PNNL-13017

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

325 Facility Special-Case Waste Disposition Alternatives Analysis

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August 1999

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RL01830

Printed in the United States of America

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325 FACILITY SPECIAL-CASE WASTE

DISPOSITION ALTERNATIVES ANALYSIS

September 18, 1998

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325 FACILITY SPECIAL-CASE WASTE DISPOSITION ALTERNATIVES ANALYSIS

1.0 BACKGROUND AND PURPOSE

1.1 Introduction

This report addresses the disposition strategy relating to special-case waste (SCW) managed by the Pacific Northwest National Laboratory (PNNL) on the Hanford Site. All of PNNL's SCW currently resides in the 325 Facility of Hanford's 300 Area. This facility is operated for the U.S. Department of Energy, Richland Operations Office (RL), by PNNL. Due to the high activity levels of the waste and difficulties in characterizing, classifying, and packaging it to meet the Hanford Site Solid Waste Acceptance Criteria (DOE 1998a), the materials were listed as SCW under the *Hanford Facility Agreement and Consent Order* (Ecology et. al.) major milestone M-33-00 and subsequently under major milestone M-92-00 (Ecology et. al.). The *Hanford Facility Agreement and Consent Order* is also known as the Tri-Party Agreement.

1.2 Tri-Party Agreement Overview

The Tri-Party Agreement is an agreement between the U.S. Department of Energy, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) to complete cleanup of the Hanford Site as required by the *Resource Conservation and Recovery Act of 1976* (RCRA) and the *Comprehensive Environmental Response, Compensation,* and Liability Act of 1980 (CERCLA). The Tri-Party Agreement terms and conditions provide the regulatory framework and the required actions and schedules (milestones) for site cleanup. The purpose of the Tri-Party Agreement is to identify RCRA compliance requirements for treatment, storage, and disposal (TSD) units, and the RCRA and CERCLA requirements for interim and final remedial actions.

The Fourth Amendment to the Tri-Party Agreement (January 1994) added major Milestone M-33-00, which required DOE to accomplish the following:

- Identify a path forward for disposition of Hanford Site solid waste and materials
- Submit a Tri-Party Agreement change package to add milestones for acquisition of the necessary TSD facilities to implement the path forward.

The waste streams that were considered in the scope of Milestone M-33-00 include SCW in the 300 Area that does not have a clearly defined disposition pathway.

In negotiations between RL, Ecology, and the EPA in 1995 and 1996, it was agreed that Major Milestone M-33-00 would be replaced by a series of decision point milestones for disposition of each major waste stream. The decisions would ultimately lead to specific interim milestones and target dates for acquiring the necessary TSD facilities.

Major Milestone M-92-00 and its associated interim milestones and target dates [refer to Change Number M-92-96-01 (Ecology 1996)] were established to govern the acquisition of new facilities, modification of existing facilities, and/or modification of planned facilities needed to store, treat, and dispose SCW from the 300 Area, including SCW stored in the 325 Building. The interim milestones and target dates under major Milestone M-92-00 that relate to the 300 Area SCW are identified in Appendix A, Table A-1 of HNF-1730, Rev. 0 (DOE 1997). The 300 Area SCW subject to M-92-00 is described in Appendix A, Table A-2 of HNF-1730, Rev. 0 (DOE 1997).

1.3 Special-Case Waste Description

The initial determination of what was considered to be SCW was not well documented. Tri-Party Agreement Change Package M-92-96-01 (Ecology 1996) lists all materials and waste initially identified as SCW by PNNL. This change package also describes a process to use for revising the SCW list. In some cases waste and material were previously listed as SCW without complete characterization or an exact determination of curie content, volume, or classification of waste versus material. As the characterization data for the SCW waste streams are improved and waste classifications are identified, the number of SCW streams without a clearly defined disposition strategy is being reduced.

SCW is primarily waste that has limited or no formerly planned disposal alternatives. This waste consists of the following:

- Waste Isolation Pilot Project (WIPP) non-certifiable defense transuranic (TRU) waste

- DOE-held fragments and components of spent nuclear fuel

- DOE-held commercial low-level waste (LLW) [see DOE Order 5820.2A (DOE 1988)] that may potentially be designated as Greater Than Class C (GTCC) under the definition found in Title 10 Code of Federal Regulations (CFR) Part 61.55, and low-level waste that exceeds Site-specific performance assessment limits (DOE 1992).

SCW includes high-activity radioactive waste currently stored in 325 Building Hot-Cells. This waste requires special handling and storage because of the high radioactive dose rates (i.e., greater than 200 millirem per hour on contact). SCW includes items such as irradiated research and test materials, borosilicate glass in stainless steel containers, dust and debris, and Hot Cell tools and equipment. None of the SCW contains hazardous constituents that would qualify it as mixed waste regulated under RCRA and the *Washington Administrative Code* (WAC) 173-303, "Dangerous Waste Regulations" (DOE 1995a).

All PNNL SCW is currently located in the 325 Building Hot Cells in the Hanford Site 300 Area. This waste must be removed from the 325 Building and placed in approved interim storage facilities or disposed of in compliance with the Tri-Party Agreement and/or permit conditions. Removing the material from the 325 Hot Cells is an essential step in eliminating SCW from the 300 Area.

1.4 Purpose

The purposes of the study are to identify the anticipated characteristics of the 325 Building SCW; identify the packaging, transportation, and storage requirements based on these characteristics; and identify a preferred disposition solution that will facilitate removal of these materials from the 325 Building Hot Cells.

1.5 Responsibilities

PNNL is responsible for preparing and packaging the waste in a manner acceptable for transport and storage/disposal by the responsible Hanford Site contractor(s). In addition, PNNL will assist the responsible Hanford contractor, where requested, in providing information germane to determining the interim or final disposition of the waste.

Waste Management Hanford (WMH) Company is responsible for providing verification of the PNNL packaging activities, performing the waste acceptance review, transporting the waste, and managing the waste for the interim and/or final disposition.

1.6 Uncertainties

SCW activities involve a number of uncertainties. Some are rather significant and will impact final decisions on the disposition pathways of the material under consideration. The following is a listing of known uncertainties:

- Research and development irradiated fuel materials are currently being considered for management as transuranic wastes (TRU) rather than spent nuclear fuel (SNF) while on the Hanford Site. Should such a decision be made, it could greatly simplify the interim management process for this material.

- Some of the SCW materials considered have little or no radionuclide characterizations beyond a description of their origin. Since most packaging and storage options have radionuclide content limitations, determination of required packaging and storage alternatives cannot be precisely performed until radionuclide contents are known.

- Final disposition of the Hanford SCW will not be known until a number of issues are decided on a national policy level. Two obvious examples are TRU waste disposal and spent fuel fragment disposition. This study examines disposition alternatives against the draft or anticipated criteria that are incorporated into the Hanford waste acceptance criteria. Any future changes to these criteria cannot be anticipated and are thus outside the scope of this evaluation.

- Some SCW waste packages are scheduled for examination, sorting, and re-labeling in the near future. This may change the final number and volumes of the differing waste classifications, and introduce uncertainties into the cost and planning estimates.

- Before waste is accepted at Hanford, the responsible contractor (i.e., Waste Management Hanford) will need to perform a detailed review to ensure a storage/disposal pathway is identified and that the waste packaging is appropriate. The time commitment for this activity can be highly variable and is difficult to anticipate.

1.7 Assumptions

This analysis was performed and the recommendations were developed using a number of assumptions. The assumptions were necessary because of the lack of verifiable information in some cases and/or because of the uncertainties associated with proposed waste handling processes or the availability of resources. The following is a listing of assumptions that were used to arrive at the recommended waste stream dispositions:

- The waste types discussed were assumed to possess defined characteristics of spent nuclear fuel fragments, low-level radioactive waste, transuranic wastes, and/or dangerous waste.

- It is assumed a characterization of the waste will be conducted which leads to a formal waste designation prior to acceptance by the Hanford Site waste management contractor.

- The fissile materials contained in the spent fuel fragments and in the TRU waste stream are not under International Safeguards Requirements.

- PNNL will prepare and package the waste for turnover to WMH Company. After acceptance of the waste, subsequent management and/or storage of the waste is the responsibility of WMH.

2.0 325 BUILDING SPECIAL CASE WASTE

This section provides a description of the material as it is currently known. This description will be used to identify disposition alternatives for the 325 Building SCW.

2.1 Spent Fuel Pieces and Fragments

Spent fuel fragments are defined as ***fragments of fuel that have been withdrawn from a nuclear reactor following irradiation, but that have not been processed to remove their constituent elements*** (DOE 1998a).

2.1.1 Detailed Description

The SCW considered in this study includes reactor-irradiated nuclear fuel from a variety of government and commercial sources. The fuel is in a variety of physical shapes and sizes, largely the result of differing research activities. Some of the pieces have been sectioned or sampled for study, some have been ground or crushed to a powdered state, and others are in the original configuration with the cladding partially or fully intact. Since the spent fuel pieces and fragments originated from power production reactor cores or from breeding experiments, they do not meet the definition of LLW. Although the fuel originated from both commercial and DOE reactors, all was used as part of DOE programs and DOE (through PNNL) is responsible for dispositioning of all of the irradiated fuel stored in the 325 Building Hot Cells.

The current inventory of spent fuel pieces and fragments in the 325 Building is provided in Table 2.1.1. While the radionuclide content and mass of the material are unlikely to change in the near future, consolidation activities are expected to change the container configuration(s).

2.1.2 Volume/Mass

Table 2.1.1 provides an inventory listing and available characterization of the fuel pieces and fragments. For convenience of handling and accounting and for safety reasons, the fuel pieces were consolidated into a number of steel pipes and welded shut. The total external volume of the pipe containers is known to slightly exceed 828 cubic inches. The actual volume of fuel is expected to be a fraction of this volume. Further consolidation of fuel is possible to reduce the total volume, unless criticality safety becomes a concern.

2.1.3 Radiological Data

Reliable radiological data do not exist for all of this material at this time. Activities for partially characterizing this waste are under way. However, the material is expected to exhibit the radiological characteristics of aged mixed fission products.

Individual cans were recently measured in an in-cell configuration. The highest reading (approximating a contact dose rate) observed was 260 R/hour. The readings are assumed to be heavily influenced by other sources within the cell.

2.1.4 Dangerous Waste Constituents

Spent fuel fragments that have not been chemically altered are regulated solely by the Atomic Energy Act. Therefore, any dangerous waste characteristics are not applicable.

2.1.5 Waste Classification

The data currently available on the sampled fuel was collected for research purposes. The waste described in this section is assumed to be fragments of spent nuclear fuel. However, the waste may be approved for management as transuranic waste on the Hanford Site in the near future.

