Table 3B.1. West Valley reprocessing summary, 1966–1972[a]

Reactor	Type	Fuel	Cladding	Campaigns	Uranium (metric tons)	Exposure (MWd)
Yankee-Rowe	PWR	UO_2	SS	4	88	1,412,000
CON ED/Indian Pt-1	PWR	UO_2	SS	2	23	426,000
CVNPA	PWR	UO_2	Zr	1	4	35,000
COMM ED/Dresden-1	BWR	UO_2	Zr	2	72	661,000
CP/Big Rock Pt	BWR	UO_2	SS	2	24	252,000
PG&E/Humboldt Bay	BWR	UO_2	Zr	1	21	220,000
NSP/Pathfinder	BWR	UO_2	SS	1	10	15,000
PR/Bonus	BWR	UO_2	SS	1	4	11,000
NPR	Graphite	Metal	Zr	11	380	774,000
CON ED/Indian Pt-1	PWR	ThO_2/UO_2[c]	Zr	1	16[b]	260,000
SEFOR	Test	PuO_2/UO_2		1	20[d]	
Total				27	662	4,066,000

[a]Source: NFS 1973
[b]Uranium plus thorium.
[c]93% U-235.
[d]Plutonium only processed.

Table 3B.2. Historical and projected total cumulative volume, radioactivity, and thermal power of interim forms of HLW stored at WVDP[a]

End of calendar year	Cumulative quantities		
	Volume (10^3 m^3)	Radioactivity (10^6 Ci)	Thermal power (10^3 W)
1989	1.9	27.9	83.2
1990	1.6	27.2	81.2
1991	1.4	26.6	79.3
1992	1.2	26.0	77.5
1993	1.0	23.0	69.6
1994	0.2	4.5	13.4
1995[b]	0.0	0.0	0.0

[a]This table includes all forms of HLW at WVDP except vitrified HLW. The table is based on information in Table 2.1 of IDB 1990, with modifications due to differences in the assumed vitrification schedules. In the schedule assumed here, which is the same as that shown in Tables 3.2.2 and 3B.3, the total HLW at the site is assumed to be 9.1% vitrified at the end of 1993, 81.8% vitrified at the end of 1994, and 100% vitrified at the end of 1995. The schedule used in IDB 1990 was based on 16.7% vitrified by the end of 1993, 83.3% vitrified by the end of 1994, and 100% vitrified by the end of 1995.

[b]Quantities of interim HLW after completion of vitrification are zero.

Table 3B.3. Projected volume, radioactivity, and thermal power of HLW glass produced at WVDP[a]

End of calendar year	Volume (10^3 m^3)	Radioactivity (10^6 Ci)	Thermal power (10^3 W)
1992[b]	0.000	0.0	0.0
1993	0.016	2.3	6.9
1994	0.146	20.2	60.4
1995	0.179	24.2	72.2
1996	0.179	23.6	70.5
1997	0.179	23.0	68.7
1998	0.179	22.5	67.2
1999	0.179	22.0	65.6
2000	0.179	21.5	64.2
2001	0.179	21.0	62.7
2002	0.179	20.5	61.2
2003	0.179	20.0	59.9
2004	0.179	19.5	58.6
2005	0.179	19.1	57.2
2006	0.179	18.6	55.9
2007	0.179	18.2	54.6
2008	0.179	17.8	53.5
2009	0.179	17.4	52.2
2010	0.179	17.0	51.0
2011	0.179	16.6	49.9
2012	0.179	16.2	48.8
2013	0.179	15.8	47.6
2014	0.179	15.5	46.6
2015	0.179	15.1	45.5
2016	0.179	14.8	44.4
2017	0.179	14.4	43.6
2018	0.179	14.1	42.6
2019	0.179	13.8	41.6
2020	0.179	13.4	40.6

[a]This is based on the assumption that vitrification at WVDP begins in 1993 and is completed in 1995 (Maestas 1990), and on the vitrification schedule assumed in Tables 3.2.2 and 3B.2. The total volume of glass produced (179 m^3) is based on the mass of glass (484,000 kg) shown in the Revision 7 Mass Balance (Crocker 1989), and on the estimated glass density (2.70 g/cm^3) shown in Eisenstatt 1986. Radioactivity and thermal power are based on ORIGEN2 calculations using the Revision 7 Mass Balance.

[b]Glass quantities prior to 1993 are zero.

Table 3B.4. Chemical composition of alkaline liquid HLW (from reprocessing via a PUREX flowsheet) at WVDP[a]

Compound	Wet basis (wt %)	Dry basis (wt %)	Total (kg)
$NaNO_3$	21.10	53.38	602,659
$NaNO_2$	10.90	27.57	311,326
Na_2SO_4	2.67	6.75	76,261
$NaHCO_3$	1.49	3.77	42,557
KNO_3	1.27	3.21	36,274
Na_2CO_3	0.884	2.24	25,249
NaOH	0.614	1.55	17,537
K_2CrO_4	0.179	0.45	5,113
NaCl	0.164	0.42	4,684
Na_3PO_4	0.133	0.34	3,799
Na_2MoO_4	0.0242	0.06	691
Na_3BO_3	0.0209	0.05	597
$CsNO_3$	0.0187	0.05	534
NaF	0.0176	0.04	503
$Sn(NO_3)_4$	0.00858	0.02	245
$Na_2U_2O_7$	0.00809	0.02	231
$Si(NO_3)_4$	0.00805	0.02	230
$NaTcO_4$	0.00620	0.02	177
$RbNO_3$	0.00417	0.01	119
Na_2TeO_4	0.00287	0.007	82
AlF_3	0.0027	0.0068	77
$Fe(NO_3)_3$	0.00151	0.004	43
Na_2SeO_4	0.00053	0.0013	15
$LiNO_3$	0.00049	0.0012	14
H_2CO_3	0.00032	0.00080	9
$Cu(NO_3)_3$	0.00021	0.00053	6
$Sr(NO_3)_2$	0.00014	0.00035	4
$Mg(NO_3)_2$	0.00007	0.00018	2
Subtotal	39.53	100.00	1,129,038
H_20 (by difference)	60.47	0.00	1,727,116
Grand total	100.00	100.00	2,856,154

[a]Source: IDB 1990.

Table 3B.5. Chemical composition of alkaline sludge HLW (from reprocessing via a PUREX flowsheet) at WVDP[a]

Compound	Weight, kg
Fission products	
$Ge(OH)_3$	0.2
$SrSO_4$	217
$Y(OH)_3$	103
$Zr(OH)_4$	964
$Ru(OH)_4$	458
$Rh(OH)_4$	79
$Pd(OH)_4$	34
AgOH	0.7
$Cd(OH)_2$	1.7
$In(OH)_3$	0.3
$Sn(OH)_4$	2.5
$Sb(OH)_3$	0.7
$BaSO_4$	303
$La(OH)_3$	185
$Ce(OH)_3$	354
$Pr(OH)_3$	170
$Nd(OH)_3$	621
$Pm(OH)_3$	1.5
$Sm(OH)_3$	143
$Eu(OH)_3$	7.5
$Gd(OH)_3$	1.7
$Tb(OH)_3$	0.3
$Dy(OH)_3$	0.2
Subtotal	3,648.3
Actinides	
$UO_2(OH)_2$	3,087
NpO_2	35
PuO_2	37
AmO_2	27
CmO_2	0.4
Subtotal	3,186.4
Others	
$Fe(OH)_3$	66,040
$FePO_4$	6,351
$Al(OH)_3$	5,852
AlF_3	613
MnO_2	4,581
$CaCO_3$	3,208
SiO_2	1,263
$Ni(OH)_2$	1,088

Table 3B.5 (continued)

Compound	Weight, kg
Others (continued)	
$MgCO_3$	826
$Cu(OH)_2$	376
$Zr(OH)_4$	964[b]
$Zn(OH)_2$	128
$Cr(OH)_3$	65
$Hg(OH)_3$	23
Subtotal	91,378
Grand total	98,213

[a]Source: Maestas 1990.
[b]Excludes fission product zirconium.

Table 3B.6. Chemical composition of acid liquid HLW (from reprocessing via a THOREX flowsheet) at WVDP[a]

Compound	Wt %	Total, kg
$Th(NO_3)_4$	36.42	31,054
$Fe(NO_3)_3$	9.92	8,462
$Al(NO_3)_3$	4.90	4,175
HNO_3	3.29	2,805
$Cr(NO_3)_3$	2.25	1,918
$Ni(NO_3)_2$	0.93	79
H_3BO_3	0.56	480
$NaNO_3$	0.27	227
KNO_3	0.22	191
Na_2SO_4	0.21	180
Na_2SiO_3	0.15	126
$KMnO_4$	0.11	98
$Nd(NO_3)_3$	0.086	73
$Mg(NO_3)_2$	0.067	57
Na_2MoO_4	0.063	54
NaCl	0.059	50
$Ce(NO_3)_4$	0.050	43
$Ru(NO_3)_4$	0.049	42
ZrO_2	0.041	35
$Ca(NO_3)_2$	0.035	30
$CsNO_3$	0.033	28
$Ba(NO_3)_2$	0.032	27
$La(NO_3)_3$	0.026	22
$Pr(NO_3)_3$	0.025	21
$Sr(NO_3)_2$	0.019	16
$Y(NO_3)_3$	0.016	14
$Sm(NO_3)_3$	0.016	14
$Zr(NO_3)_4$	0.014	12
Na_3PO_4	0.014	12
$NaTcO_4$	0.013	11
$Rh(NO_3)_4$	0.013	11
$Zn(NO_3)_2$	0.012	10
$Pd(NO_3)_4$	0.0094	8
$UO_2(NO_3)_2$	0.0070	6
$RbNO_3$	0.0070	6
Na_2TeO_4	0.0059	5
$Co(NO_3)_2$	0.0035	3
Na_2SeO_4	0.0012	1
NaF	0.0012	1
$Eu(NO_3)_3$	0.0012	1
$Np(NO_3)_4$	0.0011	0.9

Table 3B.6 (continued)

Compound	Wt %	Total, kg
$Cu(NO_3)_2$	0.00094	0.8
$Sn(NO_3)_3$	0.00082	0.7
$Pa(NO_3)_4$	0.00082	0.7
$Pu(NO_3)_4$	0.00082	0.7
$Gd(NO_3)_3$	0.00047	0.4
$Cd(NO_3)_2$	0.00035	0.3
$Sb(NO_3)_3$	0.00012	0.1
$AgNO_3$	0.000094	0.08
$In(NO_3)_3$	0.000047	0.04
$Ge(NO_3)_4$	0.000023	0.02
$Pm(NO_3)_2$	0.000011	0.01
$Tb(NO_3)_3$	0.0000047	0.004
$Dy(NO_3)_3$	0.0000023	0.002
Solids	59.95	51,125
H_2O (by difference)	40.05	34,148
Total	100.00	85,273

[a]Source: IDB 1990.

