EM U.S. Department of Energy
Office Of Environmental Management

The Current and Planned
Low-Level Waste Disposal Capacity Report
Revision 1

September 18, 1998

U.S Department of Energy
Office of Environmental Management

NIRS/PC Prefiled Exhibit 209
Docketed 09/23/2005

EXECUTIVE SUMMARY

This Report was prepared as part of the U.S. Department of Energy response to Defense Nuclear Facilities Safety Board Recommendation 94-2, Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites. The purpose of this Report is to assess whether the Department's low-level and mixed low-level waste disposal facilities have sufficient volumetric and radiological capacity to accommodate the waste that the Department expects to dispose at these facilities. This Report provides an update of a similar report, *The Current and Planned Low-Level Waste Disposal Capacity Report, Revision 0*, that the Department issued on July 30, 1998. The major difference between this Report and the 1996 report is the inclusion of a radiological assessment.

As a result of the analyses performed in this Report, based on an early 1998 snapshot of current Department waste projections and capacity information, the following conclusions can be drawn:

1. *The Department has sufficient complex-wide volumetric capacity for low-level waste disposal through 2070. The radiological capacity through 2070 for low-level waste disposal also appears to be sufficient.*

The existing and projected disposal facilities operated by the Department's Waste Management and Environmental Restoration Programs have sufficient volumetric capacity to accommodate all low-level waste that the Department projects will require disposal at DOE facilities except at Los Alamos National Laboratory Technical Area-54. However, Los Alamos National Laboratory is preparing an environmental impact statement that addresses the development of additional disposal capacity at Technical Area-54, and there is sufficient available space for additional disposal capacity pending, the results of the environmental impact statement, to ensure sufficient volumetric disposal capacity would exist. A number of sites also appear to have significant volumetric disposal capacity surpluses.

Radiological capacity appears to be sufficient for disposal of the Department's low-level waste at all facilities except the Savannah River Site Intermediate Level Vault. However, given the conservatism of this analysis and uncertainties associated with the manner by which radiological data was extrapolated, it cannot be concluded that the Savannah River Site Intermediate Level Vaults would not be able to dispose of the waste expected to be disposed by the site. To address this issue, the Department should more closely evaluate both the radionuclide profiles of the waste projected to be disposed at the facility and the disposal limits of the facility to determine whether the capacity is likely to be exceeded under the Department's current disposal projections. If it appears the capacity would be exceeded, actions can be taken to reduce the radiological content in the waste, redirect the waste to another disposal facility, or modify the facility so that the additional radioactivity can be accommodated. Other disposal sites also appear to have significant radiological disposal capacity surpluses.

2. *The Department has sufficient complex-wide radiological capacity for mixed low-level waste disposal through 2070. However, to accommodate the volume of mixed low-level waste projected to require disposal at the Department's Waste Management Program facilities, decisions must be made regarding use and expansion of these facilities.*

The Department's Waste Management Program has two mixed low-level waste disposal facilities: Hanford Radioactive Mixed Waste Trenches 31 and 34 and Nevada Test Site Mixed Waste Disposal Unit. These two facilities provide the Department a total disposal capacity of 160,000 m^3 and include room for further expansion. The Department has projected that 100,000 m^3 of mixed low-level waste will be disposed at these two facilities through 2070. Therefore, it appears there is sufficient complex-wide volumetric capacity to dispose of the projected mixed low-level waste. However, there are currently limits at the facilities which affect their available site-specific capacity. At the Hanford Radioactive Mixed Waste Land Disposal Facility, the existing capacity (42,000 m^3) is too small to accommodate all of the mixed low-level waste currently projected to be disposed there (99,000 m^3) without expansion of the disposal cells. The Nevada Test Site Mixed Waste Disposal Unit appears to be large enough to accommodate all mixed low-level waste currently projected for disposal there (less than 1 m^3). However, use of the excess capacity is limited because this facility is currently only allowed to accept mixed low-level waste generated within the State of Nevada. Both sites also possess available space to accommodate expansion, such that either site could provide sufficient volumetric disposal capacity.

3. *Site-specific Composite Analyses have the potential to impact the conclusions of this Report.*

An important purpose of this Report is to assess low-level waste disposal capacity from a radiological perspective. The analyses

and conclusions of the Report are based on DOE radiological performance objectives for low-level waste disposal facilities as contained in DOE Order 5820.2A. A composite analysis assessing all radiological sources (e.g., pre-1988 waste disposal and areas of radiological contamination) at individual sites has not been addressed in this analysis. It would therefore be appropriate in a future revision of this Report to analyze the capacity of each low-level waste disposal facility while taking into account the effect on capacity resulting from other radiological sources at a site. The conclusions of such an analysis may be different than that presented in this Report.

4. *Development of additional Environmental Restoration Program CERCLA disposal facilities may affect the available disposal capacity at existing Waste Management Program low-level and mixed low-level disposal facilities.*

The Environmental Restoration Program expects to construct CERCLA disposal facilities at Idaho National Engineering and Environmental Laboratory and Oak Ridge Reservation. Additional facilities at other sites also may be needed. The potential effect that not constructing these facilities could have on disposal capacity was assessed in the alternative scenarios presented in this Report. Developing these facilities would allow more flexibility in using the remaining available capacity at existing Waste Management Program facilities.

5. *The Department should make efforts to improve data quality and reduce uncertainties .*

The Department's confidence in data quality will be improved during future versions of this Report. The uncertainty of many of the waste stream radionuclide profiles used in this Report can be reduced in those cases where the profiles are estimates based on composited, incomplete, and extrapolated radionuclide data. Uncertainty also can be reduced in developing improved volumetric projections. Additionally, uncertainty can be reduced by an improved understanding of disposal facility performance assessment attributes.

Current Waste Disposition Strategy

The Department's current plans for disposition of low-level and mixed low-level waste are shown in Table ES-1 below. A distinction is made between DOE's Waste Management Program and Environmental Restoration Program disposal facilities because the Environmental Restoration Program facilities, which are authorized under the Comprehensive Environmental Response, Compensation, and Liability Act can only receive waste generated from on-site environmental restoration activities. In contrast, the Waste Management Program facilities typically can receive waste from off-site generators.

Table ES-1. Estimated Volume and Projected Disposition of DOE's Low-Level and Mixed Low-Level Waste

	Estimated Volume by Waste Type (in m^3)		
Projected Disposition	**Low-Level Waste**	**Mixed Low-Level Waste**	**Total**
Waste Management Program Disposal Facilities	1,500,000	100,000	1,600,000
Existing Environmental Restoration Program CERCLA Disposal Facilities	5,400,000	400	5,400,000
Environmental Restoration Program CERCLA Remediation Units	15,000	330,000	340,000
Not-yet-constructed Environmental Restoration Program CERCLA Disposal Facilities	390,000	35,000	420,000
To Be Determined	330,000	170,000	500,000
Commercial Disposal	510,000	78,000	590,000
Total	8,100,000	710,000	8,800,000

Source: 1998 *Accelerating Cleanup: Paths to Closure* data set.
Note: Because of rounding, some totals may not equal the sum of their components.

2.0 VOLUMETRIC PROJECTIONS AND CAPACITY

As reported in Revision 0 of this Report, over 2.7 million m^3 had been disposed in DOE low-level waste disposal facilities through 1995. In the following two years (1996-97), an additional 63,000 m^3 was disposed at operating DOE low-level waste disposal facilities. DOE estimates that a total of approximately 8.1 million m^3 of low-level waste will require disposal by DOE from 1998 through 2070. This includes approximately 1.5 million m^3 of low-level waste to be disposed in Waste Management Program disposal facilities. Approximately 5.8 million m^3 of low-level waste to be disposed by the Environmental Restoration Program in either existing Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) disposal facilities (5.4 million m^3), not-yet-constructed CERCLA disposal facilities (390,000 m^3), or remediation units (15,000 m^3). Nearly 510,000 m^3 of low-level waste to be disposed in commercial disposal facilities; and almost 330,000 m^3 of low-level waste that does not yet have an identified disposal facility (i.e., the disposal facility is classified as *to be determined*).

In addition to the 8.1 million m^3 of low-level waste identified above, DOE estimates that a total of 710,000 m^3 of mixed low-level waste volume will require disposal by DOE from 1998 through 2070. This includes almost 100,000 m^3 to be disposed at Waste Management Program mixed low-level waste disposal facilities. Approximately 370,000 m^3 of mixed low-level waste to be disposed by the Environmental Restoration Program in either existing CERCLA disposal facilities (400 m^3), not-yet-constructed CERCLA disposal facilities (35,000 m^3), and remediation units (330,000 m^3). Approximately 78,000 m^3 of mixed low-level waste to be disposed at commercial mixed low-level waste disposal facilities; and over 170,000 m^3 of mixed low-level waste that does not yet have an identified disposal facility.

Chapter 2.0 compares the Department's currently available and projected low-level and mixed low-level waste volumetric disposal capacity with the volume of waste projected to require disposal. Section 2.1 identifies the sources of the data and methodology used in the comparison. Section 2.2 presents a brief overview of the generator waste volume projections. Sections 2.3 and 2.4 present, respectively, the low-level waste and mixed low-level waste volumes projected to be disposed at each DOE facility and at commercial facilities. Section 2.5 compares the volume of low-level waste and mixed low-level waste projected to be disposed at each facility with the available volumetric capacity of the facility. Alternative scenarios for disposing of waste which has a disposal site designation of *to be determined* for low-level waste is presented in Section 2.6. A similar alternative scenario analysis for mixed low-level waste is presented in Section 2.7. Section 2.8 provides a summary comparison of the low-level and mixed low-level waste volume projections and disposal capacities.

This is the first revision of the Report since Revision 0 was issued on July 30, 1996. The Department's low-level waste disposal projections and facility capacities are generally consistent between Revision 0 and this Report. The following two changes are the most significant differences between the volumetric disposal projections in the two reports:

- Projections of low-level waste to be disposed at commercial facilities decreased from 1.6 million m^3 to 510,000 m^3, due primarily to 840,000 m^3 of Oak Ridge Reservation low-level waste that is no longer projected for commercial disposal.
- The Savannah River Site capacity and projected configuration has been changed, though overall Savannah River Site capacity (about 1 million m^3) is not affected. The number of vaults that had been considered previously has been reduced, and the associated space is now being considered for slit trench emplacement. This represents a flexible configuration capability that is adjusted as future needs become better defined. The majority of projected waste volumes originally considered for disposal in low-activity waste vaults is projected to be disposed in slit trenches.

Revision 0 discussed the projected volume of mixed low-level waste but did not evaluate whether DOE's available capacity was sufficient. The main change in this revision is the inclusion of such an evaluation.

2.1 Volumetric Capacity Analysis Methodology

To assess the adequacy of the Department's low-level waste and mixed low-level waste volumetric disposal capacity, the volume of waste disposed to date and projected for disposal at each facility was compared to the facility's total volumetric capacity. The comparison involved the following three types of data:

- Past Waste Disposal Volume - Data on waste volumes disposed prior to 1998 were provided by each disposal facility.
- Projected Future Waste Disposal Volume - Waste volume projections are based on data DOE compiled in early 1998 in support of the *Paths to Closure* strategy issued in June 1998. These data identify each low-level and mixed low-level waste stream projected to be generated, the projected disposal volume between 1998 and 2070, the waste type (either low-level or mixed low-level), and the disposal facility that is the generator expects will be used. In cases where the generator site has not identified a disposal facility, the disposition of the waste is identified as *to be determined*.
- Facility Disposal Capacity - The established volumetric disposal capacity of each facility was calculated from data on the dimensions of the facility. Appendix A presents the calculations used to determine each facility's total volumetric disposal capacity.

2.2 Projected Volumetric Disposal Needs

This section summarizes the total volumes of the Department's low-level and mixed low-level waste projected to require disposal from 1998 through 2070. Low-level and mixed low-level waste requiring disposal is generated by a number of Department programs. For the purpose of this Report, a distinction is made between low-level and mixed low-level waste generated by the Environmental Restoration Program and all other programs. The primary reason for this distinction is that while the Environmental Restoration Program generates the largest volume of low-level and mixed low-level waste as part of cleanup activities, the Environmental Restoration Program also manages disposal of the majority of these wastes, with only a fraction being transferred to the Waste Management Program or commercial facilities for disposal.

2.2.1 Projections from Programs Other Than Environmental Restoration

DOE programs that will provide waste for disposal in Waste Management Program disposal facilities include the Waste Management, Nuclear Materials and Facility Stabilization, Defense, Energy Research, and Nuclear Energy (including the Naval Reactors program) programs. Waste provided to the Waste Management Program includes waste that was initially generated or is derived from waste initially generated by other DOE programs and transferred to the Waste Management Program for management and disposal.

The generators from other programs typically generate waste from active operations and are listed in Table 1-1. Table 2-1, column 2, (Non-ER) presents the low-level waste volume projections by generator from Programs other than Environmental Restoration and identifies the planned disposal option. These waste volumes represent the projected low-level waste disposal needs from 1998 through 2070. Table 2-2, column 2 (Non-ER) presents similar data for mixed low-level waste.

Table 2-1. Projected Low-Level Waste Disposal Volumes by Generator Site/Program (1998 - 2070) [a]

Generator Site	Non-ER	ER	Total [b]	Disposal Site/Facility
Hanford Site	0	3,800,000	3,800,000	Hanford/Environmental Restoration Disposal Facility ($3,800,000\ m^3$)
Fernald Environmental Management Project	0	1,600,000	1,600,000	Fernald/On-Site Disposal Facility ($1,600,000\ m^3$)
Ames Laboratory	120	0	120	
Argonne National Laboratory - East	13,000	780	14,000	
Brookhaven National Laboratory	17,000	9,000	26,000	
Columbus Environmental Management Project - WJ	0	1,400	1,400	
Energy Technology Engineering Center	0	640	640	

General Atomics	0	340	340	
Hanford Site	230,000	0	230,000	
Lawrence Berkeley National Laboratory	430	0	430	(280,000 m^3)
Laboratory for Energy-Related Health Research	0	2,000	2,000	
Portsmouth Gaseous Diffusion Plant	2,000	0	2,000	
Princeton Plasma Physics Laboratory	2,000	0	2,000	
Argonne National Laboratory - West	0	140	140	Idaho/Radioactive Waste Management Complex (24,000 m^3)
Idaho National Engineering and Environmental Lab	24,000	0	24,000	
Los Alamos National Laboratory	520,000	37,000	560,000	Los Alamos/Technical Area 54 (560,000 m^3)
Energy Technology Engineering Center	0	2,800	2,800	
Fernald Environmental Management Project	0	84,000	84,000	
Lawrence Livermore National Laboratory	37,000	0	37,000	
Lovelace Respiratory Research Institute	2,300	0	2,300	
Miamisburg Environmental Management Project	0	64,000	64,000	Nevada/Area 3 and 5 Radioactive Waste Management Sites (480,000 m^3)
Nevada Test Site	360	220,000	220,000	
Pantex Plant	1,400	0	1,400	
Rocky Flats Environmental Technology Site	20,000	45,000	65,000	
Sandia National Laboratory - NM	3,700	1,400	5,100	
Savannah River Site	86,000	46,000	130,000	Savannah/Slit Trenches (130,000 m^3)
Savannah River Site	2,900	0	2,900	Savannah/Intermediate Level Vaults (2,900 m^3)
Savannah River Site	17,000	0	17,000	Savannah/Low Activity Vaults (17,000 m^3)
Idaho National Engineering and Environmental Lab	0	330,000	330,000	Idaho/Future CERCLA Disposal Facility (330,000 m^3)
Oak Ridge Reservation	0	60,000	60,000	Oak Ridge/Future CERCLA Disposal Facility (60,000 m^3)
Argonne National Laboratory - West	1,000	0	1,000	
Brookhaven National Laboratory	0	9,400	9,400	
Columbus Environmental Management Project - WJ	0	7,800	7,800	
General Electric Vallecitos Nuclear Center	0	20	20	
Grand Junction Project Office	0	55	55	
Idaho National Engineering and Environmental Lab	24,000	0	24,000	
Oak Ridge Reservation	240,000	20,000	260,000	

Paducah Gaseous Diffusion Plant	4,400	0	4,400	
Separations Process Research Unit	0	8,200	8,200	(330,000 m^3)
West Valley Demonstration Project	11,000	0	11,000	
Idaho National Engineering and Environmental Lab	0	15,000	15,000	Idaho/Return to Remediation Unit (15,000 m^3)
Argonne National Laboratory - East	1,500	0	1,500	
Ashtabula Environmental Management Project	0	15,000	15,000	
Brookhaven National Laboratory	0	100,000	100,000	
Columbus Environmental Management Project - WJ	0	1,300	1,300	
Energy Technology Engineering Center	0	15,000	15,000	
Fernald Environmental Management Project	0	360,000	360,000	Commercial Site (510,000 m^3)
Lawrence Berkeley National Laboratory	670	5	680	
Lawrence Livermore National Laboratory	7,800	0	7,800	
Los Alamos National Laboratory	0	560	560	
Pantex Plant	0	610	610	
Paducah Gaseous Diffusion Plant	0	6,100	6,100	
Savannah River Site	990	0	990	
Totals [b]	1,300,000	6,900,000	8,100,000	

[a] Volume in cubic meters. Volume projections and disposal facility designations are based on *Paths to Closure* strategy data. Some projections do not represent final decisions and will require further assessment under the National Environmental Policy Act. These data and the subsequent volumetric analysis do not include low-activity waste resulting from treatment of high-level waste.