Table 2.1.1 - Spent Fuel Pieces and Fragments in the 325 Building Hot Cells

Waste Type	Pu (g)	Pu-240 (wt%)	Depleted Uranium (g)	Enriched Uranium (g)	U-235 (wt%)	U-235 (g)	Wt. (g)	Pipe length (in)	Pipe Dia. (in)	Pipe Vol. (in^3)	TRU	Non-TRU	Location of waste	Comment	Ref.
Saxton Fuel	5	19	<50	<0.05			5.7	12	2	37.68			B-cell or C-cell	Stored in pipe with pipe caps at each end. This fuel is in 3 inch pipe 3 ft in length. Originated from HLRF.	1,5,7, 8,9
Shippingport Fuel	19	22	3000				3.5 kg						B-cell	Present as a bundle with 25 pins, 2 separate pins, and 3 pieces of pins. Appears the total quantity of fuel is approx. 28 pins. Originated from HLRF.	1,5,8, 9
Yankee Fuel	18	21		1461	1.25		1700	36	3	254.34			B-cell	Stored in pipe with pipe caps at each end. This fuel is in 2 inch pipe that is 1 ft in length. Originated from HLRF.	1,5,7, 8,9
N-Reactor FY-86 Sections Fuel				16.6	0.95		1446						C-cell	Unirradiated piece N Reactor fuel rod. Based on the absence of Pu, it appears that this fuel is unirradiated.	1,8,9
BWIP Archives								5.5	2.5	26.98	X		SAL	Fuel fragments.	2
TPB17-P1								4.5	1	3.53	X		SAL	Sectioned fuel pins.	2
86-26								7	1	5.50	X		SAL	Fuel powder.	2
OX-2	-					3.7		6.75	1.5	11.92	X		SAL	Metal fuel in pipe.	2,3
85-01(1)	-					1.9		9.75	0.75	4.31	X		SAL	Fuel powder in pipe.	2,3
85-01(2)	2					-		9.5	0.75	4.19	X		SAL	Fuel powder in pipe.	2,3
N9C R2	-					0.4		9.5	1	7.46	X		SAL	Fuel powder in pipe. U-235 is total for N9C R2 and R3	2,3
N92 R3	-							9.5	1	7.46	X		SAL	Fuel powder in pipe. U-235 is total for N9C R2 and R3	2,3
MK-16	-					5.6		6.75	1.5	11.92	X		SAL	Metal fuel in pipe.	2,3
LMO361								9.5	2.5	46.61	X		SAL	Spent fuel fragments.	2
D047								9.5	2.5	46.61		X	SAL	Spent fuel fragments.	2
CZ348								8.75	2.5	42.93	X		SAL	Spent fuel fragments.	2
CP20101								7.25	2	22.77	X		SAL	Spent fuel fragments.	2
S3								8.25	2.75	48.98	X		SAL	Spent fuel fragments.	2
S4								8.25	2.75	48.98	X		SAL	Spent fuel fragments.	2
S9								8.25	2.75	48.98	X		SAL	Spent fuel fragments.	2
S11								8.25	2.75	48.98	X		SAL	Spent fuel fragments.	2

Waste Type	Pu (g)	Pu-240 (wt%)	Depleted Uranium (g)	Enriched Uranium (g)	U-235 (wt%)	U-235 (g)	Wt. (g)	Pipe length (in)	Pipe Dia. (in)	Pipe Vol. (in^3)	TRU	Non-TRU	Location of waste	Comment	Ref.
HBR B05 AA	3					2.6		8.25	2.75	48.98	X		SAL	Small bundle of fuel rods in pipe. Pu and U-235 is total for HBR B05 AA, BB, and CC	2,3
HBR B05 BB								8.25	2.75	48.98	X		SAL	Small bundle of fuel rods in pipe. Pu and U-235 is total for HBR B05 AA, BB, and CC	2,3

SAL - Shielded Analytical Laboratory

Reference 1 - SNF Inventory - J.M. Tingey, *Spent Nuclear Fuel- High-Level Radiochemistry Facility*, 4/3/1998.

Reference 2 - Memo from R.T. Steele to M.W. McCoy, *325 Building Hot Cell pipes and their respective Waste Stream Categories*, 1/27/1998.

Reference 3 - Steele, R.T., Letter Report to Killand, B.W., *Pu and U-235 in 325 SCW*, 4/9/1996.

Reference 4 - PNNL, *Management Plan for Legacy Waste Disposition, Building 325, Shielded Analytical Laboratory*, 8/15/1997.

Reference 5 - *325 Building Waste Inventory Sheets*, MBA-307 (no date)

Reference 6 - *325 Building Waste Inventory Sheets* (no date)

Reference 7 - *Tentative Agreement on the Hanford Federal Facility Agreement and Consent Order Negotiations for Solid Waste and Materials* (pertaining to milestone M-33-00), 6/1996.

Reference 8 - Memo from B.W. Killand, *PNNL Regulated Waste Inventory - 02/23/98 Revision*, 2/23/1998.

Reference 9 - *300 Area Radionuclide Inventory - Special Case Waste*, 6/1996.

2.2 Low-Level Radioactive Waste (LLW)

Low-level radioactive waste (LLW) is defined as ***waste that contains radioactivity and is not classified as high-level waste, transuranic (TRU) waste, or spent nuclear fuel or byproduct material as defined by DOE Order 5820.2A [11e(2)]. A test specimen of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW provided the concentration of transuranic materials is less than 100 nanocuries per gram*** (DOE 1998a).

2.2.1 Detailed Description

Low-level radioactive wastes in the 325 Building Hot Cells originated predominately from hot cell work on SNF. While not considered spent fuel, the wastes in this category were contaminated by contact with, or proximity to, SNF during research activities in the hot cells. Contaminated in such a manner, the LLW is assumed to consist primarily of mixed fission products. One significant exception to that assumption is the vitrification test materials that were heavily spiked with ^{90}Sr and ^{137}Cs. This material is mostly incorporated into a glass matrix.

2.2.2 Volume/Mass

All waste in this category is sealed in approximately 23 paint cans having volumes of either 4 or 5 quarts (U.S.). The masses or volumes of the actual wastes are not well characterized. The one gallon cans have external dimensions of 6.625 in. in diameter by 7.5 in. in height giving an individual can volume of 258.54 in^3. The five quart cans measure 6.625 in. in diameter by 9.5 in. in height giving an individual can volume of 327.5 in^3. Since a ratio of 4 to 5 quart cans is not known, the 5-quart can volume was used to determine a total volume of 7,532.5 in^3.

2.2.3 Radiological Data

Characterization activities are currently ongoing. However, the radioactive material is expected to involve aged mixed fission products, with a significant quantity of ^{90}Sr and ^{137}Cs radioisotopes.

2.2.4 Dangerous Waste Constituents

This material is not expected to contain dangerous waste constituents.

2.2.5 Waste Classification

Current data indicate this material is low-level radioactive waste with characteristics that could potentially exceed Category 3 wastes. (DOE 1998a)

2.3 Transuranic Waste (TRU)

Transuranic waste or TRU waste is defined as ***waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level waste; (2) waste that the Secretary (of Energy) has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation required by the disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61 (Public Law 102-579: Waste Isolation Pilot Plant Land Withdrawal Act*** (DOE 1998a).

2.3.1 Detailed Description

A small volume of TRU waste is stored in Cell 1 of the 325-B Facility. The waste is anticipated to exceed a dose rate of 100 mrem per hour (contact) in a primary container classifying it as remote-handled (RH), as currently packaged. The TRU waste is currently packaged in 1-gallon paint cans with fitted lids.

2.3.2 Volume/Mass

The RH-TRU waste is packaged in 1-gallon paint cans with fitted lids. Actual volumes and masses of the waste are unknown. Some of the wastes were examined and sorted in 1997 and additional activities are ongoing. Currently, 57 cans of TRU are included in the SCW category in the 325 Building Hot Cells.

The 1-gallon cans have external dimensions of 6.625 in.in diameter by 7.5in. in height giving an individual can volume of 258.54 in^3. Assuming 57 cans, we calculate the total volume of RH-TRU waste to be approximately 14,737 in^3.

2.3.3 Radiological Data

This waste originated from a variety of processes, including destructive examination of spent nuclear fuel. In addition, approximately ten cans contain Tank Waste Remediation System (TWRS) tank wastes. As such, the material is anticipated to contain aged mixed fission products in addition to TRU radioisotopes. Characterization of the waste is ongoing.

2.3.4 Dangerous Waste Constituents

Approximately ten cans of the RH-TRU waste originated from TWRS. This waste therefore has a number of dangerous waste constituents. This material is in a dry solid waste form.

2.3.5 Waste Classification

TRU waste is expected to be classified as RH-TRU in its current package configuration. Re-packaging in a shielded container may decrease the external exposure rate to below 100 mrem/hour, resulting in a contact-handled situation.

2.4 Low-Level Mixed Waste

Low-Level Mixed Waste is defined as ***waste that meets both the definition of low-level waste and dangerous waste or hazardous waste*** (DOE 1998a).

PNNL has determined that none of the LLW contains hazardous constituents. Therefore, low-level mixed waste will not be considered any further in this evaluation.

3.0 HANFORD WASTE REQUIREMENTS

This section provides the waste acceptance criteria for the respective types of SCW and SNF considered in this study. This information, while not all inclusive, is provided for planning purposes. Once waste turnover has been accomplished, the responsibility for final placement or interim management rests with the appropriate Hanford waste management contractor.

3.1 Spent Fuel Pieces and Fragments

Efforts are underway to manage all DOE spent fuel consistently with the National Spent Nuclear Fuel Program. Final disposition of the Hanford SCW involving irradiated nuclear fuels is expected to be consistent with that national program. Currently, such waste is managed on the Hanford Site on a case-by-case basis. Offsite transport and management of the waste are unlikely until the national program determines a management pathway.

Specially shielded casks have been used on the Hanford Site in the past to store waste similar to the spent fuel pieces and fragments. A partial listing of the cask requirements is provided in Appendix A. This listing was derived from the current EBR II safety analysis report for packaging (WHC 1990).

3.2 Low Level Radioactive Waste (LLW)

Low-level radioactive waste may be accepted for disposal at Hanford if it meets the criteria listed in Appendix B. This waste may be disposed in the 200 West Area unlined trenches.

Other onsite permitted waste management facilities could be used for interim management of the SCW (e.g., PUREX Storage Tunnels). However, the potential for a railcar tunnel being used for storage of this material is considered low because the SCW removal schedule does not coincide with tunnel availability.

Considering the high radiation dose rate characteristics of this waste, we consider offsite management of the waste to be unlikely and this scenario was not evaluated.

3.3 Transuranic Waste (TRU)

Transuranic wastes may be handled a number of ways on the Hanford Site, depending upon the type of materials involved, waste container needs, and the available facility storage space. The following are brief descriptions of facility capabilities.

Central Waste Complex (CWC)

The CWC is a treatment and storage unit for low-level mixed and Toxic Substances Control Act (TSCA) polychlorinated biphenyl (PCB) waste, TRU waste, TRU mixed and TSCA PCB waste, and other waste requiring treatment before disposal (e.g., non-regulated low-level organic liquids, unstabilized chelating compounds). Waste stored at CWC will be treated and repackaged as required for disposal as treatment capabilities become available.

CWC treats and stores waste having characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U- and P- listed waste), certain F-listed waste (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington State-only waste codes. In addition, the CWC manages TSCA PCB waste from Hanford Site generators. Pertinent acceptance criteria are provided in Appendix C.

T-Plant

The T-Plant Complex is a treatment and storage unit having a number of functions, including equipment decontamination, and waste treatment, storage, sampling, nondestructive examination, and repackaging. The 221-T building is primarily used for highly contaminated equipment decontamination. The 2706-T and 214-T buildings are used for storage, decontamination, treatment and processing of equipment and waste having relatively lower levels of radiological contamination.

