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## 3.4 Waste Management and Chemical Inventories

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### Waste Management

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

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

Approximately 200 Hanford Site facilities have the capacity to generate dangerous and toxic waste. An annual report lists the dangerous wastes and extremely hazardous wastes generated, treated, stored, and disposed of onsite and offsite (DOE 1997c). Dangerous wastes are treated, stored, and prepared for disposal at several Hanford Site facilities. Dangerous wastes generated at the site are also shipped offsite for disposal, destruction, or recycling.

Nondangerous wastes generated at the Hanford Site have historically been buried near the 200 Areas Solid Waste Landfill; in March 1996, this landfill was closed. Beginning in late December 1995, nondangerous wastes have been disposed of at the City of Richland's Landfill, a municipal landfill located at the southern edge of the Hanford Site boundary. Since February 1996, medical wastes have been shipped to Waste Management of

Kennewick. Asbestos has been shipped to Basin Disposal, Inc. in Pasco and the onsite Environmental Restoration Disposal Facility. Starting in March 1996, nonregulated drummed waste has been shipped to Waste Management of Kennewick.

These wastes originate at a number of areas across the site. Examples of these wastes are construction debris, office trash, cafeteria waste, and packaging materials. Other materials and items classified as 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. Ash generated at powerhouses in the 200 Areas is buried in designated sites near those powerhouses. Demolition wastes from 100 Areas decommissioning projects are buried in situ or in designated sites in the 100 Areas.

Annual reports document the quantities and types of solid wastes generated onsite, received, shipped offsite, and disposed of at the Hanford Site (Hagel 1997). Solid waste program activities are regulated by the Resource Conservation and Recovery Act and Toxic Substances Control Act, discussed in Section 2.0, "Environmental Compliance Summary." Solid waste quantities generated onsite, received from offsite, shipped offsite, and disposed of at the Hanford Site from 1991 through 1996 are shown in Tables 3.4.1 through 3.4.3. Table 3.4.4 provides a detailed summary of the radioactive solid wastes stored or disposed of in 1996.

The quantities of liquid wastes generated in 1996 and stored in underground storage tanks are included in the annual dangerous waste report (DOE 1997c). Table 3.4.5 is a summary of the liquid wastes generated from 1991 through 1996, which are stored in underground storage tanks.

**Table 3.4.1.** Quantities of Solid Wastes<sup>(a)</sup> Generated on the Hanford Site (kg)

Waste Category	1991	1992	1993	1994	1995	1996
Mixed	475,370	48,641	150,012	567,670	131,755	199,272
Radioactive	1,069,703	682,684	1,116,616	1,390,647	1,892,636	3,870,461

(a) Solid waste includes containerized liquid waste.

**Table 3.4.2.** Quantities of Solid Wastes<sup>(a)</sup> Received from Offsite (kg)

Waste Category	1991	1992	1993	1994	1995	1996
Mixed	23,605	40,897	207,905	96,409	52,796	2,073
Radioactive	629,686	1,010,439	1,587,884	1,355,653	1,306,194	1,668,269

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

**Table 3.4.3.** Quantities of Hazardous Wastes<sup>(a)</sup> Shipped Offsite (kg)

Waste Category	1991	1992	1993	1994	1995	1996
Containerized	89,354	181,305	123,754	267,113	224,003	589,721
Bulk Solids	0	433,330	250,235	2,872,661	477,648	0
Bulk Liquid	331,905	11,089	94,065	248,917	130,156	98,795
Total	421,259	625,724 <sup>(b)</sup>	468,054 <sup>(c)</sup>	3,388,691 <sup>(d)</sup>	831,807	688,516

(a) Does not include Toxic Substances Control Act wastes.

(b) Includes 418,676 kg from demolition of 2727-S Building.

(c) Includes 250,235 kg from demolition of 190-B Building.

(d) Includes 2,658,788 kg from North Slope cleanup and 160,883 kg from carbon tetrachloride soil extraction.

## Chemical Inventories

Types, quantities, and locations of hazardous chemicals are tracked through compliance activities associated with the Emergency Planning and Community Right-To-Know Act (see "Community Right-To-Know Activities" in

Section 2.2). The *1996 Tier Two Emergency and Hazardous Chemical Inventory* (DOE 1997a) was issued in March 1997 in compliance with Section 312 of the Act. Table 3.4.6 summarizes the information reported, listing the 10 chemicals stored in greatest quantity on the Hanford Site in 1996.

