a TSD unit's container size limits are operational requirements that are not related to any regulation or externally approved document. If a larger container could be managed at that TSD unit with special handling provisions, the WFMP acceptance organization can grant an exception to the container size requirement.

The WFMP acceptance organization, in conjunction with the TSD operations organization, documents and certifies that the exception being granted does not affect compliance with any applicable regulations or any of the externally approved requirements of the TSD units. Project-approved exceptions will include life cycle cost and the most cost effective solution for DOE.

1.6.2 Department of Energy Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with DOE-approved requirements documents (e.g., safety basis and performance assessment) or DOE Orders will require an 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 CH2M HILL Plateau Remediation Company (CHPRC) 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 or agencies.

1.7 Precedence of Requirements

Cases may 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 General Requirements

Certain general requirements apply to acceptance of all waste at Hanford Site TSD units. These requirements are described in the sections that follow.

2.1 General Radioactive Classes of Waste Managed At Hanford Site Treatment, Storage, and/or Disposal Units

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

2.2 Composition of Waste and Containers

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

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

2.3 Prohibited Waste

The following waste types are not accepted:

- Dangerous waste not having dangerous waste numbers listed on the TSD unit's approved Part A, Form 3, permit application (Hanford Facility RCRA Permit, WA & 89000 8967, Unit Name Part A Form)
- Explosive waste (HNF-5841; HNF-21239)
- Shock sensitive waste (HNF-1886; HNF-2165; HNF-5841; HNF-9921; HNF-21239)
- Pyrophoric waste (HNF-1886; HNF-2165; HNF-5841; HNF-9921)
- Class IV oxidizer (see definitions) waste (HNF-1886; HNF-2165; HNF-5841; HNF-9921; HNF-21239)
- Waste that is readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable [DOE M 435.1-1, Chapter III and Chapter IV, N.1]
- Containers packaged such that toxic air pollutants exceed *Washington Administrative Code* (WAC) small quantity emission rates (WAC 173-460)
- Infectious waste

2.4 Physical and Chemical Characterization

The waste generator must determine the physical and chemical characteristics of the waste with sufficient accuracy and detail to provide proper designation and management of the waste in accordance with the unit-specific acceptance criteria and all applicable regulations (i.e., knowledge) (e.g., HNF-5841; HNF-9921; HNF-1886; HNF-2165; 40 CFR 264.13; WAC 173-303-300; 40 CFR 761).

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

2.4.1 Types of Knowledge

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

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

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

2.4.2 General Waste Knowledge Requirements

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

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

include SW-846 test methods or any other methods with proper quality assurance (QA) and quality control (QC).

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

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

All waste must be characterized in a sufficient manner 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 TSD in accordance with the WSRds.

2.4.3 Land Disposal Restrictions Waste Knowledge

For waste that is a hazardous waste as defined in 40 CFR 261, waste characterization must be sufficient to establish whether the waste is a restricted waste under the LDR provisions of 40 CFR 268 and, if so, to determine the applicable LDR subcategories and treatment standard(s) for that waste. Testing of a representative sample at a Hanford Site laboratory or another independent laboratory is required when a generator or treatment facility certifies that a waste stream meets a concentration-based treatment standard of 40 CFR 268. To certify that a waste stream meets a specified technology treatment standard in 40 CFR 268, the generator or treatment facility must provide data (i.e., an LDR certification form which demonstrates that the waste was properly treated by that treatment technology).

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

2.4.4 Exceptions to Physical and Chemical Characterization Requirements

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

- Hazardous debris that is managed in accordance with the alternative treatment standards for hazardous debris (40 CFR 268.45) does not require sampling and analysis for adequate physical/chemical characterization.
- Hanford Site generators can transfer waste for storage at an onsite TSD unit without full characterization for designation and LDR status, provided the characterization is sufficient to demonstrate that the waste can be managed in accordance with the unit-specific acceptance criteria and provided a representative sample (or samples) has been obtained or will be obtained at the TSD unit to fully characterize the waste.
- An alternative management path negotiated by DOE-RL with the appropriate regulatory agency can characterize waste that cannot be characterized in accordance with the requirements stated previously because of factors such as unique chemical or radiological hazards of the waste. This type of exception will be handled by the method outlined in Section 1.6.3.

2.4.5 Recertification

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

2.5 Radiological Characterization

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

2.5.1 Identification of Major Radionuclides

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

- Any TRU radionuclide present in the waste in a concentration exceeding 1 nanocurie per gram.
- Any fissionable radionuclide present in the waste in a quantity exceeding 0.1 fissile gram equivalent per container.
- Any radionuclide present in a concentration exceeding 1 percent of its respective Category 1 limit (Appendix A, Table A-2). This reporting limit does not apply to TRU waste.
- Any mobile radionuclide present in concentration exceeding its reporting limit (Appendix A, Table A-2). This reporting limit does not apply to TRU waste.
- For waste that has no detectable radiological activity but cannot be radiologically released, major radionuclides are those radionuclides believed to contribute more than 1 percent each to the radiological activity based on available process knowledge. The estimated concentration of the radionuclides should be based on the limit of detection of the analysis method used.
- The amount of uranium-235 and uranium-238 in each waste container must be reported if there is at least 0.1 gram of uranium-235 in the container, or if either isotope is a major radionuclide. The amount of uranium-233 in each waste container must be reported if it contains at least 0.1 gram of uranium-233.
- Any radionuclide that accounts for more than 1 percent of the total radiological activity of the waste must be reported. However, a radionuclide in a concentration less than 1.0 E-6 curie per m^3, and not otherwise reportable, is exempt from reporting.

2.5.2 Methods for Establishing Radionuclide Inventory

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

extensive or frequent analysis. Use of the data quality objectives (DQO) process (or an equivalent process), in accordance with DOE M 435.1-1, should help ensure that the appropriate type, quantity, and quality of radiological characterization data are obtained.

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

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

- Process knowledge – Process knowledge includes documented knowledge of the radioactive materials used and the processes that contributed to the radiological content of the waste, along with a 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 radionuclides that are not present in sufficient concentration to be major radionuclides as defined in Section 2.5.1, as long as the basis of this determination is documented.

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

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

- Computer modeling – Computer modeling, applied appropriately, could be used in conjunction with other methods for radiological characterization. An individual who is knowledgeable and experienced in the use and limitations of the model must perform the modeling. The assumptions and measurements used as inputs to computer modeling must be documented. The computer software must be controlled in a manner that meets conventional 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 radionuclides that are more difficult to measure. 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 they must be documented clearly and approved by the WFMP 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, and QA/QC methods.

2.5.3 Additional Detail on Mobile Radionuclide Characterization

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

The concentration of each mobile radionuclide must be established and compared to the Table A-2 (Appendix A) 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 analytical techniques cannot detect a mobile radionuclide at its reporting limit, the concentration could be estimated using a combination of process knowledge, scaling factors, and analytical detection limits.

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

2.5.4 Recertification

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

2.5.5 Radioactive Material Shipments Less Than Values Specified In 49 CFR 173.436 or Derived According to 49 CFR 173.433

- All shipments of radioactive materials having activities or activity concentrations less than those listed in 49 CFR 173.436, or derived according to 49 CFR 173.433, are exempt from U.S. Department of Transportation (DOT) regulations. These materials shall be shipped in a container to ensure that no loss of the radioactive material occurs during loading, inspections, transportation, and unloading.

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

- A radiological survey report shall identify the package radiation exposure rates (i.e., contact and 30 cm [11.8 in.] readings), the expected radionuclides, associated activity levels, and package contamination levels, including an evaluation of hard-to-detect radionuclides (e.g., H-3), when necessary. The radiological survey report shall be sent with the shipment as part of the shipping documents.

2.6 Waste Segregation and Treatment and/or Disposal Path

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

2.6.1 Segregation of Uncontaminated Waste from Radioactive Waste

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

2.6.2 Radiological Release of Waste

Generators shall attempt to obtain radiological release of dangerous waste and TSCA PCB waste generated from radioactive material areas in accordance with their site/facility radiological release criteria, unless one or more of the following conditions apply (for Hanford Site CHPRC generators, the Site release criteria are discussed in HNF-PRO-PR-20377 and HNF-13536):

- Radiological surface contamination exceeds the values established in CHPRC-00073, Table 4-1. Materials/equipment with potential radioactivity in volume above the background from DOE operations cannot be released unless DOE has approved an authorized limit or the conditions of HNF-PRO-20377 for TSCA/RCRA waste are satisfied.
- 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 CHPRC generators, HNF-PRO-20377 and HNF-13536).
- The waste is treated and directly disposed as radioactive waste at a cost that is lower than the cost of radiological release and disposal as nonradioactive waste.
- The basis for use of these conditions must be documented as part of the radiological characterization record(s) for the waste.

2.6.3 Segregation for Treatment, Storage, and/or Disposal

All waste shall be segregated by the WSRds and waste stream profiles to facilitate proper TSD. The WSRds identify major waste streams, grouped in a manner that defines currently available storage and disposal methods and, for waste requiring treatment, the anticipated treatment and/or disposal methods. When it is not technically feasible or it is cost prohibitive to segregate a given waste stream by WSRd and profile, the generator must document the basis for not segregating the waste. Acceptance of non-segregated waste is contingent on either (1) the WFMP 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 TSD. These criteria must be met in addition to the criteria identified in this document.

The current set of WSRds, along with instructions for selecting the appropriate WSRd, can be obtained from the *Hanford Site Solid Waste Acceptance Program* Internet Web site (available at: http://www.hanford.gov/?page=581).

2.6.4 Waste Streams Having No Established Treatment/Disposal Path

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

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

2.6.5 Mixed Low-Level Waste from Non-PRC Generators

MLLW from PRC and non-PRC generators that requires treatment to meet LDR requirements shall be treated as required to meet LDR treatment standards prior to delivery to PRC disposal units. Non-LDR-compliant MLLW presented for storage will be considered on a case-by-case basis when no treatment path is available or for treatment and disposal when treatment at the disposal facility is proposed. See Section 1.6 for the exception to non-LDR-compliant waste.

2.7 Management and Certification of Transuranic Waste

TRU waste has a unique set of management and certification requirements based on DOE/WIPP-02-3122 and DOE/WIPP-02-3214. Requirements applicable to generators of contact- and remote-handled TRU waste are identified in Appendix G and Appendix I, respectively. If TRU waste does not meet the requirements of Appendix G and Appendix I, an exception to HNF-EP-0063 would be required in order for the waste to be accepted at a SWOC facility. For TRU waste that meets general SWOC requirements, but not Appendix G and Appendix I requirements, DOE-RL will be contacted for consultation of the exception.

2.8 Records

The generator must retain all record copy material used for waste characterization and designation in accordance with federal and state requirements and DOE Orders. These records include process knowledge, sampling information, analytical data, inventory records, and related information. The generator must transfer copies of certain records, as requested by the WFMP acceptance organization, through the waste acceptance process described on the *Hanford Site Solid Waste Acceptance Program* Internet Web site (available at: http://www.hanford.gov/?page=586).

2.9 Classified and Accountable Nuclear Material

Radioactive waste to which access has been limited for national security reasons and that cannot be declassified shall be managed in accordance with the requirements of DOE M 470.4-2 and DOE O 470.4A (DOE M 435.1-1).

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

A DOE/NRC 741 form must be completed for waste that contains accountable nuclear material (DOE O 470.4A).

2.10 Waste Verification

A portion of the waste containers sent to Hanford Site TSD units must be verified by physical inspection (e.g., nondestructive examination and visual examination) or chemical screening as stated in the waste analysis plans for the TSD units (i.e., HNF-1886; HNF-5841; HNF-2165; or HNF-9921). For most waste types, this verification will be performed at the generator's location by physical inspection before or during packaging. In cases where the verification cannot be performed at the generator's location, the generators must notify the Hanford Site Technical Services organization prior to packaging the waste. The Performance Evaluation System Committee will evaluate the individual cases and determine if verification for the waste will be performed at one of the Hanford Site TSD units.

2.11 Physical and Chemical Criteria

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

2.11.1 Chemical Compatibility

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

2.11.2 Asbestos-Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as the liquid does not exceed applicable free liquid requirements (Section 3.3.1).

2.11.3 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts/m^3 (0.1 watt/ft^3), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in storage. This evaluation must be provided to and approved by the WFMP acceptance organization.

2.11.4 Gas Generation

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

When LLW is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container (DOE M 435.1-1, Chapter IV, L.1.b). Unless otherwise specified by the WFMP acceptance organization, a minimum 5-year time value shall be used to demonstrate compliance when performing gas generation calculations for LLW going directly to disposal.

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

If required, the following mitigating measures (or alternative measures approved by the WFMP acceptance organization) must be used:

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

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

2.11.5 Liquids and Liquid-Containing Waste

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

- Containerized free liquids are allowed in the following situations, but cannot exceed 1 percent of the volume of the waste (40 CFR 264.314; HNF-5841):
  - Free liquids in a very small container, such as an ampule
  - Small articles that contain free liquids required for the article to function (e.g., batteries or capacitors)

- For liquid-containing waste condensate inner plastic packaging (e.g., bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbents within the inner plastic packaging (HNF-5841). The type and amount of sorbent required shall be in accordance with Appendix E. In any case, the amount of liquid may not exceed 1 percent of the volume of the waste or 0.5 percent of waste processed to a stable form (DOE M 435.1-1).
- For waste that could form condensate during storage, sufficient sorbent shall be added to the container to sorb any condensate formed.
- Residual liquids in large debris items shall be sorbed or removed. In cases where it is not practical to remove suspected liquids and it is impossible to sample to determine if liquids are present, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item (HNF-5841). In any case, the amount of liquid cannot exceed 1 percent of the volume of the waste (DOE M 435.1-1).

2.12 Radiological Criteria

The following subsections describe the radiological criteria for acceptance of waste.

2.12.1 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B.

2.12.2 Dose Equivalent Curie Limits

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

Unvented drums equal to or greater than 33 dose-equivalent curies without overpack are prohibited (HNF-15280).

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

2.12.3 Package Removable Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of CHPRC-00073, Table 2-2. Use of fixatives is not allowed to meet the criteria. For returnable overpacks, the contamination limits and fixative prohibition also applies to the outside of the inner package.

In addition, elevated concentrations of tritium may accumulate when tritium diffuses as tritiated water (HTO) vapor from containers and concentrate in the cargo area. Shipments that are greater than 100 Ci of tritium should be shipped in open conveyances.

2.13 Packaging Criteria

The following subsections describe the packaging criteria for acceptance of waste.