Wastes that can be managed at the T-Plant Complex include TRU waste, TRU-mixed and TSCA PCB waste, LLW, and low-level mixed and TSCA PCB waste. The T-Plant Complex Part A, Form 3 permit application includes characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U- and P- listed wastes), F-listed wastes having waste codes F001 through F005, F020 through F023, F026 through F028, and F039, and all Washington state-only waste codes.

The T-Plant Complex can also manage TSCA PCB waste generated on the Hanford Site, and can manage wastes from CERCLA cleanup activities. Waste managed at the T-Plant Complex could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing at the T-Plant Complex. Pertinent acceptance criteria for T-Plant are provided in Appendix D.

Waste Receiving and Packaging (WRAP) Facility

WRAP is a treatment and storage unit. WRAP accepts waste containers for verification, sampling, nondestructive assay, nondestructive examination, treatment, and repackaging. Waste that can be handled at WRAP includes TRU waste, TRU mixed and TSCA PCB waste, low-level waste, and low-level mixed and TSCA PCB waste. The WRAP facility manages waste having characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U- and P- listed wastes), certain F-listed waste codes (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington State-only waste codes. In addition, WRAP manages TSCA PCB waste generated on the Hanford Site. Waste managed at WRAP could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing waste at WRAP. Pertinent acceptance criteria for WRAP are provided in Appendix E.

Other Waste Management Facilities

Other permitted onsite waste management facilities could be used for interim management of the SCW. However, the possibility of using these facilities is considered low.

Because of the high radiation dose rate characteristics of this waste, offsite management of the waste is considered unlikely and was not evaluated.

4.0 ALTERNATIVE IDENTIFICATION

This section identifies candidate disposition options for each of the likely waste forms of the SCW. The alternatives identified take the individual waste types as close to final disposition as is possible at this time. Because of the unusual characteristics of some of the SCW, no alternative disposition beyond long-term storage at the Hanford Site may be available. In other cases, final disposal on or off the Hanford Site may be a viable option.

It must be noted that the Hanford Site waste management contractor has the decision responsibility for placement of the waste it accepts. The reasons for identifying alternatives in this study are for planning purposes and to demonstrate that a viable, storage or disposal pathway exists.

Disposition alternatives beyond the Hanford Site were not evaluated in this study. The costs for offsite disposition would be the same up to the point where the waste is transported to an offsite location. Whereas offsite waste management could possibly cost less, the extra preparation and cost to transport the material a distance over public roadways is expected to result in a total cost increase. This option should be reevaluated if onsite waste management schedules place milestone accomplishment at risk.

4.1 Spent Fuel Pieces and Fragments

Hanford has prior and recent experience managing small amounts of spent fuel pieces and fragments as remote-handled TRU on the Hanford Site. Experience has been limited to placement of the material in EBR II liners and casks and storing the liners in concrete vaults in the 200 Area Waste Burial Grounds. Because of this experience, this alternative will be the only one evaluated for this type waste. Activities are currently underway to study the option of packaging and storing the fuel fragments as remote handled TRU. However, the schedule for this process is not well defined and could require a number of years to obtain approval.

4.1.1 Alternative 1 - Hanford Site Storage in EBR II Shielded Cask

The Hanford Site experience in management of similar material involves the use of EBR-II casks to safely store components of spent nuclear fuel. These casks are designed for transport and storage of spent nuclear fuel and Neutralized Current Acid Waste (NCAW) (WHC 1990). This study will concentrate on the spent nuclear fuel configuration of the cask. That configuration is as follows:

- Spent fuel is placed into a 4-in. pipe that is welded shut and leak tested. If only one inner container is used, a 5-in. schedule 40 pipe qualified as "Special Form" (49 CFR 173.469) will be used (WHC 1990).

- The outer dimensions of the inner containment are 5.6 in. in diameter by 41 in. long.
- The inner containment fits into the EBR-II cask with external dimensions of 17.5 in. in diameter by 59.5 in. long. The internal cask dimensions are 6 in. in diameter by 42 in. long.
- A DOT 21PF-1 Overpack (49 CFR 178.121 - CAPE 1662-4) is used to transport the EBR-II Cask. The overpack has dimensions of 43 in. in diameter by 91 in. long. The internal cavity dimensions are 31 in. in diameter by 83 in. long. The overpack is constructed of steel, wood, and phenolic foam.
- Casks are stored in concrete vaults in the 200 Area Burial Grounds. There is currently space for 3 to 5 additional casks which possibly negates the need to purchase an additional vault.
- Each concrete storage vault can store up to 12 EBR II casks.

4.2 Low-Level Radioactive Waste (LLW)

The following alternatives are identified as candidates for disposition of the SCW that may be considered LLW.

4.2.1 Alternative 1 - Disposal in Low-Level Waste Burial Grounds

Low-level radioactive wastes are frequently disposed in the low-level waste burial grounds in Hanford's 200 West Area. Disposal in low-level waste burial grounds is a viable option, dependent on the waste meeting the disposal criteria in the Hanford Site Waste Acceptance Criteria.

4.2.2 Alternative 2 - Storage at CWC, T-Plant, WRAP Facilities

Low-level radioactive wastes are accepted for storage in the 200 West Area waste management facilities. Storage at the CWC, T-Plant, and WRAP facilities is a viable option, dependent on the waste meeting the facility acceptance criteria and the availability of space.

4.2.3 Alternative 3 - Storage in PUREX Storage Tunnel

Storage in the PUREX storage tunnel was not evaluated because the waste removal schedule does not coincide with tunnel availability.

4.3 Transanic Waste (TRU)

4.3.1 Alternative 1 - Configure Package as Contact-Handled Waste

TRU wastes are frequently accepted for storage in the 200 West Area waste management facilities. Configuring the package as Contact-Handled Waste is a viable option, dependent on the waste meeting the facility acceptance criteria and the availability of space.

5.0 ALTERNATIVE ANALYSIS

The alternatives identified in Section 4.0 are evaluated with respect to technical acceptability, costs, and other relevant features.

5.1 Spent Fuel Pieces and Fragments

5.1.1 Alternative 1 - Hanford Site Storage in EBR II Shielded Cask

Technical Acceptibility

Although standard acceptance criteria do not exist for this storage pathway, EBR II casks have been recently used at the Hanford Site to safely store similar material. Therefore, a process has been established to gain acceptance of this type of waste. This storage pathway, while considered interim, appears to have no outstanding technical problems. Prior experience does show that the approval process may take a year or more. This waste is accepted on a case-by-case basis.

To accommodate the SNF volume, it is anticipated that a maximum of four EBR II casks will be needed. This assumes that material consolidation efforts will be at least partially successful and that no criticality concerns arise. Those four casks can be fitted into one storage vault in the burial ground area.

Cost

The cost of Hanford Site storage in EBR II casks can only be generally estimated due to a number of uncertainties. Significant uncertainties are included in procurement activities, activities involved in the modification of safety documentation, the availability of resources, and the DOE approval process. Table 5.1.1 provides an estimate of anticipated category costs associated with the SNF storage pathway.

Table 5.1.1 EBR II Cask Storage of Spent Fuel Pieces and Fragments

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Project Management, Integration, and Documentation	800	74,400		74,400
Characterization plan & procedures	180	16,740		16,740
Quality Assurance	35	3,255		3,255
Material characterization			50,000	50,000
RadCon support	225	13,500		13,500

Table 5.1.1 EBR II Cask Storage of Spent Fuel Pieces and Fragments

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Safety support	60	5,580		5,580
Packaging planning and procedures	80	7,440		7,440
Criticality evaluation	240	22,320		22,320
Material consolidation	450	41,850		41,850
Material packaging	250	23,250		23,250
WMH verification interface	220	20,460		20,460
Support WMH acceptance review	200	18,600		18,600
Review & modify EBR II SARP	400	37,200		37,200
Specify type and number of EBR II casks	90	8,528		8,528
Procure casks			36,782	147,000
Cask acceptance plan	160	14,880		14,880
Accept casks	40	3,720		3,720
Procurement specifications for 16 liners	54	5,022		5,022
Procure 16 liners			89,883	89,883
Specify vault	40	3,720		3,720
Procure vault			12,000	12,000
Accept vault	24	2,232		2,232
Specify welding equip.	24	2,232		2,232
Procure welding equip. & power supply			60,091	60,091
Accept & test welding equip.	40	4,192		41,192
Design in-cell hardware	48	4,464		4,464
Fabricate in-cell hardware	302	31,220		31,220
Install system in cell	44	4,434		4,434
Qualify welders & weld procedures	112	16,365		16,365
Leak test containers	50	4,650		4,650
Support DOE approval	80	7,440		7,440
Develop & qualify loadout procedures	80	7,440		7,440

Table 5.1.1 EBR II Cask Storage of Spent Fuel Pieces and Fragments

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Load & seal liners	120	11,160		11,160
NDA wastes (4 containers)			10,000	10,000
WMH Disposal fee (4 containers)			10,000	40,000
Prepare transport manifest	20	1,860		1,860
Ship waste (4 trips)			10,000	40,000
Total				904,128

Schedule

The anticipated project schedule for the SNF storage pathway is provided in Appendix F. Acceptance of this waste is subject to a number of reviews and to resource availabilities that are beyond the control of PNNL.

5.2 Low-Level Radioactive Waste (LLW)

5.2.1 Alternative 1 - Disposal in Low-Level Waste Burial Grounds

Technical Acceptibility

Low-level radioactive wastes are frequently disposed in the low-level waste burial grounds in the 200 West Area. This is a viable option, dependent on the waste meeting the disposal criteria. This disposal pathway appears to have no outstanding technical problems.

Because of the nature of the waste, containers are expected to be generally remote-handled without container shielding. A determination will be made during the acceptance review on whether the waste containers will be disposed by land burial or will take an interim storage pathway. It is anticipated that the containers will require significant shielding during storage to reduce radiation dose rates to below remote-handled levels. However, non-regulated shielding material (e.g., concrete or steel instead of lead) must be used if the waste is disposed by land burial.

It is anticipated that the LLW will be accommodated with 16 shielded 55-gallon drums. This assumes consolidation activities are at least partially successful and some drums will be able to accommodate more than one can. Transport of the shielded containers is limited to two per trip because of the requirement to use impact limiters.

Cost

Table 5.2.1 details the anticipated costs of this storage/disposal option. For planning purposes, the cost of disposing remote-handled Category 3 wastes (at $93.06 per ft^3 or $791.01 per container) is used.

Table 5.2.1 Storage/Disposal of Low-Level Radioactive Waste

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Project management, integration, and documentation	750	69,750		69,750
Characterization plan & procedures	200	18,600		18,600
Quality assurance	42	3,906		3,906
Waste characterization (sample analysis)			65,000	65,000
RadCon support	200	12,000		12,000
Safety support	60	5,580		5,580
Packaging planning and procedures	80	7,440		7,440
Material consolidation	420	39,060		39,060
Material packaging	300	27,900		27,900
WMH verification interface	240	22,320		22,320
Support to WMH acceptance review	120	11,160		11,160
Review & modify SARP as necessary	75	6,975		6,975
Specify type and number of containers	85	7,905		7,905
Procure containers (16)			20,000/drum	320,000
Container acceptance plan	85	7,905		7,905
Accept containers	36	3,348		3,348
Support DOE approval for waste movement	50	4,650		4,650
WMH Disposal Fee (16 containers)			791.01/drum	12,656
Develop & qualify Loadout Procedures	80	7,440		7,440
Waste loadout	90	8,370		8,370
NDA wastes			10,000	10,000

Table 5.2.1 Storage/Disposal of Low-Level Radioactive Waste

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Prepare transport manifest	25	2,325		2,325
Ship waste (8 trips)			5,000/trip	40,000
Total				$714,290

Schedule

The anticipated project schedule for the LLW disposal/storage pathway is provided in Appendix F. Acceptance of this waste is subject to a number of reviews and to resource availabilities that are beyond the control of PNNL.