[b] Because of rounding, some totals may not equal the sum of their components.

Table 2-2. Projected Mixed Low-Level Waste Disposal Volumes by Generator Site/Program (1998 - 2070) [a]

Generator Site	Non-ER	ER	Total	Disposal Site/Facility
Hanford Site	0	400	400	Hanford/Environmental Restoration Disposal Facility (400 m^3)
Hanford Site	99,000	0	99,000	Hanford/Radioactive Mixed Waste Land Disposal Facility (99,000 m^3)
Nevada Test Site	0.1	0	0.1	Nevada/Mixed Waste Disposal Unit (0.1 m^3)
Idaho National Engineering and Environmental Lab	0	5,900	5,900	Idaho/Planned CERCLA Disposal Facility (5,900 m^3)
Oak Ridge Reservation	0	29,000	29,000	Oak Ridge/Planned CERCLA Disposal Facility (29,000 m^3)
Argonne National Laboratory - East	0	660	660	

Energy Technology Engineering Center	0	1,400	1,400	
Hanford Site	100	0	100	
Idaho National Engineering and Environmental Lab	0	760	760	
Los Alamos National Engineering Laboratory	0	3,400	3,400	
Oak Ridge Reservation	83,000	0	83,000	
Paducah Gaseous Diffusion Plant	2,700	8	2,700	(170,000 m^3)
Portsmouth Gaseous Diffusion Plant	2,800	160	3,000	
Rocky Flats Environmental Technology Site	7,400	61,000	68,000	
Sandia National Laboratory - NM	160	0	160	
Savannah River Site	6,100	0	6,100	
West Valley Demonstration Project	26	0	26	
Idaho National Engineering and Environmental Lab	0	330,000	330,000	Idaho/Return to Remediation Unit (330,000 m^3)
Ames Laboratory	1	0	1	
Argonne National Laboratory - East	89	0	89	
Brookhaven National Laboratory	80	2,100	2,100	
Columbus Environmental Management Project - WJ	0	28	28	
Energy Technology Engineering Center	0	38	38	
Fernald Environmental Management Project	0	4,500	4,500	
General Atomics	1	0	1	
Hanford Site	0	600	600	
Idaho National Engineering and Environmental Lab	3,500	0	3,500	
Lawrence Berkeley National Laboratory	200	10	210	
Lawrence Livermore National Laboratory	1,500	0	1,500	
Los Alamos National Engineering Laboratory	2,100	0	2,100	
Lovelace Respiratory Research Institute	73	0	73	
Oak Ridge Reservation	2,500	44,000	46,000	
Pantex Plant	390	5	400	
Paducah Gaseous Diffusion Plant	87	180	270	
Portsmouth Gaseous Diffusion Plant	3,100	870	3,900	
Rocky Flats Environmental Technology Site	11,000	0	11,000	

Salmon Site	0	790	790	(78,000 m^3)
Sandia National Laboratory - NM	660	190	850	
Totals	**230,000**	**480,000**	**710,000**	

[a] Volume in cubic meters. Volume projections and disposal facility designations are based on *Paths to Closure* strategy data. Some projections do not represent final decisions and will require further assessment under the National Environmental Policy Act. These data and the subsequent volumetric analysis do not include low-activity waste resulting from treatment of high-level waste.

[b] Because of rounding, some totals may not equal the sum of their components.

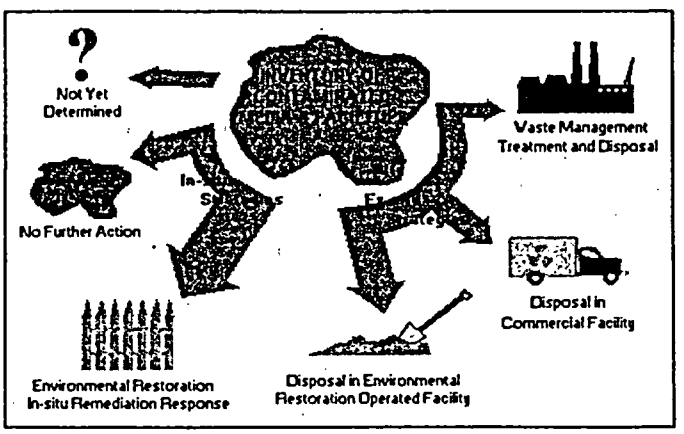
2.2.2 Environmental Restoration Generation Projections

The DOE Environmental Restoration Program generates low-level and mixed low-level waste from assessment, remediation, and facility decommissioning activities. For this analysis, DOE estimated the volume of environmental restoration low-level and mixed low-level waste requiring disposal at DOE facilities using a three-step process:

1. *Contaminated Media Volume* - Based on assessments of the type and extent of contamination at each site, DOE sites estimated the total volume of solid low-level and mixed low-level waste media and facilities present at each site. [1]
2. *Low-level and Mixed Low-Level Waste Generation Volume* - Based on the estimated volume of media and facilities from Step (1) and the expected cleanup response at each site, DOE sites estimated the volume of low-level and mixed low-level waste generated from ex-situ cleanup responses.
3. *Low-level and Mixed Low-Level Waste Disposal Volume* - Based on the estimated volume of low-level and mixed low-level waste generated from Step (2) and the expected subsequent disposition pathway of the waste (e.g., treatment, volume reduction, DOE disposal, commercial disposal), the DOE sites estimated the volume of low-level and mixed low-level waste requiring disposal at DOE facilities.

Across the complex, the Environmental Restoration Program estimated a total of 32 million m^3 of solid low-level waste media and facilities and 1.2 million m^3 of solid mixed low-level waste and facilities. These estimates are "in-place" volumes and reflect the Environmental Restoration Program's current understanding of contaminated media and facilities. These in-place volumes may increase or decrease in the future as site characterization activities continue. At each site, the volume of low-level or mixed low-level waste, if any, that will be generated and eventually disposed will depend on the specific response strategies and methodologies used. These response strategies and methodologies will be developed by the Department through discussions with Federal and State regulators. Figure 2-1 outlines the general response strategies that the Environmental Restoration Program utilizes. The strategies range from "no further action" to removal of all contaminated media for disposal in a special engineered facility. Tables 2-3 and 2-4 present the volume of waste expected to be generated by the Environmental Restoration Program at each site, indicate how the waste will be managed, and present estimates of the volume of media projected to be managed in place. As presented in these tables, the volume of low-level and mixed low-level waste considered in the capacity analysis is a subset of the volumes that are either to be transferred to the Waste Management Program, treated and disposed by the Environmental Restoration Program, or are classified as *to be determined*.

Figure 2-1. Anticipated Environmental Restoration Remediation Strategies Addressing Contaminated Media/Facilities



Of the 32 million m^3 of solid low-level waste media and facilities shown in Table 2-3, 6.9 million m^3 of low-level waste is projected to be generated through ex-situ response strategies. Table 2-1, column 3 (ER), presents the 6.9 million m^3 of projected low-level waste by generator from the Environmental Restoration Program and identifies the planned disposal option. The ex-situ response strategies include transferring the waste to the Waste Management Program (540,000 m^3), treating and disposing of the waste in facilities managed by the Environmental Restoration Program (5.8 million m^3), and transferring the waste to commercial disposal facilities (500,000 m^3). Relatively smaller volumes of low-level waste are projected to be recycled (41,000 m^3) or do not yet have a disposal option determined (27,000 m^3). In-situ responses are expected to be used to manage the remaining 25 million m^3 of solid low-level waste media and facilities. Of the 540,000 m^3 projected to be transferred to Waste Management Program, 510,000 m^3 is expected to be disposed in Waste Management Program facilities without further processing, and the remainder either does not have an identified disposal alternative (the waste is classified as *to be determined*) or the waste is treated prior to disposal.

Of the 1.2 million m^3 of solid mixed low-level waste media and facilities shown in Table 2-4, 490,000 m^3 of mixed low-level waste is projected to be generated through ex-situ response strategies. Table 2-2, column 3 (ER) presents the 490,000 m^3 of projected mixed low-level waste by generator from the Environmental Restoration Program and identifies the planned disposal option. The ex-situ response strategies include transferring the waste to the Waste Management Program (73,000 m^3), treating and disposing of the waste in facilities managed by the Environmental Restoration Program (360,000 m^3), and transferring the waste to commercial disposal facilities (54,000 m^3). An additional volume (1,400 m^3) does not have an identified disposal option yet determined. In-situ responses are expected to be used to manage the remaining 660,000 m^3 of solid media classified as mixed low-level waste. Nearly all of the 73,000 m^3 projected to be transferred to Waste Management Program is subsequently classified as *to be determined*.

Table 2-3. Disposition of Environmental Restoration Program Solid Low-Level Waste Media and Facilities (in cubic meters)

Site	Volume of Solid Low-Level Waste Generated from Environmental Responses						Volume of Media and Facilities Managed In-Situ	Total Low-Level Waste, Media, and Facilities
	Transfer to Waste Mgmt Program	Treat. and Disp. by Env. Rest. Program	Transfer to Comm. Facilities	Recycle	Ex-situ Response To Be Determ.	Total Ex-Situ Low-Level Waste Generated		
Hanford Site		3,800,000				3,800,000	20,000,000	23,800,000
Nevada Test Site	220,000					220,000	2,500,000	2,700,000
Fernald Env. Mgmt. Proj.	84,000	1,600,000	360,000	3,900		2,100,000	0	2,100,000
Idaho Nat. Eng. & Env. Lab.	14,000	340,000				360,000	1,000,000	1,400,000
Savannah River Site	46,000			2,100		48,000	1,300,000	1,400,000
Los Alamos Nat. Lab.	38,000		560			38,000	200,000	240,000
Brookhaven Nat. Lab.	9,000		100,000	35,000	10,000	160,000	0	160,000
Oak Ridge Reservation	20,000	60,000	290			80,000	0	80,000
Mound Env. Mgmt. Proj.	64,000		0			64,000	0	64,000
Rocky Flats Env. Tech. Site	45,000					45,000	0	45,000
Energy Tech. Eng. Center	3,400		15,000			18,000	0	18,000

Ashtabula Env. Mgmt. Proj.			15,000			15,000	0	15,000
Argonne Nat. Lab. - West	140				370	510	14,000	14,000
Columbus Env. Mgmt. Proj.	1,400		1,300		7,900	10,000	0	10,000
Argonne Nat. Lab. - East	780				0	780	7,600	8,400
Separations Processing Res. Unit					8,200	8,200	0	8,200
Paducah Gas. Diff. Plant	1		6,100			6,100	0	6,100
Lab. For Energy-Rel. Health Res.	2,100					2,100	0	2,100
Sandia Nat. Lab.	1,400					1,400	0	1,400
Pantex Plant			610			610	0	610
General Atomics	340		0			340	0	340
Grand Junction Proj. Office					55	55	0	55
General Elec. Vallecitos Nuc. Center					20	20	0	20
Lawrence Berkeley Nat. Lab.			5			5	0	5
Total:	540,000	5,800,000	500,000	41,000	27,000	6,900,000	25,000,000	32,000,000

NOTES

1. Volumes have been rounded to two significant figures. Because of rounding, some totals may not equal the sum of their components.
2. Volumes transferred to the Waste Management Program or treated and disposed by the Environmental Restoration Program include waste to be disposed directly as well as waste to be treated prior to disposal. Some waste transferred to the Waste Management Program is subsequently classified as *to be determined*. Therefore, the response-specific waste volumes shown here may be either larger, smaller, or equal to those in Table 2-1.
3. Data provided from March 1998 *Paths to Closure* waste and media volume database.

Table 2-4. Disposition of Environmental Restoration Program Solid Mixed Low-Level Waste Media and Facilities (in cubic meters)

Site	Volume of Solid Low-Level Waste Generated from Environmental Responses					Volume of Media and Facilities Managed In-Situ	Total Low-Level Waste, Media, and Facilities
	Transfer to Waste Mgmt Program	Treat. and Disp. by Env. Rest. Program	Transfer to Comm. Facilities	Ex-situ Response To Be Determ.	Total Ex-Situ Low-Level Waste Generated		
Idaho Nat. Eng. & Env. Lab.	60	330,000		700	330,000	430,000	770,000
Argonne Nat. Lab. - East				660	660	140,000	140,000
Oak Ridge Reservation	200	29,000	44,000		73,000	0	73,000
Rocky Flats Env. Tech. Site	61,000				61,000	0	61,000
Los Alamos Nat. Lab.	3,400				3,400	21,000	25,000
Lawrence Livermore Nat. Lab.					0	22,000	22,000
Savannah River Site	68				68	21,000	21,000

Nevada Test Site					0	13,000	13,000
Fernald Env. Mgmt. Proj.	3,600		4,500		8,100	0	8,100
Ashtabula Env. Mgmt. Proj.			180		180	4,000	4,100
Paducah Gas. Diff. Plant	3,200		180		3,400	0	3,400
Sandia Nat. Lab.			190		190	2,800	3,000
Brookhaven Nat. Lab.			2,100		2,100	0	2,100
Portsmouth Gas. Diff. Plant	160		1,500		1,700	0	1,700
Energy Tech. Eng. Center	1,400		38	0	1,400	0	1,400
Hanford Site	58	400	600		1,100	0	1,100
Argonne Nat. Lab. - West					0	880	880
Salmon Site			790		790	0	790
Pantex Plant			5		5	220	230
Separations Processing Res. Unit				70	70	0	70
Columbus Env. Mgmt. Proj.	38		28		67	0	67
Lawrence Berkeley Nat. Lab.			10		10	0	10
General Atomics	1				1	0	1
Grand Junction Proj. Office				0.15	0.15	0	0
Total:	73,000	360,000	54,000	1,400	490,000	660,000	1,200,000

NOTES

1. Volumes have been rounded to two significant figures. Because of rounding, some totals may not equal the sum of their components.
2. Volumes transferred to the Waste Management Program or treated and disposed by the Environmental Restoration Program include waste to be disposed directly as well as waste to be treated prior to disposal. Some waste transferred to the Waste Management Program is subsequently classified as *to be determined*. Therefore, the response-specific waste volumes shown here may be either larger, smaller, or equal to those in Table 2-2.
3. Data provided from March 1998 *Paths to Closure* waste and media volume database.

2.3 Low-Level Waste Disposal Volumes

This section presents a summary of the projected volume of the Department's low-level waste by disposal site. The total low-level waste volume projected to require disposal in DOE facilities from 1998 through 2070 is approximately 8.1 million m^3. The Department estimates that approximately 1.5 million m^3 of low-level waste will be disposed in Waste Management Program disposal facilities. Approximately 5.8 million m^3 of low-level waste to be disposed by the Environmental Restoration Program in either existing Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) disposal facilities (5.4 million m^3), not-yet-constructed CERCLA disposal facilities (390,000 m^3), or remediation units (15,000 m^3). Nearly 510,000 m^3 of low-level waste to be disposed in commercial disposal facilities; and almost 330,000 m^3 of low-level waste that does not yet have an identified disposal facility (i.e., the disposal facility is classified as *to be determined*). Evaluation of commercial disposal site capacity is out of the scope for this Report.

2.3.1 Low-Level Waste Disposal in Waste Management Program Disposal Facilities

The Department projects that 1.5 million m^3 of low-level waste will require disposed at Waste Management Program disposal

facilities between 1998 and 2070. A further 330,000 m^3 of low-level waste will require disposal at a *to be determined* disposal facility. *To be determined* low-level waste could be disposed at either Waste Management Program or commercial disposal facilities. *To be determined* low-level waste is discussed further in Section 2.6.

Table 2-5 presents a summary of Waste Management Program disposal sites and the low-level waste volumes corresponding to each site. These volumes include past disposal (pre-1988 and 1988 to 1997) and projected future disposal from 1988 through 2070. The future disposal includes waste from both the Environmental Restoration Program as well as non-Environmental Restoration Program waste generators. Also presented in Table 2-5 is a summary of the volume of low-level waste already disposed at each Waste Management disposal facility for two time periods, pre-1988 and 1988 to 1997. This data will be used in Section 2.5 in the evaluation of the capacity of the disposal facilities to receive the projected waste.

Table 2-5. Past and Projected Low-Level Waste Volumes for Disposal at Currently Operating Waste Management Program Facilities (in cubic meters)

Disposal Facility	Past Disposal		Projected 1998-2070		Total
	Pre-1988	1988-1997	Env. Rest.	Waste Mgmt.	
Hanford 200 Area	130,000	110,000	14,000	270,000	520,000
Idaho National Engineering and Environmental Laboratory	13,000	13,000	140	24,000	50,000
Los Alamos National Laboratory	150,000	43,000	37,000	520,000	750,000
Nevada Test Site	0	190,000	420,000	65,000	670,000
Oak Ridge Reservation	0	3,300	0	0	3,300
Savannah River Site Low-Activity Waste Vault	0	10,000	0	17,000	27,000
Savannah River Site Intermediate Level Vault	0	550	0	3,000	3,600
Savannah River Site Slit Trenches	0	770	46,000	86,000	130,000
To Be Determined	N/A	N/A	47,000	280,000	330,000
	290,000	370,000	560,000	1,300,000	
Totals	670,000		1,800,000		2,500,000

NOTE: Because of rounding, some totals may not equal the sum of their components. The past disposal values reflect disposal at ONLY the currently operating disposal facilities. It does not consider waste disposed at other facilities which are now closed. The data does not include the 390,000 m^3 of Environmental Restoration Program low-level waste to be disposed in not-yet-constructed CERCLA disposal facilities. The 390,000 m^3 is included in Table 2-6. These data and the subsequent volumetric analysis do not include low-activity waste resulting from treatment of high-level waste.

