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Multicode Comparison of Selected Source-Term Computer Codes

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DEPARTMENT OF ENERGY

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**MULTICODE COMPARISON OF SELECTED
SOURCE-TERM COMPUTER CODES**

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Office of Civilian Radioactive Waste Management**

**MARTIN MARIETTA ENERGY SYSTEMS, INC.,
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CONTENTS

SECTION	PAGE
LIST OF FIGURES	iv
LIST OF TABLES	v
ACKNOWLEDGMENTS	vii
ABSTRACT	ix
 1. INTRODUCTION	 1
 2. SUMMARY DESCRIPTION OF CODES	 2
 3. CASE DESCRIPTIONS	 4
3.1 DESCRIPTION OF THE DECAY-ONLY CASE	7
3.2 DESCRIPTION OF TYPICAL PWR EXPOSURE CASE	7
3.3 EXTENDED PWR EXPOSURE CASE	7
3.4 TYPICAL BWR EXPOSURE CASE	10
3.5 EXTENDED BWR EXPOSURE CASE	10
3.6 SUMMARY OF FUEL AND BURNUP DATA OF CASES	13
 4. METHOD OF ILLUSTRATING CODE RESULT COMPARISONS	 14
4.1 COMPARATIVE RATIO TABLES	14
4.2 NUCLIDE DISTRIBUTION SUMMARY TABLES	15
 5. EXAMINATION OF COMPARISONS IN CODE RESULTS	 16
5.1 GENERAL COMMENT ON ENTIRE SET OF COMPARISONS	16
5.2 THE DECAY-ONLY CASE	24
5.3 THE TYPICAL PWR EXPOSURE CASE	24
5.4 THE EXTENDED PWR EXPOSURE CASE	25
5.5 THE TYPICAL BWR EXPOSURE CASE	25
5.6 THE EXTENDED BWR EXPOSURE CASE	25
 6. RECONCILING SIGNIFICANT DIFFERENCES IN RESULTS	 27
6.1 RECONCILING DECAY-ONLY CASE VARIATIONS	27
6.2 VARIATIONS IN EXPOSURE CASES	28
 7. CONCLUSIONS AND RECOMMENDATIONS	 31
7.1 FISSION PRODUCTS	31
7.2 ACTINIDES	33
7.3 SUMMARY	36
7.4 RECOMMENDATIONS	36
 REFERENCES	 38
 APPENDIX A SUMMARY DESCRIPTIONS OF ORIGEN2, ORIGEN-S, AND CINDER-2	 39
APPENDIX B DATA FOR DECAY-ONLY CASE	39
APPENDIX C COMPARATIVE RATIO TABLES IN GRAM-ATOMS	63
APPENDIX D COMPARATIVE RATIO TABLES IN CURIES	89
APPENDIX E COMPARATIVE RATIO TABLES IN WATTS	112
APPENDIX F COMPARATIVE RATIO TABLES IN TOTAL WATTS	141
APPENDIX G NUCLIDE DISTRIBUTION SUMMARY TABLES	147

LIST OF FIGURES

Figure	Page
1. PWR assembly schematic showing guide tubes or water holes	9
2. BWR assembly schematic, 27.5-GWd/MTU case	11
3. BWR assembly schematic, 40-GWd/MTU case.	12
4. Decay-only case comparison of the predictions of the codes for total decay heat rate	17
5. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 33-GWd/MTU PWR	18
6. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 50-GWd/MTU PWR	19
7. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 27.5-GWd/MTU PWR	20
8. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 40-GWd/MTU BWR	21
9. Measure of agreement among the three codes, taken two at a time, when predicting the composition of selected fission products	32
10. Measure of agreement among the three codes, taken two at a time, when predicting the composition of selected actinides	34
11. Measure of agreement among the three codes, taken two at a time, when predicting the composition of the plutonium radionuclides	35
A.1. Computation flow path invoked by SAS2 module	46

LIST OF TABLES

Table	Page
1. Radionuclide listing for multicode comparison	4
2. Photon energy group structure (MeV)	5
3. Neutron energy group structure (MeV)	6
4. PWR assembly description, 33-GWd/MTU case	8
5. BWR assembly description, 27.5-GWd/MTU case	10
6. Axial water densities of BWR	11
7. Fuel enrichments of BWR assembly for 40-GWd/MTU case	12
8. Fuel exposure and burnup characteristics of cases	13
9. Tabulation of % differences in nuclide gram-atoms, curie, and decay heat predictions between codes into a frequency distribution	22
10. Tabulation of % difference frequency distribution if nuclide watts exceeds 0.01% of total watts	23
11. Significant radionuclides in the specified categories of a Federal Waste Management System	33
B.1. Data for decay-only case	60

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ABSTRACT

This report summarizes the results of a study to assess the predictive capabilities of three radionuclide inventory/depletion computer codes, ORIGEN2, ORIGEN-S, and CINDER-2. This task was accomplished through a series of comparisons of their output for several light-water reactor (LWR) models (i.e., verification). Of the five cases chosen, two modeled typical boiling-water reactors (BWR) at burnups of 27.5 and 40 GWd/MTU and two represented typical pressurized-water reactors (PWR) at burnups of 33 and 50 GWd/MTU. In the fifth case, identical input data were used for each of the codes to examine the results of decay only and to show differences in nuclear decay constants and decay heat rates. Comparisons were made for several different characteristics (mass, radioactivity, and decay heat rate) for 52 radionuclides and for nine decay periods ranging from 30 d to 10,000 years. Only fission products and actinides were considered. The results are presented in comparative-ratio tables for each of the characteristics, decay periods, and cases. A brief summary description of each of the codes has been included. Of the more than 21,000 individual comparisons made for the three codes (taken two at a time), nearly half (45%) agreed to within 1%, and an additional 17% fell within the range of 1 to 5%. Approximately 8% of the comparison results disagreed by more than 30%. However, relatively good agreement was obtained for most of the radionuclides that are expected to contribute the greatest impact to waste disposal. Even though some defects have been noted, each of the codes in the comparison appears to produce respectable results.

1. INTRODUCTION

The prediction of the radionuclide content and the resulting associated characteristics or properties of spent fuel from nuclear power plants and of high-level radioactive wastes (HLW) from fuel reprocessing and other sources is a major concern of the Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM) because it has been designated to site, design, and construct transportation, storage, and disposal systems for such materials. These radiological properties, which continue to change with the composition and the age of the material, are difficult to quantify. The DOE/OCRWM will utilize this information as input data to many of their designers and licensing applicants in the areas of performance assessment (source terms), heat transfer (thermal generation rates), criticality (radionuclide composition), and shielding (gamma and neutron generation rates).

Several technical computer codes are available that will permit the calculation of the radiological characteristics of interest. The most sophisticated tools for depletion analyses that characterize the major radionuclide composition of discharged spent fuel are multidimensional codes that allow full consideration of the spatial change in the flux spectrum throughout one assembly or an entire reactor core. However, most of these codes are expensive to run, difficult to use, and do not predict all of the needed characteristics. In addition, many (but not all) of these codes allow only a limited number of radionuclides. Historically, the above disadvantages of the multidimensional depletion analysis tools have been circumvented by the development of "point" or "pseudo-point" depletion codes that allow flexibility and ease of use. These codes are able to compute an almost unlimited number of radionuclide inventories and associated characteristic quantities (decay heat, toxicity, radiation spectra, etc.) in a flexible and useful format. One method of testing these codes for computational features, capabilities, and accuracy is through verification and benchmarking. Verification is a process that demonstrates the ability of a computer code to perform correctly its stated capabilities. This process is performed primarily through a set of test problems designed to show that the stated equations are solved in a satisfactory manner, but not necessarily indicating that the model is a valid representation of any particular physical system. The objective of validation is to ensure that the model embodied in a computer program is a correct representation of the process or system for which it is intended. A benchmark is a standard condition that may be used in the verification of computer codes and models. Oak Ridge National Laboratory (ORNL) is currently developing guidelines for verifying, validating, and enhancing a source-term code that will be used in licensing procedures by DOE/OCRWM.

This report summarizes the results of a cooperative effort between ORNL and Los Alamos National Laboratory (LANL) directed toward comparing the predictions of three radionuclide inventory/depletion computer codes, ORIGEN2, ORIGEN-S, and CINDER-2 (i.e., verification). The work was cooperative in the sense that direct interaction occurred between staff members of ORNL, who performed the ORIGEN2 and ORIGEN-S calculations, and LANL, who performed the CINDER-2 calculations. Several meetings were held among the participants to develop the following five test problems — one examining decay only, two modeling generic BWRs at two burnups, and two modeling generic PWRs at two burnups. The methodologies utilized by these codes are discussed in Sect. 2. The test problems are described in Sect. 3, and the methods of comparison are given in Sect. 4. The results are presented in Sect. 5, reconciliation of major differences are discussed in Sect. 6, and recommendations are listed in Sect. 7. This verification effort does not necessarily indicate which code is "best" or the most accurate. The comparisons may be used to identify where there is need for improved models as indicated by significant differences in predictions (e.g., the extended burnup BWR model).

2. SUMMARY DESCRIPTION OF CODES

As noted in Sect. 1, the codes used in the present comparative assessment study were ORIGEN2,¹ ORIGEN-S,² and CINDER-2.³ This section will briefly describe these codes. Code abstracts with more detail are provided in Appendix A. Each of these codes computes time-dependent concentrations and source terms of a large number of nuclides, which are simultaneously generated or depleted through neutronic transmutation, fission, radioactive decay, input feed rates, and physical or chemical removal rates. The calculations may pertain to fuel irradiation within nuclear reactors, or the storage, management, transportation, or subsequent chemical processing of removed fuel elements.

The original ORIGEN code⁴ was released in 1973 and has since been updated to produce two separate codes—ORIGEN2 and ORIGEN-S. All three of these codes use the same basic matrix exponential expansion model and numerical scheme. However, the updated versions have data libraries that are significantly improved from those of ORIGEN. The updated versions of ORIGEN also provide burnup-dependent cross sections and a number of minor modifications (e.g., calculation of fission energy release) that are improvements over the original version. The primary differences between ORIGEN-S and ORIGEN2 are in the nuclear data libraries used by the two codes. Both codes use virtually identical decay data (half-life, branching ratios, and recoverable energy per decay) and photon data (energies and intensities of gamma- and X-ray spectra). There are differences in the cross sections and fission product yield data, however. These codes have been distributed worldwide by the ORNL Radiation Shielding Information Center.

The ORIGEN2 code uses specific cross-section and fission-product yield libraries that have been developed for a number of reactor models. Here, a reactor model means a combination of a particular kind of reactor and a specified fuel cycle, for example, a uranium-fueled PWR using a once-through fuel cycle. Several cross-section libraries are available for different reactor models,⁵ and work is currently under way at ORNL to update the libraries for the latest light-water reactor (LWR) designs. The cross-section libraries for ORIGEN2 were developed by performing spatially detailed multigroup reactor physics and depletion calculations for each of the specific reactor models, and collapsing the multigroup libraries to one group for use by ORIGEN2. Burnup-dependent cross sections for the important actinide nuclides are built into ORIGEN2 for each reactor model. For the depletion analyses performed in this study, the generic PWR and BWR libraries are described in ref. 6.

One of the primary objectives in developing ORIGEN-S was that the calculations be able to utilize multi-energy-group neutron flux and cross sections in any group structure. Utilization of the multi-group data is automated via the COUPLE code, which was developed in conjunction with ORIGEN-S. COUPLE uses supplied multigroup data to update (as a function of burnup) nuclide cross sections and calculate appropriate ORIGEN-S spectral parameters (THERM, RES, FAST) to be used for nuclides where multigroup cross sections are not provided. ORIGEN-S can be run stand-alone using available card image data libraries or with one or more time-dependent binary libraries that are created with COUPLE.

ORIGEN-S and COUPLE were developed as modules of the SCALE⁷ modular code system. Within SCALE, multigroup fluxes and cross sections are provided to COUPLE via the XSDRNPM module—a 1-D discrete ordinates transport code. Burnup-dependent libraries are created for ORIGEN-S by employing successive passes through XSDRNPM-S and COUPLE using the desired multigroup cross-section library. Each successive XSDRNPM-S calculation uses irradiation time-dependent compositions evaluated by ORIGEN-S and pertinent information on the reactor history which affects the lattice cell flux calculation. This procedure is automated in SCALE with the SAS2 control module.⁸

The CINDER⁹ series of codes is the major alternative to the ORICEN-type codes in the United States. Various CINDER versions have been developed and used at LANL. The major differences between the versions are the available data libraries and the codes to which they interface to obtain the neutronic data. The CINDER-2 version used in this study interfaces with EPRI-CELL¹⁰ to obtain the updated flux spectra and cross sections at four spatial points within a unit cell model (similar to the SAS2/ORIGEN-S approach). CINDER-2 performs the depletion analysis in four energy groups using the Bateman equation solution of the balance equations for each chain of nuclides coupled through the decay or transmutation processes. Various nuclide chains are available in libraries, which are simply read from the input data stream.

As evidenced by the above discussion, one of the major important differences between point depletion codes is in the way neutronic data (primarily neutron cross sections) are prepared for use in a calculation. All the codes utilize burnup-dependent neutron cross sections for the depletion. However, appropriate neutron flux spectra for an assembly are required to generate the effective neutron cross sections for the subsequent point depletion calculation. Multidimensional neutronics analyses using specific reactor models and power history data have been performed to generate "generic" burnup-dependent cross-section libraries for ORIGEN2. The complexity and expense of this approach precludes the generation of such libraries for all the various assembly geometries, fissile enrichments, void fractions, or reactor power histories. Instead, the user tries to use the available library that best matches the application. The CINDER-2 and ORIGEN-S approach is to utilize auxiliary codes that incorporate somewhat simpler (typically one-dimensional lattice cell) neutronic analyses to obtain the burnup-dependent flux spectra. This approach allows burnup-dependent cross-section libraries to be routinely prepared for the user-specified assembly characteristics and irradiation history using modular codes developed for this purpose. Application of the "packaged" libraries beyond their model definition and the potential inadequacy of a simpler neutronic analysis are, respectively, the main disadvantages of the above methods. This study provides some insight into the effect of these two approaches on data preparation for important output variables.

3. CASE DESCRIPTIONS

The cases were chosen in order to achieve two goals:

1. to permit comparisons dependent on decay characteristics only; and
2. to permit comparisons dependent on both decay data and cross-section data used during the range in exposure to be experienced in commercial reactors.

Results from ORIGEN2, CINDER-2, and ORIGEN-S were to be compared in several different units for various nuclides important to reactor waste systems analyses and several global-type units or characteristics. The 66 radionuclides requested for the comparison are listed in Table 1. Ultimately, results for 52 radionuclides were provided by all codes. Activation product radionuclides (i.e., radioactive nuclides produced by irradiation of stable nuclides in structural materials) were not compared because they are not available in the CINDER-2 libraries.

In this project, the term "burnup" has been defined as the "atomic % fission." Also, the term "exposure," or "exposure level," was defined to mean the energy produced in units of gigawatt days/metric ton initial uranium (GWd/MTU). Each code was to apply equal burnups to each case, or approximately equal exposure levels. The purpose of using equal atomic % fissions was to eliminate energy per fission data as a cause for variations in results.

Table 1. Radionuclide listing for multicode comparison

Se-79	Sn-126	Eu-155	Pu-238
Kr-85	I-129	Nd-143	Pu-239
Sr-89	Cs-133	Nd-144	Pu-240
Sr-90	Cs-134	Nd-145	Pu-241
Y-90	Cs-135	Nd-146	Pu-242
Y-91	Cs-137	Ra-226 ^a	Am-241
Zr-93	Ce-144	Th-230 ^a	Am-242
Zr-95	Pr-144 ^a	Th-232 ^a	Am-243
Nb-93m ^a	Pm-147	U-232 ^a	Cm-242
Nb-94 ^a	Sm-147	U-233 ^a	Cm-243
Nb-95	Sm-148	U-234	Cm-244
Tc-99	Sm-149	U-235	Cm-245
Ru-106	Sm-150	U-236	Cm-246
Rh-106 ^a	Sm-151	U-238	Cm-247 ^a
Pd-107	Sm-152	Np-236 ^a	Cm-248 ^a
Sb-125	Eu-153	Np-237	
Sb-126m ^a	Eu-154	Pu-236 ^a	

^aNot included in CINDER-2 printout.

The results given for each nuclide were to be in the following units:

1. mass, in gram-atoms (moles);
2. radioactivity, in curies (Ci); and
3. decay heat rate, in watts (W).

Aggregate parameters employed were:

1. actinide, fission product, and total decay heat rate in watts;
2. photon source spectra in the ORIGEN2 energy group structure;
3. (α,n), spontaneous fission and total neutron emission rates; and
4. neutron emission energy spectra.

While the neutron emission rates computed by all codes could be compared, the neutron energy spectra cannot be computed by ORIGEN2 and the comparisons of these spectra were limited to the other two code results. The energy group boundaries are given in Tables 2 and 3 for photon and neutron spectra, respectively.

Table 2. Photon energy group structure (MeV)^a

Group	Lower energy boundary	Upper energy boundary
1	0.000	0.020
2	0.020	0.030
3	0.030	0.045
4	0.045	0.070
5	0.070	0.100
6	0.100	0.150
7	0.150	0.300
8	0.300	0.450
9	0.450	0.700
10	0.700	1.000
11	1.000	1.500
12	1.500	2.000
13	2.000	2.500
14	2.500	3.000
15	3.000	4.000
16	4.000	6.000
17	6.000	8.000
18	8.000	11.000

^aMillion electron volts.

Table 3. Neutron energy group structure (MeV)^a

Group	Lower energy boundary	Upper energy boundary
1	0.000	0.202
2	0.202	0.408
3	0.408	0.608
4	0.608	0.781
5	0.781	1.003
6	1.003	1.225
7	1.225	1.423
8	1.423	1.572
9	1.572	1.827
10	1.827	2.019
11	2.019	2.466
12	2.466	3.012
13	3.012	3.679
14	3.579	4.066
15	4.066	4.966
16	4.966	6.065
17	6.065	8.187
18	8.187	10.000
19	10.000	14.918
20	14.918	19.640

^aMillion electron volts.

This report summarizes the results for the individual nuclides as well as the actinide, fission product, and total decay heat rates. The aggregate parameters described as items 2-4 of that list will be addressed in detail in a forthcoming report. They are mentioned here as a part of the overall project definition.

The results for all cases were to be computed and tabulated at the following decay times, after discharge: 30 d and 1, 5, 10, 20, 50, 300, 1,000, and 10,000 years.

There were five different cases from which the results computed by ORIGEN2, EPRI-CELL/CINDER-2, and SAS2H/ORIGEN-S codes, or tandem code sets, were to be compared. The titles describing the five cases were:

1. The Decay-Only Case
2. The Typical PWR Exposure Case
3. The Extended PWR Exposure Case
4. The Typical BWR Exposure Case
5. The Extended BWR Exposure Case

The general criteria used for the reactor model calculations are given in the following:

1. all sites are to use the most up-to-date data libraries available;
2. fuel will be uranium dioxide;
3. fuel impurities will not be considered;
4. nonfuel components and cladding will not be compared;
5. constant power level will be used — 100% capacity factor;
6. atomic % fission from ORIGEN2 case will be used;
7. exposure time will be the same as that used by ORIGEN2;
8. basis of output will be 1 metric ton of initial uranium;
9. control rods will be withdrawn completely for each reactor or control rod assembly; and
10. up-to-date reactor model data will be used.

A description of the details of the five cases is presented in the following section.

3.1. DESCRIPTION OF THE DECAY-ONLY CASE

The units and cooling times that were used are specified above. Other specifications for the decay-only case are as follows:

1. information to be given in gram-atoms (moles);
2. exact ORIGEN2 data appear in Appendix B, g-atoms follows Z number of nuclide;
3. input basis same as output, metric ton of initial uranium; and
4. initial inventory used by all codes was that calculated by ORIGEN2 for the discharge of a PWR of 33 GWd/MTU with 0.029, 3.2, and 96.771 wt % ^{234}U , ^{235}U , and ^{238}U , respectively, at 37.5 MW/MTU.

3.2. DESCRIPTION OF TYPICAL PWR EXPOSURE CASE

Data specifying the PWR assembly are listed in Table 4. A general schematic of the assembly is shown in Fig. 1. The exposure time is 880 d. The burnup of the case is 3.443 at. % fissions, or about 33-GWd/MTU exposure level.

3.3. EXTENDED PWR EXPOSURE CASE

The data specifying the PWR assembly are the same as that in Table 4 except: the water density is 0.73 g-cm^{-3} ; the fuel composition is 4.5 wt % ^{235}U , 0.0400 wt % ^{234}U and 95.46 wt % ^{238}U ; and the UO_2 density is 94% of theoretical. The assembly is shown in Fig. 1. The exposure time is 1333.33 d. The burnup is 5.206 at. % burnup, or about 50 GWd/MTU.

Table 4. PWR assembly description, 33 GWd/MTU case

Assembly general data	
Lattice, designer	17 x 17, Westinghouse
Type	Control rod ^a
Water density, av. g-cm ⁻³	0.7295
Water temperature, K	570
Soluble boron (av of cycle), ppm (wt)	550
Number of water holes	24
Number of instrument tubes	1
Fuel rod	
Pellet diameter, in.	0.3225
Gap (diametrical), in.	0.0065
Rod OD, in.	0.374
Fuel rod pitch, in.	0.496
Pellet stack density, % TD	94.5
Clad material	Zircaloy-4
Active fuel length, in.	144
Plenum (fuel rod) length, in.	7
²³⁴ U wt %	0.0275
²³⁵ U wt %	3.1
²³⁸ U wt %	96.8725
Fuel temperature, K	811
Clad temperature, K	620
Water holes	
Guide tube ID, in.	0.45
Guide tube OD, in.	0.482
Material	Zircaloy-4

^aAs opposed to burnable poison rod assemblies. The control rods were considered to be withdrawn leaving only the guide tube and "water hole."

ORNL-DWG 87M-10264

Fig. 1. PWR assembly schematic showing guide tubes or water holes.

3.4. TYPICAL BWR EXPOSURE CASE

Data specifying the BWR assembly and axial water densities are listed in Tables 5 and 6, respectively. A general schematic of the assembly is shown in Fig. 2. The exposure time is 1061.777 d. The burnup of the case is 2.866 at. % fissions, or about 27.5 GWd/MTU. Fuel composition in place of mixed enrichments is 2.64 wt % ^{235}U , 0.0234 wt % ^{234}U , and 97.3366 wt % ^{238}U .

Table 5. BWR assembly description, 27.5 GWd/MTU case

Assembly general data	
Lattice, designer	8 x 8, General Electric
Type	Burnable poison
Water density, vol-av, g-cm^{-3}	0.392
Water temperature, av K	558
Number of poison rods	4
Number of holes	1
Channel material	Zircaloy-4
Channel water density, av, g-cm^{-3}	0.743
Fuel rod	
Pellet diameter, in.	0.4160
Gap (diametrical), in.	0.0090
Rod OD, in.	0.493
Fuel rod pitch, in.	0.640
Pellet stack density, % TD	94
Clad material	Zircaloy-2
Active fuel length, in.	148
Plenum (fuel rod) length, in.	10
Fuel temperature, K	840
Clad temperature, K	620
Type 1: 31 rods, wt % ^{235}U	2.64*
Type 2: 16 rods, wt % ^{235}U	2.30
Type 3: 8 rods, wt % ^{235}U	2.12
Type 4: 4 rods, wt % ^{235}U	1.65
Type 5: 4 rods, wt % ^{235}U	2.30, with 2.0 wt % Gd_2O_3

*This enrichment was used for all present analyses since point depletion codes require a single enrichment.

3.5. EXTENDED BWR EXPOSURE CASE

Data giving the fuel rod enrichments and Gd_2O_3 contents of the extended BWR exposure case are listed in Table 7. These apply to the BWR schematic in Fig. 3, with all other assembly and fuel rod data the same as that of the other BWR case as listed in Tables 5 and 6. The exposure time is 1544.400 d. The burnup of the case is 4.172 at. % fissions, or about 40 GWd/MTU. Fuel composition in place of mixed enrichments is 4.15 wt % ^{235}U , 0.0368 wt % ^{234}U , and 95.8132 wt % ^{238}U .

Table 6. Axial water densities of BWR

Top of node (Z, in.)	Density at Z (g-cm ⁻³)	Average density in node (g-cm ⁻³)	Average water temperature (K)
30.83	0.692	0.743	552
43.17	0.569	0.600	558
55.50	0.472	0.494	558
67.83	0.400	0.417	558
80.17	0.347	0.360	558
98.67	0.293	0.309	558
123.33	0.250	0.264	558
148.00	0.228	0.234	558

ORNL DWG 878-10265

Fig. 2. BWR assembly schematic, 27.5-GWd/MTU case.

Table 7. Fuel enrichments of BWR assembly
for 40-GWd/MTU case

Type and number	Wt % ^{235}U enrichment
Type 1: 29 rods	4.15 ^a
Type 2: 16 rods	2.90
Type 3: 8 rods	2.65
Type 4: 4 rods	2.00
Type 5: 2 rods	4.15, 2 wt % Gd_2O_3
Type 6: 4 rods	2.90, 3 wt % Gd_2O_3

^aThis enrichment was used for all present analyses since point depletion codes require single enrichment.

ORNL-DWG 87M 10266

Fig. 3. BWR assembly schematic, 40-GWd/MTU case.

3.6. SUMMARY OF FUEL AND BURNUP DATA OF CASES

A summary of the fuel and burnup data for all reactor cases is shown in Table 8. In this project, it was agreed that each code use the same at. % fission and exposure time in a case. Thus, slightly different values of energy per fission between codes caused small variations from exposures and specific powers listed.

Table 8. Fuel exposure and burnup characteristics of cases

Data type	Exposure cases			
	PWR	PWR	BWR	BWR
Reactor type	PWR	PWR	BWR	BWR
Exposure, GWd/MTU	33	50	27.5	40
Specific power, MW/MTU	37.5	37.5	25.9	25.9
At. % fission	3.443	5.206	2.866	4.172
Total exposure, d	880.0	1333.33	1061.78	1544.4
Wt % ^{234}U	0.0275	0.04	0.0234	0.0368
Wt % ^{235}U	3.1	4.5	2.64	4.15
Wt % ^{238}U	96.8725	95.46	97.3366	95.8132
Initial ^{234}U , mol	1.175	1.709	1.000	1.573
Initial ^{235}U , mol	131.9	191.5	112.3	176.6
Initial ^{238}U , mol	4070.0	4011.0	4090.0	4026.0

4. METHOD OF ILLUSTRATING CODE RESULT COMPARISONS

The results computed by ORIGEN2, ORIGEN-S, and CINDER-2 were produced both as printout and as computer data sets. In order to examine these results in an organized manner, the COMPO2SC code was written to automatically read requested results from the data sets produced by the three codes and to consolidate and compare the results in a logical tabulation. The tables produced by the comparison are presented in Appendices C through G.

Two types of tables were developed for this analysis: comparative ratio tables and nuclide distribution summary tables. The comparative ratio tables contain a more detailed comparison of results. For example, all of the requested results (excluding photon and neutron sources) for the 52 nuclides and total decay heats are listed. Also, the ratios in code results of all of these calculations are tabulated. The nuclide distribution summary tables present an overview type of comparative analyses. The nuclides in these tables are separated into a distribution dependent on percentage differences representing code-result-ratios minus unity. A more detailed description of both types of tables is presented in this section. The comparative ratio tables are given in Appendices C through F, and the nuclide distribution summary tables are given in Appendix G. Also, two summary tables and five plots are discussed in the next section.

4.1. COMPARATIVE RATIO TABLES

The complete set of comparative ratio tables are divided into four major sets and 20 subsets. All tables within a major set contain results having the same units: nuclide gram-atoms, nuclide curies, nuclide watts, or total watts. Within each major set are five subsets of tables corresponding to the five cases described in Sect. 3. Finally, within each subset are nine tables having the results for the nine spent fuel cooling times of each case.

The individual tables may contain data for either nuclides or totals. For the first eight cooling times there are two time steps given per page. After the list of nuclide names, nine columns are shown in each table. The results for the nuclides, as computed by each code, are listed first. The next three columns contain the ratios of each code's result to the average of the three (or the average of the nonzero values if one is zero). The names ORIGEN2, ORIGEN-S, and CINDER-2 are abbreviated to OR2, ORS and CIN, respectively. The last three columns in the table contain the ratios of results between each combination of two codes. In the tables having units in total watts, in place of results by individual nuclides are results of the total of all fission products, all actinides (heavy metals), and all fission products plus actinides.

In addition to the tabulation described above, summary-type information is printed at the bottom of the table. These lines pertain to average percentage deviations from unity of each column of ratios. The exact details of computing each of these averages follow. The absolute value of the difference of each nonzero ratio and unity is calculated. These values are simply "absolute-deviations." Then, the average of the absolute-deviations for all nonzero ratios are computed. Finally, this average is multiplied by 100 to convert the fractional value to the "average-absolute-deviation, as %." This type of average is calculated for all of the tabulated columns of comparison ratios.

There are additional types of averages computed for data tabulated by nuclides. A special method is used for excluding either one or two of the largest ratio deviations for each code in calculating the averages. First, in this process, the nuclide having the maximum deviation for each code is selected from only those nuclides having a deviation for that code which exceeds the deviations for both of the other two codes. Then all three of the selected nuclides for the three codes are excluded from the six calculated averages and listed as "av-abs-dev excluding largest one, %." Also, the nuclides with the

next-to-maximum deviations are excluded following a similar process, and the averages are listed on the next line. The final line contains the names of the excluded nuclides, from left to right, for ORIGEN2, ORIGEN-S, and CINDER-2. The names of nuclides exhibiting the maximum deviations are to the left of the slash and those for the next-to-maximum deviation are to the right.

This method used for comparisons of code results should be considered as only one arbitrary method and may not necessarily be the best. For example, there is probably a difference in the importance of nuclide results so that some type of weighting could be used in deriving effective averages. However, the method displays code results and their ratios, which are usually needed in examining the data. The average absolute deviations from unity appeared to be useful quantities to present. Also, it was seen that it might be helpful to determine the changes in these averages upon exclusion of the largest deviations. While this method could be improved, it certainly had the tendency to indicate both the poor and high quality of results from the codes in the variety of cases presented.

One of the advantages to the comparison method used here is that all data were read from data sets and did not have to be transcribed. Thus, once it was coded correctly, human error was avoided. One exception, however, was made to this rule of unaltered data: Due to a definition misunderstanding, there was one case in which data had to be removed. It was intended that the data computed for nuclides in watts be only the energy rate produced by the nuclide as it decays to its first daughter nuclide. However, when results were not tabulated separately for the daughters in the CINDER-2 data, the energy rates produced by the daughter were added to that of the parent nuclide. Thus, in order to avoid incorrect or misleading comparison ratios, the results for nuclides derived differently by CINDER-2 were set to zero and skipped in the analysis. In order to refrain from skipping numerous nuclides that would have meaningful comparisons, only nuclides for which the inclusion of daughter decay heats increased that of the nuclide by more than 0.1% were included in the group being skipped. Note that the above difficulty was not present in the comparisons using gram-atoms, curies, or total watts.

4.2. NUCLIDE DISTRIBUTION SUMMARY TABLES

The nuclide distribution summary tables display the variations between the results of any set of two codes. In this comparison process between any two codes, a percentage variation for each nuclide is determined by multiplying 100% by the difference in the ratio of the code results minus one. If the larger result is in the numerator, a positive percentage is produced. Or, if the smaller result is in the numerator, a negative percentage is computed. The nuclides are finally grouped into percentage difference ranges, or deltas, having the following boundaries: 30, 20, 10, 5, 1, -1, -5, -10, -20, and -30%.

Nuclide distribution tables are grouped into subsets similar to those used for the comparative ratio tables. The major division is by the units of gram-atoms, curies, and watts. Then, for tables in gram-atoms, tables are given for each of the five cases. However, the tables in curies and watts are limited to the decay-only case. Finally, there are tables for each of the nine decay times, with three per page. The reason for excluding tables in curies and watts for the reactor exposure cases is that nuclide distribution variations between tables in gram-atoms and those using the other units is demonstrated for the decay-only case, while the major variations in nuclide distributions for the reactor exposure cases appear to be illustrated sufficiently in the tables for gram-atoms.

5. EXAMINATION OF COMPARISONS IN CODE RESULTS

In comparing the results from the three codes it is not always possible to determine the chief reasons for differences in nuclide results. The depletion models used by each code in computing cross sections treated various aspects of the reactor physics analysis somewhat differently. In the decay-only case, where the calculation in all three codes began with the same discharge inventory, any reason for differences was limited to the mathematical decay model, decay paths in the library, half lives, and nuclide decay heats. Thus, usually the reasons for differences in results in the decay-only case could be determined. Also, in assessing the importance of the difference in results for any particular nuclide, consideration should be given to the impact the result of that nuclide has on the intended applications of the results.

First, a more general discussion of the comparisons for each case is presented. Then, an endeavor to reconcile some of the major differences is given.

5.1. GENERAL COMMENT ON ENTIRE SET OF COMPARISONS

Some of the differences between nuclide results computed by the three codes appear to be somewhat large. However, in relation to similar previous comparisons and the substantial differences in the cross-section processing models used by the codes, the nuclide differences are not considered greater than expected by most experienced reactor physics analysts. Also, expanding the comparisons to BWR cases and extended burnups put a further strain on the effects of some of the approximations in the models that may have been somewhat minor in the typical PWR case. Note that for most of the nuclides that contribute the greatest consequences there are relatively good agreements. While not without defects, each of the codes in the comparison appears to produce respectable results.

A summary assessment of the code comparisons can be seen in the plots in Figs. 4-8 and the tabulations in Tables 9 and 10. The plots show the percentage differences in the total decay heat rate predictions for each set of two codes. The comparisons in Fig. 4 pertain to the decay-only case. Since the input for each code was the same inventory, the decay-only case provides a good method of comparing the decay libraries used by each code. The comparisons in Figs. 5-8 pertain to predictions computed in the four reactor exposure cases, as noted in the figure captions. They show significantly more percentage differences than that of the decay-only case, particularly after a 50-year decay time.

Tables 9 and 10 are special types of summaries of the nuclide distribution summary tables described in Sect. 4.2 and given in Appendix G, in which the percentage differences between each pair of code results are distributed by percentage-difference deltas. There is a large number (i.e., 405) of these tables, since they are given for each of the three pairs of codes, the nine decay times, the five cases, and the three types of units. In order to summarize the large number of tables, a count (for each nuclide) was made of the number of times the percentage difference fell within each percentage-difference delta as each of the 405 tables were being determined. The distribution of these total counts for each nuclide was tabulated in Table 9. Observations of this table indicates for each nuclide how well the three code predictions agree.

Even though Table 9 is a useful summary, it can be misleading to assess similar distributions for two different nuclides in the table as having similar impacts upon intended applications. For example, the percentage difference for both ^{246}Cm and ^{241}Am falls within the same -10 to -20% delta for all three units at 1000 years for one of the pair of code comparisons. However, ^{246}Cm has a decay heat rate of only 5×10^{-4} W, while that for ^{241}Am is 25 W and the total decay heat rate at the same decay time is 47 W. Thus, it appeared reasonable for identifying nuclides that may require an improved computation, from the standpoint of total decay heat rates or photon sources, to determine a distribution including only the number of percentage-difference cases where the decay heat rate exceeds an appropriate minor fraction of the total decay heat rate. Since almost all of the percentage

Fig. 4. Decay-only case comparison of the predictions of the codes for total decay heat rate.

Fig. 5. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 33-GWd/MTU PWR.

Fig. 6. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 50-GWd/MTU PWR.

Fig. 7. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 27.5-GWd/MTU BWR.

Fig. 8. Comparison of the predictions of the codes for total decay heat rate as generated by fuel from a 40-GWd/MTU BWR.

Table 9. Tabulation of % differences in nuclide gram-atoms, curie, and decay heat predictions between codes into a frequency distribution

DELTA, %	SE79	KR85	SR89	SR90	Y90	Y91	ER93	ER95	MB95	IC99	RU106	PD107	AM126	SR125	Y129	CA133	CA134	CA135
-30 TO 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30 TO 20	0	0	0	0	0	0	0	23	0	0	12	54	56	0	0	0	0	108
20 TO 10	0	0	0	0	0	0	0	32	0	0	12	54	16	0	54	0	0	27
10 TO 5	0	0	0	24	24	0	0	58	0	162	36	36	0	0	90	36	18	27
5 TO 1	117	60	192	192	77	27	58	283	283	283	283	81	153	189	117	333	225	108
-1 TO 1	63	264	326	165	328	252	283	9	10	0	18	0	0	0	117	36	108	54
-5 TO -1	24	19	24	24	0	126	0	0	0	0	72	117	0	0	63	0	54	81
-10 TO -5	180	0	0	0	0	0	0	0	0	0	12	63	72	72	0	0	0	0
-20 TO -10	72	0	0	0	0	0	0	0	0	0	0	0	108	18	0	0	0	0
-30 TO -20	54	0	0	0	0	0	0	0	0	0	0	0	0	126	0	0	0	0
-30	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA, %	CS137	CE144	ND149	ND149	ND145	ND146	PM147	SM147	SM148	SM149	SM150	SM151	SM152	SM153	SM154	SM155	U234	U235
-30 TO 30	0	0	0	0	0	0	0	90	23	0	0	0	0	0	0	0	0	0
30 TO 20	0	0	0	0	0	0	0	54	168	0	54	25	0	0	0	0	0	0
20 TO 10	25	0	0	0	0	0	0	20	36	18	0	50	0	18	0	21	0	70
10 TO 5	135	8	36	18	0	0	0	13	0	36	18	0	9	54	0	42	12	80
5 TO 1	237	74	18	72	45	36	12	42	36	0	36	0	18	18	39	153	111	55
-1 TO 1	0	323	306	225	324	342	177	90	153	153	324	97	306	306	177	153	111	55
-5 TO -1	0	0	35	90	36	27	30	48	0	18	27	0	0	9	0	62	75	26
-10 TO -5	0	0	10	0	0	0	0	0	0	0	0	79	0	0	21	28	36	70
-20 TO -10	0	0	0	0	0	0	0	0	0	72	0	27	45	0	147	42	36	31
-30 TO -20	0	0	0	0	0	0	0	0	99	54	0	127	27	0	21	56	36	5
-30	0	0	0	0	0	0	0	0	81	0	0	0	0	0	0	0	60	0
DELTA, %	U236	U238	NP237	PU238	PU239	PU240	PU241	PU242	AM241	AM242	AM243	CM243	CM244	CM245	CM246			
-30 TO 30	0	0	0	0	9	0	0	2	0	0	81	27	66	96	45	135	108	
30 TO 20	0	0	0	0	3	0	0	27	135	9	0	54	0	0	66	27	54	
20 TO 10	0	0	0	0	51	81	0	82	81	99	27	137	30	0	24	27	54	
10 TO 5	0	0	0	0	21	0	0	23	34	27	0	52	3	0	45	54	54	
5 TO 1	35	0	13	3	19	0	0	35	56	27	18	0	6	0	0	27	0	
-1 TO 1	273	405	49	81	119	89	80	46	75	63	99	93	117	113	81	79	0	
-5 TO -1	55	0	68	39	16	100	29	44	51	0	9	6	0	40	0	2	0	
-10 TO -5	12	0	25	25	41	43	9	9	12	0	27	12	32	0	0	0	0	
-20 TO -10	0	0	37	80	40	173	52	0	67	54	0	54	40	21	0	54	0	
-30 TO -20	30	0	55	69	79	0	6	0	8	24	0	27	0	21	54	0	0	
-30	0	0	112	24	2	0	60	0	30	138	0	108	120	30	0	0	0	

Table 10. Tabulation of % difference frequency distribution if nuclide
watts exceeds 0.01% of total watts

DELTA5, %	SR79	KR85	SR89	SR90	Y90	Y91	RR93	RR95	MB95	TC99	FU106	PD107	BM126	BM125	A129	CM133	CM134	CM135
30 TO 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 TO 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 TO 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 TO 10	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0
1 TO 5	0	75	18	168	168	21	0	18	13	36	16	0	0	0	0	0	12	0
-1 TO 1	63	264	326	165	165	328	252	283	283	243	243	81	153	189	81	333	225	108
-5 TO -1	0	15	9	21	21	0	0	9	10	0	0	0	0	0	0	0	72	0
-10 TO -5	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	36	0
-20 TO -10	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0
-30 TO -20	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
-30	0	0	0	0	0	0	0	0	0	0	0	0	0	84	0	0	0	0

DELTA5, %	CS137	CM144	ND142	ND144	ND145	ND146	PH147	SM147	SM148	SM149	SM150	SM151	SM152	FU153	FU154	EU155	U234	U235
30 TO 30	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0
20 TO 20	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	12	0
10 TO 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0
5 TO 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
1 TO 5	127	18	0	0	0	0	0	8	0	0	0	0	0	0	36	0	21	0
-1 TO 1	237	323	306	225	324	342	177	90	153	153	324	97	306	306	177	153	111	55
-5 TO -1	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	32	12
-10 TO -5	0	0	0	0	0	0	28	0	0	0	0	0	0	0	15	15	0	0
-20 TO -10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123	22	6	0
-30 TO -20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	32	30	0
-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0

DELTA5, %	U236	U238	NP237	FU238	FU239	FU240	FU241	FU242	AM241	AM242	AM243	CM242	CM243	CM244	CM245	CM246
30 TO 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 TO 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 TO 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 TO 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 TO 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-1 TO 1	273	405	49	81	119	89	80	46	75	63	99	93	117	113	81	79
-5 TO -1	27	0	9	39	16	100	23	24	51	0	9	6	0	34	0	0
-10 TO -5	12	0	0	25	41	83	7	5	12	0	24	12	20	0	0	0
-20 TO -10	0	0	0	74	80	173	46	0	67	0	0	42	25	18	0	0
-30 TO -20	30	0	0	69	79	0	0	0	8	0	0	24	0	18	6	0
-30	0	0	90	6	2	0	0	0	30	0	0	75	75	0	0	0

differences in code predictions of total decay heat rates are $>0.1\%$, all nuclide percentage-difference cases were excluded from the distribution if the average code results for the nuclide in watts are $<0.01\%$ of the average total watts and the percentage difference was outside the -1 to $+1\%$ delta. The frequency distribution determined on this basis is shown in Table 10. Note that the code agreement depicted by this table appears to be better than that in Table 9, in particular, for the fission products. However, since cases are excluded in Table 10 from the standpoint of decay heat, the table should not be used for evaluating comparisons for some of the other purposes, such as sorption predictions during long-term disposal or criticality during storage and transportation.

5.2. THE DECAY-ONLY CASE

The decay-only case was intended to show differences in nuclide decay constants and decay heat rates in addition to total decay heat rates. Within the first 100 years all average deviations were $<1\%$. Even at 10,000 years these averages are in the 2 to 6% range or about 1% when excluding the two maximum deviations. The agreement between ORIGEN2 and ORIGEN-S was very good, with average differences $<1\%$ (except at 1,000 years) for all units except nuclide watts, for which the maximum average was 2.1%. In the comparisons of total watts of each code to the average, the differences were $<1.1\%$ throughout all time steps and $<0.3\%$ for all cooling times through 1,000 years.

The major differences in nuclide results start at 100 years, with ^{237}Np computed by CINDER-2 about 82% of the three-code average. Then, at 300 years the comparisons to the average for ^{241}Pu is 132% for ORIGEN-S and 50% for CINDER-2. At 1,000 years ^{244}Cm has gross differences, and at 10,000 years ^{241}Am results are greatly different. However, these discrepancies (except for ^{244}Cm), as discussed below, are due to the absence of a decay link between two nuclides of a decay chain in CINDER-2 and are not due to errors in decay constants.

The comparisons to the code average result are within a few percent for all fission products except ^{95}Zr , ^{95}Nb and ^{137}Cs , which differ $<10\%$ from the averages only after being greatly diminished.

The differences in results for radioactivity are almost identical to results in gram-atoms. Usually this is also the case for individual nuclide decay heat. Two exceptions to this finding are the watts for ^{79}Se and ^{107}Pd .

5.3. THE TYPICAL PWR EXPOSURE CASE

The comparisons of results for the PWR 33-GWd/MTU case are a mixture of good, poor, and fair. The ^{239}Pu content compares with the average at 30 d as 95, 106, and 99% for ORIGEN2, ORIGEN-S and CINDER-2, respectively. For ^{244}Cm , which is important for its neutron (mainly), photon, and decay heat production, the same type of comparisons are 93, 91 and 116% (for the respective codes). As for ^{235}U , the comparisons (same order) are 97, 99 and 103%. Most of the important fission products, ^{90}Sr , ^{90}Y , ^{106}Ru , ^{134}Cs , ^{137}Cs , ^{144}Ce , ^{154}Eu , and ^{155}Eu , were in fair-to-good agreement. Other fission products, ^{125}Sb , ^{126}Sn , and ^{148}Sm , have relatively poor agreement. The agreement for two important actinides at long cooling times, ^{240}Pu and ^{241}Am , is fair at 30 d, while that for the relatively unimportant, ^{242}Am and ^{243}Cm , is poor. The same discrepancies discussed for the decay-only case at long times are present in this and all remaining cases.

The total decay heat does not vary from the average by more than 6.1% (300 years) for all times or more than 1.4% for the first 20 years. The fission-product decay heat for the first 50 years varies from the average within 0.9% for ORIGEN2 and ORIGEN-S and within 1.5% for CINDER-2.

5.4. THE EXTENDED PWR EXPOSURE CASE

As expected, there is somewhat less agreement in the extended PWR exposure case than the typical burnup case. The comparisons of code results to the average of the major actinides at 30 d, for ORIGEN2, ORIGEN-S and CINDER-2, respectively, are the following: 97, 107, and 96% for ^{239}Pu ; 90, 89, and 121% for ^{244}Cm ; and 94, 100, and 106% for ^{235}U . For the fission products and actinides listed in the other PWR case, the agreements were about the same or slightly better.

The total decay-heat agreement, also, is about the same as in the other PWR case. The maximum variation from the average of total heats was 6.2% (10,000 years), and the agreement for the first 20 years remained within 2.3%. The maximum difference from the average for fission products during the 5- to 100-year period, inclusive, was 1.7%.

5.5. THE TYPICAL BWR EXPOSURE CASE

The BWR has more variation in moderation density, both axially and radially, than the PWR. Thus, it is difficult to simulate the BWR without using a three-dimensional depletion model. This problem was indicated, also, in some of the nuclide content comparisons of the typical BWR exposure case. The comparisons of code results to the average of the major actinides at 30 d, for ORIGEN2, ORIGEN-S, and CINDER-2, respectively, are the following: 109, 110, and 80% for ^{239}Pu ; 115, 88, and 97% for ^{244}Cm and 107, 101, and 92% for ^{235}U . The averages of these comparisons change from 4 to 13% for ^{239}Pu , 11 to 10% for ^{244}Cm , and 2 to 5% for ^{235}U between the typical PWR and BWR cases, respectively. These comparisons of the average of the results at 30 d are somewhat misleading, particularly for ^{244}Cm . They suggest that the differences among the codes in the prediction of ^{244}Cm content for the typical PWR case and that for the BWR are small. The percentages given are average changes between the PWR and BWR typical exposure cases in comparison of the individual code result to the average result at 30 d. Although this "average" does not change much, the comparison of the ORIGEN2 results to the 30-d average increases dramatically (+23%), and the ratio of the CINDER-2 results to the same 30-d average decreases almost equally (-17%). Thus, the average of these changes appears nearly constant, as does the ratio of the ORIGEN-S results to the average (-3%). Similar trends are seen for ^{239}Pu and ^{235}U , with the individual changes being less dramatic than those observed in the case of ^{244}Cm .

Even though the agreement for most of the more important fission products is not significantly different than in the PWR case, the differences in the results for ^{134}Cs , ^{154}Eu , and ^{155}Eu are substantially larger.

The total decay heat does not vary from the average by more than 14% (10,000 years) for all times, or more than 2.0% for the first 20 years. The fission-product decay heat for the first 50 years varies from the average within 1.5% for ORIGEN2 and ORIGEN-S and within 2.4% for CINDER-2.

5.6. THE EXTENDED BWR EXPOSURE CASE

There was somewhat less agreement between results of the three codes for the extended exposure case than that of the typical exposure BWR case. The comparisons of code results to the average of major actinides at 30 d, for ORIGEN2, ORIGEN-S, and CINDER-2, respectively, are the following: 99, 118 and 83% for ^{239}Pu ; 92, 97, and 111% for ^{244}Cm ; and 95, 106, and 99% for ^{235}U . The averages of these comparisons change from 5 to 12% for ^{239}Pu , 14 to 7% for ^{244}Cm , and 3 to 4% for ^{235}U between the extended exposure PWR and BWR cases, respectively. These percentages are based on gross averages and as in the typical exposure cases, may cause the results to appear to be in better agreement than is evident from the individual comparisons.

For most of the important fission products, the agreement was not substantially different than that of the typical BWR case. However, there was a marked improvement in the comparisons of results for ^{106}Ru and ^{134}Cs .

The total decay heat does not vary from the average by more than 12% (10,000 years) for all times, or more than 1.1% for the first 20 years. The fission-product decay heat for the first 50 years varies from the average within 0.5% for ORIGEN2 and within 1.9% for ORIGEN-S and CINDER-2.

6. RECONCILING SIGNIFICANT DIFFERENCES IN RESULTS

First, the differences in results of the decay-only case are discussed. Most of these variations can be reconciled. All reasons for results to differ in the decay-only case cause similar differences in the other cases, also. Because it appears that no benefit is gained from repeating the same reasons, the discussion for the four reactor exposure cases will be limited to differences caused by cross sections or the depletion models, only. In general, the order in which nuclides are discussed will simply follow that of increasing mass number instead of relative significance.

6.1. RECONCILING DECAY-ONLY CASE VARIATIONS

First the nuclide having significant percentage differences ($>5\%$ from average at $<10,000$ years) is stated, followed by any reconcilable reason for the large percentage differences in code results. In many cases, the nuclide concentration is so extremely small that there probably is a relatively low impact from the quantity on most likely applications. A test for fractional content of the nuclide is used to help detect such cases. If the percentage of the nuclide decay heat $<0.01\%$ of the total decay heat at cooling times where a result differs $>5\%$ from the average, it is said to fall below the "minor content" test. While the values are arbitrarily selected, the test may be helpful when considered as reasonable.

⁷⁹Se: The Q-value used by ORIGEN2 was taken from ENDF/B-IV and that used by the others was taken from ENDF/B-V. (However, the quantities are below the minor content test.)

⁹⁵Zr: The half-life used by CINDER-2 was taken from ENDF/B-V and that used by the others was taken from ENSDF. There is a 0.2% difference in the half-lives. (The quantities are below the minor content test.)

⁹⁵Nb: The half-life of ⁹⁵Nb and the branching fractions of ⁹⁵Zr used by CINDER-2 were taken from ENDF/B-V and those used by the others were taken from ENSDF. Percentage differences were as much as 10% at 20 years. (The quantities are below the minor content test.)

¹⁰⁷Pd: The Q-value used by ORIGEN2 was taken from ENDF/B-IV and that used by the others was taken from ENDF/B-V. (The quantities are below the minor content test.)

¹³⁷Cs: The half-life used by ORIGEN2 was taken from ENSDF and that used by the others was taken from ENDF/B-V. (The quantities are below the minor content test.)

²³⁷Np: The α decay of ²⁴¹Am to ²³⁷Np is not present in the CINDER-2 library. While the quantities are not large (0.02 W, with a total of 126 W at 300 years), they exceed that of the minor content test.

²⁴¹Pu: Two different causes changed these results at various time steps. The reason at 50 to 100 years was that ORIGEN2 used a half-life taken from ENSDF and that used by the others was taken from ENDF/B-V. Then, at ≥ 300 years the large reductions in CINDER-2 results were due to the omission of the ²⁴⁵Cm decay to ²⁴¹Pu in the library. (The quantities slightly exceed that of the minor content test.)

²⁴¹Am: The results through 1000 years were in good agreement, but the fraction of ²⁴¹Am from ²⁴⁵Cm (produced in the ²⁴⁵Cm-²⁴¹Pu-²⁴¹Am chain) was relatively small. Then, at 10,000 years the omission of ²⁴⁵Cm to ²⁴¹Pu in the CINDER-2 library becomes significant. The decay heat from ²⁴¹Am can be a significant fraction of the decay heat at long times, such as 100 to 10,000 years.

^{244}Cm : The results agreed through 300 years, after which a small amount was computed by ORIGEN2 and the other code results decreased to zero (or below the IBM machine word size) at 10,000 years. The branching fractions for the α decay plus spontaneous fission of ^{244}Pu are 0.9999 in the ORIGEN2 library, and the remaining 10^{-4} is treated as β decay. This small amount feeding ^{244}Am and finally ^{244}Cm incorrectly caused the very small ^{244}Cm content. (The amounts are below the minor content test.)

6.2. VARIATIONS IN EXPOSURE CASES

The depletion models from which cross sections are derived from the ORIGEN2, ORIGEN-S, and CINDER-2 are similar in that they all use a lattice of unit cells in at least part of the calculation. In regard to most multidimensional effects within the core, substantial differences in techniques are used in their simulation. It may be concluded from the descriptions of each of these models that there are good features in the methods used by each code. Since the simulation of all aspects of the depletion analysis cannot be perfect, there are also reasons why results from the codes can vary.

An explanation of why results from the three codes differ for each particular nuclide computed during depletion requires a careful study of various contributing factors. Also, precisely quantifying the effects of the different reasons would require a more complex analysis program than that used for these comparisons. A more simplified qualitative analysis is attempted in order to partially reconcile the additional nuclide differences in the exposure cases. Most of the significantly different methods applied in computing cross sections for the three codes are discussed below (with no meaning attached to the order):

1. Different cross-section data are used as sources to the computational models of each code. The data sources⁶ for ORIGEN2 were ENDF/B-IV,¹¹ the Livermore Laboratory LENDL library,¹² and Savannah River Laboratory data.¹³ The data source for CINDER-2 was ENDF/B-V.¹¹ For ORIGEN-S the data source of fission products was ENDF/B-V and that of actinides and light elements was ENDF/B-IV. For nuclides of lesser importance the ORIGEN library was a data source for ORIGEN2 and ORIGEN-S. Also, the input library, ENDF/B, does not model thermal reactors well unless an empirical adjustment is made. Savannah River Laboratory has supplied ORNL with such a factor and it is used in ORIGEN2's version of ENDF/B. Such changes result in lower values in ORIGEN2's prediction for the plutonium radionuclides.
2. The geometry description and material content of the fuel, clad, moderator and structure (spacers) were taken from the specific problems described in Sect. 3 for ORIGEN-S and CINDER-2, whereas for ORIGEN2 the data for typical PWR and BWR reactors were used in producing the PWR and BWR libraries, respectively.
3. The EPRI-CELL/CINDER-2 model allows for two fractional contributions of nonuniform lattice Dancoff calculations in the resonance self-shielding cross-section calculation. A uniform lattice Dancoff factor of the fuel pin geometry was used by ORIGEN-S. A uniform Dancoff factor of the fuel pin geometry was used only for the inner rods of the assembly in producing the ORIGEN2 libraries. The space between assemblies was used in computing the Dancoff factors for the pins on the edge of the assembly. The additional space between assemblies is significantly large for the BWR and small for the PWR. In ORIGEN2, water holes in the guide tubes of PWR control rod assemblies were not accounted for in the calculation of Dancoff factors. In analyzing the significance of the Dancoff factor by computing PWR cases by SAS2, it was determined that a decrease in the Dancoff factor by 20% caused the ^{239}Pu discharged to increase by 3.5%.

4. Flux from adjacent core zones of different ^{235}U enrichment and burnup were accounted for in ORIGEN2. In order to produce this effect, the flux was forced to be flat and have the same spectrum over the three or four zones by using the small plate model, which is effectively a zero-dimensional model. EPRI-CELL and SAS2(H) do not include this process. It is not easy to quantify the effects from this process.
5. The EPRI-CELL/CINDER-2 model used four separate space points radially or regions within the fuel of the pin for four separate depletion calculations, followed by the final combination of the four compositions. This process was not included in the ORIGEN-S or ORIGEN2 models. EPRI-CELL cases, applying both one and four depletion regions, have been computed in order to better evaluate the significance of using four separate depletion calculations. Comparisons for the PWR were performed at LANL. Cases for comparing the BWR type of fuel pin, using a BWR type of unit cell in a uniformly spaced lattice, were computed at ORNL. In both comparisons, the comparable differences did not exceed 0.5% for concentrations of ^{234}U , ^{235}U , ^{236}U , ^{238}U , ^{239}Pu , ^{240}Pu , ^{241}Pu , and ^{242}Pu .
6. The extra moderator, burnable poison, and structural materials are simulated in the ORIGEN2 and EPRI-CELL models as an extra region surrounding the unit pin-cell. In the SAS2(H) model, the extra moderator, guide tubes, and burnable poison rods, if present, are simulated more exactly. First, in this process, the infinite lattice of the unit pin-cell is computed (with no extra region) and the cell-weighted cross sections are saved. Then, a second transport calculation is performed as an infinite lattice of an expanded cell representing the volume in and around each burnable poison rod or guide tube and "water hole" in the assembly. For example, in control rod assemblies, the water hole and guide tube are placed at the center of the cell, surrounded by a fuel cell region having the size which conserves the ratio of fuel cell volume to water hole volume of the assembly. The fuel cell region has the cell-averaged densities and cell-weighted cross sections of the unit pin-cell. In the BWR, a fuel rod containing gadolinium poison is at the center, the unit cell material is next, and the outer region is composed of the higher-density moderator from the channel between assemblies (approximately half the water mass).
7. In the BWR cases, no gadolinium was used in the ORIGEN2 and EPRI-CELL/CINDER-2 models. Separate volume-power weighting techniques were used by each of the three models to simulate the moderator density of the BWR cases.
8. EPRI-CELL applies the GAM and THERMOS codes and Bondarenko factors produced from the NJOY code, while the resonance treatment and transport calculations for ORIGEN2 and SAS2H were performed by the NITAWL and XSDRNP codes. Even though these codes have similarities, the differences could affect results.

The differences in the nuclide contents for ^{239}Pu , ^{235}U , and ^{244}Cm can be caused by the above variations in the depletion models of the three codes. There appears to be a marked increase in these differences in the BWR cases, which could be due to increased significance of some of the methods and assumptions of the three cross-section production procedures. There was an important difference in the models used in the BWR cases, which required a calculation of an assembly containing gadolinium poison. Since gadolinium could not be used by the EPRI-CELL/CINDER-2 calculation, it was omitted. The ORIGEN2 library was also produced using a simulation of boron. For the ORIGEN-S case, the gadolinium pins were described precisely, using the predetermined ^{155}Gd and ^{157}Gd letdown curves (i.e., the pronounced depletion in their densities during exposure).

The agreements for ^{242}Am and ^{243}Cm are very poor, due primarily to the difference between the ORIGEN-S results and that from the other codes. This situation is due to the fact that the cross sections for these nuclides were not updated by SAS2(H) for ORIGEN-S, because the data in ENDF/B-IV were incomplete.

Fair agreement was reached between the results of most of the other actinides. The larger differences starting at 300 years are due to reasons given in the discussion of the decay-only case.

As noted above, it appears that all of the more important fission products (from the standpoint of sources and decay heats) were in good agreement, particularly in the PWR cases, except those differences illustrated in the decay-only case. The three fission products with greatest disagreement were ^{125}Sb , ^{126}Sn , and ^{148}Sm . The main reason the ORIGEN-S result for ^{125}Sb and ^{148}Sm differs is because the large ^{124}Sb and ^{147}Sm cross sections were not updated in the library production process for the cases. The reason for the large differences in results (17% from the average) for ^{126}Sn was due to substantially different fission fraction yields for nuclides in the decay chain producing ^{126}Sn . While, in general, there is not much difference in the effect of using ENDF/B-IV fission yields in ORIGEN-S, this is one case where the difference can be seen. The decay heat from ^{126}Sn contributes a maximum of 5% to the fission-product decay heat (at 10,000 years) but <0.01% of the total decay heat at all times.

In the BWR cases, the differences in code results for important fission products were substantially larger for ^{134}Cs , ^{154}Eu and ^{155}Eu . These nuclides, and several that are considered to be less important nuclides, are highly dependent on cross sections that would tend to have increased variations between codes for the BWR cases.

7. CONCLUSIONS AND RECOMMENDATIONS

The objectives of this study were to assess the predictive capabilities and features of three source-term codes that will be of use to DOE/OCRWM. This goal was accomplished through a series of comparisons of their output for several LWR reactor models at nine decay times. The benchmark computations were designed to test the data-base libraries and methodologies used by each of the codes in predicting the radionuclide content and decay heat of generic LWR spent fuel, specifically irradiated UO_2 .

This report summarizes the comparisons in results for individual nuclides in various units and the actinide, fission product, and total decay heat rates. A supplementary report¹⁴ presents comparisons of total photon and neutron emission rates, photon and neutron spectra, and photon and neutron dose rates from a typical rail shipping cask.

The number of radionuclides that DOE/OCRWM needs to have well characterized is a small set of those available in the three codes compared in this study. Kelmers et al.¹⁵ have assessed radionuclide generation and depletion codes as to their capabilities in addressing the requirements associated with the transportation, storage, and geologic disposal of HLW. In their report, they identified certain specific radionuclides that are important in the calculation of gamma dose (shielding), decay heat, criticality, and long-term disposal. Of the 36 radionuclides identified in their report and listed in Table 11, 24 were examined in this three-code comparison study. Three of the isotopes (^{14}C , ^{59}Ni , and ^{60}Co) are long-lived activation products and were not considered because this examination was limited to irradiated UO_2 containing no impurities. Other radionuclides (^{106}Rh , ^{144}Pr , and ^{230}Th) were not included in the output from CINDER-2; therefore, they were not included in this report. Most of the remaining radionuclides are minor contributors to each of the categories and were deleted from the comparison list. Additionally, only one radionuclide of three parent-daughter pairs ($^{106}\text{Ru} - ^{106}\text{Rh}$, $^{137}\text{Cs} - ^{137\text{m}}\text{Ba}$, and $^{144}\text{Ce} - ^{144}\text{Pr}$) were included because comparison of one isotope in each pair should be sufficient to verify the other member. Note that several of the isotopes appear in more than one category.

7.1. FISSION PRODUCTS

The major contributors to decay heat and radiation hazards for transportation and storage of spent fuel and other HLW are the short-lived fission products. Among the three codes, excellent agreement (within 5%) was obtained for ^{85}Kr , ^{90}Sr , and its daughter ^{90}Y . Greater variability was noted among the codes when comparing the predictions for the remaining five fission products listed in Table 11 for which comparisons were made. Figure 9 is a set of pie charts illustrating the cumulative percentage agreement among the three codes for the computed composition (in gram-atoms) for each of these five fission product nuclides. The five values given for each pie chart represent the ratio, expressed as a percentage, of the number of comparisons that are within the indicated percentage agreement (as given in the legend in Fig. 9 and tabulated in Table 9) to the total number (405) of comparisons for each radionuclide. This number was derived from the product of the three-pair comparisons (ORGEN2 vs ORIGEN-S, ORIGEN2 vs CINDER-2, and ORIGEN-S vs CINDER-2) times the nine decay periods times the five cases times the three types of information (composition, radioactivity, and decay heat). For example, 54% of the ^{154}Eu comparison pairs agree to within 5%, 5% within 5 to 10%, 36% within 10 to 20%, 5% within 20 to 30%, and there are no pairs with an agreement worse than 30%. The ranges are the same as those given in Table 9, except they were converted to absolute values. Nearly identical results are obtained if the radioactivity (curies) or decay heat (watts) are substituted for composition (gram-atoms). Of the five radionuclides given in Fig. 9, ^{125}Sb , and ^{147}Pm yield the poorest agreement.

Sb-125

Cs-134

Cs-137

Pm-147

Eu-154

Fig. 9. Measure of agreement among the three codes, taken two at a time, when predicting the composition of selected fission products.

Table 11. Significant radionuclides^a in the specified categories of a Federal Waste Management System¹⁴

Decay heat and gamma dose	Criticality	Long-term disposal
⁹⁰ Y	²³⁹ Pu	²⁴¹ Am
¹³⁴ Cs	²³⁸ U	²⁴⁰ Pu
^{137m} Ba	²³⁵ U	²³⁹ Pu
¹⁰⁶ Rh	²⁴⁰ Pu	²⁴³ Am
²³⁸ Pu	²⁴¹ Pu	²³⁴ U
²⁴⁴ Cm	²⁴¹ Am	²⁴² Pu
¹³⁷ Cs	¹⁴⁹ Sm	²³⁹ Np
¹⁴⁴ Pr	¹⁵⁵ Gd	¹⁴ C
¹⁵⁴ Eu	¹⁰³ Rh	²³⁷ Np
⁹⁰ Sr	¹⁴³ Nd	²³⁸ Pu
⁶⁰ Co	²³⁶ U	⁵⁹ Ni
²⁴¹ Am	¹³¹ Xe	²³⁸ U
²⁴⁰ Pu	¹³³ Cs	²³⁰ Th
¹⁴⁷ Pm	¹⁵¹ Sm	
⁸⁵ Kr		
¹²⁵ Sb		

^aRadionuclides are given in descending order of importance in each category.

Source:

A. D. Kelmers, A. G. Croff, L. B. Shappert, J. W. Roddy, O. W. Hermann, and C. V. Parks, *Identification and Evaluation of Preliminary Selection or Short-Listing of Radionuclide Generation/Depletion Codes for Enhancement and Utilization in Activities Associated With the Transportation, Storage, and Geologic Disposal of High-Level Radioactive Wastes*, ORNL/TM-10404, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab. (to be published).

A proper criticality analysis of high-level radioactive wastes such as LWR spent fuel requires knowledge of the concentration of the neutron absorbers. Although minor contributors, several fission products absorb neutrons. Four of those listed in Table 11 were included in this study. Excellent agreement was obtained for ¹³³Cs, moderately good agreement for ¹⁴³Nd, and fair agreement for ¹⁴⁹Sm and ¹⁵¹Sm.

7.2. ACTINIDES

These radionuclides exhibit a significant impact on each of the categories listed in Table 11. The pie charts given in Figs. 10 and 11 show that there is a significant disparity in the results predicted by the three codes. Two of the actinides, ²³⁸Pu and ²⁴⁴Cm, contribute a measurable amount to the decay heat of spent fuel at 5 years following discharge, and the agreement among the codes for these radionuclides, in many of the comparisons, is less satisfactory than the comparative agreement desired.

Fig. 10. Measure of agreement among the three codes, taken two at a time, when predicting the composition of selected actinides.

Pu-238

Pu-239

Pu-240

Pu-241

Pu-242

Fig. 11. Measure of agreement among the three codes, taken two at a time, when predicting the composition of the plutonium radionuclides.

Most of the radionuclides important in the assessment of criticality and in the long-term disposal of high-level radioactive wastes are actinides. As expected, all three codes agree to within 1% for the ^{238}U concentration in all cases and decay times. Somewhat greater than half of the comparisons fall within the 5% range for ^{234}U , but 15% of the comparisons disagree by more than 30%. The plutonium isotopes exhibit a much greater range of variability in their comparison statistics (Fig. 11). Because these radionuclides appear near the top of the list in each category in Table 11, an accurate prediction of their concentration is important.

7.3. SUMMARY

Benchmarking of computer codes has proven useful in verifying their data bases and methodologies. However, the true worth of a code is not determined until it has been through a complete validation effort. This test requires the availability of suitable experimental data for detailed comparisons. Specific output quantities of importance are used as indicators for determining whether a code provides satisfactory agreement with experimental results. These indicators can serve to measure a code's level of validation. Although some data are available in the literature, it is insufficient to be used to validate any of the three codes examined in this study.

This benchmarking study has demonstrated that the predictions by the three computer codes of the radionuclide content and the resulting decay heat of irradiated UO_2 show a wide disparity in many of the radionuclides that are of importance in the Federal Waste Management System (FWMS) for DOE/OCRWM. The differences among the codes are the result of differences in the various data base libraries each of the codes are using and not in their methodology.

7.4. RECOMMENDATIONS

This comparison study indicates the need to resolve the disparity in radionuclide production predicted by ORIGEN2, ORIGEN-S, and CINDER-2. Resolution is obtained only by validation against experimental data. The comparison study has also pointed out the different analysis features provided by the three codes. Prior to (or in conjunction with) validation, it is recommended that one code be enhanced to provide desirable attributes found in the individual codes. This code system should have the interfacing capability for performing shielding and criticality analyses for each component of the FWMS and the versatility to be expanded to meet the additional needs of DOE/OCRWM. Major features should include the following:

- a. user-friendly, free-form input, requiring both minimal data specifications and convenient choices of data defaults;
- b. "execution time" variable dimensioning;
- c. generic reactor cross-section libraries, easily accessible;
- d. alternative-conditions libraries, produced readily either by a single case separately or by a companion module during the job execution, for parameters different from that of the generic reactors.
- e. Production of total photon source spectra and neutron source spectra in any energy group structure for use in subsequent shielding analysis. As part of the validations of shipping cask analyses, it is necessary to compare dose rates computed from one group structure with those computed from significantly more groups. At present, there are features in ORIGEN-S (and SAS2) for supplying photon or neutron group structures as user input (or from the cross section library specified). For CINDER-2 spectra, the computations are performed by a separate code. The photon spectra are computed in a single built-in energy group structure in ORIGEN2. Even though the total neutron emission rate for spontaneous fission plus (α, n) reactions are computed by ORIGEN2, there is no feature for calculating neutron spectra. Thus, it is recommended that these features should be included in the final source code that is developed. A companion report to compare the relative performance of the photon and neutron source spectra predicted by the point depletion codes in a typical shipping cask analysis has been published.¹⁴

- f. Calculations of (α, n) contributions to neutron spectra for material other than UO_2 , such as borosilicate glass. The borosilicate (α, n) source is much more important than that from UO_2 . (It has been computed¹⁶ to be 0.7 times the spontaneous fission source.) Also, (α, n) emission rates and spectral data have recently been measured for almost all important light elements. A stopping power model has also been developed for computing the (α, n) source of mixtures.^{2,16}

Once assembled, the source-term module must be validated against well-characterized extended-burnup LWR spent fuel, the material expected to comprise the major inventory of a geologic repository. Each of the outputs, radionuclide composition, decay heat, neutron production, and photon generation, must be compared with experimental data. All nonfuel components must also be examined and compared. The data-base libraries must be checked and evaluated to use the most acceptable decay constants, Q-values, and branching fractions.

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APPENDIX A

SUMMARY DESCRIPTIONS OF ORIGEN2, ORIGEN-S, AND CINDER-2

ORIGEN2

CODE IDENTIFICATION:

ORIGEN2, developed by:

Chemical Technology Division
Oak Ridge National Laboratory,
Martin Marietta Energy Systems, Inc.,
Oak Ridge, Tennessee

SUMMARY:

Using a point depletion analysis for various (generic) reactor types, the ORIGEN2 code calculates time-dependent concentrations of a large number of nuclides and their associated photon spectra and total neutron emission rates. The applicable reactor types include the PWR, the BWR, the LMFBR, the FFTF, and the CANDU, with specific types of fuel, such as typically enriched ^{235}U , plutonium, uranium-plutonium mixtures, ^{233}U enriched thorium and ^{235}U enriched for extended burnup. Reactor core models, applying transport and diffusion neutronics theory, have been used in producing data for the reactor and fuel types.

MAIN PREDICTED VARIABLES:

Spent fuel concentrations of a large number of nuclides and their associated decay heat rates and photon spectra and neutron emission rates at specified irradiation and cooling times.

OTHER PREDICTED VARIABLES:

Other concentration units: g-atoms, grams, curies, total watts, toxicity (air and water), total gamma emission rates in photons/s or MeV/watt-s, and (α, n) reaction and spontaneous fission neutron emission rates. Also, continuous feed or removal rates may be used, and the amounts following fractional reprocessing separations may be computed.

EQUATION SOLVED:

The main equation used in ORIGEN2 is the following matrix equation:

$$\underline{N}(t) = \underline{N}(0)e^{\underline{A}t},$$

where

$\underline{N}$ = the vector of N_i atom concentrations,

$\underline{A}$ = the transition matrix of rate constants a_{ij} for producing N_i from N_j ,

t = time.