2.13.1 Container Selection

The packages for waste shall meet applicable 49 CFR container requirements for the hazard class/division of the waste, except that packaging for onsite transfers under an approved package-specific safety document might be allowed where cost or technical constraints make the use of a DOT-compliant

package unfeasible. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.

2.13.2 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, dents, bulges, pit or scale corrosion, or other damage that could compromise container integrity (WAC 173-303-630). Minor external surface rust that can be sanded or brushed off will be acceptable. Containers having some pit or scale corrosion could be acceptable for storage, provided the integrity of the container is confirmed. Polyurea-coated containers must have a flame spread rating of 25 or less for acceptance into the CWC.

2.13.3 Securing Waste and Shielding

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

2.13.4 Labeling

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

3 Acceptance Criteria for Disposal in the Low-Level Burial Grounds

This chapter outlines the criteria necessary in order to comply with the regulatory, permitting, safety, environmental, and operational requirements for the LLW and MLLW TSD in the LLBG.

3.1 Facility Description and Function

Trench 31 and Trench 34 of the 218-W-5 Burial Ground are RCRA-compliant units for TSD of certain MLLW. Currently, only LLW and MLLW originally designated with RCRA characteristic numbers D001 through D043, certain listed, discarded chemical product waste numbers (U- and P-listed waste), certain F-listed waste F001 through F012, F019, F028, and F039 (derived from F001 through F012, F019, and F028), and Washington state-only dangerous waste (except waste number WSC2-acid) are accepted in Trenches 31 and 34 (Table 3-1). Waste accepted for disposal at Trench 31 and Trench 34 must be disposal ready and meet the LDR treatment standards of 40 CFR 268, WAC-173-303-140, radiological stabilization, 90 percent full requirements, and the 50 per square inch compaction criteria for the disposal trenches. There also are safety-based limits on the radionuclide concentrations of waste received. The unit may also dispose of certain types of TSCA PCB waste.

Table 3-1. Low-Level Burial Ground Dangerous Waste Numbers

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001–D043	F001	U001–U012	P001–P006	WT01
	F002	U014–U039	P008–P018	WT02
	F003	U041–U053	P020–P024	WP01
	F004	U055–U064	P026–P031	WP02
	F005	U066–U099	P033	WP03
	F006	U101–U103	P034	WSC2*
	F007	U105–U138	P036–P051	WPCB
	F008	U140–U174	P054	
	F009	U176–U194	P056–P060	
	F010	U196	P062–P078	
	F011	U197	P081	
	F012	U200–U211	P082	
	F019	U213–U223	P084	
	F028	U225–U228	P085	
	F039	U231–U240	P087–P089	
		U243–U244	P092–P099	
		U246–U249	P101–P106	
		U271	P108–P116	
		U278–U280	P118–P123	
		U328	P127	
		U353	P128	
		U359	P185	
		U364	P188–P192	
		U367	P194	
		U372	P196–P199	
		U373	P201–P205	
		U375		
		U387		
		U389		
		U394		
		U395		
		U401–U404		
		U407		
		U409–U411		

Notes:

Acceptable dangerous waste numbers may be added or deleted at any time due to changes in regulations. See the currently approved Dangerous Waste Permit Application, Part A Form, Section XIV, "Description of Dangerous Waste," to verify the dangerous waste numbers acceptable at the LLBG.

*See Section 3.2.

3.2 Prohibited Waste

The following types of waste are not disposed in Trench 31 and Trench 34:

- Waste designated with WSC2-acid (Hanford Facility RCRA Permit, WA7 89000 8967, Unit Name Part A Form).
- TSCA-regulated PCB waste, except as specifically authorized by 40 CFR 761.
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.1. LLW must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical (DOE M 435.1-1, Chapter IV, G.1.d.1).
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.2. Liquid LLW or LLW containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the LLW is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form (DOE M 435.1-1, Chapter IV, G.1.d.2).
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.3. LLW must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable (DOE M 435.1-1).
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.4. LLW must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or harmful to the long-term structural stability of the disposal site (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.5. LLW in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20°C (68°F) (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.
- Waste that does not meet all applicable treatment standards of 40 CFR 268 and WAC 173-303-140.
- TRU waste and waste that exceeds other radiological limits of Section 3.4.
- Waste that is incompatible with the trench liner, as defined in Section 3.3.3 (40 CFR 264.301; WAC 173-303-665; HNF-5841).

3.3 Physical and Chemical Criteria

The following physical and chemical criteria apply to waste acceptance in the LLBG.

3.3.1 Land Disposal Restrictions

All waste subject to RCRA LDR (40 CFR 268) and/or Washington State LDR (WAC 173-303-140) must be demonstrated to meet all applicable treatment standards and requirements. For waste that has concentration-based treatment standards for specific hazardous constituents under 40 CFR 268, the waste must be tested at a Hanford Site laboratory or another independent laboratory in accordance with

40 CFR 268. For waste that has treatment standards that are not concentration-based, the generator and/or treatment facility must demonstrate that the waste meets the applicable treatment standards using process knowledge and/or by waste analysis, as required by the applicable sections of 40 CFR 268 and WAC 173-303-140 (HNF-5841).

3.3.2 Compatibility of Waste with Liner

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

Table 3-2 lists certain chemical constituents, in concentrated form, that have been evaluated and determined to be incompatible with the liner.

Table 3-2. 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 (Dlemental)	7726-95-6
Bromobenzene	108-86-1
Bromoform	75-25-2
Calcium Bisulfite	13780-03-5
Calcium Sulfide	20548-54-3
Chlorine (Dlemental)	7782-50-5
1-Chloropentane (Amyl Chloride)	543-59-9
1,1-Dichloroethylene (Vinylidene Chloride)	75-35-4
1,2-Dichloropropane (Propylene Dichloride)	78-87-5
Diethyl Benzene	105-05-5, 135-01-3, 141-93-5
Diethyl Ether	60-29-7
Chloroethane (Ethyl Chloride)	75-00-3
Fluorine (Elemental)	7782-41-4
Nitrobenzene	98-95-3
Sulfur Trioxide	7446-11-9
Sulfuric Acid, Fuming	8014-95-7
Tetrachloroethylene	127-18-4
Thionyl Chloride	7719-09-7
Trichloroethylene	79-01-6, 52037-46-4

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

3.3.3 Gas Generation

Radioactive animal carcasses must be packaged as follows:

- The waste must be packaged in an inner and outer metal package, where the outer package has a capacity at least 40 percent greater than that of the inner package. The outer package must be a metal container that meets applicable transportation requirements for shipment to the LLBG.

- The inner package shall be lined with a minimum 4-mil plastic liner. The animal carcass(es) in the inner package must be surrounded with slaked lime. The plastic liner and inner package must be sealed.

- A minimum of 7.6 cm (3 in.) of mineral sorbent must be placed in the bottom of the outer package. The inner package must be placed into the outer package, and the void space filled between the two packages with additional mineral sorbent.

- The outer package must be sealed.

3.4 Radiological Criteria

The following radiological criteria apply to waste acceptance in the LLBG.

3.4.1 Radiological Concentration Limits

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

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

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

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

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

  - Packaging in a HIC approved by the WFMP acceptance organization.

    NOTE: A list of approved HICs is available on the *Hanford Site Solid Waste Acceptance Program* Internet Web site (available at: http://www.hanford.gov/?page=581).

  - Placement in monoliths in the LLBG using the exception process in Section 1.6.

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

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

  - Mobile radionuclides. If the concentration of any mobile radionuclide exceeds the Mobile Radionuclide Reporting Limit of Appendix A, Table A-2, stabilization could be required

(WHC-EP-0645; WHC-SD-WM-TI-730). The WFMP acceptance organization will perform a case-by-case evaluation based on the LLBG performance assessment (WHC-EP-0645; WHC-SD-WM-TI-730) to determine whether the waste requires stabilization to meet the groundwater pathway dose criteria. Stabilization normally would consist of placing the waste container in a HIC, but additional stabilization might be required based on a number of factors such as waste form and radionuclide content. The WFMP acceptance organization will coordinate this evaluation.

3.4.2 Criticality Safety Limits

The fissile and fissionable material limits are provided in Appendix B. Note that fissile waste packages can be accepted only with an approved criticality safety evaluation.

3.4.3 Package Dose Rate Limits

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

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

3.5 Packaging Criteria

The packaging criteria described in the following subsections apply to acceptance in the LLBG.

3.5.1 Package Construction

Containers must meet one of the following criteria to ensure compliance with HNF-21239, *Solid Waste Operations Complex Fire Hazard Analysis*:

- Containers shall be constructed of metal, concrete, or masonry.
- Containers shall be constructed of wood that is either (1) pretreated wood having the Underwriters Laboratories FR-S stamp, or (2) painted with a fire-retardant paint that has been approved by Underwriters Laboratories or Factory Mutual.
- Containers shall be constructed of rigid plastic that has a maximum flame spread rating of 25 when tested by a nationally recognized testing laboratory to the most current version of American Society for Testing of Materials (ASTM) Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM Standard E-84. These containers will only be accepted if approved by WFMP Fire Protection Engineering.
- Containers shall be constructed of flexible plastic packaging provided the waste matrix is limited to soils, metals, concrete, or masonry. Incidental amounts of organic material such as personal protective equipment are allowed in flexible packaging.
- Other containers as authorized under the LLBG Fire Hazards Analysis and approved by WFMP Fire Protection Engineering.
- Sacrificial rigging shall not contain regulated materials, such as lead.

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

3.5.2 Handling of Packages

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

3.5.3 Minimization of Subsidence

All waste shall be packaged in a form that minimizes settling and subsidence to the maximum extent feasible (DOE M 435.1-1; WHC-EP-0645; WHC-SD-WM-TI-730). All waste accepted for disposal in the LLBG must meet one of the following minimization of subsidence criteria at the time of disposal:

- Packaged in a HIC that is procured through the WHC-S-0486 specification
- Packaged in a HIC approved by the CHPRC WFMP
- Compactable waste that has been compacted to a minimum pressure of 3.52 kg/cm^2 (50 $lb/in.^2$).
- Placed in a Hanford-provided in-trench structural monolith meeting the requirements of HNF-1981 specification for concrete encasements using the exception process in Section 1.6 (Non-PRC generators).
- A solid with a minimum "confined" compressive strength of 3.52 kg/cm^2 (50 $lb/in.^2$).
- All containerized waste must be at least 90 percent full when placed in the disposal unit (WAC 173-303-665).

3.5.4 Labeling

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

3.5.5 Bulk (Noncontainerized) Waste

Bulk waste can be disposed in the LLBG, on a case-by-case basis. Waste shall meet the following requirements to be considered:

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

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

4 Acceptance Criteria for the Central Waste Complex

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

4.1 Facility Description and Function

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

The CWC manages waste having characteristic waste numbers D001 through D043, certain listed, discarded chemical product waste numbers (U- and P-listed waste), certain F-listed waste (F001 through F012, F019 through F023, F026 through F028, and F039), and all Washington State-only waste numbers. Table 4-1 lists the acceptable dangerous waste numbers from the approved CWC Part A, Form 3 (Hanford Facility RCRA Permit, WA7 89000 8967, Unit Name Part A Form). In addition, the CWC manages TSCA PCB waste from Hanford Site generators in accordance with 40 CFR 761. The CWC also can store waste from *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) cleanup activities.

Table 4-1. Central Waste Complex Dangerous Waste Numbers

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001–D043	F001	U001–U012	P001–P006	WT01
	F002	U014–U039	P008–P018	WT02
	F003	U041–U053	P020–P024	WP01
	F004	U055–U064	P026–P031	WP02
	F005	U066–U099	P033	WP03
	F006	U101–U103	P034	WSC2
	F007	U105–U138	P036–P051	WPCB
	F008	U140–U174	P054	
	F009	U176–U194	P056–P060	
	F010	U196	P062–P078	
	F011	U197	P081	
	F012	U200–U211	P082	
	F019	U213–U223	P084	
	F020	U225–U228	P085	
	F021	U231–U240	P087–P089	
	F022	U243–U244	P092–P099	
	F023	U246–U249	P101–P106	
	F026	U271	P108–P116	
	F027	U278–U280	P118–P123	
	F028	U328	P127	
	F039	U353	P128	
		U359	P185	
		U364	P188–P192	
		U367	P194	
		U370	P196–P199	
		U372	P201–P205	
		U373		
		U376		
		U387		
		U389		
		U394		
		U395		
		U401–U404		
		U407		
		U409–U411		

Table 4-1. Central Waste Complex Dangerous Waste Numbers

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series

Notes:

Acceptable dangerous waste numbers may be added or deleted at any time due to changes in regulations. See the currently approved Dangerous Waste Permit Application, Part A Form, Section XIV, "Description of Dangerous Waste," to verify the dangerous waste numbers acceptable at the CWC.

4.2 Prohibited Waste

The following wastes are not accepted for storage at the CWC (see Section 2.3):

- Liquid waste, except if packaged in lab packs or overpacks in quantities less than or equal to 57 L (15 gal) per outer container.
- 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 (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.

4.3 Radiological Criteria

The following subsection describes the radiological criteria specific to the CWC.

4.3.1 Package Dose Rate Limits

Waste packages shall not exceed 1 milliSievert/hr (100 millirem/hr) at 30 cm (1 ft) from the waste package and 2 milliSieverts/hr (200 millirem/hr) at any point on the surface of the package. Containers exceeding these limits may be acceptable but will require container-specific review and approval by CWC Operations.

4.4 Packaging Criteria

The following subsections describe the packaging criteria for acceptance at the CWC.

4.4.1 Container Selection

Outer containers shall be constructed of noncombustible materials. Wood, fiberboard, and plastic outer containers are prohibited (HNF-15280). See Section 1.6 for exception if the outer container is combustible.

4.4.2 Protective Coatings and Liners

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

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.
- The interior coatings and liners shall be chemically compatible with the waste and protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WFMP 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.

4.4.3 Packaging of Liquid Waste in Lab Packs

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

- Up to 57 L (15 gal) of liquid can be packaged in inner glass, metal, or plastic containers. Glass containers shall not exceed 4 L (1.1 gal) 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® or equivalent lid seals (gaskets). After closure, glass lids shall be taped.
- All inner containers shall be compatible with the waste contents over the anticipated storage life of the waste.
- Each inner container shall be labeled with its contents.
- A sufficient quantity of suggested sorbent (selected in accordance with Appendix E) shall be packaged around the inner containers to sorb twice the volume of the liquid in the inner containers. The sorbent shall be placed around the inner containers in a manner that prevents shifting and breakage.

4.4.4 Package Size and Weight Limits

The baseline size limits for the CWC storage modules are shown in Table 4-2. Larger containers could be accepted into specific storage modules with special loading procedures. Drums smaller than 208 L (55 gal) are not accepted on a routine basis, but could be approved on a case-by-case evaluation.