2.3.2 Low-Level Waste Disposal in Environmental Restoration Disposal Facilities

The Environmental Restoration Program projects a total of approximately 5.8 million m^3 of low-level waste from remediation and decommissioning and dismantlement activities will be disposed in Environmental Restoration Program facilities. This

includes 5.4 million m^3 at existing disposal facilities at Fernald Environmental Management Project (1.6 million m^3) and at the Hanford Site Environmental Restoration Disposal Facility (3.8 million m^3); 390,000 m^3 at not-yet-constructed disposal facilities at Idaho National Engineering and Environmental Laboratory (330,000 m^3) and Oak Ridge Reservation (60,000 m^3); and 15,000 m^3 to be returned to remediation units at Idaho National Engineering and Environmental Laboratory. In this Report, waste projected to be disposed in the not-yet-constructed facilities is grouped with the *to be determined* waste in the alternative scenario analysis. Table 2-6 summarizes the projected Environmental Restoration low-level waste disposal volumes by disposal site.

Table 2-6. Projected Low-Level Waste Volumes for Disposal at Environmental Restoration Program Disposal Facilities (in cubic meters)

Facility Type	Disposal Facility (or Site)	Projected Volume
Existing CERCLA Disposal Facilities	Fernald Environmental Management Project	1,600,000
	Hanford Environmental Restoration Disposal Facility	3,800,000
CERCLA Remediation Units	Idaho National Engineering and Environmental Laboratory	15,000
Not-yet-constructed CERCLA Disposal Facilities	Idaho National Engineering and Environmental Laboratory CERCLA Soil Debris Consolidation Unit	330,000
	Oak Ridge Reservation	60,000
	TOTAL	5,800,000

NOTE: Because of rounding, the total does not equal the sum of its components. The 390,000 m^3 of Environmental Restoration Program low-level waste to be disposed in not-yet-constructed CERCLA disposal facilities is grouped with the *to be determined* waste in the alternative scenario analysis for low-level waste presented in Section 2.6.

2.3.3 Low-Level Waste Projections for Disposal in Commercial Disposal Facilities

The Department estimates that approximately 510,000 m^3 of low-level waste will be disposed in commercial (not DOE-owned) facilities from 1998 to 2070. This includes 500,000 m^3 of waste from the Environmental Restoration Program and 11,000 m^3 of waste from the Waste Management Program. A portion of the 330,000 m^3 of low-level waste that does not have a specified disposal option (*to be determined*) may also be disposed at commercial sites. Evaluation of commercial disposal site capacity is outside the scope of this Report. This analysis assumes that adequate commercial disposal capacity will be available. However, Section 2.6, Alternative Scenarios, considers alternative dispositions for currently projected *to be determined* low-level waste.

2.4 Mixed Low-Level Waste Disposal Volumes

This section presents a summary of the projected volume of Department's mixed low-level waste by disposal site. DOE estimates that a total of 710,000 m^3 of mixed low-level waste volume will require disposal by DOE from 1998 through 2070. This includes almost 100,000 m^3 to be disposed at Waste Management Program mixed low-level waste disposal facilities. Approximately 370,000 m^3 of mixed low-level waste to be disposed by the Environmental Restoration Program in either existing CERCLA disposal facilities (400 m^3), not-yet-constructed CERCLA disposal facilities (35,000 m^3), and remediation units (330,000 m^3). Approximately 78,000 m^3 of mixed low-level waste to be disposed at commercial mixed low-level waste disposal facilities; and over 170,000 m^3 of mixed low-level waste that does not yet have an identified disposal facility.

2.4.1 Mixed Low-Level Waste Disposal in Waste Management Program Disposal Facilities

The Department projects that approximately 100,000 m^3 of mixed low-level waste will require disposal at Waste Management Program disposal facilities between 1998 and 2070. A further 170,000 m^3 of mixed low-level waste will require disposal at a *to*

be determined disposal facility. *To be determined* mixed low-level waste could be disposed at either Waste Management Program or commercial disposal facilities. *To be determined* mixed low-level waste is discussed further in Section 2.7.

Table 2-7 presents a summary of Waste Management Program disposal sites and the mixed low-level waste volumes corresponding to each site. These volumes include past disposal (pre-1988 and 1988 to 1997) and projected future disposal from 1988 through 2070. At present, Waste Management Program disposal sites accepting mixed low-level waste are located at Hanford Site and Nevada Test Site. Nevada Test Site is only allowed to dispose of mixed low-level waste generated within the State of Nevada. The projected future disposal volumes presented in Table 2-7 include waste from both the Environmental Restoration Program as well as non-Environmental Restoration Program waste generators. Also presented in Table 2-7 is a summary of the volume of mixed low-level waste already disposed at each Waste Management disposal facility. This data will be used in Section 2.6 in the evaluation of the capacity of the disposal facilities to receive the projected waste.

Table 2-7. Past and Projected Mixed Low-Level Waste Volumes for Disposal at Currently Operating Waste Management Program Facilities (in cubic meters)

Disposal Facility (Site)	Past Disposal (pre-1998)	Projected 1998 to 2070		Total
		Env. Rest.	Waste Mgmt.	
Hanford	0	0	99,000	99,000
Nevada Test Site	0	0	1	1
To be determined	N/A	68,000	102,000	170,000
Total	0	68,000	202,000	270,000

NOTE: Because of rounding, some totals may not equal the sum of their components. These data and the subsequent volumetric analysis do not include low-activity waste resulting from treatment of high-level waste.

2.4.2 Mixed Low-Level Waste Disposal in Environmental Restoration Disposal Facilities

The Environmental Restoration Program projects a total of 370,000 m^3 of mixed low-level waste will be disposed in Environmental Restoration Program disposal facilities. This includes 330,000 m^3 to be returned to remediation units at Idaho National Engineering and Environmental Laboratory, 400 m^3 to be disposed at the Hanford Site Environmental Restoration Disposal Facility, and 35,000 m^3 to be disposed at not-yet-constructed disposal facilities at Idaho National Engineering and Environmental Laboratory (5,900 m^3) and Oak Ridge Reservation (29,000 m^3). In this Report, waste projected to be disposed in the not-yet-constructed facilities is grouped with the *to be determined* waste in the alternative scenario analysis. Table 2-8 summarizes the projected Environmental Restoration Program mixed low-level waste disposal volumes by disposal facility and site.

Table 2-8. Projected Mixed Low-Level Waste Volumes for Disposal at Environmental Restoration Program Disposal Facilities (in cubic meters)

Facility Type	Disposal Facility (or Site)	Volume
CERCLA Remediation Units	Idaho National Engineering and Environmental Laboratory	330,000
Existing CERCLA Disposal Facilities	Hanford Environmental Restoration Disposal Facility	400
Not-yet-constructed CERCLA Disposal Facilities	Idaho National Engineering and Environmental Laboratory	5,900
	Oak Ridge Reservation	29,000
	Total	390,000

NOTE: Because of rounding, the total does not equal the sum of its components. The 35,000 m^3 of Environmental Restoration Program mixed low-level waste to be disposed in not-yet-constructed CERCLA disposal facilities is grouped with the *to be determined* waste in the

alternative scenario analysis for mixed low-level waste presented in Section 2.7.

2.4.3 Mixed Low-Level Waste Projections for Disposal in Commercial Disposal Facilities

The Department estimates that approximately 78,000 m^3 of mixed low-level waste will be disposed in commercial (not DOE-owned) facilities from 1998 to 2070. This includes 53,000 m^3 of waste from the Environmental Restoration Program and 25,000 m^3 of waste from the Waste Management Program. A portion of the 170,000 m^3 of mixed low-level waste that does not have a specified disposal option (*to be determined*) may also be disposed at commercial sites. Evaluation of commercial disposal site capacity is outside the scope of this Report. This analysis assumes that adequate commercial disposal capacity will be available. However, Section 2.7, Alternative Scenarios, considers alternative dispositions for currently projected *to be determined* mixed low-level waste.

2.5 Base Case Comparison of Facility-Specific Volumetric Projections and Disposal Capacity

This section compares the volume of low-level and mixed low-level waste projected to be sent to each disposal facility discussed in Sections 2.3 and 2.4 with the disposal capacity of the facility. For Waste Management Program disposal facilities, the capacity of each facility was evaluated based on that facility's Performance Assessment and other technical documents including site waste acceptance criteria. Table 2-11 summarizes the currently available capacities of the Waste Management Program low-level and mixed low-level waste disposal facilities. In the comparison of waste volumes and facility capacities presented in the following subsections, Waste Management Program mixed low-level waste disposal facilities are discussed separately from the low-level waste disposal facilities because mixed low-level waste cannot be disposed in low-level waste facilities. Similarly, Environmental Restoration Program disposal facilities, including existing and planned facilities and remediation units, are discussed separately because, unlike Waste Management Program facilities that are generally developed to accommodate a variety of wastes from unspecified generators, Environmental Restoration Program facilities are developed to receive waste from only on-site sources resulting from specifically identified environmental restoration activities, and the facilities are designed and sized to accommodate these wastes.

Table 2-9. Volumetric Capacities of Low-Level and Mixed Low-Level Waste Disposal Facilities (in cubic meters)

Program	Site	Disposal Facility	Capacity	
			Low-Level Waste	Mixed Low-Level Waste
Waste Management	Hanford Site	200 Area Burial Grounds	2,000,000	
		Radioactive Mixed Waste Land Trenches 31 & 34		42,000
	Idaho National Engineering and Environmental Laboratory	Radioactive Waste Management Complex	97,000	
	Los Alamos National Laboratory	Technical Area-54	1,100,000	
	Nevada Test Site	Area 3 and 5 Radioactive Waste Management Sites	3,100,000	
		Mixed Waste Disposal Unit		120,000
	Oak Ridge Reservation	Solid Waste Storage Area-6, Interim Waste Management Facility	5,000	
	Savannah River Site	Low-Activity Waste Vault	110,000	
		Intermediate Level Vault	7,300	
		Slit Trenches	290,000	
	Subtotal Waste Management Program Capacity[a,b]		6,700,000	160,000
Environmental Restoration	Fernald Environmental Management Project	On-Site Disposal Facility		1,800,000
	Hanford Site	Environmental Restoration Disposal Facility[c]		3,900,000
	Subtotal Environmental Restoration Program Capacity[a,c,d]			5,700,000

[a] Because of rounding, totals may not equal the sum of their components.

[b] Facilities developed to receive low-activity waste resulting from treatment of high-level waste are not included here or in the subsequent analysis.

[c] The Hanford Environmental Restoration Disposal Facility can receive both low-level waste as well as mixed low-level waste. Therefore, the Environmental Restoration Program subtotal includes both waste types.

[d] Not-yet-constructed CERCLA disposal facilities and remediation units are not listed because capacities have not been established for these facilities.

2.5.1 Waste Management Program Low-Level Waste Disposal Facilities

2.5.1.1 Hanford Site 200 Area Low-Level Burial Grounds

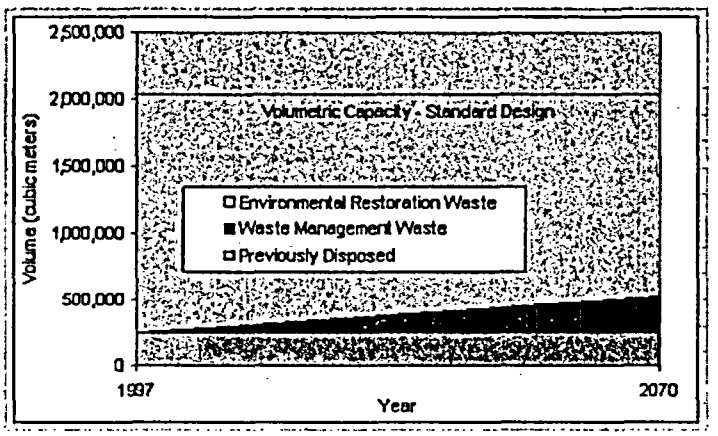
The Waste Management Program disposal facilities at Hanford Site accept both on-site and off-site low-level waste for disposal. These facilities are divided geographically into two groups; the 200-East facilities and the 200-West facilities. Only those facilities that were still open in 1995 or that had an available design are considered in the following discussion about disposal capacity and disposal volumes.

Hanford has two different design strategies for their disposal facilities. The current method, designated the standard trench design, uses unlined, sloped (about 45^0) trenches that are about 6 m to 7 m deep and vary in length up to approximately 500 m. Trenches are either "V-shaped" (about 3 m wide) or wide-bottomed (about 8 m wide). Based on the standard trench design, the

200 East and 200 West facilities have a combined disposal capacity of over 2 million m^3. A proposed alternative disposal method for this facility is a deep trench design which would use unlined, sloped trenches about 26 meters deep. Based on the deep trench design, the 200 East and 200 West facilities would have a combined disposal capacity of 12.8 million m^3.

Figure 2.2 compares the volumetric capacity of the 200-East and 200-West facilities assuming the standard trench design against the volume of waste projected to be disposed at these facilities. A total of 520,000 m^3 of low-level waste is projected to be disposed in the 200-East and 200-West facilities through 2070. This includes 130,000 m^3 of low-level waste disposed prior to 1988, 110,000 m^3 disposed from 1988 to 1997, and an estimated 280,000 m^3 projected to be disposed from 1998 through 2070. The waste volume projected for future disposal includes approximately 14,000 m^3 from the Environmental Restoration Program and approximately 270,000 m^3 from other generators.

Figure 2-2. Hanford 200 Area Low-Level Waste Disposal Volume Capacity and Projections

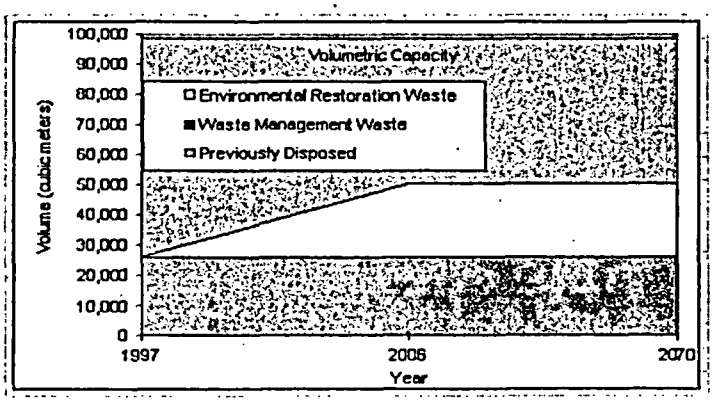


2.5.1.2 Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex

One low-level waste disposal facility, the Radioactive Waste Management Complex, is presently operating at Idaho National Engineering and Environmental Laboratory. The Radioactive Waste Management Complex disposes of on-site waste only and is currently scheduled to be closed by 2006. The facility includes a number of individual disposal units; however, the capacity analysis presented here only considers those units that were open in 1995: Pits 17, 18, 19, and 20, and the Concrete Vaults. The disposal capacity of these units is about 97,000 m^3.

The Department estimates that a total of 50,000 m^3 of low-level waste will be disposed at the Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex. This includes 13,000 m^3 disposed prior to 1988, 13,000 m^3 disposed from 1988 to 1997, and 24,000 m^3 projected to be disposed from 1998 through 2006. Approximately 140 m^3 of the projected waste is expected to come from the Environmental Restoration Program. Figure 2-3 illustrates this information.

Figure 2-3. Idaho National Engineering and Environmental Laboratory Low-Level Waste Disposal Volume Capacity and Projections

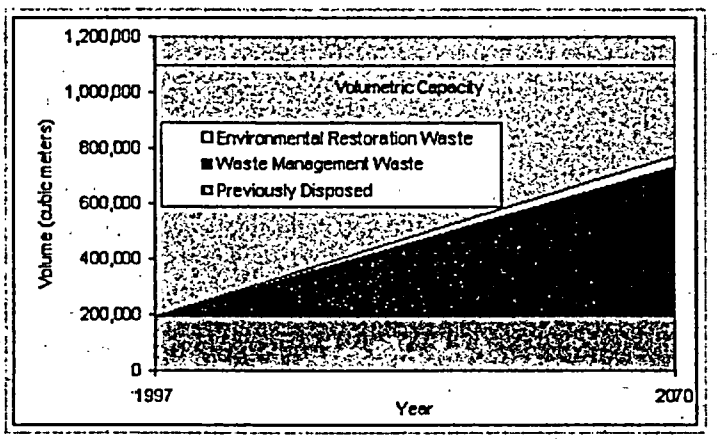


2.5.1.3 Los Alamos National Laboratory Technical Area-54

Los Alamos National Laboratory Technical Area-54 accepts primarily on-site low-level waste for disposal. Off-site waste is accepted only in special cases from Defense Programs sites. The Waste Management Program disposal facility in Technical Area-54 is located at Material Disposal Area G. The units at this facility that were open as of 1995 or had an available design at that time include pits 15, 31, 37, 38, and 39. An additional 24 acres immediately adjacent to Material Disposal Area G is dedicated for expansion of the disposal facility and is considered in this analysis. Los Alamos National Laboratory is preparing an environmental impact statement that addresses the development of additional disposal capacity in this area. This disposal expansion would increase low-level waste disposal capacity at the site by approximately ********* m^3 to a total capacity of approximately 1.1 million m^3. If the entire Technical Area-54 mesa was developed for low-level waste disposal, the total disposal capacity of the area would be about 3 million m^3.

