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PROBLEM SPECIFICATION FOR BURNUP CREDIT BENCHMARK PHASE IIIA: CRITICALITY CALCULATIONS OF BWR SPENT FUEL IN STORAGE AND TRANSPORTATION

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Problem Specification for Burnup Credit Benchmark Phase IIIA : Criticality Calculations of BWR Spent Fuel in Storage and Transportation

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December 1995

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1. Introduction

Taking reactivity credit for burned fuel in LWR is a world-wide trend in the field of nuclear criticality safety, which comes from cost-reduction needs. Burnup credit (BUC) criticality benchmark studies for PWR spent fuel have been carried out in the OECD/NEA/BUC working group as Phases I and II. BUC criticality benchmark studies for BWR spent fuel will be made in this Phase III.

The main features of BWR different from PWR in respect to criticality safety calculations are (1) moderator void distribution in a core, and (2) a complicated composition of a fuel assembly.

In BWRs, moderator voids are distributed in a core. Their volume fraction amounts to about 70% near the top region of the core, which makes the neutron energy spectrum hard and Pu production rate high compared to the bottom region where the void volume fraction is almost zero. The average void fraction over the entire core is about 40%.

A fuel assembly of BWR consists of many kinds of fuel rods whose enrichments are different from each other. Some fuel rods contain Gd, which is a strong neutron absorber. And a large water rod is located in the center.

In order to avoid unnecessary complication of the problem, simplified modeling is proposed for criticality calculations. The composition of all the fuel rods in an assembly is assumed to be the same, keeping the water rod in the center. Gadolinium is neglected in this modeling, since its reactivity worth is known to be negligibly small after the irradiation of 20 GWd/tU.

It is noted, however, that the simplified modeling is made only for the purpose of criticality calculation. As is shown in Appendix A, the number densities have been calculated in consideration of moderator void distribution, the complicated configuration of fuel in assembly and the existence of poison.

There are at least two evaluation methods for criticality safety of spent BWR fuels in storage facilities or transportation casks. One is to find the enrichment of fresh fuel to which the

reactivity worth of the burned fuel is equivalent. This method is commonly applied to PWR spent fuels. For this method, the neutron multiplication factors of fresh fuels are to be calculated, and will be surveyed in the benchmark of Phase IIIB.

In this Phase IIIA benchmark, we will seek after the 2nd evaluation method: the fuel assembly is evaluated as if it was irradiated until the average burnup under a high moderation void fraction, e.g. 70%, without consideration of burnup nor void distribution in a core. The number densities of nuclides in a fuel rod are prepared by Toshiba of Japan, and given in Appendix A. The participants are expected to calculate the neutron multiplication factor of an infinite array of assembly for 22 cases.

2. Parameters and Case Numbers

The multiplication factor is requested to calculate for 22 cases in total. The parameters and case numbers are shown in Table 1. For the cases from 15 to 22 FP nuclides (Mo-95, Tc-99, Ru-101, Rh-103, Ag-109, Cs-133, Sm-147, Sm-149, Sm-150, Sm-151, Sm-152, Nd-143, Nd-145, Eu-153 and Gd-155) should be disregarded from the nuclide list shown in Appendix A.

3. Geometry Data

An infinite array of fuel assemblies can be represented as a mirror-reflected assembly on its four faces. The dimensions of the assembly are specified by the following data.

A. Radial Dimensions (see Fig. 1)

Assembly Pitch	: 15.24 cm
Cell Pitch	: 1.63 cm
Fuel Rod Outer Radius	: 0.615 cm
Inner Radius	: 0.529 cm
Fuel Pellet Radius	: 0.529 cm
Fuel Rod Cladding Thickness	: 0.086 cm
Water Rod Outer Radius	: 1.6 cm
Inner Radius	: 1.5 cm

Water Rod Cladding Thickness : 0.1 cm
Channel Box Thickness : 0.254 cm
1/2 Thickness of Water Gap : 0.846 cm
Boundary Condition : Reflective

B. Axial Dimensions (see Fig. 2 and Fig. 3)

Fuel Length : 365.76 cm
Gas Plenum (upper side) : 30.0 cm
End Plug (each side) : 2.0 cm
Water Thickness (each side) : 30.0 cm
Boundary Condition : Vacuum

C. Axial Fuel Modeling (see Fig. 2)

The fuel rod is divided into 9 regions, which are numbered from bottom to top:

Region 1 (Bottom Blanket) : 15.24 cm
Region 2 : 45.72 cm
Region 3 : 121.92 cm
Region 4 : 91.44 cm
Region 5 : 30.48 cm
Region 6 : 15.24 cm
Region 7 : 15.24 cm
Region 8 : 15.24 cm
Region 9 (Top Blanket) : 15.24 cm

4. Material Data(at 300K)

A. Fuel

Fresh Fuel (3.80 wt %) (for Case 1 in Table 1)

Nuclide	Number Density [atom/(barn·cm)]
U-234	7.8161E-06
U-235	8.5393E-04
U-236	5.3079E-06
U-238	2.1365E-02
O	4.4760E-02

Fresh Blanket Fuel (0.71 wt %) (for Case 1 in Table 1)

Nuclide	Number Density [atom/(barn·cm)]
U-234	1.1732E-06
U-235	1.6128E-04
U-236	1.2360E-06
U-238	2.2235E-02
O	4.4797E-02

The number densities of spent fuels are given in Appendix A.

B. Cladding, Channel Box and End Plug

Zircalloy-4

Nuclide	Number Density [atom/(barn·cm)]
Cr	7.5891E-05
Fe	1.4838E-04
Zr	4.2982E-02

C. Gas Plenum

For some members who wish to smear the gas plenum region of a rod, the following data may be used.

Zircalloy-4 (for Fuel Rod)

Nuclide	Number Density [atom/(barn·cm)]
Cr	1.9741E-05
Fe	3.8597E-05
Zr	1.1181E-02

D. Moderator

Water

Nuclide	Number Density [atom/(barn·cm)]
H	6.6621E-02
O	3.3310E-02

5. Requested Information and Results

Please forward the results by E-mail to Dr. H. Okuno of JAERI.

Line No.	Contents
1	Date
2	Institute
3	Contact person
4	E-mail address or telefax number of the contact person
5	Computer code
6-27	Multiplication factors for the studied cases
28-36	Fractional fission densities from Regions 1 to 9 for Case 1
37-45	Fractional fission densities from Regions 1 to 9 for Case 5
46-54	Fractional fission densities from Regions 1 to 9 for Case 6
55-63	Fractional fission densities from Regions 1 to 9 for Case 7
64-72	Fractional fission densities from Regions 1 to 9 for Case 14
73-	Please describe your analysis environment here. It will be included in Phase IIIA report. The description should include: Institute and country, Participants, Neutron data library, Neutron data processing code or method, Neutron energy groups, Description of your code system, Geometry modeling, if any, Omitted or replaced nuclides, if any, Employed convergence limit or statistical errors for the eigen value calculations, Other information, if any.

Note : Definition of Fractional fission density for Region n

$[F.F.D.]_n$ is as follows.

$$[F.F.D.]_n = \frac{\iint dE d\vec{r}_n \Sigma_f(\vec{r}_n, E)\Phi_n(\vec{r}_n, E)}{\sum_{i=1}^{9} \iint dE d\vec{r}_i \Sigma_f(\vec{r}_i, E)\Phi_i(\vec{r}_i, E)}$$

6. Schedule

End March 1996	Results should be at the coordinator
Early June 1996	A first draft report will be prepared and distributed to participants

Table 1 A list of parameters and case numbers

Cooling Time [y]	FPs	Burnup Profile	Void Profile	Case No. Burnup [GWd/tU] 0	20	30	40
1	Yes	Yes	Yes	1	2	3	4
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
		No	Yes		N/A	N/A	N/A
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
	No	Yes	Yes		N/A	N/A	N/A
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
		No	Yes		N/A	N/A	N/A
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
5	Yes	Yes	Yes		5	6	7
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
		No	Yes		N/A	N/A	8
			40% Uniform		9	10	11
			70% Uniform		12	13	14
	No	Yes	Yes		N/A	N/A	15
			40% Uniform		N/A	N/A	N/A
			70% Uniform		N/A	N/A	N/A
		No	Yes		N/A	N/A	16
			40% Uniform		17	18	19
			70% Uniform		20	21	22

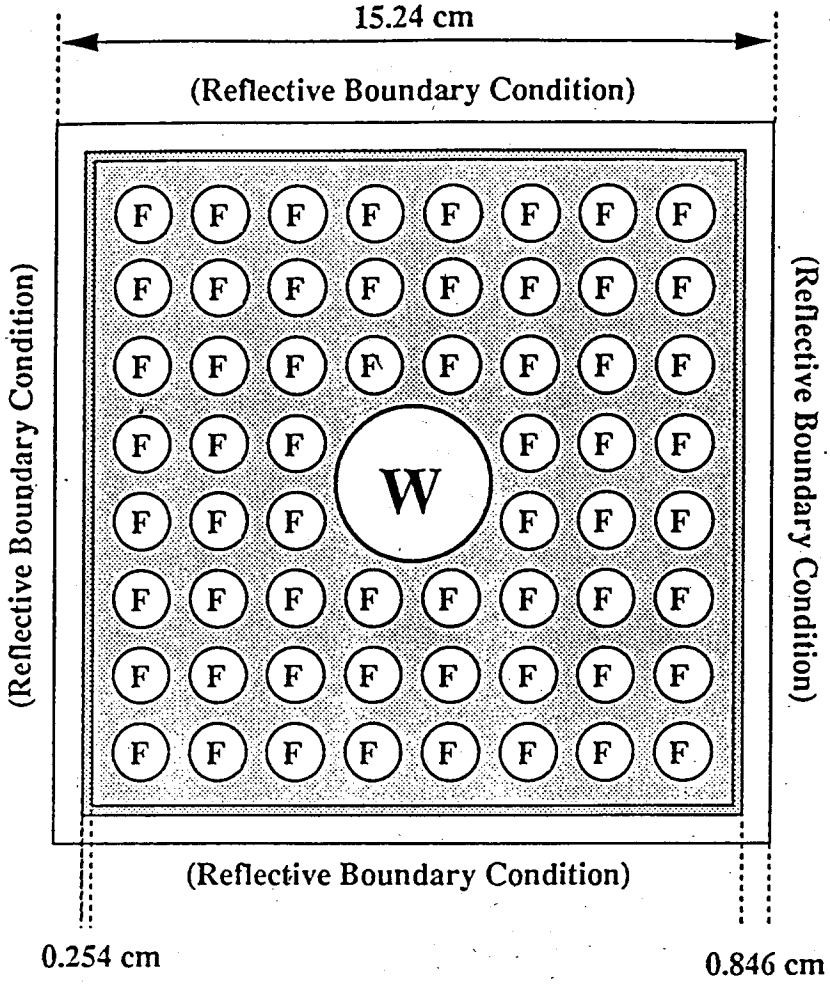
Note N/A: Not Adopted

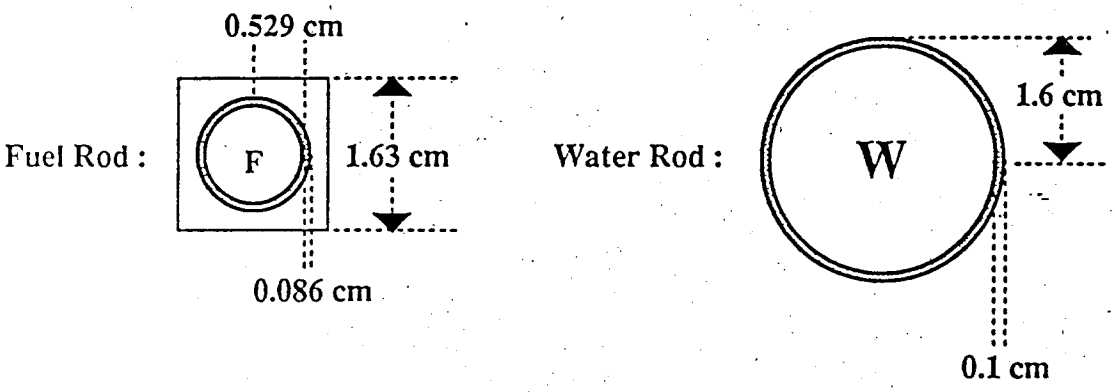
40% and 70% uniform void cases are considered as "Void Profile = No".

Table 2 The data set numbers of the atomic number densities shown in Appendix A applicable for each case to criticality calculation

Case No.	Region No.								
	1	2	3	4	5	6	7	8	9
1	See "Material Data"								
2	1	2	3	4	5	6	7	8	9
3	19	20	21	22	23	24	25	26	27
4	37	38	39	40	41	42	43	44	45
5	10	11	12	13	14	15	16	17	18
6	28	29	30	31	32	33	34	35	36
7	46	47	48	49	50	51	52	53	54
8	55	56	57	58	59	60	61	62	63
9	64	65							64
10	66	67							66
11	68	69							68
12	70	71							70
13	72	73							72
14	74	75							74
15	46	47	48	49	50	51	52	53	54
16	55	56	57	58	59	60	61	62	63
17	64	65							64
18	66	67							66
19	68	69							68
20	70	71							70
21	72	73							72
22	74	75							74

Note: For the cases from 15 to 22, FP nuclides (Mo-95, Tc-99, Ru-101, Rh-103, Ag-109, Cs-133, Sm-147, Sm-149, Sm-150, Sm-151, Sm-152, Nd-143, Nd-145, Eu-153 and Gd-155) should be disregarded from the nuclide list shown in Appendix A.





