PNNL-11273
UC-812

Inventory of LWR Spent Nuclear Fuel in the 324 Building

U. P. Jenquin

September 1996

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

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

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Richland, Washington 99352

DISCLAIMER

Summary

This document contains the results of calculations to estimate the decay heat, neutron source term, photon source term, and radioactive inventory of light-water-reactor spent nuclear fuel in the 324 Building at Pacific Northwest National Laboratory.

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Inventory of LWR Spent Nuclear Fuel in the 324 Building
September, 1996

Urban Jenquin
Materials and Engineering Analysis Group
Engineering and Analytic Sciences Department

1.0 Introduction

Irradiated light-water-reactor (LWR) fuel was brought into the 324 building for research purposes during the 1980's. The fuel consists of three complete Point Beach assemblies, two partial Calvert Cliffs assemblies, one complete Cooper assembly, one partial Cooper assembly, loose full-length fuel rods, segments of fuel rods, and powder. The Cooper Reactor is a boiling water reactor (BWR) and the Calvert Cliffs and Point Beach Reactors are pressurized water reactors (PWRs). One of the Calvert Cliffs assemblies contains some of its original fuel rods plus fuel rods from another assembly. All of the fuel rods in the Cooper assemblies plus full-length fuel rods which have been removed from the Calvert Cliffs assemblies will be consolidated in one canister. Each of the remaining assemblies will be placed in separate canisters.

This document contains the results of calculations to estimate the radioactive inventory of each canister. The calculations also give the decay heat, neutron source term, and photon source term for each canister. The source terms are needed for dose rate assessments and the inventories are needed to evaluate accident scenarios. Partial-length fuel rods and powder are not included in the estimates.

2.0 Description of Fuel

The characteristics of the fuel are summarized in Table 1. The Approved Testing Material (ATM) No. is a number assigned to various types of fuel by the Materials Characterization Center (MCC). ATM-108 fuel is Cooper fuel which contains gadolinium burnable poison. Initially, there were 10 fuel rods containing gadolinium. One was segmented, so nine remain intact. ATM-105 is the remainder of the Cooper fuel. Calvert Cliffs Assembly D047 contains 126 of its original 176 fuel rods plus 13 fuel rods from another assembly (BT03); hence, two separate columns are used to describe the fuel. The three Point Beach assemblies (H07, H12, and H25) are similar to each other.

The Cooper assemblies consist of fuel rods with several enrichments ranging from 1.33 wt% to 2.93 wt%. The assembly-average enrichment is 2.50 wt%, as shown in Table 1. The number of fuel rods in each assembly as of June 1996 is given on the third-to-the-last line of Table 1. The number of loose, full-length fuel rods are in addition to those in the assembly. Current plans are to remove all of the Cooper fuel rods from Assemblies CZ346 and CZ348 and consolidate them with the other loose Cooper fuel rods and loose Calvert Cliffs fuel rods into one canister. The consolidated fuel rods canister will contain 112 full-length fuel rods.

Table 1. Characteristics of LWR Spent Fuel in 324 Building

Assembly ID	D101	D047		CZ346	CZ348	H07*
Reactor	Calvert Cliffs	Calvert Cliffs		Cooper	Cooper	Point Beach
ATM No.	ATM-103	ATM-104	ATM-106	ATM-105/108	ATM-105/108	NA
Initial Enrichment, wt%	2.72	3.04	2.45	2.50	2.50	3.19
Burnup, GWD/MTU	30.7	41.8	42.7	28.05	27.48	32.9
Discharge Date	10/18/80	04/17/82	10/18/80	05/21/82	05/21/82	10/09/81
Decay Time, yr	15.7	14.2	15.7	14.1	14.1	14.7
Fuel Rod Mass, KgU	2.215	2.215	2.244	3.89	3.89	2.241
No. of Fuel Rods in Assembly	168	126	13	37	49	179
Assembly Mass, KgU	372.1	279.1	29.2	143.9	190.6	401.1
No. of Loose Fuel Rods	6	7	4	9	0	0

* Assemblies H12 and H25 have the same information as Assembly H07.

3.0 Methodology

Extensive characterization[1-4] of the Calvert Cliffs and Cooper fuel was made by the Materials Characterization Center (MCC) at the Pacific Northwest Laboratory. The characterization included comparison of measured data to ORIGEN2[5-7] calculated values made at Quality Assurance Impact Level 1. The correlations show quite good agreement between calculated and measured isotopic quantities. However, the calculated-to-measured value for the activity of Cm-243/244 typically was 6% low, a non-conservative result. Cm-244 is the dominant neutron source. The same calculational methods were used for this analysis. The ORIGEN2 code utilized Pacific Northwest National Laboratory's software quality assurance process as defined in the Software Control Procedures (SCPs). The SCP process is an American Society of Mechanical Engineers NQA-1 based program, and has been tested and reviewed in accordance with the appropriate SCP procedural requirements.

The ORIGEN2 models developed under the MCC Project were used to calculate inventories, decay heat, and source terms. Under the MCC Project, detailed irradiation histories were developed for each assembly except for Assembly CZ348. Cycle-average power densities were developed for Assembly CZ348. The calculations were made on an assembly-average basis.

Available information[8] indicates that all three Point Beach assemblies underwent similar irradiation; therefore, a single ORIGEN2 calculation provides the inventories, decay heat, and source terms. Detailed irradiation histories are not available for the Point Beach assemblies. Fuel cycle information in Reference 8 was used to develop cycle-average power densities for the Point Beach fuel. Detailed within-cycle power history has a negligible effect on the results. The ORIGEN2 input files are listed in Appendix A.

During irradiation the axial power distribution is peaked toward the center of the fuel rod. Therefore, the burnup in the central portion of the fuel rod is more than the average burnup and the burnup near the ends of the fuel rod is less than the average burnup. For many considerations the effect of nonuniform burnup is very small and need not be addressed in detail. The buildup of transplutonium isotopes is quite sensitive to nonuniform burnup. It is increasingly important as the number of neutron captures increases. The quantity of transplutonium isotopes is small compared to the residual uranium; however, Cm-244 is the dominant neutron source. Therefore, supplemental ORIGEN2 calculations were made to determine an axial shape for the neutron source and to determine a correction factor for the total neutron source term. Several axial Cs-137 spectral gamma scans were made from ATM-104 fuel rods[2]. These gamma scans closely approximate the axial burnup distribution. A typical gamma scan was used to estimate the peak-to-average value of about 1.09. Consequently, the localized peak burnup is assumed to be 9% greater than the average for the assembly.

Inconel grid spacers and stainless steel end fittings contain cobalt as an impurity. During irradiation, radioactive Co-60 is formed. Each Co-60 decay results in two photons, one with 1.17 MeV of energy and one with 1.33 MeV of energy. The Co-60 activity in the stainless steel end fittings was estimated based on measured values for a burnable poison rod assembly in Point Beach fuel[9], and making corrections for decay time and fuel burnup. The Co-60 activity in the grid spacers was calculated with ORIGEN2 assuming they receive assembly-average neutron fluence. Based on a tabulation of PWR hardware information[10], assumptions were made which maximize the Co-60 activity. The consolidated canister does not contain end fittings or grid spacers, so the Co-60 activity is expected to be negligible in this canister.

4.0 Results

Calculated neutron and photon total source terms and decay heat values for each assembly decayed to June 1996 are given in Table 2. As expected, Assembly D047 has the highest neutron source term; thus, it is considered the worst case. Fission product photons dominate the photon source term in the fuel. The neutron source term is dominated by spontaneous fission of Cm-244. Depending on the assembly, between 92 and 96% of the neutron source term is due to Cm-244. Relative neutron and photon source values are also given in Table 2. Decay heat values and source term values are given in Appendix B for longer decay times.

The June 1996 photon source spectrum for the fuel in Assembly D047 is given in Table 3. The energies listed are mid-point values as used by ORIGEN2. The major contribution to the 0.575 MeV group is from decay of Cs-137. Photon source spectra for longer decay times are given in Appendix B.

Table 2. Source Terms and Decay Heat for LWR Spent Fuel

Assembly ID	D101	D047	H07*	Consolidated	Total
No. of Fuel Rods in Canister	168	139	179	112	956
Decay Heat Rate, watts	328.0	407.0	390.7	337.1	2,244
Neutron Source, n/sec**	6.75E+07	1.84E+08	6.66E+07	7.54E+07	6.32E+08
Relative Neutron Source	0.367	1.000	0.362	0.410	NA
Photon Source, gammas/sec					
Fuel	2.05E+15	2.36E+15	2.41E+15	2.04E+15	1.37E+16
Grid Spacers	8.35E+12	1.23E+13	5.83E+13	0	1.95E+14
Top Nozzle			9.93E+11	0	2.98E+12
Bottom Nozzle	6.88E+11	1.14E+12	8.39E+11	0	4.34E+12
Relative Photon Source					
Fuel	0.870	1.000	1.023	0.867	NA
Grid Spacers	0.143	0.210	1.000	0	NA
Top Nozzle			1.000	0	NA
Bottom Nozzle	0.603	1.000	0.736	0	NA

* Same information for assemblies H-12 and H-25.

** Canister neutron source is increased by 6% to compensate for underpredicting Cm-243/244 activity. Total neutron source is increased by 20% to account for detailed axial shape vs. assembly average.

Table 3. Calculated Photon Source for Assembly D047

E, MeV	Photons/sec
0.010	6.00E+14
0.025	1.21E+14
0.0375	1.58E+14
0.0575	1.23E+14
0.085	6.84E+13
0.125	6.62E+13
0.225	5.70E+13
0.375	2.43E+13
0.575	1.06E+15
0.85	4.68E+13
1.25	3.25E+13
1.75	9.98E+11
2.25	6.88E+08
2.75	2.89E+08
3.5	2.62E+07
5.0	7.46E+06
7.0	8.61E+05
9.5	9.89E+04
Total	2.36E+15

The axial neutron source distribution for Assembly D047 is given in Table 4. The axial distribution for the other canisters is expected to be approximately the same.