The Department estimates that a total of approximately 750,000 m^3 of low-level waste will be disposed at this facility. This includes 150,000 m^3 disposed prior to 1988, 43,000 m^3 disposed from 1988 to 1997, and an estimated 560,000 m^3 projected to be disposed from 1998 to 2070. The waste volume projected for future disposal includes 37,000 m^3 from the Environmental Restoration Program and 520,000 m^3 from other generators. Figure 2-4 illustrates this information.

Figure 2-4. Los Alamos National Laboratory Low-Level Waste Disposal Volume Capacity and Projections



2.5.1.4 Nevada Test Site Area 3 and Area 5 Radioactive Waste Management Sites

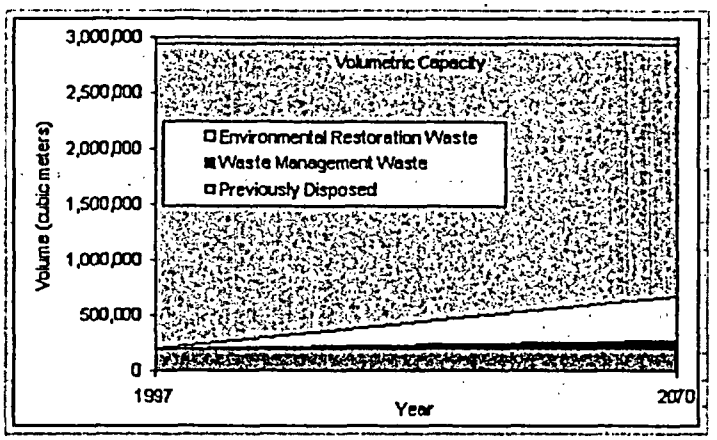
The Waste Management Program disposal facilities at the Nevada Test Site accept both on-site and off-site low-level waste for disposal. The Waste Management Program operates two disposal facilities at the Nevada Test Site: the Area 3 and Area 5 Radioactive Waste Management Sites. Only the portions of these facilities that were open in 1995 or that had an available design are considered in the comparison of disposal volumes and capacity. Area 3 includes sites U3ahat, U3bh, U3bg, and U3az. These craters represent the current design capacity in Area 3 of 553,000 m^3. Area 5 which contains current design capacity includes Pit 3, Pit 5, Pit 6 upper, Pit 6 lower, and Pit 7, with a disposal capacity of 165,000 m^3. The current design capacity at the NTS is 718,000 m^3.

Total estimated capacity in Area 5 is approximately 2,600,000 m^3. Total available low-level waste disposal capacity at Nevada Test Site is 3,150,000 m^3. Additionally, Nevada Test Site has the capability of expanding disposal operations to accommodate disposal larger volumes of low-level waste. Given the site conditions and performance attributes of disposal facilities at the Nevada Test Site, the maximum expandable volumetric capacity is limited only by the size of the usable disposal land at the Nevada Test Site.

The Department estimates that a total of approximately 670,000 m^3 of low-level waste will be disposed at the Area 3 and Area 5

facilities. This includes no waste disposed prior to 1988, 190,000 m^3 disposed from 1988 to 1997, and an estimated 480,000 m^3 projected to be disposed from 1998 to 2070. The waste volume projected for future disposal includes 420,000 m^3 from the Environmental Restoration Program and 65,000 m^3 from other generators. Figure 2-5 illustrates this information.

Figure 2-5. Nevada Test Site Low-Level Waste Disposal Volume Capacity and Projections

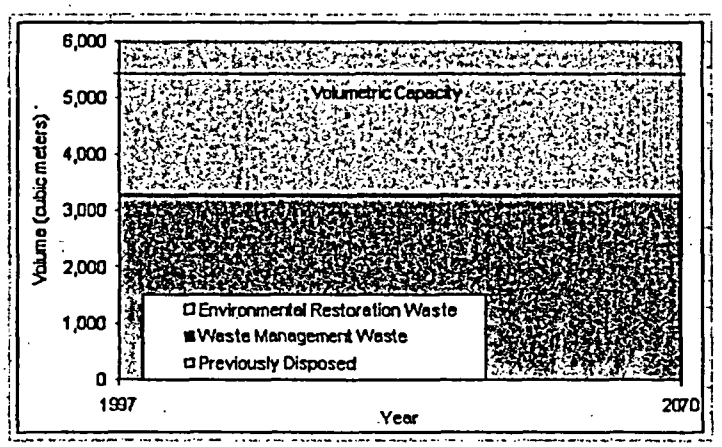


2.5.1.5 Oak Ridge Reservation Solid Waste Storage Area-6, Interim Waste Management Facility

The Waste Management Program disposal facility at Oak Ridge Reservation considered in this report is the Interim Waste Management Facility at Solid Waste Storage Area 6. This facility accepts only on-site low-level waste for disposal. This was the only low-level waste disposal facility operating at the Oak Ridge Reservation as of 1997. The facility has a disposal capacity of approximately 5,000 m^3.

The Interim Waste Management Facility at Oak Ridge Reservation received 3,300 m^3 of low-level waste between 1988 and 1997. It did not receive waste prior to 1988, and the Department does not project that additional waste will be disposed at the facility. Figure 2-6 illustrates this information.

Figure 2-6. Oak Ridge Reservation Interim Waste Management Facility Low-Level Waste Disposal Volume Capacity and Projections



2.5.1.6 Savannah River Site Waste Management Program Low-Level Waste Disposal Facilities

Savannah River Site accepts both on-site and off-site low-level waste for disposal. The Waste Management Program operates three disposal facilities in E-Area at Savannah River Site: the Low-Activity Waste Vaults, the Intermediate-Level (IL) Vault, and the shallow land burial Slit Trenches. Only those facilities that were open in 1995 or that had an available design are considered in the discussion of disposal volumes and capacity. For the purposes of this Report, it is assumed that off-site

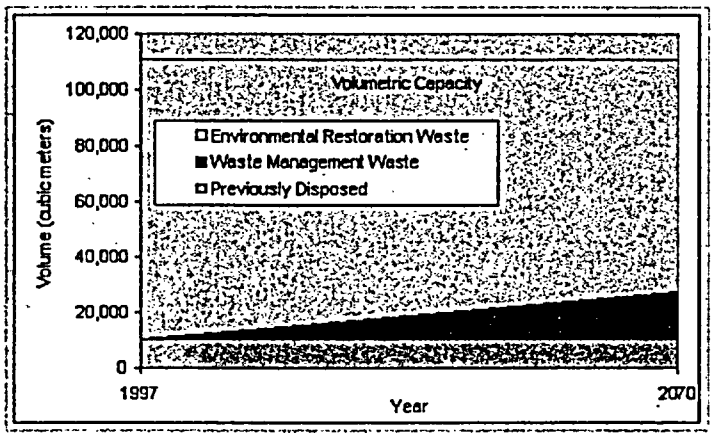
low-level waste is disposed in the Low-Activity Waste vaults.

2.5.1.6.1 Low Activity Waste Vaults

The total capacity of the Low-Activity Waste Vaults is 110,000 m^3. This includes two vaults with a capacity of 32,000 m^3 each, and one vault with a capacity of 48,000 m^3.

The Department estimates that a total of approximately 27,000 m^3 of low-level waste will be disposed at the Low-Activity Waste Vaults. This includes no waste disposed prior to 1988, 10,000 m^3 disposed from 1988 to 1997, and an estimated 17,000 m^3 projected to be disposed from 1998 to 2070. None of the future projected waste is expected to come from the Environmental Restoration Program. Figure 2-7 illustrates this information.

Figure 2-7. Savannah River Site Low-Activity Waste Vault Low-Level Waste Disposal Volume Capacity and Projections

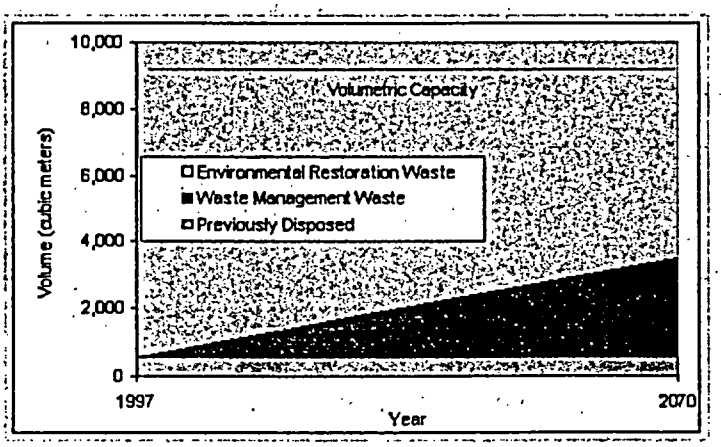


2.5.1.6.2 Intermediate Level Vault

One Intermediate Level vault for disposal of waste contaminated by more than trace amounts of tritium was considered in this evaluation. The Intermediate Level Vault has a disposal capacity of 7,300 m^3.

The Department estimates that a total of approximately 3,600 m^3 of low-level waste will be disposed at the Intermediate Level Vault. This includes no waste disposed prior to 1988, 550 m^3 disposed from 1988 to 1997, and an estimated 3,000 m^3 projected to be disposed from 1998 to 2070. None of the future projected waste is expected to come from the Environmental Restoration Program. Figure 2-8 illustrates this information.

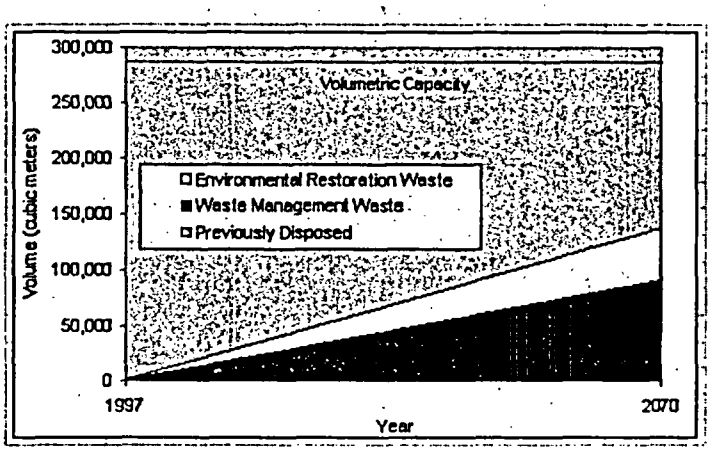
Figure 2-8. Savannah River Site Intermediate Level Vault Low-Level Waste Disposal Volume Capacity and Projections



2.5.1.6.3 Slit Trenches

Eleven slit trenches with a combined disposal capacity of 290,000 m^3 were considered in this evaluation. The Department estimates that a total of approximately 130,000 m^3 of low-level waste will be disposed in the Slit Trenches. This includes no waste disposed prior to 1988, 770 m^3 disposed from 1988 to 1997, and an estimated 130,000 m^3 projected to be disposed from 1998 to 2070. The waste volume projected for future disposal includes 46,000 m^3 from the Environmental Restoration Program and 86,000 m^3 from other generators. Figure 2-9 illustrates this information.

Figure 2-9. Savannah River Site Slit Trenches Low-Level Waste Disposal Volume Capacity and Projections



2.5.2 Waste Management Program Mixed Low-Level Waste Disposal Facilities

2.5.2.1 Hanford Radioactive Mixed Waste Trenches 31 and 34

The Radioactive Mixed Waste Trenches 31 and 34 is a Resource Conservation and Recovery Act-compliant facility for disposal of mixed low-level waste. This facility, which is located at the western end of the 218-W-5 Burial Ground in the 200 West Area, consists of two trenches with an estimated disposal capacity of 42,000 m^3.

No mixed low-level waste has been disposed in Mixed Waste Trenches to date. In the future, the Department estimates that a total of 99,000 m^3 of mixed low-level waste will be disposed in this facility. None of this waste is expected to come from the Environmental Restoration Program. While the existing capacity of this facility is not large enough for all waste expected to be received, there is a potential readily expandable area available to increase the capacity of the facility by another 100,000 m^3. Alternative designs also may be used to increase the existing capacity at this facility. Additionally, Hanford also possesses a completely unused burial ground which conceptually could accept up to 80,000 m^3 of mixed low-level waste. Finally, it is also expected that some portion of the waste projected to be disposed at this facility either may not be generated or could be disposed at other DOE or commercial sites with adequate disposal capacity for mixed low-level waste.

2.5.2.2 Nevada Test Site Mixed Waste Disposal Unit

The Nevada Test Site Mixed Waste Disposal Unit, located at the Area 5 Radioactive Waste Management Site, is under Resource Conservation and Recovery Act interim status disposal facility that is currently only allowed to accept wastes generated in the State of Nevada. The Mixed Waste Disposal Unit consists of 10 landfill cells with each cell designed to contain approximately 12,000 m^3 of mixed low-level waste, for a total capacity of approximately 120,000 m^3. No mixed low-level waste has been disposed in the Mixed Waste Disposal Unit to date. In the future, the Department estimates that only 0.1 m^3 of mixed low-level waste will be disposed in this facility. None of this waste is expected to come from the Environmental Restoration Program.

2.5.3 Environmental Restoration Program Disposal Facilities

The Environmental Restoration Program is currently using two facilities located at the Fernald Environmental Management

Project and Hanford Site for disposal of low-level waste. One of these facilities (at Hanford Site) is also expected to receive mixed low-level waste. In addition, two other not-yet-constructed facilities projected to be developed at the Idaho National Engineering and Environmental Laboratory and the Oak Ridge Reservation are expected to be used for low-level waste in the future. Finally, some low-level waste is expected to be returned to remediation units at the Idaho National Engineering and Environmental Laboratory. The capacities of the two existing Environmental Restoration Program disposal facilities are discussed in the following subsections. However, because the capacities of the not-yet-constructed disposal facilities and the remediation units have not yet been established, they have not been included in the comparison of facility capacities and waste disposal volumes.

2.5.3.1 Fernald Environmental Management Project

Low-level waste generated at the Fernald Environmental Management Project is disposed in an on-site facility constructed under a Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision. Fernald began disposing of waste in this facility in 1997. The total volume of Environmental Restoration Program low-level waste projected to require disposal at Fernald is 1.6 million m^3, and the on-site facility is designed to contain this volume. The on-site facility is expected to be filled at project completion, currently scheduled for 2007. This disposal facility has been excluded from the analyses of this Report because it is specifically designed to accommodate the volume and radiological content of the waste it is projected to receive, and cannot receive off-site waste or waste from non-cleanup activities.

2.5.3.2 Hanford Environmental Restoration Disposal Facility

The Hanford Environmental Restoration Disposal Facility is designed to dispose of on-site contaminated media generated as part of Environmental Restoration projects at the Hanford Site. The capacity of the facility is designed to equal the final disposal volume which is projected at 3.8 million m^3 . The Environmental Restoration Disposal Facility's initial two cells have a combined usable capacity of about 920,000 m^3 and began receiving waste in July 1996. Additional cells will be commissioned as needed. This facility is also being operated under a Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision. This disposal facility has also been excluded from the analysis of this Report because it is specifically designed to accommodate the volume and radiological content of the waste it is projected to receive and cannot receive off-site waste or waste from non-cleanup activities.

2.6 Alternative Scenario Comparison of Volumetric Projections and Disposal Capacity for *To Be Determined* Low-Level Waste and Waste to be Disposed in Not-Yet-Constructed Facilities

As discussed in Section 2.2, the Department has classified 330,000 m^3 of the low-level waste projected to require disposal from 1998 through 2070 as *to be determined* waste, meaning that specific disposal alternatives have not been identified for this waste. In addition, the Department projects that 390,000 m^3 of low-level waste will be disposed in Environmental Restoration Program disposal facilities that have not yet been constructed. In the Alternative Scenario comparison presented here, the four sites with existing facilities which each have excess disposal capacity of at least excess of 100,000 m^3 are evaluated to determine whether they have sufficient capacity to accommodate the 720,000 m^3 of low-level waste described above.

The four DOE sites considered in this Alternative Scenario analysis are Hanford Site (200 Area), Nevada Test Site (Areas 3 and 5), Savannah River Site (Slit Trenches), and Los Alamos National Laboratory (Technical Area-54).

2.6.1 Hanford 200 Area Low-Level Burial Grounds

As discussed in Section 2.5.1.1, the Hanford 200 Area disposal facility has a low-level waste disposal capacity of about 2 million m^3 and is projected to receive 520,000 m^3 (including both past and future disposal volumes), leaving an estimated excess capacity of about 1.5 million m^3. This facility, therefore, has enough excess volumetric disposal capacity to accommodate all of the 720,000 m^3 of low-level waste considered in the Alternative Scenario.

2.6.2 Nevada Test Site Areas 3 and 5 Radioactive Waste Management Sites

As discussed in Section 2.5.1.4, the Nevada Test Site Areas 3 and 5 have a low-level waste disposal capacity of about 3.1 million m^3 and are projected to receive 670,000 m^3 (including both past and future disposal volumes), leaving an estimated excess capacity of about 2.4 million m^3. These facilities, therefore, have enough excess volumetric disposal capacity to accommodate all of the 720,000 m^3 of low-level waste considered in the Alternative Scenario.