Geometry Data

Assembly Pitch	= 15.24 cm
Cell Pitch	= 1.63 cm
OuterRadius of Fuel Rod	= 0.615 cm
Inner Radius of Fuel Rod	= 0.529 cm
Cladding Thickness of Fuel Rod	= 0.086 cm
Outer Radius of Water Rod	= 1.6 cm
Inner Radius of Water Rod	= 1.5 cm
Cladding Thickness of Water Rod	= 0.1 cm
Channel BoxThickness	= 0.254 cm
1/2-Thickness of Water Gap	= 0.846 cm

Fig. 1 Radial Dimensions

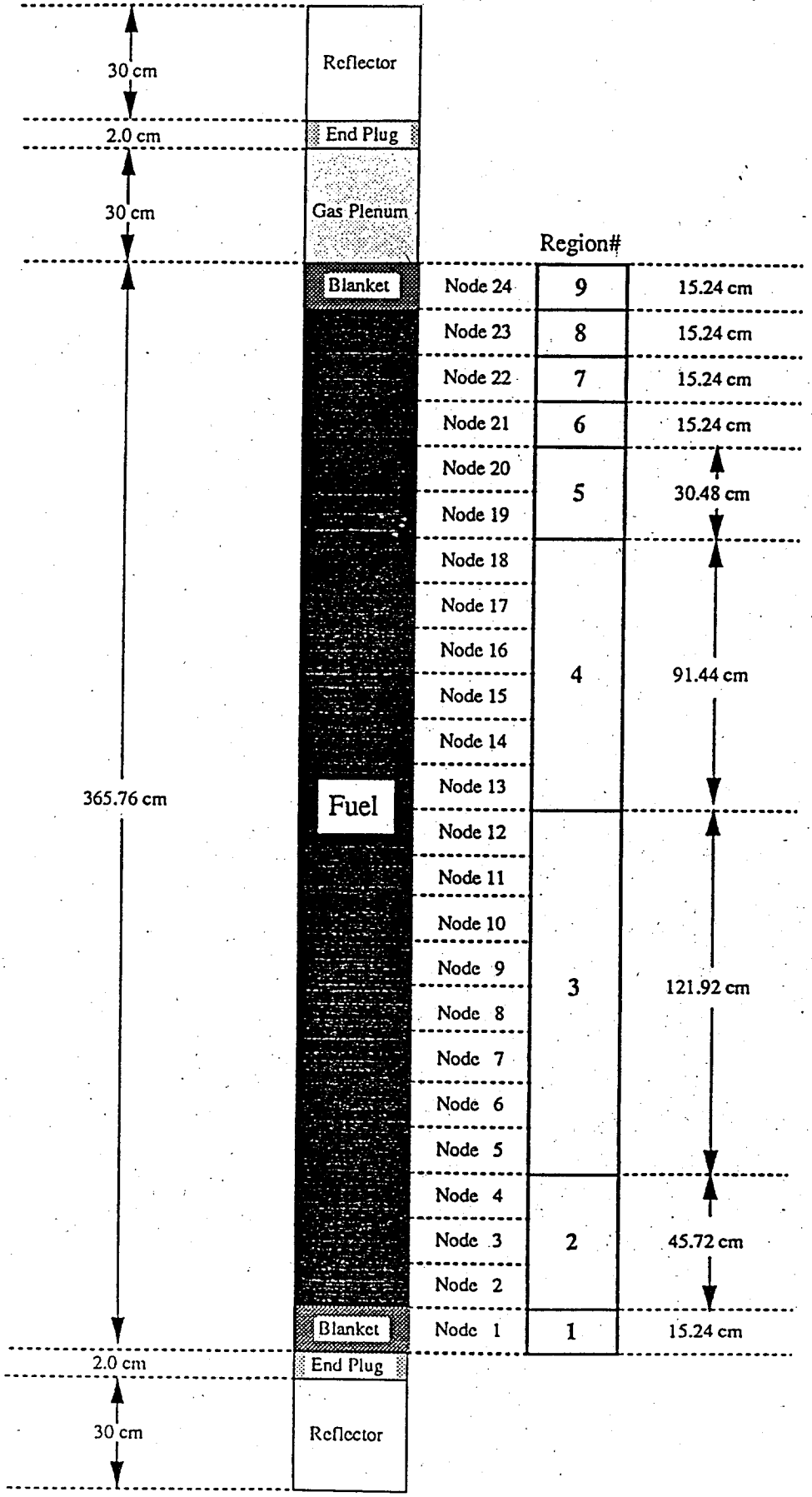


Fig. 2 Axial Dimensions

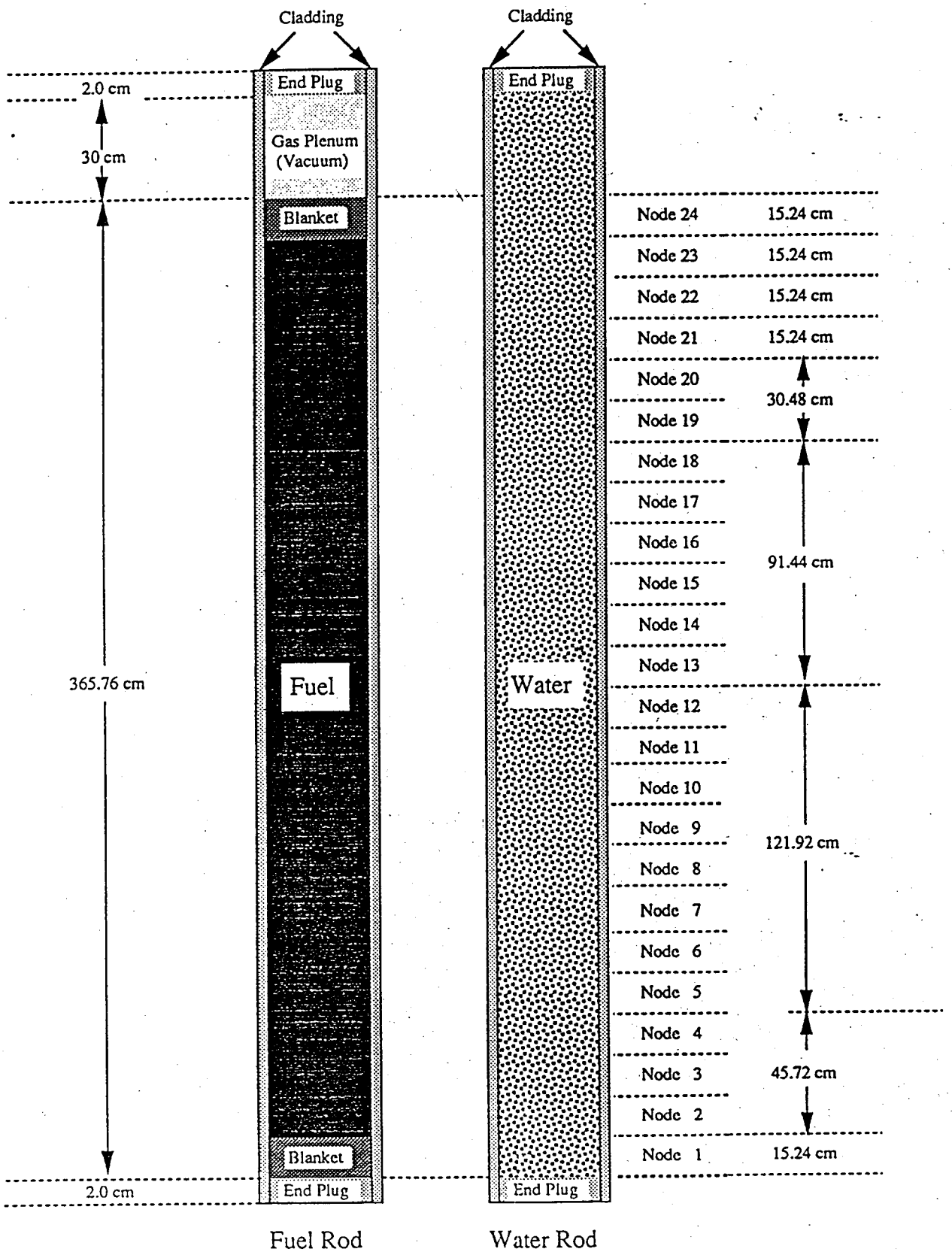


Fig. 3 Axial Structure in Fuel / Water Rod

Appendix A

Atomic Number Densities of Spent Fuels for Analysis of BWR Burnup Credit Criticality Benchmarks

Prepared by Yoshihira Ando

1. Operating History in BWRs

To calculate the fuel composition of spent fuel, void and burnup profiles in BWRs are needed. So, these operating histories were calculated on the assumption of Haling distribution for 4 batch core in which average enrichment is 3.80 w/o in fuel region and a node fuel with natural uranium is set up as the blanket in each side of the fuel. Burnup profile is shown in Fig.A1, and void profile is shown in Fig.A2.

2. Selection of BWR Fuel Assembly

I selected a typical BWR fuel assembly shown in Fig.A3. This type of fuel assembly has been used widely in the USA and Japanese commercial BWR plants. The fuel enrichment distribution shown in Fig.A3 is a typical example in which fuel rod average enrichment is 3.80 w/o. This enrichment is set up based on the fuel design to achieve a batch average exposure of about 40 GWd/tM. A fuel assembly in blanket region is shown in Fig.A4. All fuel rods in this fuel assembly contain natural uranium and the assembly has a large center water rod same as the typical fuel assembly shown in Fig.A3.

For spent fuels of theses assembly, we calculated atomic number densities used in benchmark problems.

3. Method in Calculating Atomic Number Densities of Spent Fuel

I used SPINOZA (Spectrum Induced Nuclear OrganiZation Analysis) system in calculating atomic number densities of spent fuels.

SPINOZA system has been developed in Toshiba. In this system, a user can execute ORIGEN2 calculation with cross section corresponding to neutron spectrum in BWR lattice. The schematic flow diagram of SPINOZA system is shown in Fig.A5.

In calculating the atomic number densities of spent fuels, I assumed burnup and void profiles, which are shown in Table A1 and Table A2, respectively.

4. Results of Calculation

The atomic number densities of the BWR spent fuels calculated according to the above method are shown in Table A3.

Acknowledgments

I would like to express my sincere thanks to Messrs. M. Yamamoto, K. Sakurada and I. Mitsuhashi for their valuable comments and my special thanks to Mr. Y. Hirano for the estimation of void and burnup profiles by 3D BWR core simulation.

Table A1 Burnup Profile in each Case#

Case#	Burnup	BP	VP	Region#	Discharged Burnup	Burnup at EOC (GWd/tM) Cycle-1	Cycle-2	Cycle-3	Cycle-4	Specific Power (Watt/gram) Cycle-1	Cycle-2	Cycle-3	Cycle-4	Data Set#
2&5	20 GWd/tM	Yes	Yes	1	4.646 GWd/tM	2.375	4.646			6.090	5.823			1&10
	"	"	"	2	19.610 "	10.520	19.610			26.975	23.308			2&11
	"	"	"	3	22.767 "	12.213	22.767			31.316	27.062			3&12
	"	"	"	4	22.948 "	12.233	22.948			31.367	27.474			4&13
	"	"	"	5	21.331 "	11.272	21.331			28.903	25.793			5&14
	"	"	"	6	19.116 "	10.085	19.116			25.859	23.157			6&15
	"	"	"	7	16.813 "	8.801	16.813			22.567	20.544			7&16
	"	"	"	8	13.214 "	6.788	13.214			17.405	16.477			8&17
	"	"	"	9	4.893 "	2.405	4.893			6.167	6.379			9&18
3&6	30 GWd/tM	Yes	Yes	1	7.203 GWd/tM	2.558	5.002	7.203		6.559	6.267	5.644		19&28
	"	"	"	2	29.063 "	11.326	21.114	29.063		29.041	25.098	20.383		20&29
	"	"	"	3	33.953 "	13.149	24.512	33.953		33.716	29.136	24.208		21&30
	"	"	"	4	34.461 "	13.171	24.708	34.461		33.772	29.582	25.008		22&31
	"	"	"	5	32.195 "	12.137	22.966	32.195		31.121	27.767	23.664		23&32
	"	"	"	6	28.992 "	10.858	20.582	28.992		27.841	24.934	21.565		24&33
	"	"	"	7	25.627 "	9.476	18.102	25.627		24.298	22.118	19.295		25&34
	"	"	"	8	20.340 "	7.309	14.227	20.340		18.741	17.739	15.675		26&35
	"	"	"	9	7.870 "	2.589	5.267	7.870		6.639	6.867	6.674		27&36
4&7	40 GWd/tM	Yes	Yes	1	9.402 GWd/tM	2.922	5.713	8.227	9.402	7.493	7.156	6.446	3.013	37&46
	"	"	"	2	37.343 "	12.935	24.114	33.194	37.343	33.167	28.664	23.282	10.638	38&47
	"	"	"	3	44.799 "	15.018	27.996	38.674	44.799	38.508	33.277	27.380	15.705	39&48
	"	"	"	4	46.484 "	15.043	28.219	39.359	46.484	38.572	33.785	28.564	18.270	40&49
	"	"	"	5	43.760 "	13.862	26.230	36.771	43.760	35.544	31.713	27.028	17.921	41&50
	"	"	"	6	39.610 "	12.402	23.507	33.112	39.610	31.800	28.474	24.629	16.662	42&51
	"	"	"	7	35.172 "	10.823	20.675	29.269	35.172	27.752	25.262	22.036	15.136	43&52
	"	"	"	8	28.034 "	8.347	16.249	23.231	28.034	21.403	20.262	17.903	12.316	44&53
	"	"	"	9	10.935 "	2.957	6.017	8.988	10.935	7.582	7.846	7.618	4.992	45&54

Table A1 (Cont'd)

Case#	Burnup	BP	VP	Region#	Discharged Burnup	Burnup at EOC (GWd/tM) Cycle-1	Cycle-2	Cycle-3	Cycle-4	Specific Power (Watt/gram) Cycle-1	Cycle-2	Cycle-3	Cycle-4	Data Set#
8	40 GWd/tM	No	Yes	1	40.0 GWd/tM	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	55
	"	"	"	2	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	56
	"	"	"	3	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	57
	"	"	"	4	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	58
	"	"	"	5	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	59
	"	"	"	6	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	60
	"	"	"	7	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	61
	"	"	"	8	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	62
	"	"	"	9	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	63
9&17	20 GWd/tM	No	40VH	1&9	20.0 GWd/tM	10.653	20.000			27.315	23.967			64
	"	"	"	2 ~ 8	"	10.653	20.000			27.315	23.967			65
10&18	30 GWd/tM	"	"	1&9	30.0 GWd/tM	11.465	21.533	30.000		29.398	25.816	21.711		66
	"	"	"	2 ~ 8	"	11.465	21.533	30.000		29.398	25.816	21.711		67
11&19	40 GWd/tM	"	"	1&9	40.0 GWd/tM	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	68
	"	"	"	2 ~ 8	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	69
12&20	20 GWd/tM	"	70VH	1&9	20.0 GWd/tM	10.653	20.000			27.315	23.967			70
	"	"	"	2 ~ 8	"	10.653	20.000			27.315	23.967			71
13&21	30 GWd/tM	"	"	1&9	30.0 GWd/tM	11.465	21.533	30.000		29.398	25.816	21.711		72
	"	"	"	2 ~ 8	"	11.465	21.533	30.000		29.398	25.816	21.711		73
14&22	40 GWd/tM	"	"	1&9	40.0 GWd/tM	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	74
	"	"	"	2 ~ 8	"	13.621	24.594	34.264	40.000	34.926	28.136	24.795	14.708	75

Note: The folloing operation history is assumed in the burnup calculations.
Operation period per cycle is 390 days (13 months).
Outage period per cycle is 90 days (3monts).