Calculated inventories for selected actinides and fission products, and for Co-60 in the grid spacers are given in Appendix C. As expected, Calvert Cliffs Assembly D047 has the most Cm-244, the dominant contributor to the neutron source. The dominant contributor to the photon source, Cs-137, is 1% higher in the Point Beach assemblies than in Assembly D047. Except for Co-60, no estimate of radioactive activation products was made because they are insignificant compared to actinides and fission products. Mass inventories are given in Appendix C for the isotopes corresponding to the list in the curie tables.

Table 4. Axial Neutron Source Distribution

Dist. From Bottom of Fuel, cm	**Relative Source**
0.0	0.026
3.4	0.026
6.9	0.055
10.3	0.108
13.8	0.200
20.7	0.342
27.6	0.547
34.5	0.677
44.8	0.827
62.1	1.000
280.0	1.000
300.7	0.827
311.1	0.677
321.4	0.436
330.0	0.264
335.2	0.148
338.7	0.077
343.8	0.038
349.0	0.038
Average	**0.828**

5.0 References

1. Guenther, R. J., D. E. Blahnik, T. K. Campbell, U. P. Jenquin, J. E. Mendel, L. E. Thomas, and C. K. Thornhill. April 1988. "Characterization of Spent Fuel Approved Testing Material - ATM-103". PNL-5109-103, Pacific Northwest Laboratory, Richland, Washington.

2. Guenther, R. J., D. E. Blahnik, T. K. Campbell, U. P. Jenquin, J. E. Mendel, L. E. Thomas, and C. K. Thornhill. December 1991. "Characterization of Spent Fuel Approved Testing Material - ATM-104". PNL-5109-104, Pacific Northwest Laboratory, Richland, Washington.

3. Guenther, R. J., D. E. Blahnik, T. K. Campbell, U. P. Jenquin, J. E. Mendel, and C. K. Thornhill. October 1988. "Characterization of Spent Fuel Approved Testing Material - ATM-106". PNL-5109-106, Pacific Northwest Laboratory, Richland, Washington.

4. Guenther, R. J., D. E. Blahnik, T. K. Campbell, U. P. Jenquin, J. E. Mendel, L. E. Thomas, and C. K. Thornhill. December 1991. "Characterization of Spent Fuel Approved Testing Material - ATM-105". PNL-5109-105, Pacific Northwest Laboratory, Richland, Washington.

5. Croff, A. G. July 1980. "ORIGEN2 - A Revised and Updated Version of the Oak Ridge Isotope Generation and Depletion Code". ORNL-5621, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

6. Croff, A. G. July 1980. "A User's Manual for the ORIGEN2 Computer Code". ORNL/TM-7175, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

7. Croff, A. G., M. A. Bjerke, G. W. Morrison, and L. M. Petrie. September 1978. "Revised Uranium-Plutonium Cycle PWR and BWR Models for the ORIGEN Computer Code". ORNL/TM-6051, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

8. 1986. "Point Beach Nuclear Plant Unit #1 Fuel Assembly Record for Assemblies H07, H12, and H25". Wisconsin Michigan Power Company, Milwaukee, Wisconsin.

9. Migliore, R. J., B. D. Reid, S. K. Fadeff, K. A. Pauley, and U. P. Jenquin. September 1994. "Non-Fuel Assembly Components: 10 CFR 61.55 Classification for Waste Disposal". PNL-10103, Pacific Northwest Laboratory, Richland, Washington.