2.6.3 Savannah River Site Slit Trenches

As discussed in Section 2.5.1.6, the Savannah River Site Slit Trenches have a low-level waste disposal capacity of about 290,000 m^3 and are projected to receive 130,000 m^3 (including both past and future disposal volumes), leaving an estimated excess capacity 160,000 m^3. This facility, therefore, has enough excess volumetric capacity to accommodate approximately 22 percent of the 720,000 m^3 of low-level waste considered in the Alternative Scenario.

2.6.4 Los Alamos National Laboratory Technical Area-54

As discussed in Section 2.5.1.3, Los Alamos National Laboratory Technical Area-54 has a low-level waste disposal capacity of about 1.1 million m^3 and is projected to receive 750,000 m^3 (including both past and future disposal volumes), leaving an estimated excess capacity of about 350,000 m^3. This facility, therefore, has enough excess volumetric disposal capacity to accommodate approximately 49 percent of the 720,000 m^3 of low-level waste considered in the Alternative Scenario. If the disposal capacity at Technical Area-54 were fully expanded (to about 3 million m^3), then the facility would have enough volumetric disposal capacity to accommodate all of the low-level waste considered in the Alternative Scenario.

2.7 Alternative Scenario Comparison of Volumetric Projections and Disposal Capacity for Mixed Low-Level Waste

As discussed in Section 2.2, the Department has classified 170,000 m^3 of the mixed low-level waste projected to require disposal from 1998 to 2070 as to be determined waste. In addition, the Department projects that 35,000 m^3 of mixed low-level waste will be disposed in Environmental Restoration Program disposal facilities that have not yet been constructed. In the Alternative Scenario comparison presented here, the two sites with existing facilities for mixed waste are evaluated to determine whether they have sufficient capacity to accommodate the 200,000 m^3 of mixed low-level waste described above.

2.7.1 Hanford Radioactive Mixed Waste Trenches 31 and 34

As previously discussed in Section 2.5.2.1, the current capacity of the Radioactive Mixed Waste Trenches 31 and 34 facility at Hanford is about 42,000 m^3, which is too small to accommodate the 99,000 m^3 of mixed low-level waste that the Department projects will be disposed at that facility. However, there is also a potential expandable area for increased mixed low-level waste disposal of approximately 100,000 m^3, and Hanford possesses a completely unused burial ground which conceptually could accept up to 80,000 m^3 of mixed low-level waste. This expansion would increase the total capacity of the facility to about 220,000 m^3, which would be large enough to accommodate disposal of both the volume of waste currently projected to be disposed at the facility (42,000 m^3) and about 60 percent of the 200,000 m^3 of mixed low-level waste considered in the Alternative Scenario. Decisions concerning expansion of mixed low-level waste disposal capacity at Hanford will not be considered until records of decision for mixed low-level waste disposal are issued for the Department's *Waste Management Programmatic Environmental Impact Statement.*

2.7.2 Nevada Test Site Mixed Waste Disposal Unit

As previously discussed in Section 2.5.5.2, the current capacity of the Nevada Test Site Mixed Waste Disposal Unit is about 120,000 m^3, all of which is essentially available for disposal of mixed low-level waste. This facility, therefore, has enough excess volumetric disposal capacity to accommodate approximately 60 percent of the 200,000 m^3 of mixed low-level waste considered in the Alternative Scenario. However, as noted, the Nevada Test Site has enough expandable capacity to dispose of all the Department's projected mixed low-level waste projected and could be developed to do so if such a decision were supported by the mixed low-level waste disposal record of decision to be issued under the *Waste Management Programmatic Environmental Impact Statement.*

---

[1]The Environmental Restoration Program classifies in-situ environmental media and facilities according to waste type for

purposes of response planning and coordination. These media and facilities do not become waste unless or until they are removed. The volumes of media and waste used in this analysis include only solid materials and exclude groundwater and surface water.

3.0 RADIOLOGICAL PROJECTIONS AND CAPACITY ANALYSIS

In Chapter 2, the volumetric capacities of low-level and mixed low-level waste disposal facilities were analyzed in relation to the waste volumes projected to be disposed of by 2070 at those facilities. In this chapter, the radiological capacities of Department low-level and mixed low-level waste disposal facilities are assessed. This assessment compares facility-specific radiological disposal limits with radionuclide inventories projected to be disposed of by 2070 at those facilities. This comparison indicates if and where projected radionuclide inventories in the waste to be disposed may exceed the radiological limits of the disposal facilities where the waste is currently planned to be disposed, so that complex-wide planning will ensure the Department does not exceed these radiological limits at any of its disposal facilities.

The procedure used to estimate the projected radionuclide inventories of low-level and mixed low-level waste to be disposed of in each facility and the methodology used to estimate disposal facility-specific radiological capacity is presented in Section 3.1. The projected radionuclide inventories of low-level and mixed low-level waste to be disposed of in each facility are presented in Section 3.2. Sources of uncertainty in the data and analysis are identified and discussed in Section 3.3. Section 3.4 contains site-specific results of low-level and mixed low-level waste radiological capacity and a discussion of the important radionuclides identified in the analysis. Section 3.5 describes alternative disposal scenarios for low-level waste and mixed low-level waste.

3.1 Methodology of the Radiological Disposal Capacity Analysis

Eight disposal facilities were evaluated to estimate their radiological disposal capacity. For each facility, the methodology for measuring radiological disposal capacity consists of four steps: (1) estimating the amounts of 49 radionuclides potentially present in the low-level and mixed low-level waste projected to be disposed at the facility; (2) determining the average concentration of each radionuclide in the total volume of waste expected to be disposed in the facility; (3) comparing the radionuclide concentrations to the radionuclide-specific concentration limits of the facility; and (4) determining a *sum-of-fractions* by adding together the 49 ratios produced from the comparisons. The sum-of-fractions is the indicator used in this analysis to evaluate a disposal facility's radiological capacity.

3.1.1 Estimation and Projection of Radioactivity for Disposal

Radionuclides included in this analysis were those with a half-life greater than five years identified in site-specific disposal performance documents. In the 1997 Waste Management Technical Data Request, sites were requested to report the radiological profile of their low-level and mixed low-level waste using 49 radionuclides. Some facilities identified certain radionuclide groups to facilitate their reporting. These radionuclide groups included mixed fission products, mixed activation products, natural uranium, and weapons plutonium. The radionuclide distributions that were assumed in this Report for these groups are shown in Table 3-1. Radioactivity profiles were also provided in the *Mixed Waste Inventory Report, 1995*, and the Environmental Restoration Core Database, which were also used to estimate and project radiological profiles of low-level and mixed low-level wastes identified for disposal.

Table 3-1. Assumed Distributions for Mixed Fission Products, Mixed Activation Products, Weapons Plutonium, and Natural Uranium (DOE, 1997)

Radionuclide	Relative Activity (%)	Radionuclide	Relative Activity (%)
Mixed Fission Products		*Mixed Activation Products*	
Sr-90	47.0	C-14	7.0
Tc-99	0.02	Co-60	67.0
Cs-137	49.0	Cs-137	5.0
Cd-113m	0.13	Eu-152	3.0

Sn-121	0.09
Sm-151	1.4
Eu-152	2.0
Eu-154	0.36
Weapons Plutonium	
Pu-239	81.0
Pu-240	19.0

Eu-154	18.0
Natural Uranium	
U-234	48.7
U-235	2.2
U-238	49.1

No attempt was made to associate radioactive decay products with parent radionuclides because the decay products are already considered in the estimation of the disposal limits for the parent radionuclides used in this analysis. However, if radioactive decay products were listed explicitly by the sites, they were also included in the analysis.

Radioactivity data for low-level and mixed low-level waste were collected from a 1997 Waste Management Technical Data Call, the *Mixed Waste Inventory Report, 1995*, and the Environmental Restoration Core Database, as well as estimates based on other existing waste stream information. Waste volume data was based on past disposal volume data provided by the disposal sites and projected disposal volume data from the March 1998 *Paths to Closure* waste volume database. The *Paths to Closure* data does not include radiological data for low-level and mixed low-level waste streams.

The Department attempted to crosswalk the low-level and mixed low-level waste streams from the *Paths to Closure* database to the radioactivity data from the other data sources. However, many waste streams could not be crosswalked between the data sources. For these waste streams, the Department estimated radionuclide profiles by combining and volume-weighting the radionuclide concentrations of other waste streams as presented in the other data sources, and applied the profiles to Paths to Closure waste stream volumes. The composite profiles were generally developed based on other waste streams generated at the same site with similar physical and radiological characteristics. The specific basis for the radionuclide concentrations applied to each waste stream are presented in Appendices D-1 (for non-Environmental Restoration Program waste streams) and D-2 (for Environmental Restoration Program waste streams). As further discussed in Section 3.3, this method of extrapolating radionuclide profiles does increase uncertainty in the data and may overestimate the total radionuclide content of a waste stream. However, for the purposes of this analysis, such conservatism was deemed acceptable.

3.1.2 Formulas Used in Sum-of-Fractions Capacity Analysis

For a given disposal facility, the total activity of each radionuclide in the disposed waste in curies (Ci) is the sum of its activities from all waste expected to be disposed of in the facility from all sources. The average curie concentration of a radionuclide in the disposed waste (in Ci/m^3) equals the total activity of that radionuclide in the disposed waste (in Ci) divided by the total volume of waste disposed in the facility (in m^3). The following equation shows this relationship:

$$C_i = \frac{R_i}{V}$$

where: C_i = the average concentration of radionuclide I in the disposed waste, in Ci/m^3;
R_i = the total activity of radionuclide I in the disposed waste, in Ci; and
V = the total volume of waste disposed in the facility, in m^3.

Each radionuclide concentration is then compared to disposal limits for each facility to determine the ratio of the radionuclide concentration to its respective disposal limit. Each ratio is determined by the following relationship:

$$\frac{C_i}{L_i}$$

where: L_i = the facility-specific concentration limit for radionuclide I, in Ci/m^3. (The sources of the disposal limits used in this analysis are discussed in Section 3.1.3.)

The ratios for each radionuclide concentration in the waste to its limiting concentration are summed using the sum-of-fractions method described in 10 CFR Part 61.55. The sum-of-fractions is calculated as follows:

$$Sum - of - Fractions = \sum \frac{C_i}{L_i}$$

The sum-of fractions method is used to determine if a volume of waste with multiple radionuclides meets the combined limits for each individual radionuclide. Values less than one indicate that the limits are not exceeded. For example, if radionuclide A has an average concentration of 1 and a limit of 3 and radionuclide B has an average concentration of 1 and a limit of 2, then the sum-of-fractions method results in a value of 5/6 (1/3 + 1/2), indicating that the combined radiological limits based on the two radionuclides in the waste is not exceeded.

3.1.3 Disposal Limits Used in the Radiological Capacity Analysis

The initial estimates of radiological disposal capacity are based on the *Performance Evaluation of the Technical Capabilities of DOE Sites for Disposal of Mixed Low-Level Waste* (DOE, 1996). This *Performance Evaluation* used the performance objectives from DOE Order 5820.2A and screening-level representations of the transport mechanisms used in the site-specific performance assessments to make estimates of disposal limits for several radionuclides. This *Performance Evaluation* report was used as part of the Federal Facility Compliance Act process to identify potential sites for disposal of DOE's mixed low-level waste.

Because the *Performance Evaluation* methodology was generally more conservative than the site-specific performance assessments from which it was derived, it was not used as the final arbiter for sum-of-fractions calculations. Rather, it was used to identify where the contribution of a radionuclide to the sum-of-fractions was 0.1 or greater. For these radionuclides, the disposal limit values from the site-specific performance assessments and the waste acceptance criteria derived from them were substituted in this evaluation. The site-specific documents from which radionuclide-specific values were identified are listed in Table 3-2.

The performance assessments and waste acceptance criteria for most sites consist of only one set of disposal limits. However, the waste acceptance criteria for the Hanford Site are provided as two sets of limits corresponding to two different intruder scenarios: Category 1 limits assume a homesteader intrusion scenario and Category 3 limits assume a post-drilling intruder scenario. The limits for waste disposed under Category 3 are less stringent than those for Category 1 because of the application of additional disposal measures such as more confining waste forms or deeper burial.

In Appendix B where the sum-of fractions calculations and results for each disposal facility are presented, the column in each table labeled "Source" indicates the source of the disposal limits (Performance Evaluation [PE], Performance Assessment [PA], or Waste Acceptance Criteria [WAC]) for each radionuclide. An additional column labeled "Pathway" indicates which pathway analysis (water, atmospheric, or intruder) provides the most limiting concentration.

Table 3-2. Site-Specific Documents Used for Disposal Limits in the Radiological Capacity Analysis

Disposal Facility	Document(s)
Hanford Site	Hanford Site Solid Waste Acceptance Criteria (WMH-EP-0063-Revision 5)
Idaho National Engineering and Environmental Laboratory	Addendum to Radioactive Waste Management Complex Low-Level Waste Radiological Performance Assessment (EGG-WM-8773) (INEEL/EXT-97-8773)
Los Alamos National Laboratory	Performance Assessment and Composite Analysis for Los Alamos National Laboratory Material Disposition Area G (LA-UR-97-85)
Nevada Test Site	Nevada Test Site Waste Acceptance Criteria—Revision 0
Oak Ridge Reservation	Performance Assessment for Continuing and Future Operations at Solid Waste Storage Area 6 (ORNL-6783/R1)
Savannah River Site Low Activity Waste Vaults	Radiological Performance Assessment for the E-Area Vaults Disposal Facility (WSRC-RP-94-218, Rev. 0) E-Area Vaults Low-Level Radioactive Solid Waste Acceptance Criteria (WSRC 1S, Procedure 3.10, Revision No. 2)
Savannah River Site Intermediate Level Vaults	Radiological Performance Assessment for the E-Area Vaults Disposal Facility (WSRC-RP-94-218, Rev. 0) E-Area Vaults Low-Level Radioactive Solid Waste Acceptance Criteria (WSRC 1S, Procedure 3.10, Revision No. 2)

Savannah River Site Slit Trenches	Radiological Performance Assessment for the E-Area Vaults Disposal Facility (WSRC-RP-94-218, Rev. 0), Appendix I SRS Radioactive Soil and Rubble Management Program and Waste Acceptance Criteria (WSRC 1S, Procedure 3.15, Revision 1)

3.2 Radionuclide Inventory Projections for Low-Level and Mixed Low-Level Waste

Table 3-3 presents the radionuclide inventories of low-level waste already disposed and projected to be disposed through 2070 at eight specific disposal facilities operated by the Waste Management Program. This group of inventories is considered the Base Case, as it includes only waste that is destined for specific DOE disposal facilities. Also shown in Table 3-3 is the radionuclide inventory for the Alternative Case low-level waste, which is comprised of low-level waste whose disposition is *to be determined* combined with Environmental Restoration Program low-level waste to be disposed in not-yet-constructed CERCLA disposal facilities. The Alternative Scenario waste does not include waste to be disposed at commercial facilities.

As described in Chapter 2, the Environmental Restoration Program operates two CERCLA disposal facilities located at the Fernald Environmental Management Project and Hanford Site. The Department has not included these facilities and the waste to be disposed in them in this analysis because these facilities accept waste under records of decision prepared in accordance with cleanup activities under CERCLA. All waste destined to be disposed in these facilities is within the facilities' established radiological capacity limits.