Table A2 Axial Void Profile

Region#	*Void Fraction (%) Cycle-1	Cycle-2	Cycle-3	Cycle-4
1	0.000	0.000	0.000	0.000
2	3.230	2.695	2.351	1.986
3	41.051	37.909	34.049	28.243
4	68.228	65.566	62.020	55.886
5	75.710	73.337	70.260	64.827
6	77.661	75.369	72.407	67.171
7	78.687	76.445	73.515	68.377
8	79.489	77.263	74.366	69.260
9	79.936	77.661	74.634	69.511

Table A3 OECD/NEA Burnup Credit Benchmark Phase IIIA : BWR Spent Fuel Benchmarks

Data Set No. 1 Cooling : 1 Year Region# : 1 Burnup = 4.646GWd/tM		Data Set No. 2 Cooling : 1 Year Region# : 2 Burnup = 19.610GWd/tM		Data Set No. 3 Cooling : 1 Year Region# : 3 Burnup = 22.767GWd/tM		Data Set No. 4 Cooling : 1 Year Region# : 4 Burnup = 22.948GWd/tM		Data Set No. 5 Cooling : 1 Year Region# : 5 Burnup = 21.331Gwd/tM	
u-234	1.0199E-06	u-234	6.1832E-06	u-234	5.8184E-06	u-234	5.7004E-06	u-234	5.8062E-06
u-235	8.5538E-05	u-235	4.3234E-04	u-235	3.9335E-04	u-235	4.0334E-04	u-235	4.3132E-04
u-236	1.3079E-05	u-236	7.6962E-05	u-236	8.5178E-05	u-236	8.6091E-05	u-236	8.2021E-05
u-238	2.2128E-02	u-238	2.1143E-02	u-238	2.1073E-02	u-238	2.1042E-02	u-238	2.1058E-02
pu-238	6.3818E-08	pu-238	6.4614E-07	pu-238	1.1306E-06	pu-238	1.3821E-06	pu-238	1.2292E-06
pu-239	4.9183E-05	pu-239	7.9385E-05	pu-239	9.2730E-05	pu-239	1.0417E-04	pu-239	1.0561E-04
pu-240	1.4026E-05	pu-240	2.5223E-05	pu-240	3.1838E-05	pu-240	3.4031E-05	pu-240	3.1975E-05
pu-241	3.0675E-06	pu-241	9.6492E-06	pu-241	1.3855E-05	pu-241	1.5745E-05	pu-241	1.4689E-05
pu-242	4.5546E-07	pu-242	1.9575E-06	pu-242	3.2558E-06	pu-242	3.4944E-06	pu-242	2.9300E-06
am-241	2.4901E-07	am-241	7.8005E-07	am-241	1.1123E-06	am-241	1.2647E-06	am-241	1.1868E-06
am-243	1.2931E-08	am-243	1.4543E-07	am-243	3.3594E-07	am-243	4.2653E-07	am-243	3.4864E-07
np-237	5.0422E-07	np-237	3.7757E-06	np-237	5.2564E-06	np-237	5.9017E-06	np-237	5.4950E-06
mo-95	6.2080E-06	mo-95	2.7067E-05	mo-95	3.0784E-05	mo-95	3.0698E-05	mo-95	2.8623E-05
tc-99	6.4386E-06	tc-99	2.6668E-05	tc-99	3.0641E-05	tc-99	3.0744E-05	tc-99	2.8643E-05
ru-101	5.8948E-06	ru-101	2.3871E-05	ru-101	2.7741E-05	ru-101	2.7962E-05	ru-101	2.6000E-05
rh-103	4.5721E-06	rh-103	1.5408E-05	rh-103	1.7867E-05	rh-103	1.8058E-05	rh-103	1.6878E-05
ag-109	6.0159E-07	ag-109	1.4559E-06	ag-109	1.9589E-06	ag-109	2.1027E-06	ag-109	1.9236E-06
cs-133	7.1873E-06	cs-133	2.9344E-05	cs-133	3.3456E-05	cs-133	3.3443E-05	cs-133	3.1225E-05
sm-147	8.9678E-07	sm-147	3.3537E-06	sm-147	3.5878E-06	sm-147	3.4873E-06	sm-147	3.2989E-06
sm-149	2.0604E-08	sm-149	8.2298E-08	sm-149	9.4319E-08	sm-149	1.0687E-07	sm-149	1.0490E-07
sm-150	1.2228E-06	sm-150	5.1237E-06	sm-150	6.0584E-06	sm-150	6.1436E-06	sm-150	5.7084E-06
sm-151	8.3034E-08	sm-151	3.2064E-07	sm-151	3.7207E-07	sm-151	4.1935E-07	sm-151	4.2587E-07
sm-152	8.9675E-07	sm-152	2.9332E-06	sm-152	3.3250E-06	sm-152	3.2795E-06	sm-152	3.0454E-06
nd-143	5.0075E-06	nd-143	2.1548E-05	nd-143	2.4146E-05	nd-143	2.4369E-05	nd-143	2.3080E-05
nd-145	3.7918E-06	nd-145	1.6180E-05	nd-145	1.8291E-05	nd-145	1.8207E-05	nd-145	1.7014E-05
eu-153	3.6438E-07	eu-153	1.6230E-06	eu-153	2.0982E-06	eu-153	2.1981E-06	eu-153	2.0042E-06
gd-155	5.0457E-09	gd-155	2.0994E-08	gd-155	2.9494E-08	gd-155	3.4196E-08	gd-155	3.2181E-08
o	4.4783E-02	o	4.4745E-02	o	4.4745E-02	o	4.4745E-02	o	4.4745E-02

Table A3 (Cont'd)

Data Set No. 6		Data Set No. 7		Data Set No. 8		Data Set No. 9	
Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year	
Region# : 6		Region# : 7		Region# : 8		Region# : 9	
Burnup = 19.116GWd/tM		Burnup = 16.813GWd/tM		Burnup = 13.214GWd/tM		Burnup = 4.893GWd/tM	
u-234	5.9871E-06	u-234	6.1818E-06	u-234	6.4977E-06	u-234	1.0029E-06
u-235	4.6641E-04	u-235	5.0451E-04	u-235	5.6749E-04	u-235	8.8656E-05
u-236	7.6468E-05	u-236	6.9897E-05	u-236	5.8905E-05	u-236	1.3024E-05
u-238	2.1090E-02	u-238	2.1124E-02	u-238	2.1176E-02	u-238	2.2107E-02
pu-238	9.7533E-07	pu-238	7.3234E-07	pu-238	4.2645E-07	pu-238	1.0028E-07
pu-239	1.0288E-04	pu-239	9.8901E-05	pu-239	8.9804E-05	pu-239	5.7922E-05
pu-240	2.8289E-05	pu-240	2.4318E-05	pu-240	1.7912E-05	pu-240	1.5247E-05
pu-241	1.2736E-05	pu-241	1.0593E-05	pu-241	7.2878E-06	pu-241	4.2876E-06
pu-242	2.2195E-06	pu-242	1.5873E-06	pu-242	8.2810E-07	pu-242	6.0995E-07
am-241	1.0373E-06	am-241	8.6714E-07	am-241	5.9662E-07	am-241	3.4838E-07
am-243	2.3912E-07	am-243	1.5109E-07	am-243	6.1773E-08	am-243	2.7267E-08
np-237	4.8027E-06	np-237	4.0643E-06	np-237	2.9722E-06	np-237	6.9275E-07
mo-95	2.5849E-05	mo-95	2.2928E-05	mo-95	1.8269E-05	mo-95	6.4231E-06
tc-99	2.5778E-05	tc-99	2.2786E-05	tc-99	1.8043E-05	tc-99	6.7505E-06
ru-101	2.3312E-05	ru-101	2.0514E-05	ru-101	1.6127E-05	ru-101	6.2439E-06
rh-103	1.5225E-05	rh-103	1.3486E-05	rh-103	1.0676E-05	rh-103	4.9126E-06
ag-109	1.6514E-06	ag-109	1.3782E-06	ag-109	9.7843E-07	ag-109	6.9462E-07
cs-133	2.8184E-05	cs-133	2.5013E-05	cs-133	1.9835E-05	cs-133	7.5107E-06
sm-147	3.0688E-06	sm-147	2.8052E-06	sm-147	2.3389E-06	sm-147	9.0876E-07
sm-149	1.0628E-07	sm-149	1.0496E-07	sm-149	1.0451E-07	sm-149	2.5061E-08
sm-150	5.0703E-06	sm-150	4.4383E-06	sm-150	3.4246E-06	sm-150	1.3126E-06
sm-151	4.1946E-07	sm-151	4.0436E-07	sm-151	3.7736E-07	sm-151	1.0283E-07
sm-152	2.7425E-06	sm-152	2.4234E-06	sm-152	1.9001E-06	sm-152	9.4018E-07
nd-143	2.1190E-05	nd-143	1.9081E-05	nd-143	1.5551E-05	nd-143	5.2539E-06
nd-145	1.5422E-05	nd-145	1.3733E-05	nd-145	1.1009E-05	nd-145	3.9308E-06
eu-153	1.7239E-06	eu-153	1.4439E-06	eu-153	1.0335E-06	eu-153	4.2074E-07
gd-155	2.8465E-08	gd-155	2.4307E-08	gd-155	1.9574E-08	gd-155	6.2083E-09
o	4.4745E-02	o	4.4745E-02	o	4.4745E-02	o	4.4783E-02

Table A3 (Cont'd)

Data Set No. 10 Cooling : 5 years Region# : 1 Burnup = 4.646GWd/tM		Data Set No. 11 Cooling : 5 years Region# : 2 Burnup = 19.610GWd/tM		Data Set No. 12 Cooling : 5 years Region# : 3 Burnup = 22.767GWd/tM		Data Set No. 13 Cooling : 5 years Region# : 4 Burnup = 22.948GWd/tM		Data Set No. 14 Cooling : 5 years Region# : 5 Burnup = 21.331GWd/tM	
u-234	1.0220E-06	u-234	6.2036E-06	u-234	5.8540E-06	u-234	5.7440E-06	u-234	5.8449E-06
u-235	8.5544E-05	u-235	4.3235E-04	u-235	3.9336E-04	u-235	4.0335E-04	u-235	4.3133E-04
u-236	1.3085E-05	u-236	7.6973E-05	u-236	8.5191E-05	u-236	8.6105E-05	u-236	8.2035E-05
u-238	2.2128E-02	u-238	2.1143E-02	u-238	2.1073E-02	u-238	2.1042E-02	u-238	2.1058E-02
pu-238	6.3963E-08	pu-238	6.3714E-07	pu-238	1.1148E-06	pu-238	1.3617E-06	pu-238	1.2107E-06
pu-239	4.9177E-05	pu-239	7.9376E-05	pu-239	9.2719E-05	pu-239	1.0415E-04	pu-239	1.0559E-04
pu-240	1.4020E-05	pu-240	2.5214E-05	pu-240	3.1832E-05	pu-240	3.4027E-05	pu-240	3.1970E-05
pu-241	2.5303E-06	pu-241	7.9592E-06	pu-241	1.1428E-05	pu-241	1.2987E-05	pu-241	1.2117E-05
pu-242	4.5546E-07	pu-242	1.9575E-06	pu-242	3.2558E-06	pu-242	3.4944E-06	pu-242	2.9300E-06
am-241	7.8289E-07	am-241	2.4595E-06	am-241	3.5238E-06	am-241	4.0051E-06	am-241	3.7434E-06
am-243	1.2926E-08	am-243	1.4538E-07	am-243	3.3581E-07	am-243	4.2637E-07	am-243	3.4851E-07
np-237	5.0760E-07	np-237	3.7863E-06	np-237	5.2716E-06	np-237	5.9190E-06	np-237	5.5111E-06
mo-95	6.2373E-06	mo-95	2.7190E-05	mo-95	3.0924E-05	mo-95	3.0840E-05	mo-95	2.8756E-05
tc-99	6.4386E-06	tc-99	2.6667E-05	tc-99	3.0641E-05	tc-99	3.0744E-05	tc-99	2.8642E-05
ru-101	5.8948E-06	ru-101	2.3871E-05	ru-101	2.7741E-05	ru-101	2.7962E-05	ru-101	2.6000E-05
rh-103	4.5727E-06	rh-103	1.5410E-05	rh-103	1.7870E-05	rh-103	1.8060E-05	rh-103	1.6881E-05
ag-109	6.0159E-07	ag-109	1.4559E-06	ag-109	1.9589E-06	ag-109	2.1027E-06	ag-109	1.9236E-06
cs-133	7.1873E-06	cs-133	2.9344E-05	cs-133	3.3456E-05	cs-133	3.3443E-05	cs-133	3.1225E-05
sm-147	1.6763E-06	sm-147	6.2545E-06	sm-147	6.7057E-06	sm-147	6.5417E-06	sm-147	6.2003E-06
sm-149	2.0604E-08	sm-149	8.2298E-08	sm-149	9.4319E-08	sm-149	1.0687E-07	sm-149	1.0490E-07
sm-150	1.2228E-06	sm-150	5.1237E-06	sm-150	6.0584E-06	sm-150	6.1436E-06	sm-150	5.7084E-06
sm-151	8.0514E-08	sm-151	3.1092E-07	sm-151	3.6078E-07	sm-151	4.0663E-07	sm-151	4.1295E-07
sm-152	8.9677E-07	sm-152	2.9333E-06	sm-152	3.3251E-06	sm-152	3.2796E-06	sm-152	3.0455E-06
nd-143	5.0075E-06	nd-143	2.1548E-05	nd-143	2.4146E-05	nd-143	2.4369E-05	nd-143	2.3080E-05
nd-145	3.7918E-06	nd-145	1.6180E-05	nd-145	1.8291E-05	nd-145	1.8207E-05	nd-145	1.7014E-05
eu-153	3.6439E-07	eu-153	1.6231E-06	eu-153	2.0983E-06	eu-153	2.1982E-06	eu-153	2.0043E-06
gd-155	1.8525E-08	gd-155	7.4457E-08	gd-155	1.0544E-07	gd-155	1.2089E-07	gd-155	1.1201E-07
o	4.4783E-02	o	4.4745E-02	o	4.4745E-02	o	4.4745E-02	o	4.4745E-02

Table A3 (Cont'd)

Data Set No. 15		Data Set No. 16		Data Set No. 17		Data Set No. 18	
Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years	
Region# : 6		Region# : 7		Region# : 8		Region# : 9	
Burnup = 19.116GWd/tM		Burnup = 16.813GWd/tM		Burnup = 13.214GWd/tM		Burnup = 4.893GWd/tM	
u-234	6.0178E-06	u-234	6.2048E-06	u-234	6.5111E-06	u-234	1.0061E-06
u-235	4.6643E-04	u-235	5.0452E-04	u-235	5.6750E-04	u-235	8.8662E-05
u-236	7.6480E-05	u-236	6.9908E-05	u-236	5.8912E-05	u-236	1.3031E-05
u-238	2.1090E-02	u-238	2.1124E-02	u-238	2.1176E-02	u-238	2.2107E-02
pu-238	9.6032E-07	pu-238	7.2071E-07	pu-238	4.1910E-07	pu-238	1.0041E-07
pu-239	1.0287E-04	pu-239	9.8890E-05	pu-239	8.9793E-05	pu-239	5.7915E-05
pu-240	2.8282E-05	pu-240	2.4310E-05	pu-240	1.7906E-05	pu-240	1.5241E-05
pu-241	1.0506E-05	pu-241	8.7375E-06	pu-241	6.0113E-06	pu-241	3.5367E-06
pu-242	2.2195E-06	pu-242	1.5873E-06	pu-242	8.2810E-07	pu-242	6.0995E-07
am-241	3.2540E-06	am-241	2.7107E-06	am-241	1.8650E-06	am-241	1.0946E-06
am-243	2.3903E-07	am-243	1.5103E-07	am-243	6.1750E-08	am-243	2.7257E-08
np-237	4.8167E-06	np-237	4.0761E-06	np-237	2.9803E-06	np-237	6.9747E-07
mo-95	2.5970E-05	mo-95	2.3037E-05	mo-95	1.8357E-05	mo-95	6.4547E-06
tc-99	2.5778E-05	tc-99	2.2786E-05	tc-99	1.8042E-05	tc-99	6.7504E-06
ru-101	2.3312E-05	ru-101	2.0514E-05	ru-101	1.6127E-05	ru-101	6.2439E-06
rh-103	1.5227E-05	rh-103	1.3488E-05	rh-103	1.0677E-05	rh-103	4.9134E-06
ag-109	1.6514E-06	ag-109	1.3782E-06	ag-109	9.7843E-07	ag-109	6.9462E-07
cs-133	2.8184E-05	cs-133	2.5013E-05	cs-133	1.9835E-05	cs-133	7.5107E-06
sm-147	5.7657E-06	sm-147	5.2751E-06	sm-147	4.4088E-06	sm-147	1.7129E-06
sm-149	1.0628E-07	sm-149	1.0496E-07	sm-149	1.0451E-07	sm-149	2.5061E-08
sm-150	5.0703E-06	sm-150	4.4383E-06	sm-150	3.4246E-06	sm-150	1.3126E-06
sm-151	4.0673E-07	sm-151	3.9210E-07	sm-151	3.6591E-07	sm-151	9.9711E-08
sm-152	2.7426E-06	sm-152	2.4235E-06	sm-152	1.9002E-06	sm-152	9.4020E-07
nd-143	2.1190E-05	nd-143	1.9081E-05	nd-143	1.5551E-05	nd-143	5.2539E-06
nd-145	1.5422E-05	nd-145	1.3733E-05	nd-145	1.1009E-05	nd-145	3.9308E-06
eu-153	1.7240E-06	eu-153	1.4440E-06	eu-153	1.0335E-06	eu-153	4.2076E-07
gd-155	9.6328E-08	gd-155	8.0580E-08	gd-155	6.0390E-08	gd-155	2.2655E-08
o	4.4745E-02	o	4.4745E-02	o	4.4745E-02	o	4.4783E-02

