



2.5 WASTE MANAGEMENT AND CHEMICAL INVENTORIES

L. P. Diediker and D. L. Dyekman

2.5.1 WASTE MANAGEMENT

Waste produced from Hanford Site cleanup operations is classified as either radioactive, non-radioactive, mixed, hazardous, or non-dangerous. Radioactive waste is categorized as transuranic, high-level, and low-level. Mixed waste has both radioactive and hazardous non-radioactive substances. Hazardous waste contains either dangerous waste or extremely hazardous waste or both, as defined in WAC 173-303. Hanford's hazardous waste is managed in accordance with WAC 173-303.

Radioactive and mixed waste are currently handled in several ways. High-level waste is stored in underground single- and double-shell tanks. The method used to manage low-level waste depends on the source, composition, and concentration of the waste. Low-level waste is stored in either a tank system, on storage pads, or is buried. Transuranic waste is stored in vaults or on underground and aboveground storage pads from which it can be retrieved.

Approximately 33 Hanford Site operations (WAC 173-303-040) have the capacity to produce dangerous waste during site cleanup activities. An annual report lists the dangerous waste generated, treated, stored, and disposed of onsite and offsite (DOE/RL-2003-10). Dangerous waste is treated, stored, and prepared for disposal at several Hanford Site facilities. Dangerous waste generated at the site also is shipped offsite for disposal, destruction, or recycling.

Non-dangerous waste generated at the Hanford Site historically has been buried near the 200 Areas Solid Waste Landfill. Beginning in 1999, non-dangerous waste has been disposed of at the Roosevelt Regional landfill near Goldendale, Washington, through a contract with Basin Disposal, Inc. Since 1996, medical waste has been

shipped to Waste Management, of Kennewick, Washington. Asbestos has been shipped to Basin Disposal, Inc. in Pasco, Washington, and the onsite Environmental Restoration Disposal Facility. Since 1996, non-regulated drummed waste has been shipped to Waste Management, of Kennewick, Washington.

Non-dangerous waste originates at a number of areas across the site. Examples include construction debris, office trash, cafeteria waste, and packaging materials. Other materials and items classified as non-dangerous waste are solidified filter backwash and sludge from the treatment of river water, failed and broken equipment and tools, air filters, uncontaminated used gloves and other clothing, and certain chemical precipitates such as oxalates. Non-hazardous demolition waste from 100 Areas decommissioning projects is buried in situ or in designated sites in the 100 Areas.

Annual reports document the quantities and types of radioactive solid waste generated onsite, received, shipped offsite, and disposed of at the Hanford Site (HNF-EP-0125-15). Solid waste program activities are regulated by the *Resource Conservation and Recovery Act* and *Toxic Substances Control Act*, discussed in Section 2.2. Solid waste generated onsite or received from offsite sources and disposed at the Hanford Site from 1997 through 2002 are shown in Tables 2.5.1 and 2.5.2. Quantities of hazardous waste shipped offsite from 1997 through 2002 are shown in Table 2.5.3. Table 2.5.4 provides a detailed summary by radionuclide of the radioactive solid waste stored or disposed during 2002.

The quantities of radioactive and/or mixed liquid waste generated during 2002 and stored in underground storage tanks are included in the annual dangerous waste report (DOE/RL-2003-10). Table 2.5.5 is a summary of the liquid waste generated from 1997 through 2002, which is stored in underground storage tanks.

Table 2.5.1. Quantities of Solid Waste^(a) Generated on the Hanford Site, 1997 through 2002, kg (lb)

<u>Waste Category</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>
Mixed	442,000 (975,000)	509,000 (1,120,000)	421,000 (928,000)	441,000 (973,000)	328,500 (724,300)	1,025,199 (2,260,564)
Radioactive	6,590,000 (14,500,000)	1,470,000 (3,240,000)	957,000 (2,110,000)	700,000 (1,544,000)	1,675,200 (3,693,800)	1,587,719 (3,500,920)

(a) Solid waste includes containerized liquid waste.

Table 2.5.2. Quantities of Solid Waste^(a) Received on the Hanford Site from Offsite Sources, 1997 through 2002, kg (lb)

<u>Waste Category</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>
Mixed	3,560 (7,850)	267 (589)	1,306 (2,880)	1,381 (3,045)	127,000 (280,000)	111,655 (246,199)
Radioactive	1,430,000 (3,150,000)	2,870,000 (6,330,000)	2,325,700 (5,128,000)	6,958,000 (15,343,000)	4,736,500 (10,444,000)	1,517,351 (3,345,759)

(a) Solid waste includes containerized liquid waste. Solid waste quantities do not include United States Navy reactor compartments.

Table 2.5.3. Quantities of Hazardous Waste^(a) Shipped Off the Hanford Site, 1997 through 2002, kg (lb)

<u>Waste Category</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>
Containerized	110,000 (243,000)	65,700 (145,000)	1,732,700 ^(b) (3,820,600)	33,200 ^(b) (73,220)	56,000 ^(b) (124,000)	78,413 ^(b) (172,901)
			70,000 ^(c) (154,000)	315,500 ^(c) (695,700)	2,600 ^(c) (5,800)	3,521 ^(c) (7,764)
Bulk Solids	335,000 (739,000)	47,500 (105,000)	402,300 ^(d) (887,000)	0	0	0
Bulk Liquids	5,025,000 (11,100,000)	41,800 (92,200)	0	0	0	50,649 (111,681)
Total	5,470,000 (12,100,000)	155,000 (342,000)	2,205,000 (4,862,000)	348,700 (768,883)	59,000 (130,000)	132,583 (292,346)

(a) Does not include *Toxic Substances Control Act* waste.