4.4.5 Stacking

Packages must be designed to withstand the weight of two layers of 208-L (55-gal) drums weighing 454 kg (1,000 lb) each stacked on top.

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Table 4-2. Central Waste Complex Container Size and Floor Loading Limits

Storage Units	Package Size Limit	Floor Loading Limit
Alkali Metal Modules	321-L (85-gal) drum	1,225 kg/m^2 (250 lb/ft^2)
Low-Flash Point Modules	321-L (85-gal) drum	1,225 kg/m^2 (250 lb/ft^2)
2401-W Building	3.0 m high by 3.4 m wide (10 ft high by 11 ft wide)	2,200 kg/m^2 (450 lb/ft^2)
2402-W Building	3.0 m high by 3.4 m wide (10 ft high by 11 ft wide)	3,430 kg/m^2 (700 lb/ft^2)
2402-WB through WL Buildings, 2403-W and 2404-W Facilities	3.0 m high by 3.4 m wide (10 ft high by 11 ft wide)	9,800 kg/m^2 (2,000 lb/ft^2)

4.4.6 Waste Pallets

Waste shall be stored on metal or wood pallets. However, wood pallets must meet the requirements of HNF-FMP-07-32540-RO. For the specific requirements, refer to the *Hanford Site Solid Waste Acceptance Program* Internet Web site (available at: http://www.hanford.gov/?page=581).

5 Acceptance Criteria for the T Plant Complex

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

5.1 Facility Description and Function

The 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 sand from the K Basins sandfilter backwash is currently being stored in the 221-T Building. In addition, this building can be used for decontamination, treatment, and storage of equipment and waste. The 2706-T Building is used for the decontamination, treatment, and storage, etc., of equipment and waste having relatively low levels of radiological contamination. The 214-T Building is for storage purposes.

Wastes that can be managed at the T Plant Complex include LLW, TRU, TRUM, hazardous/dangerous low-level mixed, and TSCA PCB (40 CFR 761) waste. Table 5-1 lists the acceptable dangerous waste numbers from the approved T Plant Complex, Part A, Form 3 (Hanford Facility RCRA Permit, WA7 89000 8967, Unit Name Part A Form).

Waste managed at the T Plant Complex could be sent to other Hanford Site TSD units for TSD. The acceptance criteria for these units must be met subsequent to processing at the T Plant Complex.

Table 5-1. T Plant Complex Dangerous Waste Numbers

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001–D043	F001–F012	U001–U012	P001–P006	WT01
	F019–F023	U014–U039	P008–P018	WT02
	F026–F028	U041–U053	P020–P024	WP01
	F039	U055–U064	P026–P031	WP02
		U066–U099	P033	WP03
		U101–U103	P034	WSC2
		U105–U138	P036–P051	WPCB
		U140–U174	P054	
		U176–U194	P056–P060	
		U196	P062–P078	
		U200–U211	P081	
		U213–U223	P082	
		U225–U228	P084	
		U231–U240	P085	
		U242	P087-	
		U244	P089	
		U246–U249	P092–P099	
		U271	P101–P106	
		U278–U280	P108–P116	
		U328	P118–P123	
		U353	P127	
		U359	P128	
		U364	P185	
		U367	P188–P192	
		U372	P194	
		U373	P196–P199	
		U387	P201–P205	
		U389		
		U394		
		U395		
		U401		
		U404		
		U409–U411		

Notes:

Acceptable dangerous waste numbers may be added or deleted at any time due to changes in regulations. See the currently approved Dangerous Waste Permit Application, Part A Form, Section XIV, "Description of Dangerous Waste," to verify the dangerous waste numbers acceptable at the T Plant Complex.

5.2 Prohibited Waste

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

- 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 (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.
- Prohibited wastes are described in Section 2.3

5.3 Radiological Criteria

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

5.3.1 Package External Dose Rate Limits

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

5.3.2 Internal Dose Rate and Contamination Limits for Decontamination and Processing

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

In addition, items with detectable alpha contamination may not be acceptable for decontamination or processing at the 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.

5.4 Packaging Criteria

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

5.4.1 Container Selection

Outer containers shall be constructed of metal or concrete, except that fire-retardant wooden boxes can be used. Wooden boxes shall be constructed of wood that is either (1) pretreated wood having the Underwriters Laboratories FR-S stamp, or (2) painted with a fire-retardant paint that has been approved by Underwriters Laboratories or Factory Mutual. Poly HICs are prohibited at the T Plant Complex.

5.4.2 Protective Coatings and Liners for Stored Waste

The packaging for waste to be stored shall include the following 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 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 WFMP acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

5.4.3 Container Size Limits

Container size limits are as follows:

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

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

5.4.4 Container Weight Limits

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

- Drums shall not exceed 454 kg (1,000 lb).
- Boxes shall not exceed their rated weight capacity.

Large equipment or packages shall not exceed the following limits:

- 2706-T: 5,400 kg (11,900 lb) (small vehicles); 9,100 kg (20,000 lb) per axle or 36,000 kg (80,000 lb) gross (heavy equipment). All limits can be exceeded on a case-by-case basis.
- 221-T: 41,000 kg (90,000 lb).
- 214-T: 5,400 kg (11,900 lb) (small vehicles); 9,100 kg (20,000 lb) per axle or 36,000 kg (80,000 lb) gross (heavy equipment). All limits can be exceeded on a case-by-case basis.

6 Acceptance Criteria for the Waste Receiving and Processing Facility

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

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

6.1 Facility Description and Function

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

Wastes that can be managed at the WRAP facility include TRU, TRUM, LLW, MLLW, and TSCA PCB waste. Table 6-1 lists the acceptable dangerous waste numbers from the approved WRAP Part A, Form 3 (Hanford Facility RCRA Permit, WA7 89000 8967, Unit Name Part A Form).

Waste managed at the WRAP facility could be sent to other Hanford Site TSD units for TSD. The acceptance criteria for these TSD units must be met subsequent to reprocessing waste at the WRAP facility.

6.2 Prohibited Waste

The following waste types are not accepted at the WRAP facility (see Section 2.3):

- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20°C (68°F), except for pressurized aerosol cans which can be accepted (DOE M 435.1-1). Additional requirements related to these criteria are listed in Section 2.11.4.
- Liquid waste, except if packaged in lab packs or overpacks in quantities less than or equal to 57 L (15 gal) per outer container.

6.3 Packaging Criteria

The following subsections describe the packaging criteria for acceptance at the WRAP facility.

6.3.1 Protective Coatings and Liners for Stored Waste

The packaging for mixed waste to be stored shall include the following 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 WFMP 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.

Table 6-1. Waste Removal and Processing Facility Dangerous Waste Numbers

Characteristic Waste "D" Series	Nonspecific Source "F" Series	Discarded Chemical Product "U" Series	Discarded Chemical Product "P" Series	Washington State-Only "W" Series
D001–D043	F001–F012	U001–U012	P001–P006	WT01
	F019–F023	U014–U039	P008–P018	WT02
	F026–F028	U041–U053	P020–P024	WP01
	F039	U055–U064	P026–P031	WP02
		U066–U099	P033	WP03
		U101–U103	P034	WPCB
		U105–U138	P036–P051	WSC2
		U140–U174	P054	
		U176–U194	P056–P060	
		U196	P062–P078	
		U197	P081	
		U200–U211	P082	
		U213–U223	P084	
		U225–U228	P085	
		U231–U240	P087–P089	
		U243–U244	P092–P099	
		U246–U249	P101–P106	
		U271	P108–P116	
		U278–U280	P118–P123	
		U328	P127	
		U353	P128	
		U359	P185	
		U364	P188–P192	
		U367	P194	
		U372	P196–P199	
		U373	P201–P205	
		U376		
		U387		
		U389		
		U394		
		U395		
		U401–U404		
		U407		
		U409–U411		

Notes:

Acceptable dangerous waste numbers may be added or deleted at any time due to changes in regulations. See the currently approved Dangerous Waste Permit Application, Part A Form, Section XIV, "Description of Dangerous Waste," to verify the dangerous waste numbers acceptable at the WRAP facility.

6.3.2 Noncombustible Containers

Outer containers shall be constructed of metal, except that fire-retardant wooden boxes can be used for LLW only. Wooden boxes shall be constructed of wood that is either (1) pretreated wood having the Underwriters Laboratories FR-S stamp, or (2) painted with a fire-retardant paint that has been approved by Underwriters Laboratories or Factory Mutual. Additionally, wooden boxes must be overpacked in a metal box for NDA at the WRAP.

6.3.3 Package Size Limits

The container sizes that can be handled at WRAP are described in the following subsections. These dimensions are absolute dimensions including any attachments such as lifting bails, lid flanges, or pallets if they are necessary in order to handle the container.

6.3.3.1 Nondestructive Examination

- Drums and other cylindrical containers not exceeding 1.61 m (5 ft 3.5 in.) in diameter and 1.64 m (5 ft 4.75 in.) tall.
- Boxes must be less than 2.90 m (9 ft 6 in.) long; must be less than 1.61 m (5 ft 3.5 in.) wide at bottom; above 0.6 m (2 ft) from bottom must be less than 1.93 m (6 ft 4 in.) wide; and must be less than 1.64 m (5 ft 4.75 in.) high.

6.3.3.2 Nondestructive Assay

- Drums and other cylindrical containers not exceeding 1.39 m (54.7 in.) in diameter and 0.99 m (39 in.) tall.
- Boxes not exceeding 1.83 m (72 in.) long by 1.39 m (54.7 in.) wide and 0.99 m (39 in.) tall.

6.3.4 Package Weight Limits

The maximum weights for containers handled at WRAP are as follows:

- NDE: 3,175 kg (7,000 lb)
- NDA: 1,814.3 kg (4,000 lb)

6.3.5 Labeling

Packages shall be labeled as described in Appendix C.

6.4 Package Dose Rate Limits

Containers with dose rates less than or equal to 2 milliSieverts/hr (200 millirem/hr) at contact and less than 1 milliSievert/hr (100 millirem/hr) at 30 cm (11.8 in.) are acceptable at WRAP. Containers exceeding these limits may be acceptable but will require container-specific review and approval by WRAP Operations.

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Appendix A

Radiological Calculation Methods

Terms

DE-Ci	dose equivalent curies
DOE	U.S. Department of Energy
FGE	fissile gram equivalent
ICRP	International Commission of Radiation Protection
MDSA	master documented safety analysis
NL	no applicable limit
TRU	transuranic
TSD	treatment, storage, and/or disposal
WFMP	Waste & Fuels Management Project
WIPP	Waste Isolation Pilot Plant

A1 Radiological Calculation Methods

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

- All major radionuclides in the waste, as defined in Section 2.5.1, must be considered in the calculations. If there is a major radionuclide in the waste that is not listed in Table A-1 and Table A-2 (Section A3), the generator must notify the Waste & Fuels Management Project (WFMP) acceptance organization to calculate the applicable limits and conversion factors.
- If a daughter radionuclide has a half-life less than 10 days and the parent radionuclide has a half-life greater than the daughter, the activity of the daughter should not be considered in the calculations.
- The volume of the outer waste container shall be used when limits are expressed in volume concentration. For example, a generator packaging a 1-L (0.001-m^3) jar inside of a 208-L (55-gal) drum (0.208 m^3 [0.7 ft^3]) would use the 0.208-m^3 (0.7-ft^3) volume for radiological calculation purposes. An additional example is a concrete lined 208-L (55-gal) drum (0.208 m^3 [0.7 ft^3]) having a 0.15-m^3 (0.5-ft^3) waste capacity. The generator would again use 0.208 m^3 (0.7 ft^3) for the radiological calculation volume. If the waste is not containerized, the volume is the anticipated volume the waste will occupy in the TSD unit.

A1.1 Transuranic Waste Determination

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

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

A1.2 Calculation of Plutonium-239 Fissile Gram Equivalents

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

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

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

- Sum the FGE for each fissionable isotope to a total FGE for all isotopes.

If there is more than 1 g (0.03 oz) of uranium-235, the WFMP facility criticality safety representative could use an alternate method for determining the FGE for uranium-235 in specific cases as discussed in Appendix B. Natural uranium (i.e., 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent)

are normally exempt for criticality purposes at WFMP TSD units; however, the FGE from uranium-235 is counted for acceptance at the Waste Isolation Pilot Plant (WIPP).

A1.3 Calculation of Thermal Power

The thermal power of the waste in a container is calculated from the concentration of radionuclides in the waste and the heat of decay from Table A-1. The thermal power calculation is performed using the following steps: The concentration of each isotope is multiplied by the heat of decay for that isotope from the value in Table A-1, yielding the thermal power for each isotope.

Isotope concentration (curies per m^3) x decay heat (watts/curie) = decay heat (watts per m^3)

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

A1.4 Category 1 Determination

Classification of waste as Category 1 or greater than Category 1 is a sum of fractions calculation. The concentration of each isotope (expressed in curies per m^3) is divided by its respective Category 1 limit from Table A-2.

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

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

A1.5 Category 3 Determination

Category 3 determination is performed in the same way as the Category 1 calculation (using only the Category 3 limits from Table A-2). The concentration of each isotope (expressed in curies per m^3) is divided by its respective Category 3 limit from Table A-2.

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

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

A1.6 Mobile Radionuclide Reporting

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

A1.7 Calculating Dose Equivalent Curies

Calculating dose equivalent curies (DE-Ci) is a method of normalizing the exposure risk of various isotopes. Calculating the DE-Ci of a waste container is performed by multiplying the activity (in curies) of each isotope in a given container by its respective International Commission of Radiation Protection (ICRP) 71 Correction Factor from Table A-1.

The total DE-Ci of the waste package is the sum of the DE-Ci values for all isotopes in the waste multiplied by the assigned master documented safety analysis (MDSA) DE-Ci factor (default value is 1.0). An MDSA DE-Ci Factor other than 1 may be applied based on the package factors described in Appendix 3B of the MDSA (HNF-14741). The package factors are used to adjust the effective amount of material at

risk. This is justified in those cases where the robustness of the waste packaging and dispersibility of the waste form are sufficiently different than the waste form and container used in the original analysis to adjust the facility or container DE-Ci limits.