Table A3 (Cont'd)

Data Set No. 19		Data Set No. 20		Data Set No. 21		Data Set No. 22		Data Set No. 23	
Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year	
Region# : 1		Region# : 2		Region# : 3		Region# : 4		Region# : 5	
Burnup = 7.203GWd/tM		Burnup = 29.063GWd/tM		Burnup = 33.953GWd/tM		Burnup = 34.461GWd/tM		Burnup = 32.195GWd/tM	
u-234	9.4835E-07	u-234	5.4282E-06	u-234	4.9344E-06	u-234	4.7992E-06	u-234	4.9436E-06
u-235	6.1963E-05	u-235	2.8462E-04	u-235	2.4229E-04	u-235	2.5589E-04	u-235	2.8669E-04
u-236	1.6630E-05	u-236	9.9294E-05	u-236	1.0738E-04	u-236	1.0785E-04	u-236	1.0441E-04
u-238	2.2067E-02	u-238	2.1018E-02	u-238	2.0907E-02	u-238	2.0859E-02	u-238	2.0886E-02
pu-238	1.9531E-07	pu-238	1.7913E-06	pu-238	3.0264E-06	pu-238	3.6381E-06	pu-238	3.2790E-06
pu-239	5.6589E-05	pu-239	8.3830E-05	pu-239	9.5456E-05	pu-239	1.0879E-04	pu-239	1.1248E-04
pu-240	2.3126E-05	pu-240	3.8016E-05	pu-240	4.6146E-05	pu-240	4.9630E-05	pu-240	4.7690E-05
pu-241	6.0263E-06	pu-241	1.6406E-05	pu-241	2.1849E-05	pu-241	2.4833E-05	pu-241	2.4066E-05
pu-242	1.4972E-06	pu-242	5.7668E-06	pu-242	8.9401E-06	pu-242	9.2561E-06	pu-242	7.9120E-06
am-241	6.0738E-07	am-241	1.5699E-06	am-241	2.0320E-06	am-241	2.3064E-06	am-241	2.2569E-06
am-243	6.9490E-08	am-243	6.6740E-07	am-243	1.4037E-06	am-243	1.6833E-06	am-243	1.4041E-06
np-237	8.4998E-07	np-237	6.5448E-06	np-237	8.8905E-06	np-237	9.8565E-06	np-237	9.2705E-06
mo-95	9.2947E-06	mo-95	3.8787E-05	mo-95	4.3993E-05	mo-95	4.4057E-05	mo-95	4.1380E-05
tc-99	9.8662E-06	tc-99	3.8700E-05	tc-99	4.4504E-05	tc-99	4.4887E-05	tc-99	4.2093E-05
ru-101	9.2047E-06	ru-101	3.5337E-05	ru-101	4.1213E-05	ru-101	4.1756E-05	ru-101	3.9033E-05
rh-103	7.1732E-06	rh-103	2.1771E-05	rh-103	2.4958E-05	rh-103	2.5304E-05	rh-103	2.3916E-05
ag-109	1.1114E-06	ag-109	2.6245E-06	ag-109	3.5000E-06	ag-109	3.7339E-06	ag-109	3.4337E-06
cs-133	1.0953E-05	cs-133	4.1936E-05	cs-133	4.7596E-05	cs-133	4.7775E-05	cs-133	4.4939E-05
sm-147	1.5509E-06	sm-147	5.2571E-06	sm-147	5.4377E-06	sm-147	5.2502E-06	sm-147	5.0246E-06
sm-149	1.9827E-08	sm-149	7.0036E-08	sm-149	8.2552E-08	sm-149	9.6179E-08	sm-149	1.0014E-07
sm-150	1.8854E-06	sm-150	7.4417E-06	sm-150	8.7544E-06	sm-150	9.0072E-06	sm-150	8.4080E-06
sm-151	9.6552E-08	sm-151	3.2960E-07	sm-151	3.9208E-07	sm-151	4.5670E-07	sm-151	4.6719E-07
sm-152	1.4252E-06	sm-152	4.1867E-06	sm-152	4.6415E-06	sm-152	4.5703E-06	sm-152	4.2946E-06
nd-143	6.9918E-06	nd-143	2.7884E-05	nd-143	3.0892E-05	nd-143	3.1769E-05	nd-143	3.0633E-05
nd-145	5.6491E-06	nd-145	2.2831E-05	nd-145	2.5651E-05	nd-145	2.5630E-05	nd-145	2.4156E-05
eu-153	6.6378E-07	eu-153	2.8192E-06	eu-153	3.5945E-06	eu-153	3.7524E-06	eu-153	3.4599E-06
gd-155	8.0102E-09	gd-155	3.7672E-08	gd-155	5.5695E-08	gd-155	6.5283E-08	gd-155	6.1132E-08
o	4.4783E-02	o	4.4745E-02	o	4.4744E-02	o	4.4744E-02	o	4.4744E-02

Table A3 (Cont'd)

Data Set No. 24		Data Set No. 25		Data Set No. 26		Data Set No. 27	
Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year	
Region# : 6		Region# : 7		Region# : 8		Region# : 9	
Burnup = 28.992GWd/tM		Burnup = 25.627GWd/tM		Burnup = 20.340GWd/tM		Burnup = 7.870GWd/tM	
u-234	5.1871E-06	u-234	5.4486E-06	u-234	5.8893E-06	u-234	9.2071E-07
u-235	3.2638E-04	u-235	3.7206E-04	u-235	4.4758E-04	u-235	6.5022E-05
u-236	9.8914E-05	u-236	9.1877E-05	u-236	7.9482E-05	u-236	1.6661E-05
u-238	2.0936E-02	u-238	2.0987E-02	u-238	2.1072E-02	u-238	2.2031E-02
pu-238	2.6437E-06	pu-238	2.0405E-06	pu-238	1.1965E-06	pu-238	3.1143E-07
pu-239	1.1205E-04	pu-239	1.1124E-04	pu-239	1.0439E-04	pu-239	6.8824E-05
pu-240	4.3366E-05	pu-240	3.8271E-05	pu-240	3.0404E-05	pu-240	2.5567E-05
pu-241	2.1764E-05	pu-241	1.9188E-05	pu-241	1.3604E-05	pu-241	8.2737E-06
pu-242	6.2085E-06	pu-242	4.6023E-06	pu-242	2.5839E-06	pu-242	1.9503E-06
am-241	2.0779E-06	am-241	1.8542E-06	am-241	1.3655E-06	am-241	8.2258E-07
am-243	1.0044E-06	am-243	6.7503E-07	am-243	2.9473E-07	am-243	1.4408E-07
np-237	8.2058E-06	np-237	7.1016E-06	np-237	5.1808E-06	np-237	1.1942E-06
mo-95	3.7693E-05	mo-95	3.3681E-05	mo-95	2.7352E-05	mo-95	9.9409E-06
tc-99	3.8186E-05	tc-99	3.3956E-05	tc-99	2.7343E-05	tc-99	1.0709E-05
ru-101	3.5199E-05	ru-101	3.1133E-05	ru-101	2.4786E-05	ru-101	1.0101E-05
rh-103	2.1905E-05	rh-103	1.9409E-05	rh-103	1.5998E-05	rh-103	7.9127E-06
ag-109	2.9731E-06	ag-109	2.4851E-06	ag-109	1.8018E-06	ag-109	1.3082E-06
cs-133	4.1013E-05	cs-133	3.6596E-05	cs-133	2.9714E-05	cs-133	1.1821E-05
sm-147	4.7844E-06	sm-147	4.4129E-06	sm-147	3.8859E-06	sm-147	1.5890E-06
sm-149	9.9486E-08	sm-149	9.5801E-08	sm-149	9.9486E-08	sm-149	2.6970E-08
sm-150	7.5661E-06	sm-150	6.6742E-06	sm-150	5.2499E-06	sm-150	2.0954E-06
sm-151	4.5761E-07	sm-151	4.4127E-07	sm-151	4.2192E-07	sm-151	1.2467E-07
sm-152	3.9451E-06	sm-152	3.5108E-06	sm-152	2.8985E-06	sm-152	1.5229E-06
nd-143	2.8675E-05	nd-143	2.6272E-05	nd-143	2.2188E-05	nd-143	7.6312E-06
nd-145	2.2127E-05	nd-145	1.9862E-05	nd-145	1.6296E-05	nd-145	6.0492E-06
eu-153	3.0239E-06	eu-153	2.5971E-06	eu-153	1.8716E-06	eu-153	8.0333E-07
gd-155	5.2041E-08	gd-155	4.6128E-08	gd-155	3.1544E-08	gd-155	1.0590E-08
o	4.4744E-02	o	4.4744E-02	o	4.4745E-02	o	4.4782E-02

Table A3 (Cont'd)

Data Set No. 28 Cooling : 5 years Region# : 1 Burnup = 7.203GWd/tM		Data Set No. 29 Cooling : 5 years Region# : 2 Burnup = 29.063GWd/tM		Data Set No. 30 Cooling : 5 years Region# : 3 Burnup = 33.953GWd/tM		Data Set No. 31 Cooling : 5 years Region# : 4 Burnup = 34.461GWd/tM		Data Set No. 32 Cooling : 5 years Region# : 5 Burnup = 32.195GWd/tM	
u-234	9.5465E-07	u-234	5.4848E-06	u-234	5.0300E-06	u-234	4.9140E-06	u-234	5.0471E-06
u-235	6.1969E-05	u-235	2.8463E-04	u-235	2.4230E-04	u-235	2.5590E-04	u-235	2.8671E-04
u-236	1.6640E-05	u-236	9.9310E-05	u-236	1.0740E-04	u-236	1.0787E-04	u-236	1.0443E-04
u-238	2.2067E-02	u-238	2.1018E-02	u-238	2.0907E-02	u-238	2.0859E-02	u-238	2.0886E-02
pu-238	1.9746E-07	pu-238	1.7710E-06	pu-238	2.9884E-06	pu-238	3.5886E-06	pu-238	3.2343E-06
pu-239	5.6583E-05	pu-239	8.3821E-05	pu-239	9.5446E-05	pu-239	1.0878E-04	pu-239	1.1247E-04
pu-240	2.3117E-05	pu-240	3.8017E-05	pu-240	4.6176E-05	pu-240	4.9677E-05	pu-240	4.7724E-05
pu-241	4.9709E-06	pu-241	1.3532E-05	pu-241	1.8022E-05	pu-241	2.0484E-05	pu-241	1.9851E-05
pu-242	1.4972E-06	pu-242	5.7667E-06	pu-242	8.9401E-06	pu-242	9.2560E-06	pu-242	7.9120E-06
am-241	1.6555E-06	am-241	4.4237E-06	am-241	5.8330E-06	am-241	6.6266E-06	am-241	6.4436E-06
am-243	6.9464E-08	am-243	6.6715E-07	am-243	1.4032E-06	am-243	1.6826E-06	am-243	1.4036E-06
np-237	8.5738E-07	np-237	6.5644E-06	np-237	8.9162E-06	np-237	9.8857E-06	np-237	9.2990E-06
mo-95	9.3218E-06	mo-95	3.8890E-05	mo-95	4.4112E-05	mo-95	4.4179E-05	mo-95	4.1496E-05
tc-99	9.8661E-06	tc-99	3.8699E-05	tc-99	4.4503E-05	tc-99	4.4886E-05	tc-99	4.2092E-05
ru-101	9.2047E-06	ru-101	3.5337E-05	ru-101	4.1213E-05	ru-101	4.1756E-05	ru-101	3.9033E-05
rh-103	7.1738E-06	rh-103	2.1773E-05	rh-103	2.4960E-05	rh-103	2.5306E-05	rh-103	2.3919E-05
ag-109	1.1114E-06	ag-109	2.6245E-06	ag-109	3.5000E-06	ag-109	3.7339E-06	ag-109	3.4337E-06
cs-133	1.0953E-05	cs-133	4.1936E-05	cs-133	4.7596E-05	cs-133	4.7775E-05	cs-133	4.4939E-05
sm-147	2.5055E-06	sm-147	8.4046E-06	sm-147	8.7516E-06	sm-147	8.5139E-06	sm-147	8.1786E-06
sm-149	1.9827E-08	sm-149	7.0036E-08	sm-149	8.2552E-08	sm-149	9.6179E-08	sm-149	1.0014E-07
sm-150	1.8854E-06	sm-150	7.4417E-06	sm-150	8.7544E-06	sm-150	9.0072E-06	sm-150	8.4080E-06
sm-151	9.3622E-08	sm-151	3.1961E-07	sm-151	3.8019E-07	sm-151	4.4285E-07	sm-151	4.5302E-07
sm-152	1.4252E-06	sm-152	4.1868E-06	sm-152	4.6416E-06	sm-152	4.5703E-06	sm-152	4.2947E-06
nd-143	6.9918E-06	nd-143	2.7884E-05	nd-143	3.0892E-05	nd-143	3.1769E-05	nd-143	3.0633E-05
nd-145	5.6491E-06	nd-145	2.2831E-05	nd-145	2.5651E-05	nd-145	2.5630E-05	nd-145	2.4156E-05
eu-153	6.6380E-07	eu-153	2.8193E-06	eu-153	3.5947E-06	eu-153	3.7526E-06	eu-153	3.4600E-06
gd-155	2.9300E-08	gd-155	1.3543E-07	gd-155	2.0132E-07	gd-155	2.3360E-07	gd-155	2.1603E-07
o	4.4783E-02	o	4.4745E-02	o	4.4744E-02	o	4.4744E-02	o	4.4744E-02

Table A3 (Cont'd)