Table 3-3. Base Case and Alternative Scenario Low-Level Waste Radioactivity Inventories (1988-2070) by Disposal Facility

Nuclide	Radionuclide Inventories (Ci)									
	Base Case								Alternat. Scenario	Total
	Hanford	INEEL	LANL	NTS	ORR	SRSLAW	SRS IL	SRS Slit		
Al-26	0.0e+00	0.0e+00	3.8e-08	1.0e-05	1.0e-03	0.0e+00	0.0e+00	0.0e+00	3.7e-06	1.0E-03
Am-241	5.4e+02	5.9e+00	9.3e+01	4.9e+01	3.3e-02	4.9e+00	3.6e+00	1.1e-01	2.2e+01	7.2E+02
Am-243	2.1e-01	1.3e-02	2.7e-03	9.9e-03	6.5e-04	2.7e-05	0.0e+00	0.0e+00	1.1e+01	1.1E+01
Ba-133	4.3e-03	1.4e+01	1.4e+03	1.5e+01	1.1e-05	0.0e+00	0.0e+00	0.0e+00	1.2e+02	1.5E+03
C-14	3.9e+02	6.3e+03	1.4e+00	7.5e+01	1.8e-01	6.7e-02	1.5e+00	6.8e-02	4.2e+02	7.2E+03
C-14 am	0.0e+00	0.0e+00	0.0e+00	4.2e-07	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.2E-07
Cd-113m	0.0e+00	1.1e+02	5.1e-01	2.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.3e-01	1.1e+02
Cl-36	9.1e-06	0.0e+00	1.6e-02	5.2e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.7e+02	1.7E+02
Cm-243	3.0e-01	3.4e-03	0.0e+00	3.2e-02	5.7e-05	0.0e+00	0.0e+00	6.4e-03	1.4e-02	3.6E-01
Cm-244	5.4e+00	4.5e-01	0.0e+00	3.6e-01	9.4e+00	3.6e-02	0.0e+00	6.4e-03	4.1e+03	4.1E+03
Co-60	1.2e+06	1.6e+07	1.9e+03	1.7e+05	1.4e+02	1.9e+01	7.6e+02	5.1e-01	1.2e+07	2.9E+07
Cs-135	0.0e+00	1.3e-01	7.7e-02	2.2e-03	0.0e+00	2.1e-09	0.0e+00	0.0e+00	7.8e-04	2.1E-01
Cs-137	2.1e+07	8.4e+04	1.1e+02	9.6e+05	5.7e+01	6.8e+01	7.3e+02	1.2e+01	7.3e+05	2.3e+07
Eu-152	1.3e+03	1.6e+04	9.9e-01	1.9e+02	6.5e+01	1.6e+00	0.0e+00	1.3e-03	3.8e+04	5.6e+04
Eu-154	1.9e+03	1.6e+04	2.9e+00	1.0e+03	3.0e+00	1.1e+00	0.0e+00	9.3e-04	1.7e+03	2.1e+04

H-3	1.4e+05	5.4e+06	6.4e+05	2.9e+06	1.3e+04	1.6e+05	4.4e+05	2.5e+01	9.8e+06	1.9e+07
I-129	1.6e+00	3.0e-01	1.5e-06	7.8e-02	1.5e-06	4.3e-05	8.5e-05	5.2e-03	2.8e-01	2.3e+00
K-40	3.3e-02	1.7e-01	3.5e-01	4.1e-01	1.3e-02	0.0e+00	0.0e+00	2.5e-05	3.4e+01	3.5e+01
Nb-93m	0.0e+00	5.9e+02	0.0e+00	6.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.6e+02	1.1e+03
Nb-94	0.0e+00	2.7e+01	2.8e-02	2.7e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.1e+01	4.8e+01
Ni-59	4.9e+03	8.1e+04	3.9e-01	8.6e+02	5.3e-04	5.4e-02	4.7e-01	4.9e-02	6.2e+04	1.5E+05
Ni-63	8.2e+05	3.0e+06	6.5e-02	3.9e+04	6.0e+00	6.9e+00	4.6e+01	1.3e-01	3.1e+06	7.0E+06
Np-237	2.5e-01	3.4e-01	3.9e-03	4.4e-02	6.5e-03	1.7e+00	1.4e-04	7.4e-03	3.6e+00	6.0E+00
Pa-231	1.1e-05	0.0e+00	9.0e-09	1.8e+01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.2e-01	1.8e+01
Pu-238	1.4e+02	1.8e+00	1.9e+02	1.2e+02	9.5e-03	3.2e+01	3.8e+00	1.7e-02	5.3e+00	4.9e+02
Pu-239	4.0e+02	5.0e+00	3.8e+02	1.3e+02	1.9e-02	4.5e+01	7.6e-02	9.5e-03	1.5e+01	9.8e+02
Pu-240	1.2e+02	4.2e-01	3.3e+00	2.8e+01	3.6e-02	6.9e+00	3.1e-02	4.1e-03	1.8e+01	1.8e+02
Pu-241	7.2e+02	1.5e+01	3.2e+01	5.5e+02	3.4e-06	1.0e+02	1.9e+00	8.3e-02	2.1e+01	1.4e+03
Pu-242	6.9e-03	3.6e-04	5.7e-03	1.7e+02	3.0e-06	1.2e-01	4.1e-05	4.2e-05	4.9e-03	1.7e+02
Pu-244	9.4e-05	0.0e+00	0.0e+00	4.4e-06	1.0e-06	1.2e-15	0.0e+00	0.0e+00	1.6e-06	1.0e-04
Ra-226	2.6e-02	3.8e+01	2.4e-01	3.8e+03	4.2e-03	1.1e-06	1.4e+01	2.0e-03	8.0e+01	3.9e+03
Ra-228	0.0e+00	0.0e+00	0.0e+00	2.4e+00	1.1e-02	1.3e-03	0.0e+00	4.0e-04	2.5e+00	4.9e+00
Se-79	1.9e-03	0.0e+00	2.5e-06	1.6e-03	0.0e+00	1.5e-01	4.6e-04	1.0e-07	6.0e-04	1.5e-01
Sm-151	0.0e+00	1.3e+03	7.0e-02	2.3e+01	1.1e-03	2.1e-04	0.0e+00	0.0e+00	1.2e+02	1.4e+03
Sn-121m	0.0e+00	1.8e+02	0.0e+00	2.4e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.1e+01	2.6e+02
Sn-126	0.0e+00	0.0e+00	0.0e+00	1.1e-04	0.0e+00	7.6e-03	4.9e-05	3.4e-03	4.1e-05	1.1e-02
Sr-90	2.4e+07	4.2e+04	2.9e+01	1.1e+06	3.1e+01	4.0e+01	3.2e+00	1.4e+01	4.1e+05	2.6e+07
Tc-99	1.6e+02	1.9e+01	2.5e+00	2.7e+01	1.4e-03	1.6e-01	8.4e-02	2.0e-02	2.7e+01	2.4e+02
Th-229	5.3e-04	1.8e-03	1.7e-02	2.2e-04	6.0e-08	0.0e+00	0.0e+00	0.0e+00	5.4e-01	5.6e-01
Th-230	2.1e-03	2.0e-02	1.6e-04	1.1e+03	2.4e-03	1.3e-03	0.0e+00	0.0e+00	4.8e+00	1.1e+03
Th-232	3.3e-01	4.6e+00	1.4e+00	1.8e+02	1.4e-02	1.3e-03	3.7e-04	3.6e-05	6.9e+00	1.9e+02
U-232	6.0e-04	2.2e+00	8.7e-02	2.4e-02	6.0e-02	1.9e-06	0.0e+00	0.0e+00	6.6e-02	2.4e+00
U-233	6.5e+00	9.0e-02	4.5e-01	1.7e+00	1.0e-02	7.2e-02	1.8e+00	9.7e-04	3.0e+00	1.4e+01
U-234	1.0e+02	5.8e-01	3.1e+01	1.9e+03	6.1e-01	7.5e+00	1.9e+00	1.0e-02	1.3e+03	3.3e+03

U-235	2.6e+00	7.9e+00	4.0e+00	4.4e+02	2.2e-02	1.5e-01	1.0e-01	4.9e-04	9.9e+02	1.4e+03
U-236	1.4e+00	1.1e-01	2.6e-03	7.9e-02	4.8e-05	1.2e+00	2.7e-02	2.1e-07	1.4e-01	3.0e+00
U-238	1.2e+02	3.4e+02	7.5e+01	1.1e+04	3.4e-01	3.3e+00	9.4e+00	1.4e-02	1.4e+03	1.3e+04
Zr-93	0.0e+00	2.3e+01	2.8e-05	2.3e-01	0.0e+00	2.7e-06	0.0e+00	0.0e+00	1.8e+01	4.1e+01

NOTES: INEEL = Idaho National Engineering and Environmental Laboratory, LANL = Los Alamos National Laboratory, NTS = Nevada Test Site, ORR = Oak Ridge Reservation, SRS = Savannah River Site, LAW = Low Activity Waste, IL = Intermediate Level.

Table 3-4 presents the estimated radionuclide inventories of mixed low-level waste projected to be disposed through 2070. The column identified as "Complexwide MLLW" presents the total radiological inventory of all mixed low-level waste that the Department projects will be disposed in DOE facilities, including waste destined for disposal at Hanford and Nevada Test Site, waste destined for disposal at a facility *to be determined*, and waste to be disposed in Environmental Restoration Program CERCLA disposal facilities that are not yet constructed. The inventory identified as "Hanford LLW plus MLLW" presents the sum of the radiological inventory of Hanford low-level waste (from Table 3-3) and the "Complexwide MLLW" inventory. Table 3-4 also presents a similar inventory of all mixed low-level waste and NTS low-level waste. Mixed low-level waste that is planned to be disposed of commercially was not included in this analysis. The combined radiological inventories of mixed low-level waste and either Hanford low-level waste or Nevada Test Site low-level waste represent the inventories used in the mixed low-level waste Alternative Scenario analysis presented in Sections 3.4.1 and 3.4.4, respectively.

Table 3-4. Mixed Low-Level Waste and Alternative Scenario Combined Low-Level and Mixed Low-Level Waste Radioactivity Inventories at Hanford and Nevada Test Site (1988-2070)

	Radioactivity (Ci)				Radioactivity (Ci)		
		Alternative Scenarios				Alternative Scenarios	
Nuclide	Complex-wide MLLW	Hanford LLW plus MLLW	NTS LLW plus MLLW	Nuclide	Complex-wide MLLW	Hanford LLW plus MLLW	NTS LLW plus MLLW
Al-26	0.0E+00	0.0E+00	9.6E-06	Pu-238	6.0E-01	1.4E+02	1.2E+02
Am-241	6.7E+01	5.7E+02	1.0E+02	Pu-239	3.2E+02	6.9E+02	6.3E+02
Am-243	0.0E+00	8.1E-01	9.5E-03	Pu-240	2.3E+00	1.3E+02	2.9E+01
Ba-133	0.0E+00	2.0E-02	1.4E+01	Pu-241	0.0E+00	7.0E+02	5.4E+02
C-14	0.0E+00	3.7E+02	7.2E+01	Pu-242	0.0E+00	2.7E-02	1.7E+02
C-14 am	0.0E+00	0.0E+00	4.1E-07	Pu-244	0.0E+00	4.3E-04	4.2E-06
Cd-113m	0.0E+00	0.0E+00	1.9E+00	Ra-226	3.7E-03	7.7E-02	3.8E+03
Cl-36	0.0E+00	8.2E-06	5.0E-02	Ra-228	0.0E+00	0.0E+00	2.4E+00
Cm-243	0.0E+00	1.4E+00	3.0E-02	Se-79	0.0E+00	1.7E-03	1.6E-03
Cm-244	0.0E+00	5.0E+00	3.4E-01	Sm-151	0.0E+00	0.0E+00	2.2E+01
Co-60	6.9E+04	1.2E+06	2.4E+05	Sn-121m	0.0E+00	0.0E+00	2.3E+00
Cs-135	0.0E+00	0.0E+00	2.1E-03	Sn-126	0.0E+00	0.0E+00	1.1E-04
Cs-137	5.4E+03	1.9E+07	9.2E+05	Sr-90	8.2E+03	2.1E+07	1.1E+06

Eu-152	3.1E-02	1.3E+03	1.8E+02	Tc-99	6.0E+02	7.4E+02	6.2E+02
Eu-154	5.5E-04	1.9E+03	9.9E+02	Th-229	3.3E-01	3.3E-01	3.3E-01
H-3	5.8E+08	5.8E+08	5.8E+08	Th-230	1.9E+01	1.9E+01	1.2E+03
I-129	0.0E+00	1.5E+00	7.5E-02	Th-232	3.4E-01	7.2E-01	1.8E+02
K-40	0.0E+00	3.8E-02	3.9E-01	U-232	0.0E+00	2.8E-03	2.3E-02
Nb-93m	0.0E+00	0.0E+00	5.7E+00	U-233	1.8E+00	7.7E+00	3.4E+00
Nb-94	0.0E+00	0.0E+00	2.6E-01	U-234	1.9E+03	2.0E+03	3.9E+03
Ni-59	0.0E+00	4.9E+03	8.3E+02	U-235	7.7E-01	3.3E+00	4.4E+02
Ni-63	0.0E+00	8.2E+05	3.7E+04	U-236	1.5E-01	1.4E+00	2.2E-01
Np-237	8.3E+01	8.3E+01	8.3E+01	U-238	6.9E+02	8.0E+02	1.2E+04
Pa-231	7.7E-06	5.9E-05	1.8E+01	Zr-93	0.0E+00	0.0E+00	2.2E-01

NOTES: NTS = Nevada Test Site, MLLW = mixed low-level waste, LLW = low-level waste

Appendix B provides additional details on the inventories, including the inventory by disposal site, by nuclide, and by generating organization (i.e., Waste Management or Environmental Restoration) for projected waste. Appendix B also includes radionuclide information for already disposed waste (1988-1997).

3.3 Sources of Uncertainty in the Analysis

The uncertainty in this radiological capacity analysis stems from two primary sources: (1) the estimation of facility-specific disposal limits, and (2) the estimation and projection of facility-specific radionuclide inventories. In most of the examples discussed below, the uncertainties identified in the radiological assessment methodology result in an overestimate of the total radiological profile, and thus present a more conservative picture than may be faced when projected waste is actually generated and ready for disposal. Therefore, it is expected that the site-specific radiological capacity results discussed in Section 3.4 may underestimate the available radiological disposal capacity for each disposal facility. As discussed further below, it is expected that future analysis and research will help reduce these uncertainties, and will be reflected in future revisions of this Report (Revision 2).

3.3.1 Uncertainty in Disposal Limits

The methodology for estimating radiological capacity described in Section 3.1 uses values from the *Performance Evaluation* project report (DOE, 1996) as the initial set of disposal limits to identify radionuclides with sum-of-fractions values of 0.1 or greater. Substituting facility-specific values from the performance assessments or waste acceptance criteria refines the disposal limits for these radionuclides. Performance assessments are generally based on limited data and understanding of the interactions of radionuclides and the surrounding environment. To address these general shortcomings, the Department requires periodic review and revision of these site-specific performance assessments, a process known as performance assessment maintenance.

As additional operational experience is gained and as new research on environmental transport is incorporated into the performance assessments, disposal limits change. Conservatism is typically used to address uncertain processes and data. As this uncertainty is reduced or removed, the disposal limits tend to be less restrictive. However, future research may also reveal mechanisms that require some disposal limits to become more restrictive. The ultimate disposal limits in use at facility closure are not now known, and this lack of knowledge results in a potentially significant source of uncertainty.

3.3.2 Uncertainty in Estimation and Projection of Radionuclide Inventories

The procedure for estimating and projecting radionuclide inventories for comparison with facility-specific disposal limits is described in Section 3.1.1. This report afforded the first complex-wide opportunity for the Department to estimate and compare

radionuclide inventories and concentrations in projected low-level waste with radiological capacities of DOE's existing Waste Management Program disposal facilities. (These types of data were collected for mixed low-level waste in 1994 and 1995.) Several sources of uncertainty exist in this estimation and projection procedure. The most significant sources of uncertainty arise from: (1) assigning radionuclide concentration profiles to waste streams with no profiles, (2) estimating aggregate radionuclide profiles at year 2070 by projecting existing radiological profiles, and (3) assigning disposal locations for waste streams.

3.3.2.1 Assigning Radionuclide Concentration Profiles to Waste Streams with No Profiles

As discussed in Section 3.1.1, the Department has compiled radiological profile data for only a subset of the *Paths to Closure* waste streams used in this analysis. Therefore, in cases where radiological profiles were not provided, DOE applied available waste characterization data from the Environmental Restoration Core Database or the Waste Management Technical Data Call to waste streams identified in the draft *Paths to Closure* coming from the same site and having similar media and waste type data. For example, a low-level waste rubble/debris waste stream from Hanford without radiological characterization was assigned the same radiological profile as a Hanford rubble/debris waste stream with reported radiological characterization. However, as noted, there is uncertainty associated with this approach because waste streams coming from different sources within a site may have different radiological profiles. Additionally, as discussed below, available concentration data often overestimates or provides only maximum concentration estimates of the radionuclide content of the waste.

Radiological data from the Environmental Restoration Core Database has several limitations, described below, that increased the level of uncertainty in this analysis. The specific approaches and assumptions made to accommodate weaknesses in the Core data are provided in Appendix D2.

Identification of Contaminants: The radionuclide data in the Core database was collected to help Headquarters monitor and coordinate Field projects. The database generally identifies only those radionuclides that are important in determining response decisions and, for some waste streams, does not provide any radionuclide concentration data. These radionuclides typically are only a subset of the radionuclides actually present. Additionally, the radionuclides important for determining response decisions are not necessarily the same as those important for determining disposal capacity. Also, some of the contaminants identified in the Core database do not correspond directly to specific nuclides. In these cases, waste stream specific assumptions were made in this analysis about how each contaminant would be handled. For example, some waste streams identified concentrations of both uranium and plutonium isotopes as well as a gross alpha concentration. In such an instance, it was usually assumed that the gross alpha concentration represented uranium and plutonium isotopes (particularly if the gross alpha concentration was about equal to the sum of the uranium and plutonium concentrations). In another example, total uranium was assumed to be a combination of the uranium isotopes in proportion according to their natural relative abundance.

Waste Density: Contaminant concentrations in the Core database are almost always provided in a weight basis. To convert to a volume concentration basis (which is needed for this analysis) a waste density must be used. Because the Core database contains limited waste density data, a uniform waste density of 1.6 MT/m^3 (about the same as soil) was assumed for this analysis.

Average Contaminant Concentrations: For some contaminants in some waste streams, the Core database contained only maximum contaminant concentrations instead of the average concentrations needed for this analysis. In these cases, the maximum concentration was used in the analysis, but may not be representative of and may overestimate the average concentration across the waste stream..

3.3.2.2 Estimating Aggregate Radionuclide Profiles at Year 2070 by Projection

For those waste streams with reported radiological characterizations, these characterizations are for existing waste or waste expected to be generated in the near future. For example, the data in the 1995 *Mixed Waste Inventory Report* database includes current inventories and 5-year projected inventories. These profiles do not necessarily represent long-term trends in radionuclide concentration profiles because the profiles may change as future waste generation processes change (e.g., due to waste minimization and changes in future missions).

Because long-term radiological profiles are not available, the existing radionuclide profiles were used when projecting waste volumes over the life-cycle of the disposal facility. The approach used to estimate inventories through 2070 are based on limited near-term characterization data. This approach is another source of uncertainty in the analysis.