Table 3B.7. Reference 1989 radionuclide composition of HLW at WVDP[a,b]

Radionuclide	Alkaline waste (PUREX)		Acid waste (THOREX)	Total, Ci
	Liquid,[c] Ci	Sludge, Ci	Liquid, Ci	
H-3	8.23E+01	0.00E+00	1.47E+00	8.38E+01
C-14	1.37E+02	0.00E+00	1.30E-01	1.37E+02
Fe-55	0.00E+00	4.49E+02	2.53E+02	7.02E+02
Co-60	0.00E+00	3.17E+00	7.68E+02	7.71E+02
Ni-59	0.00E+00	8.56E+01	2.03E+01	1.06E+02
Ni-63	8.69E+02	5.22E+03	2.45E+03	8.54E+03
Se-79	5.68E+01	0.00E+00	3.35E+00	6.01E+01
Sr-90	2.69E+03	6.28E+06	4.23E+05	6.70E+06
Y-90	2.69E+03	6.28E+06	4.23E+05	6.70E+06
Zr-93	2.56E-01	2.56E+02	1.62E+01	2.72E+02
Nb-93m	1.73E-01	1.71E+02	1.11E+01	1.82E+02
Tc-99	1.60E+03	0.00E+00	1.04E+02	1.70E+03
Ru-106	1.40E-02	1.40E+01	7.96E-02	1.41E+01
Rh-106	1.40E-02	1.40E+01	7.97E-02	1.41E+01
Pd-107	1.09E-02	1.09E+01	1.14E-01	1.10E+01
Cd-113m	2.09E+00	2.09E+03	3.25E+01	2.12E+03
Sn-121m	1.69E-02	1.69E+01	5.75E-01	1.75E+01
Sn-126	1.01E-01	1.01E+02	3.11E+00	1.04E+02
Sb-125	2.31E+01	7.13E+03	1.36E+02	7.29E+03
Sb-126	1.41E-02	1.41E+01	4.35E-01	1.46E+01
Sb-126m	1.01E-01	1.01E+02	3.11E+00	1.04E+02
Te-125m	5.67E+00	1.75E+03	3.34E+01	1.79E+03
I-129	2.10E-01	0.00E+00	1.80E-01	3.90E-01
Cs-134	5.07E+03	0.00E+00	1.13E+02	5.18E+03
Cs-135	1.56E+02	0.00E+00	5.47E+00	1.61E+02
Cs-137	6.77E+06	0.00E+00	4.43E+05	7.22E+06
Ba-137m	6.41E+06	0.00E+00	4.19E+05	6.83E+06
Ce-144	1.45E-06	6.38E-01	9.63E-03	6.48E-01
Pr-144	1.45E-06	6.39E-01	9.64E-03	6.48E-01
Pm-146	3.27E-02	1.05E+01	3.47E-01	1.09E+01
Pm-147	2.58E+02	8.37E+04	4.12E+03	8.80E+04
Sm-151	4.92E-01	7.96E+04	4.67E+03	8.43E+04
Eu-152	3.92E-02	3.24E+02	4.14E+01	3.65E+02
Eu-154	1.13E+01	9.34E+04	1.99E+03	9.54E+04
Eu-155	1.56E+00	2.33E+04	5.55E+02	2.38E+04

Table 3B.7 (continued)

Radionuclide	Alkaline waste (PUREX) Liquid,[c] Ci	Alkaline waste (PUREX) Sludge, Ci	Acid waste (THOREX) Liquid, Ci	Total, Ci
Tl-207	1.87E-08	8.55E-04	8.19E+00	8.19E+00
Tl-208	7.31E-02	1.04E-00	2.18E+00	3.29E+00
Pb-209	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Pb-211	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Pb-212	2.04E-01	2.88E+00	6.08E+00	9.17E+00
Bi-211	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Bi-212	2.04E-01	2.88E+00	6.08E+00	9.17E+00
Bi-213	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Po-212	1.30E-01	1.85E+00	3.90E+00	5.88E+00
Po-213	1.38E-04	1.93E-03	2.03E-01	2.05E-01
Po-215	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Po-216	2.04E-01	2.88E+00	6.08E+00	9.17E+00
At-217	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Rn-219	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Rn-220	2.04E-01	2.88E+00	6.08E+00	9.17E+00
Fr-221	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Fr-223	2.59E-10	1.18E-05	1.13E-01	1.13E-01
Ra-223	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Ra-224	2.04E-01	2.88E+00	6.08E+00	9.17E+00
Ra-225	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Ra-228	0.00E+00	5.09E-09	1.52E+00	1.52E+00
Ac-225	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Ac-227	1.88E-08	8.57E-04	8.22E+00	8.22E+00
Ac-228	0.00E+00	5.09E-09	1.52E+00	1.52E+00
Th-227	1.85E-08	8.45E-04	8.10E+00	8.10E+00
Th-228	2.04E-01	2.88E+00	6.08E+00	9.17E+00
Th-229	1.41E-04	1.97E-03	2.08E-01	2.10E-01
Th-230	7.57E-06	1.46E-02	4.38E-02	5.84E-02
Th-231	6.41E-03	8.94E-02	5.17E-03	1.01E-01
Th-232	0.00E+00	5.87E-09	1.64E+00	1.64E+00
Th-234	5.71E-02	7.97E-01	7.11E-05	8.54E-01
Pa-231	4.06E-07	2.98E-04	1.52E+01	1.52E+01
Pa-233	3.25E-06	2.31E+01	3.02E-01	2.34E+01
Pa-234m	5.71E-02	7.97E-01	7.11E-05	8.54E-01
U-232	3.04E-01	4.26E+00	2.66E+00	7.23E+00
U-233	4.98E-01	6.94E+00	2.09E+00	9.53E+00

Table 3B.7 (continued)

Radionuclide	Alkaline waste (PUREX) Liquid,[c] Ci	Alkaline waste (PUREX) Sludge, Ci	Acid waste (THOREX) Liquid, Ci	Total, Ci
U-234	2.81E-01	3.97E+00	2.21E-01	4.47E+00
U-235	6.41E-03	8.94E-02	5.17E-03	1.01E-01
U-236	1.91E-02	2.67E-01	9.80E-03	2.96E-01
U-238	5.71E-02	7.97E-01	7.11E-05	8.54E-01
Np-236	0.00E+00	9.35E+00	1.23E-01	9.47E+00
Np-237	3.25E-06	2.31E+01	3.02E-01	2.34E+01
Np-239	0.00E+00	3.39E+02	7.83E+00	3.47E+02
Pu-236	6.56E-03	8.28E-01	1.09E-02	8.46E-01
Pu-238	1.24E+02	7.82E+03	4.69E+02	8.41E+03
Pu-239	2.54E+01	1.61E+03	1.54E+01	1.65E+03
Pu-240	1.87E+01	1.18E+03	8.09E+00	1.21E+03
Pu-241	1.26E+03	7.99E+04	7.36E+02	8.19E+04
Pu-242	2.54E-02	1.61E+00	1.19E-02	1.65E+00
Am-241	6.53E+00	5.32E+04	2.44E+02	5.34E+04
Am-242	0.00E+00	2.89E+02	6.66E+00	2.95E+02
Am-242m	0.00E+00	2.90E+02	6.70E+00	2.97E+02
Am-243	0.00E+00	3.39E+02	7.83E+00	3.47E+02
Cm-242	0.00E+00	2.39E+02	5.53E+00	2.45E+02
Cm-243	0.00E+00	1.34E+02	2.18E-01	1.34E+02
Cm-244	0.00E+00	7.63E+03	1.22E+01	7.64E+03
Cm-245	0.00E+00	8.62E-01	2.00E-02	8.82E-01
Cm-246	0.00E+00	9.87E-02	2.29E-03	1.01E-01
Total	1.32E+07	1.30E+07	1.72E+06	2.79E+07

[a]Source: Maestas 1990. Compositions shown are as of the end of year 1989.

[b]Includes all radionuclides >0.1 Ci prior to year 3090.

[c]The small quantity of loaded zeolite (0.031×10^3 m^3 containing 1.9×10^6 Ci) is included with the liquid.

Table 3B.8. West Valley Demonstration Project: estimated radionuclide content per HLW canister[a]

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Fe-55	0.1104E-02	0.2760E+01	0.9313E-04
Co-60	0.2679E-02	0.3030E+01	0.4666E-01
Ni-59	0.5491E+01	0.4160E+00	0.1650E-04
Ni-63	0.4895E+00	0.3020E+02	0.3039E-02
Se-79	0.1980E+00	0.1380E-01	0.3431E-05
Sr-90	0.1928E+03	0.2630E+05	0.3048E+02
Y-90	0.4833E-01	0.2630E+05	0.1456E+03
Zr-93	0.4257E+03	0.1070E+01	0.1242E-03
Nb-93m	0.2529E-02	0.7150E+00	0.1265E-03
Tc-99	0.2524E+02	0.4280E+00	0.2144E-03
Ru-106	0.1655E-04	0.5540E-01	0.3290E-05
Rh-106	0.1556E-10	0.5540E-01	0.5307E-03
Pd-107	0.8416E+02	0.4330E-01	0.2563E-05
Cd-113m	0.3845E-01	0.8340E+01	0.1402E-01
Sn-121m	0.1160E-02	0.6860E-01	0.1373E-03
Sn-126	0.1441E+02	0.4090E+00	0.5095E-03
Sb-125	0.2769E-01	0.2860E+02	0.8929E-01
Sb-126	0.6852E-06	0.5730E-01	0.1057E-02
Sb-126m	0.5206E-08	0.4090E+00	0.5201E-02
Te-125m	0.3885E-03	0.7000E+01	0.5876E-02
Cs-134	0.1569E-01	0.2030E+02	0.2063E+00
Cs-135	0.5505E+03	0.6340E+00	0.2113E-03
Cs-137	0.3252E+03	0.2830E+05	0.3126E+02
Ba-137m	0.4981E-04	0.2680E+05	0.1051E+03
Ce-144	0.8023E-06	0.2560E-02	0.1696E-05
Pr-144	0.3387E-10	0.2560E-02	0.1879E-04
Pm-146	0.9566E-04	0.4260E-01	0.2146E-03
Pm-147	0.3721E+00	0.3450E+03	0.1236E+00
Sm-151	0.1258E+02	0.3310E+03	0.3876E-01
Eu-152	0.8267E-02	0.1430E+01	0.1080E-01
Eu-154	0.1389E+01	0.3750E+03	0.3350E+01
Eu-155	0.2014E+00	0.9370E+02	0.6806E-01
Tl-207	0.1690E-09	0.3220E-01	0.9444E-04
Tl-208	0.4312E-10	0.1270E-01	0.2985E-03
Pb-209	0.1815E-09	0.8250E-03	0.9475E-06
Pb-211	0.1308E-08	0.3230E-01	0.9666E-04
Pb-212	0.2540E-07	0.3530E-01	0.6712E-04
Bi-211	0.7718E-10	0.3230E-01	0.1287E-02
Bi-212	0.2409E-08	0.3530E-01	0.5995E-03

Table 3B.8 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Bi-213	0.4265E-10	0.8250E-03	0.3464E-05
Po-212	0.1274E-18	0.2260E-01	0.1196E-02
Po-213	0.6231E-19	0.7860E-03	0.3972E-04
Po-215	0.1095E-14	0.3230E-01	0.1440E-02
Po-216	0.1013E-12	0.3530E-01	0.1443E-02
At-217	0.5124E-15	0.8250E-03	0.3516E-04
Rn-219	0.2482E-11	0.3230E-01	0.1339E-02
Rn-220	0.3826E-10	0.3530E-01	0.1339E-02
Fr-221	0.4653E-11	0.8250E-03	0.3180E-04
Fr-223	0.1117E-10	0.4320E-03	0.1120E-05
Ra-223	0.6306E-06	0.3230E-01	0.1149E-02
Ra-224	0.2216E-06	0.3530E-01	0.1210E-02
Ra-225	0.2104E-07	0.8250E-03	0.5778E-06
Ra-228	0.2550E-04	0.5970E-02	0.4595E-06
Ac-225	0.1421E-07	0.8250E-03	0.2878E-04
Ac-227	0.4464E-05	0.3230E-03	0.1562E-06
Ac-228	0.2662E-08	0.5970E-02	0.5153E-04
Th-227	0.1034E-05	0.3180E-01	0.1159E-02
Th-228	0.4306E-04	0.3530E-01	0.1153E-02
Th-229	0.3877E-02	0.8250E-03	0.2521E-04
Th-230	0.1169E-01	0.2360E-03	0.6670E-05
Th-231	0.6657E-09	0.3540E-03	0.1984E-06
Th-232	0.5880E+05	0.6450E-02	0.1559E-03
Th-234	0.1356E-06	0.3140E-02	0.1271E-05
Pa-231	0.1264E+01	0.5970E-01	0.1796E-02
Pa-233	0.4422E-05	0.9180E-01	0.2081E-03
Pa-234m	0.4571E-11	0.3140E-02	0.1550E-04
U-232	0.1270E-02	0.2720E-01	0.8721E-03
U-233	0.3666E+01	0.3550E-01	0.1031E-02
U-234	0.2640E+01	0.1650E-01	0.4746E-03
U-235	0.1637E+03	0.3540E-03	0.9259E-05
U-236	0.1700E+02	0.1100E-02	0.2976E-04
U-238	0.9337E+04	0.3140E-02	0.7954E-04
Np-236	0.2823E+01	0.3720E-01	0.7494E-04
Np-237	0.1302E+03	0.9180E-01	0.2802E-02
Np-239	0.5861E-05	0.1360E+01	0.3283E-02
Pu-236	0.6209E-05	0.3300E-02	0.1147E-03
Pu-238	0.1904E+01	0.3260E+02	0.1079E+01
Pu-239	0.1028E+03	0.6390E+01	0.1967E+00

Table 3B.8 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Pu-240	0.2053E+02	0.4680E+01	0.1455E+00
Pu-241	0.3076E+01	0.3170E+03	0.9815E-02
Pu-242	0.1668E+01	0.6370E-02	0.1879E-03
Am-241	0.6117E+02	0.2100E+03	0.6967E+01
Am-242	0.1435E-05	0.1160E+01	0.1315E-02
Am-242m	0.1204E+00	0.1170E+01	0.4616E-03
Am-243	0.6820E+01	0.1360E+01	0.4366E-01
Cm-242	0.2912E-03	0.9630E+00	0.3544E-01
Cm-243	0.1021E-01	0.5270E+00	0.1931E-01
Cm-244	0.3707E+00	0.3000E+02	0.1048E+01
Cm-245	0.2015E-01	0.3460E-02	0.1147E-03
Cm-246	0.1279E-02	0.3930E-03	0.1285E-04
Total	0.7029E+05	0.1096E+06	0.3260E+03

[a]This table represents the radionuclide content of a canister containing 1,900 kg of HLW glass having the radionuclide composition described in the WVDP Mass Balance Revision 7 (Crocker 1989). Radioactivity shown is as of the end of year 1989. The glass composition used is the WVDP Reference 4 glass (Crocker 1989).