As a supplement, when $a_{ij}t$ is excessive, a computation by the Bateman equation is used.

FEATURES AND LIMITATIONS:

- Photon sources are produced only in the energy group structure of the FCXSEC cross-section library. Neutron emission rates are predicted as total neutron sources, but not distributed into a source spectrum.
- Nuclides in ORIGEN2 transition libraries:
700 activation products (clad and light elements)
132 actinides
880 fission products
- Nuclides in ORNL Master Photon Data Base (γ -line, x-ray, Bremsstrahlung, etc.): 427
- Number of reactor-type/fuel-type libraries: 14
- The code may be compiled for smaller size transition libraries, also.
- Burnup-dependent cross sections are included within each reactor and fuel-type ORIGEN2 library. No provision has been made for reactor problems where either the burnup exceeds the library maximum, or the fuel composition or lattice geometry (e.g., the unit cell) does not correspond to one of the specified reactor designs. However, new reactor physics analyses may be performed to produce such libraries.

ANALYTICAL METHOD:

Analytical method common to both ORIGEN-S and ORIGEN2: The generation and depletion of nuclides is evaluated by solving the nuclide rate of change balance equations,

$$\dot{N}_i = \sum_{j=1}^M a_{ij} N_j, \text{ for } M \text{ nuclides,}$$

where

$\dot{N}_i = dN_i(t)/dt$, the rate of change of N_i ,

a_{ij} = the transition rate constant for producing N_i from N_j .

Or, casting the balance equations in matrix notation,

$$\dot{\underline{N}}(t) = \underline{A}\underline{N}(t),$$

where

$\underline{N}$ = the vector of elements N_i ,

$\underline{A}$ = the matrix of elements a_{ij} .

The solution to this equation is applied,

$$\underline{N}(t) = \underline{N}(0)e^{\underline{A}t}.$$

First, the exponential is expanded into the series notation,

$$\underline{N}(t) = \left[1 + \underline{A}t + \frac{(\underline{A}t)^2}{2!} + \frac{(\underline{A}t)^3}{3!} + \dots \right] \underline{N}(0).$$

Then, after multiplying each term by $\underline{N}(0)$, it is seen that there is a common recursion relation between successive terms. Let the n th term be defined by $\underline{C}^n$, where $\underline{C}^0 = \underline{N}(0)$. Then, each term is computed by:

$$\underline{C}^{n+1} = A \underline{C}^n t / (n+1) .$$

The sum of all terms is the final vector $\underline{N}(t)$,

$$\underline{N}(t) = \sum_{n=0}^k \underline{C}^n ,$$

where k is derived internally to limit errors from roundoff to 0.1%. Also, k may be input (in ORIGEN-S) for special cases.

Excessive word roundoff error on an IBM/360 computer occurs ($>0.1\%$) if $a_{ij}t > 6.9$. This situation happens when the half-life is about 10% of the time interval. In such cases, the element a_{ij} , its row and column, are removed from A , and an adjusted A is applied. Then, $N_i(t)$ and the production of other nuclides from the i th nuclide are computed by the widely used Bateman equations.

In addition to nuclide output in various units, ORIGEN2 computes photon spectra for the activation products and the fission products using a built-in energy group structure. Bremsstrahlung may be included for either a UO_2 or H_2O medium or may be excluded from the spectra. Both spontaneous fission and (α, n) reaction neutron intensities may be computed for the actinides.

OTHER APPROPRIATE USES:

1. Predicting nuclide concentrations of discharged fuel for typical reactor designs and operating conditions of various current reactor types.
2. Projecting the composition and characteristics of radioactive waste.
3. Determining fuel material compositions in reprocessing, separation or waste treatment plants.
4. Predicting decay heat of spent fuel for storage facilities, reprocessing plants, and waste repositories.
5. Calculating the radionuclide source composition terms of a specified process or facility for risk assessments, using given released element fractions.

FUTURE DEVELOPMENT:

New extended burnup and other (typical) reactor libraries are being produced, applying multidimensional reactor physics analyses (using GPRCYCLE code system at ORNL). ORIGEN2 has been implemented on an IBM PC. Documentation and final testing is required prior to dissemination through RSIC.

LANGUAGE:

FORTRAN IV (IBM version distributed by RSIC)
 FORTRAN 77 (version for VAX)

INPUT DATA LIBRARIES:

Reactor (fuel)-type ORIGEN2 libraries
 ORIGEN2 decay library
 ORNL master photon data base

FORM OF OUTPUT:

Printed output from ORIGEN2, which may be plotted by ORMANG.

GRAPHIC OUTPUT:

Using the ORMANG code (not publicly distributed) concentrations in 22 different units (including 10 fractional units) may be plotted against time (8 different units) for principal contributing nuclides or elements.

COMPUTERS AND OPERATING SYSTEM USED:

IBM 360/370
 IBM PC
 CDC 7600
 VAX 11/780
 PRIME 400

CORE AND DISK REQUIREMENTS:

175 to 576 kilobytes (KB), range of core size, depending on libraries used. Requires unit nos. 7, 12, 13, 15, and 16 when optional output (of various types) is requested. Usually these data sets have a small size.

TYPICAL RUNNING TIME:

A typical irradiation plus decay case for a total of 22 time steps is about 2.2 CPU min on the IBM 3033, or 6 s/step.

DOCUMENTATION:

- M. J. Bell, *ORIGEN - The ORNL Isotope Generation and Depletion Code*, ORNL-4628, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1973.
- A. G. Croff, *A User's Manual for the ORIGEN2 Computer Code*, ORNL/TM-7175, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1980.
- A. G. Croff, *ORIGEN2 - A Revised and Updated Version of the Oak Ridge Isotope Generation and Depletion Code*, ORNL-5621, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1981.
- A. G. Croff, M. A. Bjerke, G. W. Morrison, and L. M. Petrie, *Revised Uranium-Plutonium Cycle PWR and BWR Models for the ORIGEN Computer Code*, ORNL/TM-6051, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1978.

- A. G. Croff and M. A. Bjerke, *Alternative Fuel Cycle PWR Models for the ORIGEN Computer Code*, ORNL/TM-7005, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1980.
- A. G. Croff, R. L. Haese, and N. B. Gove, *Updated Decay and Photon Libraries for the ORIGEN Code*, ORNL/TM-6055, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1979.
- A. G. Croff and M. A. Bjerke, *CANDU Models for the ORIGEN Computer Code*, ORNL/TM-7177, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1980.
- A. G. Croff, J. W. McAdoo, and M. A. Bjerke, *LMFBR Models for the ORIGEN2 Computer Code*, ORNL/TM-7176, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1981.
- A. G. Croff and M. A. Bjerke, *An ORIGEN2 Model and Results for the Clinch River Breeder Reactor*, NUREG/CR-2762, U.S. Nuclear Regulatory Commission, 1982.
- C. W. Forsberg, C. W. Alexander, G. W. Morrison, and O. W. Hermann, *Integrated Data Base Program: An Overview of Data Handling and Projection Modeling*, ORNL/NFW-83/08, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., 1983.
- Allen G. Croff, "ORIGEN2: A Versatile Computer Code for Calculating the Nuclide Compositions and Characteristics of Nuclear Materials," *Nucl. Technol.* **62**, 335 (1983).
- W. E. Ford, III, et al., *FCXSEC: Multigroup Cross-Section Libraries for Nuclear Fuel Cycle Shielding Calculations*, ORNL/TM-7038, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., May 1980.

PROGRAM AVAILABILITY

The ORIGEN2 code and associated libraries are packaged by RSIC as CCC-371. Requests for the ORIGEN2 code and libraries can be mailed to:

Radiation Shielding Information Center
Oak Ridge National Laboratory
P. O. Box 2008
Oak Ridge, TN 37831

or telephoned to:

615/574-6176 or to FTS 624-6176.

SAS2(H)/ORIGEN-S

CODE IDENTIFICATION:

SAS2(H)/ORIGEN-S, developed by:
Nuclear Engineering Applications Department
Computing and Telecommunications Division
Oak Ridge National Laboratory
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee

SUMMARY:

ORIGEN-S performs point depletion and decay analyses to obtain isotopic concentrations, decay heat source terms, and radiation source spectra and strengths for use in subsequent system analyses. ORIGEN-S is an updated version of the original ORIGEN code with flexible dimensioning and free-form input processing. The main transition model in ORIGEN-S is essentially that developed for the original ORIGEN code. One of the primary objectives in developing ORIGEN-S was that the calculations be able to utilize multi-energy-group neutron flux and cross sections in any group structure. Utilization of the multigroup data is automated via the COUPLE code.

The ORIGEN-S code computes time-dependent photon and neutron source spectra in any requested energy group structure. These spectra are determined from the point depletion and decay calculation of concentrations of a large number of nuclides and their energy-dependent emission rate data for photons and both (α ,n) reaction and spontaneous fission neutrons.

ORIGEN-S may be run stand-alone or as one of the six codes applied in the execution of the SAS2 control module within the SCALE computational system. The SAS2 control module consists of two analytic sequences called SAS2 and SAS2H which allow different models for the assembly lattice. The control module calls SCALE functional modules in the proper sequence to: (1) process resonance cross sections (BONAMI-S, NITAWL-S), (2) compute the neutron flux spectrum in an infinite lattice representation of a fuel assembly and collapse a multigroup set of cross sections to three groups (XSDRNP-S), (3) update an ORIGEN-S nuclear data library using the collapsed cross sections and modify THERM, RES, and FAST based on the burnup-dependent flux (COUPLE), and (4) perform a depletion calculation using the updated nuclear data (ORIGEN-S). It can repeat steps 1 through 4 as many times as requested during simulation of the operating history of a fuel assembly. A flow diagram of the SAS2 sequence is provided in Fig. A.1. The shielding analysis portion of the sequence will not be discussed here. The sequence can be easily halted after the depletion analysis is performed and later restarted to perform a shielding analysis.

MAIN PREDICTED VARIABLES:

ORIGEN-S: Spent fuel densities of numerous individual nuclides and their associated decay heat rates and photon and neutron source spectra at specified irradiation and cooling times.

Fig. A.1. Computation flow path invoked by SAS2 module.

OTHER PREDICTED VARIABLES:

SAS2(H): Burnup-dependent values for k_{∞} , neutron flux spectra and cross sections.

ORIGEN-S: For nuclides, elements and/or totals: g-atoms, grams, curies, gamma watts, total watts, fractional neutron absorption rates, toxicity (air and water), total gamma emission rates in photons/s and MeV/W-s, and (α, n) reaction and spontaneous fission total neutron emission rates. Also, continuous feed and removal rates may be used, and the amounts following fractional reprocessing separations may be computed.

EQUATION SOLVED:

SAS2(H): Effective burnup-dependent cross sections of significant nuclides are calculated together with the lattice-cell flux spectrum via a one-dimensional solution to the Boltzmann transport equation. The Nordheim Integral Treatment and Bondarenko Factor Method are available to account for resonance self-shielding.

ORIGEN-S: Primarily, the following matrix equation is applied:

$$\underline{N}(t) = \underline{N}(0)e^{At},$$

where

$\underline{N}$ = the vector of N_i atom concentrations,

A = the transition matrix of rate constants a_{ij} for producing N_i from N_j ,

t = time.

As a supplement, when $a_{ij}t$ is excessive, a computation by the Bateman equations is used.

FEATURES AND LIMITATIONS:

- The SAS2(H) control module is designed to provide burnup-dependent cross-section libraries and flux spectral data based on an infinite lattice-cell model of a fuel assembly. However, the nuclear data used by ORIGEN-S are not restricted to that produced and updated by SAS2.
- The fission product yield data in the ORIGEN-S libraries are currently ENDF/B-IV.
- The COUPLE program is available to easily update any nuclear data value on an ORIGEN-S binary library.
- Depletion energy groups: Flexible dimensioning permits any size to the gamma and neutron energy groups of the input libraries. The multigroup neutron libraries, issued with SCALE, are easily selected by keywords.
- Nuclides (or elements/mixtures) in cross-section libraries: 249
- Nuclides in ORIGEN-S transition libraries:
687 clad (light element), 101 actinides, 821 fission products
- Nuclides in ORNL Master Photon Data Base (γ -line, x-ray, Bremsstrahlung, etc.): 427

Other than computer time and cost, in general there are no other size limitations. The number of time-dependent (burnup-dependent) libraries should probably be limited to 12 to 18, with 3 to 6 recommended.

ANALYTICAL METHOD:

SAS2(H): The sets of codes, BONAMI-S, NITAWL-S, and XSDRNPM-S, are repeatedly invoked by the driver at the request of SAS2. These codes produce a one-dimensional, discrete-ordinates solution to the Boltzmann neutron transport equation, weighting cross sections for the fuel region of the unit cell describing the reactor fuel rods. SAS2 uses these codes to produce libraries input to ORIGIN-S, which in turn depletes and generates isotopes to their densities at the time required in the neutronics calculation producing the next library. Once the reactor irradiation period is completed, ORIGIN-S calculates the decay of the fuel, clad, and other light elements to a given cooling time and computes the gamma-ray and neutron energy spectra. (See this topic under ORIGIN2 for analytical method common to ORIGIN-S and ORIGIN2.)

In addition to nuclide output in various units, ORIGIN-S computes both gamma-ray spectra and neutron spectra produced from spontaneous fission and (α -n) reactions. The photon spectra may include the total from all nuclides or may be broken into light elements, actinides, and fission products. Either the built-in energy group structure for photon spectra may be used or it may be input by the user. The neutron energy group structure may be input or taken from a specified SCALE library. The nuclide (α ,n) reaction intensities and total neutron spectrum may be computed for the UO_2 medium. The in-house version of ORIGIN-S (not yet publicly distributed) allows the (α ,n) spectrum to be computed for borosilicate glass, or for almost any medium.

OTHER APPROPRIATE USES:

1. Predicting nuclide concentrations of discharged fuel for typical reactor designs and operating conditions of various current reactor types.
2. Predicting nuclide concentrations of discharged fuel, where the design and operating conditions are significantly different from that of the generic or typical reactor or where a completely new reactor design is being evaluated.
3. Projecting the composition and characteristics of radioactive wastes.
4. Determining fuel material compositions in reprocessing, separation, or waste treatment plants.
5. Predicting and tabulating tables of decay heat of spent fuel for storage facilities, reprocessing plants, and waste repositories.
6. Computing either instantaneous or time integrals of fission product activity or energy per fission of a given fissionable isotope.
7. Calculating the radionuclide source composition, terms of a specified process, or facility for risk assessments, using given released element fractions.
8. Determining, by SAS2(H), the criticality burnup credit of fuel in terms of both the significant nuclide densities and the multiplication constant, k_{∞} , as a function of initial enrichment, burnup, and cooling time.

FUTURE DEVELOPMENT:

Significant enhancements have recently been made to the SAS2 and ORIGEN-S programs available in-house at ORNL. These enhancements are described briefly below. Plans call for these developments to be implemented and documented as part of the distributed code package in the near future. Easy-to-use input specifications also need to be formed for SAS2H.

SAS2H Control Module: Even though SAS2 accounts for the basic fuel-rod lattice of the reactor fuel element, SAS2H extends the model to include both fuel pins and other types of pins or regions within the assembly. The other types may be burnable poison pins or guide-tube-water "holes" contained in control rod assemblies.

The general procedure applied by SAS2, with one major exception, is used in SAS2H. The difference is in the production of the burnup-dependent libraries. There are two parts to the cross-section calculation in place of the one done by SAS2. First, the unit cell describing the fuel rods, as for SAS2, is used by the neutronics codes. Then, a second (larger) unit cell is set up as a guide-tube-water "hole" region surrounded by the fuel region in the volumetric fuel-to-hole region ratio equaling the ratio of fuel rods to control rods in the assembly. The cell-averaged densities and cell-weighted cross sections of the first computation are used in the fuel region of the final calculation. Also, the same method is used with a corresponding change in the cell description for burnable poison, oriface, or any other type of assembly. This method accounts for all of the water moderator and other materials that could not be included as properly in the SAS2 method. The remaining decay and shielding analysis is identical to that used in SAS2.

ORIGEN-S: The (α ,n) source of neutrons from high-level radioactive waste can significantly increase when the waste contains large quantities of light element target materials (besides ^{17}O or ^{18}O) for the high-energy alphas. The in-house version of ORIGEN-S at ORNL has been updated to compute neutron intensities for (α ,n) reactions on the light elements, Li through Si, inclusive. The effect of the weighted stopping powers of alpha particles by all elements is computed as a function of nuclide concentrations. This enhancement is very important for waste vitrified in mediums such as borosilicate glass.

HOW PROGRAMS ARE COUPLED:

As a control module in the SCALE system of codes, SAS2(H) invokes the following codes: BONAMI-S, NITAWL-S, XSDRNP-S, COUPLE, ORIGEN-S, and XSDOSE.

LANGUAGE:

FORTRAN 77 for SAS2/ORIGEN-S (SCALE-4 version)
FORTRAN IV (SCALE-3 version)

INPUT DATA LIBRARIES:

SAS2(H):
SCALE master cross-section libraries
ORIGEN-S nuclear data binary libraries
ORNL master photon data base

ORIGEN-S
ORIGEN-S nuclear data card image and binary libraries
ORNL master photon data base

FORM OF OUTPUT:

Printed output only from these codes. However, output saved in a binary data set may be plotted with PLORIGEN.

GRAPHIC OUTPUT:

Using the PLORIGEN code, concentrations in 14 different units may be plotted against time (6 different units) for selected or principal contributing nuclides or elements. Case comparisons may be plotted. Also, the gamma-ray or neutron spectra may be plotted.

COMPUTERS AND OPERATING SYSTEM USED:

IBM 360/370
 CRAY X-MP
 IBM PC/370, ORIGEN-S, only
 FACON (in Japan)
 VAX, ORIGEN-S, only

CORE AND DISK REQUIREMENTS:

Both the core size and number and size of data sets are problem-dependent. The I/O requirements for SAS2 may be seen in the document on each code. A summary of the disk space required for SAS2 is given in the SAS2 document.

SAS2(H): 600 to 1000 KB, range of core size

ORIGEN-S: 250 to 500 KB, core size dependent on libraries, time steps, etc., used. Requires unit Nos. 11 and 13 (small sizes) as scratch units and unit No. 71 (small size) to save results.

TYPICAL RUNNING TIME:

SAS2/SAS2H (IBM 3033 CPU time):

Can vary greatly with cases and options such as resonances treated, convergence criteria, total energy groups, mesh intervals, and number of irradiation cycles. Note that the number of irradiation passes through the set of codes in SAS2 equals the number of cycles plus one. The range of typical CPU times per irradiation pass is 2.5 to 3.5 min. About 1 min per irradiation pass is added for SAS2H. IBM(3033)/CRAY X-MP time ratio is in 2.5 to 3.5 range.

ORIGEN-S:

Uses 1.5 to 2 CPU (IBM 3033) seconds/time-step average (dependent on output units requested).

DOCUMENTATION:

- O. W. Hermann, "SAS2: A Coupled One-Dimensional Depletion and Shielding Analysis Module," as described in Sect. S2 of *SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, Vols. 1-3, NUREG/CR-0200, U.S. Nuclear Regulatory Commission (originally issued July 1980, reissued January 1982, Rev. 1 issued July 1982, Rev. 2 issued June 1983, Rev. 3 issued December 1984).

- O. W. Hermann and R. M. Westfall, "ORIGEN-S: SCALE System Module to Calculate Fuel Depletion, Actinide Transmutation, Fission Product Buildup and Decay, and Associated Radiation Source Terms," as described in Sect. F6 of *SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, Vols. 1-3, NUREG/CR-0200, U.S. Nuclear Regulatory Commission (originally issued July 1980, reissued January 1982, Rev. 1 issued July 1982, Rev. 2 issued June 1983, Rev. 3 issued December 1984).
- J. C. Ryman, "ORIGEN-S Data Libraries," as described in Sect. M6 of *SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, Vols. 1-3, NUREG/CR-0200, U.S. Nuclear Regulatory Commission (originally issued July 1980, reissued January 1982, Rev. 1 issued July 1982, Rev. 2 issued June 1983, Rev. 3 issued December 1984).
- C. V. Parks, O. W. Hermann, and J. R. Knight, *Parametric Study of Radiation Dose Rates from Rail and Truck Spent Fuel Transport Casks*, ORNL/CSD/TM-227, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., 1985.
- O. W. Hermann and C. W. Alexander, "Spent Fuel Photon and Neutron Spectra," *Trans. Am. Nucl. Soc.* **44**, 474 (1983).
- O. W. Hermann and C. W. Alexander, *A Review of Spent Fuel Photon and Neutron Source Spectra*, ORNL/CSD/TM-205, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., 1986.
- M. J. Bell, *ORIGEN - The ORNL Isotope Generation and Depletion Code*, ORNL-4628, Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., 1973.
- O. W. Hermann, "PLORIGEN: A Plotting Program for ORIGEN-S Output, to be published as Sect. F15 of *SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, Vols. 1-3, NUREG/CR-0200, U.S. Nuclear Regulatory Commission (originally issued July 1980, reissued January 1982, Rev. 1 issued July 1982, Rev. 2 issued June 1983, Rev. 3 issued December 1984).
- J. C. Ryman et al., *Fuel Inventory and Afterheat Power Studies of Uranium-Fueled Pressurized Water Reactor Fuel Assemblies Using the SAS2 and ORIGEN-S Modules of SCALE with an ENDF/B-V Updated Cross-Section Library*, NUREG/CRF-2397 (ORNL/CSD-90), Union Carbide Corp. Nuclear Div., Oak Ridge Natl. Lab., June 1982.

PROGRAM AVAILABILITY:

Requests for the CCC-466/SCALE-3 code package containing SAS2, ORIGEN-S, and needed libraries can be mailed to:

Radiation Shielding Information Center
Oak Ridge National Laboratory
P. O. Box 2008
Oak Ridge, TN 37831

or telephoned to:

615/574-6176 or to FTS 624-6176.

EPRI-CELL/CINDER-2

CODE IDENTIFICATION:

CINDER-2, developed by:
Theoretical Division
Los Alamos National Laboratory
University of California
Los Alamos, New Mexico

EPRI-CELL, developed by:
Nuclear Associates International Corp.
Rockville, Maryland

Sponsored by:
Electric Power Research Institute
Palo Alto, California

SUMMARY:

The EPRI-CELL code is a cell-depletion neutron transport code producing the cross sections and flux used by CINDER-2. It performs a neutron spectrum calculation using a THERMOS code-type space-energy-dependent solution to the integral transport equation at thermal energies. In the epithermal range, the integral slowing down theory of the GAM-1 code is used, deriving resonance cross sections from tables of groupwise resonance shielding factors for each isotope produced by the NJOY code. Depletion is computed with a CINDER code-type model using four radial space points within the fuel rod in the thermal depletion.

The CINDER-2 code computes, for any specified initial fuel composition and flux or power history and decay time, the fuel and fission product isotopic contents and associated properties. CINDER-2, or associated utility codes, produce results in moles, curies, and watts for nuclides, and total material characterized by decay heat in watts, photon source spectra, and neutron source spectra.

The CINDER-2 code is one of the code versions developed, through various stages of improvement, from the original CINDER code written by T. R. England while associated with Westinghouse Electric Corporation. Other CINDER versions are the EPRI-CINDER, CINDER3, CINDER7, and CINDER10 codes. Even though these code versions primarily use the same model, their main differences concern: the use of ENDF/B-IV or -V cross-section data; energy group structures available to the code and cross-section collapsing capabilities; number of nuclides applied; the ENDF source of fission product yield data; and procedures or codes with which they are interfaced (e.g., DANDE and EPRI-CELL which produce burnup-dependent cross-section libraries).

PREDICTED VARIABLES

1. For each nuclide: moles, number densities, activities, barns/fission per energy group, and macroscopic absorption cross sections per energy group.

2. Totals are predicted for: fission, fissions per nuclide in power, thermal flux-time product, flux levels per energy group, barns/fission per energy group, macroscopic absorption cross sections per energy group, effective cross section, resonance integral, infinite multiplication constant (k_{∞}), reactivity, beta energy release rate, gamma line energy release rate, beta plus gamma line energy release rates, MeV/fission and total radiation activity.

EQUATION SOLVED

The CINDER codes use the Bateman equation solution of the rate of change balance equations for each chain of nuclides coupled through the decay or neutron transmutation processes. The explicit equations are given in the Analytical Method section.

FEATURES AND LIMITATIONS

The primary purpose of EPRI-CELL/CINDER-2 and the other versions of CINDER is to perform a cell depletion analysis during the irradiation period of the reactor and extending to various cooling times. Spent fuel characteristics as isotopic number densities and even activities and energy release rates may be computed by CINDER codes, but the total photon and neutron spectra cannot be directly computed. The SPEC5 code or other codes may be applied to compute individual nuclide spectra from ENDF/B-V photon energy-intensity data (using interval sizes of 0.01 and 0.05 MeV). In order to complete the shielding analysis photon spectrum, the user may manually calculate or write coding to compute the combination of CINDER nuclide densities and SPEC5 spectra, account for significant bremsstrahlung from UO_2 , and add gamma rays from spontaneous fission or (α, n) reactions as needed. The neutron spectrum may also be produced from CINDER nuclide densities, neutron emission rate yields and spontaneous fission and (α, n) reaction neutron spectra data available to the user.

Another limitation is that light-element libraries are not available. Thus, potential radiation sources arising from activation of light elements (^{59}Co) must be evaluated in some alternate fashion.

Array dimensions in EPRI-CINDER require the following limits:

- 525 nuclides total
- 40 actinides
- 450 fission product chains
- 17 nuclides per chain
- 75 time steps
- 5 yield sets applied to 7 fissionable nuclides
- 3 time-dependent g-factors
- 4 neutron energy groups
- 3 energy groups per decay

ANALYTICAL METHOD³

In terms of a few-energy-group structure, the concentration of the i^{th} nuclide in a linear chain is determined by the following coupled differential equations:

$$\frac{dN_i}{dt} = \sum_k y_i^k S^k + \alpha_{i-1} \gamma_{i-1} N_{i-1} - (\lambda_i + A_i^a) N_i \quad (1)$$

$$i = 1, 2, 3, \dots$$

where

y_i^k = yield fraction/fission from fissionable nuclide k ,

S^k = fission rate of k^{th} fissionable nuclide,

λ_i = decay constant, for i^{th} nuclide,

$A_i^a = \sum_{j=1}^4 g_i^j \sigma_i^j \phi$ = neutron absorption rate per unit nuclide density,

σ_i^j = total absorption cross section of the i^{th} nuclide in the energy group j ,

g_i^j = shielding factor of the i^{th} nuclide in the energy group j ,

A_{i-1}^c = capture rate, $A^c = A^a - A^f$, where A^f is the fission rate analogous to A^a . In lieu of branching fractions, fictitious fission cross sections may be specified for the fission products in order to achieve the correct activation cross sections leading to more than one daughter isomer.

γ_{i-1} = either λ_{i-1} or $A_{i-1}^{a,c}$ depending on coupling from precursor $i-1$

α_{i-1} = fraction of specified coupling directly feeding nuclide i (the branching fraction in radioactive decay); this is used for λ_{i-1} and A_{i-1}^a but not normally for A_{i-1}^c .

This set of equations can describe equally well the nuclides in the depletion chains (in which case $y = 0$) and in the fission-product chains.

The general solution of Eq. 1 for the n^{th} nuclide in a chain, assuming constant flux and fission rate during time increment Δt , is

$$N_n(t + \Delta t) = \sum_{m=1}^n \frac{1}{\alpha_n \gamma_n} \prod_{k=m}^n \alpha_k \gamma_k \left\{ y_m S \right. \\ \left. \left[\prod_{j=m}^n \frac{1}{(\lambda_j + A_j^a)} - \sum_{j=m}^n \frac{\exp[-(\lambda_j + A_j^a)\Delta t]}{(\lambda_j + A_j^a)} \prod_{i=m}^n \frac{1}{(\lambda_i + A_i^a - \lambda_j - A_j^a)} \right] \right. \\ \left. + N_m(t) \left[\sum_{j=m}^n \frac{\exp[-(\lambda_j + A_j^a)\Delta t]}{(\lambda_j + A_j^a)} \sum_{i=1}^n \frac{1}{(\lambda_i + A_i^a - \lambda_j - A_j^a)} \right] \right\} \quad (2)$$

Here, $\gamma_m S$ = average fission yield rate of nuclide m from all fissionable nuclides.

The CINDER-2 code is based on this general solution that can be written in other forms more suitable for computation. N_n is actually a partial concentration of the n^{th} nuclide. If any nuclide has more than one source, there will be a concentration resulting from each source; these are added by the code, as specified by the user, in all aggregate summations. In Eq. 2, if two nuclides happen to have identical removal rates, $\lambda + A^a$, the equation indicates a division by zero. In the actual coding, this presents no problem and the same nuclide can, in fact, appear more than once in any chain.

Equation 2 could be coded for any number of neutron groups. In the present version of the code, up to four groups are permitted. Users requiring more groups for any other libraries can collapse to a four-group structure and unfold the results using N_n . There are other equations and methods associated with the above analytical method. Isotopic number densities may be converted to energy release rates and activity densities. Also, various explicit neutronics variables (e.g., k_{∞}) and cross sections are computed and may be printed. Also, by applying both neutron emission rate values and available spectral data to the CINDER actinide densities, the user can then determine neutron spectra. These sources may be used in a cask shielding analysis.

APPROPRIATE USES

1. Predicting isotopic densities of discharged fuel for typical reactor designs (e.g., LWR) and operating conditions.
2. Determining the composition and characteristics of radioactive wastes.
3. Predicting decay heat of spent fuel for storage facilities, reprocessing plants, and waste repositories.
4. Computing energy per fission of a given fissionable isotope.
5. Calculating the radionuclide source composition terms of a specified process or facility for risk assessment, before released element fractions applied.
6. Determining neutron multiplication constants (k_{∞} and, possibly, k_{eff}), aggregate cross sections, and other neutronics variables.
7. Applying fission product decay gamma spectra in calculation of photoneutron spectra from $D(\gamma, n)$ reactions in the moderator of PWR fuel.

HOW PROGRAMS ARE COUPLED

CINDER-2:

CINDER-2 can be interfaced with the EPRI-CELL cell-depletion code. The EPRI-CELL results provide the neutron flux spectra and actinide cross sections as a function of burnup.

OTHER CINDER VERSIONS:

The DANDE code system controls three computation modules: the data processing module or the TRANSX code; the core neutronics module using the DIF3D, TWODANT, and TWOHEX codes; and the depletion module or CINDER3 code. CINDER3 and EPRI-CINDER can also be interfaced with EPRI-CELL.

LANGUAGE

FORTRAN IV

INPUT DATA LIBRARIES

Included with CINDER-2 are both an 84-chain library and a 12-chain library. Fission product yields are available in either thermal or fast yield sets. The libraries are simply read from the input data stream.

FORM OF OUTPUT

Printed output is the only direct output.

GRAPHIC OUTPUT

Results are commonly input for plots with the MAPPER program.

COMPUTERS USED

EPRI-CELL/CINDER-2: CRAY, IBM, CDC-6600

EPRI-CINDER: CDC-6600

DANDE-CINDER3: CRAY

TYPICAL RUNNING TIMES

Using the 84-chain library on a CDC-6600 CINDER-2 requires about 30 CPU s to compile code and store input data, approximately 2 s per irradiation time step, and about 1 s per decay time step.

DOCUMENTATION

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- W. B. Wilson, T. R. England, and R. J. LaBauve, *Extended Burnup Calculations for Operating Reactor Reload Reviews*, NUREG/CR-3108 (LA-9563-MS), Nuclear Regulatory Commission, February 1983.

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- G. E. Bosler et al., *Production of Actinide Isotopes in Simulated PWR Fuel and Their Influence on Inherent Neutron Emission*, LA-9343, Los Alamos Natl. Lab., University of California, July 1982.

APPENDIX B

DATA FOR DECAY-ONLY CASE

The data to be input by all three codes for the decay-only case were produced by ORIGEN2 and are shown in Table B.1. The first column is used to show the library type for the nuclide data on the same line: a 2 specifies the actinide library, and a 3 indicates a fission product library. This is followed by four pairs of data. The first group of numbers in each pair identifies the radionuclide (first one or two columns give the mass number), its mass (next three columns), and its stability (last column, where 0 represents stable). For example, U-235 is denoted by 922350. Its concentration is $3.3866\text{E}+1$ gram-atoms.

Table B.1. Data for decay-only case

2	20040	5.6532E-02	812070	6.5145E-18	812080	9.0121E-15	812090	8.1121E-20
2	822060	1.1576E-15	822070	3.7293E-13	822080	1.8910E-09	822090	3.4689E-16
2	822100	1.3524E-13	822110	4.9441E-17	822120	5.2153E-12	822140	1.9740E-18
2	832080	1.2340E-18	832090	3.8773E-13	832101	6.6219E-18	832100	8.3644E-17
2	832110	2.9172E-18	832120	4.9471E-13	832130	7.9850E-17	832140	1.4658E-18
2	842100	1.2056E-15	842110	3.5793E-23	842120	2.6173E-23	842130	1.1980E-25
2	842140	1.4741E-24	842150	4.0624E-23	842160	2.0425E-17	842180	2.2470E-19
2	852170	9.4164E-22	862180	2.7107E-22	862190	9.0378E-20	862200	7.5711E-15
2	862220	4.0569E-16	872210	8.3961E-18	872230	4.6021E-19	882220	2.9431E-19
2	882230	2.2547E-14	892240	4.3057E-11	882250	3.8895E-14	882260	6.1936E-11
2	882280	2.8660E-17	892250	2.5188E-14	892270	1.7518E-11	892280	9.9975E-15
2	902260	1.4406E-17	902270	3.7946E-14	902280	8.1626E-09	902290	1.9360E-09
2	902300	4.9689E-06	902310	6.0042E-09	902320	7.1204E-07	902330	1.5720E-12
2	902340	5.8631E-08	912310	1.1310E-06	912320	4.6835E-09	912330	6.0843E-08
2	912341	2.0057E-12	912340	1.0726E-11	912350	3.4854E-17	922300	1.3918E-14
2	922310	6.8610E-13	922320	1.6796E-06	922330	5.8925E-06	922340	7.6762E-01
2	922350	3.3866E-01	922360	1.6781E-01	922370	4.6861E-02	922380	3.9669E-03
2	922390	2.7659E-03	922400	2.8527E-07	922410	8.4805E-17	932350	1.9255E-08
2	932361	6.3647E-08	932360	1.7502E-06	932370	1.8219E-00	932380	5.9064E-03
2	932390	3.9800E-01	932401	2.7745E-07	932400	9.6065E-06	932410	8.1413E-14
2	942360	5.0380E-06	942370	2.1427E-07	942380	5.3864E-01	942390	2.0665E-01
2	942400	9.6327E-00	942410	5.0735E-00	942420	1.8697E-00	942430	5.7298E-04
2	942440	9.8104E-05	942450	2.4407E-09	942460	2.0164E-11	952390	4.2683E-12
2	952400	3.9428E-09	952410	1.1894E-01	952421	2.5945E-03	952420	4.0661E-04
2	952430	3.5321E-01	952441	1.4400E-05	952440	1.7602E-05	952450	4.7663E-10
2	952460	3.2265E-14	962410	3.8849E-09	962420	4.9619E-02	962430	1.3516E-03
2	962440	9.8458E-02	962450	3.5106E-03	962460	4.1825E-04	962470	3.7239E-06
2	962480	1.8148E-07	962490	2.4086E-12	962500	9.3105E-16	972490	1.6723E-09
2	972500	2.4387E-12	972510	4.0189E-16	982490	1.8863E-10	982500	3.5082E-10
2	982510	1.3348E-10	982520	7.4643E-11	982530	1.2043E-13	982540	5.6019E-15
2	982550	1.5197E-19	992530	8.2802E-14	992541	5.8029E-16	992540	1.2627E-14
2	992550	9.2201E-17	162500	5.5312E-09	0	0.0	0	0.0
3	10030	1.9143E-02	30060	2.9087E-05	30070	1.4455E-06	40090	2.1636E-06
3	40100	1.3000E-05	60140	1.8774E-06	290660	2.1496E-15	300660	5.5096E-10
3	290670	3.2449E-18	300670	2.2695E-11	300680	3.4288E-13	300690	1.0744E-19
3	300691	1.0457E-19	310690	5.0932E-16	310700	1.8289E-22	320700	1.7109E-18
3	310710	1.2466E-08	270720	1.8006E-14	280720	6.8034E-12	290720	3.3198E-11
3	300720	1.0916E-06	310720	3.3212E-07	320720	2.9711E-04	270730	5.4658E-15
3	280730	9.1806E-13	290730	2.8578E-11	300730	2.8433E-10	310730	2.2404E-07
3	320730	6.0930E-04	320731	6.7635E-12	270740	9.8674E-16	280740	9.1147E-13
3	290740	5.4945E-12	300740	2.1504E-09	310740	1.1783E-08	320740	1.3036E-03
3	270750	9.7119E-17	280750	1.0181E-13	290750	7.2199E-12	300750	3.7149E-10
3	310750	5.6803E-09	320750	2.5077E-07	320751	1.1265E-10	330750	2.6671E-03
3	280760	3.9068E-14	290760	1.5510E-12	300760	3.7362E-10	310760	2.8603E-09
3	320760	6.5476E-03	330760	3.0051E-07	340760	7.0752E-05	280770	2.5482E-15
3	290770	9.5134E-13	300770	1.0609E-10	310770	2.4477E-09	320770	3.5039E-06
3	320771	1.0199E-08	330770	3.2895E-05	340770	1.3219E-02	340771	1.1569E-11
3	280780	3.9607E-16	290780	1.3899E-13	300780	1.7806E-10	310780	1.5910E-09
3	320780	2.7483E-06	330780	2.9523E-06	340780	3.1014E-02	290790	5.0234E-14
3	300790	1.8523E-11	310790	1.0540E-09	320790	4.7140E-08	330790	6.9355E-07
3	340790	7.4310E-02	340791	3.0072E-07	350790	1.0561E-06	350791	8.6933E-15
3	360790	1.1794E-14	290800	3.2614E-15	300800	1.2301E-11	310800	6.1170E-10
3	320800	5.0550E-08	330800	4.5543E-08	340800	1.6711E-01	350800	8.5357E-11
3	350801	8.5571E-10	360800	2.8053E-06	290810	1.9725E-16	300810	5.1634E-13
3	310810	1.4884E-10	320810	2.5026E-08	330810	1.3749E-07	340810	5.1404E-06
3	340811	4.2775E-07	350810	2.6760E-01	360810	2.7488E-07	360811	4.5110E-14
3	300820	7.0786E-14	310820	1.2088E-11	320820	9.7413E-09	330820	7.6790E-08
3	330821	1.9959E-08	340820	4.1026E-01	350820	6.3088E-05	350821	7.4847E-08
3	360820	1.1837E-02	300830	4.1057E-15	310830	3.2156E-12	320830	2.8735E-09
3	330830	8.6574E-08	340830	5.4820E-06	340831	4.1890E-07	350830	8.8494E-05
3	360830	4.9334E-01	360831	6.7910E-05	310840	2.8193E-13	320840	5.9349E-10
3	330840	3.0193E-08	340840	3.3290E-06	350840	3.3353E-05	350841	2.4836E-07
3	360840	1.3491E-00	320850	2.8383E-11	330850	6.0931E-09	340850	3.7418E-07
3	340851	1.3552E-07	350850	3.5924E-06	360850	2.8348E-01	360851	3.4153E-04
3	370850	1.1447E-00	320860	5.9471E-12	330860	1.4277E-09	340860	3.0751E-07
3	350860	8.1343E-07	350861	6.6825E-08	360860	2.2075E-00	370860	2.8387E-04
3	370861	1.3066E-09	380860	4.3882E-03	320870	3.9572E-13	330870	2.3094E-10
3	340870	8.4638E-08	350870	1.8798E-06	360870	1.8325E-04	370870	2.8006E-00
3	380870	3.6054E-05	380871	6.0242E-09	320880	1.8292E-14	330880	8.5262E-12
3	340880	8.5370E-09	350880	5.7391E-07	360880	5.7453E-04	370880	6.1117E-05
3	380880	3.9727E-00	330890	9.0419E-13	340890	6.7566E-10	350890	1.0806E-07
3	360890	1.2873E-05	370890	6.6565E-05	380890	3.3838E-01	390890	4.7867E-00
3	390891	8.0477E-13	340900	2.7342E-10	350900	2.4113E-08	360900	2.1590E-06
3	370900	1.0769E-05	370901	4.4018E-06	380900	5.9549E-00	390900	1.5745E-03
3	390901	1.8530E-08	400900	2.0237E-01	400901	3.7915E-16	340910	1.3770E-11
3	350910	3.1752E-09	360910	4.3201E-07	370910	5.1796E-06	380910	3.2903E-03
3	390910	5.1492E-01	390911	1.6660E-04	400910	5.9659E-00	340920	1.0391E-12
3	350920	1.8674E-10	360920	4.5849E-08	370920	3.5155E-07	380920	1.0336E-03
3	390920	1.3567E-03	400920	6.9494E-00	410920	1.0961E-13	350930	2.1873E-11
3	360930	1.1765E-08	370930	3.4793E-07	380930	5.4919E-05	390930	4.5592E-03
3	400930	7.7218E-00	410930	5.1562E-07	410931	4.1707E-06	350940	1.0186E-12
3	360940	6.6874E-10	370940	8.5492E-08	380940	8.7631E-06	390940	1.4647E-04

Table B.1 (continued)

3 400940	7.8820E-00	410940	7.9773E-06	410941	4.2057E-11	350950	8.9626E-14
3 360950	2.2761E-10	370950	5.6530E-09	380950	2.8001E-06	390950	8.7552E-05
3 400950	8.0783E-01	410950	4.4880E-01	410951	3.3013E-04	420950	6.7207E-00
3 350960	3.3961E-15	360960	3.0777E-11	370960	9.6184E-10	380960	2.9874E-07
3 390960	1.8249E-05	400960	8.3246E-00	410960	2.5879E-05	420960	3.4231E-01
3 360970	6.2979E-13	370970	1.5253E-10	380970	7.9168E-09	390970	1.2697E-07
3 400970	8.8884E-03	410970	6.3809E-04	410971	8.3139E-06	420970	8.1455E-00
3 360980	1.0933E-13	370980	2.8141E-11	380980	1.3327E-08	390980	2.4358E-08
3 400980	4.5958E-06	410980	4.2279E-07	410981	4.9210E-16	420980	8.4196E-00
3 430980	6.4203E-05	370990	1.5306E-12	380990	2.4391E-19	390990	3.7183E-08
3 400990	3.5264E-07	410990	2.1924E-06	410991	1.0115E-06	420990	3.8287E-02
3 430990	7.7435E-00	430991	3.0572E-03	440990	3.0551E-05	371000	1.7792E-13
3 381000	9.0012E-10	391000	1.5777E-08	401000	9.5958E-07	411000	2.0568E-07
3 411001	2.0654E-07	421000	9.2962E-00	431000	6.1011E-07	441000	9.5067E-01
3 381010	3.0649E-11	391010	6.6155E-09	401010	2.8479E-07	411010	9.9399E-07
3 421010	1.3370E-04	431010	1.2990E-04	441010	7.6409E-00	381020	4.6696E-12
3 391020	4.6006E-10	401020	1.4042E-06	411020	3.6378E-07	421020	9.7699E-05
3 431020	7.7556E-07	431021	4.7428E-08	441020	7.5478E-00	451020	1.0055E-05
3 381030	5.2611E-14	391030	9.0580E-11	401030	3.2430E-08	411030	1.3319E-06
3 421030	8.6038E-06	431030	7.2868E-06	441030	4.9558E-01	451030	4.0399E-00
3 451031	4.4287E-04	381040	3.0397E-15	391040	3.2620E-12	401040	1.6616E-08
3 411040	4.1317E-08	421040	1.1160E-05	431040	1.3596E-04	441040	5.2085E+00
3 451040	3.7007E-06	451041	1.6495E-06	461040	2.0909E-00	391050	1.9859E-13
3 401050	3.3322E-10	411050	2.5375E-08	421050	4.4950E-06	431050	4.9437E-05
3 441050	1.6745E-03	451050	1.2076E-02	451051	1.3203E-06	461050	3.5597E+00
3 401060	6.5880E-11	411060	1.9957E-09	421060	4.0714E-07	431060	2.7132E-06
3 441060	1.6405E-00	451060	1.7430E-06	451061	2.5870E-05	461060	1.7683E-00
3 471060	3.4931E-14	391070	6.8859E-17	401070	7.5684E-13	411070	3.8453E-10
3 421070	1.0662E-07	431070	1.1844E-06	441070	1.5693E-05	451070	8.1494E-05
3 461070	2.0381E-00	461071	1.4973E-10	471070	1.9624E-07	401080	3.5826E-13
3 411080	2.6002E-11	421080	7.0329E-09	431080	1.2320E-07	441080	1.1642E-05
3 451080	7.3127E-07	451081	1.4491E-07	461080	1.3900E-00	471080	2.6705E-11
3 471081	1.0288E-08	481080	3.6483E-06	401090	8.9635E-15	411090	6.4993E-12
3 421090	1.5120E-09	431090	5.5413E-07	441090	9.2885E-07	451090	2.4891E-06
3 451091	6.9141E-07	461090	1.6057E-03	461091	3.9177E-06	471090	6.9811E-01
3 471091	1.3115E-06	481090	4.3009E-09	411100	3.2227E-13	421100	5.4155E-10
3 431100	2.2181E-09	441100	1.8519E-07	451100	3.6186E-07	451101	2.7132E-09
3 461100	4.4724E-01	471100	3.6454E-07	471101	8.3932E-03	481100	2.9580E-01
3 411110	3.3957E-14	421110	2.2813E-11	431110	1.1318E-09	441110	7.7549E-08
3 451110	4.3301E-07	461110	9.3076E-06	461111	2.1104E-06	471110	4.6029E-03
3 471111	4.5913E-07	481110	2.4345E-01	481111	8.0431E-09	421120	7.3187E-12
3 431120	9.9600E-11	441120	1.4905E-09	451120	1.6049E-08	461120	2.6475E-04
3 471120	4.1366E-05	481120	1.4645E-01	421130	1.4875E-13	431130	3.3849E-11
3 441130	3.1066E-09	451130	2.1362E-09	461130	2.5771E-07	471130	4.9249E-05
3 471131	1.9166E-08	481130	1.3029E-03	481131	2.3074E-03	491130	9.9317E-05
3 491131	2.6543E-15	421140	2.4779E-14	431140	2.8632E-12	441140	2.5179E-09
3 451140	2.2886E-09	461140	2.8067E-07	471140	8.9349E-09	481140	1.9423E-01
3 491140	4.3277E-11	491141	9.8691E-07	501140	8.5738E-06	421150	5.9850E-16
3 431150	7.7325E-13	441150	1.6927E-10	451150	6.0549E-09	461150	7.0119E-08
3 471150	1.6603E-06	471151	9.0684E-09	481150	3.4933E-04	481151	6.6675E-04
3 491150	1.9793E-02	491151	2.8147E-05	501150	2.7268E-03	431160	2.2871E-14
3 441160	7.2678E-11	451160	3.9656E-10	461160	1.9399E-08	471160	1.2460E-07
3 471161	8.0587E-09	481160	7.0207E-02	491160	1.4645E-08	491161	2.6609E-06
3 501160	6.1823E-02	431170	1.2369E-15	441170	2.3662E-12	451170	2.7725E-10
3 461170	6.0847E-09	471170	5.5533E-08	471171	4.0197E-09	481170	9.4171E-06
3 481171	6.6926E-06	491170	2.4540E-06	491171	8.2154E-06	501170	7.0164E-02
3 501171	1.0663E-05	441180	3.1227E-11	451180	1.1688E-10	461180	3.1225E-09
3 471180	3.7202E-03	471181	1.9448E-09	481180	4.6162E-06	491180	7.6511E-09
3 491181	1.7584E-10	501180	7.0428E-02	451190	1.4456E-11	461190	1.2706E-09
3 471190	8.3821E-09	481190	4.3015E-07	481191	1.4643E-07	491190	6.5872E-08
3 491191	1.2362E-06	501190	6.9042E-02	501191	4.7330E-04	441200	3.1106E-15
3 451200	7.8492E-13	461200	1.1782E-09	471200	1.1182E-09	481200	7.6210E-08
3 491200	3.4010E-08	491201	2.3592E-09	501200	7.0315E-02	451210	1.6866E-13
3 461210	6.6974E-11	471210	1.9885E-09	481210	1.8967E-08	491210	3.5338E-08
3 491211	6.2325E-08	501210	1.5246E-04	501211	2.8900E-05	511210	6.7836E-02
3 451220	9.7271E-15	461220	4.1886E-11	471220	4.1006E-11	481220	7.7804E-09
3 491220	1.5247E-08	491221	1.6573E-10	501220	7.6078E-02	511220	4.7426E-05
3 511221	4.4872E-10	521220	4.4113E-03	451230	1.0515E-15	461230	2.3093E-12
3 471230	1.8445E-10	481230	1.1287E-08	491230	7.4960E-09	491231	2.5423E-08
3 501230	3.9180E-03	501231	3.5657E-06	511230	7.8553E-02	521230	4.8448E-05
3 521231	1.3771E-05	461240	7.8132E-13	471240	2.6204E-11	481240	2.0999E-08
3 491240	6.4590E-09	501240	1.0137E-01	511240	6.5428E-04	511241	1.0055E-10
3 521240	2.6354E-03	471250	1.1640E-11	481250	1.4342E-09	491250	3.0346E-09
3 491251	1.1454E-08	501250	1.0727E-03	501251	1.2088E-06	511250	1.1484E-01
3 521250	3.2857E-02	521251	1.3733E-03	461260	6.0032E-15	471260	1.4732E-12
3 481260	2.4631E-09	491260	4.4111E-09	501260	2.1739E-01	511260	1.1571E-04
3 511261	5.5695E-08	521260	5.7912E-03	481270	2.4559E-10	491270	3.4250E-09
3 491271	6.2367E-09	501270	4.9583E-05	501271	7.7587E-07	511270	3.4454E-03
3 521270	3.4536E-04	521271	1.2846E-02	531270	4.2065E-01	541270	1.6617E-08
3 471280	4.0986E-14	481280	1.8272E-10	491280	1.0218E-08	501280	5.3638E-05
3 511280	4.6261E-05	511281	1.0320E-05	521280	8.6132E-01	531280	1.6697E-06
3 541280	2.2906E-02	481290	1.9566E-11	491290	1.8564E-09	501290	4.6130E-06

Table B.1 (continued)

3 501291	1.7075E-06	511290	4.6723E-04	521290	1.2350E-04	521291	1.2875E-02
3 531290	1.3723E-00	541290	1.2335E-04	541291	4.2392E-07	481300	2.6008E-11
3 491300	1.2858E-09	501300	7.1735E-06	511300	2.3592E-05	511301	1.6141E-05
3 521300	2.7231E-00	531300	1.6720E-04	531301	8.3693E-07	541300	9.2704E-02
3 481310	9.4995E-13	491310	2.6388E-10	501310	1.7434E-06	511310	1.0288E-04
3 521310	1.1968E-04	521311	1.4346E-03	531310	6.2813E-02	541310	3.1988E-00
3 541311	1.0420E-03	481320	1.0457E-13	491320	2.6406E-11	501320	5.8258E-07
3 511320	7.3172E-06	511321	7.2833E-06	521320	3.5916E-02	531320	1.0749E-03
3 541320	8.1109E-00	551320	1.5723E-05	561320	1.3877E-05	491330	2.8744E-12
3 501330	6.4039E-09	511330	7.1411E-06	521330	7.9037E-05	521331	2.1180E-04
3 531330	1.3482E-02	531331	5.2105E-08	541330	8.1610E-02	541331	1.0760E-03
3 551330	8.3726E-00	491340	1.1266E-13	501340	5.2506E-10	511340	9.3737E-08
3 511341	8.4530E-08	521340	3.6046E-04	531340	6.2102E-04	531341	4.5296E-06
3 541340	1.0961E-01	541341	4.1779E-10	551340	8.9866E-01	551341	5.1652E-05
3 561340	2.5748E-01	501350	2.0168E-11	511350	7.7973E-09	521350	1.4644E-06
3 531350	4.0137E-03	541350	1.1352E-03	541351	3.3205E-05	551350	2.2169E+00
3 551351	9.8812E-06	561350	1.6240E-03	561351	8.3891E-07	501360	2.5286E-12
3 511360	2.1003E-10	521360	8.3126E-07	531360	6.5983E-06	531361	2.1479E-06
3 541360	1.7217E-01	551360	4.9182E-03	561360	1.2047E-01	561361	2.2053E-10
3 511370	3.8881E-11	521370	3.9356E-08	531370	1.8819E-06	541370	3.6031E-05
3 551370	8.7475E-00	561370	2.4606E-01	561371	1.3415E-06	511380	2.2350E-12
3 521380	4.5668E-09	531380	2.4076E-07	541380	1.2359E-04	551380	3.1293E-04
3 551381	1.3849E-06	561380	9.2345E-00	571380	4.0801E-05	511390	2.1771E-13
3 521390	2.2993E-10	531390	3.9792E-08	541390	4.4543E-06	551390	8.6488E-05
3 561390	7.8779E-04	571390	8.7477E-00	521400	5.0205E-11	531400	3.9505E-09
3 541400	9.8642E-07	551400	8.7977E-06	561400	1.7009E-01	571400	2.3103E-02
3 581400	8.6939E-00	591400	4.8467E-10	521410	7.1598E-13	531410	3.0484E-10
3 547410	4.3775E-08	551410	2.5442E-06	561410	1.5758E-04	571410	2.0445E-03
3 581410	4.1196E-01	591410	7.4980E-00	521420	1.6122E-13	531420	2.2084E-11
3 541420	1.0646E-08	551420	1.0368E-07	561420	8.6997E-05	571420	7.7258E-04
3 581420	7.9287E-00	591420	5.3955E-04	591421	1.4654E-06	601420	1.7931E-01
3 531430	2.4587E-12	541430	4.4617E-10	551430	4.9993E-08	561430	1.6010E-06
3 571430	1.1032E-04	581430	1.5706E-02	591430	1.5253E-01	601430	5.2715E+00
3 531440	8.1181E-14	541440	2.6178E-10	551440	8.8717E-09	561440	9.6597E-07
3 571440	4.6113E-06	581440	2.7430E-00	591440	1.1687E-04	591441	5.7958E-07
3 601440	6.4125E-00	541450	2.6154E-11	551450	1.2248E-09	561450	2.8211E-07
3 571450	2.4347E-06	581450	1.6292E-05	591450	1.9494E-03	601450	4.6340E+00
3 541460	1.7401E-12	551460	6.1062E-11	561460	3.7234E-08	571460	4.5703E-07
3 581460	6.2027E-05	591460	1.0614E-04	601460	4.6889E-00	611460	5.0244E-05
3 621460	3.1197E-05	541470	4.3384E-14	551470	2.9661E-11	561470	8.7388E-09
3 571470	2.6972E-07	581470	3.9562E-06	591470	4.1849E-05	601470	5.5998E-02
3 611470	9.5697E-01	621470	3.6192E-01	551480	6.9548E-13	561480	4.1157E-09
3 571480	1.3239E-08	581480	1.7898E-06	591480	6.4100E-06	601480	2.4974E+00
3 611480	1.1821E-02	611481	9.1920E-03	621480	1.0859E+00	561490	7.3128E-11
3 571490	7.3200E-09	581490	2.3265E-08	591490	4.5259E-06	601490	2.1546E-04
3 611490	1.0704E-02	621490	1.4276E-02	551500	4.0440E-16	561500	1.0753E-11
3 571500	3.2002E-10	581500	1.0892E-08	591500	2.7583E-07	601500	1.1768E-00
3 611500	7.7100E-06	621500	2.0968E-00	631500	1.2819E-09	571510	6.0044E-11
3 581510	3.2802E-09	591510	4.9838E-08	601510	1.3764E-05	611510	1.8915E-03
3 621510	8.8694E-02	631510	5.5562E-05	561520	1.1999E-14	571520	2.1879E-12
3 581520	1.0130E-08	591520	4.6154E-08	601520	8.9335E-06	611520	3.2728E-06
3 611521	1.1285E-07	621520	8.7537E-01	631520	2.0687E-04	631521	3.0195E-07
3 641520	7.0190E-05	571530	3.1955E-13	581530	2.1842E-10	591530	1.3724E-08
3 601530	5.1833E-07	611530	2.8292E-06	621530	7.5169E-03	631530	7.0310E-01
3 641530	8.8315E-05	571540	5.9245E-15	581540	5.2592E-11	591540	5.6123E-10
3 601540	1.6241E-07	611540	8.4061E-07	611541	9.2660E-08	621540	2.4241E-01
3 631540	2.5410E-11	641540	1.5017E-02	581550	1.1928E-12	591550	1.6190E-10
3 601550	4.1266E-08	611550	1.1691E-07	621550	5.0312E-06	631550	9.0373E-02
3 641551	1.7927E-15	641550	4.7690E-04	581560	1.8325E-13	591560	8.1861E-12
3 601560	3.3707E-08	611560	2.3661E-08	621560	8.1597E-05	631560	2.4517E-02
3 641560	3.7627E-01	581570	4.4155E-15	591570	1.6391E-12	601570	6.7288E-10
3 611570	5.9984E-08	621570	7.6935E-07	631570	1.4329E-04	641570	5.3049E-04
3 591580	4.6101E-14	601580	1.9406E-10	611580	1.0975E-09	621580	2.3170E-06
3 631580	2.5913E-06	641580	1.1667E-01	591590	2.1320E-15	601590	3.3687E-12
3 611590	2.7847E-10	621590	6.7512E-08	631590	5.4782E-07	641590	4.2758E-05
3 651590	1.6192E-02	601600	3.7314E-13	611600	1.0668E-11	621600	5.2562E-08
3 631600	1.1745E-08	641600	7.8403E-03	651600	5.6034E-04	661600	1.1511E-03
3 601610	6.7531E-15	611610	1.4683E-12	621610	5.2780E-10	631610	4.1925E-09
3 641610	2.5766E-08	651610	8.2576E-05	661610	2.4951E-03	611620	2.0991E-14
3 621620	1.0111E-10	631620	7.7763E-09	641620	3.1649E-08	651620	2.3412E-08
3 651621	1.2845E-08	661620	2.2671E-03	621630	1.4535E-12	631630	9.8517E-11
3 641630	1.9462E-09	651630	2.6518E-08	661630	1.7685E-03	621640	2.0538E-13
3 631640	2.8422E-12	641640	1.0695E-08	651640	1.8390E-09	661640	2.5920E-04
3 621650	2.7485E-15	631650	5.1462E-13	641650	2.7368E-10	651650	1.4641E-10
3 661650	4.4367E-07	661651	1.7067E-09	671650	8.5912E-04	661660	9.3142E-07
3 671660	1.4615E-06	671661	8.5921E-06	681660	2.7077E-04	681670	1.8184E-05
3 681671	7.7097E-13	681680	4.8302E-05	681690	2.1561E-08	691690	3.0510E-07
3 681700	7.0090E-11	691700	4.9113E-08	691701	2.3655E-21	701700	4.6342E-08
3 681710	9.8657E-16	691710	4.4966E-09	701710	2.3525E-09	681720	2.4458E-18
3 691720	1.8401E-12	701720	1.8120E-10	0	0.0	0	0.0
0	3.3000E-04	3.2408E-14	3.75E-01				

APPENDIX C
COMPARATIVE RATIO TABLES IN GRAM-ATOMS
(See table descriptions in Sect. 4.1)

CASE: DECAY ONLY, OF ORIGIN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GMD/MTU G-ATOMS PER MTU

	10 YR										20 YR									
	ORIGIN2	ORIGIN5	CINDER	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2
				AVG	CIN	AVG	CIN	AVG	CIN	AVG										
SR 74	7.430E-02	7.430E-02	7.430E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.429E-02	7.429E-02	7.429E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 85	1.485E-01	1.485E-01	1.485E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.781E-02	7.781E-02	7.781E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 89	5.707E-23	5.694E-23	5.715E-23	1.000	0.998	1.002	1.000	1.000	1.000	0.0	0.0	0.0	9.849E-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	8.699E-00	8.691E-00	8.694E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.699E-00	3.699E-00	3.699E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Y 90	1.177E-03	1.177E-03	1.177E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	9.277E-04	9.277E-04	9.277E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Y 91	8.355E-20	8.140E-20	8.371E-20	1.000	0.999	1.002	1.000	1.000	1.000	1.000	1.344E-38	1.344E-38	1.352E-38	0.999	0.998	1.003	1.000	1.000	0.99	1.000
SR 93	7.224E-00	7.262E-00	7.262E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.726E-00	7.726E-00	7.726E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 94	5.272E-18	5.260E-18	5.272E-18	0.977	0.973	0.980	1.000	0.93	0.93	0.93	3.449E-35	3.423E-35	3.490E-35	0.953	0.945	1.02	1.01	0.86	0.86	0.86
SR 95	6.431E-18	6.416E-18	6.431E-18	0.979	0.976	0.985	1.000	0.94	0.94	0.94	4.201E-35	4.175E-35	4.231E-35	0.955	0.948	1.097	1.01	0.87	0.86	0.86
TC 44	1.785E-00	1.785E-00	1.785E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.782E-00	7.782E-00	7.782E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PD107	1.693E-03	1.693E-03	1.693E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.742E-06	7.742E-06	7.742E-06	0.998	1.000	1.002	1.000	1.000	1.000	1.000
PD107	2.038E-00	2.038E-00	2.038E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.038E-00	2.038E-00	2.038E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM126	2.174E-01	2.174E-01	2.174E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.174E-01	2.174E-01	2.174E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM126	9.492E-03	9.492E-03	9.492E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.722E-04	7.722E-04	7.722E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1129	1.386E-00	1.386E-00	1.386E-00	0.999	0.999	1.002	1.000	1.000	1.000	1.000	1.386E-00	1.386E-00	1.386E-00	0.999	0.999	1.002	1.000	1.000	1.000	1.000
CS131	8.471E-00	8.472E-00	8.469E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.473E-00	8.473E-00	8.469E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CS133	3.117E-02	3.116E-02	3.116E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.081E-03	1.080E-03	1.081E-03	1.000	0.999	1.000	1.000	1.000	1.000	1.000
CS134	2.222E-00	2.222E-00	2.222E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.222E-00	2.222E-00	2.222E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CS137	6.948E-00	6.952E-00	6.952E-00	0.999	1.000	1.000	1.000	1.000	1.000	1.000	5.031E-00	5.031E-00	5.031E-00	0.998	1.001	1.001	1.000	0.99	0.99	0.99
ND143	5.442E-00	5.440E-00	5.440E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.442E-00	5.440E-00	5.440E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ND144	9.155E-00	9.155E-00	9.155E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	9.155E-00	9.155E-00	9.155E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ND145	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ND146	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PM147	7.217E-02	7.217E-02	7.217E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.138E-03	5.138E-03	5.138E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PM147	1.303E-00	1.303E-00	1.303E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.303E-00	1.303E-00	1.303E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM148	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM149	2.520E-02	2.521E-02	2.498E-02	1.000	0.994	1.000	1.000	1.000	1.000	1.000	2.520E-02	2.521E-02	2.498E-02	1.000	1.003	0.994	1.000	1.000	1.01	1.01
SM150	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM151	8.388E-02	8.388E-02	8.387E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.766E-02	7.766E-02	7.765E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM152	8.759E-01	8.759E-01	8.759E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.755E-01	8.755E-01	8.754E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EU153	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EU154	1.135E-01	1.135E-01	1.135E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.069E-02	5.069E-02	5.069E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EU155	2.238E-02	2.238E-02	2.238E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.521E-03	5.521E-03	5.521E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000
U234	8.125E-01	8.125E-01	8.125E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.125E-01	8.125E-01	8.125E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
U236	1.679E-01	1.679E-01	1.679E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.679E-01	1.679E-01	1.679E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
U238	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000
NP237	1.887E-01	1.887E-01	1.887E-01	1.000	0.994	1.000	1.000	1.000	1.000	1.000	1.930E-01	1.929E-01	1.929E-01	1.011	1.010	0.979	1.000	1.000	1.03	1.03
P238	5.497E-01	5.497E-01	5.497E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.080E-01	5.080E-01	5.080E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P239	2.106E-01	2.106E-01	2.106E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.105E-01	2.105E-01	2.105E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P240	9.655E-00	9.655E-00	9.655E-00	1.001	0.998	1.000	1.000	1.000	1.000	1.000	9.655E-00	9.655E-00	9.655E-00	1.002	1.002	0.996	1.000	1.000	1.01	1.01
P241	3.135E-00	3.135E-00	3.135E-00	0.993	1.003	1.003	0.99	0.99	0.99	0.99	1.937E-00	1.937E-00	1.937E-00	0.987	1.007	1.007	0.98	0.98	0.98	0.98
P242	2.039E-00	2.039E-00	2.039E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.937E-00	1.937E-00	1.937E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AN242	2.965E-08	2.965E-08	2.965E-08	0.998	0.999	1.003	1.000	1.000	1.000	1.000	3.156E-00	3.156E-00	3.156E-00	1.008	0.996	0.996	1.01	1.01	1.01	1.01
AN243	3.535E-01	3.535E-01	3.535E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.535E-01	3.535E-01	3.535E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CM242	6.007E-06	6.007E-06	6.007E-06	0.998	0.998	1.004	1.000	1.000	1.000	1.000	5.730E-06	5.730E-06	5.730E-06	0.998	0.998	1.004	1.000	1.000	0.99	0.99
CM243	1.060E-03	1.060E-03	1.060E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.310E-04	8.310E-04	8.310E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CM244	6.717E-02	6.717E-02	6.717E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.581E-02	4.581E-02	4.581E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CM245	1.508E-03	1.508E-03	1.508E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.505E-03	3.505E-03	3.505E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CM246	4.176E-04	4.176E-04	4.176E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.176E-04	4.176E-04	4.176E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000

AVERAGE ABSOLUTE DEVIATION, AS % 0.15 0.15 0.26 0.1 0.4 0.4
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 0.09 0.09 0.16 0.0 0.2 0.2
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.04 0.04

CASE: DECAY ONLY, OF ORIGIN2 DISCHARGE RESULTS FOR PWR, 1.2 WT % 1.33 GMD/MTU

G-ATOMS

PER MTU

	50 YR										100 YR									
	ORIGIN2	ORIGIN S	CINDER	OR2	OR1	OR2	OR1	OR2	OR1	OR2	OR2	OR1	OR2	OR1	OR2	OR1	OR2	OR1	OR2	OR1
	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG
SR 74	7.427E-02	7.427E-02	7.427E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.423E-02	7.423E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 85	1.118E-02	1.118E-02	1.118E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.411E-04	4.409E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	1.811E-00	1.811E-00	1.811E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.510E-01	5.509E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 94	4.543E-04	4.542E-04	4.542E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.382E-04	1.381E-04	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Y 40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	7.726E-00	7.726E-00	7.726E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.726E-00	7.726E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	7.788E-00	7.788E-00	7.788E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.782E-00	7.782E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RU106	1.913E-15	1.913E-15	1.913E-15	0.998	1.000	1.000	1.000	1.000	1.000	1.000	2.237E-10	2.237E-10	0.997	0.999	1.000	1.000	0.999	0.999	0.999	0.999
PD107	2.018E-00	2.018E-00	2.018E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.038E-00	2.038E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SN126	2.173E-01	2.173E-01	2.173E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.172E-01	2.172E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SN129	4.266E-07	4.266E-07	4.266E-07	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.571E-12	1.570E-12	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CS133	1.386E-00	1.386E-00	1.386E-00	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.386E-00	1.386E-00	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000
CS134	4.508E-08	4.504E-08	4.507E-08	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.261E-15	2.261E-15	1.001	0.999	1.001	1.000	1.001	0.999	1.000	1.000
CS135	2.222E-00	2.222E-00	2.222E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.222E-00	2.222E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CS137	2.755E-00	2.753E-00	2.753E-00	0.996	1.000	1.000	1.000	1.000	1.000	1.000	2.755E-00	2.755E-00	0.991	0.990	1.000	1.000	0.990	0.990	0.990	0.990
CS144	1.254E-19	1.259E-19	1.282E-19	0.991	0.995	1.000	1.000	1.000	1.000	1.000	5.738E-39	5.738E-39	0.983	0.990	1.000	1.000	0.983	0.990	0.983	0.983
MD141	5.482E-00	5.480E-00	5.480E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	5.482E-00	5.480E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MD144	4.156E-00	4.156E-00	4.156E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.156E-00	4.156E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MD145	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.636E-00	4.636E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MD146	4.858E-00	4.858E-00	4.858E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.858E-00	4.858E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MD147	1.858E-06	1.858E-06	1.858E-06	1.001	0.999	1.000	1.000	1.000	1.000	1.000	1.858E-06	1.858E-06	1.001	0.999	1.000	1.000	1.001	0.999	1.000	1.000
SM147	1.375E-00	1.375E-00	1.375E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.375E-00	1.375E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM148	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.107E-00	1.107E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM149	2.502E-02	2.521E-02	2.498E-02	1.003	1.003	0.994	1.000	1.000	1.000	1.000	2.520E-02	2.521E-02	1.003	1.003	0.994	1.000	1.003	0.994	1.001	1.001
SM150	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.097E-00	2.097E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM151	6.164E-02	6.164E-02	6.164E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	6.164E-02	6.164E-02	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SM152	8.755E-01	8.755E-01	8.755E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.755E-01	8.755E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RU153	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7.107E-01	7.107E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RU154	4.516E-03	4.516E-03	4.516E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.516E-03	4.516E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RU155	8.338E-05	8.343E-05	8.344E-05	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.338E-05	8.338E-05	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
U234	9.614E-01	9.614E-01	9.595E-01	1.001	1.001	0.999	1.000	1.000	1.000	1.000	9.614E-01	9.614E-01	1.001	1.001	0.999	1.000	1.001	0.999	1.000	1.000
U235	3.390E-01	3.390E-01	3.387E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.390E-01	3.390E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
U236	1.683E-01	1.683E-01	1.678E-01	1.001	1.001	0.998	1.000	1.000	1.000	1.000	1.683E-01	1.683E-01	1.001	1.001	0.998	1.000	1.001	0.998	1.000	1.000
U238	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.967E-03	3.967E-03	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
NP237	2.123E-00	2.121E-00	1.869E-00	1.042	1.041	0.917	1.000	1.000	1.000	1.000	2.121E-00	2.121E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PU238	4.010E-01	4.010E-01	4.010E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.010E-01	4.010E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PU239	2.148E-01	2.148E-01	2.148E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	2.148E-01	2.148E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PU240	9.665E-00	9.665E-00	9.582E-00	1.003	1.003	0.994	1.001	1.001	1.001	1.001	9.665E-00	9.665E-00	1.003	1.003	0.994	1.001	1.003	0.993	1.001	1.001
PU241	4.571E-01	4.571E-01	4.571E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	4.571E-01	4.571E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PU242	1.870E-00	1.870E-00	1.870E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.870E-00	1.870E-00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AM241	4.481E-00	4.460E-00	4.460E-00	1.003	0.998	0.998	1.000	1.000	1.000	1.000	4.481E-00	4.481E-00	1.003	0.998	0.998	1.000	1.000	1.000	1.000	1.000
AM242	2.471E-08	2.471E-08	2.482E-08	0.999	0.999	1.003	1.000	1.000	1.000	1.000	2.471E-08	2.471E-08	0.999	0.999	1.003	1.000	1.000	1.000	1.000	1.000
AM243	3.521E-01	3.521E-01	3.521E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	3.521E-01	3.521E-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AM244	4																			