3.3.2.3 Assigning Disposal Locations for Waste Streams

Disposal locations used in this analysis were based on disposal locations specified by the waste generating sites in the *Paths to Closure* waste volume database. These traditional locations for waste disposal may change in the future depending on complex-wide decisions such as the records of decision based on the *Waste Management Programmatic Environmental Impact Statement*. Additionally, this analysis may indicate potential limitations of a disposal site that can be resolved by strategically disposing of specific waste streams at other disposal facilities or through additional treatment and waste form adjustments. The lack of certainty related to future disposal locations for specific waste streams is another uncertainty in the analysis.

3.4 Base Case Facility-Specific Radiological Projections and Capacities

In this section, the radiological capacity of each of the eight Waste Management Program low-level waste disposal facilities is compared with total radionuclide inventories projected for the 1988-2070 time frame.

The results of the Base Case sum-of-fractions analysis for these facilities are presented in Table 3-5. The sum-of-fractions value is less than or equal to 1.0 for all except one of the eight disposal facilities. Sum-of-fractions values of less than or equal to 1.0 indicate that these disposal facilities appear to possess adequate radiological capacity to dispose of the waste projected to be disposed in them. Only the Savannah River Site Intermediate Level Vault is projected to have a sum-of-fractions value greater than 1.0. The sum-of-fractions value greater than 1.0 at the Savannah River Site Intermediate Level Vault indicates that this facility may not possess adequate radiological capacity to accommodate the waste currently projected to be disposed at that facility. However, as noted it cannot be concluded at this time that the Intermediate Level Vaults would not be able to dispose of the waste expected to be disposed by the Savannah River Site. Reduction of uncertainties and a more strategic focus on specific waste streams will be required to resolve these issues. The facility-specific bases for these results are presented in the following sections with a discussion of the significant uncertainties associated with these results. The detailed results of the sum-of-fractions analyses, including the ratio of each radionuclide to its site-specific limit, are found in Appendix B.

Table 3.5. Base Case Sum-of-Fractions Results for Low-Level Waste Disposal

Disposal Facility/Site	Sum of Fractions
Hanford Site	0.3
Idaho National Engineering and Environmental Laboratory	0.8*
Los Alamos National Laboratory	0.3
Nevada Test Site	0.6
Oak Ridge Reservation	1.0
Savannah River Site Low Activity Waste Vaults	0.8
Savannah River Site Intermediate Level Vaults	2.7
Savannah River Site Slit Trenches	1.0

* The sum-of-fractions value for Idaho does not include contributions from K-40, Ra-226 and Th-232. The site-specific performance assessment did not evaluate these radionuclides and therefore the waste acceptance criteria provide no disposal limits for them. Additional discussion is provided in Section 3.4.2.

3.4.1 Hanford Site 200 Area Low-Level Burial Ground

The sum-of-fractions value for the Hanford 200 Area Low-Level Burial Grounds is estimated to be 0.3 for the low-level waste projected to be disposed at that facility through 2070. There are no radionuclides that contribute more than 0.1 to the sum-of-fractions value for the low-level waste.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility will not be exceeded throughout the duration of disposal for low-level waste.

3.4.2 Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex

The sum-of-fractions value for the Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex was initially calculated to be 16, with Ra-226 contributing 13, Th-232 contributing 2, and K-40 contributing 0.1 to the total sum-of-fractions value. However, these contributions to the sum-of-fractions value were based on disposal limits from the *Performance Evaluation* rather than limits from the site-specific performance assessment or waste acceptance criteria. The

site-specific performance assessment did not evaluate these radionuclides and the waste acceptance criteria provide no disposal limits for them because the site does not anticipate disposal of these radionuclides. Therefore, these radionuclides were not further considered in the analysis. After removing these radionuclides from the analysis, the sum-of-fractions value for this facility is 0.8. Radionuclides contributing more than 0.1 to the sum-of-fractions value are Cs-137 with 0.3, U-238 with 0.2, and Sr-90 with 0.1. These contributions are based on disposal limits from the site-specific performance assessment.

The potential contributions of Ra-226, Th-232, and K-40 to the sum-of-fractions value cannot be evaluated further without site-specific disposal limits, and as noted, disposal of these radionuclides is not anticipated at this time. Because of the lack of site-specific knowledge about the contribution of Ra-226, Th-232, and K-40 to the sum-of-fractions value, their contributions were omitted from the sum-of-fractions value of 0.8 reported in Table 3-5. As discussed in Section 3.3, there are significant uncertainties associated with the procedure for estimating and projecting the radiological profile to year 2070. Using the *Performance Evaluation* disposal limits, the sum-of-fractions value would be near one if the Ra-226 and Th-232 inventories were reduced by approximately 36 and 3 Ci, respectively.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility would not be exceeded throughout the duration of disposal for low-level waste. However, if significant inventories of Ra-226 and Th-232 are expected to be disposed of at Idaho National Engineering and Environmental Laboratory, then disposal limits must be established for these radionuclides.

3.4.3 Los Alamos National Laboratory Technical Area-54

The sum-of-fractions value for the Los Alamos National Laboratory Technical Area-54 is estimated to be 0.3 for the low-level waste projected to be disposed at that facility through 2070. There are no radionuclides that contribute more than 0.1 to the sum-of-fractions value for the low-level waste.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility will not be exceeded throughout the duration of disposal for low-level waste.

3.4.4 Nevada Test Site Areas 3 and 5

The sum-of-fractions value for the Nevada Test Site Areas 3 and 5 is estimated to be 0.6 for the low-level waste projected to be disposed at that facility through 2070. Radionuclides contributing at least 0.1 to the sum-of-fractions value are Cs-137, which contributes 0.2, and Ra-226, which contributes 0.1.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility will not be exceeded throughout the duration of disposal for low-level waste.

3.4.5 Oak Ridge Reservation Interim Waste Management Facility

The sum-of-fractions value for the Oak Ridge Reservation Interim Waste Management Facility is estimated to be 1 for the low-level waste currently disposed at the facility. The Department does not project to dispose of additional low-level waste at this facility. Radionuclides contributing at least 0.1 to the sum-of-fractions value are U-234, which contributes 0.7, and Cs-137, which contributes 0.2.

Based on the inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility has not been exceeded.

3.4.6 Savannah River Site

The Department separately evaluated the following three low-level waste disposal facilities at the Savannah River Site: the Low Activity Waste Vaults, the Intermediate Level Vault, and the Slit Trenches.

3.4.6.1 Low Activity Waste Vaults

The sum-of-fractions value for the Savannah River Low Activity Waste Vaults is estimated to be 0.8 for the low-level waste projected to be disposed at the facility through 2070. Radionuclides contributing at least 0.1 to the sum-of-fractions value are tritium (H-3), which contributes 0.3, and Np-237, which contributes 0.1.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility will not be exceeded throughout the duration of disposal for low-level waste.

3.4.6.2 Intermediate Level Vaults

The sum-of-fractions value for the Savannah River Intermediate Level Vault is estimated to be 2.7 for the low-level waste

projected to be disposed at the facility through 2070. Radionuclides contributing at least 0.1 to the sum-of-fractions value are H-3, which contributes 1.4, U-233, which contributes 0.5, I-129 and U-238, which each contribute 0.3, and C-14, which contributes 0.2. These results are based on the values contained in the performance assessment for the Intermediate Level Vaults.

The radiological capacity has not yet been exceeded for this site, efforts can be taken to reduce uncertainties in projected inventories and performance assessment attributes in the analysis and confirm whether an exceedance of the radiological limits would still exist. Additional waste treatment, waste form adjustments, or disposal of specific waste streams at other Savannah River Site trenches or at another DOE site could also avoid radiological capacity exceedances.

3.4.6.3 Slit Trenches

The sum-of-fractions value for the Savannah River Slit Trenches is estimated to be 1 for the low-level waste projected to be disposed in that facility through 2070. Radionuclides contributing more than 0.1 to the sum-of-fractions value include I-129, which contributes 0.5, H-3, which contributes 0.3, and Np-237, which contributes 0.1.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, the radiological capacity of this disposal facility will not be exceeded throughout the duration of disposal for low-level waste.

3.5 Alternative Scenario Facility-Specific Radiological Projections and Capacities

This section presents the sum-of-fractions results for five alternative scenarios involving different disposal facilities for certain low-level and mixed low-level waste streams. Three alternative scenarios involve low-level waste and calculate the effect on the sum-of-fractions values at three Waste Management Program low-level waste disposal facilities (Hanford Site, Los Alamos National Laboratory, and Nevada Test Site) if these facilities received additional low-level waste. The additional low-level waste disposed at these facilities in the low-level waste alternative scenarios has a volume of 720,000 m^3 and is comprised of all low-level waste classified as *to be determined* (330,000 m^3) and all low-level waste projected to be disposed in not-yet-constructed CERCLA disposal facilities (390,000 m^3) . These three disposal facilities were selected for the low-level waste alternative scenarios because they have enough excess volumetric capacity to accommodate the entire 720,000 m^3 of additional low-level waste.

In addition, two alternative scenarios involve mixed low-level waste disposal at the Waste Management Program disposal facilities at Hanford Site and Nevada Test Site. These scenarios calculate the effect on the sum-of-fractions values at these sites if these facilities received the entire volume of mixed-low-level waste (300,000 m^3) that is either projected to be disposed at Waste Management Program disposal facilities (99,000 m^3) or not-yet-constructed Environmental Restoration Program CERCLA disposal facilities (35,000 m^3), or is classified as *to be determined* (170,000 m^3). The Hanford and Nevada Test Site facilities were selected for the mixed low-level waste alternative scenarios because they are approved to accept mixed waste and have enough potential expandable capacity to accommodate the entire 300,000 m^3 volume of mixed low-level waste.

No waste projected to be disposed at commercial facilities was included in the additional waste volumes considered in the five alternative scenarios. The sum-of-fractions results are shown in Table 3-6 and discussed below.

Table 3.6. Alternative Scenario Sum-of-Fractions Analysis for Low-Level and Mixed Low-Level Waste Disposal

Alternative Scenario	Disposal Facility/Site	Sum of Fractions
Low-Level Waste	Hanford Site	0.3
	Los Alamos National Laboratory	81
	Nevada Test Site	0.7
Mixed Low-Level Waste	Hanford Site	0.3
	Nevada Test Site	0.6

3.5.1 Alternative Scenarios for Low-Level Waste

Based on this analysis, both Hanford and the Nevada Test Site would be able to dispose of all of the alternative scenario low-level waste in addition to their current and projected inventory of waste without exceeding radiological limits. Los Alamos National Laboratory can accept much of the waste, although it is limited primarily in terms of the total combined inventory of Cs-137 and Sr-90. The facility-specific basis for these results are presented in the following sections. Appendix B presents the detailed sum-of-fractions results of the analyses, including the ratio of each radionuclide concentration to its site-specific limit.

3.5.1.1 Hanford Site 200 Area Low-Level Burial Ground

As discussed in Section 3.4.1, the sum-of fractions results for the Hanford 200 Area Low-Level Waste Burial Grounds is estimated to be 0.3 for the current and projected low-level waste projected to be generated and currently planned to be disposed at the 200 Area. No radionuclides contribute more than 0.1 to the sum-of-fractions value for the low-level waste. When the entire inventory of *to be determined* waste is added to this inventory, the sum-of-fractions value is still about 0.3, and there are still no radionuclides that contribute more than 0.1 to the sum-of-fractions value.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, disposing of the alternative scenario low-level waste at this facility would not cause its radiological capacity to be exceeded.

3.5.1.2 Los Alamos National Laboratory Technical Area-54

As discussed in Section 3.4.3, the sum-of-fractions results for the Los Alamos National Laboratory low-level waste burial grounds at Technical Area-54 is estimated to be 0.3 for the low-level waste projected to be disposed at that facility. No radionuclides contribute more than 0.1 to the sum-of-fractions value for the low-level waste. When the entire inventory of alternative scenario low-level waste is added to the current and projected low-level waste for this facility, the sum-of-fractions value increases to 81. Major contributors to the sum-of-fractions value are Cs-137, which contributes 61, Sr-90, which contributes 15, and U-234, which contributes 1. Other radionuclides contributing more than 0.1 to the sum-of-fractions are Ra-226 and U-235 (0.8 each); Cl-36 (0.6); Ni-63 (0.3); U-238 and Nb-94 (0.2 each); and C-14 and H-3 (0.1 each).

These results indicate that all of the alternative scenario waste likely would not be able to be disposed of at the Los Alamos Technical Area-54 low-level waste burial grounds based on the radiological capacity of the facility. Waste streams with high concentrations of Cs-137, Sr-90 or U-234 would be of particular concern based on this analysis.

3.5.1.3 Nevada Test Site Areas 3 and 5

As discussed in Section 3.4.4, the sum-of-fractions results for the Nevada Test Site low-level waste burial grounds is estimated to be 0.6 for the low-level waste projected to be disposed at the Nevada Test Site. When the entire inventory of alternative scenario low-level waste is added to the current and projected low-level waste for this facility, the sum-of-fractions value increases to 0.7. Major contributors to the sum-of-fractions value are Cs-137 and Nb-94, each of which contributes 0.1.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, disposing of the alternative scenario mixed low-level waste at this facility would not cause its radiological capacity to be exceeded.

3.5.2 Alternative Scenarios for Mixed Low-Level Waste

Based on this analysis, both Hanford and the Nevada Test Site would be able to dispose of all of the alternative scenario mixed low-level waste in addition to their current and projected inventory of waste without exceeding radiological limits. The facility-specific basis for these results are presented in the following sections. Appendix B presents the detailed sum-of-fractions

results of the analyses, including the ratio of each radionuclide concentration to its site-specific limit.

3.5.2.1 Hanford Site

As discussed in Section 3.4.1, the sum-of fractions results for the Hanford 200 Area Low-Level Waste Burial Grounds is estimated to be 0.3 for the current and projected low-level waste to be generated and currently planned to be disposed at the 200 Area. No radionuclides contribute more than 0.1 to the sum-of-fractions value for the low-level waste. When the entire inventory of alternative scenario mixed low-level waste is added to this inventory, the sum-of-fractions value is still about 0.3. The only radionuclide contributing more than 0.1 to the sum-of-fractions value under the alternative scenario is Np-237, which contributes 0.2.

3.5.2.2 Nevada Test Site

As discussed in Section 3.4.4, the sum-of fractions results for the Nevada Test Site low-level waste disposal facilities is estimated to be 0.6 for the current and projected low-level waste to be generated and currently planned to be disposed at the 200 Area. Radionuclides contributing at least 0.1 to the sum-of-fractions value are Cs-137, which contributes 0.2, and Ra-226, which contributes 0.1. When the entire inventory of alternative scenario mixed low-level waste is added to this inventory, the sum-of-fractions value is still about 0.6. Radionuclides contributing at least 0.1 to the sum-of-fractions value for the alternative case are Cs-137 and Pu-239, each of which contribute 0.1.

Based on the projected inventory used in this analysis and the current waste acceptance criteria, disposing of the alternative scenario mixed low-level waste at this facility would not cause its radiological capacity to be exceeded.

APPENDIX D-1
Supporting Data

LLW and MLLW Generated by Sources Other than Environmental Restoration and Planned for Disposal by Waste Management

Overview

Overview

1.0 Introduction

This appendix provides information on the data used to support the volumetric and radiological capacity analyses for low-level (LLW) and mixed low-level (MLLW) waste generated by sources other than environmental restoration (ER) and planned for disposal by waste management (WM). Appendix D-2 addresses the supporting data for waste generated by ER. Separate sections, one for each operations office and associated sites, are included in this appendix. The following discussions provide overviews of the data and are integral to understanding the subsequent sections devoted to each operations office.

2.0 Supporting Data - Waste Streams and Projected Disposed Volumes

Information on the projected volumes of LLW and MLLW to be disposed is based on a "frozen" archive of the *Paths To Closure* Stream Disposition Data (PTCSD data). This archive, frozen in March 1998, is also being used in the analyses of LLW and MLLW treatment and disposal configuration options to support development of the Waste Management Programmatic Environmental Impact Statement (WMPEIS) Records of Decision (ROD).

The PTCSD data contains information on waste streams that are projected to be generated and/or managed by the Office of Environmental Management (EM). The information maintained on each stream includes the waste type (e.g., LLW, MLLW, etc.), current stored inventory volume, projected life cycle volume to be generated, the planned disposition (i.e., treatment, disposal), the planned disposition site/facility, and the projected life cycle volume to be dispositioned. For purposes of this data, life cycle is defined as through FY2070.

Additional information that may be derived from the PTCSD data is the program responsible for generation of the stream (i.e., ER, WM, other) and the EM program responsible for its disposition (i.e., ER or WM). For purposes of both this and the

WMPEIS ROD analyses, the PTCSD LLW and MLLW streams planned for disposal were categorized according to the following:

Category 1 Streams: generated by sources other than ER and disposed by WM
Category 2 Streams: generated by ER and disposed by WM
Category 3 Streams: generated by ER and disposed by ER

As indicated in the above introduction, this appendix only addresses the Category 1 streams. Appendix D-2 addresses the Category 2 and 3 streams.

3.0 Supporting Data - Waste Stream Isotope Profiles

The PTCSD data does not include information on the isotopes contained in the waste streams. Therefore, to support the radiological capacity analyses, waste stream isotope data reported by the sites in other DOE-wide data sets were used to derive isotope profiles for application to the PTCSD LLW and MLLW streams. The data sources used to derive the profiles for the Category 1 streams were the April 1997 Waste Management Technical Data Request (WMTDR) and the 1995 Mixed Waste Inventory Report (95 MWIR). Following is a brief summary of each data set.