Table 3B.9. Current and projected volumes of HLW at SRS[a]

End of calendar year	Volume, 10^3 m^3					
	Liquid	Sludge	Salt cake	Precipitate	Glass	Total
1989	53.3	13.76	54.8	0.13	0.0	122.0
1990	59.1	14.84	54.2	0.35	0.0	128.6
1991	57.0	16.46	50.9	1.21	0.0	125.6
1992	55.0	17.17	48.6	1.40	0.09	122.2
1993	53.7	16.77	44.7	1.67	0.28	117.1
1994	48.4	15.85	44.4	1.27	0.51	110.4
1995	46.9	14.91	41.3	1.55	0.77	105.4
1996	47.0	13.98	36.2	1.33	1.03	99.5
1997	46.7	13.06	32.6	1.71	1.26	95.3
1998	43.5	12.15	31.1	1.89	1.50	90.2
1999	43.4	11.22	27.4	1.36	1.73	85.1
2000	43.6	10.30	24.7	0.81	1.94	81.4
2001	39.3	9.41	23.6	0.16	2.15	74.7
2002	42.8	8.53	19.8	0.10	2.37	73.6
2003	44.9	7.91	19.2	0.19	2.58	74.8
2004	41.4	8.12	16.5	0.26	2.77	69.1
2005	41.2	8.32	14.8	0.21	2.94	67.4
2006	39.2	8.46	14.7	0.00	3.11	65.4
2007	39.6	8.60	16.0	0.00	3.28	67.5
2008	40.8	8.74	17.2	0.00	3.30	70.0
2009	42.9	8.88	18.1	0.00	3.30	73.2
2010	42.8	9.02	19.7	0.00	3.30	74.9
2011	42.2	9.16	21.4	0.00	3.30	76.1
2012	42.9	9.30	21.4	0.12	3.30	77.0
2013	42.2	9.44	21.4	0.24	3.30	76.6
2014	42.9	9.58	21.4	0.35	3.30	77.6
2015	42.2	9.72	21.4	0.47	3.30	77.1
2016	42.9	9.87	21.4	0.59	3.30	78.1
2017	42.2	10.00	21.4	0.71	3.30	77.6
2018	42.9	10.15	21.4	0.82	3.30	78.6
2019	42.2	10.29	21.4	0.94	3.30	78.2
2020	42.9	10.43	21.4	1.06	3.30	79.1

[a]Source: Garvin 1990.

Table 3B.10. Radioactivity of HLW at SRS[a]

End of calendar year	Radioactivity, 10^6 Ci					
	Liquid	Sludge	Salt cake	Precipitate	Glass	Total
1989	94.6	351.2	152.8	0.31	0.0	598.9
1990	90.5	326.3	146.3	7.82	0.0	570.9
1991	76.9	330.1	136.2	21.92	0.0	565.2
1992	78.7	371.1	124.2	29.04	22.6	625.6
1993	77.2	367.6	115.0	29.74	52.0	641.7
1994	68.1	385.9	118.4	23.46	87.7	683.7
1995	67.5	359.1	115.1	20.83	150.0	712.7
1996	60.8	371.7	123.2	13.74	211.0	780.4
1997	59.6	359.7	114.0	19.03	263.4	815.8
1998	59.5	445.5	110.6	11.32	310.8	937.7
1999	54.8	400.3	106.9	8.65	345.6	916.3
2000	50.7	378.2	103.0	7.62	372.2	911.8
2001	50.7	443.4	99.4	7.12	392.3	993.8
2002	49.1	462.4	95.6	6.78	410.8	1,024.8
2003	46.9	465.4	91.8	6.49	425.7	1,036.4
2004	44.7	467.2	88.1	6.22	438.3	1,044.7
2005	42.5	464.2	84.4	5.96	449.3	1,046.4
2006	34.5	319.8	80.4	5.71	458.7	899.2
2007	29.8	262.6	80.2	0.00	467.4	840.1
2008	26.9	243.5	79.9	0.00	460.4	810.7
2009	24.6	234.7	79.6	0.00	449.8	788.8
2010	23.0	234.4	79.2	0.00	439.5	776.2
2011	21.4	234.6	78.6	0.00	429.3	762.0
2012	20.2	235.7	77.2	0.77	419.4	753.3
2013	18.9	235.9	75.8	1.51	409.7	741.8
2014	18.0	240.1	74.3	2.22	400.2	734.8
2015	17.0	240.7	72.8	2.90	390.9	724.3
2016	16.2	245.2	71.3	3.55	381.9	718.2
2017	15.4	246.2	69.7	4.17	373.1	708.5
2018	14.8	250.9	68.2	4.76	364.5	703.2
2019	14.1	251.9	66.6	5.32	356.0	694.0
2020	13.7	256.5	65.1	5.85	347.8	688.9

[a]Source: Garvin 1990. Radioactivity includes actinides as well as fission products.

Table 3B.11. Thermal power of HLW at SRS[a]

End of calendar year	Thermal power, 10^3 W					
	Liquid	Sludge	Salt cake	Precipitate	Glass	Total
1989	217.7	1105.8	349.5	0.7	0.0	1673
1990	207.4	1036.1	334.8	17.9	0.0	1596
1991	176.7	1044.6	312.0	50.2	0.0	1583
1992	194.3	1196.5	284.9	66.5	56.9	1799
1993	191.7	1171.8	265.6	68.1	132.6	1830
1994	172.7	1237.9	274.9	53.7	223.1	1963
1995	171.2	1147.0	267.7	47.7	412.5	2046
1996	157.9	1199.5	288.1	31.5	603.0	2280
1997	155.6	1157.2	267.0	43.6	763.0	2387
1998	163.8	1524.1	259.9	26.1	908.0	2882
1999	151.8	1353.8	251.5	20.1	1018.8	2796
2000	142.0	1277.4	242.9	17.8	1103.5	2783
2001	147.8	1537.4	235.0	16.6	1170.7	3107
2002	146.8	1600.4	226.7	15.9	1227.4	3217
2003	142.3	1604.5	218.2	15.2	1276.2	3256
2004	137.6	1602.9	209.6	14.6	1318.1	3283
2005	132.3	1586.1	201.1	14.0	1355.0	3289
2006	102.4	1024.8	191.2	13.4	1387.2	2720
2007	86.5	827.6	190.5	0.0	1415.8	2520
2008	77.6	768.1	189.8	0.0	1397.3	2433
2009	71.2	745.4	188.9	0.0	1368.1	2374
2010	66.9	750.3	187.8	0.0	1339.9	2345
2011	62.8	751.3	186.6	0.0	1310.3	2312
2012	59.9	766.6	183.3	1.8	1281.5	2293
2013	56.7	771.5	179.9	3.6	1253.2	2265
2014	54.6	788.8	176.4	5.3	1225.6	2251
2015	51.9	793.9	172.8	6.9	1198.8	2224
2016	50.3	810.5	169.2	8.4	1172.5	2211
2017	48.1	815.5	165.6	9.9	1146.9	2186
2018	46.9	832.2	161.9	11.3	1121.9	2175
2019	45.0	836.5	158.3	12.6	1097.5	2150
2020	44.1	852.4	154.6	13.9	1073.7	2139

[a]Source: Garvin 1990. Radioactivity includes actinides as well as fission products.

Table 3B.12. Savannah River Site: estimated chemical compositions of interim HLW[a]

Liquid		Sludge	
Component	Wt %	Component	Wt %
Ag	Trace	$Fe(OH)_3$	11.8
Hg	Trace	MnO_2	2.0
Pb	Trace	$UO_2(OH)_2$	1.3
U	Trace	$Al(OH)_2$	13.7
F^-	.003	AlO(OH)	5.2
Fe	Trace	$CaCO_3$	1.5
Cl^-	0.023	$CaSO_4$	0.2
OH^-	1.63	CaC_2O_4	0.2
NO_2^-	1.10	$Ni(OH)_2$	0.8
NO_3^-	9.63	HgO	0.4
$Al(OH)_4^-$	4.54	SiO_2	0.2
CO_3^{2-}	0.72	ThO_2	1.8
CrO_4^{2-}	0.014	$Ce(OH)_3$	0.2
SO_4^{2-}	0.22	$ZrO(OH)_3$	0.2
PO_4^{3-}	0.12	$Cr(OH)_3$	0.2
NH_4^+	Trace	$Mg(OH)_2$	0.2
Na^+	11.0	$NaNO_3$	1.1
H_2O	71.0	NaOH	1.3
	———	Zeolite	1.5
	100.0	Others	1.2
		H_2O	55.0
			———
			100.0
Density (25° C), g/mL	1.1		1.4

Table 3B.12 (continued)

Salt Cake		Precipitate[b]	
Component	Wt %	Component	Wt %
$NaNO_3$	65.4	$K(C_6H_5)_4B$	9.0
$NaNO_2$	0.9	$NaNO_3$	0.7
NaOH	3.4	Others	1.8
$NaAl(OH)_4$	7.8	H_2O	88.5
Na_2CO_3	2.7		
Na_2SO_4	9.4		100.0
Na_3PO_4	Trace		
NaF	0.2		
$Na_2C_2O_4$	0.1		
Insolubles	3.7		
H_2O	6.4		
	100.0		
Density (25° C), g/mL	1.9		1.05

[a]Source: Garvin 1990.
[b]Precipitate (non-Newtonian fluid) from the in-tank precipitation process.