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU G-ATOMS PER MTU

300 YR												1 KYR															
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
SE 79	7.407E-02	7.407E-02	7.407E-02	1.000	1.000	1.000	1.00	1.00	1.00	7.352E-02	7.352E-02	7.352E-02	1.000	1.000	1.000	1.00	1.00	1.00	7.352E-02	7.352E-02	7.352E-02	1.000	1.000	1.000	1.00	1.00	1.00
KR 85	1.067E-09	1.066E-09	1.067E-09	1.000	0.999	1.000	1.00	1.00	1.00	2.353E-29	2.349E-29	2.349E-29	1.001	0.999	0.999	1.00	1.00	1.00	2.349E-29	2.349E-29	2.349E-29	1.001	0.999	0.999	1.00	1.00	1.00
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SR 90	4.717E-03	4.714E-03	4.716E-03	1.000	1.000	1.000	1.00	1.00	1.00	2.740E-10	2.736E-10	2.736E-10	1.001	1.000	1.000	1.00	1.00	1.00	2.736E-10	2.736E-10	2.736E-10	1.001	1.000	1.000	1.00	1.00	1.00
Y 90	1.181E-06	1.182E-06	1.183E-06	1.000	0.999	1.000	1.00	1.00	1.00	6.871E-14	6.861E-14	6.861E-14	1.001	1.000	1.000	1.00	1.00	1.00	6.861E-14	6.861E-14	6.861E-14	1.001	1.000	1.000	1.00	1.00	1.00
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ZR 93	7.725E-00	7.725E-00	7.725E-00	1.000	1.000	1.000	1.00	1.00	1.00	7.723E-00	7.723E-00	7.723E-00	1.000	1.000	1.000	1.00	1.00	1.00	7.723E-00	7.723E-00	7.723E-00	1.000	1.000	1.000	1.00	1.00	1.00
ZR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TC 99	7.777E-00	7.777E-00	7.777E-00	1.000	1.000	1.000	1.00	1.00	1.00	7.760E-00	7.760E-00	7.760E-00	1.000	1.000	1.000	1.00	1.00	1.00	7.760E-00	7.760E-00	7.760E-00	1.000	1.000	1.000	1.00	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PD107	2.038E-00	2.038E-00	2.038E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.038E-00	2.038E-00	2.038E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.038E-00	2.038E-00	2.038E-00	1.000	1.000	1.000	1.00	1.00	1.00
SN126	2.169E-01	2.169E-01	2.169E-01	1.000	1.000	1.000	1.00	1.00	1.00	2.159E-01	2.159E-01	2.159E-01	1.000	1.000	1.000	1.00	1.00	1.00	2.159E-01	2.159E-01	2.159E-01	1.000	1.000	1.000	1.00	1.00	1.00
SR125	0.0	0.0	2.891E-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SI129	1.386E-00	1.386E-00	1.390E-00	0.999	0.999	1.002	1.00	1.00	1.00	1.386E-00	1.386E-00	1.390E-00	0.999	0.999	1.002	1.00	1.00	1.00	1.386E-00	1.386E-00	1.390E-00	0.999	0.999	1.002	1.00	1.00	1.00
CS133	8.473E-00	8.472E-00	8.469E-00	1.000	1.000	1.000	1.00	1.00	1.00	8.473E-00	8.472E-00	8.469E-00	1.000	1.000	1.000	1.00	1.00	1.00	8.472E-00	8.472E-00	8.469E-00	1.000	1.000	1.000	1.00	1.00	1.00
CS134	0.0	0.0	1.431E-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS135	2.222E-00	2.222E-00	2.222E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.221E-00	2.221E-00	2.221E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.221E-00	2.221E-00	2.221E-00	1.000	1.000	1.000	1.00	1.00	1.00
CS137	8.548E-03	8.548E-03	8.548E-03	0.975	1.012	1.013	0.96	0.96	1.00	8.084E-10	9.196E-10	9.201E-10	0.916	1.042	1.042	0.88	0.88	1.00	8.084E-10	9.196E-10	9.201E-10	0.916	1.042	1.042	0.88	0.88	1.00
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND143	5.442E-00	5.442E-00	5.440E-00	1.000	1.000	1.000	1.00	1.00	1.00	5.442E-00	5.440E-00	5.440E-00	1.000	1.000	1.000	1.00	1.00	1.00	5.440E-00	5.440E-00	5.440E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND144	4.156E-00	4.156E-00	4.156E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.156E-00	4.156E-00	4.156E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.156E-00	4.156E-00	4.156E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND145	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND146	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.00	1.00	1.00	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.00	1.00	1.00
PM147	0.0	0.0	3.807E-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SM147	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM148	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM149	2.520E-02	2.521E-02	2.498E-02	1.003	1.003	0.994	1.00	1.01	1.01	2.520E-02	2.521E-02	2.498E-02	1.003	1.003	0.994	1.00	1.01	1.01	2.520E-02	2.521E-02	2.498E-02	1.003	1.003	0.994	1.00	1.01	1.01
SM150	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.00	1.00	1.00	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM151	8.755E-01	8.755E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00	8.755E-01	8.754E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00	8.754E-01	8.754E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00
SM152	8.755E-01	8.755E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00	8.755E-01	8.754E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00	8.754E-01	8.754E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00
EU153	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.00	1.00	1.00
EU154	8.025E-12	8.004E-12	8.012E-12	1.001	0.999	1.000	1.00	1.00	1.00	0.0	0.0	2.517E-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.517E-36	0.0	0.0	0.0	0.0	0.0	0.0	
EU155	5.568E-20	5.593E-20	5.597E-20	0.997	1.001	1.002	1.00	0.99	1.00	0.0	0.0	1.829E-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.829E-62	0.0	0.0	0.0	0.0	0.0	0.0	
U234	1.307E-00	1.307E-00	1.301E-00	1.002	1.002	0.997	1.00	1.00	1.00	1.361E-00	1.361E-00	1.354E-00	1.002	1.002	0.997	1.00	1.01	1.01	1.361E-00	1.361E-00	1.354E-00	1.002	1.002	0.997	1.00	1.01	1.01
U235	3.405E-01	3.405E-01	3.387E-01	1.002	1.002	0.996	1.00	1.01	1.01	3.446E-01	3.446E-01	3.387E-01	1.006	1.006	0.989	1.00	1.02	1.02	3.446E-01	3.446E-01	3.387E-01	1.006	1.006	0.989	1.00	1.02	1.02
U236	1.709E-01	1.709E-01	1.678E-01	1.006	1.006	0.988	1.00	1.02	1.02	1.776E-01	1.776E-01	1.678E-01	1.019	1.019	0.963	1.00	1.06	1.06	1.776E-01	1.776E-01	1.678E-01	1.019	1.019	0.963	1.00	1.06	1.06
U238	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.00	1.00	1.00	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.00	1.00	1.00	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.00	1.00	1.00
NP237	3.745E-00	3.743E-00	3.669E-00	1.201	1.200	0.999	1.00	2.00	2.00	5.982E-00	5.981E-00	5.868E-00	1.298	1.297	0.405	1.00	3.20	3.20	5.981E-00	5.981E-00	5.868E-00	1.298	1.297	0.405	1.00	3.20	3.20
PU238	5.608E-02	5.608E-02	5.609E-02	1.000	1.000	1.000	1.00	1.00	1.00	2.506E-04	2.503E-04	2.506E-04	1.000	0.999	1.000	1.00	1.00	1.00	2.503E-04	2.503E-04	2.506E-04	1.000	0.999	1.000	1.00	1.00	1.00
PU239	2.040E-01	2.090E-01	2.088E-01	1.000	1.000	0.999	1.00	1.00	1.00	2.050E-01	2.050E-01	2.047E-01	1.000	1.000	0.999	1.00	1.00	1.00	2.050E-01	2.050E							

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU

G-ATOMS PER MTU

	10 KYR			10 KYR			10 KYR		
	ORIGEN2	ORIGEN-S	CINDER	OR2	OR3	CIN	OR2	OR3	CIN
				AVG	AVG	AVG	OR3	OR3	OR3
							CIN	CIN	CIN
SR 79	6.679E-02	6.679E-02	6.679E-02	1.000	1.000	1.000	1.00	1.00	1.00
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ZR 93	7.692E-00	7.691E-00	7.691E-00	1.000	1.000	1.000	1.00	1.00	1.00
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	7.536E-00	7.536E-00	7.536E-00	1.000	1.000	1.000	1.00	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	2.036E-00	2.036E-00	2.036E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM126	2.028E-01	2.028E-01	2.028E-01	1.000	1.000	1.000	1.00	1.00	1.00
SM125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.385E-00	1.385E-00	1.390E-00	0.999	0.999	1.002	1.00	1.00	1.00
CS133	8.471E-00	8.472E-00	8.469E-00	1.000	1.000	1.000	1.00	1.00	1.00
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.215E-00	2.215E-00	2.215E-00	1.000	1.000	1.000	1.00	1.00	1.00
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	5.442E-00	5.440E-00	5.440E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND144	9.156E-00	9.156E-00	9.156E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND145	4.636E-00	4.636E-00	4.636E-00	1.000	1.000	1.000	1.00	1.00	1.00
ND146	4.689E-00	4.689E-00	4.689E-00	1.000	1.000	1.000	1.00	1.00	1.00
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	1.375E-00	1.375E-00	1.375E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM148	1.107E-00	1.107E-00	1.107E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM149	2.520E-02	2.521E-02	2.498E-02	1.003	1.003	0.994	1.00	1.01	1.01
SM150	2.097E-00	2.097E-00	2.097E-00	1.000	1.000	1.000	1.00	1.00	1.00
SM151	3.216E-35	3.231E-35	3.223E-35	0.998	1.002	1.000	1.00	1.00	1.00
SM152	8.755E-01	8.755E-01	8.754E-01	1.000	1.000	1.000	1.00	1.00	1.00
EU153	7.107E-01	7.107E-01	7.106E-01	1.000	1.000	1.000	1.00	1.00	1.00
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.332E-00	1.332E-00	1.321E-00	1.003	1.003	0.994	1.00	1.01	1.01
U235	3.917E-01	3.917E-01	3.387E-01	1.047	1.047	0.906	1.00	1.16	1.16
U236	2.314E-01	2.314E-01	1.678E-01	1.101	1.101	0.798	1.00	1.38	1.38
U238	3.967E-03	3.967E-03	3.967E-03	1.000	1.000	1.000	1.00	1.00	1.00
NP237	7.043E-00	7.043E-00	1.863E-00	1.325	1.325	0.350	1.00	3.78	3.78
PU238	4.623E-23	4.614E-23	4.659E-23	0.998	0.996	1.006	1.00	0.99	0.99
PU239	1.598E-01	1.598E-01	1.580E-01	1.004	1.004	0.992	1.00	1.01	1.01
PU240	3.371E-00	3.370E-00	3.343E-00	1.003	1.003	0.995	1.00	1.01	1.01
PU241	2.636E-06	2.691E-06	0.0	0.990	1.010	0.0	0.98	0.0	0.0
PU242	1.837E-00	1.836E-00	1.836E-00	1.000	1.000	1.000	1.00	1.00	1.00
AM241	7.974E-05	8.311E-05	5.820E-07	1.464	1.526	0.011	0.96	****	****
AM242	4.878E-28	4.869E-28	4.886E-28	1.000	0.998	1.002	1.00	1.00	1.00
AM243	1.383E-01	1.383E-01	1.383E-01	1.000	1.000	1.000	1.00	1.00	1.00
CM242	9.893E-26	9.874E-26	9.897E-26	1.001	0.999	1.001	1.00	1.00	1.00
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	2.152E-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	1.553E-03	1.553E-03	1.549E-03	1.001	1.001	0.998	1.00	1.00	1.00
CM246	9.664E-05	9.661E-05	9.660E-05	1.000	1.000	1.000	1.00	1.00	1.00

AVERAGE-ABSOLUTE-DEVIATION, AS % 2.76 2.95 5.80 0.2 **** ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 1.57 1.58 3.17 0.1 10.2 10.2
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.61 0.61 1.14 0.0 1.4 1.9
 NUCL EXCLUDED, 1ST/2ND: PU242 SM151 AM241 / ND143 AM242 NP237

CH
CC

CASE: PWR, 3.10 WT & U-235, 3.883 AT & BURNUP (33.0 GMD/MTU, APPROX.)

G-ATONS

PER MTU

	30 DAY										1 YR									
	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5
SE 74	7.15E-02	6.809E-02	6.278E-02	1.085	0.996	0.919	1.08	7.414E-02	6.809E-02	6.277E-02	1.085	0.996	0.919	1.08	7.414E-02	6.809E-02	6.277E-02	1.085	0.996	0.919
SR 85	2.795E-01	2.780E-01	2.801E-01	1.001	0.996	1.003	1.01	0.99	2.023E-01	2.038E-01	1.001	0.996	1.003	1.01	0.99	2.023E-01	2.038E-01	1.001	0.996	1.003
SR 89	2.205E-01	2.170E-01	2.170E-01	1.001	1.010	0.989	0.99	1.01	0.92	4.358E-12	4.272E-12	1.001	1.010	0.990	0.99	1.01	0.92	4.358E-12	4.272E-12	1.001
SR 90	5.877E-00	5.866E-00	5.977E-00	0.996	0.991	1.013	1.01	0.98	0.98	5.200E-00	5.316E-00	0.996	0.991	1.013	1.01	0.98	0.98	5.200E-00	5.316E-00	0.996
Y 90	1.974E-03	1.466E-03	1.499E-03	0.996	0.991	1.013	1.01	0.98	0.98	1.311E-03	1.304E-03	0.996	0.991	1.013	1.01	0.98	0.98	1.311E-03	1.304E-03	0.996
Y 91	3.583E-01	3.606E-01	3.578E-01	1.001	1.005	0.997	0.99	1.00	1.01	2.052E-10	2.052E-10	1.001	1.005	0.997	0.99	1.00	1.01	2.052E-10	2.052E-10	1.001
IR 93	7.675E-00	7.748E-00	7.571E-00	1.001	1.001	0.988	0.99	1.01	1.02	7.675E-00	7.571E-00	1.001	1.001	0.988	0.99	1.01	1.02	7.675E-00	7.571E-00	1.001
IR 95	5.607E-01	5.861E-01	5.777E-01	0.999	1.000	0.993	0.99	1.01	1.01	2.054E-09	2.070E-09	0.987	0.995	1.018	0.99	0.97	0.98	2.054E-09	2.070E-09	0.987
MB 95	4.128E-01	4.165E-01	4.086E-01	1.000	1.009	0.990	0.99	1.01	1.02	2.506E-09	2.525E-09	0.990	0.997	1.013	0.99	0.98	1.00	2.506E-09	2.525E-09	0.990
TC 99	7.767E-00	7.925E-00	7.904E-00	0.987	1.008	1.005	0.98	0.98	1.00	7.767E-00	7.925E-00	0.987	1.008	1.005	0.98	0.98	1.00	7.767E-00	7.925E-00	0.987
RU106	1.587E-01	1.503E-01	1.617E-01	1.011	0.958	1.031	1.06	0.98	0.93	5.395E-02	5.108E-02	1.012	0.958	1.031	1.06	0.98	0.93	5.395E-02	5.108E-02	1.012
PD107	2.094E-00	1.928E-00	2.147E-00	1.018	0.938	1.044	1.09	0.98	0.90	2.094E-00	2.147E-00	1.018	0.938	1.044	1.09	0.98	0.90	2.094E-00	2.147E-00	1.018
SM126	2.202E-01	1.561E-01	1.794E-01	1.189	0.883	0.969	1.41	1.23	0.87	2.202E-01	1.561E-01	1.189	0.883	0.969	1.41	1.23	0.87	2.202E-01	1.561E-01	1.189
SM125	1.551E-01	1.561E-02	6.294E-02	1.361	0.884	0.745	1.52	1.83	0.20	3.265E-02	2.311E-02	1.361	0.884	0.745	1.52	1.83	0.20	3.265E-02	2.311E-02	1.361
1129	1.388E-00	1.443E-00	1.390E-00	0.986	1.036	0.988	0.96	1.00	1.04	1.395E-00	1.450E-00	0.986	1.036	0.988	0.96	1.00	1.04	1.395E-00	1.450E-00	0.986
CS133	8.488E-00	8.625E-00	8.453E-00	0.993	1.014	0.993	0.98	1.01	1.02	8.488E-00	8.625E-00	0.993	1.014	0.993	0.98	1.01	1.02	8.488E-00	8.625E-00	0.993
CS134	8.861E-01	8.737E-01	8.769E-01	1.008	0.994	0.998	1.01	1.01	1.01	1.696E-01	1.673E-01	1.008	0.994	0.998	1.01	1.01	1.01	1.696E-01	1.673E-01	1.008
CS135	2.196E-00	2.466E-00	2.434E-00	0.928	1.083	1.029	0.89	0.90	1.01	2.196E-00	2.466E-00	0.928	1.083	1.029	0.89	0.90	1.01	2.196E-00	2.466E-00	0.928
CS137	8.733E-00	8.743E-00	8.981E-00	0.990	0.981	1.018	1.00	0.97	0.97	7.795E-00	8.021E-00	0.990	0.981	1.018	1.00	0.97	0.97	7.795E-00	8.021E-00	0.990
CR144	5.530E-00	5.551E-00	5.551E-00	0.997	1.002	1.001	0.99	1.00	1.00	3.177E-02	3.196E-02	0.996	1.002	1.002	1.00	0.99	0.99	3.177E-02	3.196E-02	0.996
MD143	6.514E-00	6.486E-00	6.442E-00	1.017	0.992	0.991	1.03	1.00	1.00	9.119E-00	8.958E-00	1.017	0.992	0.991	1.03	1.00	1.00	9.119E-00	8.958E-00	1.017
MD145	4.12E-00	4.12E-00	4.12E-00	0.992	1.014	0.994	0.98	1.00	1.02	4.12E-00	4.12E-00	0.992	1.014	0.994	0.98	1.00	1.02	4.12E-00	4.12E-00	0.992
MD146	4.908E-00	4.625E-00	4.693E-00	1.004	0.991	1.005	1.01	1.00	0.99	4.690E-00	4.625E-00	1.004	0.991	1.005	1.01	1.00	0.99	4.690E-00	4.625E-00	1.004
PM147	4.995E-01	4.292E-00	1.215E-00	0.837	1.115	1.078	0.75	0.80	0.94	2.669E-01	3.348E-01	0.837	1.115	1.078	0.75	0.80	0.94	2.669E-01	3.348E-01	0.837
SM147	3.772E-01	4.119E-01	4.393E-01	0.921	1.066	1.073	0.86	0.94	1.08	3.772E-01	4.393E-01	0.921	1.066	1.073	0.86	0.94	1.08	3.772E-01	4.393E-01	0.921
SM148	2.105E-02	3.359E-01	8.318E-01	1.240	0.826	0.935	1.50	1.33	0.88	1.111E-01	7.817E-01	1.240	0.826	0.935	1.50	1.33	0.88	1.111E-01	7.817E-01	1.240
SM149	2.509E-02	3.106E-02	2.708E-02	0.905	1.035	0.975	0.91	0.93	1.15	2.510E-02	3.106E-02	0.905	1.035	0.975	0.91	0.93	1.15	2.510E-02	3.106E-02	0.905
SM150	2.104E-00	2.51E-00	2.140E-00	0.987	1.009	1.004	0.98	1.01	1.00	2.104E-00	2.51E-00	0.987	1.009	1.004	0.98	1.01	1.00	2.104E-00	2.51E-00	0.987
SM151	9.038E-02	1.069E-01	8.520E-02	0.960	1.135	0.905	0.95	1.06	1.25	8.702E-02	1.030E-01	0.960	1.135	0.905	0.95	1.06	1.25	8.702E-02	1.030E-01	0.960
SM152	8.775E-01	8.818E-01	7.074E-01	1.067	1.022	0.860	1.00	1.24	1.25	8.775E-01	8.818E-01	1.067	1.022	0.860	1.00	1.24	1.25	8.775E-01	8.818E-01	1.067
SM153	7.179E-01	7.332E-01	8.036E-01	0.955	0.976	1.069	0.88	0.89	0.91	7.179E-01	7.332E-01	0.955	0.976	1.069	0.88	0.89	0.91	7.179E-01	7.332E-01	0.955
EU154	2.573E-01	2.587E-01	2.275E-01	1.038	1.084	0.918	0.99	1.13	1.14	1.731E-01	1.740E-01	1.038	1.084	0.918	0.99	1.13	1.14	1.731E-01	1.740E-01	1.038
EU155	9.114E-02	9.795E-02	8.787E-02	0.987	1.061	0.952	0.93	1.04	1.11	4.584E-02	4.268E-02	0.987	1.061	0.952	0.93	1.04	1.11	4.584E-02	4.268E-02	0.987
U234	7.212E-01	6.962E-01	6.826E-01	1.030	0.995	0.975	1.04	1.06	1.02	7.441E-01	7.209E-01	1.036	1.003	0.981	1.03	1.08	1.04	7.441E-01	7.209E-01	1.036
U235	1.186E-01	3.258E-01	3.381E-01	0.973	0.995	1.032	0.98	0.94	0.96	3.186E-01	3.258E-01	0.973	0.995	1.032	0.98	0.94	0.96	3.186E-01	3.258E-01	0.973
U236	1.637E-01	1.638E-01	1.630E-01	1.001	1.002	0.997	1.00	1.00	1.00	1.637E-01	1.639E-01	1.001	1.002	0.997	1.00	1.00	1.00	1.637E-01	1.639E-01	1.001
U237	3.969E-03	3.965E-03	3.965E-03	1.001	1.000	1.000	1.00	1.00	1.00	3.969E-03	3.965E-03	1.001	1.000	1.000	1.00	1.00	1.00	3.969E-03	3.965E-03	1.001
NP237	1.963E-00	1.957E-00	1.803E-00	0.994	1.044	0.962	0.95	1.03	1.09	1.871E-00	1.955E-00	0.995	1.045	0.960	0.95	1.04	1.09	1.871E-00	1.955E-00	0.995
PU238	5.614E-01	5.097E-01	5.053E-01	1.005	1.081	0.904	0.92	1.11	1.21	5.843E-01	5.308E-01	1.005	1.081	0.904	0.92	1.11	1.21	5.843E-01	5.308E-01	1.005
PU239	2.111E-01	2.369E-01	2.218E-01	0.946	1.065	0.992	0.99	0.95	1.07	2.111E-01	2.369E-01	0.946	1.065	0.992	0.99	0.95	1.07	2.111E-01	2.369E-01	0.946
PU240	9.733E-00	8.717E-00	8.661E-00	1.077	0.985	0.958	1.12	1.12	1.01	9.747E-00	8.730E-00	1.078	0.985	0.957	1.12	1.13	1.01	9.747E-00	8.730E-00	1.078
PU241	5.151E-00	5.922E-00	5.877E-00	0.913	1.085	1.042	0.87	0.88	1.00	4.065E-00	4.672E-00	0.910	1.046	1.044	0.87	0.87	1.00	4.065E-00	4.672E-00	0.910
PU242	1.954E-00	1.993E-00	2.357E-00	0.930	0.948	1.122	0.98	0.83	0.85	1.954E-00	1.993E-00	0.930	0.948	1.122	0.98	0.83	0.85	1.954E-00	1.993E-00	0.930
AM241	1.112E-01	1.165E-01	1.764E-01	0.280	1.020	1.000	0.66	0.60	0.93	1.221E-01	1.377E-01	0.280	1.020	1.000	0.66	0.60	0.93	1.221E-01	1.377E-01	0.280
AM242	3.164E-08	5.235E-08	2.557E-08	0.867	1.432	0.701	0.61	0.24	2.04	3.093E-08	5.109E-08	0.867	1.432	0.701	0.61	0.24	2.04	3.093E-08	5.109E-08	0.867
AM243	3.778E-01	4.160E-01	4.025E-01	0.888	0.978	1.134	0.91	0.78	0.86	3.778E-01	4.160E-01	0.888	0.978	1.134	0.91	0.78	0.86	3.778E-01	4.160E-01	0.888
CM242	4.573E-02	4.586E-02	4.568E-02	1.000	1.003	0.998	1.00	1.00	1.00	2.848E-05	3.562E-05	2.698E-05	0.970	1.112	0.918	0.87	1.05	1.121	0.918	0.87
CM243	1.931E-03	3.836E-04	1.284E-03	1.385	0.371	1.243	3.73	1.11	0.30	1.270E-03	3.632E-04	1.386	0.371	1.243	3.73	1.11	0.30	1.270E-03	3.632E-04	1.386
CM244	1.075E-01	1.047E-01	1.335E-01	0.933	0.909	1.159	1.03	0.81	0.78	8.908E-02	8.671E-02	0.933	0.909	1.159	1.03	0.81	0.78	8.908E-02	8.671E-02	0.933
CM245	3.897E-03	4.175E-03	6.037E-03	0.829	1.284	0.93	0.65	0.69	0.69	3.896E-03	4.173E-03	0.829	1.284	0.93	0.65</					

SR	79	ORIGEN-5										10 YR										20 YR										CM246		
		ORIGEN-5	CINDER	QRS	QRM	QRA	QRB	QRC	QRD	QRE	QRF	QRG	QRH	QRI	QRJ	QRK	QRL	QRM	QRN	QRO	QRP	QRQ	QRR	QRS	QRT	QRU	QRV	QRW	QRX	QRY	QRZ			
SR 79	1	418E-02	6	409E-02	6	277E-02	1	085	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	
SR 80	2	472E-01	1	464E-01	1	277E-02	1	001	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	0.996	0.919	1.09	1.18	1.08	
SR 81	3	507E-23	5	552E-23	5	551E-23	1	001	0.999	0.991	0.99	1.01	1.02	0.999	0.991	0.99	1.01	1.02	0.999	0.991	0.99	1.01	1.02	0.999	0.991	0.99	1.01	1.02	0.999	0.991	0.99	1.01	1.02	0.999
SR 90	4	164E-02	4	172E-02	4	270E-02	0	596	0.991	1.013	1.01	0.98	0.98	0.991	1.013	1.01	0.98	0.98	0.991	1.013	1.01	0.98	0.98	0.991	1.013	1.01	0.98	0.98	0.991	1.013	1.01	0.98	0.98	
SR 91	5	237E-20	8	285E-20	8	271E-20	0	998	1.003	0.999	0.99	1.00	1.02	1.003	0.999	0.99	1.00	1.02	1.003	0.999	0.99	1.00	1.02	1.003	0.999	0.99	1.00	1.02	1.003	0.999	0.99	1.00	1.02	1.003
SR 92	6	675E-02	7	748E-02	7	571E-02	0	1001	1.001	1.001	1.00	1.00	1.00	1.001	1.001	1.00	1.00	1.00	1.001	1.001	1.00	1.00	1.00	1.001	1.001	1.00	1.00	1.00	1.001	1.001	1.00	1.00	1.00	
SR 93	7	252E-18	5	281E-18	5	616E-18	0	976	0.984	1.043	0.99	0.94	0.94	0.984	1.043	0.99	0.94	0.94	0.984	1.043	0.99	0.94	0.94	0.984	1.043	0.99	0.94	0.94	0.984	1.043	0.99	0.94	0.94	
SR 94	8	405E-18	6	441E-18	6	600E-18	0	978	0.984	1.038	0.99	0.94	0.94	0.984	1.038	0.99	0.94	0.94	0.984	1.038	0.99	0.94	0.94	0.984	1.038	0.99	0.94	0.94	0.984	1.038	0.99	0.94	0.94	
SR 95	9	767E-02	7	925E-02	7	798E-02	0	987	1.008	1.005	0.98	0.98	1.00	1.008	1.005	0.98	0.98	1.00	1.008	1.005	0.98	0.98	1.00	1.008	1.005	0.98	0.98	1.00	1.008	1.005	0.98	0.98	1.00	1.008
SR 96	10	133E-03	1	841E-03	1	765E-03	1	1011	0.958	1.031	0.96	0.98	0.93	0.958	1.031	0.96	0.98	0.93	0.958	1.031	0.96	0.98	0.93	0.958	1.031	0.96	0.98	0.93	0.958	1.031	0.96	0.98	0.93	0.958
SR 97	11	209E-02	1	928E-02	2	187E-02	0	1018	0.938	1.044	1.09	0.98	0.90	0.938	1.044	1.09																		

G-ATOMS PER MTU

AVERAGE ABSOLUTE DEVIATION, AS %	7.09	7.71	7.24	15.5	12.0	13.9				7.32	7.94	7.63	15.6	12.0	14.6
AV ABS DEV EXCLUDING LARGEST ONE, %	5.53	6.34	5.99	8.4	10.2	10.5				5.77	6.58	6.40	8.5	11.0	11.3
AV ABS DEV EXCLUDING LARGEST TWO, %	4.75	5.12	5.09	7.7	9.3	7.8				5.12	5.25	5.45	7.9	10.1	8.3
NUCS DEVELOPED, 1ST 2ND:	SB125	CM243	CM245	SM148	AM242	CM246				SB125	CM243	CM245 /	SM148	AM242	NP237

CASE: PWR, 3.10 WT & U-235, 3.443 AT % BURNUP (33.0 GMD/MTU, APPROX.)

G-ATONS PER MTU

300 YR										1 KVR									
ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	CIN AVG	OR2 CIN	OR2 CIN	OR2 CIN	OR2 CIN	OR2 CIN	OR2 AVG	CIN AVG	OR2 AVG	CIN AVG	OR2 CIN	OR2 CIN	OR2 CIN	OR2 CIN	OR2 CIN	OR2 CIN
SR 79	7.391E-02	6.788E-02	6.258E-02	1.085	0.996	0.919	1.01	1.08	0.996	0.919	1.01	1.08	0.996	0.919	1.01	1.08	0.996	0.919	1.01
SR 85	1.058E-02	1.051E-02	1.060E-02	1.002	0.995	1.003	1.01	1.00	0.999	1.003	1.01	1.00	0.999	1.003	1.01	1.00	0.999	1.003	1.01
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	4.669E-03	4.637E-03	4.742E-03	0.997	0.990	1.013	1.01	0.98	0.998	1.013	1.01	0.98	0.998	1.013	1.01	0.98	0.998	1.013	1.01
Y 90	1.171E-06	1.163E-06	1.189E-06	0.997	0.990	1.012	1.01	0.98	0.998	1.012	1.01	0.98	0.998	1.012	1.01	0.98	0.998	1.012	1.01
Y	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 93	7.674E-02	7.749E-02	7.570E-02	1.001	1.011	0.988	0.99	1.01	1.02	0.988	0.99	1.01	1.011	0.988	0.99	1.01	1.02	0.988	0.99
SR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	7.760E-02	7.918E-02	7.896E-02	0.988	1.008	1.005	0.98	0.98	1.00	0.988	0.98	1.00	1.008	0.988	0.98	1.00	1.00	0.988	0.98
PD106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	2.094E-02	2.147E-02	2.147E-02	1.018	0.938	1.048	1.09	0.98	0.90	0.938	1.09	0.98	0.938	1.018	0.938	1.09	0.97	0.938	1.018
SR126	2.198E-01	1.558E-01	1.790E-01	1.189	0.943	0.968	1.41	1.23	0.87	0.968	1.41	1.23	0.87	0.968	1.41	1.23	0.87	0.968	1.41
SR125	0.0	0.0	1.604E-24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR129	1.395E-02	1.450E-02	1.399E-02	0.986	1.025	0.989	0.96	1.00	1.04	0.989	0.96	1.00	1.025	0.989	0.96	1.00	1.04	0.989	0.96
CS133	8.449E-02	8.627E-02	8.455E-02	0.993	1.014	0.993	0.98	1.00	1.02	0.993	0.98	1.00	1.014	0.993	0.98	1.00	1.02	0.993	0.98
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.196E-02	2.466E-02	2.434E-02	0.928	1.043	1.029	0.89	0.90	1.01	0.928	0.89	0.90	1.043	0.928	0.89	0.90	1.01	0.928	0.89
CS137	8.547E-03	8.888E-03	9.136E-03	0.965	1.003	1.031	0.96	0.94	0.97	0.965	0.94	0.97	1.003	0.965	0.94	0.97	1.003	0.965	0.94
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	5.387E-02	5.688E-02	5.588E-02	0.970	1.024	1.006	0.95	0.96	1.02	0.970	0.95	0.96	1.024	0.970	0.95	0.96	1.02	0.970	0.95
MD144	9.151E-02	8.997E-02	8.988E-02	1.012	0.995	0.994	1.02	1.00	0.99	0.995	1.02	1.00	0.995	0.994	1.02	1.00	0.99	0.995	1.02
MD145	4.612E-02	4.712E-02	4.617E-02	0.992	1.014	0.998	0.98	1.00	1.02	0.992	0.98	1.00	1.014	0.992	0.98	1.00	1.02	0.992	0.98
MD146	4.690E-02	4.625E-02	4.603E-02	1.004	0.991	1.005	1.01	1.00	0.99	0.991	1.00	0.99	1.005	0.991	1.00	0.99	1.00	0.991	1.00
PD147	0.0	0.0	4.696E-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR147	1.356E-02	1.713E-02	1.663E-02	0.860	1.086	1.054	0.79	0.82	1.03	0.860	0.79	0.82	1.086	0.860	0.79	0.82	1.03	0.860	0.79
SR148	1.111E-02	7.617E-01	6.395E-01	1.238	0.926	0.935	1.50	1.32	0.88	1.111E-02	7.617E-01	6.395E-01	1.238	0.926	0.935	1.50	1.32	0.88	1.111E-02
SR149	2.510E-02	3.106E-02	2.704E-02	0.905	1.120	0.975	0.81	0.93	1.15	0.905	0.81	0.93	1.120	0.905	0.81	0.93	1.15	0.905	0.81
SR150	2.104E-02	2.151E-02	2.140E-02	0.987	1.009	1.004	0.98	0.98	1.01	0.987	0.98	0.98	1.009	0.987	0.98	0.98	1.01	0.987	0.98
SR151	8.971E-03	1.061E-02	8.457E-03	0.960	1.135	0.905	0.85	1.25	0.82	0.960	0.85	1.25	1.135	0.960	0.85	1.25	0.82	0.960	0.85
SR152	8.777E-01	8.019E-01	7.074E-01	1.067	1.072	0.860	1.00	1.24	1.25	0.860	1.00	1.24	1.072	0.860	1.00	1.24	1.25	0.860	1.00
RU153	7.180E-01	7.332E-01	8.036E-01	0.955	0.976	1.049	0.98	0.89	0.91	0.955	0.98	0.89	0.976	0.955	0.98	0.89	0.91	0.955	0.98
RU154	8.176E-12	8.203E-12	7.220E-12	1.039	1.043	0.918	1.00	1.13	1.14	1.039	1.00	1.13	1.043	1.039	1.00	1.13	1.14	1.039	1.00
RU155	5.681E-20	6.132E-20	5.505E-20	0.984	1.062	0.954	0.93	1.03	1.11	0.984	0.93	1.03	1.062	0.984	0.93	1.03	1.11	0.984	0.93
U234	1.272E-02	1.292E-02	8.777E-01	1.109	1.126	0.765	0.98	1.45	1.87	1.272E-02	1.292E-02	8.777E-01	1.109	1.126	0.765	0.98	1.45	1.87	1.272E-02
U235	3.204E-01	3.279E-01	3.381E-01	0.974	0.997	1.028	0.98	0.95	0.97	0.974	0.98	0.95	0.997	0.974	0.98	0.95	0.97	0.974	0.98
U236	1.667E-01	1.666E-01	1.630E-01	1.008	1.007	0.985	1.00	1.02	1.02	1.008	1.00	1.02	1.007	1.008	1.00	1.02	1.02	1.008	1.00
U238	3.969E-03	3.965E-03	3.966E-03	1.001	1.000	1.000	1.00	1.00	1.00	1.001	1.00	1.00	1.000	1.001	1.00	1.00	1.00	1.001	1.00
NP237	3.777E-02	4.145E-02	1.808E-02	1.165	1.279	0.556	0.91	2.09	2.30	0.556	0.91	2.09	1.279	0.556	0.91	2.09	2.30	0.556	0.91
NP238	5.730E-02	6.214E-02	5.168E-02	1.003	1.088	0.909	0.92	1.10	1.20	1.003	0.92	1.10	1.088	1.003	0.92	1.10	1.20	1.003	0.92
PU239	2.094E-01	2.350E-01	2.145E-01	0.946	1.062	0.992	0.89	0.95	1.07	0.946	0.89	0.95	1.062	0.946	0.89	0.95	1.07	0.946	0.89
PU240	9.533E-02	8.546E-02	8.390E-02	1.080	0.969	0.951	1.12	1.14	1.02	0.969	1.12	1.14	1.080	0.969	1.12	1.14	1.02	0.969	1.12
PU241	9.220E-06	1.130E-05	4.239E-06	1.117	1.369	0.514	0.82	2.18	2.67	0.514	0.82	2.18	1.369	0.514	0.82	2.18	2.67	0.514	0.82
PU242	1.953E-02	1.992E-02	2.356E-02	0.930	0.948	1.122	0.98	0.83	0.85	0.930	0.98	0.83	0.948	0.930	0.98	0.83	0.85	0.930	0.98
AN241	3.381E-02	3.871E-02	3.859E-02	0.913	1.045	1.042	0.87	0.88	1.01	0.913	0.87	0.88	1.045	0.913	0.87	0.88	1.01	0.913	0.87
AN242	8.058E-09	1.331E-08	6.513E-09	0.867	1.432	0.701	0.61	1.24	2.04	0.867	0.61	1.24	1.432	0.867	0.61	1.24	2.04	0.867	0.61
AN243	3.673E-01	4.044E-01	4.692E-01	0.888	0.978	1.134	0.91	0.78	0.86	0.888	0.91	0.78	0.978	0.888	0.91	0.78	0.86	0.888	0.91
CH242	1.629E-06	2.691E-06	1.319E-06	0.867	1.332	0.702	0.61	1.24	2.04	0.867	0.61	1.24	1.332	0.867	0.61	1.24	2.04	0.867	0.61
CH243	9.723E-07	2.604E-07	8.723E-07	1.386	0.371	1.243	3.73	1.11	0.30	1.386	3.73	1.11	0.371	1.386	3.73	1.11	0.30	1.386	3.73
CH244	1.112E-06	1.082E-06	1.381E-06	0.933	0.308	1.159	1.03	0.81	0.78	0.933	1.03	0.81	0.308	0.933	1.03	0.81	0.78	0.933	1.03
CH245	3.803E-03	4.074E-03	5.890E-03	0.829	0.888	1.284	0.93	0.65	0.69	0.829	0.93	0.65	0.888	0.829	0.93	0.65	0.69	0.829	0.93
CH246	4.558E-04	4.798E-04	6.184E-04	0.880	0.926	1.194	0.95	0.74	0.78	0.880	0.95	0.74	0.926	0.880	0.95	0.74	0.78	0.880	0.95

AVERAGE-ABSOLUTE-DEVIATION, AS % 7.05 9.27 9.34 15.5 16.0 21.6
AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.72 7.03 8.05 9.1 13.6 16.9
AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.87 5.26 5.61 8.1 10.7 14.1
NUCS EXCLUDED, 1ST/2ND: SR148 CH243 PU241 / SR126 AN242 NP237

13.12 12.64 13.43
6.76 7.86 8.60 16.7 17.3 22.4
5.50 5.70 6.50 9.9 11.6 18.3
PU241 / SR148 AN242 NP237

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

***** 10 KYR *****										
	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN	
SE 79	6.664E-02	6.120E-02	5.642E-02	1.085	0.996	0.919	1.09	1.18	1.08	
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ZR 93	7.640E-00	7.713E-00	7.537E-00	1.001	1.011	0.988	0.99	1.01	1.02	
ZR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TC 99	7.519E-00	7.672E-00	7.651E-00	0.988	1.008	1.005	0.98	0.98	1.00	
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PD107	2.091E-00	1.926E-00	2.145E-00	1.018	0.938	1.044	1.09	0.97	0.90	
SM126	2.055E-01	1.457E-01	1.674E-01	1.189	0.843	0.968	1.41	1.23	0.87	
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
I129	1.394E-00	1.449E-00	1.398E-00	0.986	1.025	0.989	0.96	1.00	1.04	
CS133	8.449E-00	8.627E-00	8.455E-00	0.993	1.014	0.993	0.98	1.00	1.02	
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS135	2.189E-00	2.459E-00	2.427E-00	0.928	1.043	1.029	0.89	0.90	1.01	
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND143	5.387E-00	5.688E-00	5.588E-00	0.970	1.024	1.006	0.95	0.96	1.02	
ND144	9.151E-00	8.997E-00	8.988E-00	1.012	0.995	0.994	1.02	1.02	1.00	
ND145	4.612E-00	4.712E-00	4.617E-00	0.992	1.014	0.994	0.98	1.00	1.02	
ND146	4.690E-00	4.625E-00	4.693E-00	1.004	0.991	1.005	1.01	1.00	0.99	
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SM147	1.356E-00	1.713E-00	1.663E-00	0.860	1.086	1.054	0.79	0.82	1.03	
SM148	1.111E-00	7.417E-01	8.395E-01	1.238	0.826	0.935	1.50	1.32	0.88	
SM149	2.510E-02	3.106E-02	2.704E-02	0.905	1.120	0.975	0.81	0.93	1.15	
SM150	2.104E-00	2.151E-00	2.140E-00	0.987	1.009	1.004	0.98	0.98	1.01	
SM151	3.206E-15	3.816E-15	3.033E-15	0.957	1.139	0.905	0.84	1.06	1.26	
SM152	8.777E-01	8.819E-01	7.074E-01	1.067	1.072	0.860	1.00	1.24	1.25	
EU153	7.180E-01	7.332E-01	8.036E-01	0.955	0.976	1.069	0.98	0.89	0.91	
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
U234	1.300E-00	1.324E-00	8.743E-01	1.115	1.135	0.750	0.98	1.49	1.51	
U235	3.718E-01	3.855E-01	3.381E-01	1.018	1.056	0.926	0.96	1.10	1.14	
U236	2.279E-01	2.214E-01	1.630E-01	1.117	1.085	0.799	1.03	1.40	1.36	
U238	3.969E-03	3.965E-03	3.966E-03	1.001	1.000	1.000	1.00	1.00	1.00	
NP237	7.139E-00	7.993E-00	1.799E-00	1.265	1.416	0.319	0.89	3.97	4.44	
PU238	4.716E-23	7.769E-23	3.802E-23	0.869	1.431	0.700	0.61	1.24	2.04	
PU239	1.603E-01	1.798E-01	1.661E-01	0.950	1.066	0.984	0.89	0.97	1.08	
PU240	3.409E-00	3.055E-00	3.006E-00	1.080	0.968	0.952	1.12	1.13	1.02	
PU241	2.926E-06	3.200E-06	0.0	0.955	1.045	0.0	0.91	0.0	0.0	
PU242	1.420E-00	1.958E-00	2.314E-00	0.930	0.949	1.121	0.98	0.83	0.85	
AM241	8.847E-05	9.883E-05	6.765E-07	1.412	1.577	0.011	0.90	****	****	
AM242	4.977E-28	8.198E-28	4.010E-28	0.869	1.431	0.700	0.61	1.24	2.04	
AM243	1.477E-01	1.626E-01	1.886E-01	0.888	0.978	1.134	0.91	0.78	0.86	
CM242	1.009E-25	1.663E-25	8.122E-26	0.869	1.432	0.699	0.61	1.24	2.05	
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CM244	2.357E-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CM245	1.724E-03	1.847E-03	2.664E-03	0.830	0.889	1.282	0.93	0.65	0.69	
CM246	1.101E-04	1.158E-04	1.493E-04	0.880	0.926	1.194	0.95	0.74	0.78	

AVERAGE-ABSOLUTE-DEVIATION, AS % 8.75 11.33 13.49 11.4 **** **

AV-ABS-DEV EXCLUDING LARGEST ONE, % 7.13 8.70 10.43 10.3 22.3 30.5

AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.85 6.13 7.93 9.3 13.2 20.6

NUCS EXCLUDED, 1ST/2ND: SM188 CM242 AM241 / SM126 AM242 NP237

CASE: PWR, 4.50 WT & U-235, 5.206 AT & BURNUP (50.0 GWD/MTU, APPROX.)

G-ATOMS										PER MTU									

CASE: PWR, 4.50 WT & U-235, 5.206 AT % BURNUP (50.0 GMD/MTU, APPROX.)																									G-ATONS PER MTU									
																									</									

CASE: BMR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GWD/MTU, APPROX.)

G-2 COMS

PER MTU

30 DAY										5 YR									
ORIGIN-5					ORIGIN-2					ORIGIN-3					ORIGIN-4				
ORIGIN-2	ORIGIN-5	CINDER	Q2	Q1	ORIGIN-2	ORIGIN-5	CINDER	Q2	Q1	ORIGIN-3	ORIGIN-5	CINDER	Q2	Q1	ORIGIN-4	ORIGIN-5	CINDER	Q2	Q1
SE 79	6.124E-02	5.695E-02	5.266E-02	1.075	6.123E-02	5.694E-02	5.265E-02	1.075	6.123E-02	5.694E-02	5.265E-02	1.075	6.123E-02	5.694E-02	5.265E-02	1.075	6.123E-02	5.694E-02	5.265E-02
SR 85	2.273E-01	2.301E-01	2.362E-01	0.983	2.273E-01	2.301E-01	2.362E-01	0.983	2.273E-01	2.301E-01	2.362E-01	0.983	2.273E-01	2.301E-01	2.362E-01	0.983	2.273E-01	2.301E-01	2.362E-01
SR 89	1.506E-01	1.560E-01	1.544E-01	0.980	1.506E-01	1.560E-01	1.544E-01	0.980	1.506E-01	1.560E-01	1.544E-01	0.980	1.506E-01	1.560E-01	1.544E-01	0.980	1.506E-01	1.560E-01	1.544E-01
SR 90	8.832E-00	9.010E-00	5.113E-00	0.976	8.832E-00	9.010E-00	5.113E-00	0.976	8.832E-00	9.010E-00	5.113E-00	0.976	8.832E-00	9.010E-00	5.113E-00	0.976	8.832E-00	9.010E-00	5.113E-00
Y 90	1.212E-01	1.229E-01	1.282E-01	0.977	1.212E-01	1.229E-01	1.282E-01	0.977	1.212E-01	1.229E-01	1.282E-01	0.977	1.212E-01	1.229E-01	1.282E-01	0.977	1.212E-01	1.229E-01	1.282E-01
Y 91	2.445E-01	2.518E-01	2.521E-01	0.980	2.445E-01	2.518E-01	2.521E-01	0.980	2.445E-01	2.518E-01	2.521E-01	0.980	2.445E-01	2.518E-01	2.521E-01	0.980	2.445E-01	2.518E-01	2.521E-01
IR 93	6.377E-00	6.519E-00	6.431E-00	0.990	6.377E-00	6.519E-00	6.431E-00	0.990	6.377E-00	6.519E-00	6.431E-00	0.990	6.377E-00	6.519E-00	6.431E-00	0.990	6.377E-00	6.519E-00	6.431E-00
IR 95	3.944E-01	4.063E-01	4.017E-01	0.992	3.944E-01	4.063E-01	4.017E-01	0.992	3.944E-01	4.063E-01	4.017E-01	0.992	3.944E-01	4.063E-01	4.017E-01	0.992	3.944E-01	4.063E-01	4.017E-01
MB 95	2.836E-01	2.886E-01	2.839E-01	0.994	2.836E-01	2.886E-01	2.839E-01	0.994	2.836E-01	2.886E-01	2.839E-01	0.994	2.836E-01	2.886E-01	2.839E-01	0.994	2.836E-01	2.886E-01	2.839E-01
TC 99	6.618E-00	6.715E-00	6.722E-00	0.990	6.618E-00	6.715E-00	6.722E-00	0.990	6.618E-00	6.715E-00	6.722E-00	0.990	6.618E-00	6.715E-00	6.722E-00	0.990	6.618E-00	6.715E-00	6.722E-00
PD10*	1.214E-00	1.104E-00	1.145E-00	1.052	1.214E-00	1.104E-00	1.145E-00	1.052	1.214E-00	1.104E-00	1.145E-00	1.052	1.214E-00	1.104E-00	1.145E-00	1.052	1.214E-00	1.104E-00	1.145E-00
PD10*	1.781E-00	1.566E-00	1.661E-00	1.057	1.781E-00	1.566E-00	1.661E-00	1.057	1.781E-00	1.566E-00	1.661E-00	1.057	1.781E-00	1.566E-00	1.661E-00	1.057	1.781E-00	1.566E-00	1.661E-00
SM126	7.716E-01	1.282E-01	1.440E-01	1.185	7.716E-01	1.282E-01	1.440E-01	1.185	7.716E-01	1.282E-01	1.440E-01	1.185	7.716E-01	1.282E-01	1.440E-01	1.185	7.716E-01	1.282E-01	1.440E-01
SM126	8.713E-02	5.861E-02	4.818E-02	1.348	8.713E-02	5.861E-02	4.818E-02	1.348	8.713E-02	5.861E-02	4.818E-02	1.348	8.713E-02	5.861E-02	4.818E-02	1.348	8.713E-02	5.861E-02	4.818E-02
SM129	1.666E-00	1.190E-00	1.134E-00	1.082	1.666E-00	1.190E-00	1.134E-00	1.082	1.666E-00	1.190E-00	1.134E-00	1.082	1.666E-00	1.190E-00	1.134E-00	1.082	1.666E-00	1.190E-00	1.134E-00
CS133	1.632E-00	7.316E-00	7.213E-00	0.991	1.632E-00	7.316E-00	7.213E-00	0.991	1.632E-00	7.316E-00	7.213E-00	0.991	1.632E-00	7.316E-00	7.213E-00	0.991	1.632E-00	7.316E-00	7.213E-00
CS134	6.432E-01	6.121E-01	5.881E-01	1.089	6.432E-01	6.121E-01	5.881E-01	1.089	6.432E-01	6.121E-01	5.881E-01	1.089	6.432E-01	6.121E-01	5.881E-01	1.089	6.432E-01	6.121E-01	5.881E-01
CS135	2.276E-00	2.265E-00	2.057E-00	1.035	2.276E-00	2.265E-00	2.057E-00	1.035	2.276E-00	2.265E-00	2.057E-00	1.035	2.276E-00	2.265E-00	2.057E-00	1.035	2.276E-00	2.265E-00	2.057E-00
CS137	7.246E-00	7.243E-00	7.422E-00	0.992	7.246E-00	7.243E-00	7.422E-00	0.992	7.246E-00	7.243E-00	7.422E-00	0.992	7.246E-00	7.243E-00	7.422E-00	0.992	7.246E-00	7.243E-00	7.422E-00
CE144	1.822E-00	1.845E-00	1.850E-00	0.991	1.822E-00	1.845E-00	1.850E-00	0.991	1.822E-00	1.845E-00	1.850E-00	0.991	1.822E-00	1.845E-00	1.850E-00	0.991	1.822E-00	1.845E-00	1.850E-00
MD141	4.636E-00	4.710E-00	4.464E-00	1.011	4.636E-00	4.710E-00	4.464E-00	1.011	4.636E-00	4.710E-00	4.464E-00	1.011	4.636E-00	4.710E-00	4.464E-00	1.011	4.636E-00	4.710E-00	4.464E-00
MD144	5.531E-00	5.707E-00	5.933E-00	0.972	5.531E-00	5.707E-00	5.933E-00	0.972	5.531E-00	5.707E-00	5.933E-00	0.972	5.531E-00	5.707E-00	5.933E-00	0.972	5.531E-00	5.707E-00	5.933E-00
MD145	3.841E-00	3.986E-00	3.924E-00	0.988	3.841E-00	3.986E-00	3.924E-00	0.988	3.841E-00	3.986E-00	3.924E-00	0.988	3.841E-00	3.986E-00	3.924E-00	0.988	3.841E-00	3.986E-00	3.924E-00
MD146	3.841E-00	3.823E-00	3.862E-00	1.000	3.841E-00	3.823E-00	3.862E-00	1.000	3.841E-00	3.823E-00	3.862E-00	1.000	3.841E-00	3.823E-00	3.862E-00	1.000	3.841E-00	3.823E-00	3.862E-00
PM147	8.383E-01	1.103E-01	1.060E-01	0.908	8.383E-01	1.103E-01	1.060E-01	0.908	8.383E-01	1.103E-01	1.060E-01	0.908	8.383E-01	1.103E-01	1.060E-01	0.908	8.383E-01	1.103E-01	1.060E-01
SM147	3.901E-01	4.386E-01	4.775E-01	0.905	3.901E-01	4.386E-01	4.775E-01	0.905	3.901E-01	4.386E-01	4.775E-01	0.905	3.901E-01	4.386E-01	4.775E-01	0.905	3.901E-01	4.386E-01	4.775E-01
SM148	9.197E-01	6.290E-01	6.442E-01	1.257	9.197E-01	6.290E-01	6.442E-01	1.257	9.197E-01	6.290E-01	6.442E-01	1.257	9.197E-01	6.290E-01	6.442E-01	1.257	9.197E-01	6.290E-01	6.442E-01
SM149	1.937E-02	2.140E-02	1.685E-02	1.024	1.937E-02	2.140E-02	1.685E-02	1.024	1.937E-02	2.140E-02	1.685E-02	1.024	1.937E-02	2.140E-02	1.685E-02	1.024	1.937E-02	2.140E-02	1.685E-02
SM150	1.655E-00	1.695E-00	1.660E-00	1.003	1.655E-00	1.695E-00	1.660E-00	1.003	1.655E-00	1.695E-00	1.660E-00	1.003	1.655E-00	1.695E-00	1.660E-00	1.003	1.655E-00	1.695E-00	1.660E-00
SM151	8.131E-02	7.425E-02	5.810E-02	1.142	8.131E-02	7.425E-02	5.810E-02	1.142	8.131E-02	7.425E-02	5.810E-02	1.142	8.131E-02	7.425E-02	5.810E-02	1.142	8.131E-02	7.425E-02	5.810E-02
SM152	7.524E-01	7.687E-01	6.568E-01	1.037	7.524E-01	7.687E-01	6.568E-01	1.037	7.524E-01	7.687E-01	6.568E-01	1.037	7.524E-01	7.687E-01	6.568E-01	1.037	7.524E-01	7.687E-01	6.568E-01
EU153	5.845E-01	5.844E-01	6.368E-01	0.969	5.845E-01	5.844E-01	6.368E-01	0.969	5.845E-01	5.844E-01	6.368E-01	0.969	5.845E-01	5.844E-01	6.368E-01	0.969	5.845E-01	5.844E-01	6.368E-01
EU154	2.005E-01	1.902E-01	1.591E-01	1.094	2.005E-01	1.902E-01	1.591E-01	1.094	2.005E-01	1.902E-01	1.591E-01	1.094	2.005E-01	1.902E-01	1.591E-01	1.094	2.005E-01	1.902E-01	1.591E-01
EU155	7.259E-02	6.985E-02	5.415E-02	1.105	7.259E-02	6.985E-02	5.415E-02	1.105	7.259E-02	6.985E-02	5.415E-02	1.105	7.259E-02	6.985E-02	5.415E-02	1.105	7.259E-02	6.985E-02	5.415E-02
U234	6.288E-01	6.255E-01	6.295E-01	1.002	6.288E-01	6.255E-01	6.295E-01	1.002	6.288E-01	6.255E-01	6.295E-01	1.002	6.288E-01	6.255E-01	6.295E-01	1.002	6.288E-01	6.255E-01	6.295E-01
U236	2.972E-01	2.796E-01	2.553E-01	1.072	2.972E-01	2.796E-01	2.553E-01	1.072	2.972E-01	2.796E-01	2.553E-01	1.072	2.972E-01	2.796E-01	2.553E-01	1.072	2.972E-01	2.796E-01	2.553E-01
U238	1.360E-01	1.374E-01	1.390E-01	0.999	1.360E-01	1.374E-01	1.390E-01	0.999	1.360E-01	1.374E-01	1.390E-01	0.999	1.360E-01	1.374E-01	1.390E-01	0.999	1.360E-01	1.374E-01	1.390E-01
NP237	1.499E-01	1.401E-01	1.401E-01	0.999	1.499E-01	1.401E-01	1.401E-01	0.999	1.499E-01	1.401E-01	1.401E-01	0.999	1.499E-01	1.401E-01	1.401E-01	0.999	1.499E-01	1.401E-01	1.401E-01
NP238	1.499E-01	1.422E-01	1.112E-01	1.089	1.499E-01	1.422E-01	1.112E-01	1.089	1.499E-01	1.422E-01	1.112E-01	1.089	1.499E-01	1.422E-01	1.112E-01	1.089	1.499E-01	1.422E-01	1.112E-01
PU239	8.150E-01	8.106E-01	3.077E-01	1.089	8.150E-01	8.106E-01	3.077E-01	1.089	8.150E-01	8.106E-01	3.077E-01	1.089	8.150E-01	8.106E-01	3.077E-01	1.089	8.150E-01	8.106E-01	3.077E-01
PU240	8.050E-00	7.730E-00	7.726E-00	1.094	8.050E-00	7.730E-00	7.726E-00	1.094	8.050E-00	7.730E-00	7.726E-00	1.094	8.050E-00	7.730E-00	7.726E-00	1.094	8.050E-00	7.730E-00	7.726E-00
PU241	4.651E-00	4.450E-00	3.809E-00	1.080	4.651E-00	4.450E-00	3.809E-00	1.080	4.651E-00	4.450E-00	3.809E-00	1.080	4.651E-00	4.450E-00	3.809E-00	1.080	4.651E-00	4.450E-00	3.809E-00
PU242	1.632E-00	1.521E-00	1.868E-00	0.975	1.632E-00	1.521E-00	1.868E-00	0.975	1.632E-00	1.521E-00	1.868E-00	0.975	1.632E-00	1.521E-00	1.868E-00	0.975	1.632E-00	1.521E-00	1.868E-00
AM241	1.618E-01	1.521E-01	1.268E-01	1.101	1.618E-01	1.521E-01	1.268E-01	1.101	1.618E-01	1.521E-01	1.268E-01	1.101	1.618E-01	1.521E-01	1.268E-01	1.101	1.618E-01	1.521E-01	1.268E-01
AM242	3.574E-08	4.261E-08	1.749E-08	1.119	3.574E-08	4.26													

10 YR										20 YR											
SR	ORIGEN2	ORIGEN-S	CINDER	QRS AVG	CIN AVG	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QRS AVG	CIN AVG	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QRS AVG	CIN AVG	QR2 CIN	QRS CIN
SR 74	6.123E-02	5.694E-02	5.266E-02	1.000	0.935	1.000	1.000	6.122E-02	5.693E-02	5.265E-02	1.000	0.935	1.000	1.000	6.122E-02	5.693E-02	5.265E-02	1.000	0.935	1.000	1.000
SR 75	1.197E-01	1.244E-01	1.244E-01	0.993	0.995	1.025	0.99	1.197E-01	1.244E-01	1.244E-01	0.993	0.995	1.025	0.99	1.197E-01	1.244E-01	1.244E-01	0.993	0.995	1.025	0.99
SR 76	3.827E-23	3.961E-23	3.934E-23	0.979	1.018	1.007	0.97	3.827E-23	3.961E-23	3.934E-23	0.979	1.018	1.007	0.97	3.827E-23	3.961E-23	3.934E-23	0.979	1.018	1.007	0.97
SR 77	3.816E-00	3.870E-00	4.018E-00	0.976	0.990	1.033	0.99	3.816E-00	3.870E-00	4.018E-00	0.976	0.990	1.033	0.99	3.816E-00	3.870E-00	4.018E-00	0.976	0.990	1.033	0.99
SR 78	9.708E-04	9.708E-04	9.708E-04	0.976	0.990	1.033	0.99	9.708E-04	9.708E-04	9.708E-04	0.976	0.990	1.033	0.99	9.708E-04	9.708E-04	9.708E-04	0.976	0.990	1.033	0.99
SR 79	5.623E-20	5.785E-20	5.809E-20	0.980	1.008	1.012	0.98	5.623E-20	5.785E-20	5.809E-20	0.980	1.008	1.012	0.98	5.623E-20	5.785E-20	5.809E-20	0.980	1.008	1.012	0.98
SR 93	6.317E-00	6.519E-00	6.431E-00	0.990	1.012	0.998	0.98	6.317E-00	6.519E-00	6.431E-00	0.990	1.012	0.998	0.98	6.317E-00	6.519E-00	6.431E-00	0.990	1.012	0.998	0.98
SR 95	3.612E-18	3.661E-18	3.904E-18	0.969	0.983	1.048	0.99	3.612E-18	3.661E-18	3.904E-18	0.969	0.983	1.048	0.99	3.612E-18	3.661E-18	3.904E-18	0.969	0.983	1.048	0.99
SR 96	4.406E-18	4.461E-18	4.728E-18	0.982	0.985	1.083	0.99	4.406E-18	4.461E-18	4.728E-18	0.982	0.985	1.083	0.99	4.406E-18	4.461E-18	4.728E-18	0.982	0.985	1.083	0.99
SR 97	6.618E-00	6.712E-00	6.722E-00	0.990	1.006	1.006	0.98	6.618E-00	6.712E-00	6.722E-00	0.990	1.006	1.006	0.98	6.618E-00	6.712E-00	6.722E-00	0.990	1.006	1.006	0.98
SR 98	1.325E-03	1.205E-03	1.251E-03	0.951	0.956	0.993	1.00	1.325E-03	1.205E-03	1.251E-03	0.951	0.956	0.993	1.00	1.325E-03	1.205E-03	1.251E-03	0.951	0.956	0.993	1.00
SR 99	1.78E-00	1.568E-00	1.461E-00	0.967	0.938	0.995	0.99	1.78E-00	1.568E-00	1.461E-00	0.967	0.938	0.995	0.99	1.78E-00	1.568E-00	1.461E-00	0.967	0.938	0.995	0.99
SR 100	1.28E-00	1.28E-00	1.480E-00	0.985	0.960	1.14	0.97	1.28E-00	1.28E-00	1.480E-00	0.985	0.960	1.14	0.97	1.28E-00	1.28E-00	1.480E-00	0.985	0.960	1.14	0.97
SR 101	2.89E-03	4.90E-03	4.311E-03	1.388	0.907	0.785	0.98	2.89E-03	4.90E-03	4.311E-03	1.388	0.907	0.785	0.98	2.89E-03	4.90E-03	4.311E-03	1.388	0.907	0.785	0.98
SR 102	1.71E-00	1.71E-00	1.40E-00	1.002	1.023	0.995	0.98	1.71E-00	1.71E-00	1.40E-00	1.002	1.023	0.995	0.98	1.71E-00	1.71E-00	1.40E-00	1.002	1.023	0	

AVERAGE-ABSOLUTE-DEVIATION, AS %	7.68	6.36	7.74	13.5	18.3	15.1
AV-ABS-DEV EXCLUDING LARGEST ONE, %	6.12	4.70	6.67	8.5	16.0	11.6
AV-ABS-DEV EXCLUDING LARGEST TWO, %	5.62	3.85	5.81	7.5	12.8	8.6
NUC'S EXCLUDED 1ST-2ND: SB125	CH243	AH242 / SM148	AH243	CH242	CH243	CH242

CASE: BMR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GMD/MTU, APPROX.) G-ATOMS PER MTU

***** 50 YR *****									
ORIGEN-2	ORIGEN-S	CINDER	OR2 AVG	OR5 AVG	CIN AVG	OR2 CIN	OR2 CIN	OR5 CIN	OR5 CIN
SE 10	6.12E-02	5.69E-02	5.26E-02	1.075	1.000	0.925	1.08	1.16	1.08
SR 85	9.01E-03	9.12E-03	9.36E-03	0.983	0.995	1.022	0.99	0.96	0.97
SR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	1.47E-04	1.49E-04	1.55E-04	0.977	0.990	1.033	0.99	0.95	0.96
Y 90	3.69E-04	3.74E-04	3.90E-04	0.976	0.990	1.033	0.99	0.94	0.96
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 91	6.37E-00	6.51E-00	6.43E-00	0.990	1.012	0.998	0.98	0.99	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 59	6.61E-00	6.71E-00	6.72E-00	0.990	1.004	1.006	0.99	0.98	1.00
RU106	1.53E-15	1.56E-15	1.42E-15	1.066	0.948	0.986	1.12	1.08	0.96
PD107	1.78E-01	1.56E-01	1.66E-01	1.067	0.938	0.995	1.14	1.07	0.94
SM126	1.77E-01	1.28E-01	1.43E-01	1.184	0.955	0.960	1.38	1.23	0.89
SM145	3.27E-07	2.20E-07	1.81E-07	1.348	0.907	0.746	1.49	1.81	1.22
1129	1.17E-00	1.19E-00	1.16E-00	1.002	1.023	0.975	1.03	1.05	1.05
7164	7.31E-00	7.31E-00	7.21E-00	0.991	1.012	0.998	0.98	0.99	1.01
CS134	3.32E-08	3.15E-08	3.03E-08	1.049	0.995	0.956	1.05	1.10	1.04
CS135	2.27E-00	2.26E-00	2.07E-00	1.035	0.930	0.935	1.00	1.11	1.10
CS137	2.28E-00	2.30E-00	2.37E-00	0.988	0.994	1.018	0.99	0.97	0.98
CE144	8.96E-20	9.11E-20	9.29E-20	0.983	0.999	1.019	0.98	0.96	0.98
MD143	4.68E-00	4.73E-00	4.40E-00	1.011	1.021	0.968	0.99	1.04	1.05
MD144	7.40E-00	7.53E-00	7.70E-00	0.977	0.996	1.027	0.98	0.95	0.97
MD145	3.88E-00	3.98E-00	3.92E-00	0.988	1.014	0.998	0.97	0.99	1.02
MD146	1.84E-00	1.82E-00	1.66E-00	1.000	0.995	1.005	1.00	0.99	0.99
PM147	2.07E-06	2.07E-06	1.99E-06	0.840	1.001	1.059	0.76	0.79	1.04
SM148	1.24E-00	1.54E-00	1.54E-00	0.859	1.12	1.069	0.80	0.80	1.00
SM149	9.23E-01	6.34E-01	6.48E-01	1.256	0.862	0.882	1.46	1.42	0.98
SM149	1.99E-02	2.14E-02	1.66E-02	1.029	1.103	0.869	0.93	1.18	1.27
SM150	1.68E-00	1.69E-00	1.66E-00	1.003	1.009	0.988	0.99	1.02	1.02
SM151	5.53E-02	5.05E-02	3.95E-02	1.142	1.042	0.816	1.10	1.40	1.28
SM152	7.52E-01	7.68E-01	6.56E-01	1.037	1.059	0.905	0.98	1.15	1.17
EU153	5.89E-01	5.89E-01	6.56E-01	0.469	0.973	1.059	1.00	0.91	0.92
EU154	3.58E-03	3.40E-03	2.88E-03	1.095	1.038	0.868	1.05	1.26	1.20
EU155	6.74E-05	6.52E-05	5.07E-05	1.104	1.068	0.828	1.03	1.23	1.29
U235	7.78E-01	7.70E-01	6.78E-01	1.048	1.038	0.913	1.01	1.15	1.14
U236	2.97E-01	2.79E-01	2.55E-01	1.072	1.008	0.920	1.06	1.17	1.10
U238	1.36E-01	1.37E-01	1.30E-01	0.991	1.000	0.999	0.99	0.98	0.99
U238	4.00E-03	4.00E-03	4.01E-03	0.999	0.999	1.002	1.00	1.00	1.00
MP237	1.68E-00	1.65E-00	1.18E-00	1.135	1.112	0.752	1.02	1.51	1.48
PU238	3.07E-01	3.01E-01	2.31E-01	1.099	1.075	0.825	1.02	1.33	1.30
PU239	2.02E-01	2.04E-01	1.48E-01	1.094	1.103	0.803	0.99	1.36	1.37
PU240	8.86E-00	7.73E-00	7.68E-00	1.095	0.956	0.949	1.15	1.15	1.01
PU241	4.20E-01	4.23E-01	3.61E-01	1.047	0.953	0.900	0.99	1.16	1.17
PU242	1.63E-00	1.52E-00	1.86E-00	0.975	0.910	1.116	1.07	0.87	0.82
AM241	4.15E-00	3.96E-00	3.37E-00	1.085	1.034	0.881	1.05	1.23	1.17
AM242	2.84E-08	3.39E-08	1.30E-08	1.119	1.334	0.547	0.84	2.04	2.44
AM243	2.89E-01	2.61E-01	2.66E-01	1.037	0.937	1.027	1.11	1.01	0.91
CM242	5.75E-06	6.86E-06	2.82E-06	1.118	1.333	0.548	0.84	2.04	2.43
CM243	3.55E-04	9.81E-05	2.44E-04	1.529	0.422	1.049	3.63	1.46	0.40
CM244	1.09E-02	8.37E-03	9.17E-03	1.152	0.881	0.966	1.31	1.19	0.91
CM245	2.51E-03	1.86E-03	1.91E-03	1.200	0.889	0.911	1.35	1.32	0.98
CM246	2.69E-04	2.25E-04	2.38E-04	1.103	0.920	0.976	1.20	1.13	0.94

AVERAGE ABSOLUTE DEVIATION, AS % 8.25 6.98 8.46 14.5 20.0 16.7 8.36 7.17 8.75 14.6 20.7 17.5
AV ABS-DEV EXCLUDING LARGEST ONE, % 6.35 5.21 7.35 9.1 17.6 13.0 6.70 5.41 7.66 9.2 18.4 13.5
AV ABS-DEV EXCLUDING LARGEST TWO, % 6.08 4.31 6.45 8.0 14.2 9.8 5.20 4.53 6.78 8.1 15.0 10.7
MUTS EXCLUDED, 1ST-2ND: SM125 CM243 AM242 / SM148 AM243 CM242

CASE: BWR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GWD/MTU, APPROX.)