**Table 3.4.4.** Radioactive Solid Wastes Stored or Disposed of in 1996<sup>(a)</sup>

Constituent	Quantity, Ci					
	Low-Level	Low-Level Mixed	Low-Level Plus <sup>(b)</sup>	Low-Level Mixed Plus <sup>(c)</sup>	Transuranic	Transuranic Mixed
<sup>3</sup> H	1.80 x 10 <sup>4</sup>	1.34 x 10 <sup>-2</sup>	0.00	0.00	0.00	0.00
<sup>14</sup> C	8.13 x 10 <sup>-3</sup>	4.15 x 10 <sup>-3</sup>	0.00	6.09 x 10 <sup>0</sup>	0.00	0.00
<sup>54</sup> Mn	4.89 x 10 <sup>1</sup>	2.43 x 10 <sup>-2</sup>	1.35 x 10 <sup>-10</sup>	2.70 x 10 <sup>-10</sup>	0.00	0.00
<sup>55</sup> Fe	9.76 x 10 <sup>1</sup>	1.39 x 10 <sup>-3</sup>	0.00	4.25 x 10 <sup>4</sup>	0.00	0.00
<sup>59</sup> Fe	8.00 x 10 <sup>-6</sup>	1.70 x 10 <sup>-8</sup>	0.00	0.00	0.00	0.00
<sup>60</sup> Co	8.90 x 10 <sup>1</sup>	5.67 x 10 <sup>-1</sup>	2.70 x 10 <sup>-10</sup>	1.38 x 10 <sup>4</sup>	4.30 x 10 <sup>-1</sup>	5.58 x 10 <sup>-1</sup>
<sup>63</sup> Ni	7.10 x 10 <sup>1</sup>	2.35 x 10 <sup>-2</sup>	0.00	8.58 x 10 <sup>4</sup>	0.00	0.00
<sup>90</sup> Sr	1.58 x 10 <sup>4</sup>	1.64 x 10 <sup>1</sup>	8.22 x 10 <sup>-5</sup>	2.70 x 10 <sup>-9</sup>	3.33 x 10 <sup>2</sup>	2.16 x 10 <sup>1</sup>
<sup>90</sup> Y	1.58 x 10 <sup>4</sup>	1.64 x 10 <sup>1</sup>	8.22 x 10 <sup>-5</sup>	2.70 x 10 <sup>-9</sup>	3.33 x 10 <sup>2</sup>	2.16 x 10 <sup>1</sup>
<sup>99</sup> Tc	1.49 x 10 <sup>1</sup>	8.98 x 10 <sup>-3</sup>	9.44 x 10 <sup>-6</sup>	4.17 x 10 <sup>-5</sup>	1.97 x 10 <sup>0</sup>	0.00
<sup>137</sup> Cs	1.30 x 10 <sup>4</sup>	5.96 x 10 <sup>0</sup>	7.90 x 10 <sup>-5</sup>	4.44 x 10 <sup>-9</sup>	4.99 x 10 <sup>2</sup>	1.41 x 10 <sup>2</sup>
<sup>137m</sup> Ba	1.23 x 10 <sup>4</sup>	5.64 x 10 <sup>0</sup>	7.47 x 10 <sup>-5</sup>	4.20 x 10 <sup>-9</sup>	4.70 x 10 <sup>2</sup>	1.34 x 10 <sup>2</sup>
<sup>232</sup> Th	1.42 x 10 <sup>-3</sup>	6.32 x 10 <sup>-4</sup>	0.00	0.00	0.00	0.00
<sup>233</sup> U	6.02 x 10 <sup>-3</sup>	8.42 x 10 <sup>-6</sup>	0.00	0.00	0.00	0.00
<sup>234</sup> U	2.24 x 10 <sup>1</sup>	4.73 x 10 <sup>-6</sup>	2.92 x 10 <sup>-5</sup>	1.29 x 10 <sup>-4</sup>	4.59 x 10 <sup>-3</sup>	0.00
<sup>235</sup> U	7.29 x 10 <sup>-1</sup>	1.17 x 10 <sup>-1</sup>	1.49 x 10 <sup>-6</sup>	6.56 x 10 <sup>-6</sup>	2.50 x 10 <sup>-4</sup>	1.80 x 10 <sup>-5</sup>
<sup>236</sup> U	3.75 x 10 <sup>0</sup>	7.53 x 10 <sup>-2</sup>	2.47 x 10 <sup>-6</sup>	1.09 x 10 <sup>-5</sup>	9.10 x 10 <sup>-4</sup>	0.00
<sup>238</sup> U	3.73 x 10 <sup>1</sup>	2.13 x 10 <sup>0</sup>	1.82 x 10 <sup>-5</sup>	8.06 x 10 <sup>-5</sup>	6.16 x 10 <sup>-3</sup>	3.66 x 10 <sup>-4</sup>
<sup>237</sup> Np	2.57 x 10 <sup>-2</sup>	4.99 x 10 <sup>-5</sup>	0.00	0.00	0.00	2.96 x 10 <sup>-7</sup>
<sup>238</sup> Pu	3.78 x 10 <sup>0</sup>	2.40 x 10 <sup>-3</sup>	2.50 x 10 <sup>-4</sup>	0.00	1.17 x 10 <sup>2</sup>	2.21 x 10 <sup>1</sup>
<sup>239</sup> Pu	5.05 x 10 <sup>0</sup>	4.86 x 10 <sup>-2</sup>	2.97 x 10 <sup>-3</sup>	0.00	8.53 x 10 <sup>2</sup>	3.54 x 10 <sup>2</sup>
<sup>240</sup> Pu	2.28 x 10 <sup>0</sup>	6.99 x 10 <sup>-3</sup>	6.62 x 10 <sup>-4</sup>	0.00	2.68 x 10 <sup>2</sup>	8.47 x 10 <sup>1</sup>
<sup>241</sup> Pu	1.45 x 10 <sup>2</sup>	3.79 x 10 <sup>-1</sup>	2.14 x 10 <sup>-2</sup>	1.06 x 10 <sup>-8</sup>	1.50 x 10 <sup>4</sup>	2.44 x 10 <sup>3</sup>
<sup>242</sup> Pu	1.27 x 10 <sup>-3</sup>	5.05 x 10 <sup>-8</sup>	3.93 x 10 <sup>-8</sup>	0.00	6.58 x 10 <sup>-2</sup>	7.51 x 10 <sup>-3</sup>
<sup>241</sup> Am	5.22 x 10 <sup>0</sup>	4.18 x 10 <sup>-2</sup>	1.93 x 10 <sup>-4</sup>	5.42 x 10 <sup>-10</sup>	4.01 x 10 <sup>1</sup>	3.36 x 10 <sup>1</sup>
<sup>243</sup> Am	2.65 x 10 <sup>-1</sup>	3.25 x 10 <sup>-5</sup>	0.00	0.00	0.00	0.00
<sup>244</sup> Cm	5.95 x 10 <sup>0</sup>	2.92 x 10 <sup>0</sup>	0.00	0.00	0.00	0.00