Table 3B.13. Savannah River Site: radionuclide content per HLW canister[a]

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Cr-51	0.1008E-20	0.9312E-16	0.1996E-19
Co-60	0.1502E+00	0.1699E+03	0.2619E+01
Ni-59	0.3163E+00	0.2397E-01	0.9519E-06
Ni-63	0.4824E-01	0.2975E+01	0.3000E-03
Se-79	0.2439E+01	0.1699E+00	0.4232E-04
Rb-87	0.9961E+01	0.8719E-06	0.7278E-09
Sr-89	0.1470E-08	0.4267E-04	0.1473E-06
Sr-90	0.3426E+03	0.4675E+05	0.5426E+02
Y-90	0.8795E-01	0.4786E+05	0.2653E+03
Y-91	0.3085E-07	0.7568E-03	0.2715E-05
Zr-93	0.4443E+03	0.1117E+01	0.1298E-03
Zr-95	0.4680E-06	0.1005E-01	0.5084E-04
Nb-94	0.5147E-03	0.9646E-04	0.9830E-06
Nb-95	0.5407E-06	0.2115E-01	0.1013E-03
Nb-95m	0.3272E-09	0.1247E-03	0.1730E-06
Tc-99	0.1816E+03	0.3079E+01	0.1545E-02
Ru-103	0.5217E-12	0.1684E-07	0.5827E-10
Ru-106	0.6729E+00	0.2252E+04	0.1339E-00
Rh-103m	0.5028E-15	0.1636E-07	0.3761E-11
Rh-106	0.6346E-06	0.2259E+04	0.2167E+02
Pd-107	0.2863E+02	0.1473E-01	0.8732E-06
Ag-110m	0.2647E-04	0.1258E+00	0.2098E-02
Cd-113	0.1472E+00	0.5009E-13	0.8420E-16
Cd-115m	0.4763E-13	0.1213E-08	0.4518E-11
Sn-121m	0.1336E-02	0.7902E-01	0.1581E-03
Sn-123	0.3101E-04	0.2549E+00	0.7951E-03
Sn-126	0.1556E+02	0.4415E+00	0.5508E-03
Sb-124	0.4071E-11	0.7123E-07	0.9445E-09
Sb-125	0.8226E+00	0.8496E+03	0.2656E+01
Sb-126	0.7365E-06	0.6159E-01	0.1138E-02
Sb-126m	0.5619E-08	0.4415E+00	0.5622E-02

Table 3B.13 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Te-126m	0.1532E-01	0.2760E+03	0.2320E+00
Te-127	0.4555E-07	0.1202E+00	0.1622E-03
Te-128m	0.1302E-04	0.1228E+00	0.6597E-04
Te-129	0.1457E-18	0.3053E-11	0.1089E-13
Te-129m	0.1576E-15	0.4749E-11	0.8316E-14
Cs-134	0.2606E+00	0.3372E+03	0.3433E+01
Cs-135	0.8633E+02	0.9943E-01	0.3319E-04
Cs-136	0.1068E-43	0.7838E-39	0.1066E-41
Cs-137	0.4989E+03	0.4341E+05	0.4802E+02
Ba-136m	0.3195E-49	0.8607E-38	0.1040E-40
Ba-137m	0.7724E-04	0.4155E+05	0.1632E+03
Ba-140	0.1404E-40	0.1024E-35	0.2853E-38
La-140	0.7734E-42	0.4304E-36	0.7205E-38
Ce-141	0.1260E-14	0.3591E-10	0.5250E-13
Ce-142	0.4005E+03	0.9609E-05	0.0000E+00
Ce-144	0.3093E+01	0.9869E+04	0.6547E+01
Pr-143	0.1780E-38	0.1198E-33	0.2291E-37
Pr-144	0.1306E-03	0.9869E+04	0.7255E+02
Pr-144m	0.6545E-06	0.1187E+03	0.4063E-01
Nd-144	0.4110E+03	0.4860E-09	0.0000E+00
Nd-147	0.1570E-48	0.1261E-43	0.3038E-46
Pm-147	0.2609E+02	0.2419E+05	0.8679E+01
Pm-148	0.4243E-15	0.6975E-10	0.5364E-12
Pm-148m	0.4722E-13	0.1009E-08	0.1277E-10
Sm-147	0.8796E+02	0.2000E-05	0.2738E-07
Sm-148	0.1916E+02	0.5788E-11	0.6901E-13
Sm-149	0.7420E+01	0.1781E-11	0.0000E+00
Sm-151	0.9418E+01	0.2478E+03	0.2906E-01
Eu-152	0.2132E-01	0.3688E+01	0.2790E-01
Eu-154	0.2295E+01	0.6196E+03	0.5543E+01
Eu-155	0.1021E+01	0.4749E+03	0.3455E+00
Eu-156	0.9489E-36	0.5231E-31	0.5392E-33

Table 3B.13 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Tb-160	0.9923E-10	0.1120E-05	0.9110E-08
Tl-208	0.3829E-11	0.1128E-02	0.2645E-04
U-232	0.6256E-03	0.1339E-01	0.4301E-03
U-233	0.1636E-03	0.1584E-05	0.4605E-07
U-234	0.5485E+01	0.3428E-01	0.9875E-03
U-235	0.7278E+02	0.1573E-03	0.4122E-05
U-236	0.1742E+02	0.1128E-02	0.3054E-04
U-238	0.3122E+05	0.1050E-01	0.2663E-03
Np-236	0.1323E-05	0.1744E-07	0.3514E-10
Np-237	0.1263E+02	0.8904E-02	0.2722E-03
Pu-236	0.2297E-03	0.1221E+00	0.4249E-02
Pu-237	0.7401E-15	0.8941E-11	0.3292E-14
Pu-238	0.8667E+02	0.1484E+04	0.4919E+02
Pu-239	0.2076E+03	0.1291E+02	0.3979E+00
Pu-240	0.3809E+02	0.8681E+01	0.2704E+00
Pu-241	0.1620E+02	0.1670E+04	0.5176E-01
Pu-242	0.3206E+01	0.1224E-01	0.3616E-03
Am-241	0.3210E+01	0.1102E+02	0.3661E+00
Am-242	0.1776E-07	0.1436E-01	0.1628E-04
Am-242m	0.1488E-02	0.1447E-01	0.5709E-05
Am-243	0.2902E-01	0.5788E-02	0.1860E-03
Cm-242	0.1057E-04	0.3495E-01	0.1288E-02
Cm-243	0.1078E-03	0.5565E-02	0.2039E-03
Cm-244	0.1329E+01	0.1076E+03	0.3763E+01
Cm-245	0.3910E-04	0.6715E-05	0.2225E-06
Cm-246	0.1739E-05	0.5342E-06	0.1747E-07
Cm-247	0.7116E-08	0.6604E-12	0.2107E-13
Cm-248	0.1614E-09	0.6864E-12	0.8533E-13
Totals	0.3427E+05	0.2344E+06	0.7093E+03

[a]Quantities shown are for sludge-precipitate glass and are based on Baxter 1988, assuming sludge aged an average of 5 years and supernate aged an average of 15 years, with a canister load of 3,710 lb of glass (1,682 kg). Radionuclide contents are at time of filling canister.

Table 3B.14. Hanford Site: historical and projected volumes of high-level wastes[a]

End of calendar year	Volume, 10^3 m^3					
	Liquid	Sludge	Salt cake	Slurry	Sr and Cs capsules	Total
1988	26.8	46.0	93.0	77.7	0.004	244
1989	26.5	46.0	93.0	79.3	0.004	245
1990	25.8	46.0	93.0	94.2	0.004	259
1991	23.2	46.0	93.0	84.0	0.004	246
1992	19.5	46.0	93.0	85.2	0.004	244
1993	16.1	46.0	93.0	94.5	0.004	250
1994	14.3	46.0	93.0	91.0	0.004	244
1995	11.5	46.0	93.0	94.5	0.004	245
1996	11.3	46.0	93.0	99.0	0.004	249
1997	11.3	46.0	93.0	99.4	0.004	250
1998	11.3	46.0	93.0	100.9	0.004	251
1999	11.3	46.0	93.0	103.8	0.004	254
2000	11.3	46.0	93.0	108.3	0.004	259
2001	11.3	46.0	93.0	108.9	0.004	259
2002	11.3	46.0	93.0	113.0	0.004	263
2003	11.3	46.0	93.0	109.3	0.004	260
2004	11.3	46.0	93.0	110.0	0.004	260
2005	11.3	46.0	93.0	110.3	0.004	261
2006	11.3	46.0	93.0	110.7	0.004	261
2007	11.3	46.0	93.0	111.0	0.004	261
2008	11.3	46.0	93.0	111.4	0.004	262
2009	11.3	46.0	93.0	111.8	0.004	262
2010	11.3	46.0	93.0	112.1	0.004	262
2011	11.3	46.0	93.0	112.5	0.004	263
2012	11.3	46.0	93.0	112.9	0.004	263
2013	11.3	46.0	93.0	113.3	0.004	264
2014	11.3	46.0	93.0	113.6	0.004	264
2015	11.3	46.0	93.0	114.0	0.004	264
2016	11.3	46.0	93.0	114.4	0.004	265
2017	11.3	46.0	93.0	114.7	0.004	265
2018	11.3	46.0	93.0	115.1	0.004	265
2019	11.3	46.0	93.0	115.5	0.004	266
2020	11.3	46.0	93.0	115.8	0.004	266

[a]Source: Turner 1990. Liquid, sludge, and salt cake refer to the contents of single-shell tanks. Slurry represents the entire contents of double-shell tanks. Quantities shown in this table have not been adjusted downward to reflect the vitrification that is expected to begin in 1999, that is, the volumes shown here are calculated as if no vitrification occurred.

Table 3B.15. Hanford Site: historical and projected radioactivity of high-level wastes[a]

End of calendar year	Radioactivity, 10^6 Ci					
	Liquid	Sludge	Salt cake	Slurry	Sr and Cs capsules	Total
1988	23.3	121.4	12.6	111.1	177.1	446
1989	22.6	118.5	12.3	89.8	173.0	416
1990	21.5	115.7	12.1	75.3	169.1	394
1991	18.9	113.0	11.8	77.1	165.1	386
1992	15.5	110.3	11.5	88.1	161.3	387
1993	12.5	107.7	11.2	100.1	157.6	389
1994	10.9	105.1	11.0	111.3	154.0	392
1995	8.5	102.7	10.7	110.7	150.5	383
1996	8.2	100.2	10.5	115.4	147.0	381
1997	8.0	97.8	10.2	111.4	143.6	371
1998	7.8	95.5	10.0	107.9	140.3	362
1999	7.7	93.3	9.8	104.7	137.0	353
2000	7.5	91.1	9.5	101.8	133.9	344
2001	7.3	88.9	9.3	99.1	130.8	335
2002	7.2	86.8	9.1	96.5	127.8	327
2003	7.0	84.7	8.9	94.1	124.8	320
2004	6.8	82.7	8.7	91.7	122.0	312
2005	6.7	80.8	8.5	89.5	119.2	305
2006	6.5	78.9	8.3	87.3	116.4	297
2007	6.4	77.0	8.1	85.3	113.7	291
2008	6.2	75.2	7.9	83.2	111.1	284
2009	6.1	73.4	7.7	81.3	108.6	277
2010	5.9	71.7	7.5	79.4	106.0	271
2011	5.8	70.0	7.4	77.5	103.6	264
2012	5.7	68.3	7.2	75.7	101.2	258
2013	5.5	66.7	7.0	74.0	98.9	252
2014	5.4	65.1	6.9	72.3	96.6	246
2015	5.3	63.6	6.7	70.6	94.4	241
2016	5.2	62.1	6.6	69.0	92.2	235
2017	5.1	60.6	6.4	67.4	90.1	230
2018	4.9	59.2	6.3	65.8	88.0	224
2019	4.8	57.8	6.1	64.3	86.0	219
2020	4.7	56.4	6.0	62.8	84.0	214

[a]Source: Turner 1990. Liquid, sludge, and salt cake refer to the contents of single-shell tanks. Slurry represents the entire contents of double-shell tanks. Quantities shown in this table have not been adjusted downward to reflect the vitrification that is expected to begin in 1999, that is, the quantities shown are calculated as if no vitrification occurred.

Table 3B.16. Representative chemical composition of current and future HLW at HANF[a]

Component	Composition, wt %			
	Liquid[b]	Sludge[b]	Salt cake[b]	Slurry[c]
$NaNO_3$	20.8	25.3	81.5	14.8
$NaNO_2$	15.8	3.8	1.7	5.6
Na_2CO_3	0.6	2.2	0.5	1.9
NaOH	6.2	5.3	1.5	7.0
$NaAlO_2$	12.5	1.2	1.4	6.0
NaF	–	–	–	0.4
Na_2SO_4	–	1.0	1.3	0.3
Na_3PO_4	2.3	15.8	1.6	0.8
KF	–	–	–	0.4
FeO(OH)	–	1.3	–	0.2
Organic carbon	0.17	–	–	1.2
NH_4^+	–	–	–	0.08
$Al(OH)_3$	–	2.9	–	4.9
$SrO{\cdot}H_2O$	–	0.1	–	–
Na_2CrO_4	1.3	–	–	–
$Cr(OH)_3$	–	0.2	–	0.02
$Cd(OH)_2$	–	0.1	–	–
$Ni(OH)_2$	–	–	–	<0.1
$BiPO_4$	–	0.5	–	–
Cl^-	–	0.1	–	–
$Ni_2Fe(CN)_6$	–	0.6	–	–
$P_2O_5{\cdot}24WO_2{\cdot}44H_2O$	–	<0.1	–	–
$ZrO_2{\cdot}2H_2O$	–	0.5	–	0.2
Fission products	–	–	–	<0.01
H_2O	40.2	33.6	10.5	56.2
Other	<0.1	5.5	–	<0.01
Hg^+	–	0.12 ppm	–	–
Total	100.0	100.0	100.0	100.0
Density, g/mL	1.6	1.7	1.4	~1.3

[a]Source: IDB 1989, Wojtasek 1989.
[b]Stored in single-shell tanks.
[c]Stored in double-shell tanks.