G-ATOMS PER MTU

300 YR																
ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN
SR 79	6.104E-02	5.676E-02	5.249E-02	1.075	1.000	0.925	1.08	1.16	1.08	6.059E-02	5.634E-02	5.210E-02	1.075	1.000	0.925	1.08
KR 85	8.603E-10	8.694E-10	8.935E-10	0.984	0.994	1.022	0.99	0.96	0.97	1.897E-29	1.916E-29	1.967E-29	0.985	0.994	1.021	0.99
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	3.836E-03	3.887E-03	4.057E-03	0.977	0.990	1.033	0.99	0.95	0.96	2.228E-10	2.256E-10	2.354E-10	0.977	0.990	1.033	0.99
Y 90	4.620E-07	4.744E-07	1.017E-06	0.977	0.990	1.033	0.99	0.95	0.96	5.587E-14	5.657E-14	5.903E-14	0.977	0.990	1.033	0.99
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	6.376E-00	6.518E-00	6.430E-00	0.990	1.012	0.998	0.98	0.99	1.01	6.374E-00	6.516E-00	6.428E-00	0.990	1.012	0.998	0.98
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	6.611E-00	6.708E-00	6.715E-00	0.990	1.004	1.006	0.99	0.98	1.00	6.596E-00	6.693E-00	6.700E-00	0.990	1.005	1.006	0.99
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.781E-00	1.566E-00	1.661E-00	1.067	0.938	0.995	1.14	1.07	0.94	1.781E-00	1.566E-00	1.661E-00	1.067	0.938	0.995	1.14
SM126	1.772E-01	1.280E-01	1.437E-01	1.184	0.855	0.960	1.38	1.23	0.89	1.764E-01	1.273E-01	1.430E-01	1.185	0.855	0.960	1.39
SB125	0.0	0.0	1.228E-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.171E-00	1.195E-00	1.140E-00	1.002	1.023	0.975	0.98	1.03	1.05	1.171E-00	1.195E-00	1.140E-00	1.002	1.023	0.975	0.98
CS133	7.164E-00	7.317E-00	7.215E-00	0.991	1.012	0.998	0.98	0.99	1.01	7.164E-00	7.317E-00	7.215E-00	0.991	1.012	0.998	0.98
CS134	0.0	0.0	9.626E-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.276E-00	2.265E-00	2.057E-00	1.035	1.030	0.935	1.00	1.11	1.10	2.276E-00	2.264E-00	2.056E-00	1.035	1.030	0.935	1.01
CS137	7.091E-03	7.364E-03	7.550E-03	0.967	1.004	1.029	0.96	0.94	0.98	6.706E-10	7.629E-10	7.822E-10	0.908	1.033	1.059	0.88
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	4.688E-00	4.735E-00	4.490E-00	1.011	1.021	0.968	0.99	1.04	1.05	4.688E-00	4.735E-00	4.490E-00	1.011	1.021	0.968	0.99
ND144	7.405E-00	7.553E-00	7.783E-00	0.977	0.996	1.027	0.98	0.95	0.97	7.405E-00	7.553E-00	7.783E-00	0.977	0.996	1.027	0.98
ND145	3.884E-00	3.986E-00	3.924E-00	0.988	1.014	0.998	0.97	0.99	1.02	3.884E-00	3.986E-00	3.924E-00	0.988	1.014	0.998	0.97
ND146	3.841E-00	3.823E-00	3.862E-00	1.000	0.995	1.005	1.00	0.99	0.99	3.841E-00	3.823E-00	3.862E-00	1.000	0.995	1.005	1.00
PH147	0.0	0.0	4.091E-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH147	1.240E-00	1.548E-00	1.543E-00	0.859	1.072	1.069	0.80	0.80	1.00	1.240E-00	1.548E-00	1.543E-00	0.859	1.072	1.069	0.80
SH148	9.233E-01	6.342E-01	6.487E-01	1.256	0.862	0.882	1.46	1.42	0.98	9.233E-01	6.342E-01	6.487E-01	1.256	0.862	0.882	1.46
SH149	1.997E-02	2.140E-02	1.686E-02	1.029	1.103	0.869	0.93	1.18	1.27	1.997E-02	2.140E-02	1.686E-02	1.029	1.103	0.869	0.93
SH150	1.685E-00	1.696E-00	1.660E-00	1.003	1.009	0.988	0.99	1.02	1.02	1.685E-00	1.696E-00	1.660E-00	1.003	1.009	0.988	0.99
SH151	8.071E-03	7.370E-03	5.768E-03	1.142	1.042	0.816	1.10	1.40	1.28	3.671E-05	3.588E-05	2.628E-05	1.140	1.043	0.816	1.09
SH152	7.526E-01	7.685E-01	6.568E-01	1.037	1.059	0.905	0.98	1.15	1.17	7.526E-01	7.685E-01	6.568E-01	1.037	1.059	0.905	0.98
EU153	5.825E-01	5.849E-01	6.368E-01	0.969	0.973	1.059	1.00	0.91	0.92	5.825E-01	5.849E-01	6.368E-01	0.969	0.973	1.059	1.00
EU154	6.372E-12	6.010E-12	5.050E-12	1.095	1.037	0.868	1.06	1.26	1.19	0.0	1.586E-36	0.0	0.0	0.0	0.0	0.0
EU155	4.505E-20	4.33E-20	3.392E-20	1.101	1.069	0.829	1.03	1.33	1.29	0.0	1.109E-62	0.0	0.0	0.0	0.0	0.0
U234	1.044E-00	1.031E-00	7.650E-01	1.103	1.089	0.808	1.01	1.36	1.35	1.086E-00	1.072E-00	7.779E-01	1.110	1.095	0.795	1.01
U235	2.989E-01	2.813E-01	2.553E-01	1.073	1.010	0.917	1.06	1.7	1.10	3.030E-01	2.854E-01	2.553E-01	1.077	1.015	0.908	1.06
U236	1.388E-01	1.398E-01	1.390E-01	0.997	1.004	0.999	0.99	1.00	1.01	1.450E-01	1.452E-01	1.390E-01	1.014	1.015	0.972	1.00
U238	4.001E-03	4.003E-03	4.013E-03	0.999	0.999	1.002	1.00	1.00	1.00	4.001E-03	4.003E-03	4.013E-03	0.999	0.999	1.002	1.00
NP237	3.190E-00	3.092E-00	1.118E-00	1.293	1.254	0.453	1.03	2.85	2.77	5.263E+00	5.079E+00	1.118E+00	1.378	1.330	0.293	1.04
PU238	4.322E-02	4.238E-02	3.232E-02	1.100	1.078	0.822	1.02	1.34	1.31	2.026E-04	2.063E-04	1.439E-04	1.099	1.120	0.781	0.98
PU239	2.011E-01	2.027E-01	1.475E-01	1.094	1.103	0.803	0.99	1.36	1.37	1.973E-01	1.988E-01	1.446E-01	1.095	1.103	0.802	0.99
PU240	8.645E-00	7.543E-00	7.485E-00	1.096	0.956	0.949	1.15	1.15	1.01	8.027E-00	7.003E-00	6.951E-00	1.096	0.956	0.949	1.15
PU241	6.685E-06	6.377E-06	2.747E-06	1.269	1.210	0.521	1.05	2.43	2.32	3.956E-06	2.990E-06	1.270E-20	1.709	1.291	0.000	1.32
PU242	1.632E-00	1.522E-00	1.867E-00	0.975	0.909	1.116	1.07	0.87	0.82	1.630E-00	1.521E-00	1.865E-00	0.975	0.910	1.115	1.07
AN241	3.074E-00	2.947E-00	2.511E-00	1.081	1.036	0.883	1.04	1.22	1.17	1.001E+00	9.589E-01	8.170E-01	1.081	1.036	0.883	1.04
AN242	9.103E-09	1.085E-08	4.455E-09	1.119	1.334	0.548	0.84	2.04	2.44	3.741E-10	4.459E-10	1.830E-10	1.119	1.334	0.547	0.84
AN243	2.829E-01	2.556E-01	2.802E-01	1.037	0.937	1.027	1.11	1.01	0.91	2.649E-01	2.393E-01	2.623E-01	1.037	0.937	1.027	1.11
CH242	1.841E-06	2.194E-06	9.024E-07	1.119	1.333	0.548	0.84	2.04	2.43	7.564E-08	9.015E-08	3.707E-08	1.119	1.333	0.548	0.84
CH243	8.151E-07	2.245E-07	5.586E-07	1.530	0.421	1.049	3.63	1.46	0.40	3.293E-14	9.065E-15	2.255E-14	1.531	0.421	1.048	3.63
CH244	7.642E-07	5.847E-07	6.414E-07	1.152	0.881	0.967	1.31	1.19	0.91	1.434E-15	1.353E-18	1.484E-18	2.994	0.003	0.003	0.00
CH245	2.468E-03	1.827E-03	1.872E-03	1.201	0.889	0.911	1.35	1.32	0.98	2.331E-03	1.726E-03	1.768E-03	1.201	0.889	0.911	1.35
CH246	2.602E-04	2.171E-04	2.303E-04	1.103	0.920	0.976	1.20	1.13	0.94	2.348E-04	1.960E-04	2.079E-04	1.103	0.921	0.977	1.20

AVERAGE-ABSOLUTE-DEVIATION, AS % 8.76 8.03 10.38 14.2 26.1 24.0

AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.72 6.21 9.37 8.4 21.7 19.4

AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.90 5.68 8.52 7.3 15.8 13.6

NUCS EXCLUDED, 1ST/2ND: SM148 CH243 NP237 / CH245 AN243 PU241

14.67 10.92 14.45 0.00 0.00 0.00

7.32 6.87 10.20 14.8 28.4 26.7

6.04 5.94 8.65 8.3 18.7 16.9

CH244 CH243 PU241 / SM148 AN243 NP237

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.)

G-ATOMS PER MTU

	ORIGEN2	ORIGEN-5	CINDER	10 KVR QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SR 79	5.504E-02	5.118E-02	4.733E-02	1.075	1.000	0.925	1.08	1.16	1.08
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	6.348E-00	6.490E-00	6.402E-00	0.990	1.012	0.998	0.98	0.99	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	6.406E-00	6.500E-00	6.507E-00	0.990	1.004	1.006	0.99	0.98	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.779E-00	1.564E-00	1.659E-00	1.067	0.938	0.995	1.14	1.07	0.94
SN126	1.657E-01	1.196E-01	1.343E-01	1.185	0.855	0.960	1.39	1.23	0.89
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.170E-00	1.194E-00	1.140E-00	1.002	1.022	0.976	0.98	1.03	1.05
CS133	7.164E-00	7.317E-00	7.215E-00	0.991	1.012	0.998	0.98	0.99	1.01
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.270E-00	2.258E-00	2.051E-00	1.035	1.030	0.935	1.01	1.11	1.10
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	4.688E-00	4.735E-00	4.490E-00	1.011	1.021	0.968	0.99	1.04	1.05
ND144	7.405E-00	7.553E-00	7.783E-00	0.977	0.996	1.027	0.98	0.95	0.97
ND145	3.884E-00	3.986E-00	3.924E-00	0.988	1.014	0.998	0.97	0.99	1.02
ND146	3.841E-00	3.823E-00	3.862E-00	1.000	0.995	1.005	1.00	0.99	0.99
PH147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH147	1.240E-00	1.548E-00	1.543E-00	0.859	1.072	1.069	0.80	0.80	1.00
SH148	9.233E-01	6.342E-01	6.487E-01	1.256	0.862	0.882	1.46	1.42	0.98
SH149	1.997E-02	2.140E-02	1.686E-02	1.029	1.103	0.869	0.93	1.18	1.27
SH150	1.685E-00	1.696E-00	1.660E-00	1.003	1.009	0.988	0.99	1.02	1.02
SH151	2.883E-35	2.650E-35	2.069E-35	1.138	1.046	0.816	1.09	1.39	1.28
SH152	7.526E-01	7.485E-01	6.568E-01	1.037	1.059	0.905	0.98	1.15	1.17
EU153	5.825E-01	5.849E-01	6.368E-01	0.969	0.973	1.059	1.00	0.91	0.92
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.064E-00	1.051E-00	7.584E-01	1.111	1.097	0.792	1.01	1.40	1.39
U235	3.482E-01	3.310E-01	2.553E-01	1.118	1.063	0.820	1.05	1.36	1.30
U236	1.943E-01	1.882E-01	1.390E-01	1.118	1.083	0.800	1.03	1.40	1.35
U238	4.001E-03	4.003E-03	4.013E-03	0.999	0.999	1.002	1.00	1.00	1.00
NP237	6.246E-00	6.022E-00	1.115E-00	1.400	1.350	0.250	1.04	5.60	5.40
PU238	5.327E-23	6.336E-23	2.601E-23	1.120	1.333	0.547	0.84	2.05	2.44
PU239	1.535E-01	1.546E-01	1.116E-01	1.097	1.105	0.798	0.99	1.38	1.39
PU240	3.091E-00	2.697E-00	2.682E-00	1.095	0.955	0.950	1.15	1.15	1.01
PU241	1.899E-06	1.435E-06	0.0	1.139	0.861	0.0	1.32	0.0	0.0
PU242	1.604E-00	1.496E-00	1.834E-00	0.975	0.910	1.115	1.07	0.87	0.82
AN241	5.756E-05	4.453E-05	4.402E-07	1.684	1.303	0.013	1.29	****	****
AN242	5.621E-28	6.686E-28	2.743E-28	1.120	1.333	0.547	0.84	2.05	2.44
AN243	1.137E-01	1.028E-01	1.127E-01	1.036	0.937	1.027	1.11	1.01	0.91
CH242	1.140E-25	1.356E-25	5.556E-26	1.121	1.333	0.546	0.84	2.05	2.44
CH243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CH244	1.432E-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CH245	1.119E-03	8.284E-04	8.469E-04	1.201	0.889	0.909	1.35	1.32	0.98
CH246	6.282E-05	5.241E-05	5.559E-05	1.103	0.920	0.976	1.20	1.13	0.94

AVERAGE-ABSOLUTE-DEVIATION, AS % 10.18 9.46 15.14 10.5 ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 8.09 8.77 12.96 8.9 36.9 37.1
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.62 7.82 10.95 8.1 23.2 24.5
 MUCS EXCLUDED, 1ST/2ND: SH148 AN243 AN241 / CH245 NP237

CASE: BWR, 4.15 WT & U-235, 4.172 AT & BURNUP (40.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

	ORIGEN2	ORIGEN-S	CINDER	10 YR										20 YR																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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				AVG	AVG	 	

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATONS PER MTU

	50 YR									100 YR								
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QFS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QFS CIN
SE 79	8.953E-02	8.336E-02	7.667E-02	1.076	1.002	0.922	1.07	1.17	1.09	8.949E-02	8.331E-02	7.663E-02	1.076	1.002	0.922	1.07	1.17	1.09
SR 85	1.329E-02	1.312E-02	1.345E-02	1.000	0.987	1.012	1.01	0.99	0.98	5.243E-04	5.174E-04	5.303E-04	1.001	0.987	1.012	1.01	0.99	0.98
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	2.250E-00	2.215E-00	2.313E-00	0.998	0.979	1.023	1.02	0.98	0.96	6.869E-01	6.738E-01	7.035E-01	0.998	0.979	1.022	1.02	0.98	0.96
Y 90	5.662E-04	5.556E-04	5.800E-04	0.978	0.979	1.022	1.02	0.98	0.96	1.722E-04	1.690E-04	1.764E-04	0.998	0.980	1.022	1.02	0.98	0.96
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	9.625E-00	9.622E-00	9.510E-00	1.004	1.004	0.992	1.00	1.01	1.01	9.625E-00	9.622E-00	9.510E-00	1.004	1.004	0.992	1.00	1.01	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	9.446E-00	9.494E-00	9.490E-00	0.997	1.002	1.001	0.99	1.00	1.00	9.444E-00	9.493E-00	9.488E-00	0.997	1.002	1.001	0.99	1.00	1.00
RU106	1.558E-15	1.445E-15	1.509E-15	1.036	0.961	1.003	1.08	1.03	0.96	1.821E-30	1.689E-30	1.769E-30	1.035	0.960	1.005	1.08	1.03	0.95
PD107	2.166E-00	2.057E-00	2.170E-00	1.016	0.965	1.018	1.05	1.00	0.95	2.166E-00	2.057E-00	2.170E-00	1.016	0.965	1.018	1.05	1.00	0.95
SM126	2.307E-01	1.772E-01	1.949E-01	1.148	0.882	0.970	1.30	1.18	0.91	2.307E-01	1.771E-01	1.948E-01	1.149	0.882	0.970	1.30	1.18	0.91
SB125	3.683E-07	2.713E-07	2.185E-07	1.288	0.948	0.764	1.36	1.69	1.24	1.356E-12	9.984E-13	8.045E-13	1.288	0.948	0.764	1.36	1.69	1.24
I129	1.582E-00	1.680E-00	1.604E-00	0.975	1.036	0.989	0.94	0.99	1.05	1.582E-00	1.680E-00	1.604E-00	0.975	1.036	0.989	0.94	0.99	1.05
CS133	1.013E-01	1.031E-01	1.013E-01	0.994	1.012	0.994	0.98	1.00	1.02	1.013E-01	1.031E-01	1.013E-01	0.994	1.012	0.994	0.98	1.00	1.02
CS134	5.124E-08	5.012E-08	5.001E-08	1.016	0.993	0.991	1.02	1.02	1.00	2.570E-15	2.512E-15	2.508E-15	1.016	0.993	0.991	1.02	1.02	1.00
CS135	3.920E-00	4.375E-00	4.008E-00	0.956	1.067	0.977	0.90	0.98	1.09	3.920E-00	4.374E-00	4.008E-00	0.956	1.067	0.977	0.90	0.98	1.09
CS137	3.270E-00	3.291E-00	3.371E-00	0.988	0.994	1.018	0.99	0.97	0.98	1.030E-00	1.043E-00	1.069E-00	0.983	0.996	1.021	0.99	0.96	0.98
CR144	9.599E-20	9.655E-20	9.866E-20	0.989	0.995	1.016	0.99	0.97	0.98	4.388E-39	4.430E-39	4.609E-39	0.980	0.990	1.030	0.99	0.95	0.96
ND143	6.553E-00	6.904E-00	6.559E-00	0.982	1.035	0.983	0.95	1.00	1.05	6.553E-00	6.904E-00	6.559E-00	0.982	1.035	0.983	0.95	1.00	1.05
ND144	1.153E-01	1.119E-01	1.154E-01	1.010	0.980	1.011	1.03	1.00	0.97	1.153E-01	1.119E-01	1.154E-01	1.010	0.980	1.011	1.03	1.00	0.97
ND145	5.646E-00	5.756E-00	5.645E-00	0.994	1.013	0.993	0.98	1.00	1.02	5.646E-00	5.756E-00	5.645E-00	0.994	1.013	0.993	0.98	1.00	1.02
ND146	5.778E-00	5.699E-00	5.798E-00	1.003	0.990	1.007	1.01	1.00	0.98	5.778E-00	5.699E-00	5.798E-00	1.003	0.990	1.007	1.01	1.00	0.98
PM147	1.807E-06	2.430E-06	2.276E-06	0.832	1.119	1.048	0.74	0.79	1.07	3.308E-12	4.443E-12	4.165E-12	0.833	1.119	1.049	0.74	0.79	1.07
SM147	1.671E-00	2.015E-00	2.015E-00	0.879	1.060	1.060	0.83	0.83	1.00	1.671E-00	2.015E-00	2.015E-00	0.879	1.060	1.060	0.83	0.83	1.00
SM148	1.554E-00	1.151E-00	1.188E-00	1.198	0.887	0.915	1.35	1.31	0.97	1.554E-00	1.151E-00	1.188E-00	1.198	0.887	0.915	1.35	1.31	0.97
SM149	2.131E-02	2.767E-02	2.071E-02	0.917	1.191	0.892	0.77	1.03	1.34	2.131E-02	2.767E-02	2.071E-02	0.917	1.191	0.892	0.77	1.03	1.34
SM150	2.345E-00	2.423E-00	2.397E-00	0.982	1.015	1.004	0.97	0.98	1.01	2.345E-00	2.423E-00	2.397E-00	0.982	1.015	1.004	0.97	0.98	1.01
SM151	6.769E-02	7.798E-02	5.552E-02	1.009	1.163	0.828	0.87	1.22	1.40	4.605E-02	5.305E-02	3.778E-02	1.009	1.163	0.828	0.87	1.22	1.40
SM152	9.777E-01	1.016E-00	7.979E-01	1.051	1.092	0.857	0.96	1.23	1.27	9.777E-01	1.016E-00	7.979E-01	1.051	1.092	0.857	0.96	1.23	1.27
RU153	8.142E-01	8.514E-01	9.210E-01	0.944	0.987	1.068	0.96	0.88	0.92	8.142E-01	8.514E-01	9.210E-01	0.944	0.987	1.068	0.96	0.88	0.92
RU154	5.452E-03	5.515E-03	4.708E-03	1.043	1.056	0.901	0.99	1.16	1.17	9.693E-05	9.800E-05	8.368E-05	1.044	1.055	0.901	0.99	1.16	1.17
RU155	9.852E-05	1.088E-04	8.681E-05	1.005	1.110	0.885	0.91	1.13	1.25	9.088E-08	1.005E-07	8.014E-08	1.004	1.110	0.885	0.90	1.13	1.25
U234	1.201E-00	1.201E-00	9.983E-01	1.060	1.060	0.881	1.00	1.20	1.20	1.386E+00	1.406E+00	1.057E+00	1.080	1.096	0.824	0.99	1.31	1.33
U235	3.837E-01	4.296E-01	3.997E-01	0.949	1.062	0.989	0.89	0.96	1.07	3.839E-01	4.300E-01	3.997E-01	0.949	1.063	0.988	0.89	0.96	1.08
U236	2.239E-01	2.257E-01	2.254E-01	0.995	1.003	1.002	0.99	0.99	1.00	2.244E-01	2.261E-01	2.254E-01	0.996	1.004	1.000	0.99	1.00	1.00
U237	3.926E-03	3.916E-03	3.928E-03	1.001	0.998	1.001	1.00	1.00	1.00	3.926E-03	3.916E-03	3.928E-03	1.001	0.998	1.001	1.00	1.00	1.00
MF 37	2.775E-00	2.753E-00	2.034E-00	1.101	1.092	0.807	1.01	1.36	1.35	3.160E+00	3.188E+00	2.034E+00	1.131	1.181	0.728	0.99	1.55	1.57
MF 38	5.662E-01	6.283E-01	4.766E-01	1.016	1.128	0.856	0.90	1.19	1.32	3.819E-01	4.241E-01	3.214E-01	1.016	1.129	0.855	0.90	1.19	1.32
PU239	2.035E-01	2.436E-01	1.719E-01	0.986	1.181	0.833	0.84	1.18	1.42	2.032E-01	2.432E-01	1.716E-01	0.986	1.181	0.833	0.84	1.18	1.42
PU240	9.783E-00	8.928E-00	8.741E-00	1.069	0.976	0.955	1.10	1.12	1.02	9.746E+00	8.896E+00	8.695E+00	1.070	0.976	0.954	1.10	1.12	1.02
PU241	4.720E-01	5.598E-01	4.743E-01	0.940	1.115	0.945	0.84	1.00	1.18	4.253E-02	5.298E-02	4.489E-02	0.909	1.132	0.959	0.80	0.95	1.18
PU242	1.995E-00	2.048E-00	2.479E-00	0.918	0.942	1.140	0.97	0.80	0.83	1.995E-00	2.048E-00	2.479E-00	0.918	0.942	1.140	0.97	0.80	0.83
AM241	4.692E-00	5.297E-00	4.482E-00	0.973	1.098	0.929	0.89	1.05	1.18	4.737E-00	5.369E-00	4.543E-00	0.970	1.100	0.930	0.88	1.04	1.18
AM242	3.907E-08	7.178E-08	2.735E-08	0.848	1.558	0.594	0.54	1.43	2.62	3.110E-08	5.715E-08	2.178E-08	0.848	1.558	0.594	0.54	1.43	2.62
AM243	3.959E-01	4.445E-01	4.889E-01	0.893	1.003	1.103	0.89	0.81	0.91	3.940E-01	4.424E-01	4.866E-01	0.893	1.003	1.103	0.89	0.81	0.91
CM242	7.899E-06	1.451E-05	5.540E-06	0.848	1.557	0.595	0.54	1.43	2.62	6.289E-06	1.155E-05	4.411E-06	0.848	1.557	0.595	0.54	1.43	2.62
CM243	5.424E-04	1.531E-04	4.891E-04	1.374	0.388	1.239	3.54	1.11	0.31	1.608E-04	4.536E-05	1.450E-04	1.374	0.388	1.239	3.54	1.11	0.31
CM244	1.701E-02	1.798E-02	2.068E-02	0.917	0.969	1.114	0.95	0.82	0.87	2.509E-03	2.673E-03	3.051E-03	0.916	0.969	1.114	0.95	0.82	0.87
CM245	4.260E-03	5.169E-03	5.890E-03	0.834	1.012	1.153	0.82	0.72	0.88	4.242E-03	5.148E-03	5.866E-03	0.834	1.012	1.154	0.82	0.72	0.88
CM246	5.387E-04	6.729E-04	7.741E-04	0.814	1.017	1.170	0.80	0.70	0.87	5.347E-04	6.680E-04	7.685E-04	0.814	1.017	1.170	0.80	0.70	0.87

AVERAGE ABSOLUTE DEVIATION, AS % 6.63 8.46 8.33 15.4 12.8 18.6

AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.38 7.34 7.40 8.9 10.9 14.1

AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.91 5.88 6.35 8.1 10.2 10.8

MUCS EXCLUDED, 1ST/2ND: SB125 CM243 NP237 / SM148 AM242 SM151

6.83 8.69 8.62 15.5 13.5 19.3

5.53 7.48 7.53 9.1 11.7 15.0

4.90 6.18 6.48 8.4 10.0 10.6

SB125 CM243 NP237 / SM148 AM242 U234

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

	300 YR									1 YR								
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SE 79	8.930E-02	8.313E-02	7.646E-02	1.076	1.002	0.922	1.07	1.17	1.09	8.863E-02	8.251E-02	7.589E-02	1.076	1.002	0.922	1.07	1.17	1.09
KR 85	1.269E-09	1.251E-09	1.283E-09	1.001	0.987	1.012	1.01	0.99	0.98	2.797E-29	2.757E-29	2.824E-29	1.002	0.987	1.011	1.01	0.99	0.98
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	5.884E-03	5.766E-03	6.021E-03	0.999	0.979	1.022	1.02	0.98	0.96	3.418E-10	3.346E-10	3.493E-10	1.000	0.979	1.022	1.02	0.98	0.96
Y 90	1.476E-06	1.446E-06	1.510E-06	0.999	0.979	1.022	1.02	0.98	0.96	8.571E-14	8.392E-14	8.761E-14	1.000	0.979	1.022	1.02	0.98	0.96
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IR 93	9.624E-00	9.621E-00	9.509E-00	1.004	1.004	0.992	1.00	1.01	1.01	9.621E-00	9.618E-00	9.506E-00	1.004	1.004	0.992	1.00	1.01	1.01
IR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	9.438E-00	9.486E-00	9.482E-00	0.997	1.002	1.001	0.99	1.00	1.00	9.417E-00	9.465E-00	9.461E-00	0.997	1.002	1.001	0.99	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	2.166E-00	2.057E-00	2.169E-00	1.017	0.965	1.018	1.05	1.00	0.95	2.166E-00	2.057E-00	2.169E-00	1.017	0.965	1.018	1.05	1.00	0.95
SM126	2.303E-01	1.769E-01	1.946E-01	1.148	0.882	0.970	1.30	1.18	0.91	2.292E-01	1.760E-01	1.936E-01	1.148	0.882	0.970	1.30	1.18	0.91
SB125	0.0	0.0	1.480E-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.582E-00	1.680E-00	1.604E-00	0.975	1.036	0.989	0.94	0.99	1.05	1.582E-00	1.680E-00	1.604E-00	0.975	1.036	0.989	0.94	0.99	1.05
CS133	1.013E-01	1.031E-01	1.013E-01	0.994	1.012	0.994	0.98	1.00	1.02	1.013E-01	1.031E-01	1.013E-01	0.994	1.012	0.994	0.98	1.00	1.02
CS134	0.0	0.0	1.587E-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.920E-00	4.374E-00	4.007E-00	0.956	1.067	0.977	0.90	0.98	1.09	3.919E-00	4.373E-00	4.006E-00	0.956	1.067	0.977	0.90	0.98	1.09
CS137	1.013E-02	1.053E-02	1.079E-02	0.966	1.004	1.029	0.96	0.94	0.98	9.581E-10	1.091E-09	1.118E-09	0.908	1.033	1.059	0.88	0.86	0.98
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	6.553E-00	6.904E-00	6.559E-00	0.982	1.035	0.983	0.95	1.00	1.05	6.553E-00	6.904E-00	6.559E-00	0.982	1.035	0.983	0.95	1.00	1.05
ND145	1.153E-01	1.119E-01	1.154E-01	1.010	0.980	1.011	1.03	1.00	0.97	1.153E-01	1.119E-01	1.154E-01	1.010	0.980	1.011	1.03	1.00	0.97
ND146	5.646E-00	5.756E-00	5.645E-00	0.994	1.013	0.993	0.98	1.00	1.02	5.646E-00	5.756E-00	5.645E-00	0.994	1.013	0.993	0.98	1.00	1.02
ND146	5.778E-00	5.699E-00	5.798E-00	1.003	0.990	1.007	1.01	1.00	0.98	5.778E-00	5.699E-00	5.798E-00	1.003	0.990	1.007	1.01	1.00	0.98
PM147	0.0	0.0	4.671E-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	1.671E-00	2.015E-00	2.015E-00	0.879	1.060	1.060	0.83	0.83	1.00	1.671E-00	2.015E-00	2.015E-00	0.879	1.060	1.060	0.83	0.83	1.00
SM148	1.554E-00	1.151E-00	1.188E-00	1.198	0.887	0.915	1.35	1.31	0.97	1.554E-00	1.151E-00	1.188E-00	1.198	0.887	0.915	1.35	1.31	0.97
SM149	2.131E-02	2.767E-02	2.071E-02	0.917	1.191	0.892	0.77	1.03	1.34	2.131E-02	2.767E-02	2.071E-02	0.917	1.191	0.892	0.77	1.03	1.34
SM150	2.345E-00	2.423E-00	2.397E-00	0.982	1.015	1.004	0.97	0.98	1.01	2.345E-00	2.423E-00	2.397E-00	0.982	1.015	1.004	0.97	0.98	1.01
SM151	9.869E-03	1.137E-02	8.095E-03	1.009	1.163	0.828	0.87	1.22	1.40	4.492E-05	5.180E-05	3.688E-05	1.009	1.163	0.828	0.87	1.22	1.40
SM152	9.777E-01	1.016E-00	7.979E-01	1.051	1.092	0.857	0.96	1.23	1.27	9.777E-01	1.016E-00	7.979E-01	1.051	1.092	0.857	0.96	1.23	1.27
BU153	8.142E-01	8.514E-01	9.210E-01	0.944	0.987	1.068	0.96	0.88	0.92	8.142E-01	8.514E-01	9.210E-01	0.944	0.987	1.068	0.96	0.88	0.92
BU154	9.680E-12	9.775E-12	8.352E-12	1.044	1.055	0.901	0.99	1.16	1.17	0.0	0.0	2.623E-36	0.0	0.0	0.0	0.0	0.0	0.0
BU155	6.580E-20	7.296E-20	5.823E-20	1.002	1.111	0.887	0.90	1.13	1.25	0.0	0.0	1.903E-62	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.689E-00	1.743E-00	1.154E-00	1.105	1.140	0.755	0.97	1.46	1.51	1.766E-00	1.830E-00	1.178E-00	1.110	1.150	0.740	0.97	1.50	1.55
U235	1.851E-01	4.314E-01	3.997E-01	0.950	1.064	0.986	0.89	0.96	1.08	3.891E-01	4.362E-01	3.997E-01	0.953	1.068	0.979	0.89	0.97	1.09
U236	2.264E-01	2.280E-01	2.254E-01	0.999	1.006	0.995	0.99	1.00	1.01	2.332E-01	2.342E-01	2.254E-01	1.010	1.014	0.976	1.00	1.03	1.04
U238	1.926E-03	3.916E-03	3.928E-03	1.001	0.998	1.001	1.00	1.00	1.00	3.926E-03	3.916E-03	3.928E-03	1.001	0.998	1.001	1.00	1.00	1.00
NP237	4.471E-00	4.677E-00	2.034E-00	1.200	1.255	0.546	0.96	2.20	2.30	6.810E-00	7.330E-00	2.034E-00	1.263	1.360	0.377	0.93	3.35	3.60
PU238	7.925E-02	8.842E-02	6.661E-02	1.015	1.132	0.853	0.90	1.19	1.33	3.582E-04	4.314E-04	2.951E-04	0.991	1.193	0.816	0.83	1.21	1.46
PU239	2.021E-01	2.419E-01	1.706E-01	0.986	1.181	0.833	0.84	1.18	1.42	1.983E-01	2.374E-01	1.672E-01	0.987	1.181	0.832	0.84	1.19	1.42
PU240	9.544E-00	8.712E-00	8.513E-00	1.070	0.976	0.954	1.10	1.12	1.02	8.861E-00	8.088E-00	7.905E-00	1.070	0.976	0.954	1.10	1.12	1.02
PU241	9.885E-06	1.302E-05	3.601E-06	1.119	1.474	0.408	0.76	2.75	3.62	6.690E-06	8.288E-06	1.665E-06	1.340	1.660	0.000	0.81	***	***
PU242	1.994E-00	2.048E-00	2.478E-00	0.917	0.942	1.140	0.97	0.80	0.83	1.992E-00	2.045E-00	2.475E-00	0.918	0.942	1.140	0.97	0.80	0.83
AM241	1.469E-00	3.936E-00	3.330E-00	0.969	1.100	0.931	0.88	1.04	1.18	1.129E-00	1.281E-00	1.084E-00	0.969	1.100	0.931	0.88	1.04	1.18
AM242	1.249E-08	2.295E-08	8.748E-09	0.848	1.558	0.594	0.54	1.43	2.62	5.134E-10	9.431E-10	3.594E-10	0.848	1.558	0.594	0.54	1.43	2.62
AM243	3.867E-01	4.342E-01	4.775E-01	0.893	1.003	1.103	0.89	0.81	0.91	3.621E-01	4.065E-01	4.472E-01	0.893	1.003	1.103	0.89	0.81	0.91
CM242	2.526E-06	4.641E-06	1.772E-06	0.840	1.558	0.595	0.54	1.43	2.62	1.038E-07	1.907E-07	7.279E-08	0.840	1.558	0.595	0.54	1.43	2.62
CM243	1.241E-06	3.500E-07	1.119E-06	1.374	0.387	1.239	3.55	1.11	0.31	5.011E-14	1.413E-14	4.517E-14	1.374	0.387	1.239	3.55	1.11	0.31
CM244	1.188E-06	1.256E-06	1.445E-06	0.916	0.969	1.115	0.95	0.82	0.87	1.997E-15	2.906E-15	3.344E-15	2.991	0.004	0.005	***	***	0.87
CM245	4.174E-03	5.065E-03	5.771E-03	0.834	1.012	1.153	0.82	0.72	0.88	3.942E-03	4.784E-03	5.450E-03	0.834	1.012	1.153	0.82	0.72	0.88
CM246	5.193E-04	6.487E-04	7.463E-04	0.814	1.017	1.170	0.80	0.70	0.87	4.687E-04	5.854E-04	6.735E-04	0.814	1.017	1.170	0.80	0.70	0.87

AVERAGE-ABSOLUTE-DEVIATION, AS % 0.71 10.35 10.76 16.0 18.6 28.5

12.42 13.79 14.58 **** **

AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.48 8.13 9.28 9.9 15.0 21.8

6.28 8.91 9.85 17.0 18.2 27.2

AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.48 6.55 7.25 9.2 11.6 15.5

5.07 6.73 7.51 10.9 12.5 19.8

NUCS EXCLUDED, 1ST/2ND: SM148 CM243 PU241 / CM246 AM242 NP237

CM244 CM243 PU241 / SM148 AM242 NP237

CASE: BWR, 4.15 MT % U 235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATONS PER MTU

***** 10 YR *****									
	ORIGEN2	ORIGEN S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN
SE 79	8.052E-02	7.496E-02	6.894E-02	1.076	1.002	0.922	1.07	1.17	1.09
ER 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	9.582E-00	4.579E-00	9.467E-00	1.004	1.004	0.992	1.00	1.01	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	9.145E-00	9.192E-00	9.188E-00	0.997	1.002	1.001	0.99	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	2.164E-00	2.055E-00	2.167E-00	1.017	0.965	1.018	1.05	1.00	0.95
SM126	2.154E-01	1.654E-01	1.819E-01	1.148	0.882	0.970	1.30	1.18	0.91
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.582E-00	1.680E-00	1.603E-00	0.976	1.036	0.988	0.94	0.99	1.05
CS133	1.013E-01	1.031E-01	1.013E-01	0.994	1.012	0.994	0.98	1.00	1.02
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.909E-00	4.361E-00	3.996E-00	0.956	1.067	0.977	0.90	0.98	1.09
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	6.553E-00	6.904E-00	6.559E-00	0.982	1.035	0.983	0.95	1.00	1.05
MD144	1.153E-01	1.119E-01	1.154E-01	1.010	0.980	1.011	1.03	1.00	0.97
MD145	5.646E-00	5.756E-00	5.645E-00	0.994	1.013	0.993	0.98	1.00	1.02
MD146	5.778E-00	5.699E-00	5.798E-00	1.003	0.990	1.007	1.01	1.00	0.98
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	1.671E-00	2.015E-00	2.015E-00	0.879	1.060	1.060	0.83	0.83	1.00
SM148	1.554E-00	1.151E-00	1.188E-00	1.198	0.887	0.915	1.35	1.31	0.97
SM149	2.131E-02	2.767E-02	2.071E-02	0.917	1.191	0.892	0.77	1.03	1.34
SM150	2.345E-00	2.423E-00	2.397E-00	0.982	1.015	1.004	0.97	0.98	1.01
SM151	3.528E-35	4.087E-35	2.904E-35	1.006	1.166	0.828	0.86	1.21	1.41
SM152	9.777E-01	1.016E-00	7.979E-01	1.051	1.092	0.857	0.96	1.23	1.27
RU153	8.142E-01	8.514E-01	9.210E-01	0.944	0.987	1.068	0.96	0.88	0.92
RU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.727E-00	1.790E-00	1.148E-00	1.111	1.151	0.738	0.96	1.50	1.56
U235	4.347E-01	4.907E-01	3.997E-01	0.984	1.111	0.905	0.89	1.09	1.23
U236	2.877E-01	2.839E-01	2.253E-01	1.083	1.069	0.848	1.01	1.28	1.26
U238	3.926E-03	3.916E-03	3.928E-03	1.001	0.998	1.001	1.00	1.00	1.00
MP237	7.918E-00	8.589E-00	2.028E-00	1.282	1.390	0.328	0.92	3.90	4.24
PU238	7.318E-23	1.340E-22	5.106E-23	0.850	1.557	0.593	0.55	1.43	2.62
PU239	1.548E-01	1.852E-01	1.291E-01	0.990	1.184	0.826	0.84	1.20	1.43
PU240	3.412E-00	3.115E-00	3.050E-00	1.069	0.976	0.955	1.10	1.12	1.02
PU241	3.211E-06	3.978E-06	0.0	0.893	1.107	0.0	0.81	0.0	0.0
PU242	1.961E-00	2.012E-00	2.435E-00	0.918	0.942	1.140	0.97	0.81	0.83
AM241	9.705E-05	1.227E-04	5.837E-07	1.321	1.671	0.008	0.79	****	****
AM242	7.722E-28	1.414E-27	5.385E-28	0.850	1.557	0.593	0.55	1.43	2.63
AM243	1.555E-01	1.746E-01	1.920E-01	0.894	1.003	1.103	0.89	0.81	0.91
CM242	1.566E-25	2.868E-25	1.091E-25	0.850	1.557	0.592	0.55	1.44	2.63
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	1.994E-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	1.892E-03	2.296E-03	2.610E-03	0.835	1.013	1.152	0.82	0.72	0.88
CM246	1.254E-04	1.566E-04	1.801E-04	0.814	1.017	1.169	0.80	0.70	0.87

AVERAGE-ABSOLUTE-DEVIATION, AS % 8.23 12.78 14.81 12.9 **** **

AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.91 9.79 11.45 11.6 23.2 31.7

AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.49 7.48 8.22 10.7 13.6 17.7

MUCS EXCLUDED, 1ST/2ND: SM148 CM242 AM241 / CM246 AM242 MP237

APPENDIX D
COMPARATIVE RATIO TABLES IN CURIES
(See table descriptions in Sect. 4.1)

[illegible]

AVERAGE-ABSOLUTE-DEVIATION, AS 1
AV-ABS-DEV EXCLUDING LARGEST ONE,
AV-ABS-DEV EXCLUDING LARGEST TWO,
MUCS EXCLUDED, 1ST/2ND: PU2#2

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU

CURIES

PER MTU

			10 YR					20 YR										
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SR 79	4.091E-01	4.091E-01	4.089E-01	1.000	1.000	1.000	1.00	1.00	1.00	4.090E-01	4.090E-01	4.089E-01	1.000	1.000	1.000	1.00	1.00	1.00
KR 85	4.955E-03	4.955E-03	4.953E-03	1.000	1.000	1.000	1.00	1.00	1.00	2.596E-03	2.596E-03	2.595E-03	1.000	1.000	1.000	1.00	1.00	1.00
SR 89	1.476E-16	1.473E-16	1.478E-16	1.000	0.998	1.002	1.00	1.00	1.00	0.0	0.0	2.495E-38	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	5.764E-04	5.764E-04	5.762E-04	1.000	1.000	1.000	1.00	1.00	1.00	4.543E-04	4.543E-04	4.541E-04	1.000	1.000	1.000	1.00	1.00	1.00
Y 90	5.766E-04	5.766E-04	5.763E-04	1.000	1.000	1.000	1.00	1.00	1.00	4.544E-04	4.544E-04	4.543E-04	1.000	1.000	1.000	1.00	1.00	1.00
Y 91	1.865E-13	1.864E-13	1.868E-13	1.000	0.999	1.001	1.00	1.00	1.00	3.005E-32	0.0	3.018E-32	0.998	0.0	1.002	0.0	1.00	0.0
SR 93	1.806E-00	1.806E-00	1.805E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.806E-00	1.806E-00	1.805E-00	1.000	1.000	1.000	1.00	1.00	1.00
SR 95	1.078E-11	1.074E-11	1.156E-11	0.979	0.974	1.048	1.00	0.93	0.93	7.042E-29	0.0	8.127E-29	0.928	0.0	1.072	0.0	0.87	0.0
NB 95	2.393E-11	2.384E-11	2.557E-11	0.979	0.975	1.046	1.00	0.94	0.93	1.563E-28	0.0	1.797E-28	0.930	0.0	1.070	0.0	0.87	0.0
TC 99	1.307E-01	1.307E-01	1.307E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.307E-01	1.307E-01	1.307E-01	1.000	1.000	1.000	1.00	1.00	1.00
RU106	6.005E-02	6.005E-02	6.005E-02	1.000	1.000	1.000	1.00	1.00	1.00	6.180E-01	6.195E-01	6.199E-01	0.998	1.001	1.001	1.00	1.00	1.00
PD107	1.122E-01	1.121E-01	1.121E-01	1.001	1.000	1.000	1.00	1.00	1.00	1.122E-01	1.121E-01	1.121E-01	1.001	1.000	1.000	1.00	1.00	1.00
SM126	7.774E-01	7.774E-01	7.771E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.773E-01	7.774E-01	7.770E-01	1.000	1.000	1.000	1.00	1.00	1.00
SB125	1.226E-03	1.226E-03	1.225E-03	1.000	1.000	0.999	1.00	1.00	1.00	1.004E-02	1.003E-02	1.003E-02	1.001	1.000	1.000	1.00	1.00	1.00
1129	3.157E-02	3.157E-02	3.166E-02	0.999	0.999	1.002	1.00	1.00	1.00	3.157E-02	3.157E-02	3.166E-02	0.999	0.999	1.002	1.00	1.00	1.00
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	5.406E-03	5.405E-03	5.403E-03	1.000	1.000	1.000	1.00	1.00	1.00	1.875E-02	1.874E-02	1.874E-02	1.000	1.000	1.000	1.00	1.00	1.00
CS135	3.455E-01	3.455E-01	3.454E-01	1.000	1.000	1.000	1.00	1.00	1.00	3.455E-01	3.455E-01	3.454E-01	1.000	1.000	1.000	1.00	1.00	1.00
CS137	8.277E-04	8.241E-04	8.238E-04	1.003	0.999	0.998	1.00	1.00	1.00	6.570E-04	6.549E-04	6.547E-04	1.002	0.999	0.999	1.00	1.00	1.00
CE144	1.708E-02	1.709E-02	1.714E-02	0.999	0.999	1.002	1.00	1.00	1.00	2.315E-02	2.318E-02	2.333E-02	0.997	0.998	1.005	1.00	0.99	0.99
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.560E-09	1.566E-09	1.565E-09	0.998	1.001	1.001	1.00	1.00	1.00	1.560E-09	1.566E-09	1.565E-09	0.998	1.001	1.001	1.00	1.00	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	9.841E-03	9.838E-03	9.835E-03	1.000	1.000	1.000	1.00	1.00	1.00	7.008E-02	7.004E-02	7.003E-02	1.000	1.000	1.000	1.00	1.00	1.00
SM147	4.354E-06	4.456E-06	4.454E-06	0.985	1.008	1.007	0.98	0.98	1.00	4.578E-06	4.685E-06	4.683E-06	0.985	1.008	1.007	0.98	0.98	1.00
SM148	4.948E-11	4.997E-11	4.995E-11	0.994	1.003	1.003	0.99	0.99	1.00	4.948E-11	4.997E-11	4.995E-11	0.994	1.003	1.003	0.99	0.99	1.00
SM149	9.018E-13	9.022E-13	8.936E-13	1.003	1.003	0.994	1.00	1.01	1.01	9.018E-13	9.022E-13	8.936E-13	1.003	1.003	0.994	1.00	1.01	1.01
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.334E-02	3.333E-02	3.332E-02	1.000	1.000	1.000	1.00	1.00	1.00	3.086E-02	3.086E-02	3.085E-02	1.000	1.000	1.000	1.00	1.00	1.00
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	4.720E-03	4.720E-03	4.718E-03	1.000	1.000	1.000	1.00	1.00	1.00	2.108E-03	2.108E-03	2.107E-03	1.000	1.000	1.000	1.00	1.00	1.00
EU155	1.611E-03	1.611E-03	1.610E-03	1.000	1.000	1.000	1.00	1.00	1.00	3.982E-02	3.982E-02	3.981E-02	1.000	1.000	1.000	1.00	1.00	1.00
U234	1.189E-00	1.189E-00	1.187E-00	1.001	1.001	0.999	1.00	1.00	1.00	1.250E-00	1.250E-00	1.247E-00	1.001	1.001	0.999	1.00	1.00	1.00
U235	1.721E-02	1.721E-02	1.720E-02	1.000	1.000	1.000	1.00	1.00	1.00	1.722E-02	1.722E-02	1.720E-02	1.000	1.000	0.999	1.00	1.00	1.00
U236	2.565E-01	2.565E-01	2.562E-01	1.000	1.000	0.999	1.00	1.00	1.00	2.566E-01	2.566E-01	2.562E-01	1.001	1.001	0.999	1.00	1.00	1.00
U238	3.175E-01	3.175E-01	3.174E-01	1.000	1.000	1.000	1.00	1.00	1.00	3.175E-01	3.175E-01	3.174E-01	1.000	1.000	1.000	1.00	1.00	1.00
NP237	3.154E-01	3.154E-01	3.122E-01	1.003	1.003	0.993	1.00	1.01	1.01	3.226E-01	3.224E-01	3.122E-01	1.011	1.010	0.978	1.00	1.03	1.03
PU238	2.240E-03	2.240E-03	2.239E-03	1.000	1.000	1.000	1.00	1.00	1.00	2.071E-03	2.071E-03	2.070E-03	1.000	1.000	1.000	1.00	1.00	1.00
PU239	3.130E-02	3.130E-02	3.123E-02	1.001	1.001	0.999	1.00	1.00	1.00	3.129E-02	3.129E-02	3.122E-02	1.001	1.001	0.999	1.00	1.00	1.00
PU240	5.282E-02	5.282E-02	5.252E-02	1.002	1.002	0.996	1.00	1.01	1.01	5.288E-02	5.288E-02	5.246E-02	1.003	1.003	0.995	1.00	1.01	1.01
PU241	7.787E-04	7.703E-04	7.700E-04	1.007	0.997	0.996	1.01	1.01	1.00	4.812E-04	4.807E-04	4.805E-04	1.001	1.000	0.999	1.00	1.00	1.00
PU242	1.728E-00	1.779E-00	1.776E-00	0.981	1.010	1.009	0.97	0.97	1.00	1.728E-00	1.779E-00	1.776E-00	0.981	1.010	1.009	0.97	0.97	1.00
AM241	1.687E-03	1.662E-03	1.661E-03	1.010	0.995	0.995	1.02	1.02	1.00	2.643E-03	2.612E-03	2.611E-03	1.008	0.996	0.996	1.01	1.01	1.00
AM242	5.803E-00	5.805E-00	5.830E-00	0.998	0.999	1.003	1.00	1.00	1.00	5.545E-00	5.546E-00	5.570E-00	0.998	0.999	1.003	1.00	1.00	1.00
AM243	1.713E-01	1.713E-01	1.712E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.711E-01	1.711E-01	1.711E-01	1.000	1.000	1.000	1.00	1.00	1.00
CM242	4.809E-00	4.810E-00	4.843E-00	0.998	0.998	1.005	1.00	0.99	0.99	4.585E-00	4.586E-00	4.620E-00	0.997	0.998	1.005	1.00	0.99	0.99
CM243	1.330E-01	1.330E-01	1.329E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.043E-01	1.043E-01	1.042E-01	1.000	1.000	0.999	1.00	1.00	1.00
CM244	1.327E-03	1.326E-03	1.326E-03	1.001	1.000	1.000	1.00	1.00	1.00	9.047E-02	9.045E-02	9.043E-02	1.000	1.000	1.000	1.00	1.00	1.00
CM245	1.476E-01	1.476E-01	1.480E-01	0.999	0.999	1.002	1.00	1.00	1.00	1.475E-01	1.475E-01	1.478E-01	0.999	0.999	1.001	1.00	1.00	1.00
CM246	3.157E-02	3.158E-02	3.157E-02	1.000	1.000	1.000	1.00	1.00	1.00	3.153E-02	3.153E-02	3.152E-02	1.000	1.000	1.000	1.00	1.00	1.00

AVERAGE-ABSOLUTE-DEVIATION, AS % 0.29 0.24 0.37 0.2 0.6 0.5 0.52 0.14 0.52 0.2 1.0 0.2
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 0.21 0.16 0.26 0.2 0.5 0.3 0.48 0.09 0.47 0.2 0.6 0.1
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.13 0.09 0.14 0.1 0.3 0.2 0.46 0.07 0.46 0.1 0.2 0.1
 NUCS EXCLUDED, 1ST/2ND: PU242 SR 89 SR 95 / SM147 NB 95 PU242 NP237 / SM147 SM149

CASE. DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % UO₂ GND/MTU CURIES PER MTU

[illegible]

AV-ABS-DEV EXCLUDING LARGEST ONE.
AV-ABS-DEV EXCLUDING LARGEST TWO.
NUCS EXCLUDED, 1ST/2ND: PU201

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU CURISS PER MTU

300 YR										1 KYR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QAS AVG	CIN AVG	QR2 ORS	QR2 CIN	QR2 CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QAS AVG	CIN AVG	QR2 ORS	QR2 CIN	QR2 CIN	ORIGEN2	ORIGEN-S
SE 79	4.078E-01	4.078E-01	4.076E-01	1.000	1.000	1.000	1.00	1.00	1.00	4.048E-01	4.048E-01	4.046E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
KR 85	3.561E-05	3.556E-05	3.558E-05	1.001	0.999	1.000	1.00	1.00	1.00	7.852E-25	7.838E-25	7.833E-25	1.001	1.000	0.999	1.00	1.00	1.00	1.00
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	5.794E-01	5.789E-01	5.789E-01	1.001	1.000	1.000	1.00	1.00	1.00	3.365E-06	3.360E-06	3.359E-06	1.001	1.000	0.999	1.00	1.00	1.00	1.00
Y 90	5.796E-01	5.791E-01	5.791E-01	1.001	1.000	1.000	1.00	1.00	1.00	3.366E-06	3.361E-06	3.360E-06	1.001	1.000	0.999	1.00	1.00	1.00	1.00
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	1.806E-00	1.806E-00	1.805E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.805E-00	1.805E-00	1.805E-00	1.000	1.000	1.000	1.00	1.00	1.00	1.00
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.306E-01	1.306E-01	1.305E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.303E-01	1.303E-01	1.302E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD137	1.122E-01	1.121E-01	1.121E-01	1.001	1.000	1.000	1.00	1.00	1.00	1.122E-01	1.121E-01	1.121E-01	1.001	1.000	1.000	1.00	1.00	1.00	1.00
SN126	7.758E-01	7.759E-01	7.755E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.721E-01	7.721E-01	7.718E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
SB125	0.0	0.0	3.731E-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	3.157E-02	3.157E-02	3.166E-02	0.999	0.999	1.002	1.00	1.00	1.00	3.157E-02	3.157E-02	3.166E-02	0.999	0.999	1.002	1.00	1.00	1.00	1.00
CS132	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	2.481E-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.455E-01	3.455E-01	3.454E-01	1.000	1.000	1.000	1.00	1.00	1.00	3.454E-01	3.454E-01	3.453E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
CS137	1.019E-02	1.052E-02	1.052E-02	0.979	1.011	1.011	0.97	0.97	1.00	9.638E-06	0.908E-05	1.090E-05	0.920	1.040	1.040	0.88	0.88	1.00	1.00
CB144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WD144	1.560E-09	1.566E-09	1.565E-09	0.998	1.001	1.001	1.00	1.00	1.00	1.560E-09	1.566E-09	1.545E-09	0.998	1.001	1.001	1.00	1.00	1.00	1.00
WD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	5.187E-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	4.595E-06	4.703E-06	4.700E-06	0.985	1.008	1.007	0.98	0.98	1.00	4.595E-06	4.703E-06	4.700E-06	0.985	1.008	1.007	0.98	0.98	1.00	1.00
SM148	4.948E-11	4.997E-11	4.995E-11	0.994	1.003	1.003	0.99	0.99	1.00	4.948E-11	4.997E-11	4.995E-11	0.994	1.003	1.003	0.99	0.99	1.00	1.00
SM149	9.018E-13	9.022E-13	8.936E-13	1.003	1.003	0.994	1.00	1.01	1.01	9.018E-13	9.022E-13	8.936E-13	1.003	1.003	0.994	1.00	1.01	1.01	1.01
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.572E-01	3.571E-01	3.570E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.627E-01	1.627E-01	1.626E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU154	3.335E-07	3.329E-07	3.331E-07	1.001	0.999	1.006	1.00	1.00	1.00	0.0	1.046E-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU155	4.016E-15	4.033E-15	4.034E-15	0.997	1.001	1.002	1.00	1.00	1.00	0.0	1.319E-57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.912E-00	1.912E-00	1.902E-00	1.002	1.002	0.997	1.00	1.01	1.01	1.991E-00	1.991E-00	1.980E-00	1.002	1.002	0.996	1.00	1.01	1.01	1.01
U235	1.730E-02	1.730E-02	1.720E-02	1.002	1.002	0.996	1.00	1.01	1.01	1.751E-02	1.751E-02	1.720E-02	1.006	1.006	0.988	1.00	1.02	1.02	1.02
U236	2.610E-01	2.610E-01	2.562E-01	1.006	1.006	0.988	1.00	1.02	1.02	2.713E-01	2.713E-01	2.562E-01	1.019	1.019	0.962	1.00	1.06	1.06	1.06
U238	3.175E-01	3.175E-01	3.174E-01	1.000	1.000	1.000	1.00	1.00	1.00	3.175E-01	3.174E-01	3.174E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
NP237	6.259E-01	6.256E-01	3.122E-01	1.201	1.200	0.599	1.00	2.00	2.00	9.997E-01	9.996E-01	3.121E-01	1.298	1.297	0.405	1.00	3.20	3.20	3.20
PU238	2.286E-02	2.286E-02	2.285E-02	1.000	1.000	1.000	1.00	1.00	1.00	1.021E-00	1.021E-00	1.021E-00	1.000	0.999	1.000	1.00	1.00	1.00	1.00
PU239	3.106E-02	3.105E-02	3.097E-02	1.001	1.001	0.998	1.00	1.00	1.00	3.047E-02	3.047E-02	3.035E-02	1.001	1.001	0.997	1.00	1.00	1.00	1.00
PU240	5.157E-02	5.158E-02	5.093E-02	1.004	1.004	0.992	1.00	1.01	1.01	4.788E-02	4.789E-02	4.729E-02	1.004	1.004	0.992	1.00	1.01	1.01	1.01
PU241	2.118E-01	2.330E-01	8.865E-02	1.191	1.310	0.489	0.91	2.39	2.63	1.364E-01	1.364E-01	4.099E-16	1.500	1.500	0.000	1.00	****	****	****
PU242	1.728E-00	1.779E-00	1.776E-00	0.981	1.010	1.009	0.97	0.97	1.00	1.726E-00	1.777E-00	1.774E-00	0.981	1.010	1.009	0.97	0.97	1.00	1.00
AM241	2.745E-03	2.747E-03	2.746E-03	1.000	1.000	1.000	1.00	1.00	1.00	8.935E-02	8.940E-02	8.935E-02	1.000	1.000	1.000	1.00	1.00	1.00	1.00
AM242	1.547E-00	1.547E-00	1.554E-00	0.998	0.998	1.003	1.00	1.00	1.00	6.355E-02	6.355E-02	6.383E-02	0.999	0.999	1.003	1.00	1.00	1.00	1.00
AM243	1.667E-01	1.667E-01	1.666E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.561E-01	1.561E-01	1.560E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00
CM242	1.279E-00	1.279E-00	1.289E-00	0.997	0.997	1.005	1.00	0.99	0.99	5.255E-02	5.255E-02	5.294E-02	0.998	0.997	1.005	1.00	0.99	0.99	0.99
CM243	1.150E-02	1.149E-02	1.149E-02	1.001	1.000	1.000	1.00	1.00	1.00	4.647E-10	4.642E-10	4.640E-10	1.001	1.000	0.999	1.00	1.00	1.00	1.00
CM244	2.005E-02	2.004E-02	2.004E-02	1.000	1.000	1.000	1.00	1.00	1.00	4.255E-11	4.636E-14	4.637E-14	2.993	0.003	0.003	****	****	****	****
CM245	1.442E-01	1.441E-01	1.445E-01	1.000	0.999	1.002	1.00	1.00	1.00	1.362E-01	1.361E-01	1.365E-01	1.000	0.999	1.002	1.00	1.00	1.00	1.00
CM246	3.026E-02	3.026E-02	3.025E-02	1.000	1.000	1.000	1.00	1.00	1.00	2.731E-02	2.731E-02	2.730E-02	1.000	1.000	1.000	1.00	1.00	1.00	1.00

AVERAGE-ABSOLUTE-DEVIATION, AS % 1.36 1.60 2.74 0.6 7.2 7.5 8.71 5.60 8.06 **** **** ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 0.81 0.75 1.40 0.3 3.4 3.1 1.51 1.31 2.40 0.6 7.9 7.3
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.18 0.14 0.20 0.2 0.5 0.2 0.31 0.24 0.37 0.3 0.7 0.5
 NUCS EXCLUDED, 1ST/2ND: CS137 PU241 / PU242 NP237 CM244 PU238 PU241 / CS137 NP237

PER MTU

CURIES

CASE: DECAY ONLY, OF ORIGIN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % 33 GMD/MTU

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ORIGIN2 ORIGIN-S CINDER OR2 OR2 OR2 OR2 OR2 OR2 OR2 OR2
      3.677E-01 3.677E-01 3.676E-01 1.000 1.000 1.000 1.000 1.000 1.000 1.000
SR 19 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SR 85 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SR 89 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SR 90 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Y 90 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Y 91 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SR 93 1.798E-00 1.798E-00 1.797E-00 1.000 1.000 1.000 1.000 1.000 1.000 1.000
SR 95 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
RB 95 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
TC 99 1.265E-01 1.265E-01 1.265E-01 1.000 1.000 1.000 1.000 1.000 1.000 1.000
RU106 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
PD107 1.121E-01 1.120E-01 1.120E-01 1.000 1.000 1.000 1.000 1.000 1.000 1.000
SM126 7.254E-01 7.254E-01 7.251E-01 1.000 1.000 1.000 1.000 1.000 1.000 1.000
SB125 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
1129 3.155E-02 3.155E-02 3.164E-02 0.999 0.999 1.002 1.000 1.000 1.000
CS133 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
CS134 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
CS135 3.445E-01 3.445E-01 3.443E-01 1.000 1.000 1.000 1.000 1.000 1.000 1.000
CS137 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
CS140 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
MD143 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
MD144 1.560E-09 1.566E-09 1.565E-09 0.998 0.998 1.001 1.000 1.000 1.000
MD145 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
MD146 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
PM147 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SM147 4.595E-06 4.703E-06 4.700E-06 0.985 0.985 1.008 1.007 0.98 0.98 1.00
SM148 4.948E-11 4.997E-11 4.995E-11 0.994 1.003 1.003 0.99 0.99 1.00
SM149 9.018E-13 9.022E-13 9.036E-13 1.003 1.003 1.003 1.00 1.01 1.01
SM150 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
SM151 1.278E-31 0.0 1.280E-31 0.999 0.999 1.001 1.000 1.000 1.000
SM152 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
EU153 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
EU154 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
EU155 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
U234 1.949E-00 1.949E-00 1.930E-00 1.003 1.003 0.993 1.00 1.01 1.01
U235 1.991E-02 1.991E-02 1.720E-02 1.048 1.048 0.905 1.00 1.16 1.16
U236 3.534E-01 3.534E-01 2.561E-01 1.101 1.101 0.798 1.00 1.38 1.38
U238 3.175E-01 3.175E-01 3.174E-01 1.000 1.000 1.000 1.000 1.000 1.000
MP237 1.177E-00 1.177E-00 3.112E-01 1.325 1.325 0.350 1.00 3.78 3.78
PU238 1.808E-19 1.801E-19 1.808E-19 0.998 0.998 1.005 1.00 0.99 0.99
PU239 2.375E-02 2.375E-02 2.372E-02 1.205 1.205 0.91 1.00 1.01 1.01
PU240 1.844E-02 1.844E-02 1.845E-02 1.003 1.003 0.993 1.00 1.01 1.01
PU241 6.548E-02 6.547E-02 0.0 1.000 1.000 0.0 1.00 0.0 0.0
PU242 1.698E-00 1.748E-00 1.744E-00 0.982 1.010 1.008 0.97 0.97 1.00
AN241 6.598E-02 6.878E-02 8.911E-04 1.868 1.526 0.011 0.96 0.96 0.96
AN242 9.547E-20 9.529E-20 9.564E-20 1.000 0.998 1.002 1.00 1.00 1.00
AN243 6.702E-00 6.703E-00 6.699E-00 1.000 1.000 1.000 1.000 1.000 1.000
CM242 7.919E-20 7.904E-20 7.933E-20 1.000 0.998 1.002 1.00 1.00 1.00
CM243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
CM244 8.250E-11 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
CM245 6.535E-02 6.535E-02 6.536E-02 1.000 1.000 1.000 1.000 1.000 1.000
CM246 7.305E-03 7.305E-03 7.301E-03 1.000 1.000 1.000 1.000 1.000 1.000
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AVERAGE ABSOLUTE DEVIATION, AS % 3.57 3.88 7.40 0.4 0.4 0.4 0.4 0.4 0.4 0.4
AV-ABS-DEV EXCLUDING LARGEST ONE, % 2.07 2.12 4.16 0.3 13.2 13.6
AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.80 0.83 1.62 0.2 2.6 2.6
NUCS EXCLUDED, 1ST/2ND: PU242 CM242 AN241 / SM147 AN242 MP237

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CASE: PMR, 3.10 MT & U-235, 3.443 AT & BURNUP (33.0 GWD/MTU, APPROX.)

CURIES PER MTU

	***** 30 DAY *****										***** 5 YR *****																
	ORIGEN2	ORIGEN-5	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-5	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-5	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SE 79	4.082E-01	3.749E-01	3.455E-01	1.085	0.997	0.918	1.09	1.18	1.09	4.082E-01	3.749E-01	3.454E-01	1.085	0.997	0.918	1.09	1.18	1.09	4.082E-01	3.749E-01	3.454E-01	1.085	0.997	0.918	1.09	1.18	1.09
KR 85	9.324E-03	9.276E-03	9.342E-03	1.001	0.996	1.003	1.01	1.00	0.99	9.324E-03	9.276E-03	9.342E-03	1.001	0.996	1.003	1.01	1.00	0.99	9.324E-03	9.276E-03	9.342E-03	1.001	0.996	1.003	1.01	1.00	0.99
SR 89	5.705E-05	5.757E-05	5.632E-05	1.001	1.010	0.988	0.99	1.01	1.02	5.705E-05	5.757E-05	5.632E-05	1.001	1.010	0.990	0.99	1.01	1.02	5.705E-05	5.757E-05	5.632E-05	1.001	1.010	0.990	0.99	1.01	1.02
SR 90	7.210E-04	7.180E-04	7.337E-04	0.996	0.991	1.013	1.01	0.98	0.98	6.420E-04	6.387E-04	6.527E-04	0.996	0.991	1.013	1.01	0.98	0.98	6.420E-04	6.387E-04	6.527E-04	0.996	0.991	1.013	1.01	0.98	0.98
Y 90	7.223E-04	7.182E-04	7.339E-04	0.997	0.991	1.013	1.01	0.98	0.98	6.422E-04	6.388E-04	6.528E-04	0.996	0.991	1.013	1.01	0.98	0.98	6.422E-04	6.388E-04	6.528E-04	0.996	0.991	1.013	1.01	0.98	0.98
Y 91	8.000E-05	8.051E-05	7.988E-05	0.998	1.005	0.997	0.99	1.00	1.01	4.582E-04	4.610E-04	4.581E-04	0.998	1.004	0.998	0.99	1.00	1.01	4.582E-04	4.610E-04	4.581E-04	0.998	1.004	0.998	0.99	1.00	1.01
ER 93	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02
ER 95	1.186E-06	1.197E-06	1.177E-06	0.999	1.009	0.992	0.99	1.01	1.02	4.195E-03	4.246E-03	4.315E-03	0.988	0.995	1.016	0.99	0.97	0.98	4.195E-03	4.246E-03	4.315E-03	0.988	0.995	1.016	0.99	0.97	0.98
NB 95	1.534E-06	1.548E-06	1.520E-06	1.000	1.009	0.991	0.99	1.01	1.02	9.312E-03	9.383E-03	9.543E-03	0.989	0.997	1.014	0.99	0.98	0.98	9.312E-03	9.383E-03	9.543E-03	0.989	0.997	1.014	0.99	0.98	0.98
TC 99	1.304E-01	1.331E-01	1.327E-01	0.987	1.008	1.005	0.98	0.98	1.00	1.304E-01	1.331E-01	1.327E-01	0.987	1.008	1.005	0.98	0.98	1.00	1.304E-01	1.331E-01	1.327E-01	0.987	1.008	1.005	0.98	0.98	1.00
RU106	5.632E-05	5.332E-05	5.735E-05	1.012	0.958	1.030	1.06	0.98	0.93	1.914E-04	1.812E-04	1.950E-04	1.012	0.958	1.031	1.06	0.98	0.93	1.914E-04	1.812E-04	1.950E-04	1.012	0.958	1.031	1.06	0.98	0.93
PD107	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90
SM125	7.875E-01	5.504E-01	6.413E-01	1.189	0.843	0.968	1.41	1.23	0.87	7.875E-01	5.504E-01	6.413E-01	1.189	0.843	0.968	1.41	1.23	0.87	7.875E-01	5.504E-01	6.413E-01	1.189	0.843	0.968	1.41	1.23	0.87
SB125	1.487E-04	9.762E-03	8.125E-03	1.362	0.894	0.744	1.52	1.83	1.20	4.347E-03	2.873E-03	2.376E-03	1.362	0.894	0.744	1.52	1.83	1.20	4.347E-03	2.873E-03	2.376E-03	1.362	0.894	0.744	1.52	1.83	1.20
I129	3.162E-02	3.286E-02	3.166E-02	0.987	1.025	0.988	0.96	1.00	1.04	3.178E-02	3.103E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04	3.178E-02	3.103E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS134	1.537E-05	1.515E-05	1.520E-05	1.009	0.994	0.997	1.01	1.01	1.00	2.942E-04	2.901E-04	2.910E-04	1.008	0.994	0.997	1.01	1.01	1.00	2.942E-04	2.901E-04	2.910E-04	1.008	0.994	0.997	1.01	1.01	1.00
CS135	3.415E-01	3.835E-01	3.784E-01	0.928	1.043	1.029	0.89	0.90	1.01	3.415E-01	3.835E-01	3.784E-01	0.928	1.043	1.029	0.89	0.90	1.01	3.415E-01	3.835E-01	3.784E-01	0.928	1.043	1.029	0.89	0.90	1.01
CS137	1.041E-05	1.036E-05	1.064E-05	0.994	0.989	1.016	1.00	0.98	0.97	9.293E-04	9.237E-04	9.505E-04	0.994	0.990	1.016	1.00	0.98	0.97	9.293E-04	9.237E-04	9.505E-04	0.994	0.990	1.016	1.00	0.98	0.97
CE144	1.166E-06	1.172E-06	1.169E-06	0.997	1.003	1.000	0.99	1.00	1.00	1.460E-04	1.469E-04	1.467E-04	0.996	1.003	1.001	0.99	1.00	1.00	1.460E-04	1.469E-04	1.467E-04	0.996	1.003	1.001	0.99	1.00	1.00
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND144	1.127E-09	1.102E-09	1.101E-09	1.015	0.993	0.992	1.02	1.02	1.00	1.554E-09	1.533E-09	1.531E-09	1.010	0.996	0.995	1.01	1.02	1.00	1.554E-09	1.533E-09	1.531E-09	1.010	0.996	0.995	1.01	1.02	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PM147	1.322E-05	1.762E-05	1.655E-05	0.837	1.115	1.048	0.75	0.80	1.06	3.638E-04	4.837E-04	4.546E-04	0.838	1.114	1.047	0.75	0.80	1.06	3.638E-04	4.837E-04	4.546E-04	0.838	1.114	1.047	0.75	0.80	1.06
SM147	1.261E-06	1.409E-06	1.502E-06	0.907	1.013	1.080	0.89	0.84	0.94	3.639E-06	4.645E-06	4.544E-06	0.851	1.086	1.063	0.78	0.80	1.02	3.639E-06	4.645E-06	4.544E-06	0.851	1.086	1.063	0.78	0.80	1.02
SM148	4.938E-11	3.322E-11	3.754E-11	1.233	0.830	0.937	1.49	1.32	0.88	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88
SM149	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SM151	3.592E-02	4.250E-02	3.384E-02	0.960	1.136	0.904	0.85	1.06	1.26	3.593E-02	4.092E-02	3.258E-02	0.960	1.136	0.904	0.85	1.06	1.26	3.593E-02	4.092E-02	3.258E-02	0.960	1.136	0.904	0.85	1.06	1.26
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU154	1.070E-04	1.076E-04	9.456E-03	1.038	1.044	0.918	0.99	1.13	1.14	7.199E-03	7.238E-03	6.361E-03	1.039	1.044	0.918	0.99	1.13	1.14	7.199E-03	7.238E-03	6.361E-03	1.039	1.044	0.918	0.99	1.13	1.14
EU155	6.573E-03	7.063E-03	6.334E-03	0.987	1.061	0.957	0.93	1.04	1.12	3.306E-03	3.552E-03	3.185E-03	0.988	1.061	0.951	0.93	1.04	1.12	3.306E-03	3.552E-03	3.185E-03	0.988	1.061	0.951	0.93	1.04	1.12
U234	1.055E-00	1.018E-00	9.976E-01	1.031	0.995	0.975	1.04	1.06	1.02	1.088E-00	1.055E-00	1.009E-00	1.036	1.004	0.960	1.03	1.04	1.05	1.088E-00	1.055E-00	1.009E-00	1.036	1.004	0.960	1.03	1.04	1.05
U235	1.619E-02	1.656E-02	1.717E-02	0.973	0.995	1.032	0.98	0.94	0.96	1.619E-02	1.656E-02	1.717E-02	0.973	0.995	1.032	0.98	0.94	0.96	1.619E-02	1.656E-02	1.717E-02	0.973	0.995	1.032	0.98	0.94	0.96
U236	2.500E-01	2.503E-01	2.489E-01	1.																							

CURIES PER MTU

AVERAGE-ABSOLUTE-DEVIATION, AS %	7.03	7.66	7.04	16.1	11.5	13.5	7.49	8.39	7.37	17.7	12.2	14.6
AV-ABS-DEV EXCLUDING LARGEST ONE, %	5.34	6.19	5.67	8.5	9.5	9.8	5.80	6.82	6.00	9.5	10.2	10.7
AV-ABS-DEV EXCLUDING LARGEST TWO, %	4.51	4.93	4.69	7.8	8.5	6.9	4.99	5.48	5.02	8.7	9.2	7.5
MUCS EXCLUDED, 1ST/2ND:	SB125	CM243	CM245 /	SM148	AM242	CM246	SB125	CM243	CM245 /	SM148	AM242	CM246

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.)