A1.8 Calculating Plutonium-239 Equivalent Curies

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

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A3 Tables

Table A-1. Conversion Factors for General Radiological Calculations

Isotope	Half-Life (Second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[a,d]
H-3	3.891 E+08	9.613 E+03	3.383 E-05	5.20 E-06
Be-7	4.605 E+06	3.491 E+05	1.996 E-03	1.00 E-06

Table A-1. Conversion Factors for General Radiological Calculations

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

Table A-1. Conversion Factors for General Radiological Calculations

Isotope	Half-Life (Second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[a,d]
Se-79	2.051 E+12	6.969 E-02	6.019 E-04	2.20 E-05
Sr-82	2.208 E+06	6.237 E+04	7.665 E-05	4.20 E-05
Rb-83	7.448 E+06	1.827 E+04	2.934 E-03	1.38 E-05
Rb-84	2.831 E+06	4.749 E+04	6.236 E-03	2.00 E-05
Kr-85	3.383 E+08	3.927 E+02	1.498 E-03	0.00 E+00
Sr-85	5.603 E+06	2.371 E+04	3.128 E-03	7.60 E-06
Rb-86	1.612 E+06	8.145 E+04	4.518 E-03	1.86 E-05
Y-88	9.213 E+06	1.393 E+04	1.603 E-02	8.20 E-05
Sr-89	4.365 E+06	2.907 E+04	3.460 E-03	2.00 E-05
Sr-90[a]	9.037 E+08	1.388 E+02	6.695 E-03	4.80 E-04
Nb-91	2.146 E+10	5.783 E+00	1.021 E-04	2.20 E-04
Mo-93	9.504 E+10	1.278 E+00	9.834 E-05	2.00 E-05
Nb-93m	5.089 E+08	2.386 E+02	1.834 E-04	1.02 E-05
Zr-93	4.828 E+13	2.515 E-03	1.130 E-04	5.00 E-04
Nb-94	6.307 E+11	1.905 E-01	1.031 E-02	2.20 E-04
Nb-95	3.022 E+06	3.934 E+04	4.795 E-03	3.00 E-05
Zr-95[a]	5.532 E+06	2.149 E+04	5.047 E-03	5.00 E-05
Tc-99	6.668 E+12	1.711 E-02	5.986 E-04	5.80 E-06
Ru-103[a]	3.392 E+06	3.232 E+04	3.578 E-03	9.60 E-06
Ru-106[a]	3.181 E+07	3.349 E+03	9.670 E-03	1.58 E-04
Pd-107	2.050 E+14	5.148 E-04	5.513 E-05	5.00 E-07
Ag-108m[a]	1.319 E+10	7.926 E+00	1.008 E-02	1.22 E-04
Cd-109	3.997 E+07	2.592 E+03	1.237 E-04	1.62 E-04
Ag-110m[a]	2.158 E+07	4.756 E+03	1.687 E-02	1.10 E-04
Cd-113m	4.323 E+08	2.311 E+02	1.086 E-03	2.20 E-03
Sn-113[a]	9.944 E+06	1.005 E+04	2.498 E-03	1.08 E-05
Sn-119m	2.532 E+07	3.748 E+03	5.313 E-04	5.60 E-06
Sn-121m	1.736 E+09	5.376 E+01	2.396 E-04	1.60 E-05
Te-121	1.450 E+06	6.435 E+04	3.471 E-03	4.80 E-06
Te-123	3.154 E+20	2.911 E-10	1.342 E-05	7.80 E-05

Table A-1. Conversion Factors for General Radiological Calculations

Isotope	Half-Life (Second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[a,d]
Sb-124	5.205 E+06	1.749 E+04	1.331 E-02	2.60 E-05
I-125	5.135 E+06	1.759 E+04	3.655 E-04	1.02 E-04
Sb-125	8.707 E+07	1.037 E+03	3.150 E-03	2.80 E-05
Te-125m	5.011 E+06	1.802 E+04	8.582 E-04	1.02 E-05
Sb-126	1.071 E+06	8.363 E+04	1.847 E-02	2.00 E-05
Sn-126[a]	3.156 E+12	2.839 E-02	1.056 E-03	2.20 E-04
Te-127m[a]	9.418 E+06	9.440 E+03	1.870 E-03	3.00 E-05
I-129	4.951 E+14	1.768 E-04	4.633 E-04	7.20 E-04
Te-129m[a]	2.920 E+06	2.997 E+04	4.127 E-03	2.60 E-05
Xe-131m	1.028 E+06	8.382 E+04	9.622 E-04	0.00 E+00
Ba-133	3.337 E+08	2.544 E+02	2.705 E-03	3.00 E-05
Cs-134	6.517 E+07	1.293 E+03	1.018 E-02	1.32 E-04
Cs-135	7.574 E+13	1.104 E-03	3.964 E-04	1.38 E-05
Cs-136	1.137 E+06	7.300 E+04	2.326 E-03	2.40 E-05
Cs-137[a]	9.521 E+08	8.655 E+01	4.816 E-03	9.20 E-05
Ba-140[a]	1.101 E+06	7.326 E+04	2.236 E-02	2.00 E-05
Ce-141	2.808 E+06	2.851 E+04	1.467 E-03	6.40 E-05
Ce-144[a]	2.462 E+07	3.185 E+03	7.996 E-03	7.20 E-04
Nd-147	9.487 E+05	8.094 E+04	2.432 E-03	4.80 E-05
Pm-147	8.278 E+07	9.277 E+02	3.676 E-04	1.00 E-04
Sm-147	3.343 E+18	2.297 E-08	1.361 E-02	1.92 E-01
Eu-150	1.079 E+09	6.977 E+01	9.532 E-03	3.80 E-06
Sm-151	2.840 E+09	2.632 E+01	1.179 E-04	8.00 E-05
Eu-152	4.267 E+08	1.740 E+02	7.667 E-03	8.40 E-04
Gd-152	3.406 E+21	2.180 E-11	1.303 E-02	3.80 E-01
Gd-153	2.091 E+07	3.528 E+03	8.622 E-04	4.20 E-05
Eu-154	2.712 E+08	2.703 E+02	9.009 E-03	1.06 E-03
Eu-155	1.529 E+08	4.762 E+02	7.749 E-04	1.38 E-04
Tm-170	1.111 E+07	5.975 E+03	1.982 E-03	1.40 E-04
Hf-175	6.048 E+06	1.066 E+04	2.422 E-03	1.44 E-05

Table A-1. Conversion Factors for General Radiological Calculations

Isotope	Half-Life (Second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[a,d]
Hf-181	3.662 E+06	1.703 E+04	4.357 E-03	2.80 E-05
Ta-182	9.910 E+06	6.257 E+03	8.890 E-03	1.52 E-04
W-185	6.489 E+06	9.401 E+03	7.520 E-04	2.40 E-06
Re-187	1.577 E+18	3.827 E-08	3.913 E-06	4.00 E-08
Au-195	1.608 E+07	3.599 E+03	7.629 E-04	1.32 E-06
Hg-203	4.026 E+06	1.381 E+04	1.997 E-03	1.12 E-05
Tl-204	1.196 E+08	4.624 E+02	1.407 E-03	7.80 E-06
Bi-207	1.002 E+09	5.438 E+01	9.829 E-03	1.12 E-04
Pb-210	7.037 E+08	7.634 E+01	2.661 E-04	1.80 E-02
Po-210	1.196 E+07	4.493 E+03	3.206 E-02	1.22 E-02
Ra-226	5.049 E+10	9.885 E-01	2.888 E-02	7.00 E-02
Ac-227	6.871 E+08	7.232 E+01	5.021 E-04	1.10 E+01
Ra-228	1.815 E+08	2.727 E+02	1.391 E-04	5.20 E-02
Th-228	6.037 E+07	8.195 E+02	3.272 E-02	6.40 E-01
Th-229	2.316 E+11	2.127 E-01	3.055 E-02	2.20 E+00
Th-230	2.379 E+12	2.061 E-02	2.822 E-02	8.60 E-01
Pa-231	1.034 E+12	4.723 E-02	3.054 E-02	2.80 E+00
Th-232	4.434 E+17	1.097 E-07	2.426 E-02	9.00 E-01
U-232	2.203 E+09	2.207 E+01	3.210 E-02	7.40 E-01
U-233	5.026 E+12	9.633 E-03	2.912 E-02	1.92 E-01
Th-234	2.082 E+06	2.315 E+04	4.268 E-04	1.32 E-04
U-234	7.754 E+12	6.217 E-03	2.880 E-02	1.88 E-01
U-235	2.221 E+16	2.161 E-06	2.773 E-02	1.70 E-01
Pu-236	9.152 E+07	5.222 E+02	3.478 E-02	4.00 E-01
U-236	7.390 E+14	6.468 E-05	2.712 E-02	1.74 E-01
Np-237	6.753 E+13	7.047 E-04	2.944 E-02	4.60 E-01
Pu-238	2.768 E+09	1.712 E+01	3.315 E-02	9.20 E-01
U-238	1.410 E+17	3.361 E-07	2.532 E-02	1.60 E-01
Pu-239	7.609 E+11	6.202 E-02	3.109 E-02	1.00 E+00
Pu-240	2.071 E+11	2.269 E-01	3.115 E-02	1.00 E+00

Table A-1. Conversion Factors for General Radiological Calculations

Isotope	Half-Life (Second)	Specific Activity[b] (Curies/gram)	Decay Heat[a,c] (Watts/Curie)	ICRP 71 DE-Ci Correction Factor[a,d]
Am-241	1.366 E+10	3.427 E+00	3.343 E-02	8.40 E-01
Pu-241	4.544 E+08	1.030 E+02	3.177 E-05	1.80 E-02
Am-242m	4.450 E+09	1.047 E+01	4.288 E-04	7.40 E-01
Cm-242	1.408 E+07	3.311 E+03	3.682 E-02	1.04 E-01
Pu-242	1.179 E+13	3.954 E-03	2.955 E-02	9.60 E-01
Am-243	2.324 E+11	1.997 E-01	3.225 E-02	8.20 E-01
Cm-243	9.467 E+08	4.903 E+01	3.683 E-02	6.20 E-01
Cm-244	5.712 E+08	8.093 E+01	3.499 E-02	5.40 E-01
Pu-244	2.525 E+15	1.831 E-05	2.909 E-02	9.40 E-01
Cm-245	2.682 E+11	1.716 E-01	3.334 E-02	8.40 E-01
Cm-246	1.493 E+11	3.072 E-01	3.282 E-02	8.40 E-01
Bk-247	4.352 E+10	1.049 E+00	3.425 E-02	1.38 E+00
Cm-247	5.049 E+14	9.043 E-05	3.174 E-02	7.80 E-01
Cm-248	1.073 E+13	4.239 E-03	1.244 E-01	3.00 E+00
Cf-249	1.108 E+10	4.089 E+00	3.945 E-02	1.40 E+00
Cf-250	4.128 E+08	1.093 E+02	3.727 E-02	6.80 E-01
Cm-250	2.525 E+11	1.787 E-01	8.263 E-01	1.68 E+01
Cf-251	2.834 E+10	1.586 E+00	3.663 E-02	1.42 E+00
Cf-252	8.347 E+07	5.362 E+02	7.258 E-02	4.00 E-01
Es-254	2.380 E+07	1.865 E+03	5.779 E-02	1.72 E-01

Notes:

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

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

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

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

c. Decay heat: ORIGEN database.

d. ICRP 71 Factor: HNF-14741, *Master Documented Safety Analysis (MDSA) for the Solid Waste Operations Complex (SWOC)*, as amended, CH2M Hill Plateau Remediation Company, Richland, Washington. (Use most current version.)

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

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

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

Isotope	Mobile Radionuclide Reporting Limit (Curies per m^3)	Category 1 Waste Limit (Curies per m^3)	Category 3 Waste Limit (Curies per m^3)
Ni-63	NL	5.9 E+00	2.0 E+04
Ni-63 activated metal[a]	NL	5.9 E+01	2.0 E+05
Zn-65	NL	NL	NL
Ge-68	NL	NL	NL
Se-75	NL	NL	NL
Se-79	3.4 E-05	5.1 E-01	1.1 E+02
Sr-82	NL	NL	NL
Rb-83	NL	NL	NL
Rb-84	NL	NL	NL
Kr-85	NL	NL	NL
Sr-85	NL	NL	NL
Rb-86	NL	NL	NL
Y-88	NL	NL	NL
Sr-89	NL	NL	NL
Sr-90[c]	NL	1.6 E-02	5.4 E+04
Nb-91	NL	2.0 E+00	6.3 E+02
Mo-93	2.1 E-04	8.7 E-01	2.0 E+02
Nb-93m	NL	NL	NL
Zr-93	NL	2.50 E+00	5.40 E+02
Nb-94	NL	2.2 E-04	4.8 E-02
Nb-94 activated metal[a]	NL	2.2 E-03	4.8 E-01
Nb-95	NL	NL	NL
Zr-95[c]	NL	NL	NL
Tc-99	2.1 E-04	2.3 E-02	5.0 E+00
Ru-103[c]	NL	NL	NL
Ru-106[c]	NL	NL	NL
Pd-107	NL	1.5 E+01	3.3 E+03
Ag-108m	NL	NL	NL
Cd-109	NL	NL	NL
Ag-110m[c]	NL	NL	NL
Cd-113m	NL	7.6 E-01	NL

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

Isotope	Mobile Radionuclide Reporting Limit (Curies per m^3)	Category 1 Waste Limit (Curies per m^3)	Category 3 Waste Limit (Curies per m^3)
Sn-113[c]	NL	NL	NL
Sn-119m	NL	NL	NL
Sn-121m	NL	6.7 E-01	2.2 E+04
Te-121	NL	NL	NL
Te-123	NL	NL	NL
Sb-124	NL	NL	NL
I-125	NL	NL	NL
Te-125m	NL	NL	NL
Sb-125	NL	NL	NL
Sb-126	NL	NL	NL
Sn-126[c]	NL	1.6 E-04	3.4 E-02
Te-127m[c]	NL	NL	NL
I-129	1.0 E-06	8.5 E-03	1.8 E+00
Te-129m[c]	NL	NL	NL
Xe-131m	NL	NL	NL
Ba-133	NL	7.1 E-01	NL
Cs-134	NL	NL	NL
Cs-135	NL	1.6 E-01	3.5 E+01
Cs-136	NL	NL	NL
Cs-137[c]	NL	5.5 E-03	1.2 E+04
Ba-140[c]	NL	NL	NL
Ce-141	NL	NL	NL
Ce-144[c]	NL	NL	NL
Nd-147	NL	NL	NL
Pm-147	NL	NL	NL
Sm-147	NL	1.7 E-02	3.7 E+00
Eu-150	NL	1.4 E-03	6.7 E+02
Sm-151	NL	4.6 E+01	2.1 E+05
Eu-152	NL	4.8 E-02	NL
Gd-152	NL	6.4 E-03	1.4 E+00
Gd-153	NL	NL	NL