Table 3B.17. Hanford Site: radionuclide content per HLW canister, NCAW glass, maximum case[a]

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Fe-55	5.64E-02	1.41E+02	4.765E-03
Ni-59	1.80E+00	1.36E-01	5.402E-06
Co-60	3.79E-03	4.29E+00	6.615E-02
Ni-63	2.54E-01	1.57E+01	6.236E-03
Se-79	5.60E-02	3.90E-03	9.711E-07
Sr-89	2.24E-06	6.52E-02	2.254E-04
Sr-90	3.06E+02	4.18E+04	4.852E+01
Y-90	7.68E-02	4.18E+04	2.317E+02
Y-91	2.96E-05	7.26E-01	2.608E-03
Nb-93m	2.04E-03	5.77E-01	1.023E-04
Zr-93	5.13E+02	1.29E+00	1.499E-04
Zr-95	1.28E-04	2.76E+00	1.398E-02
Nb-95	1.45E-04	5.67E+00	2.720E-02
Tc-99	5.51E+02	9.35E+00	4.689E-03
Ru-103	9.23E-09	2.98E-04	9.971E-07
Rh-103m	8.27E-12	2.69E-04	6.192E-08
Ru-106	1.49E+00	4.99E+03	2.967E-01
Rh-106	1.40E-06	4.99E+03	4.786E+01
Pd-107	7.91E+01	4.07E-02	2.413E-06
Ag-110m	3.35E-04	1.59E+00	2.655E-02
Cd-113m	6.73E-02	1.46E+01	2.458E-02
In-113m	1.51E-09	2.52E-02	5.871E-05
Sn-113	2.51E-06	2.52E-02	4.198E-06
Cd-115m	3.45E-10	8.78E-06	3.275E-08
Sn-119m	1.21E-03	5.42E+00	2.802E-03
Sn-121m	1.79E-03	1.06E-01	2.124E-04
Sn-123	3.52E-04	2.89E+00	9.027E-03
Sn-126	1.62E+01	4.60E-01	5.738E-04
Sb-124	2.00E-09	3.50E-05	4.648E-07
Sb-126	7.75E-07	6.48E-02	1.197E-03
Sb-126m	5.86E-09	4.60E-01	5.858E-03
Sb-125	1.70E+00	1.76E+03	5.503E+00
Te-125m	2.38E-02	4.29E+02	3.606E-01

Table 3B.17 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Te-127	1.12E-06	2.95E+00	3.984E-03
Te-127m	3.18E-04	3.00E+00	1.614E-03
Te-129	1.79E-14	3.75E-07	1.340E-09
Te-129m	1.91E-11	5.77E-07	1.012E-09
I-129	9.23E-02	1.63E-05	7.541E-09
Cs-134	9.27E-01	1.20E+03	1.221E+01
Cs-135	2.18E+02	2.51E-01	8.378E-05
Cs-137	5.86E+02	5.10E+04	5.642E+01
Ba-137m	8.96E-05	4.82E+04	1.893E+02
Ce-141	3.97E-10	1.13E-05	1.655E-08
Ce-144	9.34E+00	2.98E+04	1.977E+01
Pr-144	3.94E-04	2.98E+04	2.191E+02
Pr-144m	1.97E-06	3.58E+02	1.225E-01
Pm-147	4.28E+01	3.97E+04	1.424E+01
Pm-148m	6.18E-10	1.32E-05	1.674E-07
Sm-151	3.18E+01	8.36E+02	9.803E-02
Eu-152	1.58E-02	2.74E+00	2.073E-02
Gd-153	3.26E-06	1.15E-02	1.039E-05
Eu-154	1.24E+00	3.36E+02	3.006E+00
Eu-155	8.83E-01	4.11E+02	2.990E-01
Tb-160	9.74E-09	1.10E-04	8.961E-07
U-234	7.71E-01	4.82E-03	1.388E-04
U-235	9.11E+01	1.97E-04	5.160E-06
U-236	7.34E+00	4.75E-04	1.287E-05
U-238	1.11E+04	3.72E-03	9.437E-05
Np-237	2.82E+02	1.99E-01	6.083E-03
Pu-238	4.48E-02	7.68E-01	2.546E-02
Pu-239	2.27E+01	1.41E+00	4.346E-02
Pu-240	2.38E+00	5.42E-01	1.688E-02
Pu-241	2.50E-01	2.58E+01	7.999E-04
Pu-242	3.43E-02	1.31E-04	3.869E-06
Am-241	1.68E+02	5.77E+02	1.917E+01
Am-242	5.12E-07	4.14E-01	4.700E-04

Table 3B.17 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Am-243	3.39E-01	6.76E-02	2.173E-03
Cm-242	1.51E-04	4.99E-01	1.839E-02
Cm-244	1.54E-01	1.25E+01	4.374E-01
Total	1.40E+04	2.98E+05	8.687E+02

[a]This table identifies the maximum expected activity of HWVP canisters at the time of vitrification. The maximum is principally based on close-coupling the final accumulated tank of NCAW (21 months from fuel discharge to HWVP). Canister contains 1,650 kg of HLW glass (85% fill). Source: Mitchell and Nelson 1988.

Table 3B.18. Hanford Site: radionuclide content per HLW canister, NCAW glass, nominal case[a]

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Fe-55	7.20E-03	1.80E+01	6.083E-04
Ni-59	1.44E+00	1.09E-01	4.330E-06
Co-60	1.33E-03	1.50E+00	2.313E-02
Ni-63	1.96E-01	1.21E+01	4.806E-03
Se-79	4.52E-02	3.15E-03	7.843E-07
Sr-89	1.84E-17	5.35E-13	1.850E-15
Sr-90	2.18E+02	2.98E+04	3.459E+01
Y-90	5.48E-02	2.98E+04	1.652E+02
Y-91	5.63E-15	1.38E-10	4.957E-13
Nb-93m	2.18E-03	6.16E-01	1.092E-04
Zr-93	4.18E+02	1.05E+00	1.220E-04
Zr-95	1.36E-13	2.92E-09	1.479E-11
Nb-95	1.72E-13	6.73E-09	3.229E-11
Tc-99	4.43E+02	7.51E+00	3.767E-03
Ru-103	1.04E-22	3.37E-18	1.126E-20
Rh-103m	9.34E-26	3.04E-18	6.988E-22
Ru-106	1.25E-02	4.18E+01	2.486E-03
Rh-106	1.17E-08	4.18E+01	4.009E-01
Pd-107	5.87E+01	3.02E-02	1.790E-06
Ag-110m	4.67E-07	2.22E-03	3.708E-05
Cd-113m	3.93E-02	8.53E+00	1.436E-02
In-113m	6.04E-15	1.01E-07	2.353E-10
Sn-113	1.01E-11	1.01E-07	1.683E-11
Cd-115m	1.26E-22	3.20E-18	1.192E-20
Sn-119m	1.52E-06	6.80E-03	3.516E-06
Sn-121m	1.31E-03	7.76E-02	1.555E-04
Sn-123	4.44E-09	3.65E-05	1.140E-07
Sn-126	1.29E+01	3.65E-01	4.553E-04
Sb-124	6.57E-19	1.15E-14	1.527E-16
Sb-126	6.10E-07	5.10E-02	9.424E-04
Sb-126m	4.65E-09	3.65E-01	4.648E-03
Sb-125	2.46E-01	2.54E+02	7.942E-01
Te-125m	3.44E-03	6.20E+01	5.212E-02
Te-127	2.48E-12	6.55E-06	8.846E-09
Te-127m	7.06E-10	6.66E-06	3.583E-09
Te-129	1.49E-30	3.14E-23	1.120E-25

Table 3B.18 (continued)

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Te-129m	1.60E-27	4.82E-23	8.440E-26
I-129	7.31E-02	1.29E-05	5.968E-09
Cs-134	7.19E-02	9.31E+01	9.476E-01
Cs-135	1.75E+02	2.02E-01	6.742E-05
Cs-137	4.15E+02	3.61E+04	3.994E+01
Ba-137m	6.32E-05	3.40E+04	1.335E+02
Ce-141	1.03E-26	2.93E-22	4.284E-25
Ce-144	2.51E-02	8.00E+01	5.307E-02
Pr-144	1.06E-06	8.00E+01	5.881E-01
Pr-144m	5.29E-09	9.60E-01	3.285E-04
Pm-147	5.62E+00	5.21E+03	1.869E+00
Pm-148m	2.92E-23	6.23E-19	7.889E-21
Sm-151	2.65E+01	6.98E+02	8.185E-02
Eu-152	8.09E-03	1.40E-00	1.059E-02
Gd-153	3.83E-09	1.35E-05	1.220E-08
Eu-154	5.37E-01	1.45E+02	1.297E+00
Eu-155	2.94E-01	1.37E+02	9.965E-02
Tb-160	8.41E-17	9.49E-13	7.730E-15
U-234	7.31E-01	4.57E-03	1.316E-04
U-235	8.83E+01	1.91E-04	5.003E-06
U-236	6.51E+00	4.21E-04	1.141E-05
U-238	1.04E+04	3.51E-03	8.904E-05
Np-237	2.21E+02	1.56E-01	4.769E-03
Pu-238	2.59E-02	4.43E-01	1.468E-02
Pu-239	1.88E+01	1.17E+00	3.606E-02
Pu-240	1.72E+00	3.93E-01	1.224E-02
Pu-241	1.22E-01	1.26E+01	3.907E-04
Pu-242	1.99E-02	7.61E-05	2.248E-06
Am-241	8.27E+01	2.84E+02	9.436E+00
Am-242	2.73E-07	2.21E-01	2.509E-04
Am-243	1.90E-01	3.79E-02	1.218E-03
Cm-242	5.50E-05	1.82E-01	6.707E-03
Cm-244	6.22E-02	5.03E+00	1.760E-01
Total	1.26E+04	1.37E+05	3.892E+02

[a]This table identifies the nominal expected activity of HWVP canisters at the time of vitrification. Canister contains 1,650 kg of HLW glass (85% fill). Source: Mitchell and Nelson 1988.

Table 3B.19. Hanford Site: total radioactivity and thermal power of 597 strontium capsules projected through year 2020[a]

End of calendar year	Radioactivity, Ci			Thermal power, 10^3 W		
	Sr-90	Y-90	Total	Sr-90	Y-90	Total
1991	2.599E+07	2.599E+07	5.198E+07	30.1	143.9	174.0
1992	2.538E+07	2.538E+07	5.075E+07	29.4	140.5	169.9
1993	2.478E+07	2.478E+07	4.956E+07	28.7	137.1	165.8
1994	2.420E+07	2.420E+07	4.839E+07	28.1	133.9	162.0
1995	2.363E+07	2.363E+07	4.726E+07	27.4	130.8	158.2
1996	2.307E+07	2.307E+07	4.614E+07	26.7	127.7	154.4
1997	2.253E+07	2.253E+07	4.506E+07	26.1	124.7	150.8
1998	2.200E+07	2.200E+07	4.400E+07	25.5	121.8	147.3
1999	2.148E+07	2.148E+07	4.296E+07	24.9	118.9	143.8
2000	2.098E+07	2.098E+07	4.195E+07	24.3	116.1	140.4
2001	2.048E+07	2.048E+07	4.097E+07	23.7	113.4	137.1
2002	2.000E+07	2.000E+07	4.000E+07	23.2	110.7	133.9
2003	1.953E+07	1.953E+07	3.906E+07	22.6	108.1	130.7
2004	1.907E+07	1.907E+07	3.814E+07	22.1	105.6	127.7
2005	1.862E+07	1.862E+07	3.725E+07	21.6	103.1	124.7
2006	1.819E+07	1.819E+07	3.637E+07	21.1	100.7	121.8
2007	1.776E+07	1.776E+07	3.552E+07	20.6	98.3	118.9
2008	1.734E+07	1.734E+07	3.468E+07	20.1	96.0	116.1
2009	1.693E+07	1.693E+07	3.387E+07	19.6	93.7	113.3
2010	1.653E+07	1.653E+07	3.307E+07	19.2	91.5	110.7
2011	1.615E+07	1.615E+07	3.229E+07	18.7	89.4	108.1
2012	1.577E+07	1.577E+07	3.153E+07	18.3	87.3	105.6
2013	1.539E+07	1.539E+07	3.079E+07	17.8	85.2	103.0
2014	1.503E+07	1.503E+07	3.007E+07	17.4	83.2	100.6
2015	1.468E+07	1.468E+07	2.936E+07	17.0	81.3	98.3
2016	1.433E+07	1.433E+07	2.867E+07	16.6	79.3	95.9
2017	1.400E+07	1.400E+07	2.799E+07	16.2	77.5	93.7
2018	1.367E+07	1.367E+07	2.734E+07	15.8	75.7	91.5
2019	1.335E+07	1.335E+07	2.669E+07	15.5	73.9	89.4
2020	1.303E+07	1.303E+07	2.606E+07	15.1	72.1	87.2

[a]Source: Turner 1990 and ORNL calculations. Curies and watts shown are totals for 597 capsules.