CURIES PER MTU

	50 YR									100 YR								
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SE 79	4.080E-01	3.747E-01	3.453E-01	1.085	0.997	0.918	1.09	1.18	1.09	4.078E-01	3.745E-01	3.451E-01	1.085	0.997	0.918	1.09	1.18	1.09
KR 85	3.697E-02	3.677E-02	3.704E-02	1.001	0.996	1.003	1.01	1.00	0.99	4.450E-01	4.450E-01	4.461E-01	1.001	0.996	1.003	1.01	1.00	0.99
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	2.200E-04	2.188E-04	2.236E-04	0.996	0.991	1.013	1.01	0.98	0.98	6.692E-03	6.655E-03	6.802E-03	0.996	0.991	1.013	1.01	0.98	0.98
Y 90	2.200E-04	2.189E-04	2.237E-04	0.996	0.991	1.013	1.01	0.98	0.98	6.693E-03	6.657E-03	6.803E-03	0.996	0.991	1.013	1.01	0.98	0.98
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.304E-01	1.331E-01	1.326E-01	0.988	1.008	1.004	0.98	0.98	1.00	1.304E-01	1.330E-01	1.326E-01	0.988	1.008	1.005	0.98	0.98	1.00
RU106	7.246E-10	6.594E-10	7.111E-10	1.038	0.944	1.018	1.10	1.02	0.93	8.472E-25	7.706E-25	8.332E-25	1.037	0.943	1.020	1.10	1.02	0.92
PD107	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90
SM126	7.872E-01	5.582E-01	6.411E-01	1.189	0.843	0.968	1.41	1.23	0.87	7.870E-01	5.581E-01	6.409E-01	1.189	0.843	0.968	1.41	1.23	0.87
SB125	5.592E-02	3.672E-02	3.058E-02	1.361	0.894	0.745	1.52	1.83	1.20	2.058E-07	1.351E-07	1.126E-07	1.361	0.894	0.745	1.52	1.83	1.20
I129	3.178E-02	3.303E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04	3.178E-02	3.303E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	7.925E-03	7.808E-03	7.839E-03	1.009	0.994	0.998	1.01	1.01	1.00	3.975E-10	3.913E-10	3.932E-10	1.009	0.993	0.998	1.02	1.01	1.00
CS135	3.415E-01	3.835E-01	3.784E-01	0.928	1.043	1.029	0.89	0.90	1.01	3.415E-01	3.835E-01	3.784E-01	0.928	1.043	1.029	0.89	0.90	1.01
CS137	3.285E-04	3.292E-04	3.380E-04	0.990	0.992	1.018	1.00	0.97	0.97	1.035E-04	1.043E-04	1.072E-04	0.986	0.993	1.021	0.99	0.97	0.97
CE144	5.734E-14	5.786E-14	5.876E-14	0.989	0.998	1.013	0.99	0.98	0.98	2.621E-33	0.0	2.745E-33	0.977	0.0	1.023	0.0	0.95	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.559E-09	1.539E-09	1.536E-09	1.009	0.996	0.994	1.01	1.01	1.00	1.559E-09	1.539E-09	1.536E-09	1.009	0.996	0.994	1.01	1.01	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	2.496E-01	3.315E-01	3.118E-01	0.839	1.114	1.048	0.75	0.80	1.06	4.571E-07	6.062E-07	5.706E-07	0.839	1.113	1.048	0.75	0.80	1.06
SK147	4.531E-06	5.859E-06	5.684E-06	0.846	1.094	1.061	0.77	0.80	1.03	4.531E-06	5.859E-06	5.684E-06	0.846	1.094	1.061	0.77	0.80	1.03
SK148	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88
SK149	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15
SK150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SK151	2.445E-02	2.893E-02	2.304E-02	0.960	1.136	0.904	0.85	1.06	1.26	1.664E-02	1.968E-02	1.568E-02	0.960	1.135	0.905	0.85	1.06	1.26
SK152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	1.915E-02	1.925E-02	1.692E-02	1.039	1.044	0.918	0.99	1.13	1.14	3.405E-00	3.420E-00	3.007E-00	1.039	1.044	0.918	1.00	1.13	1.14
EU155	6.135E-00	6.595E-00	5.915E-00	0.987	1.061	0.952	0.93	1.04	1.11	5.659E-03	6.088E-03	5.461E-03	0.987	1.061	0.952	0.93	1.04	1.11
U234	1.344E-00	1.331E-00	1.100E-00	1.068	1.058	0.874	1.01	1.22	1.21	1.540E-00	1.542E-00	1.169E-00	1.087	1.088	0.825	1.00	1.32	1.32
U235	1.621E-02	1.658E-02	1.717E-02	0.973	0.996	1.031	0.98	0.94	0.97	1.622E-02	1.659E-02	1.717E-02	0.974	0.996	1.031	0.98	0.94	0.97
U236	2.508E-01	2.510E-01	2.489E-01	1.002	1.003	0.995	1.00	1.01	1.01	2.516E-01	2.517E-01	2.489E-01	1.003	1.004	0.993	1.00	1.01	1.01
U238	3.177E-01	3.174E-01	3.173E-01	1.001	1.000	0.999	1.00	1.00	1.00	3.177E-01	3.174E-01	3.173E-01	1.001	1.000	0.999	1.00	1.00	1.00
NP237	3.551E-01	3.765E-01	3.014E-01	1.031	1.093	0.875	0.94	1.18	1.25	4.477E-01	4.480E-01	3.014E-01	1.074	1.152	0.775	0.93	1.39	1.49
PU238	1.670E-03	1.804E-03	1.515E-03	1.004	1.085	0.911	0.93	1.10	1.19	1.127E-03	1.217E-03	1.022E-03	1.004	1.085	0.911	0.93	1.10	1.19
PU239	3.134E-02	3.516E-02	3.279E-02	0.947	1.062	0.991	0.89	0.96	1.07	3.130E-02	3.512E-02	3.274E-02	0.947	1.063	0.991	0.89	0.96	1.07
PU240	5.347E-02	4.793E-02	4.702E-02	1.081	0.969	0.950	1.12	1.14	1.02	5.326E-02	4.775E-02	4.677E-02	1.081	0.969	0.949	1.12	1.14	1.02
PU241	1.157E-04	1.362E-04	1.358E-04	0.895	1.054	1.051	0.85	0.85	1.00	1.043E-03	1.289E-03	1.285E-03	0.865	1.069	1.066	0.81	0.81	1.00
PU242	1.806E-00	1.897E-00	2.239E-00	0.912	0.958	1.130	0.95	0.81	0.85	1.806E-00	1.897E-00	2.239E-00	0.912	0.958	1.130	0.95	0.81	0.85
AM241	3.779E-03	4.304E-03	4.290E-03	0.916	1.044	1.040	0.88	0.88	1.00	3.820E-03	4.370E-03	4.354E-03	0.914	1.045	1.041	0.87	0.88	1.00
AM242	4.931E-00	8.144E-00	3.987E-00	0.867	1.432	0.701	0.61	1.24	2.04	3.926E-00	6.483E-00	3.174E-00	0.867	1.432	0.701	0.61	1.24	2.04
AM243	1.822E-01	2.006E-01	2.327E-01	0.888	0.978	1.134	0.91	0.78	0.86	1.814E-01	1.997E-01	2.316E-01	0.888	0.978	1.134	0.91	0.78	0.86
CM242	4.078E-00	6.735E-00	3.307E-00	0.866	1.431	0.703	0.61	1.23	2.04	3.247E-00	5.362E-00	2.632E-00	0.867	1.431	0.702	0.61	1.23	2.04
CM243	5.333E-00	1.429E-00	4.784E-00	1.386	0.371	1.243	3.73	1.11	0.30	1.581E-00	4.236E-01	1.418E-00	1.386	0.371	1.243	3.73	1.11	0.30
CM244	3.143E-02	3.059E-02	3.900E-02	0.933	0.908	1.158	1.03	0.81	0.78	4.636E-01	4.512E-01	5.753E-01	0.933	0.908	1.158	1.03	0.81	0.78
CM245	1.633E-01	1.750E-01	2.536E-01	0.828	0.887	1.285	0.93	0.64	0.69	1.627E-01	1.742E-01	2.526E-01	0.828	0.887	1.245	0.93	0.64	0.69
CM246	3.575E-02	3.763E-02	4.849E-02	0.880	0.926	1.194	0.95	0.74	0.78	3.548E-02	3.736E-02	4.813E-02	0.880	0.927	1.194	0.95	0.74	0.78

AVERAGE-ABSOLUTE-DEVIATION, AS % 7.90 8.59 7.91 17.8 13.1 15.2
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.10 7.04 6.48 9.6 11.0 11.3
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.24 5.71 5.45 8.8 10.0 8.2
 NUCLS EXCLUDED, 1ST/2ND: SB125 CM243 CM245 / SM148 AM242 CM246

8.17 9.06 8.36 18.3 14.0 16.5
 6.39 7.50 6.96 9.9 12.0 12.5
 5.69 5.95 5.88 9.2 10.9 8.9
 SB125 CM243 CM245 / SM148 AM242 NP237

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURMUP (33.0 GWD/MTU, APPROX.)

CURIES PER MTU

	***** 300 YR *****									***** 1 KVR *****								
	ORIGEN2	ORIGEN-S	CINDER	Q2 AVG	Q2S AVG	CIN AVG	Q2 ORS	Q2 CIN	Q2S CIN	ORIGEN2	ORIGEN-S	CINDER	Q2 AVG	Q2S AVG	CIN AVG	Q2 ORS	Q2 CIN	Q2S CIN
SE 79	4.069E-01	3.737E-01	3.444E-01	1.085	0.997	0.918	1.09	1.18	1.09	4.039E-01	3.709E-01	3.418E-01	1.085	0.997	0.918	1.09	1.18	1.09
KR 85	3.529E-05	3.505E-05	3.534E-05	1.002	0.995	1.003	1.01	1.00	0.99	7.780E-25	7.726E-25	7.780E-25	1.002	0.995	1.002	1.01	1.00	0.99
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	5.734E-01	5.695E-01	5.822E-01	0.997	0.990	1.014	1.01	0.98	0.98	3.330E-06	3.305E-06	3.378E-06	0.998	0.990	1.012	1.01	0.99	0.98
Y 90	5.735E-01	5.696E-01	5.823E-01	0.997	0.990	1.012	1.01	0.98	0.98	3.331E-06	3.306E-06	3.379E-06	0.998	0.990	1.012	1.01	0.99	0.98
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	1.794E-00	1.811E-00	1.769E-00	1.001	1.011	0.988	0.99	1.01	1.02	1.793E-00	1.810E-00	1.768E-00	1.001	1.011	0.988	0.99	1.01	1.02
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.303E-01	1.329E-01	1.325E-01	0.988	1.008	1.005	0.98	0.98	1.00	1.300E-01	1.326E-01	1.322E-01	0.988	1.008	1.005	0.98	0.98	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90	1.153E-01	1.061E-01	1.181E-01	1.019	0.938	1.044	1.09	0.98	0.90
SN126	7.859E-01	5.573E-01	6.400E-01	1.189	0.843	0.968	1.41	1.23	0.87	7.821E-01	5.546E-01	6.369E-01	1.189	0.843	0.968	1.41	1.23	0.87
SM125	0.0	0.0	2.071E-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	3.178E-02	3.303E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04	3.178E-02	3.303E-02	3.185E-02	0.986	1.025	0.989	0.96	1.00	1.04
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	2.489E-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.414E-01	3.835E-01	3.783E-01	0.928	1.043	1.029	0.89	0.90	1.01	3.414E-01	3.834E-01	3.782E-01	0.929	1.043	1.029	0.89	0.90	1.01
CS137	1.019E-02	1.054E-02	1.083E-02	0.969	1.002	1.029	0.97	0.94	0.97	9.637E-06	1.092E-05	1.122E-05	0.910	1.031	1.059	0.88	0.86	0.97
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	1.559E-09	1.539E-09	1.536E-09	1.009	0.996	0.994	1.01	1.01	1.00	1.559E-09	1.539E-09	1.536E-09	1.009	0.996	0.994	1.01	1.01	1.00
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	0.0	0.0	6.399E-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	4.531E-06	5.859E-06	5.684E-06	0.846	1.094	1.061	0.77	0.80	1.03	4.531E-06	5.859E-06	5.684E-06	0.846	1.094	1.061	0.77	0.80	1.03
SM148	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88	4.964E-11	3.349E-11	3.788E-11	1.231	0.830	0.939	1.48	1.31	0.88
SM149	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15	8.980E-13	1.112E-12	9.672E-13	0.905	1.121	0.975	0.81	0.93	1.15
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.565E-01	4.218E-01	3.359E-01	0.960	1.136	0.904	0.85	1.06	1.26	1.622E-01	1.922E-01	1.531E-01	0.959	1.136	0.905	0.84	1.06	1.26
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	3.400E-07	3.411E-07	3.001E-07	1.040	1.043	0.918	1.00	1.13	1.14	0.0	0.0	9.428E-32	0.0	0.0	0.0	0.0	0.0	0.0
EU155	4.097E-15	4.421E-15	3.967E-15	0.984	1.062	0.953	0.93	1.03	1.11	0.0	0.0	1.297E-57	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.860E-00	1.889E-00	1.283E-00	1.109	1.126	0.765	0.98	1.45	1.47	1.942E+00	1.978E+00	1.311E+00	1.114	1.134	0.752	0.98	1.48	1.51
U235	1.628E-02	1.666E-02	1.717E-02	0.975	0.997	1.028	0.98	0.95	0.97	1.649E-02	1.690E-02	1.717E-02	0.978	1.003	1.019	0.98	0.96	0.98
U236	2.547E-01	2.545E-01	2.489E-01	1.008	1.007	0.985	1.00	1.02	1.02	2.651E-01	2.638E-01	2.489E-01	1.022	1.017	0.960	1.00	1.07	1.06
U238	3.177E-01	3.174E-01	3.173E-01	1.001	1.000	0.999	1.00	1.00	1.00	3.177E-01	3.174E-01	3.173E-01	1.001	1.000	0.999	1.00	1.00	1.00
NP237	6.113E-01	6.927E-01	3.014E-01	1.165	1.279	0.556	0.91	2.09	2.30	1.012E+00	1.129E+00	3.013E-01	1.243	1.387	0.370	0.90	3.36	3.75
PU238	2.336E-02	2.533E-02	2.117E-02	1.003	1.088	0.909	0.92	1.10	1.20	1.041E+00	1.195E+00	9.333E-01	0.985	1.131	0.883	0.87	1.12	1.28
PU239	3.113E-02	3.493E-02	3.255E-02	0.947	1.063	0.990	0.89	0.96	1.07	3.054E+02	3.427E+02	3.190E+02	0.947	1.063	0.990	0.89	0.96	1.07
PU240	5.216E-02	4.676E-02	4.579E-02	1.081	0.969	0.949	1.12	1.14	1.02	4.843E+02	4.341E+02	4.252E+02	1.081	0.969	0.949	1.12	1.14	1.02
PU241	2.290E-01	2.750E-01	1.031E-01	1.132	1.359	0.509	0.83	2.22	2.67	1.514E-01	1.622E-01	4.767E-16	1.448	1.552	0.000	0.93	****	****
9U242	1.805E-00	1.896E-00	2.238E-00	0.912	0.958	1.130	0.95	0.81	0.85	1.803E+00	1.894E+00	2.235E-00	0.912	0.958	1.130	0.95	0.81	0.85
AM241	2.798E-03	3.203E-03	3.192E-03	0.913	1.045	1.012	0.87	0.88	1.00	9.106E-02	1.083E-03	1.039E+03	0.913	1.046	1.042	0.87	0.88	1.00
AM242	1.577E-00	2.604E-01	1.275E-00	0.867	1.432	0.701	0.61	1.24	2.04	6.480E-02	1.070E-01	5.238E-02	0.867	1.432	0.701	0.61	1.24	2.04
AM243	1.780E-01	1.960E-01	2.273E-01	0.888	0.978	1.134	0.91	0.78	0.86	1.667E-01	1.835E-01	2.128E+01	0.888	0.978	1.134	0.91	0.78	0.86
CM242	1.304E-00	2.154E-01	1.057E-00	0.866	1.431	0.702	0.61	1.23	2.04	5.359E-02	8.849E-02	4.344E-02	0.867	1.431	0.702	0.61	1.23	2.04
CM243	1.220E-02	3.268E-03	1.094E-02	1.386	0.371	1.243	3.73	1.12	0.30	4.929E-10	1.320E-10	4.417E-10	1.386	0.371	1.243	3.73	1.12	0.30
CM244	2.196E-02	2.136E-02	2.725E-02	0.934	0.908	1.158	1.03	0.81	0.78	4.659E-11	4.944E-14	6.304E-14	2.993	0.003	0.004	****	****	0.78
CM245	1.600E-01	1.714E-01	2.485E-01	0.828	0.887	1.286	0.93	0.64	0.69	1.512E-01	1.619E-01	2.347E-01	0.828	0.887	1.285	0.93	0.64	0.69
CM246	3.446E-02	3.628E-02	4.674E-02	0.880	0.926	1.194	0.95	0.74	0.78	3.110E-02	3.274E-02	4.218E-02	0.880	0.926	1.194	0.95	0.74	0.78

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.)

CURIES PER MTU

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ORIGEN2  ORIGEN-S  CINDER  QR2  QRS  CIM  QR2  QR2  QRS
          AVG  AVG  AVG  ORS  CIM  ORS
SE 79  3.669E-01  3.370E-01  3.105E-01  1.085  0.997  0.918  1.09  1.18  1.09
KR 85  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
SR 89  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
SR 90  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
Y 90  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
Y 91  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
ER 93  1.786E+00  1.803E+00  1.761E+00  1.001  1.011  0.987  0.99  1.01  1.02
ER 95  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
MB 95  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
TC 99  1.262E-01  1.288E-01  1.284E-01  0.987  1.008  1.005  0.98  0.98  1.00
RU106  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
PD107  1.151E-01  1.060E-01  1.180E-01  1.018  0.938  1.044  1.09  0.98  0.90
SM126  7.348E-01  5.210E-01  5.984E-01  1.189  0.843  0.968  1.41  1.23  0.87
SB125  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
I129  3.177E-02  3.301E-02  3.184E-02  0.986  1.025  0.989  0.96  1.00  1.04
CS133  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
CS134  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
CS135  3.404E-01  3.824E-01  3.772E-01  0.928  1.043  1.029  0.89  0.90  1.01
CS137  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
CE144  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
ND143  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
ND144  1.559E-09  1.539E-09  1.536E-09  1.709  0.996  0.994  1.01  1.01  1.00
ND145  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
ND146  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
PM147  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
SM147  4.531E-06  5.859E-06  5.684E-06  0.846  1.094  1.061  0.77  0.80  1.03
SM148  4.964E-11  3.349E-11  3.788E-11  1.231  0.830  0.939  1.48  1.31  0.88
SM149  8.980E-13  1.112E-12  9.672E-13  0.905  1.121  0.975  0.81  0.93  1.15
SM150  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
SM151  1.274E-31  0.0  1.205E-31  1.028  0.0  0.972  0.0  1.06  0.0
SM152  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
EU153  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
EU154  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
EU155  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
U234  1.901E+00  1.936E+00  1.278E+00  1.115  1.135  0.750  0.98  1.49  1.51
U235  1.889E-02  1.959E-02  1.717E-02  1.018  1.056  0.926  0.96  1.10  1.14
U236  3.481E-01  3.383E-01  2.488E-01  1.117  1.085  0.798  1.03  1.40  1.36
U238  3.177E-01  3.174E-01  3.173E-01  1.001  1.000  0.999  1.00  1.00  1.00
NP237  1.193E+00  1.336E+00  3.005E-01  1.265  1.417  0.319  0.89  3.97  4.45
PU238  1.922E-19  3.167E-19  1.549E-19  0.869  1.431  0.700  0.61  1.24  2.04
PU239  2.382E-02  2.672E-02  2.463E-02  0.951  1.066  0.983  0.89  0.97  1.08
PU240  1.865E-02  1.672E-02  1.641E-02  1.081  0.969  0.951  1.12  1.14  1.02
PU241  7.268E-02  7.786E-02  0.0  0.966  1.034  0.0  0.93  0.0  0.0
PU242  1.775E+00  1.863E+00  2.198E+00  0.912  0.958  1.130  0.95  0.81  0.85
AM241  7.321E-02  8.178E-02  5.596E-04  1.412  1.577  0.011  0.90  ****  ****
AM242  9.740E-20  1.604E-19  7.848E-20  0.869  1.431  0.700  0.61  1.24  2.04
AM243  7.157E-00  7.880E+00  9.138E+00  0.888  0.978  1.134  0.91  0.78  0.86
CM242  8.078E-20  1.331E-19  6.510E-20  0.869  1.431  0.700  0.61  1.24  2.04
CM243  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
CM244  4.654E 11 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
CM245  7.255E-02  7.772E-02  1.124E-01  0.829  0.888  1.284  0.93  0.65  0.69
CM246  8.320E-03  8.757E-03  1.128E-02  0.880  0.926  1.193  0.95  0.74  0.78

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AVERAGE-ABSOLUTE-DEVIATION, AS % 10.30 13.49 15.93 13.7 ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 8.44 10.27 12.29 12.4 27.2 37.9
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.94 6.95 9.22 11.3 15.6 25.1
 NUCS EXCLUDED, 1ST/2ND: SM148 PU238 AM241 / SM126 CM242 NP237

[illegible]

	7.35	7.04	7.35	17.1	11.2	12.8
AVERAGE-ABSOLUTE-DEVIATION, AS %						
AV-ABS-DEV EXCLUDING LARGEST ONE,	5.27	5.32	5.63	7.6	9.4	8.8
AV-ABS-DEV EXCLUDING LARGEST TWO,	4.25	3.94	4.39	7.6	8.6	8.0
NOVS EXCLUDED, 1ST/2ND:	CM243	CM245	PM187	AM242	CM2	

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

	10 YR										20 YR									
	ORIGEN2	ORIGEN-5	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-5	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		
SE 79	6.141E-01	5.679E-01	5.191E-01	1.083	1.002	0.915	1.00	1.18	1.09	6.141E-01	5.679E-01	5.191E-01	1.083	1.002	0.915	1.00	1.18	1.09		
KR 85	7.202E-03	7.150E-03	7.190E-03	1.003	0.996	1.001	1.01	1.00	1.00	7.202E-03	7.150E-03	7.190E-03	1.003	0.997	1.001	1.01	1.00	1.00		
SR 89	1.395E-16	1.426E-16	1.443E-16	0.981	1.003	1.015	0.98	0.97	0.99	0.0	0.0	2.437E-30	0.0	0.0	0.0	0.0	0.0	0.0		
SR 90	5.579E-04	8.519E-04	8.695E-04	0.998	0.991	1.011	1.01	0.99	0.98	6.761E-04	6.714E-04	6.853E-04	0.998	0.991	1.011	1.01	0.99	0.98		
Y 90	8.581E-04	8.521E-04	8.697E-04	0.998	0.991	1.011	1.01	0.99	0.98	6.763E-04	6.716E-04	6.855E-04	0.998	0.991	1.011	1.01	0.99	0.98		
Y 91	1.775E-13	1.808E-13	1.855E-13	0.979	0.997	1.023	0.98	0.96	0.97	2.860E-32	0.0	2.997E-32	0.977	0.0	1.023	0.0	0.95	0.0		
KR 93	2.713E-00	2.730E-00	2.665E-00	1.004	1.010	0.986	0.99	1.02	1.02	2.713E+00	2.730E+00	2.665E+00	1.004	1.010	0.986	0.99	1.02	1.00		
SR 95	1.051E-11	1.065E-11	1.163E-11	0.962	0.974	1.064	0.99	0.90	0.92	6.866E-29	0.0	8.170E-29	0.913	0.0	1.087	0.0	0.84	0.0		
NB 95	2.333E-11	2.365E-11	2.571E-11	0.963	0.976	1.061	0.99	0.91	0.92	1.524E-28	0.0	1.807E-28	0.915	0.0	1.085	0.0	0.84	0.0		
TC 99	1.870E-01	1.923E-01	1.908E-01	0.984	1.012	1.004	0.97	0.98	1.01	1.870E+01	1.923E+01	1.908E+01	0.984	1.012	1.004	0.97	0.98	1.01		
RU106	7.367E-02	6.853E-02	7.614E-02	1.012	0.942	1.046	1.08	0.97	0.90	7.485E-01	7.070E-01	7.860E-01	1.033	0.931	1.035	1.11	1.00	0.90		
PD107	1.706E-01	1.554E-01	1.749E-01	1.022	0.931	1.048	1.10	0.98	0.89	1.706E+01	1.554E+01	1.749E+01	1.022	0.931	1.048	1.10	0.98	0.89		
SM126	1.141E-00	8.340E-01	9.420E-01	1.173	0.858	0.969	1.37	1.21	0.89	1.141E+00	8.339E-01	9.419E-01	1.174	0.858	0.969	1.37	1.21	0.89		
SB125	1.578E-03	1.100E-03	8.963E-02	1.324	0.923	0.752	1.43	1.76	1.23	1.292E+02	9.010E+01	7.340E+01	1.324	0.923	0.752	1.43	1.76	1.23		
I129	4.650E-02	4.955E-02	4.702E-02	0.975	1.039	0.986	0.94	0.99	1.05	4.650E-02	4.955E-02	4.702E-02	0.975	1.039	0.986	0.94	0.99	1.05		
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS134	1.004E-04	9.443E-03	9.879E-03	1.026	0.965	1.009	1.06	1.02	0.96	3.480E-01	3.274E+02	3.426E-01	1.026	0.965	1.010	1.06	1.02	0.96		
CS135	6.527E-02	7.207E-01	7.048E-01	0.942	1.040	1.017	0.91	0.93	1.02	6.527E-02	7.207E-01	7.048E-01	0.942	1.040	1.017	0.91	0.93	1.02		
CS137	1.235E-05	1.230E-05	1.263E-05	0.994	0.990	1.016	1.00	0.98	0.97	9.800E-04	9.772E-04	1.004E+05	0.993	0.990	1.017	1.				

CASE: PWR, 4.50 WT & U-235, 5.206 AT & BURNUP (50.0 GWD/WTU, APPROX.)

CURIES PER MTU

	50 YR										100 YR									
	ORIGEN2	ORIGEN-S	CINDER	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2
	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG
SR 79	6.139E-01	5.677E-01	5.189E-01	1.083	1.002	0.915	1.08	1.18	1.09	6.135E-01	5.678E-01	5.186E-01	1.083	1.002	0.915	1.08	1.18	1.09	6.135E-01	5.678E-01
KR 85	5.423E-02	5.389E-02	5.411E-02	1.003	0.996	1.001	1.01	1.00	1.00	2.139E-01	2.135E-01	2.135E-01	1.003	0.996	1.001	1.01	1.00	1.00	2.139E-01	2.135E-01
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	3.311E-04	3.287E-04	3.356E-04	0.998	0.991	1.011	1.01	0.99	0.94	1.007E-04	9.998E-03	1.021E-04	0.998	0.991	1.012	1.01	0.99	0.98	1.007E-04	9.998E-03
Y 90	3.312E-04	3.288E-04	3.356E-04	0.998	0.991	1.011	1.01	0.99	0.94	1.007E-04	1.000E-04	1.021E-04	0.998	0.991	1.012	1.01	0.99	0.98	1.007E-04	1.000E-04
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 93	2.711E-00	2.730E-00	2.665E-00	1.004	1.010	0.986	0.99	1.02	1.02	2.713E-00	2.730E-00	2.665E-00	1.004	1.010	0.986	0.99	1.02	1.02	2.713E-00	2.730E-00
SR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.870E-01	1.923E-01	1.908E-01	0.984	1.012	1.004	0.97	0.98	1.01	1.869E-01	1.922E-01	1.907E-01	0.984	1.012	1.004	0.97	0.98	1.01	1.869E-01	1.922E-01
PD106	8.616E-10	7.763E-10	8.648E-10	1.033	0.931	1.036	1.11	1.00	0.90	1.008E-24	9.072E-25	1.013E-24	1.033	0.929	1.038	1.11	1.00	0.90	1.008E-24	9.072E-25
PD107	1.706E-01	1.554E-01	1.749E-01	1.022	0.931	1.088	1.10	0.98	0.89	1.705E-01	1.555E-01	1.749E-01	1.022	0.931	1.088	1.10	0.98	0.89	1.705E-01	1.555E-01
SR126	1.141E-00	8.337E-02	9.418E-01	1.174	0.858	0.969	1.37	1.21	0.99	1.140E-00	8.338E-01	9.418E-01	1.173	0.858	0.969	1.37	1.21	0.99	1.140E-00	8.338E-01
SR125	7.094E-02	4.946E-02	4.031E-02	1.324	0.923	0.752	1.43	1.76	1.23	2.611E-07	1.820E-07	1.884E-07	1.324	0.923	0.752	1.43	1.76	1.23	2.611E-07	1.820E-07
SR129	4.650E-02	4.955E-02	4.702E-02	0.975	0.939	0.986	0.94	0.99	1.05	4.650E-02	4.955E-02	4.702E-02	0.975	0.939	0.986	0.94	0.99	1.05	4.650E-02	4.955E-02
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	1.452E-02	1.365E-02	1.429E-02	1.026	0.964	1.010	1.06	1.02	0.96	7.290E-10	6.840E-10	7.167E-10	1.026	0.964	1.010	1.06	1.02	0.96	7.290E-10	6.840E-10
CS135	6.527E-01	7.207E-01	7.048E-01	0.942	1.040	1.017	0.91	0.93	1.02	6.527E-01	7.207E-01	7.048E-01	0.942	1.040	1.017	0.91	0.93	1.02	6.527E-01	7.207E-01
CS137	4.900E-04	4.905E-04	5.040E-04	0.990	0.991	1.019	1.00	0.97	0.97	1.543E-04	1.555E-04	1.598E-04	0.990	0.991	1.021	0.99	0.97	0.97	1.543E-04	1.555E-04
CR144	6.154E-14	6.188E-14	6.478E-14	0.981	0.986	1.033	0.99	0.95	0.96	2.813E-33	0.0	3.026E-33	0.986	0.0	1.036	0.0	0.93	0.0	3.026E-33	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	2.480E-09	2.420E-09	2.417E-09	1.017	0.992	0.991	1.02	1.03	1.00	2.480E-09	2.420E-09	2.417E-09	1.017	0.992	0.991	1.02	1.03	1.00	2.480E-09	2.420E-09
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD147	2.608E-01	3.148E-01	3.476E-01	0.790	1.156	1.054	0.68	0.75	1.10	4.735E-07	6.974E-07	6.362E-07	0.791	1.155	1.054	0.68	0.75	1.10	4.735E-07	6.974E-07
SR147	9.955E-06	7.380E-06	7.082E-06	0.826	1.110	1.064	0.74	0.78	1.04	5.495E-06	7.380E-06	7.082E-06	0.826	1.110	1.064	0.74	0.78	1.04	5.495E-06	7.380E-06
SR148	9.303E-11	6.506E-11	7.265E-11	1.210	0.846	0.985	1.43	1.28	0.90	9.303E-11	6.506E-11	7.265E-11	1.210	0.846	0.985	1.43	1.28	0.90	9.303E-11	6.506E-11
SR149	1.023E-12	1.233E-12	1.143E-12	0.880	1.138	0.983	0.77	0.90	1.16	1.023E-12	1.233E-12	1.143E-12	0.880	1.138	0.983	0.77	0.90	1.16	1.023E-12	1.233E-12
SR150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR151	3.411E-02	4.237E-02	3.108E-02	0.951	1.182	0.867	0.81	1.10	1.36	2.321E-02	2.803E-02	2.115E-02	0.951	1.182	0.867	0.81	1.10	1.36	2.321E-02	2.803E-02
SR152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU154	3.348E-02	3.408E-02	2.996E-02	1.030	1.048	0.922	0.98	1.12	1.14	3.533E+00	6.056E+00	5.324E+00	1.030	1.048	0.922	0.98	1.12	1.14	3.533E+00	6.056E+00
RU155	1.110E-01	1.193E-01	1.090E-01	0.981	1.055	0.964	0.93	1.02	1.09	1.029E-02	1.101E-02	1.006E-02	0.981	1.055	0.964	0.93	1.02	1.09	1.029E-02	1.101E-02
U234	1.877E-00	1.963E-00	1.431E-00	1.064	1.117	0.818	0.96	1.31	1.37	2.309E+00	2.438E+00	1.566E+00	1.064	1.117	0.818	0.96	1.31	1.37	2.309E+00	2.438E+00
U235	1.752E-02	1.867E-02	1.943E-02	0.938	1.000	1.002	0.94	0.88	0.94	1.752E-02	1.867E-02	1.943E-02	0.938	1.000	1.002	0.94	0.88	0.94	1.752E-02	1.867E-02
U236	3.906E-01	3.914E-01	3.875E-01	1.002	1.004	0.994	1.00	1.01	1.01	3.914E-01	3.923E-01	3.875E-01	1.003	1.005	0.992	1.00	1.01	1.01	3.914E-01	3.923E-01
U237	3.100E-01	3.095E-01	3.095E-01	1.001	0.999	0.999	1.00	1.00	1.00	3.100E-01	3.095E-01	3.095E-01	1.001	0.999	0.999	1.00	1.00	1.00	3.100E-01	3.095E-01
MD237	6.014E-01	6.333E-01	5.420E-01	1.015	1.069	0.915	0.95	1.11	1.17	6.065E-01	7.265E-01	5.419E-01	1.034	1.115	0.932	0.94	1.27	1.34	6.065E-01	7.265E-01
P2339	3.653E-03	4.056E-03	3.482E-03	0.979	1.087	0.933	0.90	1.05	1.16	2.463E-03	2.736E-03	2.348E-03	0.979	1.088	0.933	0.90	1.03	1.17	2.463E-03	2.736E-03
P2338	3.623E-02	3.989E-02	3.595E-02	0.971	1.069	0.961	0.91	1.01	1.11	3.619E-02	3.988E-02	3.580E-02	0.971	1.069	0.960	0.91	1.01	1.11	3.619E-02	3.988E-02
P2401	6.190E-02	5.975E-02	5.354E-02	1.060	1.023	0.917	1.04	1.16	1.12	6.179E-02	5.968E-02	5.326E-02	1.061	1.024	0.915	1.04	1.16	1.12	6.179E-02	5.968E-02
P2401	1.559E-04	1.764E-04	1.804E-04	0.912	1.032	0.916	0.88	0.86	0.98	1.405E-03	1.669E-03	1.707E-03	0.982	1.087	1.071	0.84	0.82	0.90	1.405E-03	1.669E-03
P2422	2.982E-00	2.951E-00	3.599E-00	0.942	0.933	1.135	1.01	0.84	0.83	2.982E+00	2.951E+00	3.599E+00	0.942	0.933	1.135	1.01	0.84	0.83	2.982E+00	2.951E+00
AN241	5.146E-03	5.620E-03	5.751E-03	0.935	1.021	1.045	0.92	0.89	0.98	5.197E-03	5.701E-03	5.833E-03	0.932	1.022	1.046	0.91	0.89	0.98	5.197E-03	5.833E-03
AN242	9.316E-00	1.577E-01	7.536E-00	0.856	1.049	0.694	0.59	1.23	2.09	7.417E+00	1.256E+01	6.015E+00	0.856	1.049	0.694	0.59	1.23	2.09	7.417E+00	1.256E+01
AN243	3.667E-01	4.070E-01	4.068E-01	0.873	0.969	1.159	0.90	0.75	0.84	3.650E-01	4.050E-01	4.045E-01	0.873	0.969	1.159	0.90	0.75	0.84	3.650E-0	

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

CURIES PER MTU

	300 YR									1 KYR								
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SR 79	6.122E-01	5.662E-01	5.175E-01	1.003	1.002	0.915	1.00	1.18	1.09	6.077E-01	5.620E-01	5.137E-01	1.003	1.002	0.915	1.00	1.18	1.09
KR 85	5.176E-05	5.137E-05	5.164E-05	1.003	0.996	1.001	1.01	1.00	0.99	1.141E-24	1.132E-24	1.137E-24	1.004	0.996	1.000	1.01	1.00	1.00
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	8.624E-01	8.556E-01	8.736E-01	0.998	0.990	1.011	1.01	0.99	0.98	5.009E-06	4.965E-06	5.069E-06	0.999	0.990	1.011	1.01	0.99	0.98
Y 90	8.626E-01	8.558E-01	8.738E-01	0.998	0.990	1.011	1.01	0.99	0.98	5.010E-06	4.967E-06	5.070E-06	0.999	0.990	1.011	1.01	0.99	0.98
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 93	2.713E-00	2.730E-00	2.664E-00	1.004	1.010	0.986	0.99	1.02	1.02	2.712E-00	2.729E-00	2.663E-00	1.004	1.010	0.986	0.99	1.02	1.02
IR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.86PE-01	1.921E-01	1.906E-01	0.984	1.012	1.004	0.97	0.98	1.01	1.864E-01	1.917E-01	1.902E-01	0.984	1.012	1.004	0.97	0.98	1.01
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.706E-01	1.554E-01	1.749E-01	1.022	0.931	1.048	1.10	0.98	0.89	1.706E-01	1.554E-01	1.749E-01	1.022	0.931	1.048	1.10	0.98	0.89
SM126	1.139E-00	8.323E-01	9.401E-01	1.174	0.858	0.969	1.37	1.21	0.89	1.133E-00	8.283E-01	9.356E-01	1.173	0.858	0.969	1.37	1.21	0.89
SB125	0.0	0.0	2.730E-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	4.650E-02	4.955E-02	4.702E-02	0.975	1.039	0.986	0.94	0.99	1.05	4.649E-02	4.954E-02	4.702E-02	0.975	1.039	0.986	0.94	0.99	1.05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	4.536E-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	6.527E-01	7.207E-01	7.047E-01	0.942	1.040	1.017	0.91	0.93	1.02	6.525E-01	7.205E-01	7.046E-01	0.942	1.040	1.017	0.91	0.93	1.02
CS137	1.519E-02	1.570E-02	1.614E-02	0.969	1.001	1.030	0.97	0.94	0.97	1.436E-05	1.627E-05	1.672E-05	0.910	1.031	1.059	0.88	0.86	0.97
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	2.480E-09	2.420E-09	2.417E-09	1.017	0.992	0.991	1.02	1.03	1.00	2.480E-09	2.420E-09	2.417E-09	1.017	0.992	0.991	1.02	1.03	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	7.134E-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	5.495E-06	7.388E-06	7.082E-06	0.826	1.110	1.064	0.74	0.78	1.04	5.495E-06	7.388E-06	7.082E-06	0.826	1.110	1.064	0.74	0.78	1.04
SM148	9.303E-11	6.506E-11	7.265E-11	1.210	0.846	0.945	1.43	1.28	0.90	9.303E-11	6.506E-11	7.265E-11	1.210	0.846	0.945	1.43	1.28	0.90
SM149	1.023E-12	1.323E-12	1.143E-12	0.880	1.138	0.983	0.77	0.90	1.16	1.023E-12	1.323E-12	1.143E-12	0.880	1.138	0.983	0.77	0.90	1.16
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	4.973E-01	6.177E-01	4.532E-01	0.951	1.182	0.867	0.81	1.10	1.36	2.263E-01	2.815E-01	2.065E-01	0.950	1.182	0.867	0.80	1.10	1.36
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU154	5.946E-07	6.040E-07	5.314E-07	1.031	1.047	0.922	0.98	1.12	1.14	0.0	1.669E-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU155	7.411E-15	7.998E-15	7.310E-15	0.979	1.056	0.965	0.93	1.01	1.09	0.0	2.380E-57	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	3.006E-00	3.219E-00	1.790E-00	1.125	1.205	0.670	0.93	1.68	1.80	3.184E+00	3.418E+00	1.846E+00	1.131	1.214	0.656	0.93	1.72	1.85
U235	1.761E-02	1.876E-02	1.983E-02	0.940	1.001	1.059	0.94	0.89	0.95	1.785E-02	1.904E-02	1.983E-02	0.944	1.007	1.049	0.94	0.90	0.96
U236	3.952E-01	3.958E-01	3.875E-01	1.006	1.008	0.986	1.00	1.02	1.02	4.073E-01	4.075E-01	3.875E-01	1.016	1.017	0.967	1.00	1.05	1.05
U238	3.100E-01	3.095E-01	3.095E-01	1.001	0.999	0.999	1.00	1.00	1.00	3.100E-01	3.095E-01	3.095E-01	1.001	0.999	0.999	1.00	1.00	1.00
NP237	9.772E-01	1.046E+00	5.419E-01	1.143	1.223	0.634	0.93	1.80	1.93	1.496E+00	1.615E+00	5.418E-01	1.229	1.326	0.445	0.93	2.76	2.98
PU238	5.103E-02	5.685E-02	4.860E-02	0.978	1.090	0.932	0.90	1.05	1.17	2.242E+00	2.624E+00	2.105E+00	0.965	1.129	0.906	0.85	1.07	1.25
PU239	3.600E-02	3.963E-02	3.559E-02	0.971	1.069	0.960	0.91	1.01	1.11	3.535E+02	3.892E+02	3.488E+02	0.972	1.070	0.959	0.91	1.01	1.12
PU240	6.051E-02	5.842E-02	5.215E-02	1.061	1.024	0.914	1.04	1.16	1.12	5.619E+02	5.424E+02	4.842E+02	1.061	1.024	0.914	1.04	1.16	1.12
PU241	6.684E-01	7.510E-01	1.369E-01	1.288	1.448	0.264	0.89	4.88	5.49	5.439E-01	6.830E-01	6.332E-16	1.448	1.552	0.000	0.93	****	****
PU242	2.981E+00	2.951E+00	3.558E+00	0.942	0.933	1.125	1.01	0.84	0.83	2.978E+00	2.948E+00	3.553E+00	0.943	0.933	1.124	1.01	0.84	0.83
AM241	3.806E-03	4.180E-03	4.276E-03	0.931	1.023	1.046	0.91	0.89	0.98	1.239E+03	1.360E+03	1.391E+03	0.932	1.023	1.046	0.91	0.89	0.98
AM242	2.980E+00	5.043E+00	2.416E+00	0.856	1.449	0.694	0.59	1.23	2.09	1.224E+01	2.072E-01	9.927E-02	0.856	1.449	0.694	0.59	1.23	2.09
AM243	3.582E-01	3.975E-01	4.755E-01	0.873	0.969	1.159	0.90	0.75	0.84	3.354E+01	3.722E+01	4.453E+01	0.873	0.969	1.159	0.90	0.75	0.84
CM242	2.464E-00	4.171E-00	2.004E+00	0.856	1.448	0.696	0.59	1.23	2.08	1.013E-01	1.714E-01	8.234E-02	0.856	1.448	0.696	0.59	1.23	2.08
CM243	3.008E-02	6.398E-03	2.713E-02	1.419	0.302	1.280	4.70	1.11	0.24	1.215E-09	2.584E-10	1.095E-09	1.419	0.302	1.279	4.70	1.11	0.24
CM244	6.104E-02	6.037E-02	8.203E-02	0.900	0.890	1.210	1.01	0.74	0.74	1.083E-10	1.397E-13	1.898E-13	2.991	0.004	0.005	****	****	0.74
CM245	5.749E-01	6.161E-01	1.005E+00	0.785	0.842	1.373	0.93	0.57	0.61	5.430E-01	5.819E-01	9.494E-01	0.785	0.842	1.373	0.93	0.57	0.61
CM246	1.494E-01	1.699E-01	2.405E-01	0.801	0.911	1.289	0.88	0.62	0.71	1.348E-01	1.533E-01	2.171E-01	0.800	0.910	1.289	0.88	0.62	0.71

AVERAGE-ABSOLUTE-DEVIATION, AS % 9.03 11.61 12.35 20.7 26.0 34.3
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 7.07 8.72 10.23 10.8 15.8 20.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.00 7.20 8.78 8.9 13.1 16.0
 NUCS EXCLUDED, 1ST/2ND: SM148 CM243 PU241 / SM147 AM242 CM245

15.94 15.48 16.62 ****
 8.26 9.73 10.89 23.1 19.4 26.7
 7.06 7.45 9.79 12.1 14.3 19.3
 CM244 CM243 PU241 / SM148 AM242 NP237

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP 150.0 GWD/MTU, APPROX.)

CURIES PER MTU

	***** 10 KYR *****			*****					
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
SR 79	5.520E-01	5.105E-01	4.667E-01	1.003	1.002	0.916	1.08	1.18	1.09
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 93	2.701E+00	2.718E+00	2.653E+00	1.004	1.010	0.986	0.99	1.02	1.02
SR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.810E-01	1.861E-01	1.847E-01	0.984	1.012	1.004	0.97	0.98	1.01
BU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.704E-01	1.552E-01	1.747E-01	1.022	0.931	1.048	1.10	0.98	0.89
SM126	1.065E+00	7.782E-01	8.790E-01	1.174	0.858	0.969	1.37	1.21	0.89
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	4.648E-02	4.952E-02	4.700E-02	0.975	1.039	0.986	0.94	0.99	1.03
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	6.508E-01	7.186E-01	7.026E-01	0.942	1.040	1.017	0.91	0.93	1.02
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	2.480E-09	2.420E-09	2.417E-09	1.017	0.992	0.991	1.02	1.03	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	5.494E-06	7.388E-06	7.082E-06	0.826	1.110	1.064	0.74	0.78	1.04
SM148	9.303E-11	6.506E-11	7.265E-11	1.210	0.846	0.945	1.43	1.28	0.90
SM149	1.023E-12	1.323E-12	1.143E-12	0.880	1.138	0.983	0.77	0.90	1.16
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	1.778E-31	0.0	1.625E-31	1.045	0.0	0.955	0.0	1.09	0.0
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	3.113E+00	3.341E+00	1.800E+00	1.131	1.214	0.554	0.93	1.73	1.86
U235	2.064E-02	2.210E-02	1.983E-02	0.990	1.060	0.951	0.93	1.04	1.11
U236	5.036E-01	5.005E-01	3.874E-01	1.086	1.079	0.835	1.01	1.30	1.29
U238	3.100E-01	3.095E-01	3.095E-01	1.001	0.999	0.999	1.00	1.00	1.00
NP237	1.742E+00	1.885E+00	5.402E-01	1.254	1.357	0.389	0.92	3.22	3.49
PU238	3.632E-19	6.132E-19	2.936E-19	0.858	1.449	0.694	0.59	1.24	2.09
PU239	2.779E-02	3.059E-02	2.693E-02	0.977	1.076	0.947	0.91	1.03	1.13
PU240	2.164E-02	2.089E-02	1.868E-02	1.061	1.024	0.916	1.04	1.16	1.12
PU241	2.611E-01	2.798E-01	0.0	0.965	1.035	0.0	0.93	0.0	0.0
PU242	2.931E+00	2.901E+00	3.495E+00	0.943	0.933	1.124	1.01	0.84	0.83
AM241	2.619E-01	2.927E-01	7.496E-04	1.415	1.581	0.004	0.89	****	****
AM242	1.840E-19	3.107E-19	1.488E-19	0.858	1.449	0.694	0.59	1.24	2.09
AM243	1.440E-01	1.598E-01	1.912E-01	0.873	0.968	1.159	0.90	0.75	0.94
CM242	1.526E-19	2.577E-19	1.234E-19	0.858	1.449	0.694	0.59	1.24	2.09
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	1.081E-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	2.606E-01	2.793E-01	4.548E-01	0.786	0.842	1.372	0.93	0.57	0.61
CM246	3.606E-02	4.101E-02	5.805E-02	0.801	0.911	1.289	0.88	0.62	0.71

AVERAGE-ABSOLUTE-DEVIATION, AS % 10.67 14.23 16.93 13.8 ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 8.88 11.07 13.39 12.7 25.6 37.1
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 7.50 8.29 10.63 11.7 17.1 24.3
 NUCS EXCLUDED, 1ST/2ND: SM148 CM242 AM241 / SM147 PU238 NP237

PER MTU

501

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.)

CURIES PER MTU

10 YR										20 YR									
ORIGEN2	ORIGEN-S	CINDER	QRA AVG	QRS AVG	CIM AVG	QRA ORS	QRA CIM	QRS CIM	ORIGEN2	ORIGEN-S	CINDER	QRA AVG	QRS AVG	CIM AVG	QRA ORS	QRA CIM	QRS CIM	ORIGEN2	ORIGEN-S
SE 79	3.371E-01	3.135E-01	2.898E-01	1.075	1.000	0.925	1.08	1.16	1.08	3.371E-01	3.135E-01	2.897E-01	1.076	1.000	0.924	1.08	1.16	1.08	1.08
KR 85	3.994E-03	4.042E-03	4.148E-03	0.983	0.995	1.021	0.99	0.96	0.97	2.092E-03	2.117E-03	2.173E-03	0.983	0.995	1.021	0.99	0.96	0.97	0.97
SR 89	9.900E-17	1.025E-16	1.017E-16	0.980	1.014	1.006	0.97	0.97	1.01	0.0	0.0	1.718E-18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	4.687E-04	4.753E-04	4.957E-04	0.977	0.990	1.033	0.99	0.95	0.96	3.694E-04	3.745E-04	3.907E-04	0.977	0.990	1.033	0.99	0.95	0.96	0.96
Y 90	4.688E-04	4.754E-04	4.958E-04	0.977	0.990	1.033	0.99	0.95	0.96	3.695E-04	3.747E-04	3.908E-04	0.977	0.990	1.033	0.99	0.95	0.96	0.96
Y 91	1.255E-13	1.292E-13	1.296E-13	0.980	1.009	1.012	0.97	0.97	1.00	2.023E-12	0.0	2.094E-12	0.983	0.0	1.017	0.0	0.97	0.0	0.0
ER 93	1.491E-00	1.524E-00	1.503E-00	0.990	1.012	0.998	0.98	0.99	1.01	1.491E-00	1.524E-00	1.503E-00	0.990	1.012	0.998	0.98	0.99	1.01	1.01
ER 95	7.375E-12	7.475E-12	7.953E-12	0.970	0.983	1.046	0.99	0.93	0.94	4.818E-29	0.0	5.589E-29	0.926	0.0	1.075	0.0	0.86	0.0	0.0
NB 95	1.637E-11	1.660E-11	1.759E-11	0.971	0.985	1.044	0.99	0.93	0.94	1.070E-28	0.0	1.236E-28	0.928	0.0	1.072	0.0	0.87	0.0	0.0
TC 99	1.111E-01	1.127E-01	1.128E-01	0.990	1.004	1.005	0.99	0.98	1.00	1.111E-01	1.127E-01	1.128E-01	0.990	1.004	1.005	0.99	0.98	1.00	1.00
RU106	4.701E-02	4.275E-02	4.436E-02	1.052	0.956	0.992	1.10	1.06	0.96	4.954E-01	4.410E-01	4.578E-01	1.066	0.949	0.985	1.12	1.08	0.96	0.96
PD107	9.805E-02	8.615E-02	9.135E-02	1.068	0.938	0.995	1.14	1.07	0.94	9.805E-02	8.615E-02	9.135E-02	1.068	0.938	0.995	1.14	1.07	0.94	0.94
SM126	6.350E-01	4.585E-01	5.146E-01	1.185	0.855	0.960	1.38	1.23	0.89	6.350E-01	4.585E-01	5.146E-01	1.185	0.855	0.960	1.38	1.23	0.89	0.89
SB125	9.412E-02	6.334E-02	5.203E-02	1.348	0.907	0.745	1.49	1.81	1.22	7.707E-01	5.186E-01	4.261E-01	1.348	0.907	0.745	1.49	1.81	1.22	1.22
1129	2.667E-02	2.721E-02	2.596E-02	1.002	1.022	0.975	0.98	1.03	1.05	2.667E-02	2.721E-02	2.596E-02	1.002	1.022	0.975	0.98	1.03	1.05	1.05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	3.990E-03	3.784E-03	3.635E-03	1.049	0.995	0.956	1.05	1.10	1.04	1.384E-02	1.312E-02	1.261E-02	1.049	0.995	0.956	1.05	1.10	1.04	1.04
CS135	3.540E-01	3.522E-01	3.197E-01	1.035	1.030	0.935	1.01	1.11	1.10	3.540E-01	3.522E-01	3.197E-01	1.035	1.030	0.935	1.01	1.11	1.10	1.10
CS137	6.870E-04	6.837E-04	7.003E-04	0.995	0.990	1.014	1.00	0.98	0.98	5.452E-04	5.433E-04	5.565E-04	0.994	0.991	1.015	1.00	0.98	0.98	0.98
CB144	1.221E-02	1.237E-02	1.244E-02	0.989	1.002	1.008	0.99	0.98	0.99	1.655E-02	1.678E-02	1.693E-02	0.988	1.002	1.011	0.99	0.98	0.99	0.99
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.262E-09	1.292E-09	1.330E-09	0.975	0.998	1.027	0.98	0.95	0.97	1.262E-09	1.292E-09	1.330E-09	0.975	0.998	1.027	0.98	0.95	0.97	0.97
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	8.375E-03	1.100E-04	1.057E-04	0.839	1.102	1.059	0.76	0.79	1.04	5.964E-02	7.834E-02	7.525E-02	0.839	1.102	1.059	0.76	0.79	1.04	1.04
SM147	3.939E-06	5.019E-06	5.011E-06	0.846	1.078	1.076	0.78	0.79	1.00	4.130E-06	5.275E-06	5.257E-06	0.845	1.079	1.076	0.78	0.79	1.00	1.00
SM148	4.127E-11	2.863E-11	2.928E-11	1.248	0.866	0.866	1.44	1.41	0.98	4.127E-11	2.863E-11	2.928E-11	1.248	0.866	0.866	1.44	1.41	0.98	0.98
SM149	7.145E-13	7.660E-13	6.030E-13	1.029	1.103	0.868	0.93	1.18	1.27	7.145E-13	7.660E-13	6.030E-13	1.029	1.103	0.868	0.93	1.18	1.27	1.27
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	2.994E-02	2.734E-02	2.138E-02	1.142	1.043	0.815	1.10	1.40	1.28	2.772E-02	2.531E-02	1.980E-02	1.142	1.043	0.815	1.10	1.40	1.28	1.28
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	3.750E-03	3.556E-03	2.973E-03	1.094	1.038	0.868	1.05	1.26	1.20	1.675E-03	1.588E-03	1.328E-03	1.095	1.038	0.868	1.05	1.26	1.20	1.20
EU155	1.303E-03	1.259E-03	9.760E-02	1.105	1.068	0.828	1.03	1.34	1.29	3.222E-02	3.113E-02	2.413E-02	1.105	1.068	0.828	1.04	1.34	1.29	1.29
U234	9.712E-01	9.639E-01	9.363E-01	1.015	1.007	0.978	1.01	1.04	1.03	1.018E-00	1.010E-00	9.516E-01	1.025	1.017	0.958	1.01	1.07	1.06	1.06
U235	1.511E-02	1.421E-02	1.297E-02	1.072	1.008	0.920	1.06	1.16	1.10	1.511E-02	1.421E-02	1.297E-02	1.072	1.008	0.920	1.06	1.16	1.10	1.10
U236	2.079E-01	2.099E-01	2.122E-01	0.990	1.000	1.010	0.99	0.98	0.99	2.081E-01	2.101E-01	2.122E-01	0.990	1.000	1.010	0.99	0.98	0.99	0.99
U238	3.203E-01	3.204E-01	3.210E-01	0.999	0.999	1.001	1.00	1.00	1.00	3.203E-01	3.204E-01	3.210E-01	0.999	0.999	1.001	1.00	1.00	1.00	1.00
NP237	2.454E-01	2.414E-01	1.868E-01	1.093	1.075	0.832	1.02	1.31	1.29	2.520E-01	2.477E-01	1.868E-01	1.101	1.082	0.816	1.02	1.35	1.33	1.33
PU238	1.720E-03	1.682E-03	1.291E-03	1.100	1.075	0.825	1.02	1.33	1.30	1.589E-03	1.555E-03	1.193E-03	1.099	1.076	0.825	1.02	1.33	1.30	1.30
PU239	3.013E-02	3.037E-02	2.206E-02	1.095	1.104	0.802	0.99	1.37	1.38	3.012E-02	3.036E-02	2.205E-02	1.095	1.104	0.802	0.99	1.37	1.38	1.38
PU240	4.850E-02	4.234E-02	4.213E-02	1.094	0.955	0.951	1.15	1.15	1.00	4.853E-02	4.237E-02	4.208E-02	1.095	0.956	0.949	1.15	1.15	1.01	1.01
PU241	7.166E-04	6.794E-04	5.803E-04	1.088	1.031	0.881	1.05	1.23	1.17	4.428E-04	4.240E-04	3.621E-04	1.081	1.035	0.884	1.04	1.22	1.17	1.17
PU242	1.509E-00	1.449E-00	1.774E-00	0.957	0.919	1.125	1.04	0.85	0.82	1.509E-00	1.449E-00	1.774E-00	0.957	0.919	1.125	1.04	0.85	0.82	0.82
AM241	1.580E-03	1.490E-03	1.268E-03	1.093	1.030	0.877	1.06	1.25	1.18	2.459E-03	2.328E-03	1.982E-03	1.090	1.032	0.878	1.06	1.24	1.17	1.17
AM242	6.685E-00	7.971E-00	3.273E-00	1.119	1.334	0.548	0.84	2.04	2.44	6.387E+00	7.615E+00	3.127E+00	1.119	1.334	0.548	0.84	2.04	2.44	2.44
AM243	1.409E-01	1.273E-01	1.395E-01	1.037	0.937	1.026	1.11	1.01	0.91	1.407E-01	1.272E-01	1.393E-01	1.037	0.937	1.026	1.11	1.01	0.91	0.91
CM242	5.538E-00	6.601E-00	2.720E-00	1.118	1.333	0.549	0.84	2.04	2.43	5.282E+00	6.298E+00	2.593E+00	1.118	1.333	0.549	0.84	2.04	2.43	2.43
CM243	1.182E-01	3.259E-00	8.104E-00	1.530	0.422	1.049	3.63	1.46	0.40	9.265E+00	2.555E+00	6.354E+00	1.529	0.422	1.049	3.63	1.46	0.40	0.40
CM244	9.984E-02	7.643E-02	8.375E-02	1.152	0.882	0.966	1.31	1.19	0.91	6.809E+02	5.212E+02	5.712E+02	1.152	0.882	0.966	1.31	1.19	0.91	0.91
CM245	1.063E-01	7.872E-02	8.088E-02	1.199	0.888	0.913	1.35	1.31	0.97	1.062E-01	7.865E-02	8.081E-02	1.199	0.888	0.913	1.35	1.31	0.97	0.97
CM246	2.052E-02	1.713E-02	1.816E-02	1.103	0.921	0.976	1.20	1.13	0.94	2.049E-02	1.711E-02	1.814E-02	1.103	0.921	0.976	1.20	1.13	0.94	0.94

AVERAGE-ABSOLUTE-DEVIATION, AS % 8.73 7.00 8.52 15.5 20.5 16.6 9.14 7.62 8.93 16.8 21.4 18.1
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.98 5.11 7.33 9.7 18.0 12.6 7.38 5.58 7.74 10.5 18.9 13.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.49 4.14 6.38 8.6 14.4 9.2 6.90 4.54 6.80 9.3 15.2 10.1
 NUCS EXCLUDED, 1ST/2ND: SB125 CM243 AM242 / SM148 AM243 CM242 SB125 CM243 AM242 / SM148 AM243 CM242

CASE: BWR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GWD/MTU, APPROX.)

CURIES PER MTU

		50 YR										100 YR										CURIES										PER MTU																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		ORIGEN2	ORIGEN-S	CINDER	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR

CASE: BNR, 2.68 WT & U-235, 2.866 AT & BURNUP (27.5 GMD/MTU, APPROX.)

CURIES

PER MTU

	300 YR										1 Kyr									
	ORIGEN2	ORIGEN S	CINDER	OR2	QRS	CIN	OR2	QRS	CIN	OR2	QRS	CIN	OR2	QRS	CIN	OR2	QRS	CIN	OR2	QRS
SR 79	3.161E-01	3.125E-01	2.809E-01	1.076	1.000	0.924	1.08	1.16	1.08	3.336E-01	3.102E-01	2.867E-01	1.076	1.000	0.924	1.08	1.16	1.08	3.336E-01	3.102E-01
SR 85	2.870E-05	2.901E-05	2.980E-05	0.984	0.995	1.022	0.99	0.96	0.97	6.328E-25	6.393E-25	6.560E-25	0.985	0.995	1.021	0.99	0.96	0.97	6.328E-25	6.393E-25
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	4.711E-01	4.774E-01	4.981E-01	0.977	0.990	1.033	0.99	0.95	0.96	2.736E-06	2.771E-06	2.890E-06	0.977	0.990	1.033	0.99	0.95	0.96	2.736E-06	2.771E-06
Y 90	4.712E-01	4.775E-01	4.982E-01	0.977	0.990	1.033	0.99	0.95	0.96	2.737E-06	2.772E-06	2.891E-06	0.978	0.990	1.032	0.99	0.95	0.96	2.737E-06	2.772E-06
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IR 93	1.490E-00	1.524E-00	1.503E-00	0.990	1.012	0.998	0.98	0.99	1.01	1.490E-00	1.523E-00	1.502E-00	0.990	1.012	0.998	0.98	0.99	1.01	1.490E-00	1.523E-00
IR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.110E-01	1.126E-01	1.127E-01	0.990	1.004	1.005	0.99	0.98	1.00	1.108E-01	1.124E-01	1.125E-01	0.990	1.004	1.005	0.99	0.98	1.00	1.108E-01	1.124E-01
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	9.804E-02	9.135E-02	9.135E-02	1.067	0.938	0.995	1.14	1.07	0.94	9.804E-02	9.134E-02	9.134E-02	1.068	0.938	0.995	1.14	1.07	0.94	9.804E-02	9.134E-02
SM126	6.337E-01	4.576E-01	5.136E-01	1.185	0.855	0.960	1.38	1.23	0.89	6.307E-01	4.554E-01	5.111E-01	1.185	0.855	0.960	1.38	1.23	0.89	6.307E-01	4.554E-01
SB125	0.0	0.0	1.585E-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	2.667E-02	2.721E-02	2.596E-02	1.002	1.022	0.975	0.98	1.03	1.05	2.667E-02	2.721E-02	2.596E-02	1.002	1.022	0.975	0.98	1.03	1.05	2.667E-02	2.721E-02
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	1.669E-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.540E-01	3.522E-01	3.197E-01	1.035	1.030	0.935	1.01	1.11	1.10	3.539E-01	3.521E-01	3.196E-01	1.035	1.030	0.935	1.01	1.11	1.10	3.539E-01	3.521E-01
CS137	8.454E-01	8.729E-01	8.946E-01	0.971	1.002	1.027	0.97	0.95	0.98	7.995E-06	9.043E-06	9.268E-06	0.912	1.031	1.057	0.88	0.86	0.98	7.995E-06	9.043E-06
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	5.575E-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	4.145E-06	5.295E-06	5.275E-06	0.845	1.079	1.076	0.78	0.79	1.00	4.145E-06	5.295E-06	5.275E-06	0.845	1.079	1.076	0.78	0.79	1.00	4.145E-06	5.295E-06
SM148	4.127E-11	2.863E-11	2.928E-11	1.226	0.866	0.886	1.44	1.41	0.98	4.127E-11	2.863E-11	2.928E-11	1.226	0.866	0.886	1.44	1.41	0.98	4.127E-11	2.863E-11
SM149	7.145E-13	7.660E-13	6.030E-13	1.029	1.103	0.868	0.93	1.18	1.27	7.145E-13	7.660E-13	6.030E-13	1.029	1.103	0.868	0.93	1.18	1.27	7.145E-13	7.660E-13
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.208E-01	2.929E-01	2.291E-01	1.142	1.043	0.815	1.10	1.40	1.28	1.459E-01	1.315E-01	1.044E-01	1.140	1.044	0.816	1.09	1.40	1.28	1.459E-01	1.315E-01
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	2.650E-07	2.508E-07	2.099E-07	1.095	1.037	0.868	1.06	1.26	1.19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	3.249E-15	3.153E-15	2.445E-15	1.102	1.059	0.829	1.01	1.33	1.29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.527E-00	1.508E-00	1.118E-00	1.103	1.089	0.808	1.01	1.37	1.35	1.508E-00	1.568E-00	1.137E-00	1.110	1.096	0.785	1.01	1.30	1.38	1.508E-00	1.568E-00
U235	1.519E-02	1.430E-02	1.297E-02	1.073	1.010	0.916	1.06	1.17	1.10	1.540E-02	1.450E-02	1.272E-02	1.078	1.015	0.908	1.06	1.19	1.12	1.519E-02	1.430E-02
U236	2.120E-01	2.135E-01	2.122E-01	0.997	1.004	0.998	0.99	1.00	1.01	2.215E-01	2.218E-01	2.122E-01	1.014	1.015	0.971	1.00	1.04	1.05	2.120E-01	2.135E-01
U238	3.203E-01	3.204E-01	3.210E-01	0.999	0.999	1.001	1.00	1.00	1.00	3.203E-01	3.204E-01	3.210E-01	0.999	0.999	1.001	1.00	1.00	1.00	3.203E-01	3.204E-01
NP237	5.332E-01	5.168E-01	1.860E-01	1.293	1.234	0.453	1.03	2.85	2.77	8.796E-01	8.489E-01	1.860E-01	1.378	1.330	0.293	1.04	4.71	4.54	5.332E-01	5.168E-01
PU238	1.762E-02	1.727E-02	1.317E-02	1.100	1.078	0.822	1.02	1.34	1.31	8.259E-02	8.407E-02	5.863E-02	1.100	1.119	0.781	0.99	1.41	1.43	1.762E-02	1.727E-02
PU239	2.989E-02	3.013E-02	2.180E-02	1.095	1.104	0.801	0.99	1.37	1.38	2.932E-02	3.055E-02	2.180E-02	1.095	1.104	0.801	0.99	1.37	1.38	2.989E-02	3.013E-02
PU240	4.710E-02	4.127E-02	4.085E-02	1.096	0.937	0.947	1.15	1.16	1.01	4.391E-02	3.832E-02	3.794E-02	1.096	0.937	0.947	1.15	1.16	1.01	4.710E-02	4.127E-02
PU241	1.660E-01	1.552E-01	6.691E-02	1.283	1.200	0.517	1.07	2.48	2.32	9.825E-02	7.274E-02	3.090E-02	1.724	1.276	0.600	1.35	4.88	4.88	1.660E-01	1.552E-01
PU242	1.508E-00	1.449E-00	1.774E-00	0.956	0.919	1.125	1.04	0.85	0.82	1.507E-00	1.447E-00	1.771E-00	0.957	0.919	1.124	1.04	0.85	0.82	1.508E-00	1.449E-00
AM241	2.544E-03	2.438E-03	2.077E-03	1.081	1.036	0.883	1.04	1.22	1.17	8.279E-02	7.935E-02	6.758E-02	1.081	1.036	0.883	1.04	1.23	1.17	2.544E-03	2.438E-03
AM242	1.782E-00	2.120E-00	8.721E-01	1.119	1.324	0.548	0.84	2.04	2.44	7.321E-02	8.726E-02	3.593E-02	1.119	1.334	0.548	0.84	2.04	2.44	1.782E-00	2.120E-00
AM243	1.371E-01	1.239E-01	1.357E-01	1.037	0.937	1.026	1.11	1.01	0.91	1.288E-01	1.160E-01	1.271E-01	1.037	0.937	1.026	1.11	1.01	0.91	1.371E-01	1.239E-01
CM242	1.473E-00	1.756E-00	7.233E-01	1.118	1.333	0.549	0.84	2.04	2.43	6.054E-02	7.216E-02	2.972E-02	1.118	1.333	0.549	0.84	2.04	2.43	1.473E-00	1.756E-00
CM243	1.021E-02	2.017E-03	7.007E-03	1.530	0.421	1.048	3.63	1.46	0.0	2.132E-10	1.138E-10	2.829E-10	1.531	0.422	1.048	3.63	1.46	0.0	1.021E-02	2.017E-03
CM244	1.509E-02	1.155E-02	1.266E-02	1.152	0.882	0.965	1.31	1.19	0.91	2.832E-11	2.672E-11	2.939E-11	2.984	0.003	0.003	0.003	0.003	0.003	1.509E-02	1.155E-02
CM245	1.039E-01	7.688E-02	7.898E-02	1.200	0.888	0.912	1.35	1.32	0.99	9.809E-02	7.861E-02	7.459E-02	1.200	0.888	0.912	1.35	1.32	0.99	1.039E-01	7.688E-02
CM246	1.967E-02	1.642E-02	1.741E-02	1.103	0.921	0.976	1.20	1.13	0.94	1.775E-02	1.482E-02	1.571E-02	1.103	0.921	0.976	1.20	1.13	0.94	1.967E-02	1.642E-02

AVERAGE ABSOLUTE DEVIATION, AS % 10.29 9.13 11.87 16.7 30.5 27.7

AV. ABS. DEV. EXCLUDING LARGEST ONE, % 7.98 7.04 10.80 9.9 25.5 22.3

AV. ABS. DEV. EXCLUDING LARGEST TWO, % 7.04 6.49 9.89 8.7 18.5 15.5

MUS EXCLUDED, 1ST/2ND: SM148 CM243 NP237 / CM245 AM243 PU241

17.50 12.67 16.85 17.6 33.0 31.4
8.72 7.92 11.88 17.6 33.0 31.4
7.29 6.89 10.13 9.9 22.1 19.7
PU241 / SM148 AM243 NP237

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.)