1995 Mixed Waste Inventory Report

Developed in response to the 1992 Federal Facility Compliance Act (FFCAct), the focal point of this data set was to characterize and quantify mixed waste, including MLLW, streams in storage throughout the DOE complex. Specific, relevant information requested on each stream included the volume in storage and the radiological contaminants and concentrations.

April 1997 Waste Management Technical Data Request

The primary purpose of the WMTDR was to collect data on LLW streams generated by WM and planned for disposal to support preparation of this disposal capacity report. Specific information requested on each LLW stream included;

- planned disposition of the stream (i.e., treatment or disposal),
- identification of the intended disposition facility,
- volume in storage at the end of FY1995,
- actual volumes generated and dispositioned during FY1996,
- projected volumes to be generated and dispositioned during FY1997, FY98-2006, and FY2007-2030
- identification of the isotopes and associated concentrations contained in the stream

A secondary purpose was to update the 95MWIR data on MLLW streams. As a starting point, the sites were provided their 95MWIR data as updated via Site Treatment Plan (STP) activities. Specific data the sites were requested to update included the stored inventory volumes and the isotope data.

Unless otherwise noted in the specific operations office sections of this appendix, isotope profiles for the Category 1 LLW streams were derived based on the WMTDR. In most instances, a site-wide profile was derived based on a composite of streams reported by that site in the WMTDR. Weighted average concentrations of the isotopes were calculated via the following:

Equation 1

$$C_i = \frac{\sum_{s=1}^{s=n} C_s \times V_s}{\sum_{s=1}^{s=n} V_s}$$

where;
C_i = Composite concentration of isotope (Ci/M3)
C_s = Concentration (Ci/M3) of isotope in stream S
V_s = Volume (M3) of stream S to be disposed from 1996 through 2030

Isotope profiles for the Category 1 MLLW streams were derived based on the WMTDR, if possible. However, absent sufficient data in the WMTDR, the 95MWIR was consulted. As with the LLW streams, the profiles were derived based on a composite of streams with weighted average concentrations of the isotopes calculated via the following:

Equation 2

$$C_i = \frac{\sum_{s=1}^{s=n} C_s \times I_s}{\sum_{s=1}^{s=n} I_s}$$

where;
C_i = Composite concentration of isotope (Ci/M3)
C_S =Concentration (Ci/M3) of isotope in stream S
I_S = Stored inventory (M3) of stream S

4.0 Operations Office/Site Discussion

The remainder of this appendix provides explanations of the supporting quantity and isotope data specific to each operations office and associated sites. In general, the explanations for each site and applicable waste type (i.e., LLW or MLLW) are centered around three tables. Table 1 presents the streams from the PTCSD data that are planned for disposal. This table includes the following information:

HQ Id:	Identification code assigned to the stream by Headquarters in the Paths To Closure data base.
Map Id:	Identification code (site assigned) for the stream as depicted on the baseline disposition map
Source Map:	Baseline disposition map on which the stream originates.
Stream Name:	Name of the stream as assigned by the site.
Disposal Site:	Planned disposal site for the stream (COMM = Commercial, TBD = To Be Determined)
Life Cycle Disposed (M3):	Projected volume of the stream to be disposed (FY1998 - FY2070)

Table 2 presents the streams from the WMTDR or 95MWIR used to derive the isotope profile. This table includes the following information:

WMTDR Id:	Identification code assigned to the stream by Headquarters in the WMTDR data base.
95MWIR Id:	Identification code assigned to the stream by Headquarters in the 95MWIR data base (applies to MLLW streams only)
STP Id:	Identification code (site assigned) of the stream in the STP data base (applies to MLLW streams only).
Site Id:	Site-assigned identification code for the stream.
Stream Name:	Name of the stream as assigned by the site.

Table 3 presents the derived isotope profile applied to the PTCSD streams.

Appendix D-1
Oak Ridge Operations Office

Oak Ridge Reservation (ORR)

PTCSD Streams and Projected Disposed Volumes

As shown in Table 1-ORR, the PTCSD data includes 18 ORR LLW streams planned for disposal. Seven of these are targeted for disposal at "to be determined" off-site facilities. The remaining 11 are targeted for disposal at "to be determined" on- or off-site facilities.

Table 1-ORR. Category 1 PTCSD LLW Streams Planned for Disposal

HQ Id	Map Id	Source Map	Stream Name	Disposal Site	Life Cycle Disposed (M3)
00265	DAI	SNF	Low-level Waste to Interim Storage	TBD	0.00
01586	DBH	LLW	DAW Volume Reduction Residues	TBD	152,170.80
01588	DBJ	LLW	Construction Debris	TBD	5,701.20
01589	DBK	LLW	Soils	TBD	37,463.60
01590	DBL	LLW	Non-Reg Chem/Lab Packs	TBD	9,647.14
01591	DBM	LLW	Resins/Trapping Material	TBD	69.10
01603	DBV	LLW	Scrap Metal Treatmt Residuals	TBD	5,038.76
01608	DCM	LLW	Uranium Oxide	TBD	1,054.60
01609	DCJ	LLW	Fissile-Disposal Ready	TBD	23.20
01610	DCD	LLW	CLASSIFIED-Disposal Ready	TBD	1,362.20
01611	DCE	LLW	Contact Handled-Disposal Ready	TBD	100.20
01582	DBS	LLW	WETF Sludge	TBD	6,526.00
01584	DBF	LLW	MVST Monoliths	TBD	1,252.30
01596	DBT	LLW	CPCF Sludge	TBD	4,342.01
01597	DBU	LLW	PWTC Sludge	TBD	14,865.97
01606	DCC	LLW	MVST Treated Concentrate (final)	TBD	1,628.00

01612	DCF	LLW	RH Post-Treatment	TBD	899.00
01613	DCG	LLW	RH Aluminum	TBD	10.00

Radiological Profile

A site-wide isotope profile for application to the 18 PTCSD streams was derived based on data reported by ORR to the WMTDR. ORR reported six LLW streams in this data. Isotopes and concentrations were reported for all six streams. The planned disposition for two of the streams was reported as disposal with the location "to be determined". The planned disposition for the remaining four was reported as treatment (presumably, any LLW residues from treatment of these streams are accounted for within the two streams destined for disposal). The isotope profile (see Table 3-ORR) was derived based on a composite of the two LLW streams (see Table 2-ORR) reported as destined for disposal. The composite concentration for each isotope was calculated via Equation 1.

Table 2-ORR. Isotope Profile Basis - Category 1 LLW Streams

WMTDR Id	Site ID	Stream Name
ORR1001		LLW Process Residues Project Rollup
ORR1002		LLW Dry Active Waste Project Rollup

Table 3-ORR. Isotope Profile - Category 1 LLW Streams

Isotope	Concentration (Ci/M3)	Isotope	Concentration (Ci/M3)	Isotope	Concentration (Ci/M3)
Ac-225	1.3418e-06	Ho-166m	3.7572e-13	Ra-228	1.0148e-05
Ac-227	3.4592e-06	I-125	1.7010e-04	Re-186	1.1387e-03
Ag-108m	3.9605e-06	I-129	6.4736e-08	Re-188	1.2216e-03
Ag-110m	1.0678e-04	I-131	3.1692e-04	Ru-106	6.4987e-08
Am-241	3.1021e-05	In-114	3.6498e-07	S-35	2.5404e-04
Am-243	4.4494e-05	In-114m	1.3250e-07	Sb-124	1.5382e-04
Am-244	2.4229e-06	Ir-192	5.8911e-04	Sb-125	2.5259e-07
Ba-133	4.5517e-04	Ir-194	5.2473e-08	Sc-46	4.1304e-05
Ba-140	4.4831e-09	K-40	1.2588e-05	Se-75	5.9940e-07
C-14	2.8346e-04	Kr-85	1.7881e+01	Sm-151	4.3734e-09
Cd-109	1.4495e-08	La-140	6.4070e-05	Sn-117m	1.4697e-06
Ce-141	1.2004e-05	Mn-54	4.1831e-01	Sr-85	8.5704e-06
Ce-144	9.6648e-04	Mo-99	7.8365e-05	Sr-89	3.1120e-03

Cf-249	0.0000e+00	Na-22	1.4013e-08	Sr-90	1.5080e-02
Cf-252	5.5660e-10	Na-24	5.8219e-05	Ta-182	3.3580e-07
Cl-36	6.8144e-04	Nb-95	2.2480e-06	Tb-160	5.0628e-09
Cm-244	1.6925e-02	Ni-59	9.3189e-07	Tc-99	1.6896e-06
Co-57	7.8068e-06	Ni-63	3.8010e+00	Th-227	3.4592e-06
Co-58	5.4466e-04	Np-237	1.1682e-05	Th-228	1.0636e-05
Co-60	2.1157e-01	Np-239	1.4595e-09	Th-229	2.8299e-11
Cr-51	5.3064e-03	Os-191	8.5227e-05	Th-230	2.5723e-06
Cs-134	1.2314e-02	Os-194	1.7343e-07	Th-232	1.1054e-05
Cs-137	1.4291e+00	P-32	8.9883e-04	Th-234	5.3634e-04
Cs-138	1.5240e-04	P-33	1.6086e-06	U-232	1.6612e-07
Dy-166	1.8823e-04	Pa-231	2.3208e-07	U-233	1.1748e-05
Eu-152	1.1567e-01	Pa-233	1.1664e-05	U-234	1.0465e-03
Eu-154	3.8136e-03	Pb-210	8.4369e-06	U-235	4.7350e-05
Eu-155	7.9219e-04	Po-210	2.5544e-06	U-236	9.0193e-08
Eu-156	8.6691e-07	Pu-238	1.0146e-05	U-238	5.1226e-04
Fe-55	3.8027e+00	Pu-239	1.0996e-05	U-239	1.0484e-07
Fe-59	5.8020e-05	Pu-240	6.6101e-05	W-188	5.1753e-03
Gd-153	3.0687e-06	Pu-241	6.3222e-09	Y-88	2.2947e-10
H-3	2.3957e+01	Pu-242	1.6801e-08	Y-90	1.2268e-03
Hf-181	6.6637e-05	Ra-223	3.4592e-06	Zn-65	1.3656e-01
Hg-203	2.0367e-07	Ra-226	1.4854e-04	Zr-95	1.1826e-06

Paducah Gaseous Diffusion Plant (PGDP)

PTCSD Streams and Projected Disposed Volumes

As shown in Table 1-PGDP, the PTCSD data includes two PGDP LLW streams planned for disposal, both at "to be determined" facilities.

Table 1-PGDP. Category 1 PTCSD LLW Streams Planned for Disposal

HQ Id	Map Id	Source Map	Stream Name	Disposal Site	Life Cycle Disposed (M3)
00438	BAE	LLW	LLW Rubble/Debris	TBD	1,430.00
01972	BBZ	LLW	LLW Solids (from VORTEC)	TBD	2,949.00

Radiological Profile
The isotope profile applied to the two PTCSD streams is the same as that developed for PGDP environmental restoration MLLW (see Appendix D-2).

Portsmouth Gaseous Diffusion Plant (PORT)

PTCSD Streams and Projected Disposed Volumes
As shown in Table 1-PORT, the PTCSD data includes 2 PORT LLW streams planned for disposal at Hanford.

Table 1-PORT. Category 1 PTCSD LLW Streams Planned for Disposal

HQ Id	Map Id	Source Map	Stream Name	Disposal Site	Life Cycle Disposed (M3)
00470	AAC	LLW	LLW Solids	HANF	2,031.00

Radiological Profile
The isotope profile applied to the two PTCSD streams is the same as that developed for PORT environmental restoration MLLW (see Appendix D-2).

Oak Ridge Reservation (ORR)

PTCSD Streams and Projected Disposed Volumes
As shown in Table 1-ORR, the PTCSD data includes seven ORR MLLW streams planned for disposal..

Table 1-ORR. Category 1 PTCSD MLLW Streams Planned for Disposal

HQ Id	Map Id	Source Map	Stream Name	Disposal Site	Life Cycle Disp (M3)
01628	CAN	MLLW	Balance of Inventory (PORTS Soil) [TR]	COMM	2,453.00
01631	CAQ	MLLW	CNF Sludge to Direct Disposal	TBD	17,611.73
01633	CAU	MLLW	TSCAI Residuals to Direct Disposal	TBD	23,947.68
01637	CAZ	MLLW	TVS Glass Form to Direct Disposal	TBD	3.00
01640	CBC	MLLW	Repackaged WETF Sludge (Pre Head End Mods) to Direct Disposal	TBD	4,066.09
01664	CBY	MLLW	BOI LDR Treatment Residues	TBD	10,631.80
01667	CCB	MLLW	Process Residues LDR Treatment Residuals	TBD	26,379.97

Radiological Profile

A site-wide isotope profile for application to the seven PTCSD streams was derived based on data reported by ORR to the WMTDR. ORR reported four MLLW streams in this data. The planned disposition for two of these streams (Wastewaters and TSCA Feed) was reported as treatment. The planned disposition for one of the streams (Process Residues) was reported as disposal (this stream includes the wastewater treatment residuals and TSCA Ash/Sludge). The planned disposition for the remaining stream (Balance of Inventory) was reported as treatment (i.e., broad spectrum). Per the ORR PTCSD data, the residuals from this treatment are encompassed within the seven PTCSD streams planned for disposal.

Based on the above, the isotope profile (see Table 3-ORR) was derived based on a composite of the Process Residues and Balance of Inventory streams (see Table 2-ORR). The composite concentration for each isotope was calculated via Equation 2.

Table 2-ORR. Isotope Profile Basis - Category 1 MLLW Streams

WMTDR Id	95MWIR Id	STP Id	Site Id	Stream Name
ORR0003				MLLW Process Residues Project Rollup
ORR0004				MLLW Balance of Inventory Project Rollup

Table 3-ORR. MLLW Site-Wide Isotope Profile

Isotope	Conc (Ci/M3)	Isotope	Conc (Ci/M3)	Isotope	Conc (Ci/M3)	Isotope	Conc (Ci/M3)
Ac-228 (γ)	1.8946e-08	Cs-137	9.0710e-06	Pb-214	2.2735e-08	Th-232	3.6989e-06
Activity total	1.2313e-03	Cs-137 (γ)	9.3466e-09	Pu-238	3.0389e-07	Th-234	9.7985e-03
Am-241	5.1785e-08	Gross Alpha	1.4421e-02	Pu-239	3.2686e-05	Th-234 (γ)	1.0038e-04
Am-241 (γ)	6.8584e-07	Gross Beta	2.3210e-02	Pu-239/Pu-240	2.7341e-07	Ti-208 (γ)	3.0313e-08
Bi-212 (γ)	1.3894e-08	Gross Gamma	1.5483e-04	Ra-226	3.6629e-08	U	5.0325e+01
Co-57	9.0533e-08	H-3	2.5455e-04	Ra-226 (γ)	2.2482e-08	U-234	8.2193e-03
Co-60	1.6970e-07	K-40 (γ)	3.2839e-08	Sr-90	8.5133e-07	U-235	3.2213e-01
Co-60 (γ)	5.0522e-09	Np-237	9.9805e-04	Sr-total	5.4967e-07	U-238	6.2750e-04
Cs-134 (γ)	8.0835e-10	Pa-231 (γ)	1.1746e-07	Tc-99	6.2591e-03	U-total	4.7190e+03
Cs-135m (γ)	1.1115e-08	Pa-234 (γ)	2.1080e-06	Th-228	8.8221e-04	U-total alpha	6.0237e-04
Cs-136 (γ)	6.8205e-09	Pa-234m (γ)	1.0422e-04	Th-230	2.2502e-04		

Paducah Gaseous Diffusion Plant (PGDP)

PTCSD Streams and Projected Disposed Volumes
As shown in Table 1-PGDP, the PTCSD data includes five PGDP MLLW streams planned for disposal.

Table 1-PGDP. Category 1 PTCSD MLLW Streams Planned for Disposal

HQ Id	Map Id	Source Site	Stream Name	Disposal Site	Life Cycle Disposed (M3)
00449	BAP	MLLW	Treated Solids	TBD	2.97
00462	BBP	ER	Treated Solids (from VORTEC)	TBD	944.01
01974	BCB	MLLW	Treated MLLW Solids (from Broad Spec)	TBD	776.00
01976	BCD	MLLW	Treated Rad-PCB Solids (from Broad Spec)	TBD	950.00
01975	BCC	MLLW	Treated MLLW Solids (from Broad Spec)	COMM	87.00

Radiological Profile
The isotope profile applied to the five PTCSD streams is the same as that developed for PGDP environmental restoration MLLW (see Appendix D-2).

Portsmouth Gaseous Diffusion Plant (PORT)

PTCSD Streams and Projected Disposed Volumes
As shown in Table 1-PORT, the PTCSD data includes three PORT MLLW streams planned for disposal.

Table 1-PORT. Category 1 PTCSD MLLW Streams Planned for Disposal

HQ Id	Map Id	Source Map	Stream Name	Disposal Site	Life Cycle Disposed (M3)
00471	AAD	MLLW	TSCA Solids	TBD	2,837.00
01981	AAZ	MLLW	Incinerable Solids (to Comm)	COMM	1,526.00
01982	ABA	MLLW	Incinerable Solids (to Comm)	COMM	1,526.00

Radiological Profile
The isotope profile applied to the three PTCSD streams is the same as that developed for PORT environmental restoration MLLW (see Appendix D-2).