Table 3B.20. Hanford Site: total radioactivity and thermal power of 1350 cesium capsules projected through year 2020[a]

End of calendar year	Radioactivity, Ci			Thermal power, 10^3 W		
	Cs-137	Ba-137m	Total	Cs-137	Ba-137m	Total
1991	5.826E+07	5.512E+07	1.134E+08	64.4	216.1	280.5
1992	5.693E+07	5.386E+07	1.108E+08	62.9	211.2	274.1
1993	5.563E+07	5.263E+07	1.083E+08	61.5	206.3	267.8
1994	5.436E+07	5.143E+07	1.058E+08	60.1	201.6	261.7
1995	5.312E+07	5.025E+07	1.034E+08	58.7	197.0	255.7
1996	5.191E+07	5.910E+07	1.010E+08	57.3	192.6	249.9
1997	5.072E+07	4.798E+07	9.871E+07	56.0	188.1	244.1
1998	4.957E+07	4.689E+07	9.645E+07	54.8	183.9	238.7
1999	4.843E+07	4.582E+07	9.425E+07	53.5	179.6	233.1
2000	4.733E+07	4.477E+07	9.210E+07	52.3	175.6	227.9
2001	4.625E+07	4.375E+07	8.999E+07	51.1	171.6	222.7
2002	4.519E+07	4.275E+07	8.794E+07	49.9	167.6	217.5
2003	4.416E+07	4.177E+07	8.593E+07	48.8	163.8	212.6
2004	4.315E+07	4.082E+07	8.397E+07	47.7	160.1	207.8
2005	4.217E+07	3.989E+07	8.205E+07	46.6	156.4	203.0
2006	4.120E+07	3.898E+07	8.018E+07	45.5	152.8	198.3
2007	4.026E+07	3.809E+07	7.835E+07	44.4	149.3	193.7
2008	3.934E+07	3.722E+07	7.656E+07	43.5	145.9	189.4
2009	3.844E+07	3.637E+07	7.481E+07	42.5	142.6	185.1
2010	3.757E+07	3.554E+07	7.310E+07	41.5	139.4	180.9
2011	3.671E+07	3.473E+07	7.143E+07	40.6	136.2	176.8
2012	3.587E+07	3.393E+07	6.980E+07	39.6	133.1	172.7
2013	3.505E+07	3.316E+07	6.821E+07	38.7	130.0	168.7
2014	3.425E+07	3.240E+07	6.665E+07	37.8	127.0	164.8
2015	3.347E+07	3.166E+07	6.513E+07	37.0	124.2	161.2
2016	3.270E+07	3.094E+07	6.364E+07	36.1	121.3	157.4
2017	3.196E+07	3.023E+07	6.219E+07	35.3	118.6	153.9
2018	3.123E+07	2.954E+07	6.077E+07	34.5	115.8	150.3
2019	3.052E+07	2.887E+07	5.938E+07	33.7	113.2	146.9
2020	2.982E+07	2.821E+07	5.803E+07	32.9	110.6	143.5

[a]Source: Turner 1990 and ORNL calculations. Curies and watts shown are totals for 1350 capsules.

Table 3B.21. Idaho National Engineering Laboratory: historical and projected volumes of interim and immobilized high-level wastes[a]

End of calendar year	Volume, 10^3 m^3			
	Liquid	Calcine	Glass-ceramic	Total
1989	8.5	3.5	0.0	12.0
1990	7.6	3.7	0.0	11.3
1991	7.0	4.1	0.0	11.1
1992	8.0	4.1	0.0	12.1
1993	8.5	4.4	0.0	12.9
1994	6.4	4.9	0.0	11.3
1995	7.5	5.0	0.0	12.5
1996	5.9	5.4	0.0	11.3
1997	6.9	5.4	0.0	12.3
1998	5.8	5.9	0.0	11.7
1999	6.4	5.9	0.0	12.3
2000	6.1	6.0	0.0	12.1
2001	7.1	6.4	0.0	13.5
2002	7.4	6.9	0.0	14.3
2003	7.7	7.3	0.0	15.0
2004	8.2	7.8	0.0	16.0
2005	8.5	8.3	0.0	16.8
2006	8.7	8.8	0.0	17.5
2007	9.0	8.8	0.0	17.8
2008	9.2	8.8	0.0	18.0
2009	5.8	9.3	0.0	15.1
2010	4.7	10.0	0.0	14.7
2011	3.7	10.70	0.0	14.4
2012	2.7	10.96	0.28	13.94
2013	2.0	11.12	0.63	13.75
2014	2.3	10.95	1.03	14.28
2015	4.5	10.28	1.60	16.38
2016	3.4	10.11	2.17	15.68
2017	2.3	9.91	2.74	14.95
2018	3.3	9.43	3.31	16.04
2019	0.2	8.98	3.88	13.06
2020	0.3	8.62	4.45	13.37

[a]Source: Berreth 1990. Quantities shown are based on the assumptions that immobilization starts in year 2012 and that the glass-ceramic form is used. Each canister is assumed to contain 0.57 m^3 of ceramic (1,825 kg), with a calcine loading of 70 wt % or 1,277 kg; this is the equivalent of 0.91 m^3 of calcine prior to immobilization. The reader is cautioned that these projections are based on estimates and assumptions that are subject to change.

Table 3B.22. Idaho National Engineering Laboratory: historical and projected radioactivity and thermal power of interim and immobilized high-level wastes[a]

End of calendar year	Liquid		Calcine		Glass-Ceramic		Total	
	10^6 Ci	10^3 W	10^6 Ci	10^3 W	10^6 Ci	10^3 W	10^6 Ci	10^3 W
1989	11.5	34.3	56.9	164.9	0.00	0.0	68.4	199.2
1990	6.6	19.3	59.5	172.9	0.00	0.0	66.1	192.2
1991	11.4	33.5	62.8	182.3	0.00	0.0	74.2	215.8
1992	10.7	31.0	61.0	177.3	0.00	0.0	71.7	208.3
1993	13.2	39.5	67.8	196.9	0.00	0.0	81.0	236.4
1994	8.4	24.7	72.7	211.1	0.00	0.0	81.1	235.8
1995	7.3	21.2	75.9	220.4	0.00	0.0	83.2	241.6
1996	17.2	55.6	79.2	230.0	0.00	0.0	96.4	285.6
1997	15.7	47.8	79.2	230.0	0.00	0.0	94.9	277.8
1998	11.4	33.9	84.9	246.7	0.00	0.0	96.3	280.6
1999	5.7	16.7	87.0	252.8	0.00	0.0	92.7	269.5
2000	3.6	10.6	92.0	267.2	0.00	0.0	95.6	277.8
2001	14.5	45.9	97.8	284.0	0.00	0.0	112.3	329.9
2002	19.2	57.4	107.0	310.6	0.00	0.0	126.2	368.0
2003	21.8	65.3	119.1	345.9	0.00	0.0	140.9	411.2
2004	22.0	67.9	113.3	387.9	0.00	0.0	135.3	455.8
2005	23.6	72.1	141.1	410.6	0.00	0.0	164.7	482.7
2006	26.8	80.3	145.0	421.9	0.00	0.0	171.8	502.2
2007	24.0	70.7	140.3	408.3	0.00	0.0	164.3	479.0
2008	19.8	57.7	138.8	404.1	0.00	0.0	158.6	461.8
2009	13.9	42.5	147.4	429.0	0.00	0.0	161.3	471.5
2010	15.9	49.6	161.5	471.7	0.00	0.0	177.4	521.3
2011	15.1	45.9	178.1	521.3	0.00	0.0	193.2	567.2
2012	15.9	49.3	187.7	549.5	7.80	22.9	211.4	621.7
2013	12.8	39.0	196.7	576.8	17.74	52.0	227.2	667.8
2014	18.0	55.5	193.3	565.2	28.89	84.5	240.2	705.2
2015	25.1	77.0	182.0	533.4	45.23	132.0	252.3	742.4
2016	18.3	55.7	183.0	534.2	62.40	182.1	263.7	772.0
2017	10.0	51.4	178.8	521.5	78.62	229.4	267.4	802.3
2018	13.2	40.3	170.7	497.4	95.65	278.7	279.6	816.4
2019	2.0	5.9	160.3	466.7	110.04	320.4	272.3	793.0
2020	3.7	11.3	153.7	448.8	126.86	370.3	284.3	830.4

[a]Source: Berreth 1990 and ORNL calculations based on the assumption that the glass-ceramic produced each year has the same radionuclide composition as the average calcine in storage in that year. Each canister is assumed to contain 0.57 m^3 of ceramic (1,825 kg), with a calcine loading of 70 wt % or 1,277 kg; this is the equivalent of 0.91 m^3 of calcine prior to immobilization. The reader is cautioned that the assumptions and estimates used here are subject to change.

Table 3B.23. Representative chemical composition of current and future HLW liquid at INEL[a]

Component	Composition, wt %			
	Zirconium fluoride	Sodium bearing	Nonfluoride	Fluorinel
Al	1.3	0.8–1.6	1.51	0.742
B	0.15	0.005–0.01	0.003	0.241
Ca	–	0.03–0.2	0.27	–
Cl^-	–	0.06–0.1	0.023	–
Cd	–	–	1.42	–
Cr	–	–	0.036	0.0087
F^-	3.4	0.005–0.06	0.032	5.99
Fe	0.04	0.05–0.09	0.19	0.023
H^+	1.12	0.03–0.15	0.12	0.18
K	1.12	0.03–0.15	0.33	–
Mg	–	–	0.062	–
Mn	–	–	0.048	0.0004
Na	0.12	2.1–4.0	1.31	–
Ni	–	–	0.016	0.0049
NO_3^-	13.7	19.4–23.3	23.1	11.47
SO_4^{2-}	–	0.33–0.5	0.65	1.52
Zr	2.47	–	–	3.80
H_2O	76.6	76.6–69.2	70.9	76.0
	100.0	100.0	100.0	100.0
Density, g/mL	1.2	1.2–1.3	1.2	1.2

[a]Source: IDB 1989.

Table 3B.24. Composition of typical HLW calcines produced at INEL[a]

Component	Type of calcine and composition, wt %			
	Alumina	Zirconia	Zirconia-Fluorinel	sodium
Al_2O_3	82–95	13–17	6	12–14
Na_2O	1–3	–	--	0–5
ZrO_2	–	21–27	23	20–26
CaF_2	–	50–56	56	48–53
CaO	–	2–4	4	2–4
Nitrate	5–9	0.5–2	0.5–2	0.5–4
B_2O_3	0.5–2	3–4	4	3–4
CdO	–	–	6	–
Fission products and actinides	≤1	≤1	≤1	≤1

[a]Sources: Staples, Knecht, and Berreth, 1986; Knecht 1991.

Table 3B.25. Idaho National Engineering Laboratory: radionuclide concentrations in 3-year-cooled calcined wastes[a]

Radionuclide	Radioactivity (Ci/kg)
Se-79	6.4E-05
Rb-87	3.6E-09
Sr-90	1.3E+01
Y-90	1.3E+01
Zr-93	3.1E-04
Nb-93m	7.5E-05
Tc-99	2.1E-03
Ru-106	9.7E-01
Rh-106	9.7E-01
Pd-107	2.0E-06
Sn-126	3.2E-05
Sb-126m	3.2E-05
Sb-126	3.2E-05
Cs-134	3.3E+00
Cs-135	7.5E-05
Cs-137	1.3E+01
Ba-137m	1.2E+01
Ce-144	8.2E+00
Pr-144	8.2E+00
Pm-147	1.2E+01
Sm-151	1.7E-01
Eu-154	1.8E-01
U-233	1.2E-12
U-234	4.3E-10
U-235	1.8E-09
U-236	1.0E-08
U-237	4.8E-12
U-238	1.0E-14
Np-237	4.8E-08
Pu-238	7.0E-02
Pu-239	7.0E-04
Pu-240	6.5E-04
Pu-241	1.6E-01
Pu-242	1.8E-06
Am-241	9.1E-04
Am-243	8.3E-06
Cm-242	6.5E-04
Cm-244	5.2E-04
Total	8.5E+01

[a]Source: IDO 1982. Radioactivities are stated as curies per kg of calcine.