5.2.2 Alternative 2 - Storage at CWC, T-Plant, WRAP Facilities

Low-level radioactive waste is accepted for storage in the 200 West Area waste management facilities. This is a viable option, dependent on the waste meeting the facility acceptance criteria and the availability of space. This alternative is anticipated to contain the same activities and cost to PNNL as the first alternative. Refer to Table 5.1.1 for details of this alternative.

5.2.2 Alternative 3 - Storage in PUREX Storage Tunnel

This alternative was not evaluated; however, this disposition is available to the waste management contractor for the same cost to PNNL as the first two alternatives.

5.3 Transuranic Waste (TRU)

5.3.1 Alternative 1 - Configure Package as Contact-Handled Waste

Technical Acceptibility

TRU wastes are frequently accepted for storage in the 200 West Area waste management facilities. This is a viable option, dependent on the waste meeting the facility acceptance criteria and the availability of space. This storage pathway, while considered interim, appears to have no outstanding technical problems.

The waste containers are expected to be remote-handled without container shielding. A determination will be made during the acceptance review on whether the waste containers will be accepted as contact-handled or as remote-handled TRU waste. It is anticipated that the containers will require shielding for storage to reduce radiation dose rates to manageable levels.

It is anticipated that 42 shielded 55-gallon drums are required to accommodate the TRU waste volume. This assumes consolidation activities are at least partially successful and that some drums can accommodate more than one can. Transport of the shielded containers is limited to two per trip because of the requirement to use impact limiters.

Cost

Table 5.3.1 details the anticipated costs of this storage/disposal option. For planning purposes, the cost of storing TRU waste (at $149.96/ft^3$ or $1,274.66 per container) is used.

Table 5.3.1 Storage of Transuranic Waste

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Project management, integration, and documentation	750	69,750		69,750
Characterization plan & procedures	200	18,600		18,600
Quality assurance	42	3,906		3,906
Waste characterization (sample analysis)			65,000	65,000
RadCon support	200	12,000		12,000
Safety support	60	5,580		5,580
Packaging planning and procedures	80	7,440		7,440
Material consolidation	420	39,060		39,060
Material packaging	300	27,900		27,900
WMH verification interface	240	22,320		22,320
Support to WMH acceptance review	120	11,160		11,160
Review & modify SARP as necessary	75	6,975		6,975
Specify type and number of containers	85	7,905		7,905
Procure containers (42)			20,000/drum	840,000
Container acceptance plan	85	7,905		7,905
Accept containers	36	3,348		3,348
Support DOE approval for waste movement	50	4,650		4,650
WMH Disposal Fee (42 containers)			1,275/drum	53,550

Table 5.3.1 Storage of Transuranic Waste

Activity	Labor Hours	Labor Costs $	Fixed Costs $	Total Activity Cost $
Develop & qualify Loadout Procedures	80	7,440		7,440
Waste loadout	90	8,370		8,370
NDA wastes			10,000	10,000
Prepare transport manifest	25	2,325		2,325
Ship waste (21 trips)			5,000	105,000
Total				$1,340,184

Schedule

The anticipated project schedule for the TRU storage pathway is provided in Appendix F. Acceptance of this waste is subject to a number of reviews and to resource availabilities that are beyond the control of PNNL.

6.0 RECOMMENDED SOLUTIONS

Selection of the preferred alternative for interim or final disposition of the waste is the responsibility of the designated waste management contractor for the Hanford Site. Thus, PNNL has little or no control over the waste disposition after turnover to the waste management contractor. This study demonstrated that viable disposition pathways do exist and are currently being used. This study also provided estimates of the cost of these activities and provided proposed schedules for removal of the SCW from the 325 Building.

The following are recommendations for disposition of the SCW:

Spent Fuel Pieces and Fragments

Package: Seal and Package in EBR II Shielded Casks

Disposition: Turn over to waste management contractor for interim storage in a concrete vault in the 200 West Area burial grounds

Cost: $904,128.00

Schedule: Prompt start and complete by 9/2000

Low-Level Radioactive Waste

Package: Package in 55-gallon shielded drums with appropriate liner

Disposition: Turn over to waste management contractor for burial or interim storage in one of the 200 West Area waste management facilities.

Cost: $714,290

Schedule: Prompt start and complete by 9/2000

Transuranic Waste

Package: Package in 55-gallon shielded drums with appropriate liner

Disposition: Turn over to waste management contractor for interim storage in one of the 200 West Area waste management facilities.

Cost: $1,340,184

Schedule: Prompt start and complete by 9/2000

7.0 REFERENCES

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APPENDIX A

SPENT FUEL RESTRICTIONS FOR THE EBR II CASK

- The Pu-U compounds may be either oxides, nitrides and/or carbides.

- The plutonium in the Pu-U compounds will be limited to no more than 50%. The plutonium isotopic distribution is restricted as follows: ^{238}Pu = 0. 1% max., ^{240}Pu = 40% max., ^{241}Pu = 5% max., ^{242}Pu = 4% max., ^{239}Pu = remainder.

- The uranium isotopic distribution is restricted as follows: ^{233}U = 0.1% max., ^{234}U = 0.1% max., ^{235}U = 94% max., ^{236}U = 0.1% max., ^{238}U = remainder.

- The arrangement of the fuel in the inner containment is not restricted, however, the total dry fissile content is limited to 4000 grams and the decay heat is limited to no more than 300 watts per package.

- The package will be equipped with a positive closure which will prevent inadvertent loss of contents. The two halves of the 21PF-1 Overpack are bolted together onto a foam gasket.

- No reactions between or among packaging components or contents is allowed.

- All materials must be in a solid form.

- The inner containment must consist of either one or two stainless steel containers that are welded closed. If single containment is used, the container must qualify as a special form container.

- The inner containment is placed inside the EBR-II Cask and sealed. This seal is a gasketed flange that must pass a leak test. The EBR-11 Cask is then placed in the 21PF-1 Overpack for transport, providing at least two leak proof barriers.

- The EBR-11 Cask is administratively limited to 200 mrem/hr on contact.

- Removable external radioactive contamination must meet DOT requirements (< 22 dpm per cm^2 beta-gamma and < 2.2 dpm per cm^2 alpha)..

APPENDIX B

Pertinent Acceptance Criteria for the Unlined Portions of the Low-Level Burial Grounds

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements for the unlined portions of the Low-Level Burial Grounds (LLBG).

B.1 Facility Description and Function

The LLBG is a land disposal unit for controlled burial of low-level radioactive waste. The LLBG includes a number of unlined disposal trenches that only accept radioactive waste not regulated under 40 CFR Part 261, WAC 173-303, or 40 CFR Part 761 (TSCA PCB wastes). The LLBG also includes two disposal trenches (trenches 31 and 34) for disposal of mixed waste. This section relates the acceptance criteria for the unlined portions of LLBG only.

B.2 Prohibited Waste

The following types of waste may not be disposed in the unlined portions of the LLBG:

- Waste that is dangerous or extremely hazardous as defined by WAC 173-303, or as hazardous wastes defined by 40 CFR Part 261 (HNF-SD-EN-WAP-002).
- TSCA-regulated PCB waste (HNF-SD-EN-WAP-002).
- Waste containing free liquids, except as allowed in Section 3.3.1 (HNF-SD-EN-WAP-002).
- Contained gases with pressures exceeding 1.5 atmospheres (DOE 5820.2A).
- Unstabilized organic liquids (including sorbed organic liquids) exceeding 1% of the waste by weight.
- Unstabilized chelating compounds exceeding 1% of the waste by weight (DOE 5820.2A).
- Biohazard waste.
- Transuranic waste and waste that exceed Class C, Category 3, and other radiological limits of Section 3.4.1 of HNF-EP-0063, Rev.5. *Hanford Site Solid Waste Acceptance Criteria.*

- Waste that poses substantial hazards due to formation of flammable or toxic gases, vapors or fumes. (DOE 5820.2A).

B.3 Physical/Chemical Criteria

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

- Liquids and Liquid-Containing Waste.

- All free liquids must be absorbed or stabilized in accordance with Appendix E of HNF-EP-0063, Rev. 5, or otherwise removed from the waste, except as specifically allowed as follows (HNF-SD-EN-WAP-002).

Containerized free liquids are allowed in the following situations, but cannot exceed 1% of the volume of the outer package (HNF-SD-EN-WAP-002, DOE 5820.2A):

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

- Free liquids in containers designed to hold free liquids for use other than storage. *(Note: this refers to articles such as batteries or capacitors which contain liquids required for the article to function. In any case, the liquid in the article must not be prohibited by other requirements of this chapter, such as dangerous waste, TSCA PCB waste and organic liquids.)*

- For liquid-containing waste where condensate could form in inner plastic packaging (e.g., bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbent material within the inner plastic packaging (HNF-SD-EN-WAP-002). The type and amount of sorbent required shall be in accordance with Appendix E of HNF-EP-0063, Rev. 5.

- Residual liquids in large debris items shall be sorbed or removed. In cases where it is not practical to remove suspected liquids and it is impossible to sample to determine if liquids are present, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item (HNF-SD-EN-WAP-002).

B.3.1 Land Disposal Restrictions

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

- Hazardous debris that is exempted from regulation under 40 CFR 261.3(f)

- Waste that originally was designated only with characteristic waste codes D001 through D043 that is no longer hazardous, and that meets all of the applicable treatment standards of 40 CFR Part 268. A copy of the applicable notification to the U.S. Environmental Protection Agency (EPA) Regional Administrator, as specified in 40 CFR 268.7, and data supporting this notification must be provided to the WMH acceptance organization.

B.3.2 Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1% of the waste by weight must be stabilized to a form that chemically bonds and immobilizes the organic and chelating compounds. The stabilized waste must be non-compressible and maintain its stability in the disposal environment.

B.3.3 Asbestos-Containing Waste

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

B.3.4 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter, the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in the LLBG. This evaluation must be approved by the WMH acceptance organization.

B.3.5 Gas Generation

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

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013J 1 filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs could be used to control hydrogen concentrations in the container.

- Control of gases from biological decomposition: waste containing readily biodegradable organic materials (e.g., animal waste, vegetation) must be vented with a Nucfil 013J 1 filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic absorbent could be added to the waste to reduce biological decomposition.

Packaging of animal carcasses: Radioactive animal carcasses must be packaged as follows (Stanley 1989):

- The waste must be packaged in an inner and outer metal package, where the outer package has a capacity at least 40 percent greater than that of the inner package. The outer package must meet DOT requirements.

- The inner package shall be lined with a minimum 4 mil plastic liner. Surround the animal carcass(es) in the inner package with a mixture of ten parts mineral sorbent to 1 part slaked lime. Seal the plastic liner and inner package. Place a minimum of 7.6 cm (3 inches) of mineral sorbent in the bottom of the outer package, place the inner package into the outer package, and fill the void space between the two packages with additional mineral sorbent.

- Seal the outer package.