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

Isotope	Mobile Radionuclide Reporting Limit (Curies per m^3)	Category 1 Waste Limit (Curies per m^3)	Category 3 Waste Limit (Curies per m^3)
Eu-154	NL	7.5 E-01	NL
Eu-155	NL	NL	NL
Tm-170	NL	NL	NL
Hf-175	NL	NL	NL
Hf-181	NL	NL	NL
Ta-182	NL	NL	NL
W-185	NL	NL	NL
Re-187	3.3 E-02	3.6 E+01	7.8 E+03
Au-195	NL	NL	NL
Hg-203	NL	NL	NL
Tl-204	NL	NL	NL
Bi-207	NL	1.7 E-03	1.44 E+03
Pb-210	NL	3.7 E-02	2.1 E+06
Po-210	NL	NL	NL
Ra-226	NL	1.7 E-04	4.3 E-02
Ac-227	NL	4.2 E-03	3.0 E+05
Ra-228	NL	1.7 E+01	NL
Th-228	NL	NL	NL
Th-229	NL	4.4 E-04	9.8 E-02
Th-230	NL	2.1 E-03	1.5 E-01
Pa-231	NL	1.4 E-04	3.0 E-02
Th-232	NL	1.1 E-04	2.3 E-02
Total U	1.4 E-05	NL	NL
U-232	See Total U	4.6 E-04	4.6 E+00
U-233	See Total U	7.4 E-03	9.7 E-01
Th-234	NL	NL	NL
U-234	See Total U	8.9 E-03	1.9 E+00
U-235	See Total U	2.8 E-03	5.0 E-01
Pu-236	NL	NL	NL
U-236	See Total U	9.5 E-03	2.0 E+00
Np-237[b]	1.1 E-05	6.8 E-04	1.5 E-01

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

Isotope	Mobile Radionuclide Reporting Limit (Curies per m^3)	Category 1 Waste Limit (Curies per m^3)	Category 3 Waste Limit (Curies per m^3)
Pu-238[b]	NL	4.7 E-03	2.4 E+01
U-238	See Total U	5.7 E-03	1.2 E+00
Pu-239[b]	NL	1.9 E-03	4.2 E-01
Pu-240[b]	NL	1.9 E-03	4.3 E-01
Am-241[b]	NL	2.1 E-03	8.5 E-01
Pu-241	NL	6.1 E-02	2.5 E+01
Am-242m[b]	NL	1.9 E-03	1.6 E+00
Cm-242	NL	NL	NL
Pu-242[b]	NL	2.0 E-03	4.3 E-01
Am-243[b]	NL	1.0 E-03	2.3 E-01
Cm-243[b]	NL	1.8 E-02	3.4 E+02
Cm-244	NL	1.4 E-01	1.6 E+02
Pu-244[b]	NL	6.1 E-04	1.3 E-01
Cm-245[b]	NL	1.3 E-03	2.2 E-01
Cm-246[b]	NL	1.8 E-03	4.2 E-01
Bk-247[b]	NL	1.5 E-03	3.8 E-01
Cm-247[b]	NL	5.6 E-04	1.2 E-01
Cm-248[b]	NL	5.1 E-04	1.1 E-01
Cf-249[b]	NL	7.8 E-04	3.6 E-01
Cf-250	NL	3.8 E-01	1.5 E+02
Cm-250[b]	NL	9.3 E-05	2.1 E-02
Cf-251[b]	NL	1.3 E-03	3.8 E-01
Cf-252	NL	NL	NL
Es-254	NL	NL	NL

Source:

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

a. Limit for isotope in activated metal.

b. TRU isotope (half-life >20 years).

c. Daughters with half-life less than 10 days and with parent radionuclide half-life greater than the daughter are not reportable.

Appendix B

Fissionable Material Content Limits

Terms

AK	acceptable knowledge
CPS	criticality prevention specification
CSER	criticality safety evaluation report
CSR	criticality safety representative
CWC	Central Waste Complex
FGE	fissile gram equivalent
H/X	hydrogen to fissile atom ratio
HEPA	high-efficiency particulate air
LLBG	Low-Level Burial Grounds
NDA	nondestructive assay
SWB	standard waste box
SWOC	Solid Waste Operations Complex
TDOP	ten drum overpack
TMU	total measurement uncertainty
TRU	transuranic
TSD	treatment, storage, and/or disposal
WIPP	Waste Isolation Pilot Plant
WFMP	Waste & Fuels Management Project
WRAP	Waste Receiving and Processing

B1 Fissionable Material Content Limits

The following subsections describe the limits for fissionable material content in waste packages or bulk waste sent to treatment, storage, and/or disposal (TSD) units covered by the criteria provided in this document. Fissionable material inventories for a given container shall be restricted to ensure that they do not exceed the applicable fissionable material limit, including measurement uncertainty. For some waste packages, the generator must provide distribution of the fissionable material or moderating materials in the container to determine the applicable specification and whether criticality limits are met. Meeting criticality limits does not ensure that the container will be accepted because Waste Isolation Pilot Plant (WIPP) and disposal limits may be more restrictive.

B1.1 Exempt Materials

Waste packages (55 gallon or larger) or bulk waste shipments are exempt from criticality safety controls and fissile labeling at all TSD units if the fissile gram equivalent (FGE) for the contained fissionable material is less than 15 FGE. Natural uranium (i.e., up to 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent) is normally exempt for criticality purposes at the TSD units; however, the total mass of uranium-235 is counted for WIPP acceptance.

B1.2 Measurement Uncertainty for Nonexempt Materials

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

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

- For transuranic (TRU) waste destined for the WIPP, the sum of the measured mass and the mass corresponding to the 2 sigma total measurement uncertainty shall be less than the fissile material quantity limits in Table G-2.

For measurements of fissionable material under a critical mass limit, where the accuracy of the fissile mass measurement method is determined from nondestructive assay (NDA) measurements performed in accordance with PRC-RD-EN-10484 or equivalent NDA quality assurance program, the measured FGE plus one total measurement uncertainty (TMU) shall not exceed the values for a qualified program in Table B-2 (presented at the end of this appendix). The TMU of any measurement system shall not exceed 30 percent for any container with a measured value (without measurement uncertainty applied) greater than 100 FGE when establishing compliance with the Table B-2 FGE limits.

The acceptance of containers based on methods not equivalent to PRC-RD-EN-10484 may be allowed based on Waste & Fuels Management Project (WFMP) criticality representative review for acceptability under the alternative acceptable knowledge (AK) values specified in Table B-2.

B1.3 Non-Exempt Materials in Standard Containers

Certain non-exempt materials in standard packaging configurations (per Table B-2) are acceptable at the Low-Level Burial Grounds (LLBG), the Central Waste Complex (CWC), the T Plant Complex, and the Waste Receiving and Processing (WRAP) Facility. The fissionable material limits are expressed in plutonium-239 FGE as defined in HNF-5134, *CSER 00-005, Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, and as described in Section A1.2. Table B-1, presented at the end of this appendix, is used to determine the total FGE of fissionable material in a waste container by multiplying the gram quantity of each listed isotope by the correction factor and summing the results.

Some of the specific container limits are shown in Table B-2, which addresses the most common containers and criticality prevention specifications (CPSs). Additional requirements are detailed in the CPSs. Other container limits or acceptable configurations may be available. Exceptions can be requested as specified in Section 1.6. If a new criticality safety evaluation report (CSER) is required for a new waste stream, the generator will need to provide funding for performing the evaluation.

Assumptions and controls from the CSER for box receipt and storage, in addition to the total fissile content specified in Table B-2 that must be met, include the following for each box (other containers, which are not technically boxes, may be accepted under the box CSER as long as the containers meet these requirements):

- Box must be of robust construction and resistant to water intrusion.
- Content typically is flushed or drained equipment (e.g., pumps, piping, hoods, and glove boxes, etc.), high-efficiency particulate air (HEPA) filters, drums, or boxes.
- Although additional liquids may be acceptable at the Solid Waste Operations Complex (SWOC), box acceptance normally is limited to 1 percent, of the volume and free liquid 2 L (0.53 gal), or less to limit repackaging.

Note that for disposal of non-TRU waste in the LLBG containers are also limited to 128.5 FGE per drum equivalent volume and 42.4 FGE per ft^2 cross sectional area (CPS-SW-008).

B1.4 Non-Exempt Materials in Non-Standard Containers or Bulk Waste

Waste packages that have non-exempt quantities of fissionable material but are not in Table B-2 standard containers (e.g., in 114-L [30-gal] drums, concrete or wooden boxes, small boxes, ion exchange modules, or bulk waste shipments) may still be received for storage and disposal. Non-TRU waste packages of this type may be accepted up to a maximum of 128.5 FGE, per 55 gal drum equivalent volume and 42.4 FGE per ft^2 cross sectional area (CPS-SW-008) for disposal. Other transportation limits might apply to the entire shipment.

B1.5 Non-Exempt Quantities of Fissionable Radionuclides in Other Configurations

Limits for configurations other than those shown in Sections B1.4 and B1.5 may already be available or may be requested as described in Section 1.6. If a new CSER is required for a new waste stream, the generator will need to provide funding for performing the evaluation.

B1.6 Calculation of Uranium-235 FGE

CSER 00-005 provides a detailed method for calculating FGE, that takes into account the poisoning effect of uranium-238 in special cases. The maximum enrichment, or actual distribution for a mixture of enrichments, is required to perform this calculation. If uranium is not a significant factor, FGE may be calculated as discussed in Section A1.2 or Section B1.4. The uranium-235 FGE value for the uranium in a waste package is calculated by one of the following methods:

- The FGE for uranium-235 may be calculated using the conversion factor in Table B-1. Uranium-235 also may be excluded in calculating FGE if it is in natural or depleted uranium (less than or equal to 0.72 weight percent uranium-235 in uranium); however, the FGE from uranium-235 is counted for WIPP acceptance. The WFMP facility criticality safety representative may also exempt homogeneous uranium solutions in solid or liquid form up to 1.0 weight percent enrichment of uranium-235.

- The FGE for uranium-235 may be conservatively calculated by including all uranium-235 present with no exemptions on a 1 gram = 1 FGE basis. This conservative method of conversion was typically used for older waste packages.

B2 References

CPS-SWOC-001, *Criticality Prevention Specification: SWOC Storage, Movement, and Non-Intrusive Operations*, CH2M HILL Plateau Remediation Company, Richland, Washington.

CPS-SW-008, *Criticality Prevention Specification: Burial of Non-TRU Fissile Material in the Lined Trenches*, Fluor Hanford, Inc., Richland, Washington.

HNF-5134, 2010, CSER 00-005: *Fissile Gram Equivalence for Hanford Solid Waste Operations*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

HNF-7098, *Criticality Safety Program,* as amended, CH2M HILL Plateau Remediation Company, Richland, Washington. (Use most current version.)

PRC-RD-EN-10484, 2009, *Nondestructive Assay Management Program*, as amended, CH2M HILL Plateau Remediation Company, Richland, Washington.

B3 Tables

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

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

*Value used for U233 when calculating for U235.

Source: Section 5.0 in HNF-5134, 2010, CSER 00-005: *Fissile Gram Equivalence for Hanford Solid Waste Operations*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

Table B-2. Summary of Fissile Material Limits for Standard Waste Containers

Container	Additional Container or Content Specifications	Maximum FGE Without Handling Restrictions (CPS-SWOC-001)	Maximum FGE with Handling Restrictions (CPS-SWOC-001)	Maximum WIPP FGE
208-L (55-gal) Drum or Larger	FGE Based on Qualified Program *<32 kg Pb, <140 kg drum weight*	250	340	200[a]/100[b]
	FGE Based on AK *<32 kg Pb, <140 kg drum weight*	128	179	Not acceptable
	FGE Based on Qualified Program *>32 kg Pb, <800 kg drum weight*	216	340	200[a]/100[b]
	FGE Based on AK *>32 kg Pb, <800 kg drum weight*	108	179	Not acceptable
	FGE Based on Qualified Program *No Weight Limit*	180	250	Not acceptable
	FGE Based on AK *No Weight Limit*	87	128	Not acceptable
	Liquid Lab Pack with FGE per Qualified Program	170	Non specified	Not acceptable
	Liquid Lab Pack with FGE Based on AK	80	Non specified	Not acceptable
WIPP SWB and Other Boxes (Only SWBs are Allowed for WIPP)	SWB with Unrestricted H/X and FGE Based on Qualified Program	325-380	325-380	100-325[c]
	Waste Box with Minimum Dimension of (2.5 ft) and FGE Based on Qualified Program	250	1,000	100-325[c] (SWB only)
	Waste Box with Minimum Dimension of (2.5 ft) and FGE Based on AK	125	500	Not acceptable
TDOP	Up to 10 Drums with FGE Based on a Qualified Program	325	325	325

Notes:

250 FGE for SWB containing machine compacted waste, ≤1% by wt. Be or BeO.

100 FGE for SWB containing greater than 1% by wt. Be or BeO.

All measured FGE limits include uncertainty (2 TMU for WIPP; 1 TMU for SWOC).

WIPP and SWOC acceptance of SWBs over 325 FGE up to 380 FGE is dependent on the ^{240}Pu content.

Table B-2. Summary of Fissile Material Limits for Standard Waste Containers

Container	Additional Container or Content Specifications	Maximum FGE Without Handling Restrictions (CPS-SWOC-001)	Maximum FGE with Handling Restrictions (CPS-SWOC-001)	Maximum WIPP FGE
Exceptions for fissile containers: • Drums over 200 FGE may be acceptable at WIPP when overpacked in an SWB or a TDOP. • Non-steel drums are allowed with WFMP CSR concurrence, but handling restrictions may be required. • Waste storage drums are assumed to have nominal dimensions of 84.46 cm (33.25 in.) inner height, 88.9 cm (35 in.) outer height, 57.15 cm (22.5 in.) inner diameter, and 60.96 cm (24 in.) outer diameter. Drums smaller than these dimensions may be allowed only if overpacked in a container meeting this assumption. • Fissile boxes smaller than 1.5 m x 1.2 m x 0.9 m (5 ft x 4 ft x 3 ft) (L x W x H) may be allowed with WFMP CSR concurrence. • Over 2.2 L (0.58 gal) liquid in a container may be allowed with WFMP CSR concurrence, but FGE limits may be reduced and handling restrictions may be required. • Other containers may be acceptable at SWOC based on specific CSERs. • SWOC normally excludes depleted or natural uranium from FGE calculations, but WIPP does not. Additional process controls may be required by the applicable CPSs. Additional disposal requirements apply (CPS-SW-008). a. 200 FGE for 55, 85, or 100 gal drums containing less than 1% by wt. Be or BeO. b. 100 FGE for 55, 85, or 100 gal drums containing greater than 1% by wt. Be or BeO. c. 325 FGE for SWB containing less than 1% by wt. Be or BeO.				