10. September 1986. "Nuclear Fuel Data". WTSD-TME-148, Westinghouse Electric Corp., Madison, Pennsylvania.

Appendix A

ORIGEN2 Input Files

```
-1
-1
-1
TIT     PWR Calvert Cliffs - ATM-103 Fuel  E=2.72   30.7 GWD/MTU
BAS     MTU
LIB     0 1 2 3 204 205 206 9 3 0 1 1
PHO     101 102 103 10
LIP     0 0 0
INP     1  1 -1 -1  1  1
RDA     Burnup to 30,700 MWD/MTU
BUP
IRP      100.0    33.06        1  2  4  2
IRP      200.0    33.06        2  3  4  0
IRP      306.0    33.06        3  4  4  0
DEC      377.0                 4  5  4  0
IRP      398.1    25.97        5  6  4  0
IRP      417.6    18.12        6  7  4  0
IRP      527.6    29.37        7  8  4  0
IRP      646.0    29.37        8  9  4  0
DEC      671.0                 9  1  4  0
IRP      759.0    29.37        1  2  4  0
DEC      840.0                 2  3  4  0
IRP      959.1    25.30        3  4  4  0
IRP     1080.9    12.50        4  5  4  0
IRP     1190.9    26.01        5  6  4  0
IRP     1306.0    26.01        6  7  4  0
BUP
BAS     168 Rods
RDA     2.215 KgU/Rod
MOV     7  7  0  .3721
DEC      1.                    7  8  5  2
DEC      5.                    8  9  5  0
DEC      15.7                  9  1  5  0
DEC      19.7                  1  2  5  0
DEC      29.7                  2  3  5  0
DEC      49.7                  3  4  5  0
DEC     119.7                  4  5  5  0
HED     1  June 1996
HED     2  June 2000
HED     3  June 2010
HED     4  June 2030
HED     5  June 2100
OPTA    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTL    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.0-5  7 1.0-10  -1
OUT     5  1  0  0
STP     4
2       922340 221.    922350 27200.   922380 972580.   0 0.0
4        80000 134430.  60000 13.6      70000 27.2      90000 5.7
4       170000 5.7     260000 59.0     470000 1.1      200000 45.4
4       130000 45.4    140000 45.4     280000 28.4     270000 23.2
0
END
```

```
-1
-1
-1
TIT     PWR Calvert Cliffs - ATM-104 Fuel  E=3.038  41.8 GWD/MTU
BAS     MTU
LIB     0 1 2 3 204 205 206 9 3 0 1 1
PHO     101 102 103 10
LIP     0 0 0
INP     1  1 -1 -1  1  1
RDA     Burnup to 41,800 MWD/MTU
BUP
IRP      100.0    32.83        1  2  4  2
IRP      200.0    32.83        2  3  4  0
IRP      306.0    32.83        3  4  4  0
DEC      377.0                 4  5  4  0
IRP      398.9    30.72        5  6  4  0
IRP      418.3    20.38        6  7  4  0
IRP      528.3    31.10        7  8  4  0
IRP      646.0    31.10        8  9  4  0
DEC      671.0                 9  1  4  0
IRP      759.0    31.10        1  2  4  0
DEC      840.0                 2  3  4  0
IRP      958.3    27.23        3  4  4  0
IRP     1080.1    13.41        4  5  4  0
IRP     1190.1    27.21        5  6  4  0
IRP     1306.0    27.21        6  7  4  0
DEC     1391.0                 7  8  4  0
IRP     1506.0    21.40        8  9  4  0
IRP     1621.0    21.40        9  1  4  0
IRP     1736.0    21.40        1  2  4  0
IRP     1852.0    21.40        2  3  4  0
BUP
BAS     126 Rods
RDA     2.215 KgU/Rod
MOV     3  3  0  .2790
DEC      1.                    3  4  5  2
DEC      5.                    4  5  5  0
DEC      14.2                  5  1  5  0
DEC      18.2                  1  2  5  0
DEC      28.2                  2  3  5  0
DEC      48.2                  3  4  5  0
DEC     118.2                  4  5  5  0
HED     1  June 1996
HED     2  June 2000
HED     3  June 2010
HED     4  June 2030
HED     5  June 2100
OPTL    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.0-5  7 1.0-10  -1
OUT     5  1  0  0
STP     4
2       922340 246.   922350 30380.  922380 969370.  0 0.0
```

```
4          80000 134520.   60000 20.4        70000 26.1        90000 5.7
4         170000 5.7      260000 51.1       470000 1.1        200000 36.3
4         130000 36.3     140000 36.3       280000 28.4       270000 30.9
0
END
```

```
-1
-1
-1
TIT      PWR Calvert Cliffs - ATM-106 Fuel  E=2.453  42.7 GWD/MTU
BAS      MTU
LIB      0 1 2 3 204 205 206 9 3 0 1 1
PHO      101 102 103 10
LIP      0 0 0
INP      1 1 -1 -1 1 1
RDA      Burnup to 42,700 MWD/MTU
BUP
IRP       116.0      29.93        1  2  4  2
IRP       232.0      29.93        2  3  4  0
IRP       348.0      29.93        3  4  4  0
IRP       465.0      29.93        4  5  4  0
DEC       498.0                   5  6  4  0
IRP       588.0      28.58        6  7  4  0
IRP       666.7      28.58        7  8  4  0
IRP       730.0      17.44        8  9  4  0
DEC       811.0                   9  1  4  0
IRP       911.0      25.41        1  2  4  0
IRP      1011.0      25.41        2  3  4  0
IRP      1117.0      25.41        3  4  4  0
DEC      1188.0                   4  5  4  0
IRP      1213.0      16.87        5  6  4  0
IRP      1238.3       9.01        6  7  4  0
IRP      1348.3      19.49        7  8  4  0
IRP      1457.0      19.49        8  9  4  0
DEC      1482.0                   9  1  4  0
IRP      1570.0      21.17        1  2  4  0
DEC      1651.0                   2  3  4  0
IRP      1767.7      19.61        3  4  4  0
IRP      1891.6       9.41        4  5  4  0
IRP      2001.6      21.53        5  6  4  0
IRP      2117.0      21.53        6  7  4  0
BUP
BAS      13 Rods
RDA      2.244 KgU/Rod
MOV      7  7  0  .0292
DEC       1.                      7  8  5  2
DEC       5.                      8  9  5  0
DEC       15.7                    9  1  5  0
DEC       19.7                    1  2  5  0
DEC       29.7                    2  3  5  0
DEC       49.7                    3  4  5  0
DEC      119.7                    4  5  5  0
HED      1  June 1996
HED      2  June 2000
HED      3  June 2010
HED      4  June 2030
HED      5  June 2100
OPTL     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
```

```
CUT     5 1.0-5   7 1.0-10   -1
OUT     5  1  0  0
STP     4
2       922340 199.     922350 24530.   922380 975270.   0 0.0
4        80000 134520.   60000 21.6      70000 49.9      90000 11.3
4       170000 11.3     260000 51.1     470000 1.1      200000 45.4
4       130000 45.4     140000 45.4     280000 28.4       0 0.0
0
END
```

```
-1
-1
-1
TIT   BWR Cooper - Assembly CZ346 - ATM-105/108  E=2.50  28.05 GWD/MTU
BAS   MTU
LIB   0 1 2 3 251 252 253 9 3 0 1 4
PHO   101 102 103 10
LIP   0 0 0
INP   1  1 -1 -1  1  1
RDA   Burnup to 28,050 MWD/MTU
BUP
IRP      19    15.63        1  2  4  2
DEC      27                 2  3  4  0
IRP      90    14.21        3  4  4  0
IRP     157    22.74        4  5  4  0
DEC     174                 5  6  4  0
IRP     182    14.21        6  7  4  0
IRP     215    25.58        7  8  4  0
DEC     225                 8  9  4  0
IRP     296    27.01        9  1  4  0
IRP     451    14.21        1  2  4  0
DEC     486                 2  3  4  0
IRP     505    14.21        3  4  4  0
IRP     525    25.58        4  5  4  0
DEC     532                 5  6  4  0
IRP     554    22.74        6  7  4  0
DEC     566                 7  8  4  0
IRP     621    22.74        8  9  4  0
IRP     674    19.89        9  1  4  0
DEC     693                 1  2  4  0
IRP     718    19.89        2  3  4  0
IRP     807    22.74        3  4  4  0
DEC     866                 4  5  4  0
IRP     880    15.46        5  6  4  0
IRP     904    20.98        6  7  4  0
IRP     919    11.04        7  8  4  0
IRP     945    20.99        8  9  4  0
DEC     953                 9  1  4  0
IRP     996    20.99        1  2  4  0
IRP    1001     8.84        2  3  4  0
IRP    1017    20.99        3  4  4  0
DEC    1022                 4  5  4  0
IRP    1044    19.88        5  6  4  0
IRP    1083    13.25        6  7  4  0
IRP    1172    17.67        7  8  4  0
DEC    1203                 8  9  4  0
IRP    1367    16.95        9  1  4  0
DEC    2166                 1  2  4  0
IRP    2189    10.33        2  3  4  0
IRP    2214    11.48        3  4  4  0
IRP    2228     5.74        4  5  4  0
IRP    2326    10.91        5  6  4  0
DEC    2335                 6  7  4  0
IRP    2377    10.91        7  8  4  0
```

```
IRP     2393    11.48          8   9   4   0
IRP     2452    10.91          9   1   4   0
IRP     2483    10.33          1   2   4   0
DEC     2531                   2   3   4   0
IRP     2539     4.37          3   4   4   0
IRP     2548     8.75          4   5   4   0
IRP     2627    10.71          5   6   4   0
DEC     2688                   6   7   4   0
IRP     2743    10.71          7   8   4   0
IRP     2817    10.39          8   9   4   0
DEC     2822                   9   1   4   0
IRP     2853     9.84          1   2   4   0
IRP     2879     8.75          2   3   4   0
BUP
BAS     46 Rods
RDA     3.89 KgU/Rod
MOV     3  3  0  .1789
DEC      1.                    3   4   5   2
DEC      5.                    4   5   5   0
DEC      14.1                  5   1   5   0
DEC      18.1                  1   2   5   0
DEC      28.1                  2   3   5   0
DEC      48.1                  3   4   5   0
DEC     118.1                  4   5   5   0
HED     1  June 1996
HED     2  June 2000
HED     3  June 2010
HED     4  June 2030
HED     5  June 2100
OPTL    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.-5  7 1.-10  -1
OUT     5  1  0  0
STP     4
2       922340 227.     922350 25000.    922380 974773.   0 0.0
4        80000 134470.   60000 20.4       70000 26.1      90000 5.7
4       170000 5.7      260000 51.1      470000 1.1      200000 36.3
4       130000 36.3     140000 36.3      280000 28.4      0 0.0
0
END
```

```
-1
-1
-1
TIT  BWR Cooper-Assembly CZ348-ATM-105/108  E=2.50  27.48 GWD/MTU
BAS   MTU
LIB   0 1 2 3 251 252 253 9 3 0 1 4
PHO   101 102 103 10
LIP   0 0 0
INP   1  1 -1 -1  1  1
RDA   Burnup to 27,480 MWD/MTU
BUP
IRP      200    16.25         1  2  4  2
IRP      400    16.25         2  3  4  0
IRP      600    16.25         3  4  4  0
IRP      806    16.25         4  5  4  0
DEC      866                  5  6  4  0
IRP     1020    19.44         6  7  4  0
IRP     1171    19.44         7  8  4  0
DEC     1202                  8  9  4  0
IRP     1366    18.78         9  1  4  0
DEC     2166                  1  2  4  0
IRP     2482     8.42         2  3  4  0
DEC     2531                  3  4  4  0
IRP     2878     7.81         4  5  4  0
BUP
BAS     49 Rods
RDA     3.89 KgU/Rod
MOV     5  5  0  .1906
DEC      1.                   5  6  5  2
DEC      5.                   6  7  5  0
DEC      14.1                 7  1  5  0
DEC      18.1                 1  2  5  0
DEC      28.1                 2  3  5  0
DEC      48.1                 3  4  5  0
DEC     118.1                 4  5  5  0
HED     1  June 1996
HED     2  June 2000
HED     3  June 2010
HED     4  June 2030
HED     5  June 2100
OPTL    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.-5  7 1.-10  -1
OUT     5  1  0  0
STP     4
2       922340 227.    922350 25000.   922380 974773.   0 0.0
4       80000 134470.  60000 20.4      70000 26.1      90000 5.7
4       170000 5.7     260000 51.1     470000 1.1      200000 36.3
4       130000 36.3    140000 36.3     280000 28.4      0 0.0
0
END
```

```
-1
-1
-1
TIT    PWR - Point Beach Ave. Assembly   E=3.192   32,937 MWD/MTU
BAS    MTU
LIP    0 0 0
LIB    0 1 2 3 204 205 206 9 3 0 1 1
PHO    101 102 103 10
INP    1  1 -1 -1  1  1
MOV    1  1  0  2.4932
RDA    BURNUP TO 32,937 MWD/MTU
BUP
IRP       158    20.541         1   2   4   2
IRP       316    20.541         2   3   4   0
DEC       346                   3   4   4   0
IRP       453    33.071         4   5   4   0
IRP       560    33.071         5   6   4   0
IRP       667    33.071         6   7   4   0
DEC       691                   7   8   4   0
IRP       810    26.204         8   9   4   0
IRP       928    26.204         9   1   4   0
IRP      1047    26.204         1   2   4   0
DEC      1104                   2   3   4   0
IRP      1465     9.482         3   4   4   0
DEC      1497                   4   5   4   0
IRP      1782    10.804         5   6   4   0
BUP
BAS      1 Assembly (401.094 KgU)
RDA      2.241 KgU/Rod
MOV      6  6  0  .401094
DEC       1.                    6   7   5   2
DEC       5.                    7   8   5   0
DEC       14.7                  8   1   5   0
DEC       18.7                  1   2   5   0
DEC       28.7                  2   3   5   0
DEC       48.7                  3   4   5   0
DEC      118.7                  4   5   5   0
HED      1  June 1996
HED      2  June 2000
HED      3  June 2010
HED      4  June 2030
HED      5  June 2100
OPTL     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF     8 8 8 8 7 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT      5 1.-5   7 1.-10   -1
OUT      5  1  0  0
STP      2
2        922340 109.  922350 12803.  922360 80.  922380 388102.
4        270000 60.51  0 0.0
0
END
```

Appendix B

Decay Heat and Source Terms

Table B.1. Decay Heat and Source Terms for Year 2000

Assembly ID	D101	D047	H07*	Consol-idated	Total
Decay Heat Rate, watts	302.5	371.5	356.4	312.1	2,055
Photon Source, g/sec					
Fuel Total	1.84E+15	2.09E+15	2.16E+15	1.83E+15	1.22E+16
Top Nozzle			5.87E+11		1.76E+12
Bottom Nozzle	4.06E+11	6.74E+11	4.96E+11		2.57E+12
Grids - Co-60	4.94E+12	7.24E+12	3.44E+13		1.15E+14
Neutron Source, n/sec**	5.86E+07	1.59E+08	5.78E+07	6.54E+07	5.47E+08

* Same info for assemblies H-12 and H-25.
** Canister neutron source is increased by 6% to compensate for under-predicting Cm-243/244 activity. Total neutron source is increased by 20% to account for detailed axial shape vs. assembly average.

Table B.2. Decay Heat and Source Terms for Year 2010

Assembly ID	D101	D047	H07*	Consol-idated	Total
Decay Heat Rate, watts	253.6	306.6	294.4	263.6	1,707
Photon Source, g/sec					
Fuel Total	1.43E+15	1.62E+15	1.68E+15	1.43E+15	9.52E+15
Top Nozzle			1.58E+11		4.73E+11
Bottom Nozzle	1.09E+11	1.81E+11	1.33E+11		6.89E+11
Grids - Co-60	1.32E+12	1.94E+12	9.24E+12		3.10E+13
Neutron Source, n/sec**	4.13E+07	1.10E+08	4.09E+07	4.61E+07	3.85E+08

* Same info for assemblies H-12 and H-25.
** Canister neutron source is increased by 6% to compensate for under-predicting Cm-243/244 activity. Total neutron source is increased by 20% to account for detailed axial shape vs. assembly average.