B.4 Radiological Criteria

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

B.4.1 Radiological Concentration Limits

The methodology for classification of the radionuclide content of waste against the various limits listed in the following sections are provided in Appendix A of HNF-EP-0063, Rev. 5. A waste must meet all of the following conditions to be disposed in the LLBG:

- TRU content limit - TRU content (as calculated by method A.1 of Appendix A of HNF-EP-0063, Rev. 5) shall not exceed 100 nanocuries per gram of waste (DOE 5820.2A).

- Waste category (as calculated by methods A.4 and A.5 of Appendix A of HNF-EP-0063, Rev. 5) shall not exceed Category 3, except with an analysis performed by WMH demonstrating that the LLBG Performance Assessment conditions are met (WHC-EP-0645, WHC-SD-WM-TI-730).

- Category 3 waste (as calculated by methods A.4 and A.5 of Appendix A of HNF-EP-0063, Rev. 5) 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 meets the testing requirements of the Hanford *High Integrity Container, 300 Year* specification (WHC-S-0486).

- Packaging in a HIC approved by the WMH acceptance organization. *(Note: a list of approved HICs is available on the Hanford Site Solid Waste Acceptance Criteria internet web page (*http://www.hanford.gov/wastemgt/wac/index.htm*).*

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

- Inherently stable waste materials, such as concrete or activated metal.

- Mobile Radionuclides - If the concentration of any mobile radionuclide exceeds the Mobile Radionuclide Reporting Limit of Table A-2, stabilization could be required (WHC-EP-0645, WHC- SD-WM-TI-730). WMH will perform a case-by-case evaluation against the LLBG Performance Assessment (WHC-EP-0645, WHC-SD-WM-TI-730) to determine whether the waste requires stabilization to meet the groundwater pathway dose criteria. Stabilization would normally consist of placement of the waste container in a HIC, but additional stabilization may be required based on a number of factors such as, waste form and radionuclide content. The WMH acceptance organization will coordinate this evaluation.

- NRC Class C Limit - Waste shall not exceed the NRC Class C limits (as calculated by method A.6 of Appendix A of HNF-EP-0063, Rev.5) (DOE 5820.2A).

- Interim Safety Basis (ISB) Limits - Waste must meet the applicable ISB limits for the LLBG (as calculated by method A.7 of Appendix A of HNF-EP-0063, Rev. 5), with the following exception: if a combustible waste exceeds the combustible waste limit, but does not exceed the noncombustible waste limit, WMH can perform an evaluation to determine whether segregation or stabilization can be used to mitigate the combustibility hazard (WHC-SD-WM-ISB-002).

B.4.2 Criticality Safety Limits

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

B.4.3 Package External Contamination Limits

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

B.4.4 Package Dose Rate Limits

Contact-handled waste shall not exceed 1 mSv/h (100 millirem per hour) at 30 centimeters from the waste package and 2 mSv/h (200 millirem per hour) on the surface of the package, except that small hot spots of up to 10 mSv/h (1,000 millirem per hour) can be accepted if these are clearly marked on the package and the 30 centimeter dose rate limit is not exceeded (DOE 5820.2A, HSRCM-1).

Remote-handled waste shall not exceed 30 mSv/h (3000 millirem per hour) at 1 meter from a truck or 50 mSv/h (5000 millirem per hour) at 1 meter from a railcar used to transport the waste package (DOE 5820.2A).

B.5 Packaging Criteria

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

B.5.1 Outer Packages

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

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

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

B.5.2 Package Construction

All outer packages shall be nonflammable or constructed of fire-retardant materials. All exterior surfaces of wooden packages shall be treated with a fire-retardant material having a maximum flame-spread index of 25 when tested to ASTM *Standard Test Method for Surface Burning Characteristics of Building Materials* (ASTM E-84-89a). Cardboard containers are not acceptable for disposal (DOE 5820.2A).

Packages and sacrificial rigging shall not contain regulated materials, such as lead.

B.5.3 Condition of Containers

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

B.5.4 Securing Waste and Shielding

Large, heavy items must be secured in containers by bracing, blocking or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

B.5.5 Handling of Packages

All packages must be configured for safe unloading by forklift or crane. Alternate means of unloading could be allowed with approval from the TSD unit manager or designee.

Packages that must be unloaded by crane shall be equipped with a lifting system designed to safely lift the fully loaded package. All slings and lifting devices shall meet the requirements of the *Hanford Site Rigging Manual* (DOE-RL-92-36).

For packages that have special unloading requirements, information must be provided to the WMH acceptance organization concerning the methods for unloading before the shipment is scheduled.

Sacrificial rigging shall be provided for remote handled waste packages. Rigging shall not contain regulated materials, such as lead.

B.5.6 Minimization of Subsidence

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

- Inherently stable waste that will not subside in the disposal environment.
- Waste stabilized by grouting or packaging in a HIC.
- Containerized waste that fills at least 90% of the internal volume of the container. To calculate the volume of void spaces in the waste, only voids exceeding 5.1 centimeters (2 inches) in all dimensions need be considered. Any void fillers added to the waste must be non-compressible at 138 kilopascals (20 pounds per square inch) loading.

APPENDIX C

Pertinent Acceptance Criteria for the Central Waste Complex

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements of the Central Waste Complex (CWC).

C.1 Facility Description and Function

The CWC is a treatment and storage unit for low-level mixed and TSCA PCB waste, TRU waste, TRU mixed and TSCA PCB waste, and other waste requiring treatment before disposal (e.g., non-regulated low-level organic liquids, unstabilized chelating compounds). Waste stored at CWC will be treated and repackaged as required for disposal as treatment capabilities become available.

The CWC treats and stores waste having characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U- and P- listed waste), certain F-listed waste (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste codes. In addition, the CWC manages TSCA PCB waste from Hanford Site generators.

C.2 Prohibited Waste

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

- Explosive waste
- Unstable reactive waste
- Pyrophoric waste
- Waste that reasonably might be expected to become unstable, explosive, to generate excessive heat or toxic gases, or for any other reason cannot be stored safely over 20-year period (DOE 5820.2A, WHC-SD-WM-SAR-049)
- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards during storage (DOE 5820.2A, WHC-SD-WM-SAR-049)
- Compressed gases at pressures in excess of 1.5 atmospheres or wastes that might pressurize to exceed 1.5 atmospheres over a 20-year storage life (DOE 5820.2A, WHC-SD-WM-SAR-049)

- Waste having dangerous waste codes other than those listed on the CWC Part A Form 3 permit application (DOE-RL-88-21). The prohibited waste codes are F006 through F019, F024, F025, F032 through F038, and all K waste codes

- Waste that exceeds any of the radiological limits of Section C.4

- Liquid waste, except that lab packed and overpacked liquids could be accepted in quantities of 57 liters (15 gallons) per outer container (WHC-SD-SAR-049)

- Biohazard waste.

C.3 Physical/Chemical Criteria

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

C.3.1 Chemical Compatibility

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

C.3.2 Liquids and Liquid-Containing Waste

Sorbtion of liquids is allowed, but must be compatible with the treatment methods anticipated for disposal. Appendix E of HNF-EP-0063, Rev. 5 and the applicable WSRd specify the appropriate sorbent material to be used for various waste streams. For waste that could form condensate during storage, sufficient sorbent shall be added to the container to sorb any condensate formed.

C.3.3 Asbestos-Containing Waste

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

C.3.4 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter, the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in storage. This evaluation must be approved by the WMH acceptance organization.

C.3.5 Gas Generation

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

- Control hydrogen from radiolytic decomposition using a Nucfil 013J 2 filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013J filter or equivalent.

- In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic absorbent could be required for waste that is expected to decompose rapidly.

C.4 Radiological Criteria

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

C.4.1 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B of HNF-EP-0063, Rev. 5 (CPS-SW-149-00002).

C.4.2 Container Dose-Equivalent Curie Limits

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

C.4.3 Waste Exceeding Class C or Category 3

Waste having radionuclide concentrations exceeding Class C or Category 3 requires DOE-RL approval for acceptance.

C.4.4 Package Removable Contamination Limits

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

C.4.5 Package Dose Rate Limits

Waste containers shall not exceed 1 mSv/h (100 millirem per hour) at 30 centimeters from the waste package and 2 mSv/h (200 millirem per hour) at any point on the surface of the package (DOE 5820.2A, HSRCM-1).

C.5 Packaging Criteria

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

C.5.1 Container Selection

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

C.5.2 Protective Coatings and Liners

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

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.
- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630, WHC-SD-WM-SAR-049). Unless otherwise specified by the WMH acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix C of HNF-EP-0063, Rev. 5 defines preferred coating and liner options.

C.5.3 Noncombustible Containers

Outer containers shall be constructed of noncombustible materials.

C.5.4 Condition of Containers

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

C.5.5 Securing Waste and Shielding

Large, heavy items must be secured in containers by bracing, blocking or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

C.5.6 Package Size and Weight Limits

The preferred standard container sizes for waste are listed on each WSRd. Other container sizes could be used when dictated by the size or form of the waste. TABLE c-1 identifits the baseline size limits for CWC storage modules. Larger containers could be accepted into specific storage modules with special loading procedures.

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

Storage units	Package size limit	Floor loading limit
Alkali metal modules	320 liter (85 gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
Low-flashpoint modules	320 liter (85 gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
2401-W Building	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	2,200 kilograms per square meter (450 pounds per square foot)
Other storage buildings (2402-W, 2403-W and 2404-W)	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	3,430 - 9,800 kilograms per square meter (700 - 2,000 pounds per square foot)

APPENDIX D

Acceptance Criteria for the T-Plant Complex

This chapter defines the baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements at the T-Plant Complex.

D.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, nondestructive examination, and repackaging. The 221-T building is used primarily for highly contaminated equipment decontamination. The 2706-T and 214-T buildings are used for storage, decontamination, treatment and processing of equipment and waste having relatively lower levels of radiological contamination.

Waste that can be managed at the T-Plant Complex include TRU waste, TRU-mixed and TSCA PCB waste, LLW, and low-level mixed and TSCA PCB waste. The T-Plant Complex Part A, Form 3 permit application includes characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U- and P- listed wastes), F-listed wastes having waste codes F001 through F005, F020 through F023, F026 through F028, and F039, and all Washington state-only waste codes.

The T-Plant Complex can also manage TSCA PCB waste generated on the Hanford Site, and can manage wastes from CERCLA cleanup activities. Waste managed at the T-Plant Complex could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing at the T-Plant Complex.

D.2 Prohibited Waste

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

- Explosive waste
- Unstable reactive waste
- Pyrophoric waste
- Compressed gases, except that pressurized aerosol cans can be accepted
- Waste that could generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards.

- Waste having dangerous waste codes other than those listed on the T-Plant Complex permit application. The prohibited waste codes are F006 through F019, F024, F025, F032 through F038, and all K waste codes (DOE-RL-88-21).

- Waste that exceeds the radiological limits of Section 6.4

- Biohazard waste.

D.3 Physical/Chemical Criteria

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

D.3.1 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.

D.3.2 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter, the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers. This evaluation must be approved by the WMH acceptance organization.

D.3.3 Gas Generation

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

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013J 3 filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013J 4 filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic absorbent could be required for waste that is expected to decompose rapidly.