(b) Hazardous waste only.

(c) Mixed waste (radioactive and hazardous).

(d) Includes 399,875 kg (882,000 lb) of material associated with the extraction of carbon tetrachloride from soil.

Table 2.5.4. Radioactive Solid Waste Stored or Disposed of on the Hanford Site, 2002

Constituent^(b)	Quantity, Ci^(a)		
	Low-Level	Low-Level Mixed Waste	Transuranic
Tritium	971	120	0.00137
Carbon-14	0.095	0.004	^(c)
Manganese-54	17.9	2.24	0.00529
Iron-55	29,300	197	^(c)
Cobalt-60	299	0.0364	0.237
Nickel-63	116,000	0.0102	^(c)
Strontium-90	779	10.6	2,930
Yttrium-90	779	10.6	2,930
Technetium-99	0.378	0.0163	0.897
Rhodium-106	0.142	^(d)	^(d)
Ruthenium-106	0.142	^(d)	^(d)
Iodine-129	0.0000269	0.00184	0.00216
Cesium-137	624	11.8	9,050
Barium-137m	590	11.1	8,560
Uranium-233	0.00216	0.000125	0.00000000288
Uranium-234	1.33	0.000324	0.0706
Uranium-235	0.0652	0.000232	0.00101
Uranium-236	0.0446	0.00000505	0.0158
Neptunium-237	0.000283	0.0027	0.0378
Uranium-238	2.56	0.0136	0.024
Plutonium-238	0.806	0.00985	644
Plutonium-239	1.63	0.0554	7,790
Plutonium-240	0.827	0.015	1,850
Plutonium-241	44.1	0.488	44,200
Plutonium-242	0.000565	0.0000305	0.332
Americium-241	3.02	0.135	1,220
Cerium-235	^(d)	^(d)	0.0792
Cerium-244	0.176	0.000682	384
Total	149,000	364	79,600

(a) 1 Ci = 37 GBq.

(b) See Appendix A, Table A.7 for radionuclide half-lives.

(c) Isotope is not typically found in waste type.

(d) Value is quantitatively insignificant relative to other waste types.

2.5.2 CHEMICAL INVENTORIES

Types, quantities, and locations of hazardous chemicals are tracked through prime contractor-specific chemical management system requirements (Section 2.2.3), which include compliance activities associated with the

Emergency Planning and Community Right-To-Know Act (Section 2.2.5). The 2002 Hanford Site Tier Two *Emergency and Hazardous Chemical Inventory* (DOE/RL-2003-07) was issued during March 2003 in compliance with Section 312 of the act. Table 2.5.6 summarizes the information reported, listing the 10 hazardous chemicals stored in greatest quantity on the Hanford Site during 2002.

Table 2.5.5. Quantities of Liquid Waste^(a) Generated and Stored Within the Tank Farm System on the Hanford Site During 2002 and During Each of the Previous 5 Years, L (gal)

Type of Waste	1997^(b,c)	1998^(b,c)	1999^(b,c)	2000^(b)	2001^(b)	2002
Volume of waste added to double-shell tanks	796,000 (210,000)	1,715,000 (453,000)	5,420,000 (1,432,000)	8,920,000 (2,357,000)	2,980,000 (788,000)	9,280,000 (2,452,000)
Total volume in double-shell tanks (year end)	69,245,000 (18,295,000)	70,969,000 (18,750,000)	73,290,000 (19,363,000)	79,630,000 (21,038,000)	79,980,000 (21,131,000)	87,683,000 (23,166,000)
Volume evaporated at 242-A evaporator	3,800,000 (1,004,000)	0	3,097,000 (818,000)	2,580,000 (682,000)	2,580,000 (682,000)	1,565,000 (417,000)
Volume pumped from single-shell tanks ^(d)	244,000 (64,000)	859,000 (227,000)	2,930,000 (774,100)	2,250,000 (595,000)	590,000 (155,000)	5,288,000 (1,397,000)

- (a) Quantity of liquid waste is defined as liquid waste sent to double-shell underground storage tanks during these years. This does not include containerized waste (e.g., barreled) included in the solid waste category.
- (b) Quantity of liquid waste is defined as shown by different categories on left-hand side of table during these years. This does not include containerized waste (e.g., barreled) included in the solid waste category.
- (c) Quantity of liquid waste shown is a corrected figure for these years.
- (d) Volume does not include dilution or flush water.

Table 2.5.6. Average Quantity of Ten Hazardous Chemicals Stored on the Hanford Site, 2002

Hazardous Chemical	Average Quantity, kg (lb)
Mineral oil	1,700,000 (3,800,000)
Sodium	1,000,000 (2,300,000)
Diesel fuel (Grades 1 and 2)	430,000 (960,000)
Ethylene glycol	260,000 (580,000)
Nitrogen	57,000 (130,000)
Propane	50,000 (110,000)
Argon	45,000 (99,000)
Sulfuric acid	37,000 (82,000)
Polychlorinated biphenyls	32,000 (71,000)
Silicon dioxide	26,000 (58,000)