Appendix C

Labeling of Waste Containers

Terms

CIN	container identification number
DOT	U.S. Department of Transportation
PCB	polychlorinated biphenyl

C1 Labeling of Waste Containers

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

C1.1 Bar Code

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

- For containers purchased through the Hanford Site procurement system, the bar code will be attached to the containers when the containers are received at the Central Stores warehouse. The CIN is a unique seven-digit number.
- 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: (1) "Facility ID-Year-Sequential #," where the Facility ID is the generating facility's unique four-character (letter and/or number) identifier, (2) "Year" is the last two digits of the year the CIN was assigned, and (3) "Sequential #" is the generator's sequential numbering of containers for that year.
- For offsite generators, a bar code will be attached when the container is received on the Hanford Site. The CIN will be the unique container identification number provided by the waste generator. (NOTE: Offsite generators should contact the Waste & Fuels Management Project acceptance organization for guidance on assigning a unique identification number.)

C1.2 Durability

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

C1.3 Placement of Labels

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

C1.4 Size of Labels

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

C1.5 Labeling Inner Containers in Lab Packs

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

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

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

C2 References

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr61_09.html.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr761_09.html.

49 CFR, "Transportation," *Code of Federal Regulations*, Available at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?type=simple;c=ecfr;cc=ecfr;sid=c7b2238ee3b61d4b0ea97d92cbac750c;idno=49;region=DIV1;q1=49%20CFR;rgn=div5;view=text;node=49%3A1.0.1.1.1.

DOE/RL-2001-36, 2003, *Hanford Sitewide Transportation Safety Document*, Rev. 0-A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/pdwdocs/fsd0001/osti/2002/I0032776.pdf.(Use most current version.)

HNF-PRO-15333, 2007, *Environmental Protection Processes*, Rev. 11, Fluor Hanford, Inc., Richland, Washington.

C3 Tables

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

Label	When Required	Location on Drum	Location on Box
Bar code with container identification number	All containers	Bottom third of drum	Short side of box
Gross weight in kg (kilogram units must appear on label)	All containers	Same side as bar code	Same side as bar code
Applicable DOT labeling	All containers	As specified in 49 CFR	As specified in 49 CFR
Dangerous waste or hazardous waste label	Dangerous and mixed waste containers	Same side as bar code	Same side as bar code
Major risk label(s)[a]	Dangerous and mixed waste containers	Same side as bar code	Same side as bar code
PCB label[b]	Waste that is regulated for PCB content under 40 CFR 761	Same side as bar code	Same side as bar code
Asbestos label	As required per 40 CFR 61, Subpart M	Same side as bar code	Same side as bar code
Solid Waste Information Tracking System-generated fissile label (printed with a barcode printer) and fissile trefoil label (or symbol)[c]	Containers with 15 FGE or more fissionable material	Same side as bar code	Same side as bar code

Sources:

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

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

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

DOE/RL-2001-36, 2003, *Hanford Sitewide Transportation Safety Document,* U.S. Department of Energy, Richland Operations Office, Richland, Washington. (Use most current version).

a. Refer to Table C-2 for major risk labeling of dangerous, mixed, and transuranic mixed waste.

b. Label in accordance with 40 CFR 761.40 and 40 CFR 761.45. The label placed on containers holding PCB items must include the date the item was removed from service. For PCB articles and containers, the label must include the date the waste was placed into storage, including 30-day temporary storage areas.

c. These labels might conflict with the DOT fissile label; for shipments of waste from offsite and many onsite generators, labels should be placed on the containers at the time the waste arrives on the Hanford Site or at the receiving facility.

d. For packages shipped within a Special Packaging Zone as allowed by DOE/RL-2001-36, the minimum marking and labeling requirements are the bar code with the CIN and the gross weight in kg.

Table C-2. Selection of Major Risk Labeling

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

Notes:

Choose the label or marking, or combination of labels or markings, that most clearly communicates the major risk(s) associated with the waste. Markings in Table C-2 must be applied for dangerous waste major risk(s), regardless of the DOT radioactive labeling status. If the dangerous waste is only DOT radioactive hazard class 7, the "Dangerous Waste" or "Hazardous Waste" marking suffices as the dangerous waste major risk. DOT labels must be used when required by the DOT.

Appendix D

Selection of Compatible Containers, Coatings, and Liners

Terms

HPC	high performance coating
LDR	land disposal restrictions
LPC	low performance coating
MPC	medium performance coating
TRU	transuranic
WAC	*Washington Administrative Code*

D1 Selection of Compatible Containers, Coatings, and Liners

The 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, and 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, and dry waste), and the anticipated length of storage.

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

Hanford Site procurement specifications for metal drums (HNF-7403) and boxes (HNF-7656) identify several options for container coatings, with varying degrees of chemical resistance. The document WHC-SD-TP-ES-002, *Justification for Packaging Acceptance Criteria,* describes a set of standard packages from the Hanford Site that generally will be compatible with the types of waste generated on the Hanford Site. Table D-1, presented at the end of this appendix, 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 the container is compatible with the waste. (NOTE: The Hanford Site specifications and Table D-1 are provided for information purposes only. It is not necessary to select packaging according to Hanford Site specifications.)

D2 References

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

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

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

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

D3 Table

Table D-1. Standard Container/Liner Combinations

Wasted Specification Record Series	Subgroup[a]	Minimum Coatings/Liners[b]
100—Low-level waste	Low-level dry waste for disposal	LPC/no liner
	Low-level absorbed liquids	LPC/10-mil liner
200—TRU waste	Dry debris and soil	LPC/10-mil liner MPC/no liner
	Sorbed or solidified corrosive (acid or caustic) liquids	LPC/90-mil liner HPC/no liner
	Sorbed or solidified noncorrosive liquids, sludges, and wet soil	MPC/10-mil liner LPC/90-mil liner
400—Mixed waste overpacked and lab-packed liquids	Organic liquids (noncorrosive)	MPC/10-mil liner LPC/90-mil liner
	Corrosive (acidic or caustic) or oxidizing liquids	HPC/no liner LPC/90-mil liner
	Other noncorrosive waste	MPC/10-mil liner LPC/90-mil liner
500—Mixed waste solids, sorbed liquids, and soils	Sorbed organic liquids or sludges (noncorrosive)	MPC/10-mil liner LPC/90-mil liner
	Corrosive (acidic or caustic) or oxidizing waste	HPC/no liner LPC/90-mil liner
	Noncorrosive sorbed liquid, sludges, or wet soils	MPC/10-mil liner LPC/90-mil liner
	Noncorrosive dry solids or dry soils	MPC/no liner LPC/10-mil liner
600—Mixed debris waste	Corrosive (acidic or caustic) or oxidizing debris	HPC/no liner LPC/90-mil liner
	Other noncorrosive debris	MPC/no liner LPC/10-mil liner
800—Mixed waste with specific treatment standards	Lead solids, beryllium powder	LPC/no liner
	Elemental mercury	LPC/10-mil (0.6 in.) liner
	Batteries containing acids or caustics	HPC/no liner LPC/90-mil liner
	Other	Case-by-case evaluation
900—State-only mixed waste and LDR-compliant mixed waste	Solid corrosive waste	HPC/no liner LPC/90-mil liner
	Other	MPC/no liner LPC/10-mil liner

Notes:

10-mil liner—10-mil or thicker nylon-reinforced polyethylene liner.

90-mil liner—90-mil or thicker high-density polyethylene rigid liner.

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

Appendix E

Selection and Use of Void Fillers, Sorbents, and Stabilizing Materials

Terms

CFR	*Code of Federal Regulations*
LDR	land disposal restrictions
TRU	transuranic
TRUM	transuranic mixed
WSRd	waste specification record

E1 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 described in Chapter 3 and Chapter 4.

Sorbents and stabilizing materials can be used to meet free liquid requirements or 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 the *Code of Federal Regulations* (CFR) 10 CFR 264.314(e). Table E-1, presented at the end of this appendix, lists the general types of sorbents and stabilizing materials that can be used for major Hanford Site waste streams. Specific products used must meet the definitions of Section E1.1 that have been listed on an approved Waste Profile Sheet.

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

E1.1 General Types of Sorbents and Stabilizing Materials Potentially Allowed

The following general types of sorbents and stabilizing materials are potentially allowed:

- Inorganic mineral sorbents including aluminosilicates, clays, vermiculite, zeolites, lime, silica, diatomaceous earth, perlite, fly ash, and other inorganic materials used for absorption
- High molecular weight synthetic polymers (polymer sorbents) including polyethylene, high-density polyethylene, polypropylene, polyacrylate, and other synthetic polymers (this excludes polymers derived from biological material [e.g., cellulose-based materials], and polymers specifically designed to be degradable)
- Stabilizing materials including concrete, portland cement, lime/pozzolans, and a variety of other inorganic materials.

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

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

E1.2 Selection and Use of Sorbents and Stabilizing Materials

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

- Determine from Table E-1 what general classes of materials can be used and the conditions for use. The allowable types of sorbents for various waste streams are based on the anticipated treatment/disposal methods.
- Select a product that is appropriate for the material to be treated. Generators can request approval of products in the waste stream profile sheet by providing data to support the intended use. Approval of the profile constitutes approval of the product.

- Obtain manufacturer's instructions and limitations for use of the product. It is critical to use sorbents and stabilizing materials in accordance with the manufacturer's instructions. The following information is required:
  - Compatibility of the sorbent or stabilizing material with the waste
  - The recommended ratio of sorbent to waste for the liquid being sorbed
  - For stabilizing materials, the exact ratio of liquid to stabilizing materials and methods of mixing

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

E1.3 Hanford Site Requirements for Use of Sorbents

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

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

E2 References

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_10/40cfr264_10.html.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq. Available at: http://www4.law.cornell.edu/uscode/42/6901.html.

E3 Table

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

Waste Specification Record Series	Subgroup	Allowable Sorbents/Stabilizing Materials
100—Low-level waste	Low-level liquids for disposal	Mineral sorbents Polymer sorbents Stabilizing materials
	Low-level organic liquids (>1%) and chelating agents (>1%) for disposal	Stabilizing materials
200—TRU waste	TRUM waste	Mineral sorbents Polymer sorbents Stabilizing materials
	TRU waste (not mixed)	Mineral sorbents Polymer sorbents Stabilizing materials
400—Mixed waste overpacked and lab packed liquids*	All types	Mineral sorbents Polymer sorbents
500—Mixed waste solids, sorbed liquids and soils	Non-thermal treatment WSRds (520 series)	Mineral sorbents Polymer sorbents
	Thermal treatment WSRds (500 series)	Mineral sorbents Polymer sorbents
600—Mixed debris waste	Thermal treatment WSRds (620 series)	Mineral sorbents Polymer sorbents
	Non-thermal treatment WSRds (640 series)	Mineral sorbents Polymer sorbents
800—Other mixed waste with specific treatment standards	All types	Polymer sorbents (or as specified in waste stream profile)
900—State-only mixed waste and LDR-compliant mixed waste	Thermal treatment WSRds (920 series)	Mineral sorbents Polymer sorbents
	Other WSRds	Mineral sorbents Polymer sorbents

* Sorbent for lab packs is placed around containers, not mixed with liquids.

Appendix F

Radiological Release of Waste

F1 Radiological Release of Waste

Appendix F has been retired. Radiological release information is reflected in the following two documents:

PRC-PRO-RP-20377, *Determination of the Radiological Status of RCRA/TSCA Waste*, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-RP-40026, *Standard Radiological Release Surveys for Material and Equipment*, CH2M HILL Plateau Remediation Company, Richland, Washington.

Appendix G

Contact-Handled Transuranic Waste Acceptance Criteria

Terms

AK	acceptable knowledge
CBFO	Carlsbad Field Office
CH	contact-handled
CH-TRAMPAC	*Contact Handled Transuranic Waste Authorized Methods for Payload Control*
DOE	U.S. Department of Energy
DOE-RL	DOE Richland Operations Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FGE	fissile gram equivalent
PCB	polychlorinated biphenyl
PE-Ci	plutonium equivalent curie
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act of 1976*
SWB	standard waste box
SWOC	Solid Waste Operations Complex
TRU	transuranic
TRUM	transuranic mixed
TRUPACT II	transuranic package transporter II
VUP	volume utilization percentage
WIPP	Waste Isolation Pilot Plant

G1 Contact-Handled Transuranic Waste Certification Criteria

As a generator of transuranic (TRU) and transuranic mixed (TRUM) waste destined for disposal at the Waste Isolation Pilot Plant (WIPP), the Hanford Site must ensure that its contact-handled (CH) TRU waste meets the requirements of U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*, DOE/WIPP-02-3122, and the Contact Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC) document. DOE/WIPP-02-3122 establishes the specific physical, chemical, radiological, and packaging criteria for acceptance of defense TRU waste shipments at the WIPP, as required, depending on the waste material form and packaging configurations.

In addition to meeting the Solid Waste Operations Complex (SWOC) treatment, storage, and/or disposal requirements identified in this document, specific TRU waste acceptance criteria are described in the following subsections. When generators satisfy the requirements of this appendix, the waste will be in a certifiable form.

G1.1 Remote-Handled Transuranic Criteria

See Appendix I.

G1.2 Contact-Handled Transuranic Criteria

CH TRU waste acceptance criteria are as follows:

- Waste must be segregated by the waste specification record, including segregation of defense from non-defense waste. Non-defense waste is prohibited for shipment to WIPP, but may be shipped to a SWOC facility for storage using the exception process in Section 1.6.
- Defense waste is waste generated, in whole or in part, by the Secretary of DOE (and predecessor agencies) while carrying out any of these functions: naval reactors development; weapons activities, including defense inertial confinement fusion; verification and control technology; defense nuclear material production; defense nuclear waste and materials byproduct management; defense nuclear materials security investigations; and defense research and development.
- The generator must supply sufficient information for the TRU program to prepare and document an appropriate defense determination. Final approval of the defense determination will be made, as applicable by DOE Richland Operations Office (DOE-RL) technical, RL Chief Counsel, RL TRU Project Director, Carlsbad Field Office (CBFO) technical, CBFO Chief Counsel, and (if necessary) DOE Headquarters (HQ) General Counsel.
- Waste must meet all requirements in Table G-1 through Table G-5, except as allowed with profile sheet approval. The Hanford TRU Project may determine additional requirements for specific TRU waste are necessary, beyond those listed in Table G-1 through Table G-5.
- Waste will be characterized and certified for shipment to WIPP under a centralized TRU Project. Generators are not responsible for certification of TRU waste; however, generators are responsible for providing TRU waste that is certifiable and acceptable knowledge (AK) to support this certification. Generator-supplied documentation demonstrating compliance with the requirements in Tables G-1 through G-5 will ensure the TRU waste is certifiable.
- Newly generated waste that cannot be verified using radiography must be packaged using visual examination. This requirement, if applicable, will be communicated to the generator as a waste stream

profile condition of approval. Waste Support Services personnel are available to conduct visual examinations at the generator location.