D.4 Radiological Criteria

The following are the radiological acceptance criteria for the T-Plant Complex:

D.4.1 Total Facility Dose Equivalent Curie Limits

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

D.4.2 Criticality Safety Limits

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

- 221-T canyon and tunnel: 200 grams fissile material per piece of equipment and 900 grams fissile material in the facility
- All other areas of the T-Plant Complex: 15 grams fissile material total facility limit. Individual waste containers must additionally meet the limits of Appendix B of HNF-EP-0063, Rev. 5.

D.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall meet the limits of the *Hanford Site Radiological Control Manual*, Table 2-2 (HSRCM-1).

D.4.4 Package External Dose Rate Limits

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

D.4.5 Internal Dose Rate and Contamination Limits for Decontamination and Processing

The contact dose rate for equipment and waste to be decontaminated or processed will be determined on a case-by-case basis during acceptance review. When internal contact dose rates exceed 1 mSv/h (100 millirem per hour), detailed radiological survey information must be provided by the generator. In addition, items with detectable alpha contamination may not be acceptable for decontamination or processing at 2706-T. If the waste contains detectable alpha contamination, the generator must provide detailed radiological survey information to determine whether the waste can be processed at 2706-T.

D.5 Packaging Criteria

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

D.5.1 Container Selection

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

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

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

D.5.2 Non-combustible Containers

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

D.5.3 Protective Coatings and Liners

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

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

- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WMH acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D of HNF-EP-0063, Rev. 5 defines preferred coating and liner options.

D.5.4 Condition of Containers

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

D.5.5 Securing Waste and Shielding

Large, heavy items must be secured in containers by bracing, blocking or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

D.5.6 Container Size Limits

Container size limits are as follows:

2706-T: 12.2 meters (40 ft.) long by 4.3 meters (14 ft.) high by 3.7 meters (12 ft.) wide

221-T: 6.7 meters (22 ft.) long by 4.0 meters (13 ft.) high by 5.5 meters (18 ft.) wide

14-T: 6.0 meters (20 ft.) long by 3.0 meters (10 ft.) high by 3 meters (10 ft.) wide.

D.5.7 Container Weight Limits

General container weight limits are as follows:

- Heavier containers can be accepted on a case-by case basis
- Drums shall not exceed 454 kilograms (1000 lb.)
- Plywood boxes shall not exceed 2270 kilograms (5000 lb.).

Large equipment or packages shall not exceed the following limits:

2706-T: 5,400 kg (small vehicles); 9,100 kg per axle or 36,000 kg gross (heavy equipment); or 110,000 kg (rail rolling stock). All limits except rail rolling stock can be exceeded on a case-by-case basis

221-T: 41,000 kilograms.

APPENDIX E

Pertinent Acceptance Criteria for the Waste Receiving and Processing Facility

The following acceptance criteria apply to newly generated waste sent to the Waste Receiving and Processing facility (WRAP) facility. Acceptance criteria for retrieved waste containers in the LLBG will be established through project-specific acceptance procedures.

E.1 Facility Description and Function

WRAP is a storage and treatment unit. WRAP accepts waste containers for verification, sampling, nondestructive assay, nondestructive examination, treatment, and repackaging. Waste that can be handled at WRAP includes TRU waste, TRU mixed and TSCA PCB waste, low-level waste, and low-level mixed and TSCA PCB waste. The WRAP facility manages waste having characteristic waste codes D001 through D043, all listed discarded chemical product waste codes (U-and P- listed wastes), certain F-listed waste codes (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste codes. In addition, WRAP manages TSCA PCB waste generated on the Hanford Site. Waste managed at WRAP could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing waste at WRAP.

E.2 Prohibited Waste

The following waste types cannot be accepted at WRAP:

- Liquid wastes, except those inner containers having less than 57 liters (15 gallons) of liquid, are unacceptable
- Compressed gases, except that pressurized aerosol cans can be accepted
- Explosive waste
- Unstable reactive waste
- Pyrophoric waste
- Waste that might generate toxic gases, vapors, or fumes in concentrations that reasonably could be expected to exceed occupational exposure limits and/or air emission standards
- Waste having dangerous waste codes other than those listed on the WRAP Part A, Form 3 permit application (DOE-RL-88-21). The prohibited waste codes are F006 through F019, F024, F025, F032 through F038, and all K waste codes)

- Waste that exceeds any of the radiological limits of Section 7.4
- Biohazard waste.

E.3 Physical/Chemical Criteria

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

E.3.1 Hazardous Material Limits

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

E.3.2 Asbestos-Containing Waste

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

E.3.3 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter, the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers. This evaluation must be approved by the WMH acceptance organization.

E.3.4 Gas Generation

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

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013J 4 filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013J 5 filter or equivalent. In addition to filtering, a mixture of 10% by weight slaked lime in 90% inorganic absorbent could be required for waste that is expected to decompose rapidly.

E.4 Radiological Criteria

The following are the radiological acceptance criteria for WRAP:

E.4.1 Container Dose-Equivalent Curie Limits

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

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

E.4.2 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B of HNF-EP-0063, Rev. 5 (WRP1-CPS-001).

E.4.3 Package External Contamination Limits

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

E.4.4 Package External Dose Rate Limits

Waste containers shall not exceed 1 mSv/h (100 millirem per hour) at 30 centimeters from the waste package and 2 mSv/h (200 millirem) per hour at any point on the surface of the package (HSRCM-1).

E.5 Packaging Criteria

The following are the packaging criteria for acceptance at WRAP:

E.5.1 Container Selection

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

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

- Strong, tight packages that have been evaluated through an approved packaging safety analysis.

E.5.2 Protective Coatings and Liners

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

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

The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WMH acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D of HNF-EP-0063, Rev. 5 defines preferred coating and liner options.

E.5.3 Noncombustible Containers

Outer containers shall be constructed of metal, except that fire-retardant wood boxes may be used for low-level waste only. Additionally, wood boxes must be overpacked in a metal box for nondestructive assay in the WRAP facility (HNF-SD-W026-SAR-002).

E.5.4 Condition of Containers

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

E.5.5 Securing Waste and Shielding

Large, heavy items must be secured in containers by bracing, blocking or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

E.5.6 Package Size Limits

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

- 208 liter (55 gallon) drums
- 321 liter (85 gallon) drums.

Boxes not exceeding the following dimensions may be received for nondestructive examination and/or nondestructive assay:

- Nondestructive examination: 2.74 m long by 1.6 m wide by 1.7 m high
- Nondestructive assay: 2.43 m long by 1.5 m wide by 1.5 m high.

E.5.7 Package Weight Limits

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

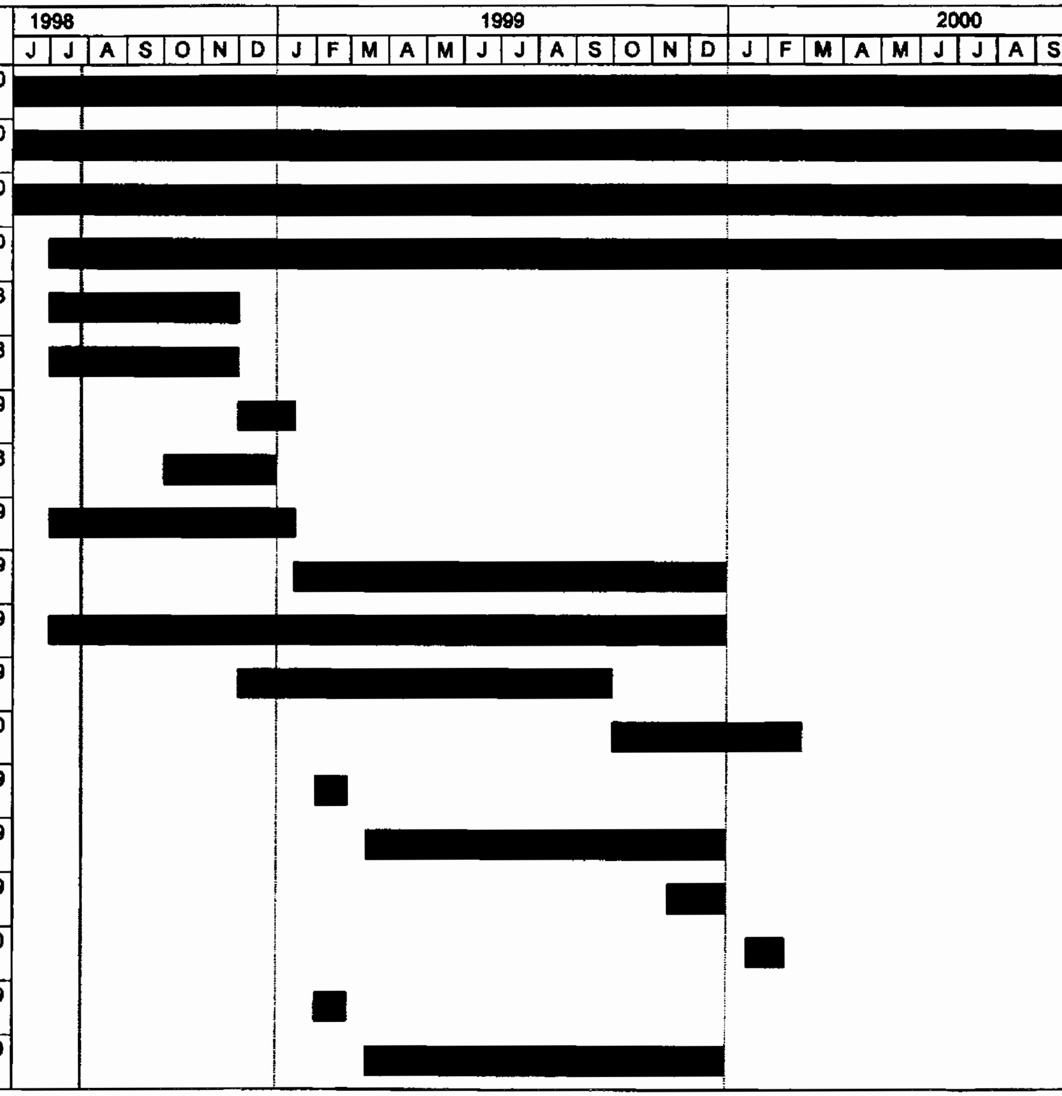
- Drums: 454 kilograms (1,000 lb.)
- SWB: 1,800 kilograms (3,970 lb.)
- Other Boxes: 3,180 kilograms (7,000 lb.).