Data Set No. 33 Cooling : 5 years Region# : 6 Burnup = 28.992GWd/tM		Data Set No. 34 Cooling : 5 years Region# : 7 Burnup = 25.627GWd/tM		Data Set No. 35 Cooling : 5 years Region# : 8 Burnup = 20.340GWd/tM		Data Set No. 36 Cooling : 5 years Region# : 9 Burnup = 7.870GWd/tM	
u-234	5.2705E-06	u-234	5.5130E-06	u-234	5.9270E-06	u-234	9.3073E-07
u-235	3.2639E-04	u-235	3.7207E-04	u-235	4.4759E-04	u-235	6.5029E-05
u-236	9.8932E-05	u-236	9.1893E-05	u-236	7.9494E-05	u-236	1.6672E-05
u-238	2.0936E-02	u-238	2.0987E-02	u-238	2.1072E-02	u-238	2.2031E-02
pu-238	2.6083E-06	pu-238	2.0133E-06	pu-238	1.1805E-06	pu-238	3.1401E-07
pu-239	1.1204E-04	pu-239	1.1123E-04	pu-239	1.0438E-04	pu-239	6.8816E-05
pu-240	4.3382E-05	pu-240	3.8275E-05	pu-240	3.0398E-05	pu-240	2.5558E-05
pu-241	1.7952E-05	pu-241	1.5827E-05	pu-241	1.1221E-05	pu-241	6.8246E-06
pu-242	6.2085E-06	pu-242	4.6023E-06	pu-242	2.5839E-06	pu-242	1.9503E-06
am-241	5.8638E-06	am-241	5.1919E-06	am-241	3.7314E-06	am-241	2.2616E-06
am-243	1.0040E-06	am-243	6.7478E-07	am-243	2.9462E-07	am-243	1.4402E-07
np-237	8.2317E-06	np-237	7.1246E-06	np-237	5.1974E-06	np-237	1.2042E-06
mo-95	3.7800E-05	mo-95	3.3778E-05	mo-95	2.7433E-05	mo-95	9.9725E-06
tc-99	3.8186E-05	tc-99	3.3956E-05	tc-99	2.7342E-05	tc-99	1.0709E-05
ru-101	3.5199E-05	ru-101	3.1133E-05	ru-101	2.4786E-05	ru-101	1.0101E-05
rh-103	2.1907E-05	rh-103	1.9411E-05	rh-103	1.6000E-05	rh-103	7.9135E-06
ag-109	2.9731E-06	ag-109	2.4851E-06	ag-109	1.8018E-06	ag-109	1.3082E-06
cs-133	4.1013E-05	cs-133	3.6596E-05	cs-133	2.9714E-05	cs-133	1.1821E-05
sm-147	7.7782E-06	sm-147	7.1614E-06	sm-147	6.3296E-06	sm-147	2.6073E-06
sm-149	9.9486E-08	sm-149	9.5801E-08	sm-149	9.9486E-08	sm-149	2.6970E-08
sm-150	7.5661E-06	sm-150	6.6742E-06	sm-150	5.2499E-06	sm-150	2.0954E-06
sm-151	4.4373E-07	sm-151	4.2788E-07	sm-151	4.0912E-07	sm-151	1.2089E-07
sm-152	3.9452E-06	sm-152	3.5110E-06	sm-152	2.8986E-06	sm-152	1.5229E-06
nd-143	2.8675E-05	nd-143	2.6272E-05	nd-143	2.2188E-05	nd-143	7.6312E-06
nd-145	2.2127E-05	nd-145	1.9862E-05	nd-145	1.6296E-05	nd-145	6.0492E-06
eu-153	3.0240E-06	eu-153	2.5973E-06	eu-153	1.8716E-06	eu-153	8.0337E-07
gd-155	1.8158E-07	gd-155	1.5426E-07	gd-155	1.0290E-07	gd-155	3.8543E-08
o	4.4744E-02	o	4.4744E-02	o	4.4745E-02	o	4.4782E-02

Table A3 (Cont'd)

Data Set No. 37 Cooling : 1 Year Region# : 1 Burnup = 9.402GWd/tM		Data Set No. 38 Cooling : 1 Year Region# : 2 Burnup = 37.343GWd/tM		Data Set No. 39 Cooling : 1 Year Region# : 3 Burnup = 44.799GWd/tM		Data Set No. 40 Cooling : 1 Year Region# : 4 Burnup = 46.484GWd/tM		Data Set No. 41 Cooling : 1 Year Region# : 5 Burnup = 43.760GWd/tM	
u-234	8.9316E-07	u-234	4.7794E-06	u-234	4.1324E-06	u-234	3.9567E-06	u-234	4.1262E-06
u-235	4.7044E-05	u-235	1.8309E-04	u-235	1.3806E-04	u-235	1.4794E-04	u-235	1.7496E-04
u-236	1.8779E-05	u-236	1.1291E-04	u-236	1.1947E-04	u-236	1.2067E-04	u-236	1.1852E-04
u-238	2.2014E-02	u-238	2.0893E-02	u-238	2.0721E-02	u-238	2.0643E-02	u-238	2.0681E-02
pu-238	3.9591E-07	pu-238	3.3592E-06	pu-238	5.7679E-06	pu-238	7.1191E-06	pu-238	6.5197E-06
pu-239	6.0080E-05	pu-239	8.2042E-05	pu-239	9.3844E-05	pu-239	1.0856E-04	pu-239	1.1237E-04
pu-240	3.0090E-05	pu-240	4.8865E-05	pu-240	5.5755E-05	pu-240	5.9750E-05	pu-240	6.1451E-05
pu-241	8.2373E-06	pu-241	1.9312E-05	pu-241	2.6717E-05	pu-241	3.1481E-05	pu-241	3.0057E-05
pu-242	2.8953E-06	pu-242	1.0878E-05	pu-242	1.6727E-05	pu-242	1.7670E-05	pu-242	1.5346E-05
am-241	1.1394E-06	am-241	2.4274E-06	am-241	2.9588E-06	am-241	3.3857E-06	am-241	3.3245E-06
am-243	1.8343E-07	am-243	1.6446E-06	am-243	3.5433E-06	am-243	4.3119E-06	am-243	3.5608E-06
np-237	1.1820E-06	np-237	8.9794E-06	np-237	1.2348E-05	np-237	1.3835E-05	np-237	1.3028E-05
mo-95	1.1846E-05	mo-95	4.8236E-05	mo-95	5.5368E-05	mo-95	5.7227E-05	mo-95	5.4391E-05
tc-99	1.2770E-05	tc-99	4.8713E-05	tc-99	5.7114E-05	tc-99	5.8626E-05	tc-99	5.5425E-05
ru-101	1.2071E-05	ru-101	4.5325E-05	ru-101	5.4050E-05	ru-101	5.5792E-05	ru-101	5.2582E-05
rh-103	9.3130E-06	rh-103	2.6530E-05	rh-103	3.0186E-05	rh-103	3.0919E-05	rh-103	2.9806E-05
ag-109	1.5925E-06	ag-109	3.8299E-06	ag-109	5.1908E-06	ag-109	5.6225E-06	ag-109	5.2277E-06
cs-133	1.4091E-05	cs-133	5.2010E-05	cs-133	5.9569E-05	cs-133	6.0628E-05	cs-133	5.7770E-05
sm-147	2.2814E-06	sm-147	7.0633E-06	sm-147	6.9677E-06	sm-147	6.6474E-06	sm-147	6.5196E-06
sm-149	1.8732E-08	sm-149	5.4246E-08	sm-149	6.4430E-08	sm-149	7.8322E-08	sm-149	8.4438E-08
sm-150	2.4384E-06	sm-150	9.3869E-06	sm-150	1.1313E-05	sm-150	1.1792E-05	sm-150	1.1151E-05
sm-151	1.0567E-07	sm-151	3.4006E-07	sm-151	4.0252E-07	sm-151	4.7410E-07	sm-151	4.9572E-07
sm-152	1.8562E-06	sm-152	5.1202E-06	sm-152	5.6516E-06	sm-152	5.5805E-06	sm-152	5.3196E-06
nd-143	8.3795E-06	nd-143	3.1297E-05	nd-143	3.4029E-05	nd-143	3.5809E-05	nd-143	3.5667E-05
nd-145	7.1624E-06	nd-145	2.8015E-05	nd-145	3.1676E-05	nd-145	3.2074E-05	nd-145	3.0621E-05
eu-153	9.5742E-07	eu-153	3.9352E-06	eu-153	5.0452E-06	eu-153	5.3119E-06	eu-153	4.9732E-06
gd-155	1.1242E-08	gd-155	5.8059E-08	gd-155	8.7854E-08	gd-155	1.0494E-07	gd-155	1.0012E-07
o	4.4782E-02	o	4.4744E-02	o	4.4743E-02	o	4.4742E-02	o	4.4743E-02

Table A3 (Cont'd)

Data Set No. 42		Data Set No. 43		Data Set No. 44		Data Set No. 45	
Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year		Cooling : 1 Year	
Region# : 6		Region# : 7		Region# : 8		Region# : 9	
Burnup = 39.610GWd/tM		Burnup = 35.172GWd/tM		Burnup = 28.034GWd/tM		Burnup = 10.935GWd/tM	
u-234	4.4053E-06	u-234	4.7290E-06	u-234	5.2743E-06	u-234	8.4967E-07
u-235	2.1240E-04	u-235	2.5636E-04	u-235	3.3906E-04	u-235	4.7942E-05
u-236	1.1461E-04	u-236	1.0892E-04	u-236	9.6955E-05	u-236	1.9093E-05
u-238	2.0752E-02	u-238	2.0831E-02	u-238	2.0952E-02	u-238	2.1953E-02
pu-238	5.4505E-06	pu-238	4.2608E-06	pu-238	2.6019E-06	pu-238	6.8245E-07
pu-239	1.1501E-04	pu-239	1.1389E-04	pu-239	1.1112E-04	pu-239	7.4602E-05
pu-240	5.6927E-05	pu-240	5.2463E-05	pu-240	4.2812E-05	pu-240	3.4753E-05
pu-241	2.8695E-05	pu-241	2.5554E-05	pu-241	2.0001E-05	pu-241	1.1791E-05
pu-242	1.2426E-05	pu-242	9.5884E-06	pu-242	5.7014E-06	pu-242	4.0054E-06
am-241	3.2401E-06	am-241	2.9909E-06	am-241	2.4621E-06	am-241	1.4979E-06
am-243	2.7026E-06	am-243	1.8540E-06	am-243	8.8087E-07	am-243	4.0952E-07
np-237	1.1862E-05	np-237	1.0296E-05	np-237	7.8097E-06	np-237	1.7401E-06
mo-95	5.0053E-05	mo-95	4.4523E-05	mo-95	3.6555E-05	mo-95	1.3392E-05
tc-99	5.0713E-05	tc-99	4.5562E-05	tc-99	3.6985E-05	tc-99	1.4691E-05
ru-101	4.7724E-05	ru-101	4.2528E-05	ru-101	3.4057E-05	ru-101	1.4068E-05
rh-103	2.7753E-05	rh-103	2.5393E-05	rh-103	2.1176E-05	rh-103	1.0790E-05
ag-109	4.5743E-06	ag-109	3.8874E-06	ag-109	2.8365E-06	ag-109	1.9838E-06
cs-133	5.3247E-05	cs-133	4.8312E-05	cs-133	3.9766E-05	cs-133	1.6075E-05
sm-147	6.3411E-06	sm-147	6.0944E-06	sm-147	5.5237E-06	sm-147	2.3798E-06
sm-149	8.6026E-08	sm-149	8.6962E-08	sm-149	9.0403E-08	sm-149	2.6642E-08
sm-150	1.0044E-05	sm-150	8.9726E-06	sm-150	7.1744E-06	sm-150	2.8798E-06
sm-151	4.8702E-07	sm-151	4.7418E-07	sm-151	4.5654E-07	sm-151	1.4456E-07
sm-152	4.9360E-06	sm-152	4.5492E-06	sm-152	3.8247E-06	sm-152	2.0662E-06
nd-143	3.4181E-05	nd-143	3.2130E-05	nd-143	2.7990E-05	nd-143	9.6495E-06
nd-145	2.8378E-05	nd-145	2.5879E-05	nd-145	2.1522E-05	nd-145	8.0952E-06
eu-153	4.4407E-06	eu-153	3.8541E-06	eu-153	2.8836E-06	eu-153	1.2432E-06
gd-155	8.7631E-08	gd-155	7.2071E-08	gd-155	5.1440E-08	gd-155	1.6411E-08
o	4.4743E-02	o	4.4743E-02	o	4.4744E-02	o	4.4782E-02

Table A3 (Cont'd)

Data Set No. 46		Data Set No. 47		Data Set No. 48		Data Set No. 49		Data Set No. 50	
Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years	
Region# : 1		Region# : 2		Region# : 3		Region# : 4		Region# : 5	
Burnup = 9.402GWd/tM		Burnup = 37.343GWd/tM		Burnup = 44.799GWd/tM		Burnup = 46.484GWd/tM		Burnup = 43.760GWd/tM	
u-234	9.0581E-07	u-234	4.8851E-06	u-234	4.3140E-06	u-234	4.1808E-06	u-234	4.3315E-06
u-235	4.7051E-05	u-235	1.8310E-04	u-235	1.3808E-04	u-235	1.4795E-04	u-235	1.7497E-04
u-236	1.8792E-05	u-236	1.1293E-04	u-236	1.1949E-04	u-236	1.2070E-04	u-236	1.1854E-04
u-238	2.2014E-02	u-238	2.0893E-02	u-238	2.0721E-02	u-238	2.0643E-02	u-238	2.0681E-02
pu-238	3.9592E-07	pu-238	3.3036E-06	pu-238	5.6718E-06	pu-238	6.9986E-06	pu-238	6.4108E-06
pu-239	6.0073E-05	pu-239	8.2034E-05	pu-239	9.3835E-05	pu-239	1.0855E-04	pu-239	1.1236E-04
pu-240	3.0080E-05	pu-240	4.8902E-05	pu-240	5.5911E-05	pu-240	5.9979E-05	pu-240	6.1625E-05
pu-241	6.7946E-06	pu-241	1.5930E-05	pu-241	2.2037E-05	pu-241	2.5967E-05	pu-241	2.4793E-05
pu-242	2.8953E-06	pu-242	1.0878E-05	pu-242	1.6727E-05	pu-242	1.7670E-05	pu-242	1.5346E-05
am-241	2.5700E-06	am-241	5.7831E-06	am-241	7.6037E-06	am-241	8.8595E-06	am-241	8.5501E-06
am-243	1.8336E-07	am-243	1.6439E-06	am-243	3.5420E-06	am-243	4.3103E-06	am-243	3.5594E-06
np-237	1.1941E-06	np-237	9.0061E-06	np-237	1.2382E-05	np-237	1.3875E-05	np-237	1.3067E-05
mo-95	1.1860E-05	mo-95	4.8287E-05	mo-95	5.5441E-05	mo-95	5.7311E-05	mo-95	5.4474E-05
tc-99	1.2770E-05	tc-99	4.8712E-05	tc-99	5.7113E-05	tc-99	5.8625E-05	tc-99	5.5424E-05
ru-101	1.2071E-05	ru-101	4.5325E-05	ru-101	5.4050E-05	ru-101	5.5792E-05	ru-101	5.2582E-05
rh-103	9.3134E-06	rh-103	2.6531E-05	rh-103	3.0188E-05	rh-103	3.0921E-05	rh-103	2.9808E-05
ag-109	1.5925E-06	ag-109	3.8299E-06	ag-109	5.1908E-06	ag-109	5.6225E-06	ag-109	5.2277E-06
cs-133	1.4091E-05	cs-133	5.2010E-05	cs-133	5.9569E-05	cs-133	6.0628E-05	cs-133	5.7770E-05
sm-147	3.2155E-06	sm-147	9.8947E-06	sm-147	9.9599E-06	sm-147	9.6611E-06	sm-147	9.5113E-06
sm-149	1.8732E-08	sm-149	5.4246E-08	sm-149	6.4430E-08	sm-149	7.8322E-08	sm-149	8.4438E-08
sm-150	2.4384E-06	sm-150	9.3869E-06	sm-150	1.1313E-05	sm-150	1.1792E-05	sm-150	1.1151E-05
sm-151	1.0247E-07	sm-151	3.2974E-07	sm-151	3.9031E-07	sm-151	4.5972E-07	sm-151	4.8068E-07
sm-152	1.8563E-06	sm-152	5.1203E-06	sm-152	5.6517E-06	sm-152	5.5806E-06	sm-152	5.3197E-06
nd-143	8.3795E-06	nd-143	3.1297E-05	nd-143	3.4029E-05	nd-143	3.5809E-05	nd-143	3.5667E-05
nd-145	7.1624E-06	nd-145	2.8015E-05	nd-145	3.1676E-05	nd-145	3.2074E-05	nd-145	3.0621E-05
eu-153	9.5745E-07	eu-153	3.9353E-06	eu-153	5.0453E-06	eu-153	5.3121E-06	eu-153	4.9734E-06
gd-155	3.9360E-08	gd-155	2.0147E-07	gd-155	3.1243E-07	gd-155	3.7193E-07	gd-155	3.4969E-07
o	4.4782E-02	o	4.4744E-02	o	4.4743E-02	o	4.4742E-02	o	4.4743E-02