Table B.3. Decay Heat and Source Terms for Year 2030

Assembly ID	D101	D047	H07*	Consol-idated	Total
Decay Heat Rate, watts	186.4	220.7	213.7	195.9	1,244
Photon Source, g/sec					
Fuel Total	8.99E+14	1.01E+15	1.05E+15	8.96E+14	5.97E+15
Top Nozzle			1.14E+10		3.41E+10
Bottom Nozzle	7.86E+09	1.30E+10	9.58E+09		4.96E+10
Grids - Co-60	9.54E+10	1.40E+11	6.66E+11		2.23E+12
Neutron Source, n/sec**	2.14E+07	5.46E+07	2.14E+07	2.39E+07	1.97E+08

* Same info for assemblies H-12 and H-25.
** Canister neutron source is increased by 6% to compensate for under-predicting Cm-243/244 activity. Total neutron source is increased by 20% to account for detailed axial shape vs. assembly average.

Table B.4. Decay Heat and Source Terms for Year 2100

Assembly ID	D101	D047	H07*	Consol-idated	Total
Decay Heat Rate, watts	88.6	100.6	98.7	95.9	581
Photon Source, g/sec					
Fuel Total	2.02E+14	2.26E+14	2.34E+14	2.04E+14	1.34E+15
Top Nozzle			1.14E+06		3.42E+06
Bottom Nozzle	7.89E+05	1.31E+06	9.62E+05		4.98E+06
Grids - Co-60	9.58E+06	1.41E+07	6.68E+07		2.24E+08
Neutron Source, n/sec**	4.85E+06	8.96E+06	5.09E+06	5.41E+06	4.14E+07

* Same info for assemblies H-12 and H-25.
** Canister neutron source is increased by 6% to compensate for under-predicting Cm-243/244 activity. Total neutron source is increased by 20% to account for detailed axial shape vs. assembly average.

Table B.5. Calculated Photon Spectra for Assembly D047, photons/sec

E, MeV	June 1996	Year 2000	Year 2010	Year 2030	Year 2100
0.010	6.00E+14	5.43E+14	4.28E+14	2.71E+14	6.48E+13
0.025	1.21E+14	1.08E+14	8.39E+13	5.24E+13	1.11E+13
0.0375	1.58E+14	1.39E+14	1.05E+14	6.34E+13	1.22E+13
0.0575	1.23E+14	1.13E+14	9.39E+13	6.71E+13	2.88E+13
0.085	6.84E+13	6.03E+13	4.58E+13	2.81E+13	5.63E+12
0.125	6.62E+13	5.49E+13	3.67E+13	1.95E+13	3.61E+12
0.225	5.70E+13	5.07E+13	3.86E+13	2.34E+13	4.49E+12
0.375	2.43E+13	2.10E+13	1.59E+13	9.75E+12	1.86E+12
0.575	1.06E+15	9.49E+14	7.46E+14	4.69E+14	9.30E+13
0.85	4.68E+13	2.72E+13	1.15E+13	3.32E+12	3.01E+11
1.25	3.25E+13	2.33E+13	1.06E+13	2.47E+12	1.04E+11
1.75	9.98E+11	7.38E+11	3.57E+11	9.83E+10	7.71E+09
2.25	6.88E+08	7.23E+07	2.69E+07	1.40E+07	2.17E+06
2.75	2.89E+08	2.23E+08	1.99E+08	1.61E+08	7.98E+07
3.5	2.62E+07	1.56E+07	1.04E+07	5.02E+06	6.76E+05
5.0	7.46E+06	6.43E+06	4.43E+06	2.14E+06	2.88E+05
7.0	8.61E+05	7.41E+05	5.11E+05	2.47E+05	3.29E+04
9.5	9.89E+04	8.51E+04	5.87E+04	2.84E+04	3.77E+03
Total	2.36E+15	2.09E+15	1.62E+15	1.01E+15	2.26E+14

Appendix C

Radioactivity and Mass Inventories

Table C.1. LWR Spent Fuel Radioactivity as of June 1996, Ci/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	8.80E+02	8.72E+02	9.20E+02	9.20E+02	9.20E+02	9.44E+02
Am-242	3.65E+00	4.56E+00	6.37E+00	6.37E+00	6.37E+00	1.07E+01
Am-242m	3.66E+00	4.59E+00	6.40E+00	6.40E+00	6.40E+00	1.07E+01
Am-243	6.86E+00	1.28E+01	6.82E+00	6.82E+00	6.82E+00	7.31E+00
Ba-137m	2.33E+04	2.67E+04	2.70E+04	2.70E+04	2.70E+04	2.32E+04
Cd-113m	9.74E+00	1.31E+01	1.05E+01	1.05E+01	1.05E+01	9.01E+00
Cm-242	3.02E+00	3.77E+00	5.27E+00	5.27E+00	5.27E+00	8.82E+00
Cm-243	5.83E+00	1.05E+01	4.68E+00	4.68E+00	4.68E+00	7.33E+00
Cm-244	4.35E+02	1.21E+03	4.26E+02	4.26E+02	4.26E+02	4.84E+02
Co-60	1.13E+02	1.66E+02	7.88E+02	7.88E+02	7.88E+02	1.23E-02
Cs-134	2.44E+02	4.91E+02	3.07E+02	3.07E+02	3.07E+02	2.56E+02
Cs-137	2.47E+04	2.82E+04	2.85E+04	2.85E+04	2.85E+04	2.46E+04
Eu-154	1.04E+03	1.55E+03	1.20E+03	1.20E+03	1.20E+03	1.09E+03
Eu-155	2.53E+02	4.02E+02	2.97E+02	2.97E+02	2.97E+02	2.74E+02
H-3	7.81E+01	9.28E+01	8.86E+01	8.86E+01	8.86E+01	7.48E+01
I-129	1.12E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.15E-02
Kr-85	1.09E+03	1.22E+03	1.31E+03	1.31E+03	1.31E+03	1.02E+03
Np-237	1.07E-01	1.30E-01	1.34E-01	1.34E-01	1.34E-01	1.07E-01
Np-239	6.86E+00	1.28E+01	6.82E+00	6.82E+00	6.82E+00	7.31E+00
Pm-147	6.72E+02	7.66E+02	8.17E+02	8.17E+02	8.17E+02	6.77E+02
Pu-238	8.34E+02	1.36E+03	1.04E+03	1.04E+03	1.04E+03	1.07E+03
Pu-239	1.16E+02	9.78E+01	1.25E+02	1.25E+02	1.25E+02	1.23E+02
Pu-240	1.96E+02	1.92E+02	2.12E+02	2.12E+02	2.12E+02	2.06E+02
Pu-241	2.22E+04	2.44E+04	2.38E+04	2.38E+04	2.38E+04	2.37E+04
Pu-242	6.76E-01	9.39E-01	6.84E-01	6.84E-01	6.84E-01	6.99E-01
Rh-106	3.40E+00	8.43E+00	4.36E+00	4.36E+00	4.36E+00	4.45E+00
Ru-106	3.40E+00	8.42E+00	4.34E+00	4.34E+00	4.34E+00	4.44E+00
Sb-125	9.35E+01	1.30E+02	1.05E+02	1.05E+02	1.05E+02	7.79E+01
Sm-151	1.10E+02	1.06E+02	1.23E+02	1.23E+02	1.23E+02	1.14E+02
Sr-90	1.64E+04	1.78E+04	1.98E+04	1.98E+04	1.98E+04	1.62E+04
Tc-99	4.51E+00	4.86E+00	5.21E+00	5.21E+00	5.21E+00	4.66E+00
Te-125m	2.28E+01	3.17E+01	2.56E+01	2.56E+01	2.56E+01	1.90E+01
U-234	3.57E-01	3.02E-01	4.72E-01	4.72E-01	4.72E-01	4.04E-01
U-235	5.34E-03	2.88E-03	6.91E-03	6.91E-03	6.91E-03	5.38E-03
U-236	8.15E-02	7.95E-02	1.07E-01	1.07E-01	1.07E-01	8.28E-02
U-237	5.44E-01	5.99E-01	5.83E-01	5.83E-01	5.83E-01	5.82E-01
U-238	1.19E-01	9.71E-02	1.27E-01	1.27E-01	1.27E-01	1.30E-01
Y-90	1.64E+04	1.78E+04	1.98E+04	1.98E+04	1.98E+04	1.62E+04
Total	1.09E+05	1.24E+05	1.27E+05	1.27E+05	1.27E+05	1.10E+05