APPENDIX F

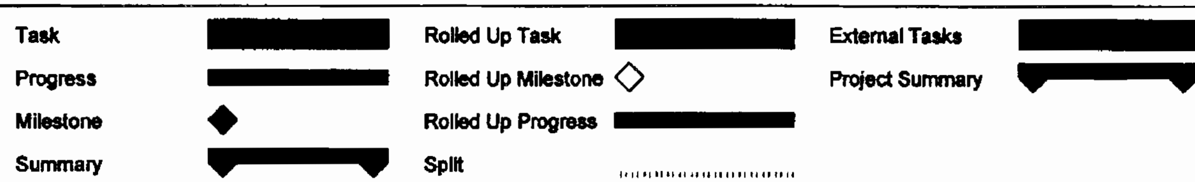
Project Cost and Schedule

SNF Waste Project Schedule

ID	Task Name	Duration	Start	Finish
1	Project management, integration, and documentation	610 days	Mon 6/1/98	Fri 9/29/00
2	Radcon support	610 days	Mon 6/1/98	Fri 9/29/00
3	Safety support	610 days	Mon 6/1/98	Fri 9/29/00
4	Quality assurance	588 days	Wed 7/1/98	Fri 9/29/00
5	Characterization plan & procedures	110 days	Wed 7/1/98	Tue 12/1/98
6	Material charaterization	109 days	Wed 7/1/98	Mon 11/30/98
7	Packaging planning and procedures	34 days	Tue 12/1/98	Fri 1/15/99
8	Criticality evaluation	65 days	Thu 10/1/98	Wed 12/30/98
9	Material consolidation	143 days	Wed 7/1/98	Fri 1/15/99
10	Material packaging	250 days	Fri 1/15/99	Thu 12/30/99
11	WMH verification interface	392 days	Wed 7/1/98	Thu 12/30/99
12	Support to WMH acceptance review	218 days	Tue 12/1/98	Thu 9/30/99
13	Review & modify EBR II SARP	107 days	Fri 10/1/99	Mon 2/28/00
14	Specify type and number of EBR II casks	20 days	Mon 2/1/99	Fri 2/26/99
15	Procure casks	209 days	Mon 3/15/99	Thu 12/30/99
16	Cask acceptance plan	34 days	Mon 11/15/99	Thu 12/30/99
17	Accept casks	22 days	Mon 1/17/00	Tue 2/15/00
18	Procurement specifications for 16 liners	20 days	Mon 2/1/99	Fri 2/26/99
19	Procure 16 liners	209 days	Mon 3/15/99	Thu 12/30/99

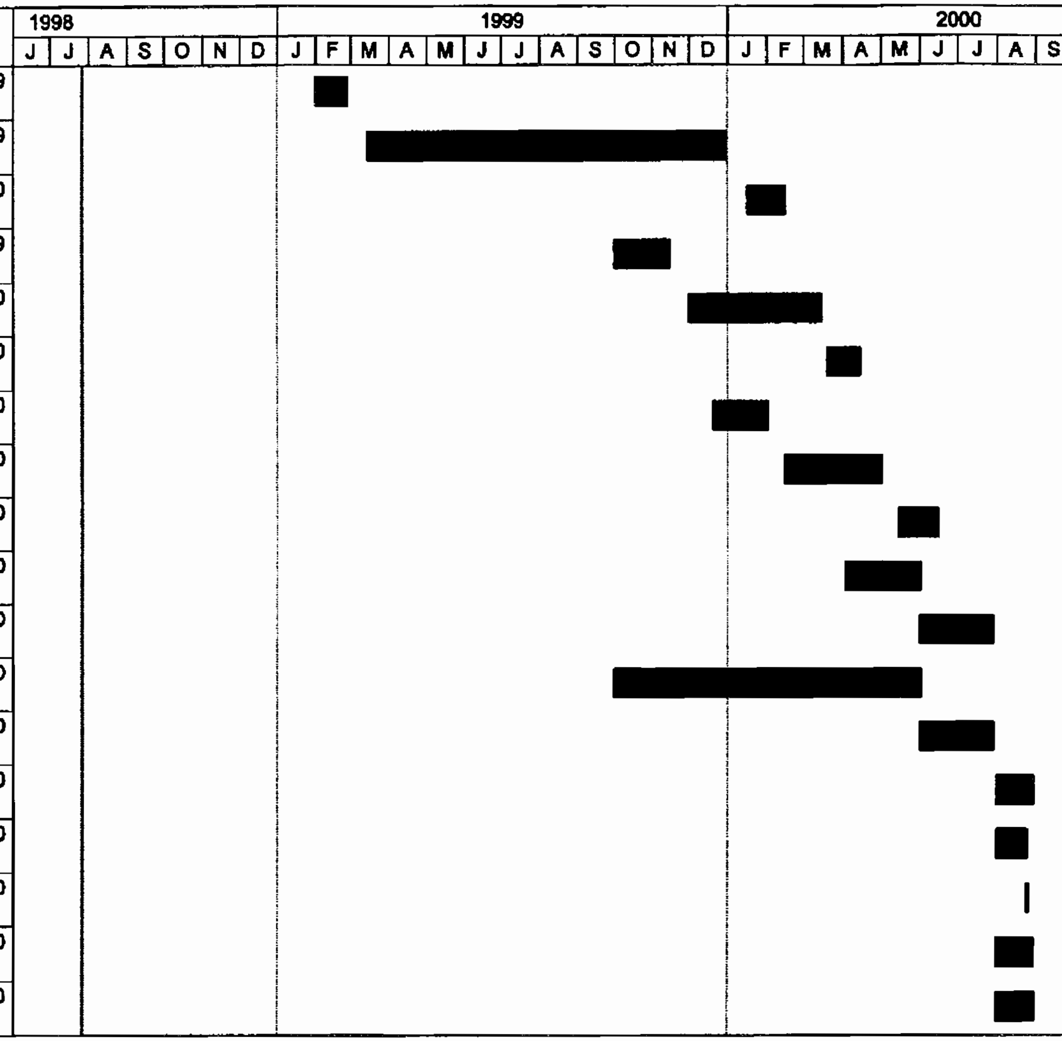


Project: Project1
Date: Sun 7/26/98



SNF Waste Project Schedule

ID	Task Name	Duration	Start	Finish
20	Specify vault	20 days	Mon 2/1/99	Fri 2/26/99
21	Procure vault	209 days	Mon 3/15/99	Thu 12/30/99
22	Accept vault	22 days	Mon 1/17/00	Tue 2/15/00
23	Specify welding equipment	32 days	Fri 10/1/99	Mon 11/15/99
24	Procure welding equipment & power supply	76 days	Wed 12/1/99	Wed 3/15/00
25	Accept & test welding equipment	20 days	Mon 3/20/00	Fri 4/14/00
26	Design in-cell hardware	32 days	Mon 12/20/99	Tue 2/1/00
27	Fabricate in-cell hardware	55 days	Tue 2/15/00	Mon 5/1/00
28	Install system in cell	24 days	Mon 5/15/00	Thu 6/15/00
29	Qualify welders & weld procedures	44 days	Mon 4/3/00	Thu 6/1/00
30	Leak test containers	42 days	Thu 6/1/00	Fri 7/28/00
31	Support DOE approval for waste movement	175 days	Fri 10/1/99	Thu 6/1/00
32	Develop & qualify Loadout Procedures	42 days	Thu 6/1/00	Fri 7/28/00
33	Load & seal liners	22 days	Mon 7/31/00	Tue 8/29/00
34	NDA wastes (4 containers)	19 days	Mon 7/31/00	Thu 8/24/00
35	WMH Disposal fee (4 containers)	2 days	Thu 8/24/00	Fri 8/25/00
36	Prepare transport manifest	22 days	Sun 7/30/00	Tue 8/29/00
37	Ship waste (4 trips)	23 days	Sun 7/30/00	Wed 8/30/00



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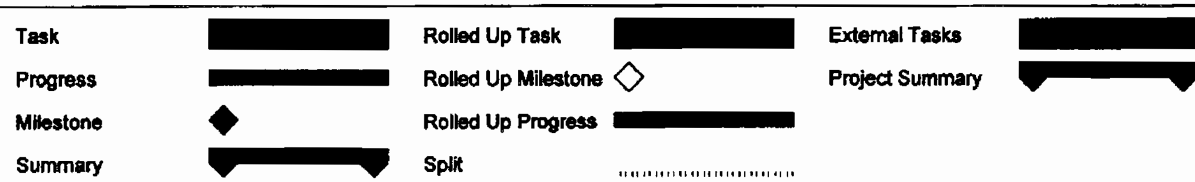
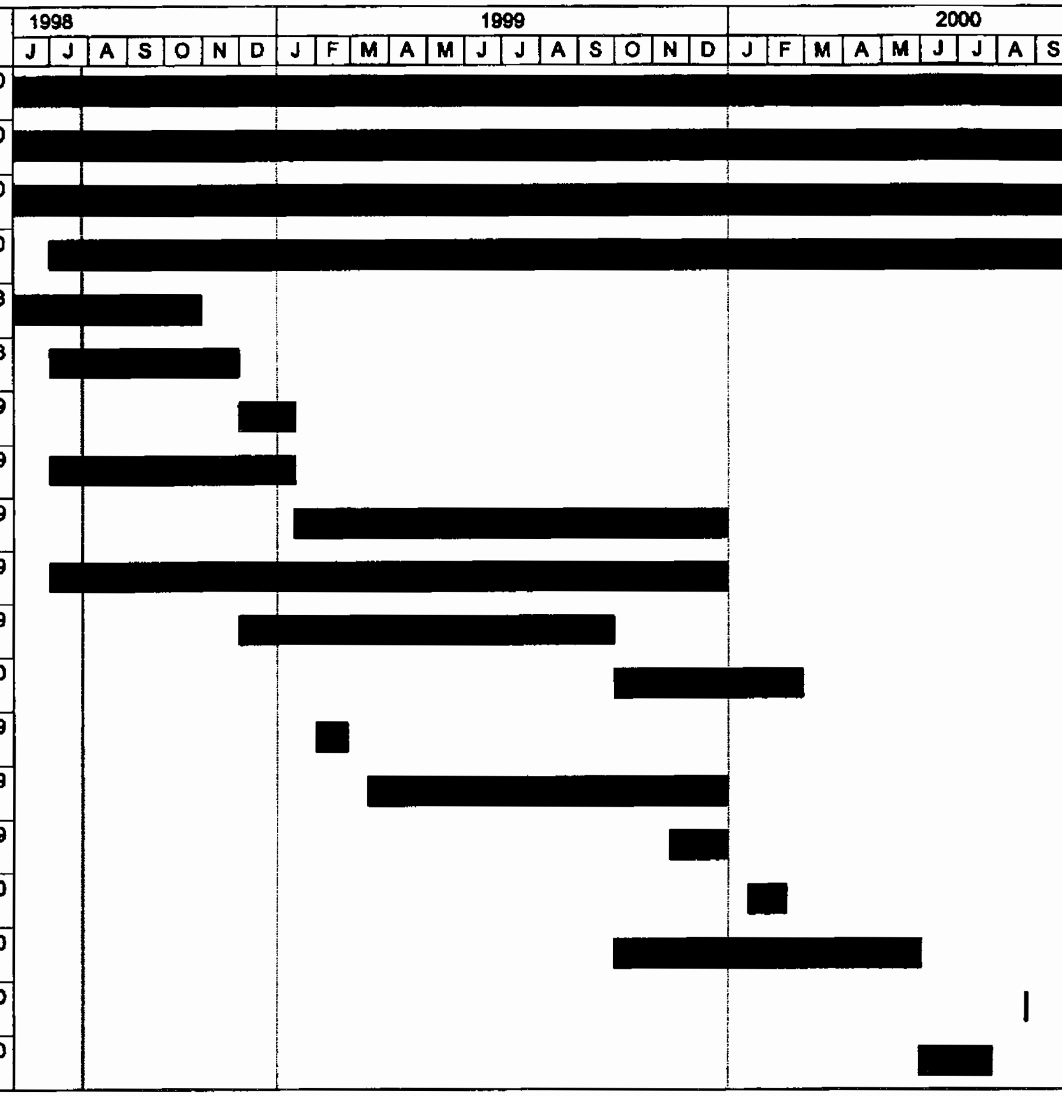
Date: Sun 7/26/98