CURIES

PER MTU

	ORIGEN2	ORIGEN-S	CINDER	10 KYR Q22 AVG	Q22 AVG	CIN AVG	Q22 OR2	Q22 CIN	Q22 CIN
SE 79	3.030E-01	2.818E-01	2.605E-01	1.075	1.000	0.925	1.08	1.16	1.09
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	1.484E-00	1.517E-00	1.496E-00	0.990	1.012	0.998	0.98	0.99	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.076E-01	1.091E-01	1.092E-01	0.990	1.004	1.005	0.99	0.99	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	9.794E-02	8.606E-02	9.125E-02	1.067	0.938	0.995	1.14	1.07	0.94
SM126	5.925E-01	4.279E-01	4.802E-01	1.185	0.855	0.960	1.38	1.23	0.99
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	2.666E-02	2.720E-02	2.595E-02	1.002	1.022	0.975	0.98	1.03	1.05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	3.529E-01	3.512E-01	3.188E-01	1.035	1.030	0.935	1.00	1.11	1.10
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.262E-09	1.292E-09	1.330E-09	0.975	0.998	1.047	0.98	0.95	0.97
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	4.145E-06	5.295E-06	5.276E-06	0.845	1.079	1.076	0.78	0.79	1.00
SM148	4.127E-11	2.863E-11	2.928E-11	1.248	0.866	0.886	1.44	1.41	0.98
SM149	7.145E-13	7.660E-13	6.030E-13	1.029	1.103	0.868	0.93	1.18	1.27
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	1.146E-31	0.0	8.217E-32	1.165	0.0	0.835	0.0	1.39	0.0
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	1.556E-00	1.537E-00	1.108E-00	1.111	1.098	0.791	1.11	1.40	1.39
U235	1.769E-02	1.682E-02	1.297E-02	1.118	1.063	0.820	1.05	1.36	1.30
U236	2.968E-01	2.875E-01	2.122E-01	1.118	1.083	0.799	1.03	1.40	1.35
U238	3.203E-01	3.204E-01	3.210E-01	0.999	0.999	1.001	1.00	1.00	1.00
NP237	1.044E-00	1.006E-00	1.862E-01	1.401	1.350	0.250	1.04	5.61	5.40
PU238	2.171E-19	2.583E-19	1.059E-19	1.120	1.333	0.547	0.84	2.05	2.44
PU239	2.202E-02	2.298E-02	1.655E-02	1.098	1.106	0.796	0.99	1.38	1.39
PU240	1.691E-02	1.475E-02	1.464E-02	1.096	0.956	0.949	1.15	1.16	1.01
PU241	4.716E-02	3.492E-02	0.0	1.149	0.851	0.0	1.35	0.0	0.0
PU242	1.483E-00	1.423E-00	1.742E-00	0.957	0.918	1.124	1.04	0.85	0.82
AM241	4.763E-02	3.685E-02	3.641E-04	1.684	1.303	0.013	1.29	****	****
AM242	1.100E-19	1.308E-19	5.369E-20	1.121	1.332	0.547	0.84	2.05	2.44
AM243	5.512E-00	4.981E-00	5.457E-00	1.037	0.937	1.026	1.11	1.01	0.91
CM242	9.124E-20	1.085E-19	4.453E-20	1.121	1.333	0.547	0.84	2.05	2.44
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	2.829E-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	4.708E-02	3.485E-02	3.573E-02	1.200	0.889	0.911	1.35	1.32	0.98
CM246	4.749E-03	3.963E-03	4.201E-03	1.103	0.921	0.976	1.20	1.13	0.94

AVERAGE-ABSOLUTE-DEVIATION, AS % 12.59 11.57 10.29 13.0 **** ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 10.23 10.93 15.88 11.1 46.1 46.7
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 8.50 9.83 13.51 10.2 29.1 30.5
 NUCS EXCLUDED, 1ST/2ND: SM148 AM243 AM241 / CM245 NP237

[illegible]

	6.32	7.31	7.15	15.2	11.4	18.9
AVERAGE-ABSOLUTE-DEVIATION, AS %						
AV-ABS-DEV EXCLUDING LARGEST ONE, %	5.17	5.06	6.12	8.3	9.3	9.9
AV-ABS-DEV EXCLUDING LARGEST TWO, %	4.64	4.26	4.94	8.3	9.3	9.9
AV-ABS-DEV EXCLUDING LARGEST TWO, 1ST/2ND, %	CM203	SM151 / SM180	AM242	PUZ180		

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

CURIES PER MTU

***** 10 YR *****										***** 20 YR *****									
ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR5 AVG	CIN AVG	OR2 ORS	OR2 CIN	OR5 CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR5 AVG	CIN AVG	OR2 ORS	OR2 CIN	OR5 CIN	ORIGEN2	ORIGEN-S
SR 79	4.932E-01	4.591E-01	4.221E-01	1.077	1.002	0.921	1.07	1.17	1.09	4.931E-01	4.591E-01	4.220E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.931E-01
KR 85	5.890E-03	5.815E-03	5.956E-03	1.001	0.988	1.012	1.01	0.99	0.98	3.085E-03	3.046E-03	3.120E-03	1.000	0.988	1.012	1.01	0.99	0.98	3.085E-03
SR 89	1.034E-16	1.066E-16	1.064E-16	0.980	1.011	1.009	0.97	0.97	1.00	0.0	1.796E-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	7.185E-04	7.051E-04	7.357E-04	0.998	0.980	1.022	1.02	0.98	0.96	5.664E-04	5.537E-04	5.799E-04	0.998	0.979	1.022	1.02	0.98	0.96	5.664E-04
Y 90	7.187E-04	7.053E-04	7.359E-04	0.998	0.980	1.022	1.02	0.98	0.96	5.665E-04	5.559E-04	5.800E-04	0.998	0.980	1.022	1.02	0.98	0.96	5.665E-04
Y 91	1.301E-13	1.333E-13	1.343E-13	0.981	1.006	1.013	0.98	0.97	0.99	2.096E-32	0.0	2.169E-32	0.983	0.0	1.017	0.0	0.97	0.0	2.096E-32
XR 93	2.250E-00	2.249E-00	2.222E-00	1.004	1.004	0.992	1.00	1.01	1.01	2.250E-00	2.249E-00	2.222E-00	1.004	1.004	0.992	1.00	1.01	1.01	2.250E-00
XR 95	7.431E-12	7.539E-12	8.035E-12	0.969	0.983	1.048	0.99	0.92	0.94	4.855E-29	0.0	5.647E-29	0.925	0.0	1.075	0.0	0.86	0.0	4.855E-29
NR 95	1.650E-11	1.674E-11	1.777E-11	0.970	0.985	1.045	0.99	0.93	0.94	1.078E-28	0.0	1.249E-28	0.927	0.0	1.073	0.0	0.86	0.0	1.078E-28
TC 99	1.586E-01	1.594E-01	1.593E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.586E-01	1.594E-01	1.593E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.586E-01
RU106	4.775E-02	4.527E-02	4.715E-02	1.022	0.969	1.009	1.05	1.01	0.96	5.031E-01	4.670E-01	4.866E-01	1.036	0.962	1.002	1.08	1.03	0.96	5.031E-01
PD107	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01
SN126	8.254E-01	6.339E-01	6.969E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.254E-01	6.339E-01	6.969E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.254E-01
SB125	1.058E-03	7.794E-02	6.270E-02	1.288	0.949	0.763	1.36	1.69	1.24	8.662E-01	6.382E-01	5.114E-01	1.288	0.949	0.763	1.36	1.69	1.24	8.662E-01
I129	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	6.145E-03	6.015E-03	5.994E-03	1.015	0.994	0.991	1.02	1.03	1.00	2.131E-02	2.085E-02	2.079E-02	1.016	0.994	0.991	1.02	1.03	1.00	2.131E-02
CS135	6.097E-01	6.803E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.097E-01	6.803E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.097E-01
CS137	9.825E-04	9.781E-04	1.001E-05	0.995	0.991	1.014	1.00	0.98	0.98	7.798E-04	7.773E-04	7.957E-04	0.994	0.991	1.015	1.00	0.98	0.98	7.798E-04
CR144	1.308E-02	1.311E-02	1.320E-02	0.996	0.998	1.005	1.00	0.99	0.99	1.778E-02	1.796E-02	1.796E-02	0.994	0.998	1.008	1.00	0.99	0.99	1.778E-02
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	9.577E-03	1.290E-04	1.207E-04	0.832	1.120	1.048	0.74	0.79	1.07	6.820E-02	9.182E-02	8.593E-02	0.832	1.120	1.048	0.74	0.79	1.07	6.820E-02
SH147	5.351E-06	6.507E-06	6.586E-06	0.868	1.065	1.068	0.81	0.81	1.00	5.569E-06	6.868E-06	6.867E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.569E-06
SH148	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11
SH149	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH151	3.661E-02	4.217E-02	3.001E-02	1.010	1.163	0.828	0.87	1.22	1.41	3.389E-02	3.904E-02	2.779E-02	1.009	1.163	0.828	0.87	1.22	1.40	3.389E-02
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH154	5.697E-03	5.764E-03	4.918E-03	1.043	1.056	0.901	0.99	1.16	1.17	2.544E-03	2.574E-03	2.196E-03	1.043	1.056	0.901	0.99	1.16	1.17	2.544E-03
SH155	1.903E-03	2.101E-03	1.675E-03	1.005	1.110	0.885	0.91	1.14	1.25	4.705E-02	5.194E-02	4.142E-02	1.005	1.110	0.885	0.91	1.14	1.25	4.705E-02
U234	1.450E-00	1.416E-00	1.361E-00	1.029	1.005	0.966	1.02	1.07	1.04	1.536E-00	1.511E-00	1.389E-00	1.039	1.022	0.939	1.02	1.11	1.09	1.536E-00
U235	1.948E-02	2.182E-02	2.030E-02	0.949	1.063	0.989	0.89	0.96	1.07	1.949E-02	2.182E-02	2.030E-02	0.949	1.062	0.988	0.89	0.96	1.07	1.949E-02
U236	3.413E-01	3.441E-01	3.441E-01	0.995	1.003	1.003	0.99	0.99	1.00	3.415E-01	3.443E-01	3.441E-01	0.995	1.003	1.002	0.99	0.99	1.00	3.415E-01
U238	3.142E-01	3.134E-01	3.143E-01	1.001	0.998	1.001	1.00	1.00	1.00	3.142E-01	3.134E-01	3.143E-01	1.001	0.998	1.001	1.00	1.00	1.00	3.142E-01
NP237	4.224E-01	4.135E-01	3.399E-01	1.078	1.055	0.867	1.02	1.24	1.22	4.300E-01	4.220E-01	3.399E-01	1.082	1.062	0.856	1.02	1.27	1.24	4.300E-01
PU238	3.163E-03	3.508E-03	2.661E-03	1.017	1.128	0.855	0.90	1.19	1.32	2.923E-03	3.242E-03	2.459E-03	1.017	1.128	0.855	0.90	1.19	1.32	2.923E-03
PU239	3.027E-02	3.624E-02	2.551E-02	0.987	1.181	0.832	0.84	1.19	1.42	3.026E-02	3.623E-02	2.551E-02	0.987	1.181	0.832	0.84	1.19	1.42	3.026E-02
PU240	5.341E-02	4.870E-02	4.791E-02	1.068	0.974	0.958	1.10	1.11	1.02	5.349E-02	4.879E-02	4.786E-02	1.069	0.975	0.956	1.10	1.12	1.02	5.349E-02
PU241	8.040E-04	8.983E-04	7.606E-04	0.979	1.094	0.926	0.90	1.06	1.18	4.968E-04	5.605E-04	4.746E-04	0.973	1.098	0.929	0.89	1.05	1.18	4.968E-04
PU242	1.844E-00	1.949E-00	2.355E-00	0.900	0.951	1.149	0.95	0.78	0.83	1.844E-00	1.949E-00	2.355E-00	0.900	0.951	1.149	0.95	0.78	0.83	1.844E-00
AM241	1.799E-03	2.023E-03	1.712E-03	0.975	1.097	0.928	0.89	1.05	1.18	2.785E-03	3.129E-03	2.647E-03	0.976	1.096	0.928	0.89	1.05	1.18	2.785E-03
AM242	9.175E-00	1.686E-01	6.425E-00	0.848	1.558	0.594	0.54	1.43	2.62	8.766E-00	1.611E-01	6.139E-00	0.848	1.558	0.594	0.54	1.43	2.62	8.766E-00
AM243	1.926E-01	2.162E-01	2.377E-01	0.894	1.003	1.103	0.89	0.81	0.91	1.926E-01	2.160E-01	2.375E-01	0.894	1.003	1.103	0.89	0.81	0.91	1.926E-01
CH242	7.600E-00	1.396E-01	5.339E-00	0.848	1.557	0.595	0.54	1.42	2.61	7.250E-00	1.332E-01	5.092E-00	0.848	1.557	0.595	0.54	1.42	2.62	7.250E-00
CH243	1.801E-01	5.082E-00	1.623E-01	1.374	0.388	1.238	3.54	1.11	0.31	1.412E-01	3.985E-00	1.273E-01	1.374	0.388	1.239	3.54	1.11	0.31	1.412E-01
CH244	1.552E-03	1.642E-03	1.887E-03	0.916	0.969	1.114	0.95	0.82	0.87	1.059E-03	1.120E-03	1.287E-03	0.917	0.969	1.114	0.95	0.82	0.87	1.059E-03
CH245	1.798E-01	2.182E-01	2.493E-01	0.833	1.011	1.155	0.82	0.72	0.88	1.797E-01	2.180E-01	2.491E-01	0.833	1.011	1.155	0.82	0.72	0.88	1.797E-01
CH246	4.096E-02	5.118E-02	5.885E-02	0.814	1.017	1.169	0.80	0.70	0.87	4.090E-02	5.110E-02	5.877E-02	0.814	1.017	1.169	0.80	0.70	0.87	4.090E-02

AVERAGE-ABSOLUTE-DEVIATION, AS % 6.72 8.42 8.32 16.1 12.8 18.4
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.60 7.05 7.37 9.2 10.7 13.6
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.90 5.76 6.30 8.3 10.0 10.0
 NUCL EXCLUDED, 1ST/2ND: SB125 CH243 SH151 / SH148 AM242 PU242

SB125 CH243 SH151 / SH148 AM242 PU242
 7.11 9.21 8.70 17.5 13.5 20.0
 5.99 7.76 7.75 10.0 11.5 14.9
 5.30 6.38 6.69 9.1 10.7 10.9

CASE: BMR, 4.15 MT & U-235, 4.172 AT & BURNUP (40.0 GWD/MTU, APPROX.)

CURIES PER MTU

	*****										*****										*****									
	ORIGEN2		ORIGEN-S		CINDER		50 YR		100 YR		ORIGEN2		ORIGEN-S		CINDER		50 YR		100 YR		ORIGEN2		ORIGEN-S		CINDER		50 YR		100 YR	
							OR2	ORS	CIN	OR2	ORS	OR2	ORS	CIN	OR2	ORS	CIN	OR2	ORS	CIN	OR2	ORS	CIN	OR2	ORS	CIN	OR2	ORS	CIN	
SR 79	4.929E-01	4.589E-01	4.219E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.927E-01	4.587E-01	4.217E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.927E-01	4.587E-01	4.217E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.927E-01	4.587E-01	4.217E-01
KR 85	4.435E-02	4.378E-02	4.484E-02	1.001	0.988	1.012	1.01	0.99	0.98	1.749E-01	1.726E-01	1.768E-01	1.001	0.988	1.012	1.01	0.99	0.98	1.749E-01	1.726E-01	1.768E-01	1.001	0.988	1.012	1.01	0.99	0.98	1.749E-01	1.726E-01	1.768E-01
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SR 90	2.773E-04	2.721E-04	2.839E-04	0.998	0.980	1.022	1.02	0.98	0.96	8.436E-03	8.275E-03	8.636E-03	0.998	0.979	1.022	1.02	0.98	0.96	8.436E-03	8.275E-03	8.636E-03	0.998	0.979	1.022	1.02	0.98	0.96	8.436E-03	8.275E-03	8.636E-03
Y 90	2.774E-04	2.722E-04	2.840E-04	0.998	0.980	1.022	1.02	0.98	0.96	8.438E-03	8.277E-03	8.638E-03	0.998	0.979	1.022	1.02	0.98	0.96	8.438E-03	8.277E-03	8.638E-03	0.998	0.979	1.022	1.02	0.98	0.96	8.438E-03	8.277E-03	8.638E-03
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ER 93	2.250E+00	2.249E+00	2.222E+00	1.004	1.004	0.992	1.00	1.01	1.01	2.250E+00	2.249E+00	2.222E+00	1.004	1.004	0.992	1.00	1.01	1.01	2.250E+00	2.249E+00	2.222E+00	1.004	1.004	0.992	1.00	1.01	1.01	2.250E+00	2.249E+00	2.222E+00
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TC 99	1.586E-01	1.594E-01	1.593E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.586E-01	1.594E-01	1.593E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.586E-01	1.594E-01	1.593E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.586E-01	1.594E-01	1.593E-01
RU106	5.526E-10	5.128E-10	5.352E-10	1.036	0.961	1.003	1.08	1.03	0.96	6.462E-25	5.992E-25	6.272E-25	1.035	0.960	1.005	1.08	1.03	0.96	6.462E-25	5.992E-25	6.272E-25	1.035	0.960	1.005	1.08	1.03	0.96	6.462E-25	5.992E-25	6.272E-25
PD107	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01	1.132E-01	1.193E-01
SM126	8.252E-01	6.337E-01	6.967E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.249E-01	6.335E-01	6.965E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.249E-01	6.335E-01	6.965E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.249E-01	6.335E-01	6.965E-01
SB125	4.756E-02	3.503E-02	2.820E-02	1.288	0.949	0.764	1.36	1.69	1.24	1.750E-07	1.289E-07	1.038E-07	1.288	0.948	0.764	1.36	1.69	1.24	1.750E-07	1.289E-07	1.038E-07	1.288	0.948	0.764	1.36	1.69	1.24	1.750E-07	1.289E-07	1.038E-07
I129	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02	3.828E-02	3.651E-02
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS134	8.888E-03	8.693E-03	8.670E-03	1.016	0.993	0.991	1.02	1.03	1.00	4.458E-10	4.357E-10	4.349E-10	1.016	0.993	0.991	1.02	1.03	1.00	4.458E-10	4.357E-10	4.349E-10	1.016	0.993	0.991	1.02	1.03	1.00	4.458E-10	4.357E-10	4.349E-10
CS135	6.096E-01	6.802E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.096E-01	6.802E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.096E-01	6.802E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.096E-01	6.802E-01	6.229E-01
CS137	3.899E-04	3.901E-04	3.994E-04	0.992	0.992	1.016	1.00	0.98	0.98	1.228E-04	1.237E-04	1.266E-04	0.987	0.995	1.018	0.99	0.97	0.98	1.228E-04	1.237E-04	1.266E-04	0.987	0.995	1.018	0.99	0.97	0.98	1.228E-04	1.237E-04	1.266E-04
CB144	4.411E-14	4.436E-14	4.530E-14	0.989	0.995	1.016	0.99	0.97	0.98	2.017E-33	0.0	2.116E-33	0.976	0.0	1.024	0.0	0.95	0.0	2.017E-33	0.0	2.116E-33	0.976	0.0	1.024	0.0	0.95	0.0	2.017E-33	0.0	2.116E-33
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND144	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09	1.913E-09	1.972E-09
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PH147	2.463E-01	3.113E-01	3.102E-01	0.832	1.120	1.048	0.74	0.79	1.07	4.510E-07	6.058E-07	5.676E-07	0.833	1.119	1.048	0.74	0.79	1.07	4.510E-07	6.058E-07	5.676E-07	0.833	1.119	1.048	0.74	0.79	1.07	4.510E-07	6.058E-07	5.676E-07
SH147	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.586E-06	6.891E-06	6.889E-06
SH148	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11	5.198E-11	5.362E-11
SH149	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13	9.902E-13	7.410E-13
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SH151	2.690E-02	3.099E-02	2.205E-02	1.010	1.163	0.827	0.87	1.22	1.41	1.830E-02	2.108E-02	1.501E-02	1.009	1.163	0.828	0.87	1.22	1.40	1.830E-02	2.108E-02	1.501E-02	1.009	1.163	0.828	0.87	1.22	1.40	1.830E-02	2.108E-02	1.501E-02
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SH153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU154	2.267E-02	2.293E-02	1.957E-02	1.044	1.056	0.901	0.99	1.16	1.17	4.031E+00	4.076E+00	3.479E+00	1.044	1.055	0.901	0.99	1.16	1.17	4.031E+00	4.076E+00	3.479E+00	1.044	1.055	0.901	0.99	1.16	1.17	4.031E+00	4.076E+00	3.479E+00
EU155	7.105E-00																													

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

CURIES PER MTU

300 YR										1 KYR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S
SE 79	4.916E-01	4.577E-01	4.208E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.880E-01	4.543E-01	4.177E-01	1.076	1.002	0.921	1.07	1.17	1.09	4.880E-01
KR 85	4.233E-05	4.173E-05	4.278E-05	1.001	0.987	1.012	1.01	0.99	0.98	9.332E-25	9.198E-25	9.410E-25	1.002	0.987	1.011	1.01	0.99	0.98	9.332E-25
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	7.227E-01	7.081E-01	7.392E-01	0.999	0.979	1.022	1.02	0.98	0.96	4.197E-06	4.110E-06	4.289E-06	1.000	0.979	1.022	1.02	0.98	0.96	4.197E-06
Y 90	7.228E-01	7.083E-01	7.394E-01	0.999	0.979	1.022	1.02	0.98	0.96	4.198E-06	4.111E-06	4.290E-06	1.000	0.979	1.022	1.02	0.98	0.96	4.198E-06
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	2.250E-00	2.249E-00	2.222E-00	1.004	1.004	0.992	1.00	1.01	1.01	2.249E-00	2.248E-00	2.221E-00	1.004	1.004	0.992	1.00	1.01	1.01	2.249E-00
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.585E-01	1.593E-01	1.591E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.581E-01	1.589E-01	1.588E-01	0.997	1.002	1.001	0.99	1.00	1.00	1.581E-01
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01	1.132E-01	1.193E-01	1.017	0.965	1.017	1.05	1.00	0.95	1.193E-01
SM126	8.238E-01	6.326E-01	6.955E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.198E-01	6.296E-01	6.921E-01	1.148	0.882	0.970	1.30	1.18	0.91	8.198E-01
SB125	0.0	0.0	1.910E-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02	3.828E-02	3.651E-02	0.976	1.036	0.988	0.94	0.99	1.05	3.605E-02
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	2.752E-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	5.096E-01	6.802E-01	6.229E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.095E-01	6.801E-01	6.227E-01	0.956	1.067	0.977	0.90	0.98	1.09	6.095E-01
CS137	1.208E-02	1.249E-02	1.279E-02	0.970	1.003	1.027	0.97	0.94	0.98	1.142E-05	1.294E-05	1.325E-05	0.911	1.032	1.057	0.88	0.86	0.98	1.142E-05
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97	1.965E-09
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	6.365E-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00	5.586E-06
SM148	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97	6.945E-11
SM149	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34	7.626E-13
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.922E-01	4.518E-01	3.216E-01	1.009	1.163	0.828	0.87	1.22	1.40	1.785E-01	2.059E-01	1.465E-01	1.009	1.163	0.828	0.87	1.22	1.41	1.785E-01
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	4.026E-07	4.065E-07	3.472E-07	1.045	1.055	0.901	0.99	1.16	1.17	0.0	0.0	1.091E-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	4.745E-15	5.260E-15	4.197E-15	1.002	1.111	0.887	0.90	1.13	1.25	0.0	0.0	1.372E-57	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	2.471E-00	2.550E-00	1.687E-00	1.105	1.140	0.754	0.97	1.46	1.51	2.583E+00	2.677E+00	1.721E+00	1.110	1.150	0.740	0.96	1.50	1.56	2.583E+00
U235	1.957E-02	2.192E-02	2.030E-02	0.950	1.064	0.986	0.89	0.96	1.08	1.978E-02	2.217E-02	2.030E-02	0.953	1.068	0.978	0.89	0.97	1.09	1.978E-02
U236	3.458E-01	3.483E-01	3.441E-01	0.999	1.006	0.994	0.99	1.00	1.01	3.563E-01	3.578E-01	3.441E-01	1.010	1.014	0.976	1.00	1.04	1.04	3.563E-01
U238	3.142E-01	3.134E-01	3.143E-01	1.001	0.998	1.001	1.00	1.00	1.00	3.142E-01	3.134E-01	3.143E-01	1.001	0.998	1.001	1.00	1.00	1.00	3.142E-01
NP237	7.473E-01	7.816E-01	3.398E-01	1.200	1.255	0.546	0.96	2.20	2.30	1.138E+00	1.225E+00	3.398E-01	1.263	1.360	0.377	0.93	3.35	3.61	1.138E+00
PU238	3.230E-02	3.604E-02	2.714E-02	1.015	1.132	0.853	0.90	1.19	1.33	1.460E+00	1.758E+00	1.202E+00	0.951	1.193	0.816	0.83	1.21	1.46	1.460E+00
PU239	3.004E-02	3.596E-02	2.530E-02	0.987	1.182	0.831	0.84	1.19	1.42	2.947E+02	3.528E+02	2.480E+02	0.987	1.182	0.831	0.84	1.19	1.42	2.947E+02
PU240	5.221E-02	4.766E-02	4.648E-02	1.070	0.977	0.953	1.10	1.12	1.03	4.848E+02	4.425E+02	4.315E+02	1.070	0.977	0.953	1.10	1.12	1.03	4.848E+02
PU241	2.455E-01	3.168E-01	8.757E-02	1.133	1.462	0.404	0.77	2.80	3.62	1.662E-01	2.016E-01	4.049E-16	1.356	1.644	0.000	0.82	***	***	1.662E-01
PU242	1.844E-00	1.949E-00	2.354E-00	0.900	0.951	1.149	0.95	0.78	0.83	1.842E+00	1.947E+00	2.352E+00	0.900	0.951	1.149	0.95	0.78	0.83	1.842E+00
AM241	2.871E-03	3.257E-03	2.754E-03	0.970	1.100	0.930	0.88	1.04	1.18	9.343E+02	1.060E+03	8.963E+02	0.970	1.100	0.930	0.88	1.04	1.18	9.343E+02
AM242	2.445E-00	4.492E-00	1.712E-00	0.848	1.558	0.594	0.54	1.43	2.62	1.005E-01	1.846E-01	7.034E-02	0.848	1.558	0.594	0.54	1.43	2.62	1.005E-01
AM243	1.874E-01	2.104E-01	2.313E-01	0.894	1.003	1.103	0.89	0.81	0.91	1.755E-01	1.970E-01	2.166E-01	0.894	1.003	1.103	0.89	0.81	0.91	1.755E-01
CM242	2.022E-00	3.715E-00	1.420E-00	0.848	1.557	0.595	0.54	1.42	2.62	8.309E-02	1.526E-01	5.835E-02	0.848	1.557	0.595	0.54	1.42	2.62	8.309E-02
CM243	1.557E-02	4.392E-03	1.403E-02	1.374	0.388	1.238	3.55	1.11	0.31	6.289E-10	1.774E-10	5.666E-10	1.374	0.388	1.238	3.55	1.11	0.31	6.289E-10
CM244	2.347E-02	2.480E-02	2.853E-02	0.917	0.969	1.114	0.95	0.82	0.87	3.943E-11	5.740E-14	6.600E-14	2.991	0.004	0.005	***	***	0.87	3.943E-11
CM245	1.756E-01	2.131E-01	2.434E-01	0.833	1.011	1.155	0.82	0.72	0.88	1.659E-01	2.013E-01	2.299E-01	0.834	1.011	1.155	0.82	0.72	0.88	1.659E-01
CM246	3.926E-02	4.905E-02	5.641E-02	0.814	1.017	1.169	0.80	0.70	0.87	3.543E-02	4.426E-02	5.091E-02	0.814	1.017	1.169	0.80	0.70	0.87	3.543E-02

AVERAGE-ABSOLUTE-DEVIATION, AS % 7.67 11.79 12.21 18.5 21.4 32.8
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.25 9.27 10.55 11.4 17.1 25.0
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.08 7.43 8.17 9.5 12.1 12.8
 NUCS EXCLUDED, 1ST/2ND: SM148 CM243 PU241 / CM246 AM242 NP237

14.62 16.00 16.89 ***
 7.26 10.29 11.32 20.2 21.1 31.7
 5.87 7.72 8.57 12.8 14.3 22.9
 CM244 CM243 PU241 / SM148 AM242 NP237

CASE: BWR, 4.15 MT & U-235, 4.172 AT & BURNUP 140.0 GWD/MTU, APPROX.1

CURIEN PER MTU

***** 10 KYR *****									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
SE 79	4.433E-01	4.127E-01	3.794E-01	1.076	1.002	0.921	1.07	1.17	1.09
KR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	2.240E-00	2.239E-00	2.212E-00	1.004	1.004	0.992	1.00	1.01	1.01
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	1.535E-01	1.543E-01	1.542E-01	0.997	1.002	1.001	0.99	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.192E-01	1.131E-01	1.192E-01	1.017	0.965	1.017	1.05	1.00	0.95
SM126	7.702E-01	5.915E-01	6.503E-01	1.148	0.882	0.970	1.30	1.18	0.91
SB125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	3.603E-02	3.826E-02	3.650E-02	0.976	1.036	0.988	0.94	0.99	1.05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	6.078E-01	6.782E-01	6.210E-01	0.956	1.067	0.977	0.90	0.98	1.09
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	1.965E-09	1.913E-09	1.972E-09	1.008	0.981	1.011	1.03	1.00	0.97
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	5.586E-06	6.891E-06	6.889E-06	0.865	1.067	1.067	0.81	0.81	1.00
SM148	6.945E-11	5.198E-11	5.362E-11	1.190	0.891	0.919	1.34	1.30	0.97
SM149	7.626E-13	9.902E-13	7.410E-13	0.917	1.191	0.891	0.77	1.03	1.34
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	1.402E-31	0.0	1.153E-31	1.097	0.0	0.903	0.0	1.22	0.0
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	2.527E-00	2.618E-00	1.678E-00	1.111	1.151	0.738	0.97	1.51	1.56
U235	2.209E-02	2.494E-02	2.030E-02	0.984	1.111	0.905	0.89	1.09	1.23
U236	4.394E-01	4.336E-01	3.440E-01	1.083	1.069	0.848	1.01	1.28	1.26
U238	3.142E-01	3.134E-01	3.143E-01	1.001	0.998	1.001	1.00	1.00	1.00
MP237	1.323E-00	1.435E-00	3.388E-01	1.282	1.390	0.328	0.92	3.90	4.24
PU238	2.983E-19	5.462E-19	2.080E-19	0.850	1.557	0.593	0.55	1.43	2.63
PU239	2.331E-02	2.752E-02	1.914E-02	0.991	1.185	0.824	0.84	1.20	1.44
PU240	1.867E-02	1.704E-02	1.665E-02	1.070	0.976	0.954	1.10	1.12	1.02
PU241	7.976E-02	9.679E-02	0.0	0.904	1.096	0.0	0.82	0.0	0.0
PU242	1.812E-00	1.915E-00	2.313E-00	0.900	0.951	1.149	0.95	0.78	0.83
AM241	8.030E-02	1.015E-01	4.828E-04	1.322	1.670	0.008	0.79	****	****
AM242	1.511E-19	2.768E-19	1.054E-19	0.850	1.557	0.593	0.55	1.43	2.63
AM243	7.535E-00	8.460E-00	9.301E-00	0.894	1.003	1.103	0.89	0.81	0.91
CM242	1.253E-19	2.296E-19	8.743E-20	0.850	1.557	0.593	0.55	1.43	2.63
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	3.938E-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	7.962E-02	9.663E-02	1.101E-01	0.834	1.012	1.153	0.82	0.72	0.88
CM246	9.478E-03	1.184E-02	1.361E-02	0.814	1.017	1.169	0.80	0.70	0.87

AVERAGE-ABSOLUTE-DEVIATION, AS % 10.10 15.19 17.51 15.4 ****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 8.66 11.52 13.53 14.0 28.4 38.7
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 7.04 8.58 9.53 12.9 16.3 20.2
 NUCS EXCLUDED, 1ST/2ND: SM148 CM242 AM241 / CM246 AM242 MP237

APPENDIX E
COMPARATIVE RATIO TABLES IN WATTS
(See table descriptions in Sect. 4.1)

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % 6 33 GWD/MTU WATTS PER MTU

	30 DAY										5 YR									
	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q25 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q25 CIN	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q25 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q25 CIN	Q22 ORS	Q22 CIN
SE 79	1.019E-04	7.785E-05	7.787E-05	1.187	0.907	0.907	1.31	1.31	1.00	1.019E-04	7.784E-05	7.787E-05	1.187	0.907	0.907	1.31	1.31	1.00	1.00	1.00
RR 85	1.410E-01	1.410E-01	1.410E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.026E-01	1.026E-01	1.026E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
SR 89	2.005E-03	2.005E-03	2.005E-03	1.000	1.000	1.000	1.00	1.00	1.00	3.932E-08	3.926E-08	3.934E-08	1.000	0.999	1.001	1.00	1.00	1.00	1.00	1.00
SR 90	8.472E-01	8.472E-01	8.468E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.536E-01	7.536E-01	7.533E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
Y 90	4.048E-02	4.047E-02	4.053E-02	1.000	0.999	1.001	1.00	1.00	1.00	3.599E-02	3.600E-02	3.605E-02	0.999	1.000	1.001	1.00	1.00	1.00	1.00	1.00
Y 91	2.914E-03	2.914E-03	2.911E-03	1.000	1.000	0.999	1.00	1.00	1.00	1.669E-06	1.668E-06	1.669E-06	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
ER 93	2.099E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	2.099E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	0.0	0.0
ZR 95	6.037E-03	6.037E-03	5.998E-03	1.002	1.002	0.996	1.00	1.01	1.01	2.136E-05	2.132E-05	2.199E-05	0.991	0.989	1.020	1.00	0.97	0.97	0.97	0.97
NB 95	7.398E-03	7.398E-03	7.392E-03	1.000	1.000	0.999	1.00	1.00	1.00	4.490E-05	4.483E-05	4.626E-05	0.991	0.989	1.020	1.00	0.97	0.97	0.97	0.97
TC 99	6.555E-03	6.555E-03	6.560E-03	1.000	1.000	1.001	1.00	1.00	1.00	6.555E-03	6.555E-03	6.560E-03	1.000	1.000	1.001	1.00	1.00	1.00	1.00	1.00
RU106	1.271E-01	1.261E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0	1.112E-00	1.108E-00	0.0	1.002	0.998	0.0	1.00	0.0	0.0	0.0	0.0
PD107	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00	1.00	1.00
SN126	9.696E-04	9.697E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	9.696E-04	9.696E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	0.0	0.0
SB125	4.579E-01	4.579E-01	4.604E-01	0.998	0.998	1.004	1.00	0.99	0.99	1.339E-01	1.339E-01	1.346E-01	0.998	0.998	1.004	1.00	0.99	0.99	0.99	0.99
I129	1.453E-05	1.452E-05	1.411E-05	1.010	1.009	0.981	1.00	1.03	1.03	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03	1.03	1.03
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	1.543E-03	1.543E-03	1.541E-03	1.000	1.000	0.99	1.00	1.00	1.00	2.954E-02	2.954E-02	2.950E-02	1.000	1.000	0.999	1.00	1.00	1.00	1.00	1.00
CS135	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
CS137	1.151E-02	1.145E-02	0.0	1.003	0.997	0.0	1.01	0.0	0.0	1.023E-02	1.023E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0	0.0	0.0
CE144	7.771E-02	7.770E-02	0.0	1.000	1.000	0.0	1.00	0.0	0.0	9.733E-00	9.736E-00	0.0	1.000	1.000	0.0	1.00	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	1.279E-11	1.279E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	1.766E-11	1.766E-11	0.0	1.000	1.000	0.0	0.0	0.0	0.0	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	4.808E-01	4.807E-01	4.916E-01	0.993	0.992	1.015	1.00	0.98	0.98	1.323E-01	1.322E-01	1.352E-01	0.993	0.992	1.015	1.00	0.98	0.98	0.98	0.98
SM147	1.753E-08	1.795E-08	1.794E-08	0.984	1.008	1.007	0.98	0.98	1.00	5.054E-08	5.175E-08	5.171E-08	0.985	1.008	1.007	0.98	0.98	0.98	1.00	1.00
SM148	5.876E-13	5.852E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0	0.0	0.0
SM149	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	0.0	1.01	1.01
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	4.219E-02	4.223E-02	4.219E-02	1.000	1.001	1.000	1.00	1.00	1.00	4.062E-02	4.066E-02	4.062E-02	1.000	1.001	1.000	1.00	1.00	1.00	1.00	1.00
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU154	9.390E-01	9.390E-01	9.380E-01	1.000	1.000	0.999	1.00	1.00	1.00	6.317E-01	6.317E-01	6.310E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.00	1.00
BU155	4.687E-00	4.686E-00	4.710E-00	0.998	0.998	1.003	1.00	1.00	0.99	2.357E-00	2.357E-00	2.369E-00	0.998	0.998	1.003	1.00	0.99	0.99	0.99	0.99
U234	3.236E-02	3.236E-02	3.239E-02	1.000	1.000	1.001	1.00	1.00	1.00	3.330E-02	3.330E-02	3.333E-02	1.000	1.000	1.001	1.00	1.00	1.00	1.00	1.00
U235	4.507E-04	4.507E-04	4.757E-04	0.982	0.982	1.036	1.00	0.95	0.95	4.507E-04	4.507E-04	4.757E-04	0.982	0.982	1.036	1.00	0.95	0.95	0.95	0.95
U236	6.944E-03	6.944E-03	6.957E-03	0.999	0.999	1.001	1.00	1.00	1.00	6.946E-03	6.946E-03	6.957E-03	0.999	0.999	1.001	1.00	1.00	1.00	1.00	1.00
U238	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00	1.00	1.00
NP237	9.535E-03	9.535E-03	9.144E-03	1.014	1.014	0.972	1.00	1.04	1.04	9.574E-03	9.573E-03	9.155E-03	1.015	1.015	0.970	1.00	1.05	1.05	1.05	1.05
PU238	7.432E-01	7.431E-01	7.423E-01	1.000	1.000	0.999	1.00	1.00	1.00	7.723E-01	7.723E-01	7.714E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.00	1.00
PU239	9.649E-00	9.650E-00	9.701E-00	0.998	0.998	1.004	1.00	0.99	0.99	9.647E-00	9.649E-00	9.700E-00	0.998	0.998	1.004	1.00	0.99	0.99	0.99	0.99
PU240	1.641E-01	1.641E-01	1.637E-01	1.001	1.001	0.998	1.00	1.00	1.00	1.643E-01	1.643E-01	1.636E-01	1.001	1.001	0.997	1.00	1.00	1.00	1.00	1.00
PU241	3.891E-00	3.836E-00	3.907E-00	0.995	1.006	0.999	0.99	1.00	1.01	3.071E-00	3.121E-00	3.098E-00	0.992	1.008	1.000	0.98	0.99	0.99	1.01	1.01
PU242	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	1.00	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	0.97	1.00	1.00
AM241	3.819E-00	3.808E-00	3.813E-00	1.002	0.999	1.000	1.00	1.00	1.00	3.295E-01	3.242E-01	3.245E-01	1.011	0.994	0.995	1.02	1.02	1.00	1.00	1.00
AM242	6.892E-03	6.894E-03	7.029E-03	0.993	0.994	1.013	1.00	0.98	0.98	6.739E-03	6.741E-03	6.874E-03	0.993	0.994	1.013	1.00	0.98	0.98	0.98	0.98
AM243	5.511E-01	5.511E-01	5.508E-01	1.000	1.000	1.000	1.00	1.00	1.00	5.509E-01	5.509E-01	5.506E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
CM242	1.297E-03	1.297E-03	1.299E-03	1.000	1.000	1.001	1.00	1.00	1.00	8.113E-01	8.113E-01	8.049E-01	1.003	1.003	0.995	1.00	1.01	1.01	1.01	1.01
CM243	6.210E-01	6.210E-01	6.178E-01	1.002	1.002	0.997	1.00	1.01	1.01	5.510E-01	5.510E-01	5.482E-01	1.002	1.002	0.997	1.00	1.01	1.01	1.01	1.01
CM244	6.782E-01	6.781E-01	6.779E-01	1.000	1.000	1.000	1.00	1.00	1.00	5.619E-01	5.618E-01	5.616E-01	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
CM245	4.902E-03	4.902E-03	4.905E-03	1.000	1.000	1.000	1.00	1.00	1.00	4.900E-03	4.900E-03	1.903E-03	1.000	1.000	1.000	1.00	1.00	1.00	1.00	1.00
CM246	1.035E-03	1.035E-03	1.025E-03	1.003	1.003	0.994	1.00	1.01	1.01	1.034E-03	1.035E-03	1.025E-03	1.003	1.004	0.994	1.00	1.01	1.01	1.01	1.01

AVERAGE-ABSOLUTE-DEVIATION, AS % 0.85 0.52 0.75 1.1 1.8 0.6 0.92 0.59 0.87 1.2 2.0 0.8
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 0.39 0.28 0.45 0.4 0.9 0.5 0.47 0.35 0.57 0.5 1.1 0.7
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.22 0.18 0.31 0.2 0.6 0.4 0.31 0.27 0.43 0.3 0.8 0.6
 NUCS EXCLUDED, 1ST/2ND: SE 79 PU241 U235 / PD107 NP237 SE 79 U235 / PD107 NP237

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 10 YR *****										***** 20 YR *****									
	ORIGEN2	ORIGEN-S	CINDER	QO2 AVG	QO3 AVG	CIN AVG	QO2 ORS	QO2 CIN	QO3 CIN	ORIGEN2	ORIGEN-S	CINDER	QO2 AVG	QO3 AVG	CIN AVG	QO2 ORS	QO2 CIN	QO3 CIN	
SE 79	1.010E-04	7.704E-05	7.706E-05	1.186	0.907	0.907	1.31	1.31	1.00	1.010E-04	7.703E-05	7.705E-05	1.186	0.907	0.907	1.31	1.31	1.00	
KR 85	7.423E-00	7.423E-00	7.423E-00	1.000	1.000	1.000	1.00	1.00	1.00	3.888E+00	3.888E+00	3.888E+00	1.000	1.000	1.000	1.00	1.00	1.00	
SW 89	5.104E-19	5.092E-19	5.111E-19	1.000	0.998	1.002	1.00	1.00	1.00	0.0	0.0	8.630E-41	0.0	0.0	0.0	0.0	0.0	0.0	
SR 90	6.690E-01	6.690E-01	6.688E-01	1.000	1.000	1.000	1.00	1.00	1.00	5.273E-01	5.273E-01	5.271E-01	1.000	1.000	1.000	1.00	1.00	1.00	
Y 90	3.196E-02	3.196E-02	3.201E-02	1.000	1.000	1.001	1.00	1.00	1.00	2.519E-02	2.519E-02	2.523E-02	1.000	1.000	1.001	1.00	1.00	1.00	
Y 91	6.699E-16	6.694E-16	6.710E-16	1.000	0.999	1.001	1.00	1.00	1.00	1.079E-34	0.0	1.084E-34	0.998	0.0	1.002	0.0	1.00	0.0	
ER 93	2.099E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	2.098E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	
ER 95	5.459E-14	5.440E-14	5.830E-14	0.979	0.976	1.045	1.00	0.94	0.93	3.567E-31	0.0	4.097E-31	0.931	0.0	1.069	0.0	0.87	0.0	
MB 95	1.148E-13	1.144E-13	1.226E-13	0.979	0.975	1.046	1.00	0.94	0.93	7.499E-31	0.0	8.618E-31	0.931	0.0	1.069	0.0	0.87	0.0	
TC 99	6.555E-03	6.555E-03	6.560E-03	1.000	1.000	1.000	1.00	1.00	1.00	6.554E-03	6.555E-03	6.560E-03	1.000	1.000	1.001	1.00	1.00	1.00	
RU106	3.570E-02	3.559E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0	3.674E-05	3.672E-05	0.0	1.000	1.000	0.0	1.00	0.0	0.0	
PD107	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00	
SM126	9.695E-04	9.696E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	9.695E-04	9.695E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	
SB125	3.832E-00	3.831E-00	3.853E-00	0.998	0.998	1.004	1.00	0.99	0.99	3.137E-01	3.137E-01	3.155E-01	0.998	0.998	1.004	1.00	0.99	0.99	
I129	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03	
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS134	5.502E-01	5.501E-01	5.493E-01	1.001	1.000	0.999	1.00	1.00	1.00	1.908E+00	1.907E+00	1.905E+00	1.001	1.000	0.999	1.00	1.00	1.00	
CS135	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00	
CS137	9.155E-01	9.116E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0	7.267E-01	7.244E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0	
CM144	1.133E-01	1.134E-01	0.0	1.000	1.000	0.0	1.00	0.0	0.0	1.536E-05	1.538E-05	0.0	0.999	1.001	0.0	1.00	0.0	0.0	
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND144	0.0	1.773E-11	1.772E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	1.773E-11	1.772E-11	0.0	1.000	1.000	0.0	0.0	1.00	
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PM147	3.530E-00	3.520E-00	3.609E-00	0.993	0.992	1.015	1.00	0.98	0.98	2.514E-01	2.512E-01	2.570E-01	0.993	0.992	1.015	1.00	0.98	0.98	
SM147	5.962E-08	6.104E-08	6.099E-08	0.985	1.008	1.007	0.98	0.98	1.00	6.269E-08	6.418E-08	6.413E-08	0.985	1.008	1.007	0.98	0.98	1.00	
SM148	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0	
SM149	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01	
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SM151	3.909E-02	3.912E-02	3.909E-02	1.000	1.001	1.000	1.00	1.00	1.00	3.619E-02	3.622E-02	3.619E-02	1.000	1.001	1.000	1.00	1.00	1.00	
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EU154	4.222E-01	4.222E-01	4.217E-01	1.000	1.000	0.999	1.00	1.00	1.00	1.886E+01	1.885E+01	1.884E+01	1.001	1.000	0.999	1.00	1.00	1.00	
EU155	1.172E-00	1.172E-00	1.178E-00	0.998	0.998	1.003	1.00	1.00	1.00	2.896E-01	2.896E-01	2.912E-01	0.998	0.998	1.004	1.00	0.99	0.99	
U234	3.423E-02	3.423E-02	3.425E-02	1.000	1.000	1.000	1.00	1.00	1.00	3.599E-02	3.599E-02	3.599E-02	1.000	1.000	1.000	1.00	1.00	1.00	
U235	4.508E-04	4.508E-04	4.757E-04	0.982	0.982	1.036	1.00	0.95	0.95	4.509E-04	4.509E-04	4.757E-04	0.982	0.982	1.036	1.00	0.95	0.95	
U236	6.948E-03	6.948E-03	6.957E-03	1.000	1.000	1.001	1.00	1.00	1.00	6.952E-03	6.952E-03	6.957E-03	1.000	1.000	1.000	1.00	1.00	1.00	
U238	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00	
NP237	9.641E-03	9.639E-03	9.155E-03	1.017	1.017	0.966	1.00	1.05	1.05	9.860E-03	9.855E-03	9.155E-03	1.025	1.024	0.951	1.00	1.08	1.08	
P238	7.425E-01	7.425E-01	7.417E-01	1.000	1.000	0.999	1.00	1.00	1.00	6.862E-01	6.862E-01	6.854E-01	1.000	1.000	0.999	1.00	1.00	1.00	
P239	9.646E-00	9.648E-00	9.699E-00	0.998	0.998	1.004	1.00	0.99	0.99	9.644E+00	9.645E+00	9.696E+00	0.998	0.998	1.004	1.00	0.99	0.99	
P240	1.645E-01	1.645E-01	1.635E-01	1.002	1.002	0.996	1.00	1.01	1.01	1.646E-01	1.647E-01	1.634E-01	1.002	1.003	0.995	1.00	1.01	1.01	
P241	2.414E-00	2.466E-00	2.447E-00	0.988	1.010	1.002	0.98	0.99	1.01	1.492E+00	1.539E+00	1.527E+00	0.982	1.013	1.005	0.97	0.98	1.01	
P242	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	1.00	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	1.00	
AM241	5.604E-01	5.520E-01	5.526E-01	1.010	0.995	0.996	1.02	1.01	1.00	8.779E-01	8.676E-01	8.686E-01	1.007	0.996	0.997	1.01	1.01	1.00	
AM242	6.587E-03	6.589E-03	6.719E-03	0.993	0.994	1.013	1.00	0.98	0.98	6.294E-03	6.295E-03	6.419E-03	0.993	0.994	1.013	1.00	0.98	0.98	
AM243	5.506E-01	5.506E-01	5.503E-01	1.000	1.000	1.000	1.00	1.00	1.00	5.501E-01	5.501E-01	5.498E-01	1.000	1.000	1.000	1.00	1.00	1.00	
CM242	1.772E-01	1.772E-01	1.785E-01	0.998	0.998	1.005	1.00	0.99	0.99	1.690E-01	1.690E-01	1.703E-01	0.998	0.998	1.005	1.00	0.99	0.99	
CM243	4.879E-01	4.879E-01	4.854E-01	1.002	1.002	0.997	1.00	1.01	1.01	3.826E-01	3.826E-01	3.806E-01	1.002	1.002	0.997	1.00	1.01	1.01	
CM244	4.640E-01	4.639E-01	4.638E-01	1.000	1.000	1.000	1.00	1.00	1.00	3.164E-01	3.164E-01	3.163E-01	1.000	1.000	1.000	1.00	1.00	1.00	
CM245	4.898E-03	4.898E-03	4.901E-03	1.000	1.000	1.000	1.00	1.00	1.00	4.894E-03	4.894E-03	4.897E-03	1.000	1.000	1.000	1.00	1.00	1.00	
CM246	1.034E-03	1.034E-03	1.024E-03	1.003	1.003	0.993	1.00	1.01	1.01	1.032E-03	1.032E-03	1.022E-03	1.003	1.003	0.994	1.00	1.01	1.01	
AVERAGE-ABSOLUTE-DEVIATION, AS %																			
AV-ABS-DEV EXCLUDING LARGEST ONE, %				0.99	0.66	1.02	1.2	2.3	1.0					1.27	0.61	1.21	1.3	2.8	0.8
AV-ABS-DEV EXCLUDING LARGEST TWO, %				0.54	0.42	0.71	0.5	1.3	0.9					0.81	0.34	0.89	0.5	1.8	0.6
				0.37	0.31	0.54	0.3	0.9	0.7					0.65	0.24	0.75	0.3	1.1	0.5
NUCS EXCLUDED, 1ST/2ND: SE 79 SR 89 MB 95 / PD107 ER 95 SE 79 NP237 / PD107 U235																			

CASE: DECAY ONLY, OF ORIGN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/NTU WATTS PER MTU

	50 YR									100 YR														
	ORIGN2	ORIGN-5	CINDER	Q22 AVG	Q25 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q25 CIN	ORIGN2	ORIGN-5	CINDER	Q22 AVG	Q25 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q25 CIN						
SE 79	1.018E-04	7.781E-05	7.783E-05	1.186	0.907	0.907	1.31	1.31	1.00	1.017E-04	7.776E-05	7.779E-05	1.186	0.907	0.907	1.31	1.31	1.00						
KR 85	5.589E-01	5.588E-01	5.589E-01	1.000	1.000	1.000	1.00	1.00	1.00	2.204E-02	2.203E-02	2.204E-02	1.000	1.000	1.000	1.00	1.00	1.00						
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SR 90	2.582E-01	2.582E-01	2.581E-01	1.000	1.000	1.000	1.00	1.00	1.00	7.854E+00	7.852E+00	7.850E+00	1.000	1.000	1.000	1.00	1.00	1.00						
Y 90	1.233E-02	1.233E-02	1.235E-02	0.999	0.999	1.001	1.00	1.00	1.00	3.752E+01	3.751E+01	3.757E+01	1.000	0.999	1.001	1.00	1.00	1.00						
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
ER 93	2.098E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	2.098E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0						
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
TC 99	6.554E-03	6.554E-03	6.559E-03	1.000	1.000	1.001	1.00	1.00	1.00	6.553E-03	6.553E-03	6.558E-03	1.000	1.000	1.001	1.00	1.00	1.00						
RU106	4.036E-14	4.032E-14	0.0	1.000	1.000	0.0	1.00	0.0	0.0	4.719E-29	4.712E-29	0.0	1.001	0.999	0.0	1.00	0.0	0.0						
PD107	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00	6.652E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00						
SM126	9.693E-04	9.693E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	9.689E-04	9.690E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0						
SB125	1.722E-04	1.722E-04	1.733E-04	0.998	0.998	1.004	1.00	0.99	0.99	6.340E-10	6.337E-10	6.380E-10	0.998	0.998	1.004	1.00	0.99	0.99						
I129	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03						
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
CS134	7.958E-05	7.951E-05	7.945E-05	1.001	1.000	0.999	1.00	1.00	1.00	3.991E-12	3.985E-12	3.985E-12	1.001	0.999	1.000	1.00	1.00	1.00						
CS135	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00						
CS137	3.633E-01	3.636E-01	0.0	1.000	1.000	0.0	1.00	0.0	0.0	1.144E+01	1.153E+01	0.0	0.996	1.004	0.0	0.99	0.0	0.0						
CE144	3.822E-17	3.836E-17	0.0	0.998	1.002	0.0	1.00	0.0	0.0	1.747E-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
ND144	0.0	1.773E-11	1.772E-11	0.0	0.0	1.000	0.0	0.0	1.00	0.0	1.773E-11	1.772E-11	0.0	1.000	1.000	0.0	0.0	1.00						
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
PM147	9.076E-05	9.063E-05	9.275E-05	0.993	0.992	1.015	1.00	0.98	0.98	1.662E-10	1.657E-10	1.697E-10	0.994	0.991	1.015	1.00	0.98	0.98						
SM147	6.292E-08	6.442E-08	6.437E-08	0.985	1.008	1.007	0.98	0.98	1.00	6.292E-08	6.442E-08	6.437E-08	0.985	1.008	1.007	0.98	0.98	1.00						
SM148	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0						
SM149	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01						
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SM151	2.872E-02	2.875E-02	2.873E-02	1.000	1.001	1.000	1.00	1.00	1.00	1.954E-02	1.956E-02	1.954E-02	1.000	1.001	1.000	1.00	1.00	1.00						
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
EU154	1.680E-00	1.680E-00	1.678E-00	1.000	1.000	0.999	1.00	1.00	1.00	2.987E-02	2.985E-02	2.983E-02	1.001	1.000	0.999	1.00	1.00	1.00						
EU155	4.374E-03	4.375E-03	4.399E-03	0.998	0.998	1.004	1.00	0.99	0.99	4.034E-06	4.039E-06	4.061E-06	0.997	0.999	1.004	1.00	0.99	0.99						
U234	4.051E-02	4.051E-02	4.047E-02	1.000	1.000	0.999	1.00	1.00	1.00	4.602E-02	4.602E-02	4.593E-02	1.001	1.001	0.999	1.00	1.00	1.00						
U235	4.511E-04	4.511E-04	4.757E-04	0.982	0.982	1.036	1.00	0.95	0.95	4.515E-04	4.515E-04	4.757E-04	0.982	0.982	1.035	1.00	0.95	0.95						
U236	6.965E-03	6.965E-03	6.957E-03	1.000	1.000	0.999	1.00	1.00	1.00	6.986E-03	6.986E-03	6.957E-03	1.001	1.001	0.997	1.00	1.00	1.00						
U238	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00						
NP237	1.085E-02	1.083E-02	9.155E-03	1.056	1.054	0.891	1.00	1.19	1.18	1.272E-02	1.271E-02	9.155E-03	1.103	1.103	0.794	1.00	1.39	1.39						
PU238	5.417E-01	5.417E-01	5.411E-01	1.000	1.000	0.999	1.00	1.00	1.00	3.654E+01	3.653E+01	3.649E+01	1.001	1.000	0.999	1.00	1.00	1.00						
PU239	9.636E-00	9.638E-00	9.687E-00	0.998	0.998	1.003	1.00	0.99	0.99	9.623E+00	9.625E+00	9.674E+00	0.998	0.998	1.003	1.00	0.99	0.99						
PU240	1.647E-01	1.647E-01	1.628E-01	1.004	1.004	0.992	1.00	1.01	1.01	1.640E+01	1.640E+01	1.620E+01	1.004	1.004	0.992	1.00	1.01	1.01						
PU241	3.520E-01	3.739E-01	3.712E-01	0.963	1.022	1.015	0.94	0.95	1.01	3.171E-02	3.538E-02	3.513E-02	0.931	1.038	1.031	0.90	0.90	1.01						
PU242	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	1.00	5.104E-02	5.255E-02	5.245E-02	0.981	1.010	1.008	0.97	0.97	1.00						
AM241	1.232E-02	1.226E-02	1.227E-02	1.003	0.998	0.999	1.00	1.00	1.00	1.245E-02	1.245E-02	1.246E-02	1.000	1.000	1.001	1.00	1.00	1.00						
AM242	5.489E-03	5.490E-03	5.598E-03	0.993	0.994	1.013	1.00	0.98	0.98	4.370E-03	4.371E-03	4.457E-03	0.993	0.994	1.013	1.00	0.98	0.98						
AM243	5.485E-01	5.485E-01	5.483E-01	1.000	1.000	1.000	1.00	1.00	1.00	5.460E-01	5.460E-01	5.457E-01	1.000	1.000	1.000	1.00	1.00	1.00						
CM242	1.474E-01	1.474E-01	1.485E-01	0.998	0.998	1.005	1.00	0.99	0.99	1.173E-01	1.173E-01	1.182E-01	0.997	0.997	1.005	1.00	0.99	0.99						
CM243	1.844E-01	1.844E-01	1.835E-01	1.002	1.002	0.997	1.00	1.01	1.01	5.467E-02	5.466E-02	5.438E-02	1.002	1.002	0.997	1.00	1.01	1.01						
CM244	1.004E-01	1.003E-01	1.003E-01	1.001	1.000	1.000	1.00	1.00	1.00	1.481E-00	1.480E-00	1.480E-00	1.000	1.000	1.000	1.00	1.00	1.00						
CM245	4.882E-03	4.882E-03	4.885E-03	1.000	1.000	1.000	1.00	1.00	1.00	4.862E-03	4.863E-03	4.863E-03	1.000	1.000	1.000	1.00	1.00	1.00						
CM246	1.028E-03	1.028E-03	1.018E-03	1.003	1.003	0.993	1.00	1.01	1.01	1.020E-03	1.020E-03	1.010E-03	1.003	1.003	0.994	1.00	1.01	1.01						
AVERAGE-ABSOLUTE-DEVIATION, AS %																			1.13	0.71	1.12	1.4	2.6	1.1
AV-ABS-DEV EXCLUDING LARGEST ONE, %																			0.55	0.38	0.59	0.6	1.2	0.6
AV-ABS-DEV EXCLUDING LARGEST TWO, %																			0.36	0.27	0.41	0.4	0.8	0.5
NUCS EXCLUDED, 1ST/2ND: SE 79 SM151 NP237 / PD107 U235																			SE 79	NP237	PU241	U235		
																			1.37	0.89	1.45	1.5	3.4	1.7
																			0.64	0.43	0.63	0.7	1.4	0.6
																			0.43	0.29	0.46	0.5	1.0	0.5

CASE: DECAY ONLY, OF ORIGIN2 DISCHARGE RESULTS FOR PWR, 3.2 WT & 6.33 GWD/MTU WATTS PER MTU

	300 YR			1 YR					
	ORIGIN2	ORIGIN-S	CINDER	ORIGIN2	ORIGIN-S	CINDER	ORIGIN2	ORIGIN-S	CINDER
	ORIGIN2	ORIGIN-S	CINDER	ORIGIN2	ORIGIN-S	CINDER	ORIGIN2	ORIGIN-S	CINDER
SR 79	1.015E-04	7.760E-05	7.762E-05	1.186	0.907	0.907	1.31	1.31	1.00
KR 85	5.335E-08	5.326E-08	5.332E-08	1.001	0.999	1.000	1.00	1.00	1.00
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	6.724E-02	6.719E-02	6.719E-02	1.000	1.000	1.000	1.00	1.00	1.00
Y 91	3.212E-01	3.209E-01	3.216E-01	1.000	0.999	1.001	1.00	1.00	1.00
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	2.094E-04	2.098E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	6.548E-03	6.549E-03	6.554E-03	1.000	1.000	1.001	1.00	1.00	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	6.651E-06	6.116E-06	6.113E-06	1.057	0.972	0.971	1.09	1.09	1.00
SW126	9.676E-04	9.676E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0
SB125	0.0	0.0	1.173E-31	0.0	0.0	0.0	0.0	0.0	0.0
1129	1.460E-05	1.460E-05	1.421E-05	1.009	1.009	0.982	1.00	1.03	1.03
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	2.522E-41	0.0	0.0	0.0	0.0	0.0	0.0
CS135	1.153E-04	1.153E-04	1.153E-04	1.000	1.000	1.000	1.00	1.00	1.00
CS137	1.127E-01	1.164E-01	0.0	0.984	1.016	0.0	0.97	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND141	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND141	0.0	1.773E-11	1.772E-11	0.0	1.000	1.000	0.0	0.0	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	0.0	0.0	1.904E-33	0.0	0.0	0.0	0.0	0.0	0.0
SW147	6.292E-08	6.442E-08	6.437E-08	0.985	1.008	1.007	0.98	0.98	1.00
SW148	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0
SW149	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH151	4.188E-03	4.192E-03	4.188E-03	1.000	1.001	1.000	1.00	1.00	1.00
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	2.983E-09	2.977E-09	2.977E-09	1.001	0.999	0.999	1.00	1.00	1.00
EU155	2.921E-18	2.933E-18	2.951E-18	0.995	0.999	1.005	1.00	0.99	0.99
U234	5.4E-02	5.506E-02	5.489E-02	1.001	1.001	0.998	1.00	1.00	1.00
U235	4.4E-04	4.531E-04	4.757E-04	0.984	0.984	1.033	1.00	0.95	0.95
U236	7.070E-03	7.069E-03	6.957E-03	1.005	1.005	0.989	1.00	1.02	1.02
U238	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00
NP237	1.913E-02	1.912E-02	9.154E-03	1.211	1.210	0.579	1.00	2.09	2.09
PU238	7.575E-00	7.575E-00	7.568E-00	1.000	1.000	0.999	1.00	1.00	1.00
PU239	9.571E-00	9.572E-00	9.618E-00	0.998	0.998	1.003	1.00	1.00	1.00
PU240	1.606E-01	1.606E-01	1.586E-01	1.004	1.004	0.992	1.00	1.01	1.01
PU241	6.566E-06	7.458E-06	2.818E-06	1.170	1.328	0.502	0.88	2.33	2.65
PU242	5.102E-02	5.253E-02	5.243E-02	0.981	1.010	1.008	0.97	0.97	1.00
AN241	9.119E-01	9.125E-01	9.136E-01	0.999	1.000	1.001	1.00	1.00	1.00
AN242	1.756E-03	1.756E-03	1.790E-03	0.994	0.994	1.013	1.00	0.98	0.98
AN243	5.358E-01	5.358E-01	5.355E-01	1.000	1.000	1.000	1.00	1.00	1.00
CH242	4.713E-02	4.713E-02	4.749E-02	0.997	0.997	1.005	1.00	0.99	0.99
CH243	4.220E-04	4.217E-04	4.197E-04	1.002	1.001	0.997	1.00	1.01	1.01
CH244	7.014E-04	7.008E-04	7.011E-04	1.000	1.000	1.000	1.00	1.00	1.00
CH245	4.784E-03	4.784E-03	4.786E-03	1.000	1.000	1.000	1.00	1.00	1.00
CH246	9.906E-04	9.908E-04	9.812E-04	1.003	1.003	0.994	1.00	1.01	1.01

AVERAGE-ABSOLUTE-DEVIATION, AS % 2.17 2.11 3.67 1.8 10.1 9.1 9.93 6.17 9.58 **** **

AV-ABS-DEV EXCLUDING LARGEST ONE, % 1.23 1.02 2.02 0.6 5.0 4.2 2.46 1.86 3.25 1.9 11.5 9.1

AV-ABS-DEV EXCLUDING LARGEST TWO, % 0.39 0.32 0.50 0.6 1.2 0.6 0.82 0.62 0.70 1.0 1.4 0.8

NUCS EXCLUDED, 1ST/2ND: SR 79 KR 85 PU241 / PD107 NP237 CH244 Y 90 PU241 / SR 79 NP237

CASE: DECAY ONLY, OF ORIGIN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

	ORIGIN2	ORIGIN S	CINDER	10 YR							
				QRA	QRA	QRA	QRA	QRA	QRA	QRA	QRA
				AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG
SE 79	9.155E-05	6.997E-05	6.999E-05	1.186	0.907	0.907	1.31	1.31	1.00		
SR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
IR 93	2.089E-04	2.089E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0		
IR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
TC 99	6.345E-03	6.345E-03	6.350E-03	1.000	1.000	1.001	1.00	1.00	1.00		
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PD107	6.645E-06	6.109E-06	6.106E-06	1.057	0.972	0.971	1.09	1.09	1.00		
SM126	9.047E-04	9.047E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0		
SR125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
IR129	1.460E-05	1.459E-05	1.420E-05	1.009	1.009	0.982	1.00	1.03	1.03		
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS135	1.150E-04	1.150E-04	1.149E-04	1.000	1.000	1.000	1.00	1.00	1.00		
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD144	0.0	1.773E-11	1.772E-11	0.0	1.000	1.000	0.0	0.0	1.00		
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM147	6.292E-08	6.442E-08	6.437E-08	0.985	1.008	1.007	0.98	0.98	1.00		
SM148	5.907E-13	5.883E-13	0.0	1.002	0.998	0.0	1.00	0.0	0.0		
SM149	0.0	1.020E-14	1.010E-14	0.0	1.005	0.995	0.0	0.0	1.01		
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM151	1.498E-35	0.0	1.502E-35	0.999	0.0	1.001	0.0	1.00	0.0		
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
U234	5.614E-02	5.614E-02	5.570E-02	1.003	1.003	0.995	1.00	1.01	1.01		
U235	5.213E-04	5.213E-04	4.757E-04	1.030	1.030	0.940	1.00	1.10	1.10		
U236	9.573E-03	9.573E-03	6.955E-03	1.100	1.100	0.799	1.00	1.38	1.38		
U238	8.054E-03	8.054E-03	8.043E-03	1.000	1.000	0.999	1.00	1.00	1.00		
NP237	3.597E-02	3.597E-02	9.125E-03	1.331	1.331	0.338	1.00	3.94	3.94		
PU238	6.245E-21	6.233E-21	6.287E-21	0.998	0.997	1.005	1.00	0.99	0.99		
PU239	7.318E-00	7.319E-00	7.277E-00	1.402	1.002	0.996	1.00	1.01	1.01		
PU240	5.742E-00	5.742E-00	5.682E-00	1.004	1.004	0.993	1.00	1.01	1.01		
PU241	2.030E-06	2.096E-06	0.0	0.984	1.016	0.0	0.97	0.0	0.0		
PU242	5.015E-02	5.161E-02	5.151E-02	0.982	1.010	1.008	0.97	0.97	1.00		
AM241	2.192E-03	2.285E-03	1.602E-05	1.464	1.526	0.011	0.96	0.96	0.96		
AM242	1.048E-22	1.092E-22	1.102E-22	0.995	0.993	1.012	1.00	0.98	0.98		
AM243	2.155E-01	2.155E-01	2.153E-01	1.000	1.000	0.999	1.00	1.00	1.00		
CM242	2.918E-21	2.912E-21	2.923E-21	1.000	0.998	1.002	1.00	1.00	1.00		
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CM244	1.487E-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CM245	2.169E-03	2.169E-03	2.165E-03	1.001	1.001	0.999	1.00	1.00	1.00		
CM246	2.392E-04	2.391E-04	2.368E-04	1.003	1.003	0.993	1.00	1.01	1.01		

AVERAGE ABSOLUTE DEVIATION, AS % 4.81 4.39 8.83 2.1 0.00 0.00
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 2.61 2.35 4.93 0.8 18.2 16.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 1.01 0.93 1.81 0.4 3.4 3.1
 MUCS EXCLUDED, 1ST/2ND: SE 79 CM242 AM241 / PD107 MP237

CASE: PMR, 3.10 MT & U-235, 3.443 AT & BURNUP (33.0 GWD/MTU, APPROX.)

WATTS PER MTU

	JO DAY			5 YR														
	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR3 AVG	CIN AVG	OR2 ORS	OR2 CIN	OR3 CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR3 AVG	CIN AVG	OR2 ORS	OR2 CIN	OR3 CIN
SR 79	1.016E-04	7.133E-05	6.578E-05	1.277	0.896	0.827	1.42	1.54	1.08	1.016E-04	7.133E-05	6.578E-05	1.277	0.896	0.827	1.42	1.54	1.08
KR 85	1.397E-01	1.390E-01	1.400E-01	1.001	0.996	1.003	1.01	1.00	0.99	1.016E-01	1.011E-01	1.019E-01	1.001	0.996	1.003	1.00	1.00	0.99
SR 89	1.972E-03	1.990E-03	1.988E-03	1.001	1.010	0.989	0.99	1.01	1.02	3.863E-08	3.897E-08	3.821E-08	1.001	1.009	0.990	0.99	1.01	1.02
SR 90	8.377E-01	8.333E-01	8.516E-01	0.996	0.991	1.013	1.01	0.98	0.98	7.452E-01	7.413E-01	7.575E-01	0.996	0.991	1.013	1.01	0.98	0.98
Y 90	4.003E-02	3.981E-02	4.076E-02	0.996	0.990	1.014	1.01	0.98	0.98	3.559E-02	3.541E-02	3.625E-02	0.995	0.990	1.014	1.01	0.98	0.98
Y 91	2.873E-03	2.892E-03	2.869E-03	0.998	1.005	0.997	0.99	1.00	1.01	1.646E-06	1.656E-06	1.645E-06	0.998	1.004	0.998	0.99	1.00	1.01
IR 93	2.084E-04	2.104E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0	2.084E-04	2.104E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0
IR 95	6.005E-03	6.061E-03	5.933E-03	1.001	1.010	0.989	0.99	1.01	1.02	2.125E-05	2.141E-05	2.176E-05	0.990	0.997	1.013	0.99	0.98	0.98
NB 95	7.359E-03	7.425E-03	7.289E-03	1.000	1.009	0.991	0.99	1.01	1.02	4.467E-05	4.501E-05	4.576E-05	0.989	0.997	1.014	0.99	0.98	0.98
TC 99	6.540E-03	6.673E-03	6.660E-03	0.987	1.007	1.005	0.98	0.98	1.00	6.540E-03	6.673E-03	6.660E-03	0.987	1.007	1.005	0.98	0.98	1.00
RU106	3.348E-01	3.161E-01	0.0	1.029	0.971	0.0	1.06	0.0	0.0	1.138E-00	1.074E-00	0.0	1.029	0.971	0.0	1.06	0.0	0.0
PD107	6.833E-06	5.785E-06	6.441E-06	1.076	0.911	1.014	1.18	1.06	0.90	6.833E-06	5.785E-06	6.441E-06	1.076	0.911	1.014	1.18	1.06	0.90
SN126	9.822E-04	6.965E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0	9.822E-04	6.965E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0
SB125	4.647E-01	3.052E-01	2.555E-01	1.360	0.893	0.748	1.52	1.82	1.19	1.359E-01	8.925E-01	7.472E-00	1.360	0.893	0.747	1.52	1.82	1.19
I129	1.463E-05	1.519E-05	1.421E-05	0.997	1.035	0.968	0.96	1.03	1.07	1.470E-05	1.527E-05	1.429E-05	0.996	1.035	0.969	0.96	1.03	1.07
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	1.564E-03	1.542E-03	1.546E-03	1.009	0.994	0.997	1.01	1.01	1.00	2.955E-02	2.953E-02	2.959E-02	1.009	0.995	0.997	1.01	1.01	1.00
CS135	1.140E-04	1.280E-04	1.263E-04	0.929	1.043	1.029	0.89	0.90	1.01	1.140E-04	1.280E-04	1.263E-04	0.929	1.043	1.029	0.89	0.90	1.01
CS137	1.152E-02	1.146E-02	0.0	1.003	0.997	0.0	1.01	0.0	0.0	1.028E-02	1.024E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0
CR144	7.733E-02	7.774E-02	0.0	0.997	1.003	0.0	0.99	0.0	0.0	9.685E-00	9.741E-00	0.0	0.997	1.003	0.0	0.99	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	1.248E-11	1.247E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	1.736E-11	1.734E-11	0.0	1.001	0.999	0.0	0.0	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	4.743E-01	6.317E-01	6.075E-01	0.830	1.106	1.064	0.75	0.78	1.04	1.305E-01	1.735E-01	1.668E-01	0.832	1.105	1.063	0.75	0.78	1.04
SH147	1.726E-08	1.930E-08	2.057E-08	0.906	1.013	1.000	0.89	0.84	0.94	4.983E-08	6.364E-08	6.223E-08	0.951	1.087	1.063	0.78	0.80	1.02
SH148	5.895E-13	3.911E-13	0.0	1.202	0.798	0.0	1.51	0.0	0.0	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0
SH149	0.0	1.257E-14	1.094E-14	0.0	1.069	0.931	0.0	0.0	1.15	0.0	1.257E-14	1.094E-14	0.0	1.069	0.931	0.0	0.0	1.15
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH151	4.211E-02	4.988E-02	3.971E-02	0.959	1.136	0.905	0.84	1.06	1.26	4.055E-02	4.802E-02	3.823E-02	0.959	1.136	0.905	0.84	1.06	1.26
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	9.572E-01	9.623E-01	8.453E-01	1.039	1.044	0.917	0.99	1.13	1.14	6.440E-01	6.474E-01	5.686E-01	1.039	1.044	0.917	0.99	1.13	1.14
EU155	4.781E-00	5.137E-00	4.633E-00	0.986	1.059	0.955	0.93	1.03	1.11	2.404E-00	2.583E-00	2.330E-00	0.986	1.059	0.955	0.93	1.03	1.11
U234	3.038E-02	2.933E-02	2.879E-02	1.030	0.994	0.976	1.04	1.06	1.02	3.135E-02	3.037E-02	2.913E-02	1.035	1.003	0.962	1.03	1.08	1.04
U235	4.240E-04	4.336E-04	4.749E-04	0.955	0.976	1.069	0.98	0.89	0.91	4.240E-04	4.337E-04	4.749E-04	0.955	0.976	1.069	0.98	0.89	0.91
U236	6.772E-03	6.780E-03	6.758E-03	1.000	1.001	0.998	1.00	1.00	1.00	6.774E-03	6.781E-03	6.758E-03	1.000	1.001	0.998	1.00	1.00	1.00
U238	8.058E-03	8.050E-03	8.041E-03	1.001	1.000	0.999	1.00	1.00	1.00	8.058E-03	8.050E-03	8.041E-03	1.001	1.000	0.999	1.00	1.00	1.00
NP237	9.517E-03	9.995E-03	8.829E-03	1.007	1.058	0.935	0.95	1.08	1.13	9.556E-03	1.004E-02	8.839E-03	1.008	1.059	0.933	0.95	1.08	1.14
PU238	7.584E-01	8.236E-01	6.818E-01	1.005	1.091	0.904	0.92	1.11	1.21	7.892E-01	8.521E-01	7.154E-01	1.005	1.085	0.911	0.93	1.10	1.19
PU239	9.671E-00	1.085E-01	1.024E-01	0.944	1.060	0.996	0.89	0.95	1.06	9.669E-00	1.085E-01	1.020E-01	0.944	1.060	0.996	0.89	0.95	1.06
PU240	1.658E-01	1.485E-01	1.472E-01	1.078	0.965	0.957	1.12	1.13	1.01	1.660E-01	1.487E-01	1.471E-01	1.078	0.966	0.956	1.12	1.13	1.01
PU241	3.966E-00	4.588E-00	4.543E-00	0.908	1.051	1.041	0.86	0.87	1.01	3.130E-00	3.639E-00	3.603E-00	0.905	1.053	1.042	0.86	0.87	1.01
PU242	5.334E-02	5.601E-02	6.611E-02	0.912	0.958	1.130	0.95	0.81	0.85	5.334E-02	5.601E-02	6.611E-02	0.912	0.958	1.130	0.95	0.81	0.85
AM241	3.881E-00	4.493E-00	4.854E-00	0.880	1.019	1.101	0.86	0.80	0.93	3.357E-01	3.784E-01	3.806E-01	0.920	1.037	1.043	0.89	0.88	0.99
AM242	7.028E-03	1.161E-02	5.768E-03	0.864	1.427	0.709	0.61	1.22	2.01	6.872E-03	1.135E-02	5.640E-03	0.864	1.427	0.709	0.61	1.22	2.01
AM243	5.885E-01	6.480E-01	7.513E-01	0.888	0.978	1.134	0.91	0.78	0.86	5.882E-01	6.477E-01	7.510E-01	0.888	0.978	1.134	0.91	0.78	0.86
CH242	1.349E-03	1.353E-03	1.388E-03	0.999	1.002	0.999	1.00	1.00	1.00	8.400E-01	9.622E-01	7.959E-01	0.970	1.111	0.919	0.87	1.06	1.21
CH243	6.588E-01	1.766E-01	5.881E-01	1.388	0.372	1.239	3.73	1.12	0.30	5.885E-01	1.622E-01	5.218E-01	1.388	0.372	1.239	3.73	1.12	0.30
CH244	7.428E-01	7.231E-01	9.217E-01	0.933	0.909	1.158	1.03	0.81	0.78	6.153E-01	5.990E-01	7.636E-01	0.933	0.909	1.158	1.03	0.81	0.78
CH245	5.442E-03	5.830E-03	8.435E-03	0.828	0.888	1.284	0.93	0.65	0.69	5.440E-03	5.828E-03	8.432E-03	0.828	0.888	1.284	0.93	0.65	0.69
CH246	1.179E-03	1.241E-03	1.584E-03	0.883	0.930	1.187	0.95	0.74	0.78	1.178E-03	1.240E-03	1.583E-03	0.883	0.930	1.187	0.95	0.74	0.78

AVERAGE-ABSOLUTE-DEVIATION, AS % 7.21 6.73 7.39 16.4 12.6 12.0
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.46 5.19 5.85 8.5 10.3 7.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.47 4.05 4.81 7.6 9.0 7.7
 NUCL EXCLUDED, 1ST/2ND: SB125 CH243 CH245 / SR 79 AM242 CH246

7.38 7.12 7.44 16.8 12.8 12.3
 5.64 5.61 5.91 9.0 10.5 8.0
 4.66 4.50 4.47 8.1 9.2 8.0
 SB125 CH243 CH245 / SR 79 AM242 CH246

CASE: PWR, 3.10 WT & U-235, 3.443 AT & BURNUP (33.0 GWD/MTU, APPROX.)