Table 3B.26. Idaho National Engineering Laboratory: radionuclide content per HLW canister[a]

Radionuclide	Mass (g/canister)	Radioactivity (Ci/canister)	Thermal power (W/canister)
Se-79	0.1173E+01	0.8173E-01	0.2035E-04
Rb-87	0.5252E+02	0.4597E-05	0.3843E-08
Sr-90	0.1217E+03	0.1660E+05	0.1927E+02
Y-90	0.3051E-01	0.1660E+05	0.9204E+02
Zr-93	0.1575E+03	0.3959E+00	0.4600E-04
Nb-93m	0.3387E-03	0.9577E-01	0.1697E-04
Tc-99	0.1582E+03	0.2682E+01	0.1346E-02
Ru-106	0.3701E+00	0.1239E+04	0.7365E-01
Rh-106	0.3479E-06	0.1239E+04	0.1188E+02
Pd-107	0.4965E+01	0.2554E-02	0.1514E-06
Sn-126	0.1440E+01	0.4086E-01	0.5097E-04
Sb-126m	0.5201E-09	0.4086E-01	0.5203E-03
Sb-126	0.4887E-06	0.4086E-01	0.7552E-03
Cs-134	0.3256E+01	0.4214E+04	0.4290E+02
Cs-135	0.8316E+02	0.9577E-01	0.3197E-04
Cs-137	0.1908E+03	0.1660E+05	0.1837E+02
Ba-137m	0.2848E-04	0.1532E+05	0.6017E+02
Ce-144	0.3282E+01	0.1047E+05	0.6947E+01
Pr-144	0.1386E-03	0.1047E+05	0.7700E+02
Pm-147	0.1653E+02	0.1532E+05	0.5499E+01
Sm-151	0.8250E+01	0.2171E+03	0.2546E-01
Eu-154	0.8513E+00	0.2299E+03	0.2056E+01
U-233	0.1583E-06	0.1532E-08	0.4456E-10
U-234	0.8785E-04	0.5491E-06	0.1582E-07
U-235	0.1063E+01	0.2299E-05	0.6020E-07
U-236	0.1973E+00	0.1277E-04	0.3459E-06
U-237	0.7507E-13	0.6130E-08	0.1158E-10
U-238	0.3797E-04	0.1277E-10	0.3235E-12
Np-237	0.8693E-01	0.6130E-04	0.1874E-05
Pu-238	0.5221E+01	0.8939E+02	0.2963E+01
Pu-239	0.1437E+02	0.8939E+00	0.2754E-01
Pu-240	0.3642E+01	0.8300E+00	0.2585E-01
Pu-241	0.1983E+01	0.2043E+03	0.6336E-02
Pu-242	0.6018E+00	0.2299E-02	0.6788E-04
Am-241	0.3385E+00	0.1162E+01	0.3861E-01
Am-243	0.5315E-01	0.1060E-01	0.3407E-03
Cm-242	0.2510E-03	0.8300E+00	0.3059E-01
Cm-244	0.8201E-02	0.6640E+00	0.2322E-01
Total	0.8315E+03	0.1088E+06	0.3393E+03

[a]Quantities are at time of filling canister and are based on 3-year-old calcine immobilized in glass-ceramic with a load of 1,277 kg of calcine per canister (1,825 kg of glass-ceramic per canister). Based on IDO 1982 and Berreth 1986c.

DISTRIBUTION

DOE — Office of Civilian Radioactive Waste Management, Washington, DC 20585

J. W. Bartlett
J. C. Bresee
S. Brocoum
*A. B. Brownstein
*J. H. Carlson
*M. Conroy
W. J. Danker
J. B. Easterling
H. J. Hale
V. King
*P. Kumar
W. Lake
*W. Lemeshewsky
R. Milner
*N. Montgomery
*T. D. Nguyen
M. L. Payton
J. Roberts
S. Rousso
J. D. Saltzman
W. Sprecher
*V. Trebules
*J. R. Williams

DOE — Office of Nuclear Energy, Washington, DC 20545

F. J. Goldner
E. F. Mastal
J. L. Smiley
J. A. Turi

DOE — Office of Defense Programs, Washington, DC 20545

E. A. Jordon
A. L. Taboas
R. Cooperstein
G. H. Daly

DOE — Office of Environmental Restoration, 1000 Independence Ave., Washington, DC 20585

W. W. Bixby
R. P. Whitfield

DOE — Office of Environmental Restoration and Waste Management, Washington, DC 20585-0002

J. A. Coleman
L. Duffy
C. Frank
R. I. Greenberg
E. A. Jordan
A. F. Kluk
M. J. Lilly
W. E. Murphie
G. P. Turi
W. E. Wisenbaker

DOE — Energy Information Administration, 1707 H. Street, NW, Washington, DC 20006

*J. A. Disbrow
*K. Gibbard
*B. K. O'Brien

DOE — Environmental Protection Agency, Washington, DC 20460

J. W. Gunther
M. Halper
M. Oge

DOE — Albuquerque Operations Office, P.O. Box 5400, Albuquerque, NM 87115

*K. Golliher
D. M. Lund

DOE — Chicago Operations Office, Bldg. 201, 9800 S. Cass Ave., Argonne, IL 60439

M. Klimas
S. A. Mann

DOE — Idaho Operations Office, 785 DOE Place, Idaho Falls, ID 83402

M. Fisher
R. Sandwina
K. Svinicki
T. J. Zielinski

DOE — Idaho Operations, West Valley Project Office, P. O. Box 191, West Valley, NY 14171-0191

T. J. Rowland
W. S. Ketola

DOE — Yucca Mountain Site Characterization Project Office, 101 Convention Center Drive, Suite 200, Las Vegas, NV 89109

*M. Blanchard
*C. Gertz
*R. Dyer
*D. Harrison-Giesler
*E. Petrie
*D. Royer
*W. Simecka

DOE — Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831

R. Collier

DOE — Richland Operations Office, P.O. Box 550, Richland, WA 99352

D. C. Langstaff

DOE — Richland Operations, Shippingport Project Office, P.O. Box 335, Shippingport, PA 15077

J. J. Schreiber

DOE — Savannah River Operations Office, P.O. Box A, Aiken, SC 29801

J. M. Gallagher
W. D. Pearson

DOE — WIPP Project Office, P.O. Box 3090, Carlsbad, NM 88220

W. Walker

U.S. Nuclear Regulatory Commission, 1717 H Street NW, Washington, DC 20555

Director, Div. of High-level Waste Mgmt., NMSS. OWFN, MS 4-H-3
Director, Div. of Low-Level Waste Mgmt. and Decommissioning, NMSS, OWFN, MS 5-E-4
Director, Div. of Safeguards and Transportation, NMSS, OWFN, MS 4-E-4
Director, Div. of Industrial and Medical Nuclear Safety, OWFN, MS 6-H-3
Irradiated Fuel Section, Source Containment & Devices Branch

U. S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460

Analysis and Support Division, Martin Halper (ANR-461)
Criteria and Standards Division, James W. Gunther, (ANR-460W)
Office of Radiation Programs, M. Oge, (ANR-450W)

Office of Technology Assessment, 600 Pennsylvania Avenue., SW., Washington, DC 20510

Defense Nuclear Facilities Safety Board, 625 Indiana Ave., NW, Suite 700, Washington, DC 20004

L. A. Ettlinger

Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439

S. Y. Chen
J. Peterson
M. J. Steindler

Brookhaven National Laboratory, Upton, Long Island, NY 11973

B. Barletta
R. Fullwood
C. Sastre
R. Youngblood

Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550

*J. Blink
*T. Buschek
L. J. Jardine
H. Leider
W. R. Lloyd
R. B. Stout
R. Van Konynenberg

Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545

D. T. Oakley
K. K. S. Pillay
L. Walker
J. L. Warren
W. J. Whitty

Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831

J. M. Begovich
J. T. Bell
A. G. Croff
C. W. Forsberg
W. Fulkerson
R. K. Genung
H. W. Godbee
D. S. Joy
*J. A. Klein
S. B. Ludwig
A. P. Malinauskas
K. J. Notz (50 copies)
C. V. Parks
R. L. Pearson
*R. B. Pope
R. R. Rawl
W. J. Reich
R. Salmon
S. N. Storch
T. D. Welch
R. M. Westfall

Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352

S. R. Bierman
M. E. Cunningham
R. Einziger
U. Jenquin
*A. T. Luksic
J. McElroy
R. W. McKee
G. Mellinger
R. I. Smith
V. W. Thomas
S. Vance
R. C. Walling

Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM 87185

*G. Allen
R. S. Case
A. W. Dennis
T. Hunter
P. C. Reardon
L. E. Romesberg
*E. Ryder
*T. Sanders
*R. Sandoval

Westinghouse/Hanford Company, P.O. Box 1970, Richland, WA 99352

G. M. Bain
C. S. Clark
F. M. Coony
J. A. Nelson
O. A. Turner
R. A. Watrous
R. T. Wilde
B. A. Wolfe

Westinghouse/Idaho Nuclear Company, P.O. Box 4000, Idaho Falls, ID 83404

D. A. Knecht
G. G. Simpson

Westinghouse/WIPP Project, P.O. Box 2078, Carlsbad, NM 88220

K. S. Donovan
J. Lippis

Westinghouse/Savannah River Company, P.O. Box 616, Aiken, SC 29802

P. D. D'Entremont
W. T. Goldston
S. L. Marra
M. J. Plodinec

Advanced Nuclear Fuels Corporation, P.O. Box 90777, Bellevue, WA 98009

J. D. Floyd

Advanced Nuclear Fuels Corporation, 2101 Horn Rapids Road, Richland, WA 99352

D. L. Adams
K. R. Merckx
M. Valentine

Analysas Corporation, 151 Lafayette Drive, Oak Ridge, TN 37830

Debbie Gifford

Anatech Research Corp., P. O. Box 9165, La Jolla, CA 92038

A. J. Zangari

Arizona State University, Nuclear Engineering Science Program, Tempe, AZ 85287-5706

J. W. McKlveen

Automated Sciences Group, 800 Oak Ridge Turnpike, Oak Ridge, TN 37830

*C. G. Cowart
E. A. Dorsey
R. S. Moore (10 copies)
D. Murphy

Babcock and Wilcox, P.O. Box 10935, Lynchburg, VA 24506

P. Childress
J. Matheston
L. Walton
D. A. Wesley
G. Vames

Bechtel National, Inc., P.O. Box 3965, San Francisco, CA 94119

Chin W. Ma
R. J. Tosetti

Bechtel National, 800 Oak Ridge Turnpike, Oak Ridge, TN 37831-0350

P. Bradbury
R. A. Langley
R. Philippone
A. Yazdi

E. J. Bentz & Associates, Inc., 7915 Richfield Road, Springfield, VA 22153

R. Peterson

Brown Boveri Nuclear Services, Inc., 9190 Red Branch Road, Columbia, MD 21045

B. Snyder

Carolina Power and Light Co., Rt. 1, P.O. Box 327, New Hill, NC 27562

R. Wild

Chem-Nuclear Systems, Inc., 220 Stoneridge Drive, Columbia, SC 29210

P. A. Craig

Clark County — Nuclear Waste Division, 301 E. Clark, Suite 570, Las Vegas, NV 89101

J. Duke

Columbia University, Department of Applied Physics, New York, NY 10027

L. Lidofsky

Combustion Engineering, 1000 Prospect Hill Road, Windsor, CT 06095

W. Burns
D. Hayduk

Dataphile, 9121 Garrison Rd., Knoxville, TN 37931

K. E. Jones

David Andress Associates, Inc., 11008 Harriett Lane, Kensington, MD 20895

*D. Andress

Duke Engineering & Services, P. O. Box 1004, Charlotte, NC 28201

D. Anthony
*R. Eble (3 copies)
*V. H. Pierce
*A. Segrest
*J. Stringer

Ebasco Environmental, 143 Union Boulevard, Suite 1010, Lakewood, CO 80228-1824

W. T. Gregory

Edison Electric Institute, 1111 19th Street NW, Washington, DC 20036

S. Kraft

EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415

M. T. Magleby
R. R. Piscitella
R. L. Scott
H. Worle

Energy Resources International, Inc., 1015 18th St., N.W., Suite 500, Washington, DC 20036