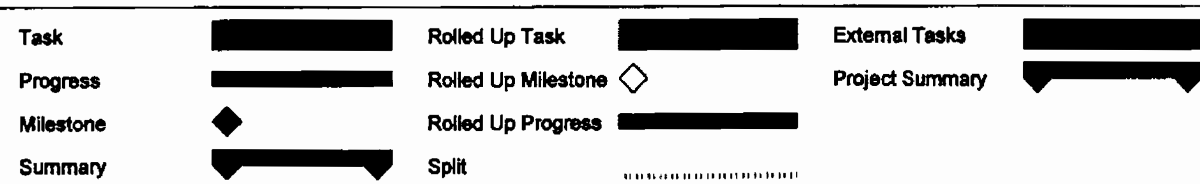


LLW Project Schedule

ID	Task Name	Duration	Start	Finish
1	Project management, integration, and documentation	610 days	Mon 6/1/98	Fri 9/29/00
2	Radcon support	610 days	Mon 6/1/98	Fri 9/29/00
3	Safety support	610 days	Mon 6/1/98	Fri 9/29/00
4	Quality assurance	588 days	Wed 7/1/98	Fri 9/29/00
5	Characterization plan & procedures	110 days	Mon 6/1/98	Fri 10/30/98
6	Material charaterization	109 days	Wed 7/1/98	Mon 11/30/98
7	Packaging planning and procedures	34 days	Tue 12/1/98	Fri 1/15/99
8	Material consolidation	143 days	Wed 7/1/98	Fri 1/15/99
9	Material packaging	250 days	Fri 1/15/99	Thu 12/30/99
10	WMH verification interface	392 days	Wed 7/1/98	Thu 12/30/99
11	Support to WMH acceptance review	218 days	Tue 12/1/98	Thu 9/30/99
12	Review & modify SARP as necessary	107 days	Fri 10/1/99	Mon 2/28/00
13	Specify type and number of containers	20 days	Mon 2/1/99	Fri 2/26/99
14	Procure containers	209 days	Mon 3/15/99	Thu 12/30/99
15	Containers acceptance plan	34 days	Mon 11/15/99	Thu 12/30/99
16	Acceptance containers	22 days	Mon 1/17/00	Tue 2/15/00
17	Support DOE approval for waste movement	175 days	Fri 10/1/99	Thu 6/1/00
18	WMH Disposal Fee (25 containers)	2 days	Thu 8/24/00	Fri 8/25/00
19	Develop & qualify Loadout Procedures	42 days	Thu 6/1/00	Fri 7/28/00

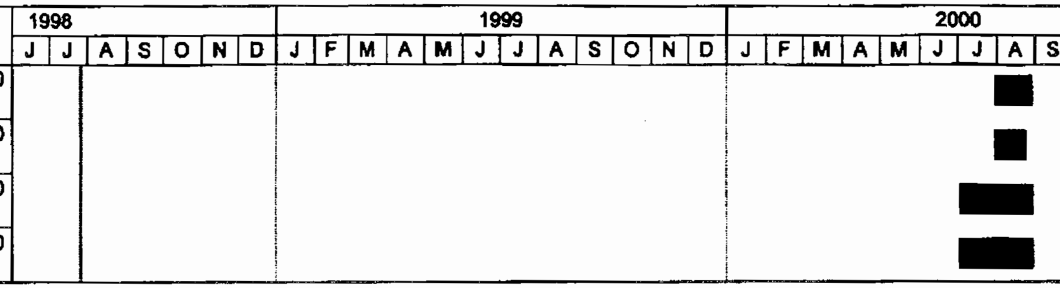


Project: Project1
Date: Sun 7/26/98



LLW Project Schedule

ID	Task Name	Duration	Start	Finish
20	Waste loadout	22 days	Sun 7/30/00	Tue 8/29/00
21	NDA wastes	19 days	Mon 7/31/00	Thu 8/24/00
22	Prepare transport manifest	43 days	Sat 7/1/00	Wed 8/30/00
23	Ship waste (13 trips)	43 days	Sat 7/1/00	Wed 8/30/00

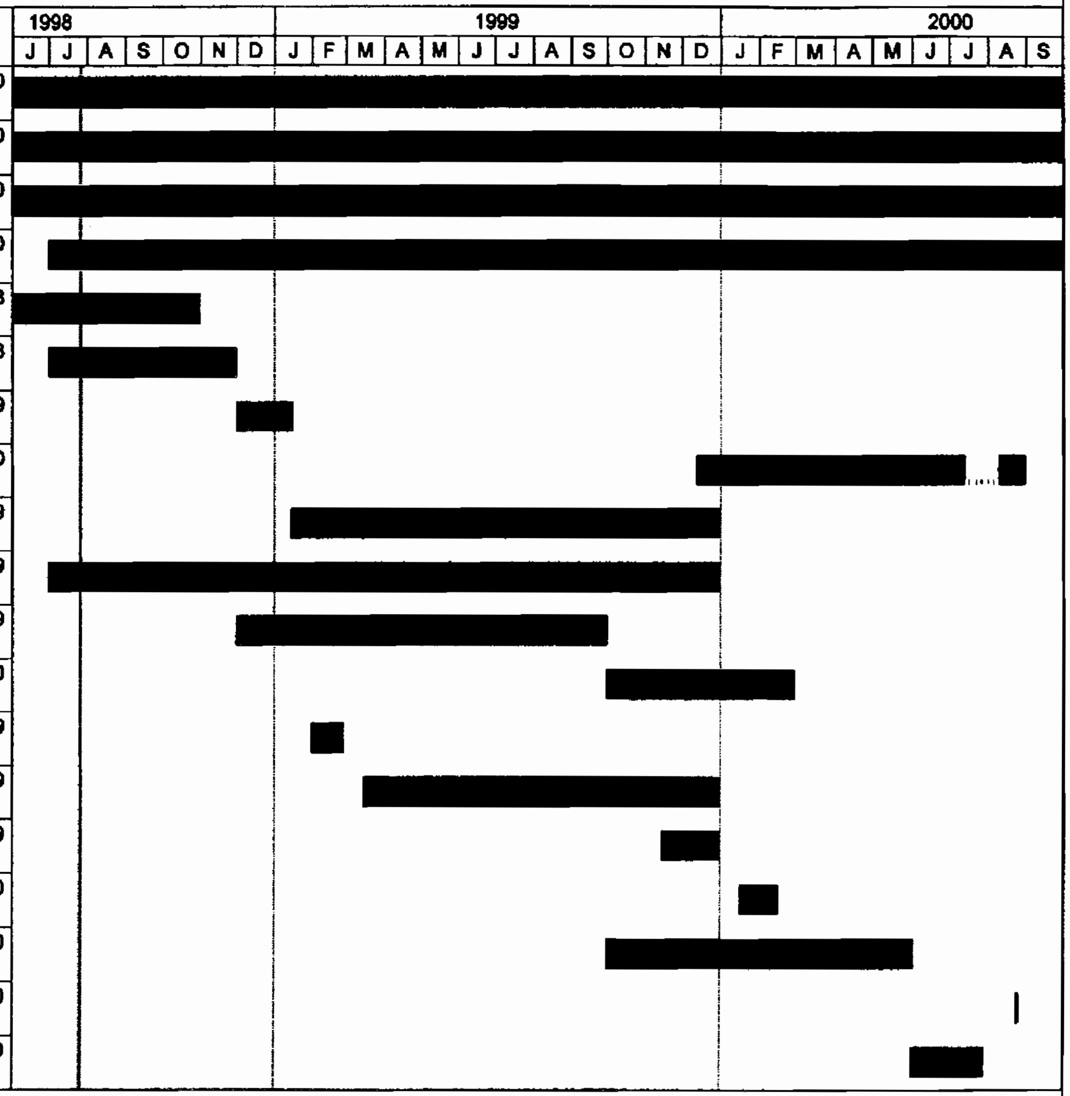


Project: Project1
Date: Sun 7/26/98

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary

TRU Waste Project Schedule

ID	Task Name	Duration	Start	Finish
1	Project management, integration, and documentation	610 days	Mon 6/1/98	Fri 9/29/00
2	Radcon support	610 days	Mon 6/1/98	Fri 9/29/00
3	Safety support	610 days	Mon 6/1/98	Fri 9/29/00
4	Quality assurance	588 days	Wed 7/1/98	Fri 9/29/00
5	Characterization plan & procedures	110 days	Mon 6/1/98	Fri 10/30/98
6	Material charaterization	109 days	Wed 7/1/98	Mon 11/30/98
7	Packaging planning and procedures	34 days	Tue 12/1/98	Fri 1/15/99
8	Material consolidation	168 days	Mon 12/13/99	Wed 8/30/00
9	Material packaging	250 days	Fri 1/15/99	Thu 12/30/99
10	WMH verification interface	392 days	Wed 7/1/98	Thu 12/30/99
11	Support to WMH acceptance review	218 days	Tue 12/1/98	Thu 9/30/99
12	Review & modify SARP as necessary	107 days	Fri 10/1/99	Mon 2/28/00
13	Specify type and number of containers	20 days	Mon 2/1/99	Fri 2/26/99
14	Procure containers	209 days	Mon 3/15/99	Thu 12/30/99
15	Containers acceptance plan	34 days	Mon 11/15/99	Thu 12/30/99
16	Acceptance containers	22 days	Mon 1/17/00	Tue 2/15/00
17	Support DOE approval for waste movement	175 days	Fri 10/1/99	Thu 6/1/00
18	WMH Disposal Fee (25 containers)	2 days	Thu 8/24/00	Fri 8/25/00
19	Develop & qualify Loadout Procedures	42 days	Thu 6/1/00	Fri 7/28/00



Project: Project1
Date: Sun 7/26/98

Task	Rolled Up Task	External Tasks
Progress	Rolled Up Milestone	Project Summary
Milestone	Rolled Up Progress	
Summary	Split	

TRU Waste Project Schedule

ID	Task Name	Duration	Start	Finish
20	Waste loadout	22 days	Mon 7/31/00	Tue 8/29/00
21	NDA wastes	19 days	Mon 7/31/00	Thu 8/24/00
22	Prepare transport manifest	43 days	Mon 7/3/00	Wed 8/30/00
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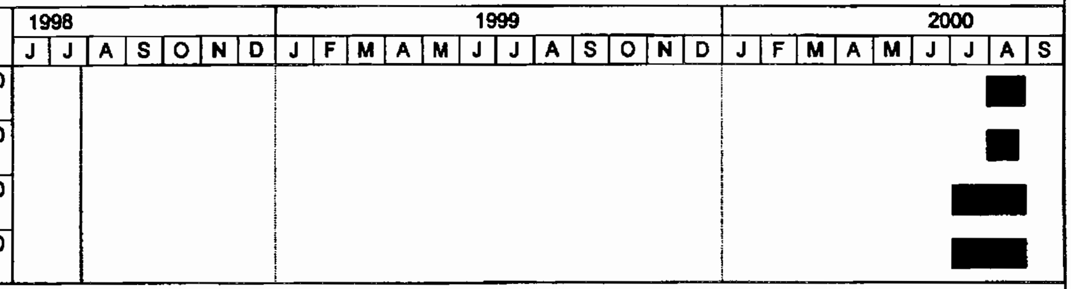

Project: Project1
Date: Sun 7/26/98