- (a) Currently, only low-level and low-level mixed plus wastes are permanently disposed of on the Hanford Site. Low-level mixed, transuranic, and mixed transuranic wastes are managed as stored wastes. This table does not include inventories of waste contained in temporary storage facilities. The mixed category identifies wastes that are regulated under the Resource Conservation and Recovery Act. The plus category identifies wastes that are regulated under the Toxic Substances Control Act (e.g., polychlorinated biphenyls).
- (b) Low-level with polychlorinated biphenyls.
- (c) Low-level mixed with polychlorinated biphenyls. The majority of quantities in this category are from the United States Navy submarine reactor compartments disposed of at the Hanford Site.

**Table 3.4.5.** Quantities of Bulk Liquid Wastes<sup>(a)</sup> Generated and Stored on the Hanford Site (L)

<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>
15,498,826	12,604,981	22,176,538	10,726,296	18,217,841	2,422,000

(a) Bulk liquid waste is defined as liquid waste sent to double-shell underground storage tanks. This does not include containerized waste (e.g., barreled) included in the solid waste category.

**Table 3.4.6.** Average Balance of Ten Chemicals Stored in Greatest Quantity, 1996

<u>Hazardous Material</u>	<u>Average Daily Balance, kg</u>
Coal	11,000,000
Mineral oil	1,800,000
Sodium	1,200,000
Diesel fuel	720,000
Bentonite	370,000
#6 Fuel oil	370,000
Ethylene glycol	240,000
Unleaded gasoline	120,000
Carbon	92,000
Sulfuric acid	76,000