Table A3 (Cont'd)

Data Set No. 51		Data Set No. 52		Data Set No. 53		Data Set No. 54	
Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years	
Region# : 6		Region# : 7		Region# : 8		Region# : 9	
Burnup = 39.610GWd/tM		Burnup = 35.172GWd/tM		Burnup = 28.034GWd/tM		Burnup = 10.935GWd/tM	
u-234	4.5770E-06	u-234	4.8633E-06	u-234	5.3563E-06	u-234	8.7151E-07
u-235	2.1241E-04	u-235	2.5637E-04	u-235	3.3908E-04	u-235	4.7951E-05
u-236	1.1464E-04	u-236	1.0894E-04	u-236	9.6973E-05	u-236	1.9107E-05
u-238	2.0752E-02	u-238	2.0831E-02	u-238	2.0952E-02	u-238	2.1953E-02
pu-238	5.3629E-06	pu-238	4.1951E-06	pu-238	2.5635E-06	pu-238	6.8371E-07
pu-239	1.1500E-04	pu-239	1.1388E-04	pu-239	1.1111E-04	pu-239	7.4594E-05
pu-240	5.7038E-05	pu-240	5.2521E-05	pu-240	4.2823E-05	pu-240	3.4747E-05
pu-241	2.3669E-05	pu-241	2.1078E-05	pu-241	1.6498E-05	pu-241	9.7258E-06
pu-242	1.2426E-05	pu-242	9.5884E-06	pu-242	5.7015E-06	pu-242	4.0054E-06
am-241	8.2285E-06	am-241	7.4325E-06	am-241	5.9379E-06	am-241	3.5466E-06
am-243	2.7016E-06	am-243	1.8533E-06	am-243	8.8054E-07	am-243	4.0937E-07
np-237	1.1899E-05	np-237	1.0330E-05	np-237	7.8371E-06	np-237	1.7565E-06
mo-95	5.0131E-05	mo-95	4.4595E-05	mo-95	3.6617E-05	mo-95	1.3415E-05
tc-99	5.0712E-05	tc-99	4.5561E-05	tc-99	3.6984E-05	tc-99	1.4691E-05
ru-101	4.7724E-05	ru-101	4.2528E-05	ru-101	3.4057E-05	ru-101	1.4068E-05
rh-103	2.7755E-05	rh-103	2.5394E-05	rh-103	2.1177E-05	rh-103	1.0791E-05
ag-109	4.5743E-06	ag-109	3.8874E-06	ag-109	2.8365E-06	ag-109	1.9838E-06
cs-133	5.3247E-05	cs-133	4.8312E-05	cs-133	3.9766E-05	cs-133	1.6075E-05
sm-147	9.2384E-06	sm-147	8.8762E-06	sm-147	8.0336E-06	sm-147	3.4643E-06
sm-149	8.6026E-08	sm-149	8.6962E-08	sm-149	9.0403E-08	sm-149	2.6642E-08
sm-150	1.0044E-05	sm-150	8.9726E-06	sm-150	7.1744E-06	sm-150	2.8798E-06
sm-151	4.7225E-07	sm-151	4.5980E-07	sm-151	4.4269E-07	sm-151	1.4017E-07
sm-152	4.9361E-06	sm-152	4.5493E-06	sm-152	3.8249E-06	sm-152	2.0663E-06
nd-143	3.4181E-05	nd-143	3.2130E-05	nd-143	2.7990E-05	nd-143	9.6495E-06
nd-145	2.8378E-05	nd-145	2.5879E-05	nd-145	2.1522E-05	nd-145	8.0952E-06
eu-153	4.4408E-06	eu-153	3.8543E-06	eu-153	2.8837E-06	eu-153	1.2432E-06
gd-155	3.0132E-07	gd-155	2.4553E-07	gd-155	1.6692E-07	gd-155	5.8320E-08
o	4.4743E-02	o	4.4743E-02	o	4.4744E-02	o	4.4782E-02

Table A3 (Cont'd)

Data Set No. 55 Cooling : 5 years Region# : 1 Burnup = 40.000GWd/tM		Data Set No. 56 Cooling : 5 years Region# : 2 Burnup = 40.000GWd/tM		Data Set No. 57 Cooling : 5 years Region# : 3 Burnup = 40.000GWd/tM		Data Set No. 58 Cooling : 5 years Region# : 4 Burnup = 40.000GWd/tM		Data Set No. 59 Cooling : 5 years Region# : 5 Burnup = 40.000GWd/tM	
u-234	5.0581E-07	u-234	4.6844E-06	u-234	4.6311E-06	u-234	4.5758E-06	u-234	4.5592E-06
u-235	1.1809E-06	u-235	1.5694E-04	u-235	1.7915E-04	u-235	2.0054E-04	u-235	2.0728E-04
u-236	2.1143E-05	u-236	1.1591E-04	u-236	1.1523E-04	u-236	1.1525E-04	u-236	1.1491E-04
u-238	2.1252E-02	u-238	2.0847E-02	u-238	2.0806E-02	u-238	2.0762E-02	u-238	2.0748E-02
pu-238	3.0132E-06	pu-238	3.8990E-06	pu-238	4.5127E-06	pu-238	5.2103E-06	pu-238	5.4295E-06
pu-239	6.6743E-05	pu-239	8.2723E-05	pu-239	9.4722E-05	pu-239	1.0919E-04	pu-239	1.1414E-04
pu-240	6.3645E-05	pu-240	5.0326E-05	pu-240	5.3213E-05	pu-240	5.6085E-05	pu-240	5.7124E-05
pu-241	1.7260E-05	pu-241	1.7602E-05	pu-241	1.9978E-05	pu-241	2.2792E-05	pu-241	2.3598E-05
pu-242	3.6914E-05	pu-242	1.2861E-05	pu-242	1.2953E-05	pu-242	1.2847E-05	pu-242	1.2720E-05
am-241	5.6121E-06	am-241	6.1142E-06	am-241	7.0024E-06	am-241	8.0292E-06	am-241	8.3283E-06
am-243	8.9638E-06	am-243	2.1496E-06	am-243	2.4217E-06	am-243	2.6900E-06	am-243	2.7729E-06
np-237	3.9404E-06	np-237	9.9345E-06	np-237	1.0864E-05	np-237	1.1774E-05	np-237	1.1989E-05
mo-95	4.1714E-05	mo-95	5.1084E-05	mo-95	5.0553E-05	mo-95	4.9953E-05	mo-95	4.9759E-05
tc-99	4.8941E-05	tc-99	5.1780E-05	tc-99	5.1573E-05	tc-99	5.1314E-05	tc-99	5.1222E-05
ru-101	5.1073E-05	ru-101	4.8476E-05	ru-101	4.8399E-05	ru-101	4.8269E-05	ru-101	4.8212E-05
rh-103	2.7745E-05	rh-103	2.7738E-05	rh-103	2.8027E-05	rh-103	2.8100E-05	rh-103	2.8057E-05
ag-109	7.9643E-06	ag-109	4.2392E-06	ag-109	4.4219E-06	ag-109	4.5909E-06	ag-109	4.6365E-06
cs-133	4.9820E-05	cs-133	5.4916E-05	cs-133	5.4490E-05	cs-133	5.3981E-05	cs-133	5.3804E-05
sm-147	6.5998E-06	sm-147	1.0032E-05	sm-147	9.7681E-06	sm-147	9.4532E-06	sm-147	9.3463E-06
sm-149	3.5650E-08	sm-149	5.6248E-08	sm-149	6.6485E-08	sm-149	7.9068E-08	sm-149	8.3535E-08
sm-150	9.0195E-06	sm-150	9.9689E-06	sm-150	1.0082E-05	sm-150	1.0184E-05	sm-150	1.0220E-05
sm-151	2.0148E-07	sm-151	3.2777E-07	sm-151	3.8502E-07	sm-151	4.5177E-07	sm-151	4.7531E-07
sm-152	5.5582E-06	sm-152	5.3606E-06	sm-152	5.2184E-06	sm-152	5.0584E-06	sm-152	5.0013E-06
nd-143	1.5914E-05	nd-143	3.1779E-05	nd-143	3.3111E-05	nd-143	3.4194E-05	nd-143	3.4500E-05
nd-145	2.3563E-05	nd-145	2.9474E-05	nd-145	2.9166E-05	nd-145	2.8786E-05	nd-145	2.8652E-05
eu-153	4.8174E-06	eu-153	4.2983E-06	eu-153	4.4066E-06	eu-153	4.4867E-06	eu-153	4.5009E-06
gd-155	2.8513E-07	gd-155	2.3201E-07	gd-155	2.5813E-07	gd-155	2.9022E-07	gd-155	3.0202E-07
o	4.4780E-02	o	4.4744E-02	o	4.4744E-02	o	4.4743E-02	o	4.4743E-02

Table A3 (Cont'd)

Data Set No. 60 Cooling : 5 years Region# : 6 Burnup = 40.000GWd/tM		Data Set No. 61 Cooling : 5 years Region# : 7 Burnup = 40.000GWd/tM		Data Set No. 62 Cooling : 5 years Region# : 8 Burnup = 40.000GWd/tM		Data Set No. 63 Cooling : 5 years Region# : 9 Burnup = 40.000GWd/tM	
u-234	4.5546E-06	u-234	4.5516E-06	u-234	4.5499E-06	u-234	5.9620E-07
u-235	2.0901E-04	u-235	2.0986E-04	u-235	2.1059E-04	u-235	3.9757E-06
u-236	1.1496E-04	u-236	1.1505E-04	u-236	1.1501E-04	u-236	2.1024E-05
u-238	2.0744E-02	u-238	2.0742E-02	u-238	2.0741E-02	u-238	2.1207E-02
pu-238	5.4989E-06	pu-238	5.5269E-06	pu-238	5.5557E-06	pu-238	4.3983E-06
pu-239	1.1547E-04	pu-239	1.1616E-04	pu-239	1.1670E-04	pu-239	9.1742E-05
pu-240	5.7422E-05	pu-240	5.7604E-05	pu-240	5.7739E-05	pu-240	7.3579E-05
pu-241	2.3832E-05	pu-241	2.3950E-05	pu-241	2.4035E-05	pu-241	2.3768E-05
pu-242	1.2686E-05	pu-242	1.2674E-05	pu-242	1.2636E-05	pu-242	3.1171E-05
am-241	8.4132E-06	am-241	8.4552E-06	am-241	8.4869E-06	am-241	7.9505E-06
am-243	2.7967E-06	am-243	2.8117E-06	am-243	2.8188E-06	am-243	9.1144E-06
np-237	1.2065E-05	np-237	1.2091E-05	np-237	1.2124E-05	np-237	5.0117E-06
mo-95	4.9703E-05	mo-95	4.9673E-05	mo-95	4.9651E-05	mo-95	4.1560E-05
tc-99	5.1195E-05	tc-99	5.1181E-05	tc-99	5.1171E-05	tc-99	4.8654E-05
ru-101	4.8197E-05	ru-101	4.8187E-05	ru-101	4.8181E-05	ru-101	5.0196E-05
rh-103	2.8034E-05	rh-103	2.8022E-05	rh-103	2.8013E-05	rh-103	2.8498E-05
ag-109	4.6488E-06	ag-109	4.6549E-06	ag-109	4.6597E-06	ag-109	7.9248E-06
cs-133	5.3754E-05	cs-133	5.3724E-05	cs-133	5.3706E-05	cs-133	4.9106E-05
sm-147	9.3162E-06	sm-147	9.2976E-06	sm-147	9.2861E-06	sm-147	6.4543E-06
sm-149	8.4360E-08	sm-149	8.4823E-08	sm-149	8.5396E-08	sm-149	4.7045E-08
sm-150	1.0232E-05	sm-150	1.0239E-05	sm-150	1.0243E-05	sm-150	9.7870E-06
sm-151	4.8156E-07	sm-151	4.8492E-07	sm-151	4.8786E-07	sm-151	2.8408E-07
sm-152	4.9857E-06	sm-152	4.9767E-06	sm-152	4.9702E-06	sm-152	5.1201E-06
nd-143	3.4571E-05	nd-143	3.4602E-05	nd-143	3.4641E-05	nd-143	2.0316E-05
nd-145	2.8613E-05	nd-145	2.8591E-05	nd-145	2.8577E-05	nd-145	2.3517E-05
eu-153	4.5046E-06	eu-153	4.5060E-06	eu-153	4.5076E-06	eu-153	4.9911E-06
gd-155	3.0537E-07	gd-155	3.0717E-07	gd-155	3.0893E-07	gd-155	3.5349E-07
o	4.4743E-02	o	4.4743E-02	o	4.4743E-02	o	4.4779E-02

Table A3 (Cont'd)