- Newly generated TRU waste requires WIPP certification of the nondestructive assay equipment used to quantify the radiological properties. This requirement, if applicable, will be communicated to the generator as a waste stream profile condition of approval.
- AK data must be provided through use of a waste stream profile sheet from the Hanford Site Solid Waste Acceptance Program Internet Web site. The profile sheet is available at: http://www.hanford.gov/?page=581.
- Packaging requirements will be established and communicated to the generator as a waste stream profile condition of approval. Generators must obtain waste stream profile approval prior to generating and/or packaging their CH TRU waste.

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

The Hanford TRU program must be consulted before any waste containing plutonium in excess of 20 percent by weight is submitted for storage or disposal.

G2 References

40 CFR 262.32, "Standards Applicable to Generators of Hazardous Waste," "Marking," Subpart C "Pre-Transport Requirements." *Code of Federal Regulations.*, as amended.

40 CFR 761.40, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," "Applicability," Subpart C "Marking of PCBs and PCB Items, Marking Requirements," *Code of Federal Regulations,* as amended.

49 CFR, "Transportation," *Code of Federal Regulations*. Available at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?type=simple;c=ecfr;cc=ecfr;sid=c7b2238ee3b61d4b0ea97d92cbac750c;idno=49;region=DIV1;q1=49%20CFR;rgn=div5;view=text;node=49%3A1.0.1.1.1., as amended.

49 CFR 173, "Shippers—General Requirements for Shipments and Packagings," Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr173_09.html,.as amended.

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Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq. Available at: http://www4.law.cornell.edu/uscode/42/6901.html.

U.S. Nuclear Regulatory Commission, 2009, *Contact Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)*, Rev. 3, Office of Regulatory Procedures, U.S. Nuclear Regulatory Commission, Washington D.C. Available at: http://www.wipp.energy.gov/Documents_Transportation.htm.

Waste Isolation Pilot Plant Land Withdrawal Act, Public Law 102-579, Available at: http://www.westgov.org/wga/initiatives/wipp/PIG-Web/Introduction/WIPP%20Land%20Withdrawl%20Act.pdf.

G3 Tables

Table G-1. Container Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Payload container description	DOT Type A or equivalent 208-L (55-gal) drums (direct fill or containing a pipe component) 208-L (55-gal) drums are <393 cm (24 in.) in diameter (including gasket, locking ring, and torqued accordingly) and <573 cm (34 - 15/16 in.) tall (fully assembled) SWBs (standard waste box)	Site procurement specifications and QA acceptance reports, or manufacturer's fabrication documentation and records demonstrating equivalency with DOT Type A requirements, or testing records showing compliance with 49 CFR 173.461, or comparison to technical criteria/industry standards Pipe overpack containers' and SWB's specifications procured consistent with CH-TRAMPAC requirements Visual inspection to verify container integrity
Container weights	<454 kg (1,000 lb)/55- or 85-gal (208- or 322-L) drum <1,814 kg (4,000 lb)/SWB 208-L (55-gal) drum with inner pipe component—contact Hanford TRU Program	Records of loaded container weights
Removable surface contamination	For individual containers and payload assemblies: <20 dpm/100 cm^2 for alpha <200 dpm/100 cm^2 for beta-gamma The fixing of surface contamination to meet these limits is not allowed	Records of surface contamination surveys taken on individual containers prior to release from a radiological contamination area
Container identification and marking	Bar code label consisting of a unique container identification number Shipping category Yellow and Magenta—DOT radioactive sticker Mixed—TRU waste marked as "Hazardous Waste" per 40 CFR 262.32 TRU waste containing PCBs marked per 40 CFR 761.40	Visual inspection at time of shipment

Table G-1. Container Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Confinement requirements	Maximum layers of confinement allowed is six, including the liners Smaller number of confinement layers may be required as a waste stream profile condition of approval Newly generated waste must be packaged with filtered bags or be horsetailed Filtered bags are considered layers of confinement	Contents inventory records, which clearly indicate the number of confinement layers
Filter vents	Payload containers vented using one or more filter(s) that meet the WIPP Hazardous Waste Facility Permit and the CH-TRAMPAC Section 2.5.1 specification (Drums with vent clips are not considered vented)	Site procurement specifications and QA acceptance reports, manufacturer's fabrication documentation, and/or records of visual inspection

Source:

40 CFR 262.32, Subpart C, "Standards Applicable to Generators of Hazardous Waste, Pre-Transport Requirements, Marking," *Code of Federal Regulations,* as amended.

40 CFR 761.40, Subpart C, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions, Marking of PCBs and PCB Items, Marking Requirements," *Code of Federal Regulations,* as amended.

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

Table G-2. Radiological Properties for Non-Machine Compacted Waste Only

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Radionuclide composition	Assay measurements Information on radionuclide composition, with emphasis on quantification of Am-241, Pu-238, Pu-239, Pu-240, Pu-242, U-233, U-234, U-238, Sr-90, Cs-137, and other radionuclides contributing to 95 percent of the radiologic activity of the container	Records of assay data and/or AK documentation.
Fissile material quantity (Pu-239 fissile gram equivalent)[a]	<200 g (55-gal) drum (direct fill or containing a pipe component) if Be <1% by weight <200 g (85-gal) drum if Be <1% by weight <325 g/SWB if Be <1% by weight <100 g/container for all containers if Be >1% by wt. of the waste (up to 100 kg [220 lb] in a 55- or 85-gal drum, or up to 18.14 kg [39.9 lb] in a SWB and is particulate) Note that uncertainty must be accounted for in accordance with HNF-EP-0063 Appendix B, Section B1.3	Records of assay data or AK documentation and calculations using isotopic composition, specific activity of the isotopes, and measured assay values to calculate Pu-239 FGE.

Table G-2. Radiological Properties for Non-Machine Compacted Waste Only

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
TRU alpha activity concentration	>100 nCi of alpha-emitting TRU isotopes with half-lives greater than 20 years per gram of waste	Records of assay data or AK documentation and records of calculations showing concentrations of the total TRU radionuclides in the waste matrix.
Pu-239 equivalent activity (PE-Ci)	Untreated waste: <80 PE-Ci/ 208 L (55-gal) drum or 322 L (85 gal) drum <560 PE-Ci/SWB <1,100 PE-Ci/undamaged 208-L (55-gal) drum overpacked in a 322-L (85-gal) drum <1,200 PE-Ci/ undamaged 208-L (55-gal) or 322-L (85-gal) drum overpacked into a SWB, no single payload container within the SWB can exceed 1100 PE-Ci.[b] <1,800 PE-Ci/208 L (55-gal) drum containing a pipe component Solidified/vitrified waste: ≤1,800 PE-Ci/any payload container	Records of assay data or AK documentation and records of conversion and calculations using Appendix B of the WIPP waste acceptance criteria.
Radiation dose rate	<200 mrem/h at the surface of the payload (waste) container and the TRUPACT-II <10 mrem/h at 2 m (6.5 ft) <179 mrem/hr for S100 pipe overpack containers <155 mrem/hr for S300 pipe overpack containers	Measurements shall be made on each CH TRU waste container with instruments calibrated using sources traceable to a national standard. Internal payload container shielding cannot be used to meet dose rate requirements except for the approved pipe component configuration.
Decay heat	≤Limit established per waste stream profile	Compliance will be per direction in the waste stream profile and will be based on generator-supplied isotopic and loading data.

a. Waste containing beryllium and/or has been machine compacted has more restrictive critical safety requirements. Contact TRU Program for these more restrictive requirements.

b. When overpacking one or more damaged waste containers, the direct-loaded PE-Ci limits apply.

Table G-3. Physical Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Liquids	Liquid waste is prohibited in payload containers, except in the following quantities: • Free liquids shall be no more than 1 percent by volume of the outermost container. • Internal containers may contain 60 milliliters or 3 percent by volume, whichever is greater, of free liquid. • Containers with Hazardous Waste Number U134 assigned shall have no free liquid. • Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not intended to hold liquid are not internal containers.	AK documentation, records of radiography, and/or visual examination
Sealed containers	No sealed containers greater than 4 L (1 gal) except for Waste Material Type II.2 packaged in metal containers. Sealed containers greater than 4 L (1 gal) including rigid liners, shall be vented. Heat-sealed plastic bags must have at least one filter vent. NOTE: See CH-TRAMPAC (Section 2.8,) for waste material type II.2 definition.	AK, radiography, visual examination, and/or packaging records Taping a lid around the edges to secure it without venting the lid is considered a sealed container Cross-taping across the lid, or crimping the container are acceptable methods for securing materials in internal containers
Compressed gases (pressurized containers)	Compressed gases in pressurized containers (e.g., aerosol cans) are prohibited. Venting methods of the pressurized container must be observable.	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination
Sharp/heavy objects	Sharp/heavy objects must be blocked, braced or suitably packaged to provide puncture protection for the payload container.	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination
Greater than 60% VUP	The Volume Utilization Percentage (percent full) of a waste container must be at least 60%. The container may be less than 60% VUP if the container is limited due to transportation limits (FGE or PE-Ci or weight limits).	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination

Table G-4. Chemical Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Pyrophoric materials	<1 percent (by weight) radionuclide pyrophorics, generally dispersed in the waste No nonradionuclide pyrophorics	AK documentation and/or records of procedures, processes, or evidence that shows no presence of pyrophorics or treatment to eliminate the characteristic
Hazardous waste	Limited to EPA hazardous waste numbers identified as allowable in the WIPP	Approved Standardized Waste Profile Sheet

Table G-4. Chemical Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
	Hazardous Waste Facility Permit and all Washington State waste codes Ignitable (D001), corrosive (D002), and reactive (D003) waste prohibited	AK documentation and/or records of procedures, processes, or evidence that shows hazardous waste codes as listed in Table G-5
Chemical compatibility	No wastes incompatible with backfill, seal and panel closures materials, container and packaging materials, shipping container materials, or other wastes	AK documentation and/or records of sampling and analysis, records of verification by visual examination or radiography[3] that the waste meets the assigned waste stream description in the waste profile
Explosives, corrosives, and compressed gases	No explosives, corrosives, or compressed gases (pressurized containers)	Radiography records, visual examination records, or AK documentation, and site policies/procedures prohibiting these items
Polychlorinated biphenyls	PCB-contaminated TRU and PCB-contaminated TRU waste mixed with a hazardous waste, including PCB remediation waste, PCB articles, and PCB bulk product waste may be stored and disposed at the WIPP	AK and/or records of sampling and analysis Information from the generator must include the earliest date of waste generation (i.e., the date of removal from service for disposal), the estimated weight of PCBs in kg, and a description of the type of PCB waste (e.g., PCB remediation waste, PCB bulk product waste, etc.)

Table G-5. Acceptable RCRA Hazardous Waste Codes for the Waste Isolation Pilot Plant

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

Appendix H

Approved Vents

H1 Approved Vents

Containers requiring a vent shall have a vent installed (HNF-14741). Table H-1 provides a list of the approved vents. The NucFil-019 DS is the preferred vent for newly generated transuranic waste packages; other vents will be approved on a case-by-case basis in the waste profile.

Table H-1. Approved Vents

Manufacturer	Model Number
Fairey[a]	98867[b]
Fairey	99421
Nuclear Filter Technology	NucFil®[c]-012
Nuclear Filter Technology	NucFil-013
Nuclear Filter Technology	NucFil-013 GorTex
Nuclear Filter Technology	NucFil-013 SSS
Nuclear Filter Technology	NucFil-015 DS
Nuclear Filter Technology	NucFil-016
Nuclear Filter Technology	NucFil-016 SS HP
Nuclear Filter Technology	NucFil-019
Nuclear Filter Technology	NucFil-019 DS
Nuclear Filter Technology	NucFil-019-EPD
Nuclear Filter Technology	NucFil-019-HCR
Nuclear Filter Technology	NucFil-019SDS
Nuclear Filter Technology	NucFil-020
Nuclear Filter Technology	NucFil-407DS
Nuclear Filter Technology	NucFil-049
Nuclear Filter Technology	NucFil-049LS
Nuclear Filter Technology	NucFil-049S
Nuclear Filter Technology	NucFil-050[d]
Nuclear Filter Technology	NucFil-051
Nuclear Filter Technology	NucFil-051CT
Nuclear Filter Technology	NucFil-007
Nuclear Filter Technology	NucFil-7DS
Nuclear Filter Technology	NucFil-007LS
Nuclear Filter Technology	NucFil-007S
Nuclear Filter Technology	NucFil-072
Nuclear Filter Technology	NucFil-072 SSS

Table H-1. Approved Vents

Manufacturer	Model Number
Nuclear Filter Technology	NucFil-073
Nuclear Filter Technology	NucFil-074
Nuclear Filter Technology	NucFil-075
Nuclear Filter Technology	NucFil-DVS3
Nuclear Filter Technology	NucFil-DVS3A
Nuclear Filter Technology	NucFil-DVS3 IP
Nuclear Filter Technology	NucFil-DVS307
Nuclear Filter Technology	NucFil-NFS7A
UltraTech™[e]	9400
UltraTech	9402
UltraTech	9408
UltraTech	9412
UltraTech	9413
UltraTech	9416
UltraTech	9450
UltraTech	9460
UltraTech	9500
UltraTech	9550
West	WTM01D

a. Fairey Holdings Limited Company, Middlesex, England.

b. Wildcard designator used by manufacturer.

c. NucFil is a registered trademark of the Nuclear Filter Technology Corporation, Lakewood, Colorado.

d. Not approved for TRU package transporter-model II-authorized methods for payload control applications.

e. UltraTech is a trademark of the registered Copeland Scroll® compressor, Emerson Climate Technologies, Sidney, Ohio.

H2 References

HNF-14741, 1005, *Waste Management Project (WMP) Master Documented Safety Analysis (MDSA) for the Solid Waste Operations Complex (SWOC)*, Rev. 2A, Fluor Hanford, Inc., Richland, Washington.