WATTS PER MTU

	50 YR									100 YR								
	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q23 ORS	CIN ORS	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q23 ORS	CIN ORS
SE 79	1.016E-04	7.130E-05	6.575E-05	1.277	0.896	0.827	1.42	1.55	1.08	1.015E-04	7.126E-05	6.571E-05	1.277	0.896	0.827	1.42	1.54	1.08
KR 85	5.530E-01	5.508E-01	5.551E-01	1.001	0.996	1.003	1.01	1.00	0.99	2.184E-02	2.172E-02	2.189E-02	1.001	0.996	1.003	1.01	1.00	0.99
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	2.553E-01	2.540E-01	2.595E-01	0.996	0.991	1.013	1.01	0.98	0.98	7.767E-00	7.724E-00	7.894E-00	0.996	0.991	1.013	1.01	0.98	0.98
Y 90	1.220E-02	1.213E-02	1.242E-02	0.996	0.990	1.014	1.01	0.98	0.98	3.710E-01	3.689E-01	3.778E-01	0.996	0.990	1.014	1.01	0.98	0.98
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	2.084E-04	2.104E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0	2.084E-04	2.104E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	6.539E-03	6.672E-03	6.659E-03	0.987	1.007	1.005	0.98	0.98	1.00	6.539E-03	6.671E-03	6.658E-03	0.987	1.007	1.005	0.98	0.98	1.00
RU106	4.308E-14	3.909E-14	0.0	1.049	0.951	0.0	1.10	0.0	0.0	5.037E-29	4.568E-29	0.0	1.049	0.951	0.0	1.10	0.0	0.0
PD107	6.833E-06	5.785E-06	6.441E-06	1.076	0.911	1.014	1.18	1.06	0.90	6.833E-06	5.785E-06	6.441E-06	1.076	0.911	1.014	1.18	1.06	0.90
SN126	9.818E-04	6.962E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0	9.818E-04	6.960E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0
SB125	1.748E-04	1.148E-04	9.615E-05	1.359	0.893	0.748	1.52	1.82	1.19	6.435E-10	4.224E-10	3.541E-10	1.360	0.892	0.748	1.52	1.82	1.19
I129	1.470E-05	1.527E-05	1.429E-05	0.996	1.035	0.969	0.96	1.03	1.07	1.470E-05	1.527E-05	1.429E-05	0.996	1.035	0.969	0.96	1.03	1.07
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	8.066E-05	7.946E-05	7.970E-05	1.009	0.994	0.997	1.02	1.01	1.00	4.046E-12	3.982E-12	3.998E-12	1.009	0.993	0.997	1.02	1.01	1.00
CS135	1.140E-04	1.280E-04	1.263E-04	0.929	1.043	1.029	0.89	0.90	1.01	1.140E-04	1.280E-04	1.263E-04	0.929	1.043	1.029	0.89	0.90	1.01
CS137	3.634E-01	3.641E-01	0.0	0.999	1.001	0.0	1.00	0.0	0.0	1.145E-01	1.154E-01	0.0	0.996	1.004	0.0	0.99	0.0	0.0
CE144	3.803E-17	0.0	0.0	0.995	1.005	0.0	0.99	0.0	0.0	1.739E-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	1.742E-11	1.740E-11	0.0	1.001	0.999	0.0	0.0	1.00	0.0	1.742E-11	1.740E-11	0.0	1.001	0.999	0.0	0.0	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	8.954E-05	1.189E-04	1.144E-04	0.832	1.105	1.063	0.75	0.78	1.04	1.640E-10	2.174E-10	2.094E-10	0.833	1.104	1.063	0.75	0.78	1.04
SH147	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03
SH148	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0
SH149	0.0	1.257E-14	1.094E-14	0.0	1.069	0.931	0.0	0.0	1.15	0.0	1.257E-14	1.094E-14	0.0	1.069	0.931	0.0	0.0	1.15
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH151	2.867E-02	3.396E-02	2.703E-02	0.959	1.136	0.905	0.84	1.06	1.26	1.951E-02	2.310E-02	1.839E-02	0.959	1.136	0.905	0.84	1.06	1.26
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BU154	1.713E-00	1.722E-00	1.512E-00	1.039	1.044	0.917	0.99	1.13	1.14	3.045E-02	3.059E-02	2.688E-02	1.039	1.044	0.917	1.00	1.13	1.14
BU155	4.462E-03	4.797E-03	4.327E-03	0.985	1.059	0.955	0.93	1.03	1.11	4.116E-06	4.428E-06	3.994E-06	0.985	1.059	0.956	0.93	1.03	1.11
U234	3.871E-02	3.833E-02	3.174E-02	1.068	1.057	0.875	1.01	1.22	1.21	4.434E-02	4.441E-02	3.374E-02	1.066	1.088	0.826	1.00	1.31	1.32
U235	4.244E-04	4.341E-04	4.749E-04	0.955	0.977	1.068	0.98	0.89	0.91	4.244E-04	4.345E-04	4.749E-04	0.955	0.977	1.068	0.98	0.89	0.91
U236	6.793E-03	6.799E-03	6.758E-03	1.001	1.002	0.996	1.00	1.01	1.01	6.814E-03	6.818E-03	6.758E-03	1.003	1.003	0.994	1.00	1.01	1.01
U238	8.058E-03	8.050E-03	8.041E-03	1.001	1.000	0.999	1.00	1.00	1.00	8.058E-03	8.050E-03	8.041E-03	1.001	1.000	0.999	1.00	1.00	1.00
NP237	1.085E-02	1.151E-02	8.839E-03	1.043	1.107	0.850	0.94	1.23	1.30	1.277E-02	1.369E-02	8.839E-03	1.085	1.163	0.751	0.93	1.44	1.55
PU239	5.536E-01	5.980E-01	5.018E-01	1.004	1.085	0.910	0.93	1.10	1.19	3.733E-01	4.035E-01	3.384E-01	1.004	1.085	0.910	0.93	1.10	1.19
PU239	9.658E-00	1.084E-01	1.018E-01	0.944	1.060	0.996	0.89	0.95	1.06	9.645E-00	1.082E-01	1.017E-01	0.945	1.060	0.996	0.89	0.95	1.06
PU240	1.665E-01	1.492E-01	1.464E-01	1.081	0.969	0.951	1.12	1.14	1.02	1.658E-01	1.487E-01	1.456E-01	1.081	0.969	0.950	1.11	1.14	1.02
PU241	3.588E-01	4.359E-01	4.316E-01	0.878	1.066	1.056	0.82	0.83	1.01	3.233E-02	4.125E-02	4.085E-02	0.848	1.081	1.071	0.78	0.79	1.01
PU242	5.333E-02	5.601E-02	6.611E-02	0.912	0.958	1.130	0.95	0.81	0.85	5.333E-02	5.601E-02	6.610E-02	0.912	0.958	1.130	0.95	0.81	0.85
AN243	1.255E-02	1.430E-02	1.427E-02	0.916	1.043	1.041	0.88	0.88	1.00	1.269E-02	1.451E-02	1.449E-02	0.913	1.044	1.043	0.87	0.88	1.00
AN242	5.597E-03	9.244E-03	4.594E-03	0.864	1.427	0.709	0.61	1.22	2.01	4.566E-03	7.360E-03	3.657E-03	0.864	1.427	0.709	0.61	1.22	2.01
AN243	5.858E-01	6.449E-01	7.478E-01	0.888	0.978	1.134	0.91	0.78	0.86	5.830E-01	6.419E-01	7.443E-01	0.888	0.978	1.134	0.91	0.78	0.86
CH242	1.503E-01	2.482E-01	1.219E-01	0.867	1.431	0.703	0.61	1.23	2.04	1.196E-01	1.976E-01	9.701E-02	0.866	1.431	0.703	0.61	1.23	2.04
CH243	1.957E-01	5.244E-02	1.747E-01	1.389	0.372	1.239	3.73	1.12	0.30	5.799E-02	1.554E-02	5.177E-02	1.388	0.372	1.239	3.73	1.12	0.30
CH244	1.099E-01	1.070E-01	1.364E-01	0.933	0.909	1.158	1.03	0.81	0.78	1.622E-00	1.578E-00	2.012E-00	0.934	0.908	1.158	1.03	0.81	0.78
CH245	5.420E-03	5.807E-03	8.401E-03	0.828	0.888	1.284	0.93	0.65	0.69	5.398E-03	5.783E-03	8.366E-03	0.828	0.888	1.284	0.93	0.65	0.69
CH246	1.170E-03	1.232E-03	1.573E-03	0.883	0.930	1.187	0.95	0.74	0.78	1.162E-03	1.223E-03	1.561E-03	0.883	0.930	1.187	0.95	0.74	0.78

AVERAGE-ABSOLUTE-DEVIATION, AS % 8.68 8.91 9.33 19.4 15.7 16.9 9.15 9.39 9.80 20.0 16.8 17.9
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.85 7.38 7.78 10.9 13.4 12.4 7.30 7.86 8.30 11.3 14.6 13.6
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.87 6.29 6.31 9.1 11.6 9.6 6.44 6.50 6.67 9.5 12.9 10.8
 NUCS EXCLUDED, 1ST/2ND: SB125 CH243 CH245 / SE 79 CH242 CH246 SB125 CH243 CH245 / SE 79 CH242 NP237

CASE: PWR, 3.10 WT & U-235, 1.443 AT & BURNUP (33.0 GMD/MTU, APPROX.)

300 YR										1 KYR										2 KYR																
ORIGEN2	ORIGEN-5	CINDER	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	CIN	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	CIN	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	CIN	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	CIN	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5	CIN	ORIGEN-2	ORIGEN-5	ORIGEN-2	ORIGEN-5			
SE 79	1.013E-04	7.111E-05	6.557E-05	1.277	0.896	0.827	1.42	1.54	1.08	1.006E-04	7.058E-05	6.509E-05	1.277	0.896	0.826	1.43	1.55	1.08	1.006E-04	7.058E-05	6.509E-05	1.277	0.896	0.826	1.43	1.55	1.08	1.006E-04	7.058E-05	6.509E-05	1.277	0.896	0.826	1.43	1.55	1.08
KR 85	5.286E-08	5.251E-08	5.266E-08	1.002	0.995	0.993	1.01	1.00	0.99	1.165E-27	1.157E-27	1.166E-27	1.002	0.995	1.003	1.01	1.00	0.99	1.165E-27	1.157E-27	1.166E-27	1.002	0.995	1.003	1.01	1.00	0.99	1.165E-27	1.157E-27	1.166E-27	1.002	0.995	1.003	1.01	1.00	0.99
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SR 90	6.655E-02	6.609E-02	6.757E-02	0.997	0.990	1.012	1.01	0.98	0.98	3.865E-09	3.835E-09	3.920E-09	0.998	0.990	1.012	1.01	0.99	0.98	3.865E-09	3.835E-09	3.920E-09	0.998	0.990	1.012	1.01	0.99	0.98	3.865E-09	3.835E-09	3.920E-09	0.998	0.990	1.012	1.01	0.99	0.98
Y 90	3.179E-01	3.157E-01	3.236E-01	0.997	0.990	1.014	1.01	0.98	0.98	1.846E-08	1.832E-08	1.876E-08	0.997	0.990	1.013	1.01	0.98	0.98	1.846E-08	1.832E-08	1.876E-08	0.997	0.990	1.013	1.01	0.98	0.98	1.846E-08	1.832E-08	1.876E-08	0.997	0.990	1.013	1.01	0.98	0.98
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
YR 93	2.084E-04	2.104E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0	2.083E-04	2.103E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0	2.083E-04	2.103E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0	2.083E-04	2.103E-04	0.0	0.995	1.005	0.0	0.99	0.0	0.0
YR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
TC 99	6.534E-03	6.647E-03	6.654E-03	0.987	1.007	1.005	0.98	0.98	1.00	6.519E-03	6.652E-03	6.639E-03	0.987	1.007	1.005	0.98	0.98	1.00	6.519E-03	6.652E-03	6.639E-03	0.987	1.007	1.005	0.98	0.98	1.00	6.519E-03	6.652E-03	6.639E-03	0.987	1.007	1.005	0.98	0.98	1.00
PU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PU107	6.833E-06	6.785E-06	6.840E-06	1.076	0.911	1.014	1.18	1.06	0.90	6.832E-06	6.785E-06	6.840E-06	1.076	0.911	1.014	1.18	1.06	0.90	6.832E-06	6.785E-06	6.840E-06	1.076	0.911	1.014	1.18	1.06	0.90	6.832E-06	6.785E-06	6.840E-06	1.076	0.911	1.014	1.18	1.06	0.90
PU108	9.801E-04	6.950E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0	9.758E-04	6.917E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0	9.758E-04	6.917E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0	9.758E-04	6.917E-04	0.0	1.170	0.830	0.0	1.41	0.0	0.0
SM126	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM124	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM123	1.229	1.470E-05	1.527E-05	0.996	1.035	0.969	0.96	1.03	1.07	1.470E-05	1.527E-05	1.425E-05	0.996	1.035	0.969	0.96	1.03	1.07	1.470E-05	1.527E-05	1.425E-05	0.996	1.035	0.969	0.96	1.03	1.07	1.470E-05	1.527E-05	1.425E-05	0.996	1.035	0.969	0.96	1.03	1.07
CS131	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS134	0.0	0.0	2.530E-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS135	1.139E-04	1.280E-04	1.263E-04	0.928	1.043	1.029	0.89	0.90	1.01	1.139E-04	1.280E-04	1.262E-04	0.928	1.043	1.029	0.89	0.90	1.01	1.139E-04	1.280E-04	1.262E-04	0.928	1.043	1.029	0.89	0.90	1.01	1.139E-04	1.280E-04	1.262E-04	0.928	1.043	1.029	0.89	0.90	1.01
CS137	1.127E-01	1.165E-01	0.0	0.983	1.017	0.0	0.0	0.0	0.0	1.066E-08	1.207E-08	0.0	0.938	1.062	0.0	0.0	0.0	0.0	1.066E-08	1.207E-08	0.0	0.938	1.062	0.0	0.0	0.0	0.0	1.066E-08	1.207E-08	0.0	0.938	1.062	0.0	0.0	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD163	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD164	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PM147	0.0	0.0	2.330E-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM147	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03	6.204E-08	8.026E-08	7.785E-08	0.845	1.094	1.061	0.77	0.80	1.03
SM148	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0	5.926E-13	3.942E-13	0.0	1.201	0.799	0.0	1.50	0.0	0.0
SM149	0.0	1.257E-14	1.046E-14	0.0	1.069	0.931	0.0	0.0	0.0	1.257E-14	1.046E-14	0.0	0.0	1.069	0.931	0.0	0.0	0.0	1.257E-14	1.046E-14	0.0	0.0	1.069	0.931	0.0	0.0	0.0	1.257E-14	1.046E-14	0.0	0.0	1.069	0.931	0.0	0.0	0.0
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM151	4.180E-03	4.951E-03	3.942E-03	0.959	1.136	0.905	0.84	1.06	1.26	4.180E-03	4.951E-03	3.942E-03	0.959	1.136	0.905	0.84	1.																			

CASE: PMR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

WATTS

PER MTU

30 DAY										5 YR									
ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR2 AVG	CIN AVG	OR2 OR2 CIN	OR2 OR2 CIN	OR2 OR2 CIN	OR2 OR2 CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	OR2 AVG	CIN AVG	OR2 OR2 CIN	OR2 OR2 CIN	OR2 OR2 CIN	OR2 OR2 CIN
SE 79	1.529E-04	1.081E-04	9.887E-05	1.275	0.901	0.824	1.41	1.55	1.09	1.529E-04	1.081E-04	9.886E-05	1.275	0.901	0.824	1.41	1.55	1.09	1.09
KR 85	2.049E-01	2.036E-01	2.046E-01	1.003	0.996	1.001	1.01	1.00	1.00	1.491E-01	1.482E-01	1.489E-01	1.003	0.996	1.001	1.01	1.00	1.00	1.00
SR 89	1.896E-03	1.941E-03	1.959E-03	0.981	1.005	1.014	0.98	0.97	0.99	3.715E-08	3.800E-08	3.842E-08	0.981	1.004	1.015	0.98	0.97	0.99	0.99
SR 90	1.261E-02	1.252E-02	1.278E-02	0.998	0.991	1.011	1.01	0.99	0.98	1.121E-02	1.114E-02	1.137E-02	0.997	0.991	1.011	1.01	0.99	0.98	0.98
Y 90	6.025E-02	5.980E-02	6.116E-02	0.997	0.990	1.013	1.01	0.99	0.98	5.357E-02	5.320E-02	5.440E-02	0.997	0.990	1.013	1.01	0.99	0.98	0.98
Y 91	2.773E-03	2.827E-03	2.891E-03	0.980	0.999	1.021	0.98	0.96	0.98	1.588E-06	1.619E-06	1.658E-06	0.979	0.998	1.022	0.98	0.96	0.98	0.98
ZK 93	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	0.0
ZR 95	5.886E-03	5.988E-03	6.030E-03	0.986	1.003	1.010	0.98	0.98	0.99	2.082E-05	2.115E-05	2.211E-05	0.975	0.990	1.035	0.98	0.94	0.96	0.96
NB 95	7.217E-03	7.326E-03	7.397E-03	0.987	1.002	1.011	0.99	0.98	0.99	4.378E-05	4.447E-05	4.651E-05	0.975	0.990	1.035	0.98	0.94	0.96	0.96
TC 99	9.378E-03	9.643E-03	9.580E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.378E-03	9.643E-03	9.580E-03	0.984	1.011	1.005	0.97	0.98	1.01	1.01
RU106	4.012E-01	3.721E-01	0.0	1.038	0.962	0.0	1.08	0.0	0.0	1.364E+00	1.265E+00	0.0	1.038	0.962	0.0	1.08	0.0	0.0	0.0
PD107	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.89	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.89	0.89
SM126	1.423E-03	1.040E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	1.423E-03	1.040E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	0.0
SB129	5.897E-01	4.112E-01	3.369E-01	1.322	0.922	0.756	1.43	1.75	1.22	1.724E+01	1.202E+01	9.849E+00	1.322	0.922	0.756	1.43	1.75	1.22	1.22
1225	2.144E-05	2.282E-05	2.101E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	1.09
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	2.865E-03	2.696E-03	2.817E-03	1.026	0.965	1.009	1.06	1.02	0.96	5.485E-02	5.161E-02	5.394E-02	1.026	0.965	1.009	1.06	1.02	0.96	0.96
CS135	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	1.02
CS137	1.718E-02	1.708E-02	0.0	1.003	0.997	0.0	1.01	0.0	0.0	1.533E-02	1.526E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0	0.0
CE144	8.299E-02	8.314E-02	0.0	0.999	1.001	0.0	1.00	0.0	0.0	1.039E-01	1.042E-01	0.0	0.999	1.001	0.0	1.00	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	2.212E-11	2.194E-11	0.0	1.004	0.996	0.0	0.0	1.01	0.0	2.733E-11	2.731E-11	0.0	1.000	1.000	0.0	0.0	1.00	1.00
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	4.457E-01	7.273E-01	6.776E-01	0.782	1.148	1.070	0.68	0.73	1.07	1.363E-01	1.996E-01	1.860E-01	0.783	1.147	1.069	0.68	0.73	1.07	1.07
SM147	2.846E-08	3.107E-08	3.313E-08	0.921	1.006	1.073	0.92	0.86	0.94	6.248E-08	6.208E-08	7.958E-08	0.936	1.099	1.063	0.76	0.79	1.03	1.03
SM148	1.107E-12	7.623E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	0.0
SM149	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	1.16
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	5.874E-02	7.304E-02	5.357E-02	0.951	1.182	0.867	0.80	1.10	1.36	5.656E-02	7.033E-02	5.157E-02	0.951	1.182	0.867	0.80	1.10	1.36	1.36
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ZU154	1.674E-02	1.704E-02	1.497E-02	1.030	1.049	0.921	0.98	1.12	1.14	1.126E-02	1.146E-02	1.007E-02	1.030	1.049	0.921	0.98	1.12	1.14	1.14
ZU155	8.648E-00	9.292E-00	8.536E-00	0.980	1.053	0.967	0.93	1.01	1.09	4.349E+00	4.673E+00	4.293E+00	0.980	1.053	0.967	0.93	1.01	1.09	1.09
U234	3.583E-02	3.631E-02	3.551E-02	0.999	1.012	0.990	0.99	1.01	1.02	3.795E-02	3.866E-02	3.617E-02	1.010	1.028	0.962	0.98	1.05	1.07	1.07
U235	4.583E-04	4.883E-04	5.484E-04	0.920	0.980	1.100	0.94	0.84	0.89	4.583E-04	4.884E-04	5.484E-04	0.920	0.980	1.100	0.94	0.84	0.89	0.89
U236	1.056E-02	1.058E-02	1.052E-02	1.001	1.002	0.997	1.00	1.00	1.01	1.056E-02	1.058E-02	1.052E-02	1.001	1.002	0.997	1.00	1.00	1.01	1.01
U238	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	1.00
NP237	1.655E-02	1.737E-02	1.588E-02	0.997	1.046	0.957	0.95	1.04	1.09	1.661E-02	1.743E-02	1.589E-02	0.998	1.047	0.955	0.95	1.05	1.10	1.10
PU238	1.684E-02	1.875E-02	1.592E-02	0.981	1.092	0.927	0.90	1.06	1.18	1.726E-02	1.916E-02	1.645E-02	0.979	1.087	0.933	0.90	1.05	1.17	1.17
PU239	1.118E-01	1.231E-01	1.115E-01	0.968	1.066	0.966	0.91	1.00	1.10	1.118E-01	1.231E-01	1.115E-01	0.968	1.066	0.966	0.91	1.00	1.10	1.10
PU240	1.894E-01	1.827E-01	1.676E-01	1.053	1.016	0.932	1.04	1.13	1.09	1.902E-01	1.835E-01	1.675E-01	1.054	1.017	0.929	1.04	1.14	1.10	1.10
PU241	5.345E-00	5.943E-00	6.034E-00	0.926	1.029	1.045	0.90	0.89	0.98	4.218E+00	4.713E+00	4.785E+00	0.923	1.031	1.047	0.89	0.88	0.98	0.98
PU242	8.806E-02	8.716E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.806E-02	8.716E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	0.83
AM241	7.170E-00	7.456E-00	8.311E-00	0.938	0.975	1.087	0.96	0.86	0.90	4.717E+01	5.064E+01	5.242E+01	0.942	1.011	1.047	0.93	0.90	0.97	0.97
AM242	1.328E-02	2.248E-02	1.093E-02	0.853	1.444	0.702	0.59	1.21	2.06	1.298E-02	2.198E-02	1.069E-02	0.853	1.444	0.703	0.59	1.21	2.06	2.06
AM243	1.184E-00	1.314E-00	1.572E-00	0.873	0.969	1.159	0.90	0.75	0.84	1.184E-00	1.314E-00	1.571E-00	0.873	0.969	1.158	0.90	0.75	0.84	0.84
CM242	2.414E-03	2.529E-03	2.552E-03	0.966	1.012	1.021	0.95	0.95	0.99	1.523E+00	1.819E+00	1.507E+00	0.942	1.125	0.932	0.84	1.01	1.21	1.21
CM243	1.624E-02	3.457E-01	1.458E-00	1.421	0.303	1.276	4.70	1.11	0.24	1.441E+00	3.067E-01	1.294E+00	1.421	0.303	1.276	4.70	1.11	0.24	0.24
CM244	2.065E-02	2.043E-02	2.775E-02	0.900	0.891	1.209	1.01	0.74	0.74	1.710E-02	1.693E-02	2.299E-02	0.900	0.891	1.209	1.01	0.74	0.74	0.74
CM245	1.455E-02	2.096E-02	3.413E-02	0.786	0.842	1.372	0.93	0.57	0.61	1.954E-02	2.095E-02	3.412E-02	0.786	0.842	1.372	0.93	0.57	0.61	0.61
CM246	5.109E-03	5.812E-03	8.151E-03	0.804	0.914	1.282	0.88	0.63	0.71	5.106E-03	5.808E-03	8.145E-03	0.804	0.914	1.282	0.88	0.63	0.71	0.71

AVERAGE-ABSOLUTE-DEVIATION, AS % 7.60 7.24 8.35 18.5 12.9 13.8
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 5.77 5.53 6.57 8.5 10.9 9.3
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 4.57 4.34 4.88 6.7 9.6 9.3
 NUCS EXCLUDED, 1ST/2ND: SB125 CM243 CM245 / SE 79 AM242 CM246

7.93 7.72 8.54 19.2 13.2 14.4
 6.13 6.05 6.77 9.2 11.2 9.9
 4.96 4.90 5.10 7.5 9.9 9.9
 SB125 CM243 CM245 / SE 79 AM242 CM246

CASE: PMR, 4.50 MT & U-235, 5.206 AT & BURNUP 150.0 GMD/MTU, APPROX.)

MATTIS

PER MTU

	10 YR										20 YR									
	ORIGEN2	ORIGEN-5	CINDER	QRC	QRC	CIN	QRC	QRC	QRC	CIN	QRC	QRC	CIN	QRC	QRC	CIN	QRC	QRC	CIN	QRC
SE 79	1.529E-04	1.091E-04	9.886E-05	1.275	0.901	0.824	1.41	1.55	1.09	1.329E-04	1.081E-04	9.885E-05	1.275	0.901	0.824	1.41	1.55	1.09	1.329E-04	1.081E-04
KR 85	1.079E-01	1.077E-01	1.077E-01	1.003	0.996	1.001	1.01	1.00	0.99	5.617E-00	5.617E-00	5.617E-00	1.002	0.996	1.001	1.01	1.00	1.00	5.617E-00	5.617E-00
SR 89	4.822E-19	4.929E-19	4.992E-19	0.981	1.003	1.016	0.98	0.97	0.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	9.957E-01	9.887E-01	1.009E-01	0.998	0.991	1.011	1.01	0.99	0.98	7.848E-01	7.793E-01	7.954E-01	0.998	0.991	1.011	1.01	0.99	0.98	7.848E-01	7.793E-01
Y 90	8.756E-02	8.723E-02	8.809E-02	0.997	0.990	1.013	1.01	0.98	0.98	3.287E-02	3.222E-02	3.071E-02	0.997	0.990	1.013	1.01	0.98	0.98	3.287E-02	3.222E-02
Y 91	6.355E-16	6.495E-16	6.663E-16	0.979	0.998	1.023	0.98	0.96	0.97	1.027E-04	0.0	1.076E-04	0.977	0.990	1.023	0.98	0.96	0.97	1.027E-04	0.0
XR 93	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.152E-04	3.172E-04
XR 95	5.323E-14	5.396E-14	5.861E-14	0.963	0.976	1.061	0.99	0.91	0.92	3.787E-01	0.0	4.119E-01	0.963	0.976	1.061	0.99	0.91	0.92	3.787E-01	0.0
MB 95	1.119E-13	1.134E-13	1.233E-13	0.963	0.976	1.061	0.99	0.91	0.92	7.312E-01	0.0	8.669E-01	0.963	0.976	1.061	0.99	0.91	0.92	7.312E-01	0.0
TC 99	9.378E-03	9.643E-03	9.580E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.377E-03	9.642E-03	9.579E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.377E-03	9.642E-03
RU106	4.300E-02	4.062E-02	0.0	1.038	0.962	0.0	1.08	0.0	0.0	4.564E-05	4.191E-05	0.0	1.033	0.947	0.0	1.11	0.0	0.0	4.564E-05	4.191E-05
PD107	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.89	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.89	1.011E-05	8.474E-06
SM126	1.423E-03	1.048E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	1.423E-03	1.048E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	1.423E-03	1.048E-03
SM129	4.933E-00	3.402E-00	2.819E-00	1.322	0.922	0.756	1.43	1.75	1.22	4.840E-01	2.817E-01	2.308E-01	1.322	0.922	0.756	1.43	1.75	1.22	4.840E-01	2.817E-01
1129	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS138	1.021E-02	9.610E-01	1.004E-02	1.026	0.965	1.009	1.06	1.02	0.96	3.342E-00	3.322E-00	3.483E-00	1.026	0.965	1.009	1.06	1.02	0.96	3.342E-00	3.322E-00
CS139	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04
CS137	1.366E-02	1.360E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0	1.084E-02	1.081E-02	0.0	1.001	0.999	0.0	1.00	0.0	0.0	1.084E-02	1.081E-02
CR144	1.210E-01	1.213E-01	0.0	0.999	1.001	0.0	1.00	0.0	0.0	1.540E-05	1.645E-05	0.0	0.998	1.002	0.0	1.00	0.0	0.0	1.540E-05	1.645E-05
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	2.740E-11
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	3.630E-00	3.325E-00	4.963E-00	0.784	1.147	1.069	0.68	0.73	1.07	2.590E-01	3.791E-01	3.538E-01	0.784	1.147	1.069	0.68	0.73	1.07	2.590E-01	3.791E-01
SM147	7.183E-08	9.610E-08	9.235E-08	0.828	1.107	1.064	0.75	0.78	1.04	7.859E-08	1.008E-07	9.665E-08	0.828	1.107	1.064	0.75	0.78	1.04	7.859E-08	1.008E-07
SM148	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13
SM149	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	5.442E-02	6.767E-02	4.963E-02	0.951	1.182	0.867	0.80	1.10	1.36	5.039E-02	6.265E-02	4.595E-02	0.951	1.182	0.867	0.80	1.10	1.36	5.039E-02	6.265E-02
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	7.525E-01	7.661E-01	6.729E-01	1.030	1.049	0.921	0.98	1.12	1.14	3.361E-01	3.422E-01	3.005E-01	1.030	1.049	0.921	0.98	1.12	1.14	3.361E-01	3.422E-01
EU155	2.162E-00	2.323E-00	2.135E-00	0.980	1.053	0.967	0.93	1.01	1.09	5.344E-01	5.744E-01	5.277E-01	0.980	1.053	0.967	0.93	1.01	1.09	5.344E-01	5.744E-01
U234	4.003E-02	4.098E-02	3.683E-02	1.019	1.043	0.938	0.98	1.09	1.11	4.396E-02	4.534E-02	3.808E-02	1.035	1.068	0.997	0.97	1.15	1.19	4.396E-02	4.534E-02
U235	4.584E-04	4.884E-04	5.404E-04	0.920	0.980	1.100	0.94	0.84	0.89	4.584E-04	4.884E-04	5.404E-04	0.920	0.980	1.100	0.94	0.84	0.89	4.584E-04	4.884E-04
U236	1.056E-02	1.052E-02	1.052E-02	1.001	1.002	0.997	1.00	1.00	1.01	1.052E-02	1.052E-02	1.052E-02	1.001	1.003	0.996	1.00	1.00	1.01	1.052E-02	1.052E-02
U238	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03
MP237	1.670E-02	1.753E-02	1.589E-02	1.000	1.049	0.951	0.95	1.05	1.10	1.701E-02	1.786E-02	1.589E-02	1.005	1.056	0.939	0.95	1.07	1.12	1.701E-02	1.786E-02
PU238	1.650E-02	1.842E-02	1.581E-02	0.980	1.087	0.933	0.90	1.05	1.17	1.534E-02	1.702E-02	1.589E-02	0.980	1.087	0.933	0.90	1.05	1.17	1.534E-02	1.702E-02
PU239	1.118E-01	1.231E-01	1.115E-01	0.968	1.066	0.965	0.91	1.00	1.10	1.117E-01	1.230E-01	1.114E-01	0.968	1.066	0.965	0.91	1.00	1.10	1.118E-01	1.231E-01
PU240	1.904E-01	1.841E-01	1.674E-01	1.055	1.018	0.926	1.04	1.14	1.10	1.917E-01	1.850E-01	1.673E-01	1.057	1.020	0.922	1.04	1.15	1.11	1.904E-01	1.841E-01
PU241	3.316E-00	3.723E-00	3.780E-00	0.919	1.032	1.048	0.89	0.88	0.98	2.049E-00	2.323E-00	2.359E-00	0.913	1.033	1.051	0.88	0.87	0.98	2.049E-00	2.323E-00
PU242	8.066E-02	8.715E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.066E-02	8.715E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.066E-02	8.715E-02
AM241	7.887E-01	8.503E-01	8.754E-01	0.941	1.014	1.044	0.93	0.90	0.97	1.324E-02	1.362E-02	1.362E-02	0.938	1.017	1.044	0.92	0.90	0.97	1.324E-02	1.362E-02
AM242	1.269E-02	1.149E-02	1.045E-02	0.953	1.445	0.702	0.59	1.21	2.06	1.312E-02	2.053E-02	1.068E-02	0.953	1.445	0.702	0.59	1.21	2.06	1.312E-02	2.053E-02
AM243	1.183E-00	1.313E-00	1.571E-00	0.873	0.969	1.159	0.90	0.75	0.84	1.182E-00	1.312E-00	1.568E-00	0.873	0.969	1.159	0.90	0.75	0.84	1.182E-00	1.312E-00
CM243	3.213E-01	3.775E-01	2.777E-01	0.856	1.448	0.696	0.59	1.23	2.08	3.355E-01	5.510E-01	2.648E-01	0.856	1.448	0.696	0.59	1.23	2.08	3.355E-01	5.510E-01
CM242	1.276E-00	2.716E-01	1.146E-00	1.421	0.303	1.276	4.70	1.11	0.24	1.000E-00	2.130E-01	8.982E-01	1.421	0.303	1.276	4.70	1.11	0.24	1.000E-00	2.130E-01
CM244	1.472E-02	1.398E-02	1.898E-02	0.900	0.891	1.210	1.01	0.74	0.74	9.633E-01	9.533E-01	1.295E-02	0.900	0.891	1.210	1.01	0.74	0.74	9.633E-01	9.533E-01
CM245	1.953E-02	2.094E-02	3.410E-02	0.786	0.842	1.372	0.93	0.61	0.61	1.952E-02	2.092E-02	3.407E-02	0.786	0.842	1.372	0.93	0.61	0.61	1.952E-02	2.092E-02
CM246	5.102E-03	5.803E-03	8.139E-03	0.804	0.914	1.282	0.88	0.63	0.71	5.095E-03	5.795E-03	8.127E-03	0.804	0.914	1.282	0.88	0.63	0.71	5.095E-03	5.795E-03

CASE: PWR, 4.50 WT & U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

WATTS PER MTU

	50 YR										100 YR									
	ORIGEN2	ORIGEN-S	CINDER	QRA AVG	QRS AVG	CIM AVG	QRA ORS	QRA CIM	QRS CIM	ORIGEN2	ORIGEN-S	CINDER	QRA AVG	QRS AVG	CIM AVG	QRA ORS	QRA CIM	QRS CIM	ORIGEN2	ORIGEN-S
SE 79	1.528E-04	1.080E-04	9.881E-05	1.275	0.901	0.824	1.41	1.55	1.09	1.527E-04	1.080E-04	9.876E-05	1.274	0.901	0.824	1.41	1.55	1.09	1.527E-04	1.080E-04
KR 85	8.123E-01	8.072E-01	8.112E-01	1.003	0.996	1.001	1.01	1.00	1.00	3.204E-02	3.183E-02	3.199E-02	1.003	0.996	1.001	1.01	1.00	0.99	3.204E-02	3.183E-02
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	3.843E-01	3.815E-01	3.895E-01	0.998	0.991	1.011	1.01	0.99	0.98	1.169E+01	1.160E+01	1.185E+01	0.998	0.990	1.011	1.01	0.99	0.98	1.169E+01	1.160E+01
Y 90	1.835E-02	1.822E-02	1.864E-02	0.997	0.990	1.013	1.01	0.98	0.98	5.583E+01	5.543E+01	5.669E+01	0.997	0.990	1.013	1.01	0.98	0.98	5.583E+01	5.543E+01
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ZR 93	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.152E-04	3.172E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.152E-04	3.172E-04
ZR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	9.377E-03	9.641E-03	9.578E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.375E-03	9.640E-03	9.577E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.375E-03	9.640E-03
RU106	5.123E-14	4.602E-14	0.0	1.054	0.946	0.0	1.11	0.0	0.0	5.990E-29	5.378E-29	0.0	1.054	0.946	0.0	1.11	0.0	0.0	5.990E-29	5.378E-29
PD107	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.99	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.99	1.011E-05	8.474E-06
SM126	1.423E-03	1.040E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	1.422E-03	1.039E-03	0.0	1.156	0.844	0.0	1.37	0.0	0.0	1.422E-03	1.039E-03
SB125	2.218E-04	1.546E-04	1.268E-04	1.322	0.922	0.756	1.43	1.75	1.22	8.163E-10	5.690E-10	4.668E-10	1.322	0.922	0.756	1.43	1.75	1.22	8.163E-10	5.690E-10
I129	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	1.477E-04	1.389E-04	1.453E-04	1.026	0.965	1.009	1.06	1.02	0.96	7.410E-12	6.962E-12	7.287E-12	1.026	0.964	1.009	1.06	1.02	0.96	7.410E-12	6.962E-12
CS135	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04
CS137	5.420E-01	5.425E-01	0.0	1.000	1.000	0.0	1.00	0.0	0.0	1.707E+01	1.720E+01	0.0	0.996	1.004	0.0	0.99	0.0	0.0	1.707E+01	1.720E+01
CE144	4.082E-17	4.105E-17	0.0	0.997	1.003	0.0	0.99	0.0	0.0	1.866E-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.866E-36	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	2.740E-11
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	9.354E-05	1.368E-04	1.276E-04	0.784	1.147	1.069	0.68	0.73	1.07	7.173E-10	2.501E-10	2.334E-10	0.785	1.146	1.069	0.68	0.73	1.07	7.173E-10	2.501E-10
SM147	7.524E-08	1.012E-07	9.700E-08	0.825	1.110	1.064	0.74	0.78	1.04	7.524E-08	1.012E-07	9.700E-08	0.825	1.110	1.064	0.74	0.78	1.04	7.524E-08	1.012E-07
SM148	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13
SM149	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.999E-02	4.973E-02	3.647E-02	0.951	1.182	0.867	0.80	1.10	1.36	2.721E-02	3.383E-02	2.481E-02	0.951	1.182	0.867	0.80	1.10	1.36	2.721E-02	3.383E-02
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	2.995E-00	3.048E-00	2.678E-00	1.030	1.049	0.921	0.98	1.12	1.14	5.325E-02	5.417E-02	4.759E-02	1.031	1.048	0.921	0.98	1.12	1.14	5.325E-02	5.417E-02
EU155	8.072E-03	8.677E-03	7.972E-03	0.980	1.053	0.967	0.93	1.01	1.09	7.645E-06	8.010E-06	7.360E-06	0.979	1.053	0.968	0.93	1.01	1.09	7.645E-06	8.010E-06
U234	5.405E-02	5.654E-02	4.129E-02	1.068	1.117	0.816	0.96	1.31	1.37	6.637E-02	7.022E-02	4.520E-02	1.095	1.159	0.746	0.95	1.47	1.55	6.637E-02	7.022E-02
U235	4.588E-04	4.888E-04	5.484E-04	0.920	0.980	1.100	0.94	0.84	0.89	4.592E-04	4.894E-04	5.484E-04	0.920	0.981	1.099	0.94	0.84	0.89	4.592E-04	4.894E-04
U236	1.058E-02	1.060E-02	1.052E-02	1.001	1.003	0.996	1.00	1.01	1.01	1.061E-02	1.063E-02	1.052E-02	1.002	1.004	0.994	1.00	1.01	1.01	1.061E-02	1.063E-02
U238	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03
NP237	1.838E-02	1.935E-02	1.589E-02	1.028	1.083	0.889	0.95	1.16	1.22	2.098E-02	2.221E-02	1.589E-02	1.065	1.128	0.807	0.94	1.32	1.40	2.098E-02	2.221E-02
PU238	1.211E-02	1.344E-02	1.153E-02	0.980	1.087	0.933	0.90	1.05	1.17	8.164E+01	9.068E+01	7.776E+01	0.979	1.088	0.933	0.90	1.05	1.17	8.164E+01	9.068E+01
PU239	1.117E-01	1.229E-01	1.113E-01	0.969	1.066	0.966	0.91	1.00	1.10	1.115E+01	1.228E+01	1.112E+01	0.968	1.066	0.965	0.91	1.00	1.10	1.115E+01	1.228E+01
PU240	1.927E-01	1.861E-01	1.667E-01	1.060	1.023	0.917	1.04	1.16	1.12	1.924E+01	1.857E+01	1.658E+01	1.061	1.024	0.915	1.04	1.16	1.12	1.924E+01	1.857E+01
PU241	4.835E-01	5.645E-01	5.733E-01	0.895	1.045	1.061	0.86	0.84	0.98	4.357E-02	5.343E-02	5.426E-02	0.864	1.060	1.076	0.82	0.80	0.98	4.357E-02	5.343E-02
PU242	8.806E-02	8.716E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.805E-02	8.716E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.805E-02	8.716E-02
AM241	1.709E-02	1.867E-02	1.914E-02	0.934	1.020	1.046	0.92	0.89	0.98	1.726E+02	1.894E+02	1.941E+02	0.931	1.022	1.047	0.91	0.89	0.98	1.726E+02	1.894E+02
AM242	1.058E-02	1.790E-02	8.707E-03	0.854	1.444	0.702	0.59	1.22	2.06	8.419E-03	1.425E-02	6.932E-03	0.853	1.444	0.703	0.59	1.21	2.06	8.419E-03	1.425E-02
AM243	1.179E-00	1.308E-00	1.565E-00	0.873	0.968	1.159	0.90	0.75	0.84	1.173E+00	1.302E+00	1.557E+00	0.873	0.969	1.159	0.90	0.75	0.84	1.173E+00	1.302E+00
CM242	2.839E-01	4.806E-01	2.310E-01	0.856	1.448	0.696	0.59	1.23	2.08	2.260E-01	3.826E-01	1.839E-01	0.856	1.448	0.696	0.59	1.23	2.08	2.260E-01	3.826E-01
CM243	4.823E-01	1.027E-01	4.330E-01	1.421	0.303	1.276	4.70	1.11	0.24	4.430E-01	3.043E-01	1.283E-01	1.422	0.303	1.276	4.70	1.11	0.24	4.430E-01	3.043E-01
CM244	3.055E-01	3.023E-01	4.106E-01	0.900	0.890	1.210	1.01	0.74	0.74	4.508E+00	4.460E+00	6.058E+00	0.900	0.890	1.209	1.01	0.74	0.74	4.508E+00	4.460E+00
CM245	1.947E-02	2.087E-02	3.399E-02	0.786	0.842	1.372	0.93	0.57	0.61	1.939E-02	2.079E-02	3.385E-02	0.786	0.842	1.372	0.93	0.57	0.61	1.939E-02	2.079E-02
CM246	5.072E-03	5.770E-03	8.092E-03	0.804	0.914	1.282	0.88	0.63	0.71	5.035E-03	5.727E-03	8.033E-03	0.804	0.914	1.282	0.88	0.63	0.71	5.035E-03	5.727E-03

AVERAGE-ABSOLUTE-DEVIATION, AS % 9.12 9.64 10.56 21.9 16.3 19.4
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 7.22 7.94 8.76 11.1 14.3 14.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.01 6.81 7.04 8.3 12.6 11.9
 NUCS EXCLUDED, 1ST/2ND: SB125 CM243 CM245 / SE 79 CM242 CM246

9.63 10.14 11.05 22.7 1

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

WATTS PER MTU

	300 YR										1 YR									
	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q23 CIN	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q22 CIN	Q23 CIN		
SE 79	1.524E-04	1.077E-04	9.855E-05	1.275	0.901	0.824	1.42	1.55	1.09	1.513E-04	1.069E-04	9.782E-05	1.275	0.901	0.824	1.42	1.55	1.09		
KR 85	7.753E-08	7.695E-08	7.739E-08	1.003	0.996	1.001	1.01	1.00	0.99	1.709E-27	1.696E-27	1.704E-27	1.004	0.996	1.001	1.01	1.00	1.00		
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SR 90	1.001E-01	9.930E-02	1.014E-01	0.998	0.990	1.011	1.01	0.99	0.98	5.813E-09	5.763E-09	5.803E-09	0.999	0.990	1.011	1.01	0.99	0.98		
Y 90	4.781E-01	4.743E-01	4.853E-01	0.998	0.990	1.013	1.01	0.99	0.98	2.777E-08	2.753E-08	2.815E-08	0.998	0.990	1.012	1.01	0.99	0.98		
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ER 93	3.152E-04	3.171E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0	3.151E-04	3.170E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0		
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
NB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
TC 99	9.369E-03	9.634E-03	9.571E-03	0.984	1.011	1.005	0.97	0.98	1.01	9.348E-03	9.612E-03	9.549E-03	0.984	1.011	1.005	0.97	0.98	1.01		
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PD107	1.011E-05	8.474E-06	9.536E-06	1.079	0.904	1.017	1.19	1.06	0.89	1.011E-05	8.473E-06	9.535E-06	1.079	0.904	1.017	1.19	1.06	0.89		
SM126	1.420E-03	1.038E-03	0.0	1.155	0.845	0.0	1.37	0.0	0.0	1.413E-03	1.033E-03	0.0	1.155	0.845	0.0	1.37	0.0	0.0		
SB125	0.0	0.0	8.584E-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
I129	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09	2.151E-05	2.291E-05	2.110E-05	0.985	1.049	0.966	0.94	1.02	1.09		
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS134	0.0	0.0	8.612E-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS135	2.178E-04	2.405E-04	2.352E-04	0.942	1.040	1.017	0.91	0.93	1.02	2.178E-04	2.405E-04	2.351E-04	0.942	1.040	1.017	0.91	0.93	1.02		
CS137	1.680E-01	1.737E-01	0.0	0.983	1.017	0.0	0.97	0.0	0.0	1.589E-08	1.799E-08	0.0	0.938	1.062	0.0	0.88	0.0	0.0		
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ND144	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00		
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PM147	0.0	0.0	2.618E-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM147	7.524E-08	1.012E-07	9.700E-08	0.825	1.110	1.064	0.74	0.78	1.04	7.524E-08	1.012E-07	9.700E-08	0.825	1.110	1.064	0.74	0.78	1.04		
SM148	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0		
SM149	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16		
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM151	5.820E-03	7.250E-03	5.317E-03	0.951	1.182	0.867	0.80	1.10	1.36	2.654E-05	3.304E-05	2.423E-05	0.950	1.183	0.867	0.80	1.10	1.36		
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
RU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
RU154	5.318E-09	5.403E-09	4.750E-09	1.031	1.048	0.921	0.98	1.12	1.14	0.0	0.0	1.492E-33	0.0	0.0	0.0	0.0	0.0	0.0		
RU155	5.390E-18	5.817E-18	5.347E-18	0.977	1.054	0.969	0.93	1.01	1.09	0.0	0.0	1.748E-60	0.0	0.0	0.0	0.0	0.0	0.0		
U234	8.659E-02	9.270E-02	5.165E-02	1.125	1.204	0.671	0.93	1.68	1.79	9.172E-02	9.845E-02	5.326E-02	1.130	1.213	0.656	0.93	1.72	1.85		
U235	4.611E-04	4.914E-04	5.484E-04	0.922	0.982	1.096	0.94	0.94	0.90	4.675E-04	4.985E-04	5.484E-04	0.926	0.988	1.086	0.94	0.85	0.91		
U236	1.071E-02	1.072E-02	1.052E-02	1.006	1.006	0.988	1.00	1.02	1.02	1.103E-02	1.104E-02	1.052E-02	1.015	1.016	0.969	1.00	1.05	1.05		
U238	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00	7.864E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00		
NP237	2.987E-02	3.196E-02	1.589E-02	1.153	1.234	0.613	0.93	1.88	2.01	4.571E-02	4.936E-02	1.589E-02	1.236	1.335	0.430	0.93	2.88	3.11		
PU238	1.691E-01	1.884E-01	1.610E-01	0.978	1.090	0.931	0.90	1.05	1.17	7.429E-02	8.697E-02	6.972E-02	0.965	1.130	0.906	0.85	1.07	1.25		
PU239	1.109E-01	1.222E-01	1.105E-01	0.968	1.067	0.965	0.91	1.00	1.11	1.089E-01	1.200E-01	1.083E-01	0.969	1.067	0.964	0.91	1.01	1.11		
PU240	1.884E-01	1.819E-01	1.624E-01	1.061	1.024	0.914	1.04	1.16	1.12	1.750E-01	1.689E-01	1.508E-01	1.061	1.024	0.914	1.04	1.16	1.12		
PU241	2.072E-05	2.404E-05	4.352E-06	1.266	1.468	0.266	0.86	0.76	5.52	1.686E-05	1.866E-05	2.013E-05	1.424	1.576	0.000	0.90	0.00	0.00		
U242	8.803E-02	8.715E-02	1.051E-01	0.942	0.933	1.125	1.01	0.84	0.83	8.793E-02	8.705E-02	1.049E-01	0.942	0.933	1.125	1.01	0.84	0.83		
AM241	1.264E-02	1.388E-02	1.423E-02	0.931	1.022	1.047	0.91	0.89	0.98	4.116E-01	4.519E-01	4.630E-01	0.931	1.022	1.047	0.91	0.89	0.98		
AM242	3.382E-03	5.725E-03	2.785E-03	0.853	1.444	0.702	0.59	1.21	2.06	1.390E-04	2.352E-04	1.144E-04	0.853	1.444	0.702	0.59	1.22	2.06		
AM243	1.151E-00	1.278E-00	1.528E-00	0.873	0.969	1.159	0.90	0.75	0.84	1.078E-00	1.197E-00	1.431E-00	0.873	0.969	1.158	0.90	0.75	0.84		
CM242	9.079E-02	1.537E-01	7.386E-02	0.856	1.448	0.696	0.59	1.23	2.08	3.731E-03	6.314E-03	3.034E-03	0.856	1.448	0.696	0.59	1.23	2.08		
CM243	1.104E-03	2.347E-04	9.905E-04	1.422	0.302	1.276	4.70	1.11	0.24	4.459E-11	9.480E-12	3.999E-11	1.422	0.302	1.275	4.70	1.12	0.24		
CM244	2.135E-03	2.112E-03	2.870E-03	0.900	0.890	1.210	1.01	0.74	0.74	3.787E-12	4.886E-15	6.638E-15	2.991	0.004	0.005	0.00	0.00	0.74		
CM245	1.908E-02	2.045E-02	3.330E-02	0.786	0.842	1.372	0.93	0.57	0.61	1.802E-02	1.931E-02	3.145E-02	0.786	0.842	1.372	0.93	0.57	0.61		
CM246	4.890E-03	5.562E-03	7.801E-03	0.804	0.914	1.282	0.88	0.63	0.71	4.413E-03	5.020E-03	7.040E-03	0.804	0.914	1.282	0.88	0.63	0.71		

AVERAGE-ABSOLUTE-DEVIATION, AS % 9.73 12.01 13.98 22.6 30.1 38.1

AV-ABS-DEV EXCLUDING LARGEST ONE, % 7.57 9.27 11.34 12.0 18.5 23.1

AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.69 7.55 9.75 10.1 15.6 17.2

NUCS EXCLUDED, 1ST/2ND: SE 79 CM243 PU241 / SM147 CM242 NP237

17.05 15.93 18.83 **** **** ****

9.03 10.15 12.51 25.3 23.0 30.1

7.55 8.08 9.70 13.7 16.6 21.4

CM244 CM243 PU241 / SE 79 CM242 NP237

PER MTU

WATTS

CASE: PMR, 4.50 WT & U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

***** 10 KVR *****									
ORIGEN2	ORIGEN-5	CINDER	OR2	OR2	OR2	CIN	OR2	OR2	OR2
			AVG	AVG	AVG	AVG	CIN	CIN	CIN
SE 79	1.374E-04	9.714E-05	8.886E-05	1.275	0.901	0.824	1.41	1.55	1.09
SR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XR 93	3.138E-04	3.158E-04	0.0	0.997	1.003	0.0	0.99	0.0	0.0
XR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	9.078E-03	9.334E-03	9.273E-03	0.984	1.011	1.005	0.97	0.98	1.01
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	1.010E-05	8.465E-06	9.526E-06	1.079	0.904	1.017	1.19	1.06	0.89
SM126	1.328E-03	9.705E-04	0.0	1.156	0.844	0.0	1.37	0.0	0.0
SM125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	2.150E-05	2.290E-05	2.109E-05	0.985	1.049	0.966	0.94	1.02	1.09
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.172E-04	2.398E-04	2.345E-04	0.942	1.040	1.017	0.91	0.93	1.02
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	0.0	2.740E-11	2.737E-11	0.0	1.000	1.000	0.0	0.0	1.00
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	7.524E-08	1.012E-07	9.700E-08	0.825	1.110	1.064	0.74	0.78	1.04
SM148	1.111E-12	7.659E-13	0.0	1.184	0.816	0.0	1.45	0.0	0.0
SM149	0.0	1.496E-14	1.292E-14	0.0	1.073	0.927	0.0	0.0	1.16
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	2.084E-15	0.0	1.907E-15	1.044	0.0	0.956	0.0	1.09	0.0
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	9.966E-02	9.622E-02	5.193E-02	1.131	1.214	0.655	0.93	1.73	1.85
U235	5.405E-04	5.789E-04	5.484E-04	0.972	1.041	0.986	0.93	0.99	1.06
U236	1.364E-02	1.356E-02	1.052E-02	1.085	1.078	0.837	1.01	1.30	1.29
U278	7.844E-03	7.851E-03	7.844E-03	1.001	1.000	0.999	1.00	1.00	1.00
NP237	5.324E-02	5.762E-02	1.584E-02	1.261	1.364	0.375	0.92	3.36	3.64
PU238	1.204E-20	2.032E-20	9.722E-21	0.858	1.449	0.693	0.59	1.24	2.09
PU239	8.561E-00	9.430E-00	8.364E-00	0.975	1.073	0.952	0.91	1.02	1.13
PU240	6.737E-00	6.504E-00	5.817E-00	1.060	1.024	0.916	1.04	1.16	1.12
PU241	8.032E-06	8.957E-06	0.0	0.949	1.051	1.0	0.90	0.0	0.0
PU242	8.636E-02	8.566E-02	1.032E-01	0.943	0.933	1.124	1.01	0.84	0.83
AM241	8.698E-03	9.722E-03	2.494E-05	1.415	1.581	0.004	0.89	0.00	0.00
AM242	2.089E-22	3.527E-22	1.714E-22	0.855	1.443	0.702	0.59	1.22	2.06
AM243	4.630E-01	5.138E-01	6.146E-01	0.873	0.969	1.159	0.90	0.75	0.84
CM242	5.624E-21	9.496E-21	4.547E-21	0.858	1.449	0.694	0.59	1.24	2.09
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM244	3.742E-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CM245	8.648E-03	9.271E-03	1.506E-02	0.787	0.843	1.370	0.93	0.57	0.62
CM246	1.181E-03	1.342E-03	1.883E-03	0.804	0.914	1.282	0.88	0.63	0.71

AVERAGE ABSOLUTE DEVIATION, AS % 11.86 14.76 18.97 15.8 *****
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 9.79 11.68 14.64 14.7 31.1 40.2
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 8.37 8.95 11.55 13.8 19.0 30.6
 NUCS EXCLUDED, 1ST/2ND: SE 79 PU238 AM241 / SM147 CM242 NP237

CASE: BWR, 2.64 MT & U-235, 2.866 AT & BURNUP (27.5 GWD/MTU, APPROX.)

WATTS

PER MTU

	10 DAY										5 YR									
	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q23 ORS	CIN ORS	ORIGEN2	ORIGEN-S	CINDER	Q22 AVG	Q23 AVG	CIN AVG	Q22 ORS	Q23 ORS	CIN ORS		
SE 79	8.394E-05	5.966E-05	5.518E-05	1.267	0.900	0.833	1.41	1.52	1.08	8.393E-05	5.965E-05	5.518E-05	1.267	0.900	0.833	1.41	1.52	1.08		
KR 85	1.136E-01	1.150E-01	1.181E-01	0.983	0.995	1.022	0.99	0.96	0.97	8.266E-00	8.366E-00	8.590E-00	0.983	0.995	1.022	0.99	0.96	0.97		
SR 89	1.346E-03	1.395E-03	1.381E-03	0.980	1.015	1.005	0.96	0.97	1.01	2.637E-08	2.731E-08	2.708E-08	0.980	1.014	1.006	0.97	0.97	1.01		
SR 90	6.888E-01	6.986E-01	7.286E-01	0.977	0.990	1.033	0.99	0.95	0.96	6.127E-01	6.214E-01	6.481E-01	0.977	0.990	1.033	0.99	0.95	0.96		
Y 90	3.291E-02	3.337E-02	3.487E-02	0.976	0.990	1.034	0.99	0.94	0.96	2.927E-02	2.968E-02	3.102E-02	0.976	0.990	1.034	0.99	0.94	0.96		
Y 91	1.960E-03	2.019E-03	2.020E-03	0.980	1.010	1.010	0.97	0.97	1.00	1.123E-06	1.156E-06	1.158E-06	0.980	1.009	1.011	0.97	0.97	1.00		
ER 93	1.732E-04	1.771E-04	0.0	0.989	1.011	0.0	0.98	0.0	0.0	1.732E-04	1.771E-04	0.0	0.989	1.011	0.0	0.98	0.0	0.0		
ER 95	4.130E-03	4.202E-03	4.125E-03	0.995	1.012	0.993	0.98	1.00	1.02	1.461E-05	1.484E-05	1.512E-05	0.993	0.999	1.018	0.98	0.97	0.98		
NB 95	5.055E-03	5.144E-03	5.065E-03	0.994	1.011	0.995	0.98	1.00	1.02	3.072E-05	3.120E-05	3.181E-05	0.983	0.999	1.018	0.98	0.97	0.98		
TC 99	5.572E-03	5.654E-03	5.664E-03	0.990	1.004	1.006	0.99	0.98	1.00	5.572E-03	5.654E-03	5.664E-03	0.990	1.004	1.006	0.99	0.98	1.00		
RU106	2.560E-01	2.321E-01	0.0	1.049	0.951	0.0	1.10	0.0	0.0	8.701E-01	7.889E-01	0.0	1.049	0.951	0.0	1.10	0.0	0.0		
PD107	5.812E-06	4.698E-06	4.982E-06	1.126	0.910	0.965	1.24	1.17	0.94	5.812E-06	4.698E-06	4.982E-06	1.126	0.910	0.965	1.24	1.17	0.94		
SM126	7.920E-04	5.719E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0	7.920E-04	5.719E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0		
SB125	3.517E-01	2.367E-01	1.955E-01	1.346	0.906	0.748	1.49	1.80	1.21	1.028E-01	6.920E-00	5.717E+00	1.346	0.906	0.748	1.49	1.80	1.21		
1129	1.229E-05	1.253E-05	1.159E-05	1.013	1.032	0.955	0.98	1.06	1.08	1.234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08		
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CS134	1.139E-03	1.081E-03	1.037E-03	1.049	0.996	0.955	1.05	1.10	1.04	2.181E-02	2.068E-02	1.984E-02	1.050	0.995	0.955	1.05	1.10	1.04		
CS135	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10		
CS137	9.555E-01	9.497E-01	0.0	1.003	0.997	0.0	1.01	0.0	0.0	8.529E-01	8.483E-01	0.0	1.003	0.997	0.0	1.01	0.0	0.0		
CM144	5.554E-02	5.625E-02	0.0	0.994	1.006	0.0	0.99	0.0	0.0	6.956E+00	7.048E+00	0.0	0.993	1.007	0.0	0.99	0.0	0.0		
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ND144	0.0	1.105E-11	1.148E-11	0.0	0.981	1.019	0.0	0.0	0.96	0.0	1.458E-11	1.502E-11	0.0	0.985	1.015	0.0	0.0	0.97		
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PM147	4.044E-01	5.394E-01	5.300E-01	0.831	1.094	1.075	0.76	0.77	1.02	1.126E-01	1.479E-01	1.453E-01	0.832	1.093	1.074	0.76	0.77	1.02		
SM147	1.812E-08	2.055E-08	2.236E-08	0.891	1.010	1.099	0.88	0.81	0.92	4.622E-08	5.836E-08	5.865E-08	0.849	1.073	1.078	0.79	0.79	1.00		
SM148	4.901E-13	3.347E-13	0.0	1.188	0.812	0.0	1.46	0.0	0.0	4.927E-13	3.370E-13	0.0	1.188	0.812	0.0	1.46	0.0	0.0		
SM149	0.0	8.663E-15	6.818E-15	0.0	1.119	0.881	0.0	0.0	1.27	0.0	8.663E-15	6.818E-15	0.0	1.119	0.881	0.0	0.0	1.27		
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
SM151	3.789E-02	3.463E-02	2.708E-02	1.141	1.043	0.816	1.09	1.40	1.28	3.648E-02	3.334E-02	2.607E-02	1.141	1.043	0.816	1.09	1.40	1.28		
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
EU154	7.460E-01	7.074E-01	5.911E-01	1.095	1.038	0.867	1.05	1.26	1.20	5.019E-01	4.759E-01	3.977E-01	1.095	1.038	0.867	1.05	1.26	1.20		
EU155	3.792E-00	3.663E-00	2.855E-00	1.103	1.066	0.831	1.04	1.33	1.28	1.907E-00	1.842E-00	1.436E-00	1.103	1.066	0.831	1.04	1.33	1.28		
U234	2.653E-02	2.635E-02	2.655E-02	1.002	0.995	1.003	1.01	1.00	0.99	2.726E-02	2.706E-02	2.678E-02	1.008	1.001	0.991	1.01	1.02	1.01		
U235	3.955E-04	3.721E-04	3.586E-04	1.054	0.991	0.955	1.06	1.10	1.04	3.955E-04	3.721E-04	3.586E-04	1.054	0.991	0.955	1.06	1.10	1.04		
U236	5.629E-03	5.683E-03	5.763E-03	0.989	0.998	1.013	0.99	0.98	0.99	5.631E-03	5.685E-03	5.763E-03	0.989	0.999	1.012	0.99	0.98	0.99		
U238	8.124E-03	8.127E-03	8.136E-03	0.999	1.000	1.001	1.00	1.00	1.00	8.124E-03	8.127E-03	8.136E-03	0.999	1.000	1.001	1.00	1.00	1.00		
NP237	7.402E-03	7.287E-03	5.473E-03	1.101	1.084	0.814	1.02	1.35	1.33	7.436E-03	7.319E-03	5.478E-03	1.103	1.085	0.812	1.02	1.36	1.34		
PU238	5.606E-01	5.546E-01	4.152E-01	1.099	1.087	0.814	1.01	1.35	1.34	5.927E-01	5.797E-01	4.447E-01	1.100	1.075	0.825	1.02	1.33	1.30		
PU239	9.287E-00	9.364E-00	6.854E-00	1.092	1.101	0.806	0.99	1.36	1.37	9.286E+00	9.362E+00	6.853E-00	1.092	1.101	0.806	0.99	1.36	1.37		
PU240	1.508E-01	1.317E-01	1.313E-01	1.093	0.955	0.952	1.15	1.15	1.00	1.509E-01	1.318E-01	1.312E-01	1.094	0.955	0.951	1.14	1.15	1.00		
PU241	3.581E-00	3.472E-00	2.944E-00	1.075	1.042	0.884	1.03	1.22	1.18	2.826E+00	2.753E+00	2.335E+00	1.071	1.044	0.885	1.03	1.21	1.18		
PU242	4.456E-02	4.280E-02	5.239E-02	0.957	0.919	1.125	1.04	0.85	0.82	4.456E-02	4.280E-02	5.239E-02	0.957	0.919	1.125	1.04	0.85	0.82		
AM241	4.446E-00	4.182E-00	3.489E-00	1.101	1.035	0.864	1.06	1.27	1.20	3.125E-01	2.941E-01	2.502E-01	1.094	1.030	0.876	1.06	1.25	1.18		
AM242	7.940E-03	9.467E-03	3.946E-03	1.116	1.330	0.554	0.84	2.01	2.40	7.764E-03	9.257E-03	3.858E-03	1.116	1.330	0.554	0.84	2.01	2.40		
AM243	4.532E-01	4.095E-01	4.487E-01	1.037	0.937	1.026	1.11	1.01	0.91	4.530E-01	4.093E-01	4.485E-01	1.037	0.937	1.026	1.11	1.01	0.91		
CM242	1.208E-03	1.042E-03	1.024E-03	1.107	0.955	0.938	1.16	1.18	1.02	7.958E-01	7.552E-01	5.934E-01	1.113	1.057	0.830	1.05	1.34	1.27		
CM243	5.517E-01	1.522E-01	3.766E-01	1.532	0.423	1.046	3.62	1.46	0.40	4.895E-01	1.350E-01	3.342E-01	1.532	0.422	1.046	3.63	1.46	0.40		
CM244	5.105E-01	3.908E-01	4.282E-01	1.152	0.882	0.966	1.31	1.19	0.91	4.229E-01	3.237E-01	3.547E-01	1.152	0.882	0.966	1.31	1.19	0.91		
CM245	3.531E-03	2.615E-03	2.681E-03	1.200	0.889	0.911	1.35	1.32	0.98	3.530E-03	2.614E-03	2.680E-03	1.200	0.889	0.911	1.35	1.32	0.98		
CM246	6.729E-04	5.617E-04	5.899E-04	1.106	0.924	0.970	1.20	1.14	0.95	6.724E-04	5.613E-04	5.895E-04	1.106	0.924	0.970	1.20	1.14	0.95		

AVERAGE-ABSOLUTE-DEVIATION, AS % 9.11 6.78 8.49 16.7 20.7 14.9

AV-ABS-DEV EXCLUDING LARGEST ONE, % 7.32 4.88 7.14 10.8 17.7 10.3

AV-ABS-DEV EXCLUDING LARGEST TWO, % 6.84 4.57 6.61 9.8 15.9 10.0

NUCS EXCLUDED, 1ST/2ND: SB125 CM243 AM242 / SE 79 AM243 PU239

9.27 6.84 8.73 16.7 21.3 15.2

7.48 4.94 7.39 10.7 18.3 10.7

7.02 4.64 6.89 9.8 16.5 10.4

SB125 CM243 AM242 / SE 79 AM243 PU239

CASE: BWR, 2.64 WT & U-235, 2.866 AT & RUMUP (27.5 GWD/MTU, APPROX.)