M. H. Schwartz

EPRI — Electric Power Research Institute, P.O. Box 10412, Palo Alto, CA 94303

C. Braun
O. Ozer
R. L. Yang
R. W. Lambert
R. Williams

E. R. Johnson Associates, Inc., 10461 White Granite Drive, Suite 204, Oakton, VA 22124

*B. M. Cole
E. R. Johnson
D. C. Jones
*D. A. Williamson
*N. B. McLeod
M. White
*R. R. MacDonald
*W. Teer

Fluor Daniel, Inc., 3333 Michelson Drive, Irvine, CA 92730

G. E. Benedict
S. Little
T. O. Mallonee
B. R. McElmurry

Foster Wheeler Development Corporation, 12 Peach Tree Hill Road, Livingston, NJ 07039

S. E. Himsl

Georgia Institute of Technology, Nuclear Engineering Program, Atlanta, GA 30332-0405

S. I. Abdel-Khalik
D. B. Bullen

General Atomics, P. O. Box 85608, MS 15-219A, San Diego, CA 92186-9784

J. Boshoven
R. M. Grenier

General Electric Nuclear Energy, 175 Curtner Ave., San Joe, CA 95125

S. O. Akerlund
R. E. Spicka

H & R Technical Associates, 575 Oak Ridge Turnpike, Oak Ridge, TN 37830

W. R. Rhyne

International Atomic Energy Agency, P. O. Box 250, A-1400 Vienna, Austria

M. J. Bell
A. Grigoriev
B. F. Judson

Institute of Nuclear Energy Research, P. O. Box 3-7, Lung-Tan, 32500 TAIWAN

L. C. Liu

Kaiser Engineering, P.O. Box 23210, Oakland, CA 94623

H. Isakari

Korea Atomic Energy Research Institute, P. O. Box 7, Dalduk-Danji, Taejeon, Korea 305-606

Jong Won Choi

Los Alamos Technical Associates, 6501 Americus Parkway, Suite 900, Albuquerque, NM 87110

D. Guerin

Louisiana State University, Nuclear Science Center, Baton Rouge, LA 70803-5820

E. N. Lambremont
M. L. Williams

Massachusetts Institute of Technology, Dept. of Nuclear Engineering, 77 Massachusetts Avenue., Bldg. 24-102, Cambridge, MA 02139

M. S. Kazimi
N. C. Rasmussen
N. E. Todreas

Monsanto Research Corporation, Mound Facility, Miamisburg, OH 45342

J. W. Doty

National TSING HUA University, Dept. of Nuclear Engineering, 101 Section 2, Kuang-Fu Rd., Hsinchu 30043, TAIWAN

S - P. Teng

North Carolina State University, Dept. of Nuclear Engineering, 1110 Burlington Laboratories, Raleigh, NC 27695-7909

D. J. Dudziak
T. S. Elleman
P. J. Turinsky

Northeast Technology Corp., 26 Pearl Street, UPO Box 4178, Kingston, NY 12401

K. O. Lindquist

Northeast Utilities, 107 Selden St., P. O. Box 270, Berlin, CT 06037

G. Betancourt
B. Isakson

Nuclear Assurance Corp., 6251 Crooked Creek Road, Norcross, GA 30092

M. Aucoin
I. F. Stuart
Information Center

NUS Corporation, 910 Clopper Road, Gaithersburg, MD 20878

C. Heath
Y. S. Kim

Nutech Engineers, 340 Six Branches Court, Roswell, GA 30076

J. D. Rollins

Nutech Engineers, 14 S. Martinvale Lane, San Jose, CA 95119

N. W. Edwards

Oklahoma Dept. of Libraries, U.S. Government Infor. 200 N.E. 18th St., Oklahoma City, OK 73105-3298

S. Beleu

Oregon State University, Dept. of Nuclear Engineering, Radiation Center C116, Corvallis, OR 97331-5902

A. H. Robinson
J. C. Ringle

PAI Corporation, P.O. Box 1135, Oak Ridge, TN 37830

D. L. Phung
F. E. Harrington

Pacific Nuclear Fuel Services, Inc., 145 Martinvale Lane, San Jose, CA 95119

L. M. Stamm

Pacific Nuclear Systems, 1010 South 336th Street, Federal Way, WA 98003

C. J. Temus

Public Utility Commission of Texas, 7800 Shoal Greek Boulevard, Suite 400N, Austin, TX 78757

J. McArthur

Purdue University, School of Nuclear Engineering, West Lafayette, IN 47907

V. H. Ransom

Radioactive Exchange, P.O. Box 9528, Washington, DC 20016

E. L. Helminski

Raytheon, Yucca Mountain Project, 101 Convention Center Dr., Suite P-250, Las Vegas, NV 89109

R. C. DeKlever

REECO, P.O. Box 14400, Las Vegas, NV 89114

G. W. Kendall

Rensselaer Polytechnic Institute, Dept. of Nuclear Engineering & Engineering Physics, Troy, NY 12180-3590

R. C. Block
D. R. Harris

RE/SPEC Inc., 4775 Indian School Road NE, Suite 300, Albuquerque, NM 87110

S. Petney

Rochester Gas and Electric Corp., 89 East Avenue, Rochester, NY 14649

A. Fuierer

Rockwell International Corporation, P. O. Box 800, Richland, WA 99352

K. A. Gasper

Rockwell International Corp., 6633 Canoga Avenue, Canoga Park, CA 91303

J. Guon

Rogers & Associates Engineering Corporation, P. O. Box 330, Salt Lake City, UT 84110-0330

B. Bailey

San Francisco State University, 1600 Holloway Ave., San Francisco, CA 94132

Y. T. Mandra

Science Applications International Corp., 4900 Hopyard Road, Suite 310, Pleasanton, CA 94588

J. Cohen
C. Smith

Science Applications International Corp., 800 Oak Ridge Turnpike, Oak Ridge, TN 37830

E. Bergman
R. Best

Science Applications International Corp., 20030 Century Boulevard, Suite 201, Germantown, MD 20874

R. E. Yoder

Science Applications International Corp., 101 Convention Center Drive, Las Vegas, NV 89109

W. MacNabb
*R. Morissette (3 copies)
J. Nelson
R. D. Zimmerman
*M. Voegele (3 copies)

Science Applications International Corp., Atlanta, GA

L. Danese

Southwest Research Institute, 6220 Culebra Rd., San Antonio, TX 78228

H. Manaktala

State of Washington, Department of Social and Health Services, Olympia, WA 98504

E. L. Gronemeyer

State of Nevada, Division of Health, 505 East King St., Carson City, NV 89710

S. Marshall

Texas A&M University, Dept. of Nuclear Engineering, 129 Zachry Engineering Center, College Station, TX 77843

K. L. Peddicord
J. W. Poston

The Ohio State University, Nuclear Engineering Program, 206 West 18th Avenue, Columbus, OH 43210

A. W. Fentiman
D. W. Miller

The Pennsylvania State University, Nuclear Engineering Dept., 231 Sackett Building, University Park, PA 16802

E. H. Klevans

TLG Engineering, 31 N. Pond Rd., Chesshire, CT 06410

A. Levin

TRW Environmental Safety Systems Inc., 2650 Park Tower Drive, Suite 800, Vienna, VA 22180-7306

*W. Bailey (3 copies)
*E. Bogart
*G. Carruth (5 copies)
*J. R. Clark
*W. R. Griffin (3 copies)
*C. Kerrigan (17 copies; 1 controlled)
*P. Lovett
*J. Mayer
J. Miller
*L. Rickertson
*W. Stanley
G. Vawter (2 copies)

TRW Environmental Safety Systems Inc., 600 Maryland Avenue SW, Suite 695, Washington, DC 20024

P. M. Krishna

TRW Environmental Safety Systems Inc., 101 Convention Center Drive, Suite P-110, Las Vegas, NV 89109

*H. Benton (2 copies)
J. Berg
J. K. Clark
*T. Doering (2 copies)
M. Fortsch
*L. D. Foust
J. Gauthier
H. Hartman
R. Jiu
R. Low
S. Pahwa (2 copies)
*W. D. Schutt

University of Arizona, Department of Nuclear and Energy Engineering, Tucson, AZ 85721

S. C. Crow
M. E. Wacks

University of California, Dept. of Nuclear Engineering, Berkeley, CA 94720

D. R. Olander
T. H. Pigford
S. G. Prussin

University of California, School of Engineering and Applied Science, 405 Hilgard Ave., Los Angeles, CA 90024-1597

P. Friedmann
D. Okrent

University of Cincinnati, Dept. of Mechanical, Industrial and Nuclear Engineering, Mail Location 72, Cincinnati, OH 45221

R. Eckart

University of Colorado, Campus Box 184, Boulder, CO 80309-0184

Government Publications

University of Florida, Dept. of Nuclear Engineering Sci., 202 Nuclear Sciences Ctr, Gainesville, FL 32611

J. S. Tulenko

University of Illinois, Dept. of Nuclear Engineering, Urbana, IL 61801

R. A. Axford B. G. Jones

University of Lowell, Dept. of Chemical and Nuclear Engineering, One University Avenue, Lowell, MA 01854

J. P. Phelps

University of Michigan, 108 Cooley Lab, North Campus, Dept. of Nuclear Engineering, Ann Arbor, MI 48109-2104

W. R. Martin

University of Missouri-Columbia, Nuclear Engineering Program, 333 Electrical Engineering Bldg., Columbia, MO 65211

J. F. Kunze

University of Missouri-Rolla, Department of Nuclear Engineering, 102 Fulton Hall, Rolla, MO 65401-0249

A. E. Bolon N. Tsoulfanidis

University of Nevada — Las Vegas, J. R. Dickinson Library, 4505 Maryland Pkwy, Las Vegas, NV 89154

K. Schott

University of New Mexico, Dept. of Chemical and Nuclear Engineering, Farris Engineering Center, Room 209, Albuquerque, NM 87131

F. L. Williams

University of Tennessee, Knoxville, Nuclear Engineering Dept., 315 Pasqua Building, Knoxville, TN 37996-2300

H. L. Dodds T. W. Kerlin
E. M. Katz L. F. Miller

University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, Madison, WI 53705

T. J. Evans

University of Wisconsin-Madison, Dept. of Nuclear Engineering and Engineering Physics, 151 Engineering Research Building, Madison, WI 53706

M. W. Carbon M. L. Corradini

Westinghouse Electric Corp., Nuclear Waste Technology, 1501 Ardmore Blvd., Pittsburgh, PA 15221

R. Bahorich
P. J. Kersting
B. R. Nair
W. J. Severson

West Valley Demonstration Project, P.O. Box 191, West Valley, NY 14171-0191

R. L. Crocker
E. Maestas
J. Pope

West Valley Nuclear Services Company Inc., P. O. Box 191, West Valley, NY 14171-0191

G. G. Baker
S. M. Barnes
R. L. Crocker
R. G. Gessner
D. H. Kurasch
R. E. Lawrence
R. A. Palmer
D. K. Ploetz
S. J. Szalinski
WVDP Technical Library

Weston, 955 L'Enfant Plaza, SW, Eighth Floor, Washington, DC 20024

*P. A. Bolton
*E. Ching
A. Mobasheran
*N. A. Norman
*M. Rahimi
W. Wowak

ORNL Central Research Library
ORNL Laboratory Records Department
ORNL Laboratory Records, RC
ORNL Y-12 Technical Library, Document Reference Section
ORNL Patent Section

Given distribution as shown in document DOE/OSTI-4500-R75 under categories UC-810, 812, and 820 (299 copies including those for NTIS):

UC-810 High Level Radioactive Waste Management
UC-812 Spent Fuel Storage
UC-820 Transport of High Level Radioactive Waste

Extra copies for OSTI to fill orders (15).

NOTE: Asterisk by name means controlled distribution.

*U.S GOVERNMENT PRINTING OFFICE 1992-648-191/60014