Table C.2. LWR Spent Fuel Radioactivity as of Year 2000, Ci/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	1.00E+03	1.01E+03	1.05E+03	1.05E+03	1.05E+03	1.08E+03
Am-242	3.58E+00	4.48E+00	6.25E+00	6.25E+00	6.25E+00	1.05E+01
Am-242m	3.60E+00	4.50E+00	6.28E+00	6.28E+00	6.28E+00	1.05E+01
Am-243	6.85E+00	1.28E+01	6.82E+00	6.82E+00	6.82E+00	7.30E+00
Ba-137m	2.13E+04	2.43E+04	2.46E+04	2.46E+04	2.46E+04	2.12E+04
Cd-113m	8.05E+00	1.08E+01	8.65E+00	8.65E+00	8.65E+00	7.45E+00
Cm-242	2.97E+00	3.71E+00	5.18E+00	5.18E+00	5.18E+00	8.68E+00
Cm-243	5.29E+00	9.56E+00	4.24E+00	4.24E+00	4.24E+00	6.65E+00
Cm-244	3.73E+02	1.04E+03	3.65E+02	3.65E+02	3.65E+02	4.15E+02
Co-60	6.67E+01	9.79E+01	4.65E+02	4.65E+02	4.65E+02	7.29E-03
Cs-134	6.36E+01	1.28E+02	7.99E+01	7.99E+01	7.99E+01	6.68E+01
Cs-137	2.25E+04	2.57E+04	2.60E+04	2.60E+04	2.60E+04	2.24E+04
Eu-154	7.55E+02	1.12E+03	8.71E+02	8.71E+02	8.71E+02	7.87E+02
Eu-155	1.45E+02	2.30E+02	1.70E+02	1.70E+02	1.70E+02	1.57E+02
H-3	8.12E-06	2.44E-05	7.08E+01	7.08E+01	7.08E+01	8.38E-06
I-129	1.12E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.15E-02
Kr-85	8.44E+02	9.45E+02	1.01E+03	1.01E+03	1.01E+03	7.90E+02
Np-237	1.08E-01	1.31E-01	1.35E-01	1.35E-01	1.35E-01	1.08E-01
Np-239	6.85E+00	1.28E+01	6.82E+00	6.82E+00	6.82E+00	7.30E+00
Pm-147	2.34E+02	2.66E+02	2.84E+02	2.84E+02	2.84E+02	2.35E+02
Pu-238	8.08E+02	1.31E+03	1.01E+03	1.01E+03	1.01E+03	1.03E+03
Pu-239	1.16E+02	9.78E+01	1.25E+02	1.25E+02	1.25E+02	1.23E+02
Pu-240	1.96E+02	1.92E+02	2.12E+02	2.12E+02	2.12E+02	2.06E+02
Pu-241	1.83E+04	2.02E+04	1.96E+04	1.96E+04	1.96E+04	1.96E+04
Pu-242	6.76E-01	9.39E-01	6.84E-01	6.84E-01	6.84E-01	6.99E-01
Rh-106	2.17E-01	5.39E-01	2.78E-01	2.78E-01	2.78E-01	2.84E-01
Ru-106	2.17E-01	5.39E-01	2.78E-01	2.78E-01	2.78E-01	2.84E-01
Sb-125	3.44E+01	4.77E+01	3.85E+01	3.85E+01	3.85E+01	2.86E+01
Sm-151	1.07E+02	1.03E+02	1.19E+02	1.19E+02	1.19E+02	1.11E+02
Sr-90	1.49E+04	1.62E+04	1.80E+04	1.80E+04	1.80E+04	1.47E+04
Tc-99	4.51E+00	4.86E+00	5.21E+00	5.21E+00	5.21E+00	4.66E+00
Te-125m	8.39E+00	1.16E+01	9.40E+00	9.40E+00	9.40E+00	6.99E+00
U-234	3.66E-01	3.17E-01	4.84E-01	4.84E-01	4.84E-01	4.15E-01
U-235	5.34E-03	2.88E-03	6.91E-03	6.91E-03	6.91E-03	5.39E-03
U-236	8.15E-02	7.95E-02	1.07E-01	1.07E-01	1.07E-01	8.28E-02
U-237	4.48E-01	4.94E-01	4.81E-01	4.81E-01	4.81E-01	4.80E-01
U-238	1.19E-01	9.71E-02	1.27E-01	1.27E-01	1.27E-01	1.30E-01
Y-90	1.49E+04	1.62E+04	1.80E+04	1.80E+04	1.80E+04	1.47E+04
Total	9.67E+04	1.09E+05	1.12E+05	1.12E+05	1.12E+05	9.76E+04

Table C.3. LWR Spent Fuel Radioactivity as of Year 2010, Ci/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	1.22E+03	1.25E+03	1.28E+03	1.28E+03	1.28E+03	1.31E+03
Am-242	3.42E+00	4.28E+00	5.97E+00	5.97E+00	5.97E+00	1.00E+01
Am-242m	3.44E+00	4.30E+00	6.00E+00	6.00E+00	6.00E+00	1.01E+01
Am-243	6.85E+00	1.28E+01	6.81E+00	6.81E+00	6.81E+00	7.30E+00
Ba-137m	1.69E+04	1.93E+04	1.95E+04	1.95E+04	1.95E+04	1.68E+04
Cd-113m	5.01E+00	6.74E+00	5.38E+00	5.38E+00	5.38E+00	4.63E+00
Cm-242	2.83E+00	3.54E+00	4.94E+00	4.94E+00	4.94E+00	8.27E+00
Cm-243	4.15E+00	7.50E+00	3.33E+00	3.33E+00	3.33E+00	5.22E+00
Cm-244	2.54E+02	7.09E+02	2.49E+02	2.49E+02	2.49E+02	2.83E+02
Co-60	1.79E+01	2.63E+01	1.25E+02	1.25E+02	1.25E+02	1.96E-03
Cs-134	2.21E+00	4.43E+00	2.77E+00	2.77E+00	2.77E+00	2.32E+00
Cs-137	1.79E+04	2.04E+04	2.07E+04	2.07E+04	2.07E+04	1.78E+04
Eu-154	3.37E+02	5.02E+02	3.89E+02	3.89E+02	3.89E+02	3.51E+02
Eu-155	3.58E+01	5.69E+01	4.19E+01	4.19E+01	4.19E+01	3.88E+01
H-3	4.63E-06	1.39E-05	4.04E+01	4.04E+01	4.04E+01	4.78E-06
I-129	1.12E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.15E-02
Kr-85	4.42E+02	4.95E+02	5.29E+02	5.29E+02	5.29E+02	4.14E+02
Np-237	1.12E-01	1.35E-01	1.39E-01	1.39E-01	1.39E-01	1.12E-01
Np-239	6.85E+00	1.28E+01	6.81E+00	6.81E+00	6.81E+00	7.30E+00
Pm-147	1.66E+01	1.90E+01	2.02E+01	2.02E+01	2.02E+01	1.67E+01
Pu-238	7.47E+02	1.21E+03	9.32E+02	9.32E+02	9.32E+02	9.55E+02
Pu-239	1.16E+02	9.78E+01	1.25E+02	1.25E+02	1.25E+02	1.23E+02
Pu-240	1.96E+02	1.93E+02	2.12E+02	2.12E+02	2.12E+02	2.06E+02
Pu-241	1.13E+04	1.25E+04	1.21E+04	1.21E+04	1.21E+04	1.21E+04
Pu-242	6.76E-01	9.39E-01	6.84E-01	6.84E-01	6.84E-01	6.99E-01
Rh-106	2.25E-04	5.56E-04	2.89E-04	2.89E-04	2.89E-04	2.94E-04
Ru-106	2.25E-04	5.53E-04	2.89E-04	2.89E-04	2.89E-04	2.93E-04
Sb-125	2.82E+00	3.90E+00	3.16E+00	3.16E+00	3.16E+00	2.35E+00
Sm-151	9.88E+01	9.53E+01	1.10E+02	1.10E+02	1.10E+02	1.03E+02
Sr-90	1.18E+04	1.28E+04	1.42E+04	1.42E+04	1.42E+04	1.16E+04
Tc-99	4.51E+00	4.86E+00	5.21E+00	5.21E+00	5.21E+00	4.66E+00
Te-125m	6.87E-01	9.53E-01	7.70E-01	7.70E-01	7.70E-01	5.72E-01
U-234	3.88E-01	3.53E-01	5.11E-01	5.11E-01	5.11E-01	4.44E-01
U-235	5.34E-03	2.88E-03	6.91E-03	6.91E-03	6.91E-03	5.39E-03
U-236	8.16E-02	7.95E-02	1.07E-01	1.07E-01	1.07E-01	8.29E-02
U-237	2.77E-01	3.05E-01	2.97E-01	2.97E-01	2.97E-01	2.96E-01
U-238	1.19E-01	9.71E-02	1.27E-01	1.27E-01	1.27E-01	1.30E-01
Y-90	1.18E+04	1.28E+04	1.42E+04	1.42E+04	1.42E+04	1.16E+04
Total	7.31E+04	8.25E+04	8.47E+04	8.47E+04	8.47E+04	7.37E+04

Table C.4. LWR Spent Fuel Radioactivity as of Year 2030, Ci/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	1.41E+03	1.46E+03	1.49E+03	1.49E+03	1.49E+03	1.51E+03
Am-242	3.12E+00	3.91E+00	5.45E+00	5.45E+00	5.45E+00	9.13E+00
Am-242m	3.14E+00	3.93E+00	5.48E+00	5.48E+00	5.48E+00	9.17E+00
Am-243	6.83E+00	1.28E+01	6.80E+00	6.80E+00	6.80E+00	7.28E+00
Ba-137m	1.06E+04	1.22E+04	1.23E+04	1.23E+04	1.23E+04	1.06E+04
Cd-113m	1.94E+00	2.60E+00	2.08E+00	2.08E+00	2.08E+00	1.79E+00
Cm-242	2.58E+00	3.23E+00	4.51E+00	4.51E+00	4.51E+00	7.55E+00
Cm-243	2.55E+00	4.61E+00	2.05E+00	2.05E+00	2.05E+00	3.21E+00
Cm-244	1.18E+02	3.30E+02	1.16E+02	1.16E+02	1.16E+02	1.32E+02
Co-60	1.29E+00	1.89E+00	9.00E+00	9.00E+00	9.00E+00	1.41E-04
Cs-134	2.67E-03	5.34E-03	3.32E-03	3.32E-03	3.32E-03	2.80E-03
Cs-137	1.13E+04	1.29E+04	1.30E+04	1.30E+04	1.30E+04	1.12E+04
Eu-154	6.72E+01	1.00E+02	7.76E+01	7.76E+01	7.76E+01	7.01E+01
Eu-155	2.19E+00	3.47E+00	2.56E+00	2.56E+00	2.56E+00	2.37E+00
H-3	1.51E-06	4.53E-06	1.31E+01	1.31E+01	1.31E+01	1.55E-06
I-129	1.12E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.15E-02
Kr-85	1.21E+02	1.36E+02	1.45E+02	1.45E+02	1.45E+02	1.14E+02
Np-237	1.20E-01	1.43E-01	1.48E-01	1.48E-01	1.48E-01	1.21E-01
Np-239	6.83E+00	1.28E+01	6.80E+00	6.80E+00	6.80E+00	7.28E+00
Pm-147	8.44E-02	9.61E-02	1.03E-01	1.03E-01	1.03E-01	8.49E-02
Pu-238	6.38E+02	1.04E+03	7.96E+02	7.96E+02	7.96E+02	8.16E+02
Pu-239	1.16E+02	9.77E+01	1.25E+02	1.25E+02	1.25E+02	1.23E+02
Pu-240	1.96E+02	1.93E+02	2.12E+02	2.12E+02	2.12E+02	2.06E+02
Pu-241	4.31E+03	4.76E+03	4.63E+03	4.63E+03	4.63E+03	4.61E+03
Pu-242	6.76E-01	9.39E-01	6.84E-01	6.84E-01	6.84E-01	6.99E-01
Rh-106	2.39E-10	5.89E-10	3.07E-10	3.07E-10	3.07E-10	3.12E-10
Ru-106	2.39E-10	5.89E-10	3.07E-10	3.07E-10	3.07E-10	3.12E-10
Sb-125	1.89E-02	2.62E-02	2.12E-02	2.12E-02	2.12E-02	1.57E-02
Sm-151	8.47E+01	8.17E+01	9.44E+01	9.44E+01	9.44E+01	8.79E+01
Sr-90	7.30E+03	7.93E+03	8.80E+03	8.80E+03	8.80E+03	7.19E+03
Tc-99	4.51E+00	4.86E+00	5.21E+00	5.21E+00	5.21E+00	4.66E+00
Te-125m	4.61E-03	6.39E-03	5.16E-03	5.16E-03	5.16E-03	3.84E-03
U-234	4.27E-01	4.17E-01	5.60E-01	5.60E-01	5.60E-01	4.94E-01
U-235	5.34E-03	2.88E-03	6.91E-03	6.91E-03	6.91E-03	5.39E-03
U-236	8.17E-02	7.97E-02	1.07E-01	1.07E-01	1.07E-01	8.30E-02
U-237	1.06E-01	1.17E-01	1.14E-01	1.14E-01	1.14E-01	1.13E-01
U-238	1.19E-01	9.71E-02	1.27E-01	1.27E-01	1.27E-01	1.30E-01
Y-90	7.31E+03	7.94E+03	8.80E+03	8.80E+03	8.80E+03	7.19E+03
Total	4.36E+04	4.91E+04	5.07E+04	5.07E+04	5.07E+04	4.39E+04