Data Set No. 64		Data Set No. 65		Data Set No. 66		Data Set No. 67		Data Set No. 68		Data Set No. 69	
Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years		Cooling : 5 years	
Region# : 1&9		Region# : 2-8		Region# : 1&9		Region# : 2-8		Region# : 1&9		Region# : 2-8	
Burnup = 20.000GWd/tM		Burnup = 20.000GWd/tM		Burnup = 30.000GWd/tM		Burnup = 30.000GWd/tM		Burnup = 40.000GWd/tM		Burnup = 40.000GWd/tM	
u-234	6.9964E-07	u-234	6.0728E-06	u-234	5.8859E-07	u-234	5.3171E-06	u-234	5.4701E-07	u-234	4.6286E-06
u-235	1.5846E-05	u-235	4.3763E-04	u-235	4.6918E-06	u-235	2.9119E-04	u-235	2.0925E-06	u-235	1.8067E-04
u-236	2.2410E-05	u-236	7.8080E-05	u-236	2.2077E-05	u-236	1.0067E-04	u-236	2.1005E-05	u-236	1.1498E-04
u-238	2.1736E-02	u-238	2.1111E-02	u-238	2.1489E-02	u-238	2.0967E-02	u-238	2.1235E-02	u-238	2.0802E-02
pu-238	1.3121E-06	pu-238	8.3312E-07	pu-238	2.4284E-06	pu-238	2.2952E-06	pu-238	3.6102E-06	pu-238	4.6024E-06
pu-239	7.4078E-05	pu-239	9.0283E-05	pu-239	7.4464E-05	pu-239	9.5907E-05	pu-239	7.6813E-05	pu-239	9.6665E-05
pu-240	5.2179E-05	pu-240	2.7445E-05	pu-240	6.1319E-05	pu-240	4.2279E-05	pu-240	6.7165E-05	pu-240	5.3243E-05
pu-241	1.5440E-05	pu-241	9.5844E-06	pu-241	1.8248E-05	pu-241	1.5680E-05	pu-241	1.9944E-05	pu-241	2.0356E-05
pu-242	1.3285E-05	pu-242	2.2899E-06	pu-242	2.4522E-05	pu-242	6.5424E-06	pu-242	3.4508E-05	pu-242	1.2880E-05
am-241	4.6525E-06	am-241	2.9619E-06	am-241	5.6625E-06	am-241	5.1281E-06	am-241	6.5702E-06	am-241	7.1288E-06
am-243	2.0970E-06	am-243	2.0715E-07	am-243	5.2931E-06	am-243	9.0772E-07	am-243	9.1126E-06	am-243	2.4533E-06
np-237	2.9190E-06	np-237	4.4761E-06	np-237	3.7974E-06	np-237	7.6704E-06	np-237	4.4910E-06	np-237	1.1031E-05
mo-95	2.3162E-05	mo-95	2.7406E-05	mo-95	3.2435E-05	mo-95	3.9473E-05	mo-95	4.1525E-05	mo-95	5.0358E-05
tc-99	2.6299E-05	tc-99	2.7078E-05	tc-99	3.7824E-05	tc-99	3.9671E-05	tc-99	4.8816E-05	tc-99	5.1523E-05
ru-101	2.5881E-05	ru-101	2.4373E-05	ru-101	3.8444E-05	ru-101	3.6453E-05	ru-101	5.0718E-05	ru-101	4.8379E-05
rh-103	1.8583E-05	rh-103	1.5821E-05	rh-103	2.3872E-05	rh-103	2.2522E-05	rh-103	2.8110E-05	rh-103	2.7923E-05
ag-109	4.0459E-06	ag-109	1.6181E-06	ag-109	6.0694E-06	ag-109	2.9236E-06	ag-109	7.9245E-06	ag-109	4.4209E-06
cs-133	2.8052E-05	cs-133	2.9687E-05	cs-133	3.9318E-05	cs-133	4.2734E-05	cs-133	4.9489E-05	cs-133	5.4381E-05
sm-147	4.4215E-06	sm-147	6.1599E-06	sm-147	5.5044E-06	sm-147	8.2518E-06	sm-147	6.5271E-06	sm-147	9.6906E-06
sm-149	4.8320E-08	sm-149	9.2472E-08	sm-149	4.5571E-08	sm-149	8.2115E-08	sm-149	3.9647E-08	sm-149	6.6765E-08
sm-150	5.3175E-06	sm-150	5.2739E-06	sm-150	7.3817E-06	sm-150	7.7272E-06	sm-150	9.3495E-06	sm-150	1.0077E-05
sm-151	1.6582E-07	sm-151	3.5027E-07	sm-151	1.9106E-07	sm-151	3.7421E-07	sm-151	2.3225E-07	sm-151	3.8681E-07
sm-152	3.5033E-06	sm-152	2.9404E-06	sm-152	4.5729E-06	sm-152	4.1910E-06	sm-152	5.3779E-06	sm-152	5.1842E-06
nd-143	1.3466E-05	nd-143	2.1912E-05	nd-143	1.5273E-05	nd-143	2.8860E-05	nd-143	1.7698E-05	nd-143	3.3070E-05
nd-145	1.3651E-05	nd-145	1.6299E-05	nd-145	1.8870E-05	nd-145	2.3161E-05	nd-145	2.3589E-05	nd-145	2.9119E-05
eu-153	2.5779E-06	eu-153	1.7490E-06	eu-153	3.8291E-06	eu-153	3.0551E-06	eu-153	4.9632E-06	eu-153	4.4164E-06
gd-155	1.4073E-07	gd-155	8.6753E-08	gd-155	2.2813E-07	gd-155	1.6330E-07	gd-155	3.1413E-07	gd-155	2.6184E-07
o	4.4781E-02	o	4.4745E-02	o	4.4780E-02	o	4.4744E-02	o	4.4779E-02	o	4.4743E-02

Table A3 (Cont'd)

Data Set No. 70 Cooling : 5 years Region# : 1&9 Burnup = 20.000GWd/tM		Data Set No. 71 Cooling : 5 years Region# : 2-8 Burnup = 20.000GWd/tM		Data Set No. 72 Cooling : 5 years Region# : 1&9 Burnup = 30.000GWd/tM		Data Set No. 73 Cooling : 5 years Region# : 2-8 Burnup = 30.000GWd/tM		Data Set No. 74 Cooling : 5 years Region# : 1&9 Burnup = 40.000GWd/tM		Data Set No. 75 Cooling : 5 years Region# : 2-8 Burnup = 40.000GWd/tM	
u-234	7.0596E-07	u-234	5.9709E-06	u-234	6.1868E-07	u-234	5.2188E-06	u-234	5.8686E-07	u-234	4.5692E-06
u-235	1.9626E-05	u-235	4.4970E-04	u-235	8.0349E-06	u-235	3.1033E-04	u-235	3.4724E-06	u-235	2.0453E-04
u-236	2.2113E-05	u-236	7.8529E-05	u-236	2.2147E-05	u-236	1.0050E-04	u-236	2.0940E-05	u-236	1.1447E-04
u-238	2.1720E-02	u-238	2.1083E-02	u-238	2.1468E-02	u-238	2.0927E-02	u-238	2.1213E-02	u-238	2.0753E-02
pu-238	1.4733E-06	pu-238	1.0234E-06	pu-238	2.8789E-06	pu-238	2.7365E-06	pu-238	4.2483E-06	pu-238	5.3753E-06
pu-239	8.3583E-05	pu-239	1.0185E-04	pu-239	8.5779E-05	pu-239	1.1020E-04	pu-239	8.9018E-05	pu-239	1.1307E-04
pu-240	5.3578E-05	pu-240	2.9282E-05	pu-240	6.5287E-05	pu-240	4.4898E-05	pu-240	7.2143E-05	pu-240	5.6628E-05
pu-241	1.7057E-05	pu-241	1.0933E-05	pu-241	2.0821E-05	pu-241	1.7905E-05	pu-241	2.3034E-05	pu-241	2.3351E-05
pu-242	1.2505E-05	pu-242	2.4546E-06	pu-242	2.2676E-05	pu-242	6.6569E-06	pu-242	3.1814E-05	pu-242	1.2634E-05
am-241	5.1597E-06	am-241	3.3835E-06	am-241	6.5308E-06	am-241	5.8623E-06	am-241	7.6816E-06	am-241	8.2295E-06
am-243	2.2365E-06	am-243	2.6639E-07	am-243	5.3944E-06	am-243	1.0814E-06	am-243	9.1477E-06	am-243	2.7459E-06
np-237	3.1911E-06	np-237	5.0296E-06	np-237	4.2433E-06	np-237	8.4505E-06	np-237	4.9541E-06	np-237	1.1962E-05
mo-95	2.3084E-05	mo-95	2.7123E-05	mo-95	3.2510E-05	mo-95	3.8979E-05	mo-95	4.1430E-05	mo-95	4.9698E-05
tc-99	2.6210E-05	tc-99	2.6962E-05	tc-99	3.7761E-05	tc-99	3.9453E-05	tc-99	4.8646E-05	tc-99	5.1218E-05
ru-101	2.5796E-05	ru-101	2.4384E-05	ru-101	3.8198E-05	ru-101	3.6404E-05	ru-101	5.0303E-05	ru-101	4.8216E-05
rh-103	1.8530E-05	rh-103	1.5885E-05	rh-103	2.4257E-05	rh-103	2.2527E-05	rh-103	2.8288E-05	rh-103	2.7925E-05
ag-109	4.0237E-06	ag-109	1.7341E-06	ag-109	6.0653E-06	ag-109	3.0825E-06	ag-109	7.8920E-06	ag-109	4.5971E-06
cs-133	2.7871E-05	cs-133	2.9457E-05	cs-133	3.9138E-05	cs-133	4.2305E-05	cs-133	4.9101E-05	cs-133	5.3783E-05
sm-147	4.3599E-06	sm-147	5.9775E-06	sm-147	5.5267E-06	sm-147	7.9493E-06	sm-147	6.4261E-06	sm-147	9.3257E-06
sm-149	5.2450E-08	sm-149	1.0546E-07	sm-149	5.2195E-08	sm-149	9.5769E-08	sm-149	4.4836E-08	sm-149	8.0535E-08
sm-150	5.4157E-06	sm-150	5.3071E-06	sm-150	7.6600E-06	sm-150	7.8222E-06	sm-150	9.6705E-06	sm-150	1.0193E-05
sm-151	1.8728E-07	sm-151	3.9591E-07	sm-151	2.3516E-07	sm-151	4.3419E-07	sm-151	2.7174E-07	sm-151	4.6048E-07
sm-152	3.3967E-06	sm-152	2.8801E-06	sm-152	4.4185E-06	sm-152	4.0697E-06	sm-152	5.1643E-06	sm-152	4.9983E-06
nd-143	1.4135E-05	nd-143	2.1939E-05	nd-143	1.7335E-05	nd-143	2.9238E-05	nd-143	1.9563E-05	nd-143	3.4217E-05
nd-145	1.3597E-05	nd-145	1.6104E-05	nd-145	1.8844E-05	nd-145	2.2828E-05	nd-145	2.3512E-05	nd-145	2.8678E-05
eu-153	2.6289E-06	eu-153	1.8228E-06	eu-153	3.9546E-06	eu-153	3.1507E-06	eu-153	5.0253E-06	eu-153	4.4977E-06
gd-155	1.5301E-07	gd-155	9.9093E-08	gd-155	2.5692E-07	gd-155	1.8792E-07	gd-155	3.4529E-07	gd-155	2.9876E-07
o	4.4781E-02	o	4.4745E-02	o	4.4780E-02	o	4.4744E-02	o	4.4779E-02	o	4.4743E-02