Appendix I

Remote-Handled Transuranic Waste Acceptance Criteria

Terms

AK	acceptable knowledge
CBFO	Carlsbad Field Office
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy Headquarters
DOE-RL	U.S. Department of Energy, Richland Operations Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FGE	fissile gram equivalent
HQ	headquarters
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
PE-Ci	plutonium equivalent curie
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act of 1976*
RH	remote-handled
RH-TRAMPAC	*Remote Handled Transuranic Waste Authorized Methods for Payload Control*
SWOC	Solid Waste Operations Complex
TRU	transuranic
TRUM	transuranic mixed
VUP	volume utilization percentage
WIPP	Waste Isolation Pilot Plant

I1 Remote-Handled Transuranic Waste Acceptance Criteria

As a generator of remote-handled (RH) transuranic (TRU) waste and RH transuranic mixed (TRUM) waste destined for disposal at the Waste Isolation Pilot Plant (WIPP), the Hanford Site must ensure the RH TRU waste meets the requirements of U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*, DOE/WIPP 02-3122, and the *Remote Handled Transuranic Waste Authorized Methods for Payload Control (RH-TRAMPAC)* document. DOE/WIPP 02-3122 establishes the requirements for the characterization and certification of RH TRU to meet the requirements of the U.S. Environmental Protection Agency (EPA) for disposal of RH TRU waste at WIPP. Additional and/or different characterization requirements may be in place by the time the Hanford RH TRU Program is certified. RH TRU waste may be transported to WIPP in the U.S. Nuclear Regulatory Commission (NRC)-approved RH TRU 72-B shipping casks. The waste characterization and packaging requirements for this cask is contained in the *Safety Analysis Report for the RH-TRU 72-B Shipping Package* (NRC, 2002).

RH TRU waste may be packaged in 114-L or 208-L (30-gal or 55-gal) drums for shipment to the appropriate facility within the Solid Waste Operations Complex (SWOC). The drums will be overpacked into RH-72B canisters prior to shipment to WIPP. The requirements for packaging and shipping in the RH-TRU 72-B cask must be met before the RH-TRU waste can be accepted into a SWOC facility. Waste generators may also directly load RH-72B canisters prior to shipment to a SWOC facility. Newly generated RH TRU waste must be visually examined by Waste Support Services personnel during packaging.

I1.1 Remote-Handled Transuranic Waste Criteria

- Waste must be segregated by waste specification record, including segregation of defense from non-defense waste. Non-defense waste is prohibited for shipment to WIPP, but may be shipped to a SWOC facility for storage using the exception process in Section 1.6.

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

- The generator must supply sufficient information for the TRU Program to prepare and document an appropriate defense determination. Final approval of the defense determination will be made as appropriate by DOE, Richland Operations Office (DOE-RL) technical, RL Chief Counsel, RL TRU Project Director, Carlsbad Field Office (CBFO) technical, CBFO Chief Counsel, and (if necessary) DOE Headquarters (HQ) General Counsel.

- Waste must meet all requirements of Table I-1 through Table I-5, except as allowed with profile sheet approval. The Hanford TRU Program may determine additional requirements are necessary for specific TRU waste, beyond those listed in Table I-1 through Table I-5.

- Waste will be characterized and certified prior to shipment to WIPP. Generators are not responsible for certification of TRU waste; however, they are responsible for providing TRU waste that is certifiable. Generator-supplied documentation demonstrating compliance with the requirements in Table I-1 through Table I-5 will ensure that the TRU waste is certifiable.

- Newly generated waste must undergo visual examination by Waste Support Services at the time of packaging and may require sampling to verify the radioisotopic properties of the waste. It is recommended that packaging operations be recorded on video/audio media. If the waste generator does not propose to record the packaging on video/audio media, prior approval is required by Waste Support Services.

- Retrievably stored RH TRU waste, i.e., waste that is already packaged, may be shipped to a SWOC facility. The generator must provide acceptable knowledge (AK) information related to the physical form, originating process, and radioactive contents of the waste.

- AK data must be provided through the use of a waste profile sheet from the Hanford Site Solid Waste Acceptance Program Internet Web site. The profile sheet is available at: http://www.hanford.gov/?page=581.

- Packaging requirements will be established by the Hanford TRU Program and communicated to the generator as a waste stream profile condition of approval. Generators must obtain waste stream profile approval prior to generating and/or packaging their RH TRU waste. Tables I-1 through I-5 are based on shipping using the RH TRU 72-B.

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

I2 References

49 CFR, "Transportation," *Code of Federal Regulations*. Available at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?type=simple;c=ecfr;cc=ecfr;sid=c7b2238ee3b61d4b0ea97d92cbac750c;idno=49;region=DIV1;q1=49%20CFR;rgn=div5;view=text;node=49%3A1.0.1.1.1., as amended.

49 CFR 173, "Shippers – General Requirements for Shipments and Packagings," *Code of Federal Regulations*, as amended.. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr173_09.html.

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DOE/WIPP-02-3214, 2003, *RH TRU Waste Characterization Program Implementation Plan (WCPIP)*, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (Use most current version.)

DOE/WIPP 02-3283, 2003, *RH Packaging Program Guidance*, Rev. 0, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (Use most current version.)Available at: http://www.osti.gov/bridge/purl.cover.jsp;jsessionid=0BE4C431C06371838CD93B1A67631810?purl=/815189-Rfi71Z/native/.

DOE/WIPP 02-3284, 2003, *RH Packaging Operations Manual*, Rev. 0, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (Use most current version.)Available at: http://www.osti.gov/bridge/purl.cover.jsp?purl=/815586-Avk79D/native/.

DOE/WIPP 02-3285, 2004, *RH Packaging Maintenance Manual*, Rev. 1, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (Use most current version.)

Hanford Site Solid Waste Acceptance Program. Available at: http://www.hanford.gov/?page=577.

NRC, 2002, Safety Analysis Report for the RH-TRU 72-B Shipping Package, NRC Docket No. 71-9212, U.S. Nuclear Regulatory Commission, Washington, D.C. (Use most current version.)

NRC, 2006, *Remote Handled Transuranic Waste Authorized Methods for Payload Control (RH-TRAMPAC)*, Rev. 0, U.S. Nuclear Regulatory Commission, Washington D.C.

Waste Isolation Pilot Plant Land Withdrawal Act, Public Law 102-579. Available at: http://www.westgov.org/wga/initiatives/wipp/PIG-Web/Introduction/WIPP%20Land%20Withdrawl%20Act.pdf.

I3 Tables

Table I-1. Container Properties for Shipment in Remote-Handled Transuranic 72-B

Container Attribute	Waste Acceptance Criteria	Compliance Method
Payload Container Description	RH TRU Waste Canister—Direct Loaded or Drum Loaded	Site procurement specifications and QA acceptance reports.
Container Weights	Removable Lid Canister—4240 lbs	Records of measurement of loaded container weight. The canister and contents may be weighed separately.
Removable Surface Contamination	≤20 dpm/100 cm^2 (3,531 ft^3) for alpha ≤200 dpm/100 cm^2 (3,531 ft^3) for beta-gamma	Records of surface contamination surveys taken on individual containers prior to release from a radiological contamination area.
Container Identification and Marking	Each payload container shall be marked with a unique container identification number Yellow and magenta "Radioactive Material" label – DOT Mixed – TRU marked as "Hazardous waste" per 40 CFR 262.32	Records that the container number was visually verified. The record shall include the name of the person that verified the container number and the date of verification.*
Filter Vents	RH TRU canisters and any inner sealed containers greater than 4 L (1 gal) in size must be vented or filtered in accordance with the RH TRU 72-B packaging Certificate of Compliance	Site procurement specifications and QA acceptance reports, manufacturer's fabrication documentation, and records of visual inspection.*

* Newly generated RH TRU waste must be visually examined by Waste Support Services personnel during packaging. Retrievably stored RH TRU waste must have records (e.g., visual examination data forms, packaging logs, loading sheets or contents inventory sheets) available that demonstrate the attribute has been met.

Table I-2. Radiological Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Method
Radionuclide Composition	Information on radionuclide composition, with emphasis on the activities and masses of ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs. Information on radionuclides contributing to ^{239}Pu equivalent curies and other radionuclides contributing to 95% of the radioactive hazard for the payload container. The total activity shall not exceed 82.5 dose equivalent curies per container for acceptance at SWOC facilities. Note: For WIPP acceptance the maximum activity level may not exceed 23 curies per L (averaged over the volume of the RH TRU canister).	Acceptable Knowledge (AK documentation, records of radioassay, dose-to-curie conversion, and/or radiochemistry as required by DOE/WIPP 02-3214.
Fissile Material Quantity (Pu-239 FGE)	Non-machine compacted waste only. 325 g (11.5 oz) when Be/BeO limited to <1% by weight of the waste up to <25 kg (55 lb) including credit taken for >5 g (.17 oz.) of Pu-240 poisoning. 315 g (11.11 oz) when Be/BeO limited to <1% by weight of the waste up to <25 kg (55 lb). 305 g (10.75 oz) when Be/BeO limited to >1% by weight of the waste up to <25 kg (55 lb) and is chemically or mechanically bound. 100 g (3.52 oz) when Be/BeO limited to >1% by weight of the waste up to <25 kg (55 lb) and is not chemically or mechanically bound. Note that uncertainty must be accounted for in accordance with HNF-EP-0063 Appendix B, Section B1.3.	Records of radioassay, dose-to-curie conversion, radiochemistry, and/or AK documentation.
TRU Alpha Activity Concentration	The RH TRU canister shall contain more than 100 nCi/g of alpha-emitting TRU isotopes with half-lives greater than 20 years.	Records of radioassay, dose-to-curie conversion, radiochemistry, and/or AK documentation. Records of calculations demonstrating compliance with DOE/WIPP 02-3214.
PE-Ci Limits	RH-TRU Waste Canister with solidified or vitrified waste - <1,800 PE-Ci RH-TRU. Waste Canister with all other approved waste forms - <240 PE-Ci.	Records of radioassay, dose to curie conversion, radiochemistry, and/or AK documentation.

Table I-2. Radiological Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Method
Radiation Dose Rate	The external radiation dose equivalent rate of individual payload containers shall be greater than or equal to 200 mrem/hr and less than or equal to 1,000 rem/hr at the surface of an individual container. Note: No more than 5 percent by volume of the RH TRU waste received at the WIPP may have a surface dose rate in excess of 100 rem/hr. Waste generators must coordinate planning with the Hanford TRU Project Group if they will generate RH TRU waste with dose rates greater than 100 rem/hr for approval on a case-by-case basis. For waste containers that contain shielding, e.g., lead-lined drums, the generator must provide both the actual dose rate and the calculated dose rate if the shielding was not present. Note: For storage at SWOC facilities, waste containers must be shielded to less than 200 mrem at contact. This may be accomplished through the use of shielded overpack containers. Contact Waste Support Services for guidance. An exception is not required to use shielded overpack containers for storing certifiable TRU waste.	Records of radiation dose surveys.
Decay Heat	≤Limit established per waste stream profile.	Compliance will be per direction in the waste stream profile and will be based on generator-supplied isotopic and loading data.

Source:

DOE/WIPP-02-3214, 2003, *RH TRU Waste Characterization Program Implementation Plan (WCPIP)*, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (Use most current version.)

Table I-3. Physical Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Method
Liquids	Liquid waste is prohibited in payload containers, except in the following quantities: • Free liquids shall be no more than 1 percent by volume of the outermost container. • Internal containers may contain 60 milliliters or 3 percent by volume, whichever is greater, of free liquid. • Containers with Hazardous Waste Number U134 assigned shall have no free liquid. • Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not intended to hold liquid are not internal containers.	AK documentation, records of radiography, and/or visual examination.*
Sealed Containers	Sealed containers greater than 4 L (1 gal.) in size are prohibited, except for metal containers packaging solid inorganic waste. All waste containers with inner rigid containers greater than 4 L (1 gal) shall be vented.	AK documentation, records of radiography, and/or visual examination.*
Compressed gases (pressurized containers)	Compressed gases in pressurized containers (e.g., aerosol cans) are prohibited. Venting methods of the pressurized container must be observable.	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination.
Sharp/heavy objects	Sharp/heavy objects must be blocked, braced or suitably packaged to provide puncture protection for the payload container.	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination.
Greater than 60% VUP	The Volume Utilization Percentage (percent full) of a waste container must be at least 60%. The container may be less than 60% VUP if the container is limited due to transportation limits (FGE or PE-Ci or weight limits).	Contents inventory sheets, AK documentation, records of radiography, and/or visual examination.

* Newly generated RH TRU waste must be visually examined by Waste Support Services personnel during packaging. Retrievably stored RH TRU waste must have records (e.g., visual examination data forms, packaging logs, loading sheets, or contents inventory sheets) available that demonstrate the attribute has been met.

Table I-4. Chemical Properties

Waste Attribute	Waste Acceptance Criteria	Compliance Methods
Pyrophoric Materials	<1 percent (by weight) pyrophoric radionuclides No nonradionuclide pyrophoric materials	AK documentation, records of radiography and/or visual examination.[a]
Hazardous Waste	Limited to EPA hazardous waste numbers identified as allowable in the WIPP Hazardous Waste Facility Permit and all Washington State waste codes No hazardous wastes not occurring as co-contaminants with TRUM wastes (non-mixed hazardous wastes)	AK documentation showing the waste contains no EPA codes other than those listed in Table I-5.
Chemical Compatibility	No wastes incompatible with backfill, seal, and panel closures materials, container and packaging materials, shipping container materials, or other wastes	AK documentation and/or records of verification by visual examination or radiography that the waste meets the assigned waste stream description in the waste profile.
Explosives or Compressed Gasses	No wastes containing explosives or compressed gases (pressurized containers)	AK documentation with verification through radiography or visual examination.*
Polychlorinated Biphenyls	PCB-contaminated TRU and PCB-contaminated TRU waste mixed with a hazardous waste including PCB remediation waste, PCB articles, and PCB bulk product waste may be stored and disposed at the WIPP	AK documentation with records of verification through radiography or visual examination.* Information from the generator must include the earliest date of waste generation (i.e., the date of removal from service for disposal), the estimated weight of PCBs in kg, and a description of the type of PCB waste (e.g., PCB remediation waste, PCB bulk product waste, etc.).
Reactives, Corrosives, or Ignitables	No wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003)	AK documentation with verification through radiography or visual examination.*

* Newly generated RH TRU waste must be visually examined by Waste Support Services personnel during packaging. Retrievably stored RH TRU waste must have records (e.g., visual examination data forms, packaging logs, loading sheets, or contents inventory sheets) available that demonstrate the attribute has been met.

Table I-5. Acceptable RCRA Hazardous Waste Numbers for the Waste Isolation Pilot Plant

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