Table C.5. LWR Spent Fuel Radioactivity as of June 2100, Ci/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	1.39E+03	1.44E+03	1.47E+03	1.47E+03	1.47E+03	1.48E+03
Am-242	2.27E+00	2.84E+00	3.96E+00	3.96E+00	3.96E+00	6.63E+00
Am-242m	2.28E+00	2.85E+00	3.98E+00	3.98E+00	3.98E+00	6.67E+00
Am-243	6.79E+00	1.27E+01	6.75E+00	6.75E+00	6.75E+00	7.23E+00
Ba-137m	2.11E+03	2.41E+03	2.44E+03	2.44E+03	2.44E+03	2.10E+03
Cd-113m	6.96E-02	9.36E-02	7.48E-02	7.48E-02	7.48E-02	6.44E-02
Cm-242	1.88E+00	2.35E+00	3.28E+00	3.28E+00	3.28E+00	5.49E+00
Cm-243	4.65E-01	8.40E-01	3.73E-01	3.73E-01	3.73E-01	5.85E-01
Cm-244	8.12E+00	2.26E+01	7.95E+00	7.95E+00	7.95E+00	9.04E+00
Co-60	1.29E-04	1.90E-04	9.02E-04	9.02E-04	9.02E-04	1.41E-08
Cs-134	1.61E-13	3.22E-13	2.00E-13	2.00E-13	2.00E-13	1.69E-13
Cs-137	2.23E+03	2.55E+03	2.58E+03	2.58E+03	2.58E+03	2.22E+03
Eu-154	2.38E-01	3.55E-01	2.75E-01	2.75E-01	2.75E-01	2.49E-01
Eu-155	1.23E-04	1.96E-04	1.44E-04	1.44E-04	1.44E-04	1.34E-04
H-3	2.96E-08	8.90E-08	2.58E-01	2.58E-01	2.58E-01	3.06E-08
I-129	1.12E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.15E-02
Kr-85	1.31E+00	1.47E+00	1.57E+00	1.57E+00	1.57E+00	1.23E+00
Np-237	1.53E-01	1.77E-01	1.82E-01	1.82E-01	1.82E-01	1.56E-01
Np-239	6.79E+00	1.27E+01	6.75E+00	6.75E+00	6.75E+00	7.23E+00
Pm-147	7.84E-10	8.92E-10	9.52E-10	9.52E-10	9.52E-10	7.89E-10
Pu-238	3.68E+02	5.98E+02	4.60E+02	4.60E+02	4.60E+02	4.72E+02
Pu-239	1.16E+02	9.75E+01	1.25E+02	1.25E+02	1.25E+02	1.23E+02
Pu-240	1.95E+02	1.93E+02	2.11E+02	2.11E+02	2.11E+02	2.05E+02
Pu-241	1.48E+02	1.64E+02	1.59E+02	1.59E+02	1.59E+02	1.59E+02
Pu-242	6.76E-01	9.39E-01	6.84E-01	6.84E-01	6.84E-01	6.99E-01
Rh-106	2.98E-31	7.33E-31	3.82E-31	3.82E-31	3.82E-31	3.89E-31
Ru-106	2.98E-31	7.33E-31	3.83E-31	3.83E-31	3.83E-31	3.89E-31
Sb-125	4.66E-10	6.46E-10	5.22E-10	5.22E-10	5.22E-10	3.88E-10
Sm-151	4.94E+01	4.77E+01	5.51E+01	5.51E+01	5.51E+01	5.12E+01
Sr-90	1.38E+03	1.50E+03	1.66E+03	1.66E+03	1.66E+03	1.36E+03
Tc-99	4.51E+00	4.86E+00	5.21E+00	5.21E+00	5.21E+00	4.66E+00
Te-125m	1.14E-10	1.58E-10	1.27E-10	1.27E-10	1.27E-10	9.47E-11
U-234	5.25E-01	5.75E-01	6.82E-01	6.82E-01	6.82E-01	6.18E-01
U-235	5.35E-03	2.89E-03	6.92E-03	6.92E-03	6.92E-03	5.40E-03
U-236	8.21E-02	8.01E-02	1.08E-01	1.08E-01	1.08E-01	8.34E-02
U-237	3.64E-03	4.02E-03	3.91E-03	3.91E-03	3.91E-03	3.90E-03
U-238	1.19E-01	9.71E-02	1.27E-01	1.27E-01	1.27E-01	1.30E-01
Y-90	1.38E+03	1.50E+03	1.66E+03	1.66E+03	1.66E+03	1.36E+03
Total	9.40E+03	1.06E+04	1.09E+04	1.09E+04	1.09E+04	9.59E+03

Table C.6. LWR Spent Fuel Mass as of June 1996, g/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	2.56E+02	2.54E+02	2.68E+02	2.68E+02	2.68E+02	2.75E+02
Am-242	4.51E-06	5.64E-06	7.87E-06	7.87E-06	7.87E-06	1.32E-05
Am-242m	3.77E-01	4.72E-01	6.58E-01	6.58E-01	6.58E-01	1.10E+00
Am-243	3.44E+01	6.43E+01	3.42E+01	3.42E+01	3.42E+01	3.66E+01
Ba-137m	4.34E-05	4.96E-05	5.01E-05	5.01E-05	5.01E-05	4.32E-05
Cd-113m	4.48E-02	6.03E-02	4.82E-02	4.82E-02	4.82E-02	4.15E-02
Cm-242	9.12E-04	1.14E-03	1.59E-03	1.59E-03	1.59E-03	2.67E-03
Cm-243	1.13E-01	2.04E-01	9.06E-02	9.06E-02	9.06E-02	1.42E-01
Cm-244	5.37E+00	1.50E+01	5.26E+00	5.26E+00	5.26E+00	5.98E+00
Co-60	9.97E-02	1.46E-01	6.96E-01	6.96E-01	6.96E-01	1.09E-05
Cs-134	1.88E-01	3.79E-01	2.37E-01	2.37E-01	2.37E-01	1.98E-01
Cs-137	2.83E+02	3.24E+02	3.28E+02	3.28E+02	3.28E+02	2.82E+02
Eu-154	3.86E+00	5.75E+00	4.45E+00	4.45E+00	4.45E+00	4.02E+00
Eu-155	5.44E-01	8.64E-01	6.38E-01	6.38E-01	6.38E-01	5.90E-01
H-3	8.14E-03	9.68E-03	9.24E-03	9.24E-03	9.24E-03	7.80E-03
I-129	6.35E+01	7.14E+01	7.14E+01	7.14E+01	7.14E+01	6.49E+01
Kr-85	2.78E+00	3.11E+00	3.33E+00	3.33E+00	3.33E+00	2.61E+00
Np-237	1.51E+02	1.84E+02	1.90E+02	1.90E+02	1.90E+02	1.51E+02
Np-239	2.95E-05	5.52E-05	2.94E-05	2.94E-05	2.94E-05	3.15E-05
Pm-147	7.24E-01	8.25E-01	8.80E-01	8.80E-01	8.80E-01	7.29E-01
Pu-238	4.87E+01	7.92E+01	6.07E+01	6.07E+01	6.07E+01	6.22E+01
Pu-239	1.87E+03	1.57E+03	2.01E+03	2.01E+03	2.01E+03	1.99E+03
Pu-240	8.59E+02	8.41E+02	9.29E+02	9.29E+02	9.29E+02	9.04E+02
Pu-241	2.15E+02	2.37E+02	2.31E+02	2.31E+02	2.31E+02	2.30E+02
Pu-242	1.77E+02	2.46E+02	1.79E+02	1.79E+02	1.79E+02	1.83E+02
Rh-106	9.53E-10	2.37E-09	1.22E-09	1.22E-09	1.22E-09	1.25E-09
Ru-106	1.01E-03	2.51E-03	1.30E-03	1.30E-03	1.30E-03	1.33E-03
Sb-125	9.05E-02	1.26E-01	1.01E-01	1.01E-01	1.01E-01	7.54E-02
Sm-151	4.18E+00	4.03E+00	4.66E+00	4.66E+00	4.66E+00	4.34E+00
Sr-90	1.20E+02	1.30E+02	1.45E+02	1.45E+02	1.45E+02	1.18E+02
Tc-99	2.66E+02	2.86E+02	3.07E+02	3.07E+02	3.07E+02	2.75E+02
Te-125m	1.27E-03	1.76E-03	1.42E-03	1.42E-03	1.42E-03	1.05E-03
U-234	5.71E+01	4.84E+01	7.56E+01	7.56E+01	7.56E+01	6.46E+01
U-235	2.47E+03	1.33E+03	3.20E+03	3.20E+03	3.20E+03	2.49E+03
U-236	1.26E+03	1.23E+03	1.65E+03	1.65E+03	1.65E+03	1.28E+03
U-237	6.66E-06	7.34E-06	7.14E-06	7.14E-06	7.14E-06	7.12E-06
U-238	3.53E+05	2.89E+05	3.79E+05	3.79E+05	3.79E+05	3.88E+05
Y-90	3.01E-02	3.27E-02	3.63E-02	3.63E-02	3.63E-02	2.97E-02
Total	3.61E+05	2.96E+05	3.89E+05	3.89E+05	3.89E+05	3.96E+05