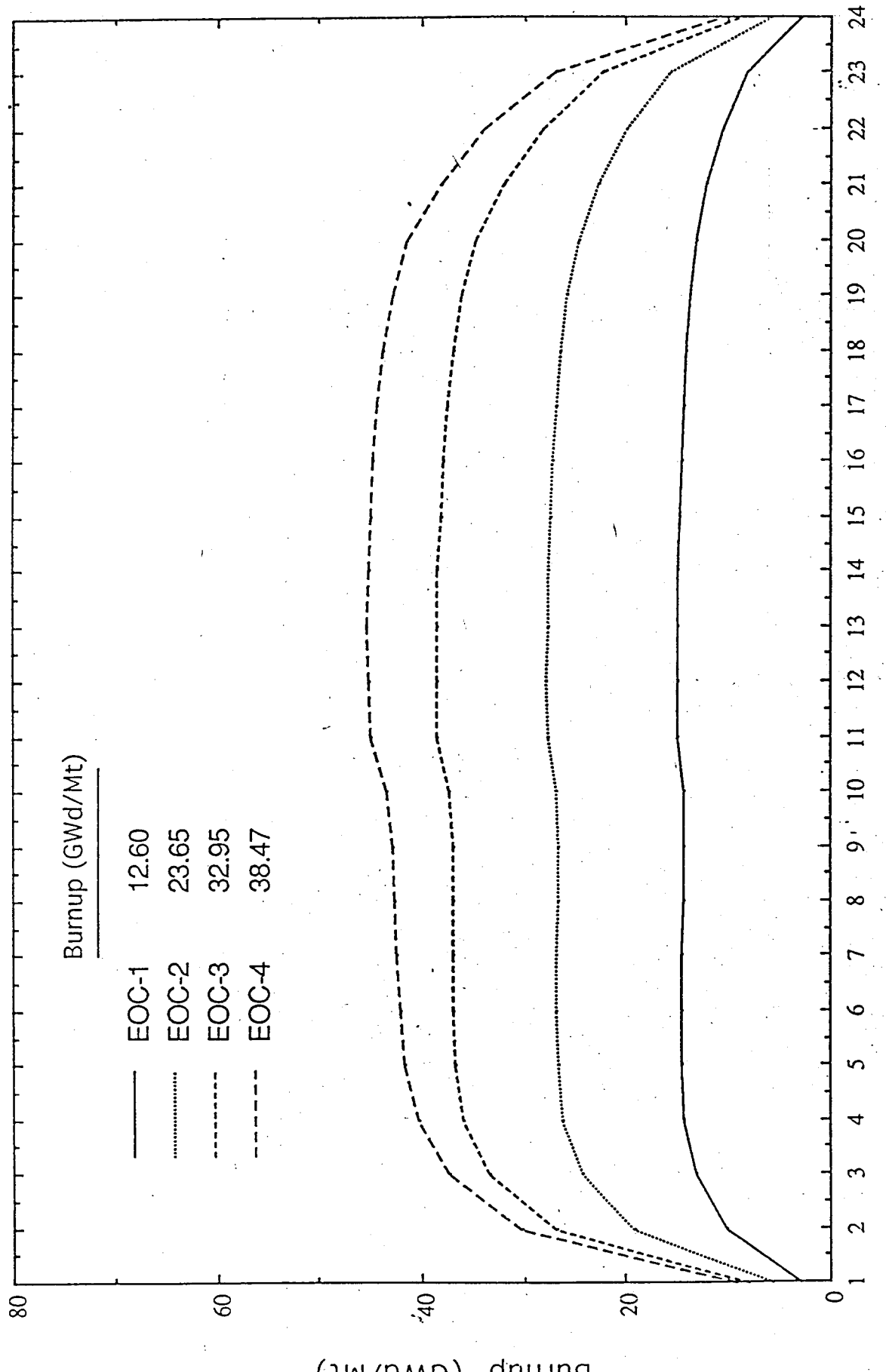


Fig. A1 Burnup Profile based on Haling Calculation

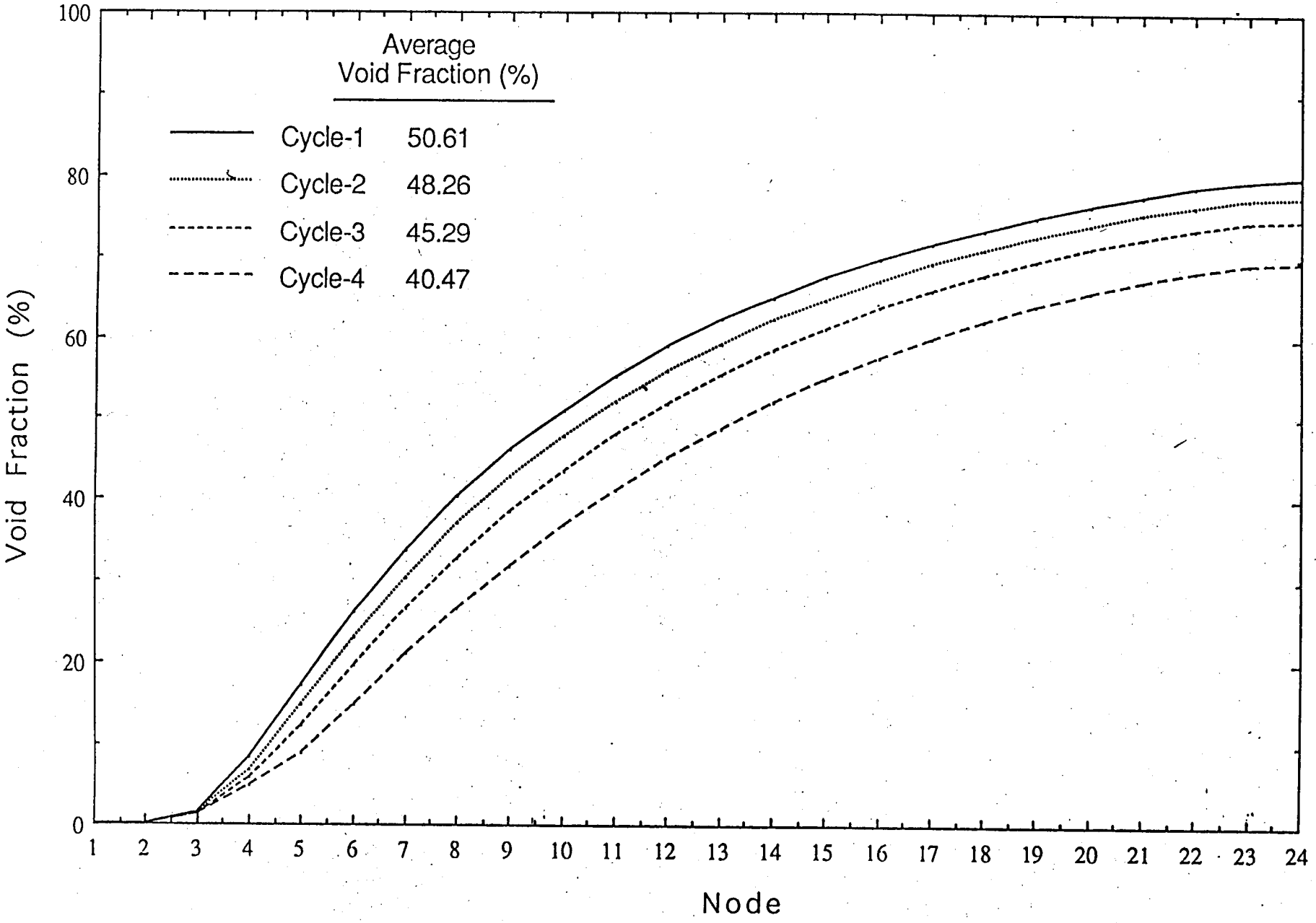
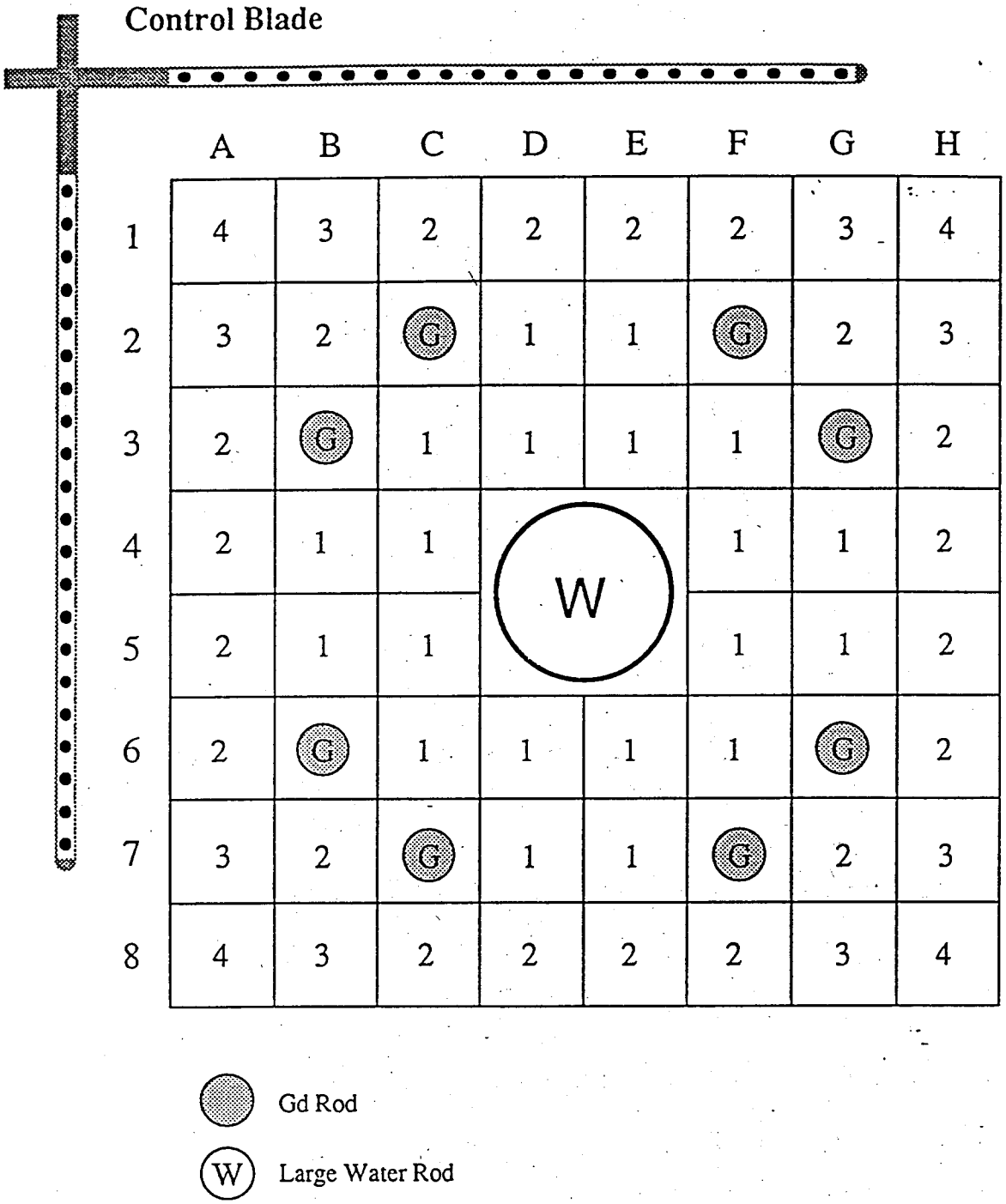


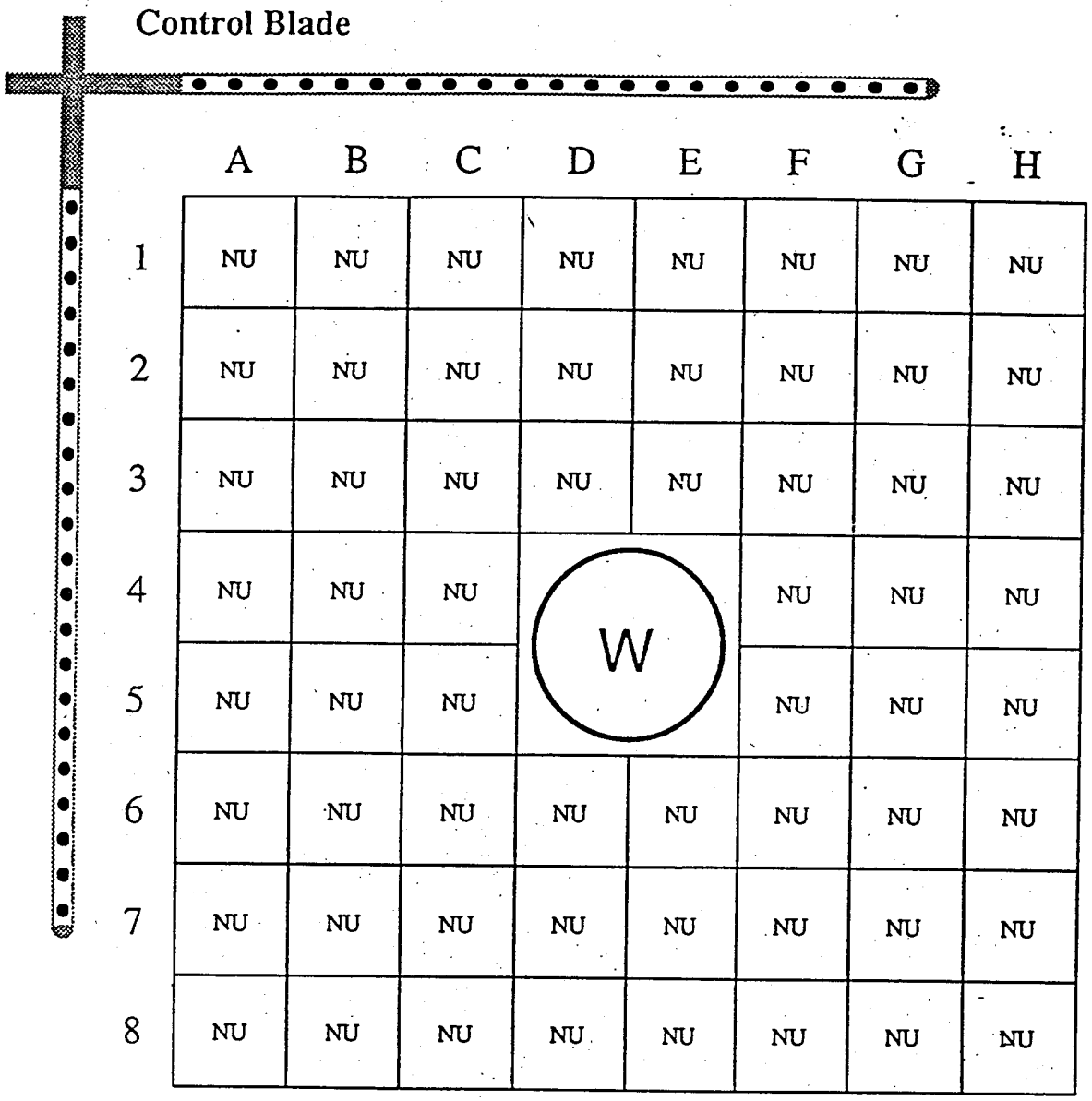
Fig. A2 Void Profile based on Haling Calculation



Rod Type#	U-235 Enrichment	Gadolinia Content	No. of Rods
1	4.9 w/o		20
2	3.6		20
3	3.0		8
4	2.3		4
G	3.0	4.5 w/o	8
W	Water Rod		1

Assembly Average U-235 Enrichment = 3.80 w/o

Fig. A3 Typical BWR Fuel Assembly



Rod Type#	U-235 Enrichment	No. of Rods
NU	0.71 w/o	60
W	Water Rod	1

Assembly Average U-235 Enrichment = 0.71 w/o

Fig. A4 Blanket Fuel Assembly

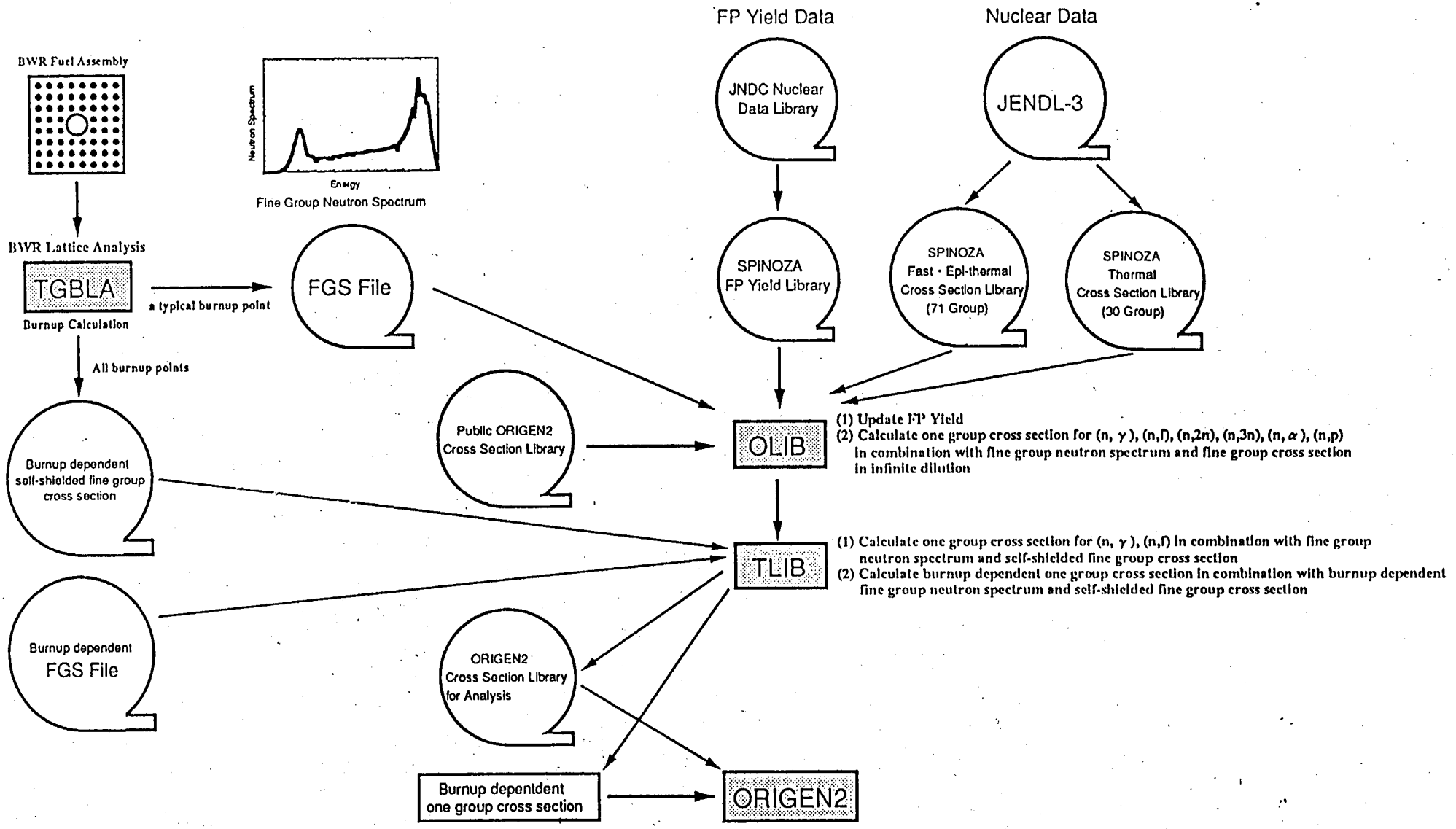


Fig. A5 Schematic Flow Diagram in SPINOZA System