Table C.7. LWR Spent Fuel Mass as of Year 2000, g/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	2.93E+02	2.94E+02	3.07E+02	3.07E+02	3.07E+02	3.13E+02
Am-242	4.43E-06	5.54E-06	7.73E-06	7.73E-06	7.73E-06	1.29E-05
Am-242m	3.70E-01	4.63E-01	6.46E-01	6.46E-01	6.46E-01	1.08E+00
Am-243	3.44E+01	6.42E+01	3.42E+01	3.42E+01	3.42E+01	3.66E+01
Ba-137m	3.95E-05	4.52E-05	4.57E-05	4.57E-05	4.57E-05	3.94E-05
Cd-113m	3.71E-02	4.99E-02	3.98E-02	3.98E-02	3.98E-02	3.43E-02
Cm-242	8.97E-04	1.12E-03	1.57E-03	1.57E-03	1.57E-03	2.62E-03
Cm-243	1.03E-01	1.85E-01	8.22E-02	8.22E-02	8.22E-02	1.29E-01
Cm-244	4.61E+00	1.28E+01	4.51E+00	4.51E+00	4.51E+00	5.14E+00
Co-60	5.89E-02	8.65E-02	4.11E-01	4.11E-01	4.11E-01	6.44E-06
Cs-134	4.91E-02	9.87E-02	6.17E-02	6.17E-02	6.17E-02	5.16E-02
Cs-137	2.58E+02	2.96E+02	2.99E+02	2.99E+02	2.99E+02	2.57E+02
Eu-154	2.79E+00	4.16E+00	3.22E+00	3.22E+00	3.22E+00	2.91E+00
Eu-155	3.11E-01	4.94E-01	3.65E-01	3.65E-01	3.65E-01	3.37E-01
H-3	8.46E-10	2.54E-09	7.38E-03	7.38E-03	7.38E-03	8.73E-10
I-129	6.35E+01	7.14E+01	7.14E+01	7.14E+01	7.14E+01	6.49E+01
Kr-85	2.15E+00	2.40E+00	2.57E+00	2.57E+00	2.57E+00	2.01E+00
Np-237	1.53E+02	1.86E+02	1.92E+02	1.92E+02	1.92E+02	1.53E+02
Np-239	2.95E-05	5.52E-05	2.94E-05	2.94E-05	2.94E-05	3.15E-05
Pm-147	2.52E-01	2.87E-01	3.06E-01	3.06E-01	3.06E-01	2.53E-01
Pu-238	4.72E+01	7.68E+01	5.89E+01	5.89E+01	5.89E+01	6.03E+01
Pu-239	1.87E+03	1.57E+03	2.01E+03	2.01E+03	2.01E+03	1.99E+03
Pu-240	8.59E+02	8.43E+02	9.29E+02	9.29E+02	9.29E+02	9.04E+02
Pu-241	1.77E+02	1.96E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02
Pu-242	1.77E+02	2.46E+02	1.79E+02	1.79E+02	1.79E+02	1.83E+02
Rh-106	6.09E-11	1.51E-10	7.81E-11	7.81E-11	7.81E-11	7.97E-11
Ru-106	6.48E-05	1.61E-04	8.31E-05	8.31E-05	8.31E-05	8.48E-05
Sb-125	3.33E-02	4.61E-02	3.73E-02	3.73E-02	3.73E-02	2.77E-02
Sm-151	4.05E+00	3.91E+00	4.52E+00	4.52E+00	4.52E+00	4.20E+00
Sr-90	1.09E+02	1.19E+02	1.31E+02	1.31E+02	1.31E+02	1.08E+02
Tc-99	2.66E+02	2.86E+02	3.07E+02	3.07E+02	3.07E+02	2.75E+02
Te-125m	4.65E-04	6.46E-04	5.21E-04	5.21E-04	5.21E-04	3.88E-04
U-234	5.86E+01	5.08E+01	7.74E+01	7.74E+01	7.74E+01	6.65E+01
U-235	2.47E+03	1.33E+03	3.20E+03	3.20E+03	3.20E+03	2.49E+03
U-236	1.26E+03	1.23E+03	1.65E+03	1.65E+03	1.65E+03	1.28E+03
U-237	5.49E-06	6.05E-06	5.89E-06	5.89E-06	5.89E-06	5.88E-06
U-238	3.53E+05	2.89E+05	3.79E+05	3.79E+05	3.79E+05	3.88E+05
Y-90	2.74E-02	2.98E-02	3.30E-02	3.30E-02	3.30E-02	2.70E-02
Total	3.61E+05	2.96E+05	3.89E+05	3.89E+05	3.89E+05	3.96E+05

Table C.8. LWR Spent Fuel Mass as of Year 2010, g/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	3.55E+02	3.63E+02	3.74E+02	3.74E+02	3.74E+02	3.80E+02
Am-242	4.23E-06	5.30E-06	7.39E-06	7.39E-06	7.39E-06	1.24E-05
Am-242m	3.54E-01	4.43E-01	6.18E-01	6.18E-01	6.18E-01	1.03E+00
Am-243	3.43E+01	6.42E+01	3.42E+01	3.42E+01	3.42E+01	3.66E+01
Ba-137m	3.14E-05	3.59E-05	3.63E-05	3.63E-05	3.63E-05	3.12E-05
Cd-113m	2.31E-02	3.10E-02	2.48E-02	2.48E-02	2.48E-02	2.13E-02
Cm-242	8.55E-04	1.07E-03	1.49E-03	1.49E-03	1.49E-03	2.50E-03
Cm-243	8.04E-02	1.45E-01	6.44E-02	6.44E-02	6.44E-02	1.01E-01
Cm-244	3.14E+00	8.76E+00	3.08E+00	3.08E+00	3.08E+00	3.50E+00
Co-60	1.58E-02	2.32E-02	1.10E-01	1.10E-01	1.10E-01	1.73E-06
Cs-134	1.70E-03	3.42E-03	2.14E-03	2.14E-03	2.14E-03	1.79E-03
Cs-137	2.05E+02	2.35E+02	2.37E+02	2.37E+02	2.37E+02	2.04E+02
Eu-154	1.25E+00	1.86E+00	1.44E+00	1.44E+00	1.44E+00	1.30E+00
Eu-155	7.68E-02	1.22E-01	9.01E-02	9.01E-02	9.01E-02	8.33E-02
H-3	4.83E-10	1.45E-09	4.21E-03	4.21E-03	4.21E-03	4.98E-10
I-129	6.35E+01	7.14E+01	7.14E+01	7.14E+01	7.14E+01	6.49E+01
Kr-85	1.12E+00	1.26E+00	1.35E+00	1.35E+00	1.35E+00	1.05E+00
Np-237	1.58E+02	1.91E+02	1.97E+02	1.97E+02	1.97E+02	1.59E+02
Np-239	2.95E-05	5.52E-05	2.93E-05	2.93E-05	2.93E-05	3.15E-05
Pm-147	1.79E-02	2.04E-02	2.18E-02	2.18E-02	2.18E-02	1.80E-02
Pu-238	4.36E+01	7.10E+01	5.44E+01	5.44E+01	5.44E+01	5.58E+01
Pu-239	1.87E+03	1.57E+03	2.01E+03	2.01E+03	2.01E+03	1.99E+03
Pu-240	8.60E+02	8.46E+02	9.29E+02	9.29E+02	9.29E+02	9.05E+02
Pu-241	1.10E+02	1.21E+02	1.18E+02	1.18E+02	1.18E+02	1.17E+02
Pu-242	1.77E+02	2.46E+02	1.79E+02	1.79E+02	1.79E+02	1.83E+02
Rh-106	6.30E-14	1.56E-13	8.10E-14	8.10E-14	8.10E-14	8.25E-14
Ru-106	6.71E-08	1.65E-07	8.62E-08	8.62E-08	8.62E-08	8.76E-08
Sb-125	2.72E-03	3.78E-03	3.05E-03	3.05E-03	3.05E-03	2.27E-03
Sm-151	3.75E+00	3.62E+00	4.18E+00	4.18E+00	4.18E+00	3.89E+00
Sr-90	8.61E+01	9.35E+01	1.04E+02	1.04E+02	1.04E+02	8.48E+01
Tc-99	2.66E+02	2.86E+02	3.07E+02	3.07E+02	3.07E+02	2.75E+02
Te-125m	3.81E-05	5.28E-05	4.27E-05	4.27E-05	4.27E-05	3.17E-05
U-234	6.21E+01	5.65E+01	8.18E+01	8.18E+01	8.18E+01	7.10E+01
U-235	2.47E+03	1.33E+03	3.20E+03	3.20E+03	3.20E+03	2.49E+03
U-236	1.26E+03	1.23E+03	1.65E+03	1.65E+03	1.65E+03	1.28E+03
U-237	3.39E-06	3.74E-06	3.64E-06	3.64E-06	3.64E-06	3.63E-06
U-238	3.53E+05	2.89E+05	3.79E+05	3.79E+05	3.79E+05	3.88E+05
Y-90	2.16E-02	2.35E-02	2.60E-02	2.60E-02	2.60E-02	2.13E-02
Total	3.61E+05	2.96E+05	3.88E+05	3.88E+05	3.88E+05	3.96E+05

Table C.9. LWR Spent Fuel Mass as of Year 2030, g/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	4.10E+02	4.25E+02	4.34E+02	4.34E+02	4.34E+02	4.39E+02
Am-242	3.86E-06	4.83E-06	6.74E-06	6.74E-06	6.74E-06	1.13E-05
Am-242m	3.23E-01	4.04E-01	5.64E-01	5.64E-01	5.64E-01	9.44E-01
Am-243	3.43E+01	6.41E+01	3.41E+01	3.41E+01	3.41E+01	3.65E+01
Ba-137m	1.98E-05	2.26E-05	2.29E-05	2.29E-05	2.29E-05	1.97E-05
Cd-113m	8.92E-03	1.20E-02	9.58E-03	9.58E-03	9.58E-03	8.25E-03
Cm-242	7.81E-04	9.77E-04	1.36E-03	1.36E-03	1.36E-03	2.28E-03
Cm-243	4.94E-02	8.93E-02	3.96E-02	3.96E-02	3.96E-02	6.22E-02
Cm-244	1.46E+00	4.08E+00	1.43E+00	1.43E+00	1.43E+00	1.63E+00
Co-60	1.14E-03	1.67E-03	7.94E-03	7.94E-03	7.94E-03	1.24E-07
Cs-134	2.06E-06	4.13E-06	2.56E-06	2.56E-06	2.56E-06	2.16E-06
Cs-137	1.29E+02	1.48E+02	1.49E+02	1.49E+02	1.49E+02	1.29E+02
Eu-154	2.49E-01	3.71E-01	2.87E-01	2.87E-01	2.87E-01	2.60E-01
Eu-155	4.69E-03	7.46E-03	5.50E-03	5.50E-03	5.50E-03	5.09E-03
H-3	1.57E-10	4.72E-10	1.37E-03	1.37E-03	1.37E-03	1.62E-10
I-129	6.35E+01	7.14E+01	7.14E+01	7.14E+01	7.14E+01	6.49E+01
Kr-85	3.09E-01	3.46E-01	3.70E-01	3.70E-01	3.70E-01	2.89E-01
Np-237	1.71E+02	2.04E+02	2.10E+02	2.10E+02	2.10E+02	1.72E+02
Np-239	2.95E-05	5.51E-05	2.93E-05	2.93E-05	2.93E-05	3.14E-05
Pm-147	9.09E-05	1.04E-04	1.10E-04	1.10E-04	1.10E-04	9.15E-05
Pu-238	3.73E+01	6.06E+01	4.65E+01	4.65E+01	4.65E+01	4.77E+01
Pu-239	1.87E+03	1.57E+03	2.01E+03	2.01E+03	2.01E+03	1.98E+03
Pu-240	8.59E+02	8.49E+02	9.29E+02	9.29E+02	9.29E+02	9.05E+02
Pu-241	4.19E+01	4.62E+01	4.49E+01	4.49E+01	4.49E+01	4.48E+01
Pu-242	1.77E+02	2.46E+02	1.79E+02	1.79E+02	1.79E+02	1.83E+02
Rh-106	6.71E-20	1.65E-19	8.62E-20	8.62E-20	8.62E-20	8.76E-20
Ru-106	7.14E-14	1.76E-13	9.17E-14	9.17E-14	9.17E-14	9.32E-14
Sb-125	1.83E-05	2.53E-05	2.05E-05	2.05E-05	2.05E-05	1.52E-05
Sm-151	3.22E+00	3.10E+00	3.59E+00	3.59E+00	3.59E+00	3.34E+00
Sr-90	5.35E+01	5.81E+01	6.44E+01	6.44E+01	6.44E+01	5.27E+01
Tc-99	2.66E+02	2.86E+02	3.07E+02	3.07E+02	3.07E+02	2.75E+02
Te-125m	2.55E-07	3.54E-07	2.86E-07	2.86E-07	2.86E-07	2.13E-07
U-234	6.84E+01	6.67E+01	8.97E+01	8.97E+01	8.97E+01	7.90E+01
U-235	2.47E+03	1.33E+03	3.20E+03	3.20E+03	3.20E+03	2.49E+03
U-236	1.26E+03	1.23E+03	1.65E+03	1.65E+03	1.65E+03	1.28E+03
U-237	1.30E-06	1.43E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06
U-238	3.53E+05	2.89E+05	3.79E+05	3.79E+05	3.79E+05	3.88E+05
Y-90	1.34E-02	1.46E-02	1.61E-02	1.61E-02	1.61E-02	1.32E-02
Total	3.61E+05	2.96E+05	3.88E+05	3.88E+05	3.88E+05	3.96E+05

Table C.10. LWR Spent Fuel Mass as of Year 2100, g/Canister

	Calvert Cliffs		Point Beach			Consolidated
Nuclide	D101	D047	H-07	H-12	H-25	
Am-241	4.04E+02	4.21E+02	4.27E+02	4.27E+02	4.27E+02	4.33E+02
Am-242	2.81E-06	3.51E-06	4.90E-06	4.90E-06	4.90E-06	8.21E-06
Am-242m	2.35E-01	2.94E-01	4.10E-01	4.10E-01	4.10E-01	6.86E-01
Am-243	3.41E+01	6.37E+01	3.39E+01	3.39E+01	3.39E+01	3.63E+01
Ba-137m	3.92E-06	4.49E-06	4.54E-06	4.54E-06	4.54E-06	3.90E-06
Cd-113m	3.20E-04	4.31E-04	3.44E-04	3.44E-04	3.44E-04	2.97E-04
Cm-242	5.67E-04	7.10E-04	9.91E-04	9.91E-04	9.91E-04	1.66E-03
Cm-243	9.01E-03	1.63E-02	7.22E-03	7.22E-03	7.22E-03	1.13E-02
Cm-244	1.00E-01	2.80E-01	9.83E-02	9.83E-02	9.83E-02	1.12E-01
Co-60	1.14E-07	1.68E-07	7.97E-07	7.97E-07	7.97E-07	1.25E-11
Cs-134	1.24E-16	2.49E-16	1.55E-16	1.55E-16	1.55E-16	1.30E-16
Cs-137	2.56E+01	2.93E+01	2.96E+01	2.96E+01	2.96E+01	2.55E+01
Eu-154	8.82E-04	1.31E-03	1.02E-03	1.02E-03	1.02E-03	9.20E-04
Eu-155	2.64E-07	4.21E-07	3.10E-07	3.10E-07	3.10E-07	2.87E-07
H-3	3.09E-12	9.28E-12	2.69E-05	2.69E-05	2.69E-05	3.19E-12
I-129	6.35E+01	7.14E+01	7.14E+01	7.14E+01	7.14E+01	6.49E+01
Kr-85	3.34E-03	3.74E-03	4.00E-03	4.00E-03	4.00E-03	3.13E-03
Np-237	2.17E+02	2.51E+02	2.59E+02	2.59E+02	2.59E+02	2.21E+02
Np-239	2.93E-05	5.47E-05	2.91E-05	2.91E-05	2.91E-05	3.12E-05
Pm-147	8.45E-13	9.62E-13	1.03E-12	1.03E-12	1.03E-12	8.50E-13
Pu-238	2.15E+01	3.49E+01	2.69E+01	2.69E+01	2.69E+01	2.76E+01
Pu-239	1.87E+03	1.57E+03	2.00E+03	2.00E+03	2.00E+03	1.98E+03
Pu-240	8.54E+02	8.46E+02	9.24E+02	9.24E+02	9.24E+02	9.00E+02
Pu-241	1.44E+00	1.59E+00	1.55E+00	1.55E+00	1.55E+00	1.54E+00
Pu-242	1.77E+02	2.46E+02	1.79E+02	1.79E+02	1.79E+02	1.83E+02
Rh-106	8.36E-41	2.06E-40	1.07E-40	1.07E-40	1.07E-40	1.09E-40
Ru-106	8.89E-35	2.19E-34	1.14E-34	1.14E-34	1.14E-34	1.16E-34
Sb-125	4.51E-13	6.25E-13	5.05E-13	5.05E-13	5.05E-13	3.75E-13
Sm-151	1.88E+00	1.81E+00	2.09E+00	2.09E+00	2.09E+00	1.95E+00
Sr-90	1.01E+01	1.10E+01	1.22E+01	1.22E+01	1.22E+01	9.95E+00
Tc-99	2.66E+02	2.86E+02	3.07E+02	3.07E+02	3.07E+02	2.75E+02
Te-125m	6.30E-15	8.74E-15	7.07E-15	7.07E-15	7.07E-15	5.25E-15
U-234	8.39E+01	9.20E+01	1.09E+02	1.09E+02	1.09E+02	9.89E+01
U-235	2.47E+03	1.34E+03	3.20E+03	3.20E+03	3.20E+03	2.50E+03
U-236	1.27E+03	1.24E+03	1.66E+03	1.66E+03	1.66E+03	1.29E+03
U-237	4.46E-08	4.92E-08	4.78E-08	4.78E-08	4.78E-08	4.77E-08
U-238	3.53E+05	2.89E+05	3.79E+05	3.79E+05	3.79E+05	3.88E+05
Y-90	2.53E-03	2.75E-03	3.05E-03	3.05E-03	3.05E-03	2.50E-03
Total	3.61E+05	2.95E+05	3.88E+05	3.88E+05	3.88E+05	3.96E+05

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