WATTS PER MTU

10 YR										20 YR																	
ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN	ORIGEN2	ORIGEN-S	CINDER	OR2 AVG	ORS AVG	CIN AVG	OR2 ORS	OR2 CIN	ORS CIN	
SR 79	8.393E-05	5.965E-05	5.518E-05	1.267	0.900	0.833	1.41	1.52	1.08	8.392E-05	5.964E-05	5.517E-05	1.267	0.900	0.833	1.41	1.52	1.08	8.392E-05	5.964E-05	5.517E-05	1.267	0.900	0.833	1.41	1.52	1.08
KR 85	5.982E-00	6.055E-00	6.217E-00	0.983	0.995	1.022	0.99	0.96	0.97	3.134E-00	3.171E-00	3.256E-00	0.983	0.995	1.022	0.99	0.96	0.97	3.134E-00	3.171E-00	3.256E-00	0.983	0.995	1.022	0.99	0.96	0.97
SR 89	3.422E-19	3.542E-19	3.519E-19	0.979	1.014	1.007	0.97	0.97	1.01	0.0	0.0	5.942E-41	0.0	0.0	0.0	0.0	0.0	0.0	3.422E-19	3.542E-19	3.519E-19	0.979	1.014	1.007	0.97	0.97	1.01
SR 90	5.439E-01	5.517E-01	5.754E-01	0.977	0.991	1.033	0.99	0.95	0.96	4.287E-01	4.348E-01	4.535E-01	0.977	0.990	1.033	0.99	0.95	0.96	4.287E-01	4.348E-01	4.535E-01	0.977	0.990	1.033	0.99	0.95	0.96
Y 90	2.598E-02	2.635E-02	2.754E-02	0.976	0.990	1.034	0.99	0.94	0.96	2.048E-02	2.077E-02	2.170E-02	0.976	0.990	1.034	0.99	0.94	0.96	2.048E-02	2.077E-02	2.170E-02	0.976	0.990	1.034	0.99	0.94	0.96
Y 91	4.509E-16	4.639E-16	4.656E-16	0.980	1.008	1.012	0.97	0.97	1.00	7.265E-35	0.0	7.521E-35	0.983	0.0	1.017	0.0	0.97	0.0	4.509E-16	4.639E-16	4.656E-16	0.980	1.008	1.012	0.97	0.97	1.00
SR 93	1.732E-04	1.771E-04	0.0	0.989	1.011	0.0	0.98	0.0	0.0	1.732E-04	1.771E-04	0.0	0.989	1.011	0.0	0.98	0.0	0.0	1.732E-04	1.771E-04	0.0	0.989	1.011	0.0	0.98	0.0	0.0
SR 95	3.735E-14	3.786E-14	4.010E-14	0.972	0.985	1.043	0.99	0.93	0.94	2.441E-31	0.0	2.818E-31	0.928	0.0	1.072	0.0	0.87	0.0	3.735E-14	3.786E-14	4.010E-14	0.972	0.985	1.043	0.99	0.93	0.94
NB 95	7.853E-14	7.960E-14	8.433E-14	0.972	0.985	1.043	0.99	0.93	0.94	5.131E-31	0.0	5.927E-31	0.928	0.0	1.072	0.0	0.87	0.0	7.853E-14	7.960E-14	8.433E-14	0.972	0.985	1.043	0.99	0.93	0.94
TC 99	5.572E-03	5.654E-03	5.664E-03	0.990	1.004	1.006	0.99	0.98	1.00	5.572E-03	5.654E-03	5.664E-03	0.990	1.004	1.006	0.99	0.98	1.00	5.572E-03	5.654E-03	5.664E-03	0.990	1.004	1.006	0.99	0.98	1.00
RU106	2.795E-02	2.534E-02	0.0	1.049	0.951	0.0	1.10	0.0	0.0	2.946E-05	2.614E-05	0.0	1.060	0.940	0.0	1.13	0.0	0.0	2.795E-02	2.534E-02	0.0	1.049	0.951	0.0	1.10	0.0	0.0
PD107	5.812E-06	4.698E-06	4.982E-06	1.126	0.910	0.965	1.24	1.17	0.94	5.812E-06	4.698E-06	4.982E-06	1.126	0.910	0.965	1.24	1.17	0.94	5.812E-06	4.698E-06	4.982E-06	1.126	0.910	0.965	1.24	1.17	0.94
SN126	7.920E-04	5.719E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0	7.919E-04	5.719E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0	7.920E-04	5.719E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0
SB125	2.943E-00	1.980E-00	1.636E-00	1.346	0.906	0.748	1.49	1.80	1.21	2.409E-01	1.621E-01	1.340E-01	1.346	0.906	0.749	1.49	1.80	1.21	2.943E-00	1.980E-00	1.636E-00	1.346	0.906	0.749	1.49	1.80	1.21
I129	1.234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08	1.234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08	1.234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	4.061E-01	3.852E-01	3.696E-01	1.049	0.995	0.955	1.05	1.10	1.04	4.088E-00	1.335E-00	1.282E-00	1.050	0.995	0.955	1.05	1.10	1.04	4.061E-01	3.852E-01	3.696E-01	1.049	0.995	0.955	1.05	1.10	1.04
CS135	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10
CS137	7.598E-01	7.562E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0	6.031E-01	6.010E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0	7.598E-01	7.562E-01	0.0	1.002	0.998	0.0	1.00	0.0	0.0
CE144	8.101E-02	8.208E-02	0.0	0.993	1.007	0.0	0.99	0.0	0.0	1.098E-05	1.113E-05	0.0	0.993	1.007	0.0	0.99	0.0	0.0	8.101E-02	8.208E-02	0.0	0.993	1.007	0.0	0.99	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	1.462E-11	1.506E-11	0.0	0.985	1.015	0.0	0.0	0.97	0.0	1.462E-11	1.506E-11	0.0	0.985	1.015	0.0	0.0	0.97	0.0	1.462E-11	1.506E-11	0.0	0.985	1.015	0.0	0.0	0.97
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	3.004E-00	3.947E-00	3.878E-00	0.832	1.093	1.074	0.76	0.77	1.02	2.139E-01	2.810E-01	2.761E-01	0.832	1.093	1.074	0.76	0.77	1.02	3.004E-00	3.947E-00	3.878E-00	0.832	1.093	1.074	0.76	0.77	1.02
SM147	5.394E-08	6.875E-08	6.863E-08	0.846	1.078	1.076	0.78	0.79	1.00	5.655E-08	7.226E-08	7.200E-08	0.845	1.080	1.076	0.78	0.79	1.00	5.394E-08	6.875E-08	6.863E-08	0.846	1.078	1.076	0.78	0.79	1.00
SM148	4.927E-13	3.370E-13	0.0	1.188	0.812	0.0	1.46	0.0	0.0	4.927E-13	3.370E-13	0.0	1.188	0.812	0.0	1.46	0.0	0.0	4.927E-13	3.370E-13	0.0	1.188	0.812	0.0	1.46	0.0	0.0
SM149	0.0	8.663E-15	6.818E-15	0.0	1.119	0.881	0.0	0.0	1.27	0.0	8.663E-15	6.818E-15	0.0	1.119	0.881	0.0	0.0	1.27	0.0	8.663E-15	6.818E-15	0.0	1.119	0.881	0.0	0.0	1.27
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3.510E-02	3.208E-02	2.509E-02	1.141	1.043	0.816	1.09	1.40	1.28	3.250E-02	2.971E-02	2.323E-02	1.141	1.043	0.816	1.09	1.40	1.28	3.510E-02	3.208E-02	2.509E-02	1.141	1.043	0.816	1.09	1.40	1.28
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	3.354E-01	3.180E-01	2.658E-01	1.095	1.038	0.867	1.05	1.26	1.20	1.498E-01	1.420E-01	1.187E-01	1.095	1.038	0.868	1.05	1.26	1.20	3.354E-01	3.180E-01	2.658E-01	1.095	1.038	0.868	1.05	1.26	1.20
EU155	9.480E-01	9.160E-01	7.139E-01	1.103	1.066	0.831	1.03	1.33	1.28	2.343E-01	2.264E-01	1.765E-01	1.103	1.066	0.831	1.03	1.33	1.28	9.480E-01	9.160E-01	7.139E-01	1.103	1.066	0.831	1.03	1.33	1.28
U234	2.797E-02	2.776E-02	2.702E-02	1.014	1.006	0.980	1.01	1.04	1.03	2.932E-02	2.908E-02	2.746E-02	1.024	1.016	0.960	1.01	1.07	1.06	2.797E-02	2.776E-02	2.702E-02	1.014	1.006	0.980	1.01	1.04	1.03
U235	1.956E-04	3.722E-04	3.586E-04	1.054	0.991	0.955	1.06	1.10	1.04	3.957E-04	3.722E-04	3.586E-04	1.054	0.991	0.955	1.06	1.10	1.04	1.956E-04	3.722E-04	3.586E-04	1.054	0.991	0.955	1.06	1.10	1.04
U236	5.633E-03	5.687E-03	5.763E-03	0.989	0.999	1.012	0.99	0.98	0.99	5.636E-03	5.690E-03	5.763E-03	0.98														

[illegible]

CASE: BMR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GMD/MTU, APPROX.)

MATTERS

PER MTU

SR	YR	100 YR										1 YR									
		ORIGEN-2	ORIGEN-5	CINDER	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2	OR2
SR 79	8	167E-05	5.947E-05	5.501E-05	1.267	0.900	0.833	1.41	1.52	1.08	8.305E-05	5.902E-05	5.460E-05	1.267	0.900	0.833	1.41	1.52	1.08	8.305E-05	5.460E-05
SR 85	8	249E-08	8.365E-08	8.465E-08	0.988	0.988	0.988	0.988	0.988	0.988	8.305E-05	5.460E-05	5.460E-05	0.988	0.988	0.988	0.988	0.988	0.988	8.305E-05	5.460E-05
SR 89	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	8	460E-02	5.541E-02	5.781E-02	0.977	0.900	1.033	0.99	0.95	0.96	3.176E-09	3.176E-09	3.176E-09	0.977	0.900	1.033	0.99	0.95	0.96	3.176E-09	3.176E-09
Y 40	0	612E-01	2.646E-01	2.761E-01	0.976	0.989	1.034	0.99	0.94	0.96	1.517E-08	1.517E-08	1.517E-08	0.976	0.989	1.034	0.99	0.94	0.96	1.517E-08	1.517E-08
Y 91	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ZR 91	1	732E-04	1.770E-04	0.0	0.984	1.011	0.0	0.0	0.0	0.0	1.731E-04	1.770E-04	0.0	0.984	1.011	0.0	0.0	0.0	0.0	1.731E-04	1.770E-04
ZR 95	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 95	5	567E-03	5.648E-03	5.659E-03	0.990	1.004	1.006	0.99	0.98	1.00	5.554E-03	5.636E-03	5.648E-03	0.990	1.004	1.006	0.99	0.98	1.00	5.554E-03	5.636E-03
RU106	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	8	812E-06	8.698E-06	8.982E-06	1.126	0.910	0.965	1.24	1.17	0.94	8.811E-06	8.698E-06	8.982E-06	1.126	0.910	0.965	1.24	1.17	0.94	8.811E-06	8.698E-06
SM126	7	904E-04	5.707E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0	7.866E-04	5.680E-04	0.0	1.161	0.839	0.0	1.38	0.0	0.0	7.866E-04	5.680E-04
SB125	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1124	1	234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08	1.234E-05	1.258E-05	1.165E-05	1.012	1.032	0.956	0.98	1.06	1.08	1.234E-05	1.258E-05
CS133	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	1	181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10	1.181E-04	1.175E-04	1.067E-04	1.035	1.030	0.935	1.01	1.11	1.10	1.181E-04	1.175E-04
CS137	9	351E-02	9.656E-02	0.0	0.984	1.016	0.0	0.97	0.0	0.0	8.843E-09	1.000E-08	0.0	0.984	1.016	0.0	0.97	0.0	0.0	8.843E-09	1.000E-08
CS144	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD145	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PH147	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR147	5	675E-08	7.243E-08	7.243E-08	0.845	1.000	1.076	0.78	0.79	1.00	5.675E-08	7.243E-08	7.243E-08	0.845	1.000	1.076	0.78	0.79	1.00	5.675E-08	7.243E-08
SR148	4	27E-13	3.370E-13	0.0	1.188	0.812	0.0	1.44	0.0	0.0	4.27E-13	3.370E-13	0.0	1.188	0.812	0.0	1.44	0.0	0.0	4.27E-13	3.370E-13
SR149	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM150	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	3	761E-03	3.437E-03	2.680E-03	1.141	1.043	0.816	1.09	1.40	1.28	1.710E-05	1.566E-05	1.225E-05	1.140	1.043	0.816	1.09	1.40	1.28	1.710E-05	1.566E-05
SM152	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU153	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU154	2	370E-09	2.243E-09	1.74E-09	1.096	1.037	0.867	1.06	1.26	1.20	0.0	0.0	0.0	1.096	1.037	0.867	1.06	1.26	1.20	0.0	0.0
RU155	2	363E-18	2.203E-18	1.708E-18	1.100	1.067	0.833	1.03	1.32	1.28	0.0	0.0	0.0	1.100	1.067	0.833	1.03	1.32	1.28	0.0	0.0
U234	4	957E-02	4.343E-02	3.227E-02	1.102	0.989	0.809	1.01	1.36	1.35	4.574E-02	4.343E-02	3.227E-02	1.102	0.989	0.809	1.01	1.36	1.35	4.574E-02	4.343E-02
U235	3	974E-03	3.744E-03	3.586E-03	1.055	0.993	0.951	1.06	1.11	1.04	4.032E-04	3.744E-03	3.586E-03	1.055	0.993	0.951	1.06	1.11	1.04	4.032E-04	3.744E-03
U236	5	744E-03	5.784E-03	5.765E-03	0.997	1.004	1.000	0.99	1.00	1.00	6.000E-03	5.784E-03	5.765E-03	0.997	1.004	1.000	0.99	1.00	1.00	6.000E-03	5.784E-03
U238	8	124E-03	8.127E-03	8.136E-03	0.999	1.000	1.001	1.00	1.00	1.00	8.124E-03	8.127E-03	8.136E-03	0.999	1.000	1.001	1.00	1.00	1.00	8.124E-03	8.127E-03
NP237	1	629E-02	1.580E-02	5.470E-02	1.301	1.262	0.437	1.03	2.97	2.88	2.688E-02	2.594E-02	5.477E-02	1.383	1.335	0.282	1.04	4.91	4.74	2.688E-02	2.594E-02
PU238	5	629E-02	1.580E-02	5.470E-02	1.301	1.262	0.437	1.03	2.97	2.88	2.688E-02	2.594E-02	5.477E-02	1.383	1.335	0.282	1.04	4.91	4.74	2.688E-02	2.594E-02
PU239	9	211E-00	9.266E-00	6.795E-00	1.100	1.079	0.822	1.02	1.34	1.31	2.737E-02	2.786E-02	1.942E-02	1.100	1.120	0.780	0.98	1.41	1.43	2.737E-02	2.786E-02
PU240	1	731E-01	1.285E-01	7.795E-01	1.093	1.101	0.806	0.99	1.36	1.37	9.036E-01	9.108E-01	6.660E-01	1.093	1.102	0.805	0.99	1.36	1.37	9.036E-01	9.108E-01
PU241	5	140E-06	4.967E-06	2.124E-06	1.262	1.218	0.521	1.04	2.42	2.34	3.846E-06	2.388E-06	9.821E-06	1.700	1.300	0.000	1.31	0.00	0.00	3.846E-06	2.388E-06
PU242	4	454E-02	4.279E-02	5.237E-02	0.956	0.919	1.125	1.04	0.85	0.82	4.449E-02	4.279E-02	5.237E-02	0.956	0.919	1.125	1.04	0.85	0.82	4.449E-02	4.279E-02
AR241	8	450E-01	8.100E-01	6.910E-01	1.081	1.036	0.884	1.04	1.22	1.17	7.505E-01	6.910E-01	2.249E-01	1.081	1.036	0.884	1.04	1.22	1.17	7.505E-01	6.910E-01
AR242	2	022E-03	2.411E-03	1.005E-03	1.115	1.330	0.554	0.84	2.01	2.40	8.310E-05	9.905E-05	4.129E-05	1.116	1.330	0.554	0.84	2.01	2.40	8.310E-05	9.905E-05
AR243	4	406E-01	3.982E-01	1.037E-01	1.037	0.937	1.026	1.11	1.01	0.91	4.126E-01	3.982E-01	4.095E-01	1.037	0.937	1.026	1.11	1.01	0.91	4.126E-01	3.982E-01
AR242	5	429E-02	6.472E-02	2.665E-02	1.118	1.333	0.549	0.84	2.04	2.43	2.231E-03	2.659E-03	1.095E-03	1.118	1.333	0.549	0.84	2.04	2.43	2.231E-03	2.659E-03
CR243	3	753E-04	1.033E-04	2.558E-04	1.533	0.422	1.045	3.63	1.47	0.40	1.516E-11	8.173E-12	1.033E-11	1.533	0.422	1.045	3.63	1.47	0.40	1.516E-11	8.173E-12
CR244	5	279E-04	4.039E-04	4.425E-04	1.152	0.881	0.966	1.31	1.19	0.91	9.907E-13	9.366E-16	1.021E-15	2.994	0.003	0.003	0.003	0.003	0.003	9.907E-13	9.366E-16
CR245	3	446E-03	2.551E-03	2.616E-03	1.200	0.889	0.911	1.35	1.32	0.98	3.355E-03	2.402E-03	2.471E-03	1.200	0.889	0.911	1.35	1.32	0.98	3.355E-03	2.402E-03
CR246	6	440E-04	5.375E-04	5.646E-04	1.106	0.923	0.970	1.10	1.14	0.95	5.812E-04	5.646E-04	5.095E-04	1.106	0.923	0.970	1.10	1.14	0.95	5.812E-04	5.646E-04

AVERAGE ABSOLUTE DEVIATION, AS % 11.12 9.86 13.03 18.7 35.0 30.7
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 8.64 7.91 11.71 11.5 28.7 24.5
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 7.79 7.39 10.77 10.4 21.5 16.8
 NUCL EXCLUDED, 1ST/2ND: SE 79 CR243 NP237 / CR245 AM243 PU241

18.79 13.46 18.66 0.00 0.00 0.00
 9.60 8.72 13.17 20.0 39.9 35.6
 8.07 7.88 11.

[illegible]

	6.95	7.57	8.12	16.4	13.7	16.5
AVERAGE ABSOLUTE DEVIATION, AS %						
AV ABS DEV EXCLUDING LARGEST ONE, %	5.79	6.14	7.23	9.2	11.3	10.9
AV ABS DEV EXCLUDING LARGEST TWO, %	5.06	4.60	5.70	8.4	10.1	11.0
MINUS EXCLUDED, 1ST 2ND: SB195 (M24)	SH151	SE 79	AM242	P22		

CASE: BMR, 4.15 WT & U-235, 4.172 AT % BURNUP (40.0 GMD/MTU, APPROX.)

MATE

PER MTU

SR	ORIGEN-2	ORIGEN-3	CINDER	10 YR				20 YR				PER MTU			
				ORIGEN-2	ORIGEN-3	CINDER	ORIGEN-2	ORIGEN-3	CINDER	ORIGEN-2	ORIGEN-3	CINDER	ORIGEN-2	ORIGEN-3	CINDER
SR 19	1.228E-04	8.736E-05	8.037E-05	1.268	0.902	0.830	1.41	1.53	1.09	1.228E-04	8.736E-05	8.037E-05	1.268	0.902	0.830
SR 85	8.922E-00	8.711E-00	8.925E-00	1.000	0.998	1.012	1.01	0.99	0.98	8.621E-00	8.563E-00	8.675E-00	1.000	0.998	1.012
SR 89	3.574E-19	3.686E-19	3.680E-19	0.980	1.011	1.009	0.97	0.97	1.00	0.0	0.0	0.0	0.0	0.0	0.0
SR 94	8.340E-01	8.183E-01	8.539E-01	0.998	0.980	1.022	1.02	0.98	0.96	8.730E-01	8.630E-01	8.730E-01	0.998	0.980	1.022
Y 90	3.983E-02	4.087E-02	4.087E-02	0.998	0.979	1.023	1.02	0.97	0.96	3.180E-02	3.081E-02	3.231E-02	0.998	0.979	1.023
Y 91	4.673E-16	4.787E-16	4.823E-16	0.981	1.005	1.013	0.98	0.97	0.96	7.529E-35	0.0	7.792E-35	0.983	0.0	1.017
ER 93	2.614E-04	2.613E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	2.614E-04	2.613E-04	0.0	1.000	1.000	0.0
ER 95	3.764E-14	3.819E-14	4.051E-14	0.971	0.985	1.045	0.99	0.93	0.94	2.459E-31	0.0	2.847E-31	0.927	0.0	1.073
MB 95	7.914E-14	8.029E-14	8.520E-14	0.971	0.985	1.045	0.99	0.93	0.94	5.171E-31	0.0	5.988E-31	0.927	0.0	1.073
TC 99	7.954E-03	7.955E-03	7.998E-03	0.996	1.002	1.002	0.99	0.99	1.00	7.954E-03	7.955E-03	7.998E-03	0.996	1.002	1.002
RU106	2.839E-02	2.843E-02	0.0	1.028	0.972	0.0	1.06	0.0	0.0	2.991E-05	2.768E-05	0.0	1.039	0.961	0.0
PD107	7.070E-06	6.172E-06	6.507E-06	1.074	0.938	0.988	1.15	1.04	0.95	7.070E-06	6.172E-06	6.507E-06	1.074	0.938	0.988
SM126	1.029E-03	7.906E-04	0.0	1.131	0.869	0.0	1.30	0.0	0.0	1.029E-03	7.905E-04	0.0	1.131	0.869	0.0
SM125	3.107E-00	2.437E-00	1.972E-00	1.286	0.948	0.767	1.36	1.68	1.24	2.708E-01	1.995E-01	1.615E-01	1.286	0.947	0.767
1129	1.668E-05	1.770E-05	1.638E-05	1.086	1.046	0.968	0.94	1.02	1.08	1.668E-05	1.770E-05	1.638E-05	1.086	1.046	0.968
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS138	6.255E-01	6.221E-01	6.095E-01	1.016	0.994	0.990	1.02	1.03	1.00	2.169E-00	2.123E-00	2.114E-00	1.016	0.994	0.990
CS135	2.035E-04	2.270E-04	2.079E-04	0.956	1.067	0.977	0.90	0.98	1.09	2.035E-04	2.270E-04	2.079E-04	0.956	1.067	0.977
CS137	1.087E-02	1.082E-02	0.0	1.002	0.998	0.0	1.00	0.0	0.0	8.623E-01	8.598E-01	0.0	1.002	0.998	0.0
CS144	8.674E-02	8.697E-02	0.0	0.999	1.001	0.0	1.00	0.0	0.0	1.178E-05	1.180E-05	0.0	0.998	1.002	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD144	0.0	2.166E-11	2.233E-11	0.0	0.985	1.015	0.0	0.0	0.0	2.166E-11	2.233E-11	0.0	0.0	0.985	1.015
MD145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PR147	7.435E-00	6.425E-00	6.428E-00	0.825	1.111	1.064	0.74	0.78	1.04	7.435E-00	6.425E-00	6.428E-00	0.825	1.111	1.064
SM147	7.327E-08	8.956E-08	8.020E-08	0.867	1.065	1.068	0.81	0.81	1.00	7.327E-08	8.956E-08	8.020E-08	0.867	1.065	1.068
SM148	8.242E-13	6.120E-13	0.0	1.151	0.849	0.0	1.35	0.0	0.0	8.242E-13	6.120E-13	0.0	1.151	0.849	0.0
SM149	0.0	1.120E-14	8.379E-15	0.0	1.144	0.856	0.0	0.0	1.34	0.0	1.120E-14	8.379E-15	0.0	1.144	0.856
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	4.292E-02	4.949E-02	3.521E-02	1.009	1.163	0.828	0.87	1.22	1.41	3.974E-02	4.582E-02	3.260E-02	1.009	1.163	0.828
RU152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU154	5.096E-01	5.155E-01	4.366E-01	1.044	1.056	0.900	0.99	1.16	1.17	2.275E-01	2.303E-01	1.963E-01	1.044	1.056	0.900
RU155	1.384E-00	1.528E-00	1.225E-00	1.004	1.108	0.889	0.91	1.13	1.25	3.422E-01	3.778E-01	3.029E-01	1.004	1.108	0.889
U234	4.176E-02	4.078E-02	3.928E-02	1.028	1.004	0.967	1.02	1.06	1.04	4.176E-02	4.078E-02	3.928E-02	1.028	1.004	0.967
U235	5.103E-04	5.114E-04	5.615E-04	0.932	1.043	1.025	0.89	0.91	1.02	5.103E-04	5.114E-04	5.615E-04	0.932	1.043	1.025
U236	9.245E-03	9.322E-03	9.343E-03	0.994	1.002	1.004	0.99	0.99	1.00	9.250E-03	9.322E-03	9.343E-03	0.994	1.002	1.004
U238	7.970E-03	7.950E-03	7.965E-03	1.001	0.999	1.000	1.00	1.00	1.00	7.970E-03	7.950E-03	7.965E-03	1.001	0.999	1.000
MP237	1.291E-02	1.264E-02	9.966E-03	1.090	1.068	0.842	1.02	1.30	1.27	1.314E-02	1.290E-02	9.966E-03	1.095	1.075	0.830
P238	1.044E-02	1.163E-02	8.814E-01	1.017	1.128	0.855	0.90	1.19	1.32	9.689E-01	1.075E-01	8.145E-01	1.017	1.128	0.855
P239	9.323E-00	1.117E-01	7.924E-00	0.985	1.179	0.836	0.84	1.18	1.41	9.323E-00	1.117E-01	7.924E-00	0.985	1.179	0.836
P240	1.663E-01	1.516E-01	1.492E-01	1.068	0.974	0.938	1.10	1.11	1.02	1.663E-01	1.516E-01	1.492E-01	1.068	0.974	0.938
P241	2.463E-01	2.875E-01	2.410E-01	0.961	1.108	0.932	0.87	1.03	1.19	2.463E-01	2.875E-01	2.410E-01	0.961	1.108	0.932
P242	5.486E-02	5.755E-02	6.955E-02	0.900	0.951	1.149	0.95	0.78	0.83	5.486E-02	5.755E-02	6.955E-02	0.900	0.951	1.149
AR241	5.977E-01	6.719E-01	5.696E-01	0.975	1.096	0.929	0.89	1.05	1.18	9.252E-01	1.040E-01	8.088E-01	0.975	1.096	0.929
AR242	1.042E-02	1.914E-02	7.405E-03	0.846	1.553	0.601	0.54	1.41	2.58	9.951E-03	1.828E-02	7.075E-03	0.846	1.553	0.601
AR243	6.190E-01	6.950E-01	7.641E-01	0.894	1.003	1.103	0.89	0.81	0.91	6.190E-01	6.944E-01	7.633E-01	0.894	1.003	1.103
AR242	2.808E-01	5.183E-01	1.967E-01	0.848	1.557	0.596	0.34	1.42	2.61	2.671E-01	4.908E-01	1.476E-01	0.848	1.557	0.596
CM243	6.606E-01	1.864E-01	5.927E-01	1.377	0.988	1.235	3.54	1.11	0.91	6.606E-01	1.864E-01	5.927E-01	1.377	0.988	1.235
CM244	5.430E-01	5.743E-01	6.602E-01	0.916	0.969	1.114	0.95	0.82	0.87	5.430E-01	5.743E-01	6.602E-01	0.916	0.969	1.114
CM245	5.968E-03	7.242E-03	8.257E-03	0.834	1.012	1.154	0.82	0.72	0.88	5.968E-03	7.242E-03	8.257E-03	0.834	1.012	1.154
CM246	1.341E-03	1.675E-03	1.909E-03	0.817	1.020	1.163	0.80	0.70	0.88	1.341E-03	1.673E-03	1.906E-03	0.817	1.021	1.163

AVERAGE ABSOLUTE DEVIATION, AS % 7.36 8.67 9.63 17.3 13.3 20.5

AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.24 7.32 8.66 10.2 13.1 15.1

AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.36 6.03 7.22 8.5 11.0 11.1

NUCS EXCLUDED, 1ST/2ND: SB125 CM243 SM151 / SE 79 CM242 MP237

7.78 9.51 10.12 16.9 16.2 22.7

6.65 8.08 9.16 11.2 14.0 16.9

5.78 6.69 7.69 9.3 11.9 12.4

CM242 MP237

CASE: BWR, 4.15 MT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

MATTB PER MTU

	300 YR									1 KYR								
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QR3 AVG	CIN AVG	QR2 ORS	QR2 CIN	QR3 CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QR3 AVG	CIN AVG	QR2 ORS	QR2 CIN	QR3 CIN
SE 79	1.224E-04	8.709E-05	8.013E-05	1.268	0.902	0.830	1.41	1.53	1.09	1.215E-04	8.644E-05	7.953E-05	1.268	0.902	0.830	1.41	1.53	1.09
KR 85	6.341E-08	6.251E-08	6.410E-08	1.001	0.987	1.012	1.01	0.99	0.98	1.398E-27	1.378E-27	1.411E-27	1.002	0.987	1.011	1.01	0.99	0.98
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	8.387E-02	8.219E-02	8.580E-02	0.999	0.979	1.022	1.02	0.98	0.96	4.872E-09	4.770E-09	4.978E-09	1.000	0.979	1.021	1.02	0.98	0.96
Y 90	4.006E-01	3.926E-01	4.106E-01	0.998	0.978	1.023	1.02	0.98	0.96	2.327E-08	2.278E-08	2.382E-08	0.999	0.978	1.023	1.02	0.98	0.96
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ER 93	2.614E-04	2.613E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0	2.613E-04	2.612E-04	0.0	1.000	1.000	0.0	1.00	0.0	0.0
ER 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	7.947E-03	7.988E-03	7.990E-03	0.996	1.002	1.002	0.99	0.99	1.00	7.929E-03	7.970E-03	7.972E-03	0.996	1.002	1.002	0.99	0.99	1.00
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	7.070E-06	6.172E-06	6.507E-06	1.074	0.938	0.988	1.15	1.09	0.95	7.070E-06	6.171E-06	6.507E-06	1.074	0.937	0.988	1.15	1.09	0.95
SM126	1.027E-03	7.890E-04	0.0	1.131	0.869	0.0	1.30	0.0	0.0	1.022E-03	7.852E-04	0.0	1.131	0.869	0.0	1.30	0.0	0.0
SB125	0.0	0.0	6.005E-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I129	1.668E-05	1.770E-05	1.638E-05	0.986	1.046	0.968	0.94	1.02	1.08	1.668E-05	1.770E-05	1.638E-05	0.986	1.046	0.968	0.94	1.02	1.08
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	2.798E-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.034E-04	2.270E-04	2.079E-04	0.956	1.067	0.977	0.90	0.98	1.09	2.034E-04	2.270E-04	2.078E-04	0.956	1.067	0.977	0.90	0.98	1.09
CS137	1.336E-01	1.381E-01	0.0	0.983	1.017	0.0	0.97	0.0	0.0	1.263E-08	1.431E-08	0.0	0.938	1.062	0.0	0.88	0.0	0.0
CE144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND144	0.0	2.166E-11	2.233E-11	0.0	0.985	1.015	0.0	0.0	0.97	0.0	2.166E-11	2.233E-11	0.0	0.985	1.015	0.0	0.0	0.97
ND145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ND146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PR147	0.0	0.0	2.336E-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH147	7.648E-08	9.439E-08	9.435E-08	0.865	1.068	1.067	0.81	0.81	1.00	7.648E-08	9.439E-08	9.435E-08	0.865	1.068	1.067	0.81	0.81	1.00
SH148	8.291E-13	6.120E-13	0.0	1.151	0.849	0.0	1.35	0.0	0.0	8.291E-13	6.120E-13	0.0	1.151	0.849	0.0	1.35	0.0	0.0
SH149	0.0	1.120E-14	8.379E-15	0.0	1.144	0.856	0.0	0.0	1.34	0.0	1.120E-14	8.379E-15	0.0	1.144	0.856	0.0	0.0	1.34
SH150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SH151	4.598E-03	5.302E-03	3.773E-03	1.009	1.163	0.828	0.87	1.22	1.41	2.093E-05	2.416E-05	1.719E-05	1.008	1.164	0.828	0.87	1.22	1.41
SH152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU154	3.601E-09	3.636E-09	3.103E-09	1.045	1.055	0.900	0.99	1.16	1.17	0.0	9.748E-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU155	3.451E-18	3.826E-18	3.070E-18	1.001	1.109	0.890	0.90	1.12	1.25	0.0	1.003E-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	7.117E-02	7.346E-02	4.868E-02	1.105	1.140	0.755	0.97	1.46	1.51	7.440E-02	7.709E-02	4.968E-02	1.110	1.150	0.741	0.97	1.50	1.55
U235	5.125E-04	5.741E-04	5.615E-04	0.933	1.045	1.022	0.89	0.91	1.02	5.179E-04	5.805E-04	5.615E-04	0.936	1.049	1.015	0.89	0.92	1.03
U236	9.369E-03	9.434E-03	9.343E-03	0.999	1.006	0.996	0.99	1.00	1.01	9.651E-03	9.692E-03	9.343E-03	1.009	1.014	0.977	1.00	1.03	1.04
U238	7.970E-03	7.950E-03	7.965E-03	1.001	0.999	1.000	1.00	1.00	1.00	7.970E-03	7.950E-03	7.965E-03	1.001	0.999	1.000	1.00	1.00	1.00
NP237	2.284E-02	2.389E-02	9.966E-03	1.209	1.264	0.527	0.96	2.29	2.40	3.479E-02	3.744E-02	9.963E-03	1.270	1.367	0.364	0.93	3.49	3.76
PU238	1.071E-01	1.194E-01	8.987E-00	1.016	1.132	0.852	0.90	1.19	1.33	4.839E-02	5.827E-02	3.981E-02	0.991	1.193	0.815	0.83	1.22	1.46
PU239	9.257E-00	1.108E-01	7.858E-00	0.985	1.179	0.836	0.84	1.18	1.41	9.083E-00	1.087E-01	7.702E-00	0.985	1.179	0.835	0.84	1.18	1.41
PU240	1.626E-01	1.484E-01	1.447E-01	1.071	0.977	0.952	1.10	1.12	1.03	1.510E-01	1.378E-01	1.343E-01	1.071	0.977	0.952	1.10	1.12	1.03
PU241	7.612E-06	1.014E-05	2.784E-06	1.112	1.481	0.407	0.75	2.73	3.64	5.152E-06	6.454E-06	1.287E-20	1.332	1.660	0.000	0.80	***	***
PU242	5.445E-02	5.755E-02	6.952E-02	0.900	0.951	1.149	0.95	0.78	0.83	5.438E-02	5.748E-02	6.943E-02	0.900	0.951	1.149	0.95	0.78	0.83
AM241	9.535E-01	1.082E-02	9.164E-01	0.969	1.100	0.931	0.88	1.04	1.18	3.104E-01	3.521E-01	2.982E-01	0.969	1.099	0.931	0.88	1.04	1.18
AM242	2.776E-03	5.099E-03	1.973E-03	0.846	1.553	0.601	0.54	1.41	2.58	1.141E-04	2.095E-04	8.106E-05	0.846	1.553	0.601	0.54	1.41	2.58
AM243	6.024E-01	6.763E-01	7.435E-01	0.894	1.003	1.103	0.89	0.81	0.91	5.640E-01	6.333E-01	6.962E-01	0.894	1.003	1.103	0.89	0.81	0.91
CM242	7.451E-02	1.369E-01	5.234E-02	0.848	1.557	0.595	0.54	1.42	2.62	3.062E-03	5.624E-03	2.150E-03	0.848	1.557	0.595	0.54	1.42	2.62
CM243	5.711E-04	1.611E-04	5.124E-04	1.377	0.388	1.235	3.55	1.11	0.31	2.307E-11	6.507E-12	2.069E-11	1.377	0.388	1.235	3.55	1.12	0.31
CM244	8.209E-04	8.676E-04	9.981E-04	0.917	0.969	1.115	0.95	0.82	0.87	1.379E-12	2.008E-15	2.309E-15	2.991	0.004	0.005	***	***	0.87
CM245	5.828E-03	7.073E-03	8.063E-03	0.834	1.012	1.154	0.82	0.72	0.88	5.505E-03	6.681E-03	7.615E-03	0.834	1.012	1.154	0.82	0.72	0.88
CM246	1.285E-03	1.606E-03	1.829E-03	0.817	1.021	1.163	0.80	0.70	0.88	1.160E-03	1.449E-03	1.651E-03	0.817	1.020	1.163	0.80	0.70	0.88

AVERAGE-ABSOLUTE DEVIATION, AS % 8.37 12.20 13.72 20.2 25.4 36.4
 AV-ABS-DEV EXCLUDING LARGEST ONE, % 6.73 9.70 11.70 12.7 20.6 27.8
 AV-ABS-DEV EXCLUDING LARGEST TWO, % 5.51 7.87 9.05 11.9 15.6 19.0
 NUCS EXCLUDED, 1ST/2ND: SE 79 CH243 PU241 / CH246 CM242 NP237

15.73 16.51 18.98 ***
 8.05 10.76 12.83 22.1 25.8 35.9
 6.32 8.27 9.18 14.4 17.1 25.4

CM244 CM243 PU241 / SE 79 CM242 NP237

PER MTU

WATTS

CASE: BWR, 8.15 WT & U-235, 4.172 AT % BURNUP (40.0 GMD/MTU, APPROX.)

	ORIGEN2		ORIGEN-S		CINDER		10 KVR		OR3		CIN		OR2		OR3	
	ORIGEN2	ORIGEN-S	ORIGEN2	ORIGEN-S	CINDER	CINDER	10 KVR	10 KVR	OR3	OR3	CIN	CIN	OR2	OR2	OR3	OR3
SR 79	1.104E-04	7.853E-05	7.225E-05	1.268	0.902	0.830	1.81	1.53	1.09							
SR 85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 93	2.602E-04	2.601E-04	0.0	1.000	1.000	0.0	1.000	0.0	1.000	0.0	1.000	0.0	1.000	0.0	0.0	0.0
SR 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB 95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TC 99	7.700E-03	7.740E-03	7.742E-03	0.996	1.002	1.002	0.99	0.99	1.00							
RU106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PD107	7.063E-06	6.165E-06	6.500E-06	1.074	0.937	0.988	1.15	1.09	0.95							
SM126	9.606E-04	7.377E-04	0.0	1.131	0.869	0.0	1.30	0.0	0.0							
SM125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1129	1.667E-05	1.769E-05	1.638E-05	0.986	1.046	0.968	0.94	1.02	1.08							
CS133	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS134	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS135	2.028E-04	2.263E-04	2.073E-04	0.956	1.067	0.977	0.90	0.98	1.09							
CS137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR144	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD143	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD145	0.0	2.166E-11	2.233E-11	0.0	0.985	1.015	0.0	0.0	0.97							
MD146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM147	7.648E-08	9.439E-08	9.435E-08	0.865	1.058	1.067	0.81	0.81	1.00							
SM148	8.291E-13	6.120E-13	0.0	1.151	0.889	0.0	1.35	0.0	0.0							
SM149	0.0	1.120E-14	8.379E-15	0.0	1.148	0.856	0.0	0.0	1.34							
SM150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM151	1.644E-35	0.0	1.353E-35	1.097	0.0	0.903	0.0	1.21	0.0							
SM152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U234	7.272E-02	7.540E-02	8.843E-02	1.110	1.151	0.739	0.97	1.50	1.56							
U235	5.785E-04	6.531E-04	5.615E-04	0.968	1.093	0.939	0.89	1.03	1.16							
U236	1.190E-02	1.175E-02	9.341E-03	1.082	1.068	0.849	1.01	1.27	1.26							
U238	7.971E-03	7.950E-03	7.965E-03	1.001	0.998	1.000	1.00	1.00	1.00							
MP237	8.045E-02	8.387E-02	9.938E-03	1.287	1.396	0.316	0.92	4.07	4.42							
PU238	9.885E-21	1.810E-20	6.889E-21	0.850	1.557	0.593	0.55	1.43	2.63							
PU239	7.091E-00	8.483E-00	5.946E-00	0.989	1.183	0.829	0.84	1.19	1.43							
PU240	5.813E-00	5.306E-00	5.183E-00	1.070	0.976	0.954	1.10	1.12	1.02							
PU241	2.873E-06	3.048E-06	0.0	0.888	1.112	0.0	0.0	0.0	0.0							
P 242	5.352E-02	5.655E-02	6.829E-02	0.900	0.951	1.149	0.55	0.78	0.83							
AM241	2.668E-03	3.373E-03	1.607E-05	1.521	1.671	0.008	0.79	0.00	0.00							
AM242	1.715E-22	3.142E-22	1.215E-22	0.847	1.552	0.600	0.55	1.41	2.59							
AM243	2.422E-01	2.720E-01	2.990E-01	0.894	1.003	1.103	0.89	0.81	0.91							
CM242	8.618E-21	8.458E-21	3.222E-21	0.850	1.557	0.593	0.55	1.43	2.63							
CM243	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
CM244	1.372E-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
CM245	2.842E-03	3.207E-03	3.647E-03	0.835	1.013	1.152	0.82	0.72	0.88							
CM246	3.103E-04	3.876E-04	4.615E-04	0.817	1.021	1.162	0.80	0.70	0.88							

AVERAGE ABSOLUTE DEVIATION, AS 1 11.36 15.68 19.62 17.5 0.00 0.00
 AV-ABS-DEV EXCLUDING LARGEST ONE, 1 9.62 12.12 18.94 16.2 35.5 44.2
 AV-ABS-DEV EXCLUDING LARGEST TWO, 1 7.97 9.22 10.47 15.2 20.0 22.3
 NUCS EXCLUDED, 1ST/2ND: SR 79 PU238 AM241 / CM246 CM242 MP237

APPENDIX F
COMPARATIVE RATIO TABLES IN TOTAL WATTS
(See table descriptions in Sect. 4.1)

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 30 DAY *****													***** 5 YR *****						
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
P. P.	5.063E-04	5.063E-04	5.076E-04	0.999	0.999	1.002	1.00	1.00	1.00	1.581E-03	1.578E-03	1.578E-03	1.001	0.999	0.999	1.00	1.00	1.00	
ACT.	1.561E-03	1.561E-03	1.561E-03	1.000	1.000	1.000	1.00	1.00	1.00	1.976E-02	1.971E-02	1.970E-02	1.002	0.999	0.999	1.00	1.00	1.00	
TOTAL	5.219E-04	5.219E-04	5.232E-04	0.999	0.999	1.002	1.00	1.00	1.00	1.778E-03	1.775E-03	1.775E-03	1.001	0.999	0.999	1.00	1.00	1.00	
AVERAGE-ABSOLUTE-DEVIATION, AS %				0.06	0.06	0.12	0.0	0.2	0.2					0.15	0.06	0.09	0.2	0.2	0.0

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 10 YR *****													***** 20 YR *****						
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
P. P.	4.062E-02	4.045E-02	9.044E-02	1.001	0.999	0.999	1.00	1.00	1.00	6.469E-02	6.460E-02	6.460E-02	1.001	1.000	1.000	1.00	1.00	1.00	
ACT.	2.066E-02	2.058E-02	2.057E-02	1.003	0.999	0.998	1.00	1.00	1.00	2.169E-02	2.160E-02	2.158E-02	1.003	0.999	0.999	1.00	1.00	1.00	
TOTAL	1.113E-01	1.110E-01	1.110E-01	1.002	0.999	0.999	1.00	1.00	1.00	8.639E-02	8.620E-02	8.618E-02	1.002	0.999	0.999	1.00	1.00	1.00	
AVERAGE-ABSOLUTE-DEVIATION, AS %				0.19	0.08	0.11	0.3	0.3	0.0					0.18	0.08	0.11	0.3	0.3	0.0

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 50 YR *****													***** 100 YR *****						
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
P. P.	3.098E-02	3.099E-02	3.100E-02	1.000	1.000	1.000	1.00	1.00	1.00	9.534E-01	9.568E-01	9.571E-01	0.998	1.001	1.001	1.00	1.00	1.00	
ACT.	2.149E-02	2.143E-02	2.142E-02	1.002	0.999	0.999	1.00	1.00	1.00	1.895E-02	1.894E-02	1.894E-02	1.000	1.000	1.000	1.00	1.00	1.00	
TOTAL	5.247E-02	5.242E-02	5.242E-02	1.001	1.000	1.000	1.00	1.00	1.00	2.848E-02	2.851E-02	2.851E-02	0.999	1.000	1.000	1.00	1.00	1.00	
AVERAGE-ABSOLUTE-DEVIATION, AS %				0.10	0.04	0.06	0.1	0.2	0.0					0.12	0.05	0.07	0.2	0.2	0.0

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 300 YR *****													***** 1 KYR *****						
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
P. P.	9.041E-01	9.197E-01	9.203E-01	0.998	1.005	1.006	0.98	0.98	1.00	2.011E-02	2.009E-02	2.019E-02	0.999	0.999	1.003	1.00	1.00	1.00	
ACT.	1.252E-02	1.252E-02	1.251E-02	1.000	1.000	1.000	1.00	1.00	1.00	5.472E-01	5.474E-01	5.456E-01	1.001	1.001	0.998	1.00	1.00	1.00	
TOTAL	1.261E-02	1.261E-02	1.261E-02	1.000	1.000	1.000	1.00	1.00	1.00	5.474E-01	5.476E-01	5.458E-01	1.001	1.001	0.998	1.00	1.00	1.00	
AVERAGE-ABSOLUTE-DEVIATION, AS %				0.40	0.20	0.23	0.6	0.6	0.1					0.09	0.14	0.23	0.1	0.3	0.4

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

***** 10 KYR *****												
	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN			
P. P.	1.910E-02	1.908E-02	1.919E-02	0.999	0.998	1.003	1.00	1.00	0.99			
ACT.	1.350E-01	1.350E-01	1.331E-01	1.005	1.005	0.990	1.00	1.01	1.01			
TOTAL	1.352E-01	1.352E-01	1.333E-01	1.005	1.005	0.990	1.00	1.01	1.01			
AVERAGE-ABSOLUTE-DEVIATION, AS %				0.36	0.39	0.75	0.0	1.1	1.1			

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.) WATTS PER MTU

30 DAY										5 YR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
F. P.	5.062E-04	5.076E-04	5.097E-04	0.997	1.000	1.004	1.00	0.99	1.00	1.585E+03	1.567E+03	1.592E+03	1.002	0.991	1.007	1.01	1.00	0.98	
ACT.	1.621E-03	1.630E-03	1.620E-03	0.998	1.004	0.998	0.99	1.00	1.01	2.056E+02	2.143E+02	2.167E+02	0.969	1.010	1.021	0.96	0.95	0.99	
TOTAL	5.224E-04	5.239E-04	5.259E-04	0.997	1.000	1.003	1.00	0.99	1.00	1.790E+03	1.781E+03	1.809E+03	0.998	0.993	1.009	1.00	0.99	0.98	
AVERAGE-ABSOLUTE-DEVIATION, AS %			0.27	0.15	0.31	0.4	0.5	0.5					1.17	0.86	1.22	1.9	2.2	1.4	

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.) WATTS PER MTU

10 YR										20 YR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
F. P.	9.037E-02	8.992E-02	9.132E-02	0.998	0.993	1.009	1.01	0.99	0.98	6.440E+02	6.418E+02	6.548E+02	0.996	0.992	1.012	1.00	0.98	0.98	
ACT.	2.140E-02	2.257E-02	2.256E-02	0.965	1.018	1.017	0.95	0.95	1.00	2.234E+02	2.394E+02	2.358E+02	0.959	1.028	1.012	0.93	0.95	1.02	
TOTAL	1.118E-03	1.125E-03	1.139E-03	0.992	0.998	1.010	0.99	0.98	0.99	8.674E+02	8.812E+02	8.905E+02	0.986	1.002	1.012	0.98	0.97	0.99	
AVERAGE-ABSOLUTE-DEVIATION, AS %			1.50	0.89	1.21	2.1	2.7	0.9					1.97	1.25	1.23	2.9	3.2	1.5	

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.) WATTS PER MTU

50 YR										100 YR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
F. P.	3.082E-02	3.077E-02	3.152E-02	0.993	0.991	1.015	1.00	0.98	0.98	9.484E+01	9.501E+01	9.740E+01	0.991	0.992	1.017	1.00	0.97	0.98	
ACT.	2.197E-02	2.408E-02	2.330E-02	0.950	1.042	1.008	0.91	0.94	1.03	1.931E+02	2.139E+02	2.065E+02	0.944	1.046	1.010	0.90	0.94	1.04	
TOTAL	5.279E-02	5.485E-02	5.481E-02	0.975	1.013	1.012	0.96	0.96	1.00	2.879E+02	3.089E+02	3.039E+02	0.959	1.029	1.012	0.93	0.95	1.02	
AVERAGE-ABSOLUTE-DEVIATION, AS %			2.72	2.10	1.19	4.2	2.9	1.9					3.55	2.75	1.31	5.6	4.8	2.6	

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.) WATTS PER MTU

300 YR										1 KYR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
F. P.	9.001E-01	9.113E-01	9.346E-01	0.983	0.996	1.021	0.99	0.96	0.98	2.026E+02	1.661E+02	1.802E+02	1.107	0.908	0.985	1.22	1.12	0.92	
ACT.	1.273E-02	1.411E-02	1.385E-02	0.939	1.040	1.021	0.90	0.92	1.02	5.552E+01	5.956E+01	5.856E+01	0.959	1.029	1.012	0.93	0.95	1.02	
TOTAL	1.282E-02	1.420E-02	1.394E-02	0.939	1.040	1.021	0.90	0.92	1.02	5.554E+01	5.958E+01	5.858E+01	0.959	1.029	1.012	0.93	0.95	1.02	
AVERAGE-ABSOLUTE-DEVIATION, AS %			4.64	2.82	2.11	6.9	6.6	2.1					6.29	5.01	1.29	11.8	7.6	3.7	

CASE: PWR, 3.10 WT % U-235, 3.443 AT % BURNUP (33.0 GWD/MTU, APPROX.) WATTS PER MTU

10 KYR									
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	
F. P.	1.924E-02	1.582E-02	1.716E-02	1.105	0.909	0.986	1.22	1.12	0.92
ACT.	1.360E-01	1.393E-01	1.318E-01	1.002	1.026	0.971	0.98	1.03	1.06
TOTAL	1.362E-01	1.395E-01	1.320E-01	1.002	1.026	0.971	0.98	1.03	1.06
AVERAGE-ABSOLUTE-DEVIATION, AS %			3.66	4.80	2.38	8.8	6.2	6.4	

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.) WATTS PER MTU

30 DAY											5 YR										
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN				
F. P.	5.414E-04	5.430E-04	5.609E-04	0.987	0.990	1.023	1.00	0.97	0.97	2.376E-03	2.324E-03	2.388E-03	1.006	0.984	1.011	1.02	0.99	0.97			
ACT.	2.941E-03	3.077E-03	3.134E-03	0.964	1.009	1.027	0.96	0.94	0.98	4.297E-02	4.506E-02	4.840E-02	0.945	0.991	1.064	0.95	0.89	0.93			
TOTAL	5.709E-04	5.738E-04	5.923E-04	0.986	0.991	1.023	0.99	0.96	0.97	2.806E-03	2.775E-03	2.872E-03	0.996	0.985	1.019	1.01	0.98	0.97			
AVERAGE-ABSOLUTE-DEVIATION, AS %			2.09	0.92	2.44	1.7	4.4	2.7				2.16	1.36	3.15	2.7	4.7	4.3				

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.) WATTS PER MTU

10 YR											20 YR										
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN				
F. P.	1.378E-03	1.367E-03	1.390E-03	1.000	0.992	1.009	1.01	0.99	0.98	9.700E-02	9.658E-02	9.844E-02	0.996	0.992	1.011	1.00	0.99	0.98			
ACT.	4.228E-02	4.459E-02	4.704E-02	0.947	0.999	1.054	0.95	0.90	0.95	4.074E-02	4.338E-02	4.449E-02	0.950	1.012	1.038	0.94	0.92	0.97			
TOTAL	1.801E-03	1.813E-03	1.861E-03	0.987	0.993	1.020	0.99	0.97	0.97	1.377E-03	1.400E-03	1.429E-03	0.982	0.998	1.020	0.98	0.96	0.98			
AVERAGE-ABSOLUTE-DEVIATION, AS %			2.20	0.53	2.73	2.2	4.7	3.1				2.37	0.71	2.29	2.7	4.5	2.2				

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.) WATTS PER MTU

50 YR											100 YR										
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN				
F. P.	4.621E-02	4.608E-02	4.718E-02	0.994	0.991	1.015	1.00	0.98	0.98	1.421E-02	1.421E-02	1.457E-02	0.992	0.992	1.017	1.00	0.98	0.98			
ACT.	3.558E-02	3.850E-02	3.786E-02	0.954	1.032	1.015	0.92	0.94	1.02	2.911E-02	3.175E-02	3.078E-02	0.953	1.039	1.008	0.92	0.95	1.03			
TOTAL	8.179E-02	8.458E-02	8.504E-02	0.976	1.009	1.015	0.97	0.96	0.99	4.332E-02	4.596E-02	4.534E-02	0.965	1.024	1.010	0.94	0.96	1.01			
AVERAGE-ABSOLUTE-DEVIATION, AS %			2.55	1.66	1.47	3.7	4.0	1.5				3.00	2.40	1.15	4.7	4.1	2.3				

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.) WATTS PER MTU

300 YR											1 KYR										
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN				
F. P.	1.346E-00	1.362E-00	1.396E-00	0.984	0.996	1.021	0.99	0.96	0.98	2.936E-02	2.454E-02	2.634E-02	1.098	0.918	0.985	1.20	1.11	0.93			
ACT.	1.749E-02	1.899E-02	1.875E-02	0.950	1.032	1.018	0.92	0.93	1.01	7.106E-01	7.575E-01	7.394E-01	0.966	1.029	1.005	0.94	0.96	1.02			
TOTAL	1.762E-02	1.913E-02	1.889E-02	0.950	1.031	1.019	0.92	0.93	1.01	7.109E-01	7.577E-01	7.397E-01	0.966	1.029	1.005	0.94	0.96	1.02			
AVERAGE-ABSOLUTE-DEVIATION, AS %			3.87	2.24	1.92	5.6	5.7	1.7				5.54	4.71	0.83	10.7	6.4	3.9				

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.) WATTS PER MTU

10 KYR										
ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN		
F. P.	2.787E-02	2.337E-02	2.508E-02	1.096	0.919	0.986	1.19	1.11	0.93	
ACT.	1.613E-01	1.683E-01	1.500E-01	1.009	1.053	0.938	0.96	1.08	1.12	
TOTAL	1.616E-01	1.685E-01	1.503E-01	1.009	1.052	0.938	0.96	1.08	1.12	
AVERAGE-ABSOLUTE-DEVIATION, AS %			3.79	6.22	4.58	9.2	8.7	10.4		

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.) WATTS PER MTU

***** 30 DAY ***** 5 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	3.577E-04	3.579E-04	3.579E-04	1.000	1.000	1.000	1.00	1.00	1.00	1.252E+03	1.229E+03	1.241E+03	1.009	0.991	1.000	1.02	1.01	0.99
ACT.	1.403E-03	1.219E-03	1.177E-03	1.108	0.963	0.930	1.15	1.19	1.04	1.619E+02	1.465E+02	1.288E+02	1.111	1.005	0.884	1.11	1.26	1.14
TOTAL	3.717E-04	3.701E-04	3.697E-04	1.003	0.999	0.998	1.00	1.01	1.00	1.414E+03	1.376E+03	1.370E+03	1.020	0.992	0.988	1.03	1.03	1.00

AVERAGE-ABSOLUTE-DEVIATION, AS % 3.71 1.29 2.42 5.2 6.6 1.2 4.66 0.76 4.29 5.1 9.9 5.1

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.) WATTS PER MTU

***** 10 YR ***** 20 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	7.382E-02	7.368E-02	7.517E-02	0.995	0.993	1.013	1.00	0.98	0.98	5.308E+02	5.325E+02	5.476E+02	0.989	0.992	1.020	1.00	0.97	0.97
ACT.	1.723E-02	1.576E-02	1.370E-02	1.107	1.013	0.880	1.09	1.26	1.15	1.851E+02	1.719E+02	1.474E+02	1.101	1.022	0.877	1.08	1.26	1.17
TOTAL	9.105E-02	8.944E-02	8.887E-02	1.014	0.996	0.990	1.02	1.02	1.01	7.159E+02	7.044E+02	6.950E+02	1.015	0.999	0.986	1.02	1.03	1.01

AVERAGE-ABSOLUTE-DEVIATION, AS % 4.22 0.79 4.76 3.8 10.0 5.9 4.26 1.06 5.25 3.2 10.5 6.9

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.) WATTS PER MTU

***** 50 YR ***** 100 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	2.545E-02	2.562E-02	2.646E-02	0.985	0.991	1.024	0.99	0.96	0.97	7.836E+01	7.914E+01	8.182E+01	0.982	0.992	1.026	0.99	0.96	0.97
ACT.	1.890E-02	1.790E-02	1.514E-02	1.092	1.034	0.874	1.06	1.25	1.18	1.697E+02	1.620E+02	1.367E+02	1.087	1.038	0.876	1.05	1.24	1.18
TOTAL	4.435E-02	4.352E-02	4.160E-02	1.028	1.008	0.964	1.02	1.07	1.05	2.480E+02	2.411E+02	2.185E+02	1.051	1.022	0.926	1.03	1.13	1.10

AVERAGE-ABSOLUTE-DEVIATION, AS % 4.49 1.70 6.19 2.7 11.8 8.7 5.19 2.26 7.45 2.9 13.9 10.7

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.) WATTS PER MTU

***** 300 YR ***** 1 KYR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	7.439E-01	7.582E-01	7.831E-01	0.977	0.995	1.028	0.98	0.95	0.97	1.668E+02	1.383E+02	1.481E+02	1.104	0.915	0.980	1.21	1.13	0.93
ACT.	1.149E-02	1.095E-02	9.355E-01	1.084	1.033	0.883	1.05	1.23	1.17	5.082E+01	4.797E+01	4.149E+01	1.087	1.026	0.887	1.06	1.22	1.16
TOTAL	1.157E-02	1.103E-02	9.433E-01	1.084	1.033	0.884	1.05	1.23	1.17	5.084E+01	4.798E+01	4.151E+01	1.087	1.026	0.887	1.06	1.22	1.16

AVERAGE-ABSOLUTE-DEVIATION, AS % 6.38 2.35 8.73 3.9 16.8 12.4 9.26 4.54 8.16 10.8 19.2 12.6

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.) WATTS PER MTU

***** 10 KYR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	1.584E-02	1.318E-02	1.411E-02	1.102	0.917	0.982	1.20	1.2	0.93
ACT.	1.266E-01	1.202E-01	9.978E-00	1.096	1.040	0.864	1.05	1.27	1.20
TOTAL	1.268E-01	1.203E-01	9.992E-00	1.096	1.040	0.864	1.05	1.27	1.20

AVERAGE-ABSOLUTE-DEVIATION, AS % 9.79 5.46 9.70 10.3 22.0 15.8

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 30 DAY *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	3.763E-04	3.790E-04	3.795E-04	0.995	1.002	1.003	0.99	0.99	1.00	1.761E+03	1.736E+03	1.762E+03	1.005	0.990	1.005	1.01	1.00	0.99
ACT.	1.905E-03	2.082E-03	1.923E-03	0.967	1.057	0.976	0.91	0.99	1.08	2.425E+02	2.636E+02	2.346E+02	0.982	1.068	0.950	0.92	1.03	1.12
TOTAL	3.953E-04	3.998E-04	3.987E-04	0.993	1.005	1.002	0.99	0.99	1.00	2.003E+03	2.000E+03	1.997E+03	1.002	1.000	0.998	1.00	1.00	1.00

AVERAGE-ABSOLUTE-DEVIATION, AS % 1.50 2.12 0.96 3.4 0.9 2.9 0.80 2.58 1.88 3.2 1.2 4.7

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 10 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	1.092E-03	1.080E-03	1.104E-03	1.000	0.989	1.011	1.01	0.99	0.98	7.862E+02	7.780E+02	8.001E+02	0.998	0.987	1.015	1.01	0.98	0.97
ACT.	2.491E-02	2.717E-02	2.381E-02	0.985	1.074	0.941	0.92	1.05	1.14	2.556E+02	2.803E+02	2.405E+02	0.988	1.083	0.929	0.91	1.06	1.17
TOTAL	1.341E-03	1.352E-03	1.342E-03	0.997	1.005	0.998	0.99	1.00	1.01	1.042E+03	1.058E+03	1.041E+03	0.995	1.011	0.994	0.98	1.00	1.02

AVERAGE-ABSOLUTE-DEVIATION, AS % 0.61 3.00 2.40 3.4 1.9 5.7 0.65 3.56 3.07 3.8 2.7 7.0

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 50 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	3.766E-02	3.733E-02	3.856E-02	0.995	0.986	1.019	1.01	0.98	0.97	1.159E+02	1.152E+02	1.191E+02	0.993	0.987	1.020	1.01	0.97	0.97
ACT.	2.449E-02	2.711E-02	2.264E-02	0.990	1.096	0.915	0.90	1.08	1.20	2.106E+02	2.343E+02	1.943E+02	0.988	1.100	0.912	0.90	1.08	1.21
TOTAL	6.215E-02	6.444E-02	6.120E-02	0.993	1.029	0.978	0.96	1.02	1.05	3.264E+02	3.495E+02	3.134E+02	0.990	1.060	0.950	0.93	1.04	1.12

AVERAGE-ABSOLUTE-DEVIATION, AS % 0.75 4.62 4.21 4.7 4.0 9.4 0.97 5.75 5.26 5.8 5.1 11.8

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 100 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	1.094E-00	1.102E-00	1.137E-00	0.985	0.992	1.023	0.99	0.96	0.97	2.254E+02	1.941E+02	2.051E+02	1.083	0.932	0.985	1.16	1.10	0.95
ACT.	1.325E-02	1.471E-02	1.239E-02	0.985	1.094	0.921	0.90	1.07	1.19	5.607E+01	6.081E+01	5.185E+01	0.997	1.081	0.922	0.92	1.08	1.17
TOTAL	1.336E-02	1.482E-02	1.250E-02	0.985	1.093	0.922	0.90	1.07	1.19	5.609E+01	6.083E+01	5.187E+01	0.997	1.081	0.922	0.92	1.08	1.17

AVERAGE-ABSOLUTE-DEVIATION, AS % 1.50 6.49 6.00 6.8 5.9 13.4 2.96 7.67 5.70 10.6 8.7 13.3

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 300 YR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	1.094E-00	1.102E-00	1.137E-00	0.985	0.992	1.023	0.99	0.96	0.97	2.254E+02	1.941E+02	2.051E+02	1.083	0.932	0.985	1.16	1.10	0.95
ACT.	1.325E-02	1.471E-02	1.239E-02	0.985	1.094	0.921	0.90	1.07	1.19	5.607E+01	6.081E+01	5.185E+01	0.997	1.081	0.922	0.92	1.08	1.17
TOTAL	1.336E-02	1.482E-02	1.250E-02	0.985	1.093	0.922	0.90	1.07	1.19	5.609E+01	6.083E+01	5.187E+01	0.997	1.081	0.922	0.92	1.08	1.17

AVERAGE-ABSOLUTE-DEVIATION, AS % 1.50 6.49 6.00 6.8 5.9 13.4 2.96 7.67 5.70 10.6 8.7 13.3

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.) WATTS PER MTU

***** 1 KYR *****

	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN	ORIGEN2	ORIGEN-S	CINDER	QR2 AVG	QRS AVG	CIN AVG	QR2 ORS	QR2 CIN	QRS CIN
P. P.	2.144E-02	1.851E-02	1.955E-02	1.081	0.933	0.986	1.16	1.10	0.95									
ACT.	1.341E-01	1.434E-01	1.158E-01	1.023	1.094	0.883	0.94	1.16	1.24									
TOTAL	1.343E-01	1.436E-01	1.160E-01	1.023	1.094	0.883	0.94	1.16	1.24									

AVERAGE-ABSOLUTE-DEVIATION, AS % 4.23 8.48 8.26 9.6 13.8 17.7

APPENDIX G
NUCLIDE DISTRIBUTION SUMMARY TABLES
(See table descriptions in Sect. 4.2)

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	*****	30 DAY	*****	5 YR	*****	10 YR	*****
		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	
5 TO 10						SR95 NB95 SR95 NB95	
1 TO 5				SR95 NB95 SR95 NB95			
-1 TO 1		SH149 CB144 AM242 I129 AM242 I129	PU241 CS137 PU241 AM242 AM242 I129	PU241 CB137 PU241 CM242 CM242 AM242			
		AM242 PU241 ER95 CB144 Y90 ER95	CB144 SH149 I129 CB144 SR89 CB144	CB144 SH149 AM242 CB144 CB144 SR89			
		CM242 ND146 PU241 ND144 CM244 CM245	ER155 CM242 Y91 CB137 Y91 RU106	AM242 CM242 I129 Y91 I129 Y91			
		CM246 CM245 CM246 CM245 CM243 ND144	CM246 CM245 SR89 RU106 CM244 CM246	ND146 CM246 SR89 CB137 SR90 CM244			
		PU242 CM243 CM244 CM243 CM246 AM241	ND146 CM243 CM246 CM243 CM243 PU242	PU242 CM243 SB125 CM243 SB125 CM243			
		PU240 AM243 PU240 PU242 PU241 PU240	PU240 PU242 PU238 CM245 PU238 CM245	PU240 AM243 CM246 CM245 CM246 CM245			
		PU238 CS137 PU238 CS137 PU238 NP237	PU238 NP237 PU242 CM244 U238 PU241	PU238 CM245 CM244 RU106 PU242 RU106			
		U238 U236 U238 U236 U238 U236	U238 U236 U235 SM150 U235 SM150	U238 U236 U235 PU242 U235 U238			
		U235 U234 U235 U234 U235 U234	U235 U234 AM243 SM126 AM243 SM126	U235 U234 AM243 SM126 AM243 SM126			
		EU155 NP237 AM243 NP237 AM243 EU154	AM243 EU154 U238 SM152 AM241 SM152	EU155 NP237 U238 SM152 AM241 SM152			
		EU153 SM152 EU153 SM152 EU153 PU242	EU153 SM152 SR90 ND145 SR90 ND145	EU153 SM152 SR90 SM150 PU241 SM150			
		SM151 SM150 SR90 SM150 SR90 SM150	SM151 SM150 KR85 SM148 KR85 SM148	SM151 SM150 KR85 SM148 KR85 SM148			
		PU239 SM148 PU239 SM148 PU239 SM148	PU239 SM148 SM147 PM147 SM147 PM147	PU239 SM148 SM147 PD107 SM147 PM147			
		SM147 PM147 SM147 PD107 SM147 PD107	SM147 PM147 ND146 CB134 ND146 CB134	SM147 PD107 ND146 ND145 ND146 ND145			
		RU106 ND145 ND146 ND145 ND146 ND145	CS135 ND145 TC99 EU155 TC99 ND143	RU106 ND145 ND144 EU155 ND144 ND143			
		ND144 ER95 SR89 CS135 SR89 ND143	ND144 I129 EU154 ER93 EU154 CB137	ND144 I129 EU154 ER93 EU154 CB137			
		EU154 Y91 EU154 SM126 CB144 CS137	AM242 Y91 CS135 Y90 CB135 Y90	EU154 SM126 CB135 Y90 CB135 CB134			
		CS135 CS134 CS134 TC99 CS135 CS134	PD107 CS134 SR79 PU239 ER93 PU239	CS135 Y90 TC99 PU239 TC99 PU239			
		SR89 I129 SB125 ER93 TC99 SB125	TC99 SB125 SB125 PD107 SB125 SR79	TC99 SB125 PU238 SR79 PU238 ER93			
		SB125 SM126 RU106 SR79 SM126 RU106	SM126 Y90 ND144 EU153 PD107 ND144	ER93 KR85 SM151 PM147 PD107 Y90			
		PD107 KR85 Y90 PM147 ER93 SM152	SR90 KR85 SM151 U234 EU153 EU155	SR79 CB133 EU153 CB134 SR79 EU155			
		TC99 NB95 SM151 EU155 SR79 PM147	ER93 SR79 ND143 CB133 SM151 U234	PM147 CM244 ND143 CB133 SM151 EU153			
		ER93 SR90 CM242 Y91 SM151 EU155	CB133 RU106 U236 PU240 CB133 U236	SR90 CB134 U234 U236 CB133 U234			
		SR79 CM244 KR85 ND143 CM242 Y91	CM244 ND143 NP237 SM149 PU240 NP237	ND143 Y91 PU240 SM149 U236 PU240			
		CS133 ND143 CS133 NB95 CS133 KR85	SR89 ER95 CM242 SM149 CM242	SR89 NB95 NP237 SM149 NP237			
		Y90 AM241 AM241 SM149 NB95 SM149	NB95	ER95			
-5 TO -1			AM241 AM241	AM241 AM241		AM241 AM241	

G-ATOMS PER NTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATION MINUS UNITY

[illegible]

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 MT @ 6.33 GWD/MTU G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR	1 KYR	10 KYR
ORS/OR2-1	CIN/OR2-1	ORS/OR2-1	CIN/OR2-1
10 TO 20	PU241	CS137	CS137
1 TO 5	CS137	CS137	AM241, PU241
-1 TO 1	RU155 AM241 CM242 RU155 CM242 AM242 SM149 AM242 AM242 I129 I129 BU154 PU242 ND145 AM241 PU238 KR85 Y90 CM242 CM246 ND145 PU242 RU155 CS137 SM126 U238 CM246 TC99 CM243 SR90 CM244 U235 U238 CM244 PU238 CM244 PU240 PU239 SM151 SM150 PU242 TC99 SM148 SM147 KR85 SM126 SM150 CM246 SM152 ND146 SM147 Y90 SM126 U238 TC99 ND144 ND146 SR93 CM245 ND146 AM243 SR93 ND144 AM243 ND145 ND144 CM245 CS135 SM148 CM245 AM243 SM147 SM151 SM150 CS135 SR79 AM241 CS135 I129 PU238 PD107 SM152 SM151 SR93 SR79 PD107 BU153 SR90 PD107 SM148 U236 U234 CM243 ND143 SR79 ND143 BU153 CS133 CS133 PU239 SM152 BU153 ND143 NP237 BU154 U234 CS133 PU239 SR90 CM243 U235 SM149 U234 U235 Y90 KR85 SM149	SM149 SM151 CM242 AM242 CM242 AM242 ND145 ND146 I129 ND145 I129 PU238 PU242 CM246 ND146 TC99 CS137 CM244 SM126 U238 CM246 SM126 CM243 CM246 SM152 U235 PU242 CS135 TC99 PU242 ND144 PU239 SM151 SM150 Y90 SR90 SM148 SM147 ND144 SM148 SM150 KR85 CM245 U236 U238 PD107 SM126 U238 PU240 U234 AM243 SM147 PD107 ND146 AM241 PU238 ND145 ND144 CS135 SR93 SR79 AM243 SM147 TC99 SM150 SM152 BU153 AM241 CS135 I129 SR79 CM245 ND143 SM148 SR93 SR93 PD107 CS133 CM243 ND143 SR79 BU153 CS133 Y90 SR90 SM152 BU153 CM242 NP237 PU239 KR85 SM151 CM245 ND143 CM243 U234 SM149 CS133 PU239 PU240 Y90 U234 SM149 SR90 KR85 PU240	SM151 SM149 PU238 I129 PU238 I129 NP237 U238 SM151 AM242 AM242 CM242 U235 ND144 CM242 TC99 PU242 TC99 SM148 SM126 CS135 SM126 SM147 SM126 CS135 ND146 U238 PD107 U238 PD107 SM150 SM147 ND146 SM150 ND146 SM150 AM243 SR79 SM147 AM243 ND144 AM243 CM245 SM152 SM148 SR79 SM148 SR93 ND145 U234 ND145 ND144 CS135 ND145 PU239 I129 SM152 SR93 SR79 ND143 TC99 PD107 BU153 ND143 CM246 SM152 U236 BU153 CM246 CS133 BU153 CS133 CS133 SR93 PU242 CM245 SM151 CM245 PU240 CM246 U234 PU240 PU240 U234 ND143 PU242 SM149 SM149 AM242 CM242 PU238
-5 TO -1	PU240 U236	U235	U235
-10 TO -5		U236	U236
-20 TO -10			U235
-30 TO -20			U236
-30	NP237 PU241 NP237 PU241	CM244	NP237 CM244 NP237 PU241

CASE: PMR, 3.10 WT & U-235, 3.443 AT & EURNUP (33.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	30 DAY						5 YR						10 YR					
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1			
-30	AM242	PM147	CM245	CM246	CM243	CM245	AM242	PM147	CM245	CM246	CM243	CM245	AM242	CM242	CM245	CM246	CM243	CM245
													PM147					
20 TO 30	SM149	AM243	PM147	CM246	CM244		SM147	SM149	AM243	PM147	CM246	CM244	SM147	SM149	AM243	PM147	CM246	CM244
		AM241	CM244						CM244	SM147					CM244	SM147		
		PU242							PU242						PU242			
10 TO 20	SM151	AM241	SM147	PU241	PU242	AM243	SM151	PU241	PU241	AM241	PU242	AM243	SM151	PU241	PU241	AM241	PU242	AM243
	PU241	CS135	EU153	CS135	SM126	SM148	CM242	AM241	EU153	CS135	SM126	SM148	AM241	CS135	EU153	CS135	SM126	SM148
	PU239	AM243			PD107		CM135	PU239			PD107		PU239	AM243			PD107	
							AM243											
5 TO 10	SM147	PU238	SM149	U235	EU153	AM241	PU238	EU155	SM149	U235	EU153	RU106	PU238	EU155	SM149	SR95	EU153	RU106
	EU155	CM245			RU106	SM147	CM245	MD143			CM245	MD143	CM245	MD143	MD95	U235	SR95	MD95
	MD143	CM246					CM246	NP237					CM246	NP237				
	NP237																	
1 TO 5	I129	U235	PU239	MD143	U235	CS137	I129	U235	PU239	MD143	U235	CS137	I129	U235	PU239	MD143	U235	CS137
	SM150	MD145	CS137	PD107	Y90	SR90	SM150	MD145	SR95	CS137	SR95	SR90	SM150	MD145	CS137	PD107	Y90	SR90
	EU153	CS133	EU106	TC99	MD146		EU153	CS133	PD107	MD95	Y90	MD95	EU153	CS133	EU106	TC99	MD146	
	TC99	PU242	SM150	SR90			TC99	PU242	EU106	TC99	MD146		TC99	PU242	Y90	SM150		
			Y90						SM150	SR90					SR90			
								Y90										
-1 TO 1	SR89	SR93	CR144	KR85	KR85	CS134	SR93	SR89	CR144	I129	KR85	AM241	SR93	SR89	CR144	I129	KR85	CS134
	SR95	MD95	I129	MD145	U238	MD144	SR95	MD95	KR85	MD145	CS134	U238	CR144	Y91	KR85	Y91	CR144	AM241
	Y91	CR144	MD146	CS133	CR144	PU241	Y91	CR144	CS133	MD146	CR144	MD144	MD95	SR95	MD145	CS133	U238	MD144
	EU154	SM152	U238	Y91	TC99	CM242	EU154	SM152	Y91	U238	PU241	TC99	EU154	SM152	MD146	U238	PU241	TC99
	CM242	CS137	CM242	U236	U236	SM150	CS137	U236	U236		SM150	U236	CS137	U236	U236	SR89	Y91	SM150
	U236	U238	SR95		PU240	Y91	U238	Y90			Y91	PU240	U238	Y90			U236	
	SR90	KR85					SR90	KR85					SR90	KR85				
	Y90																	
-5 TO -1	MD146	CS134	MD95	CS134	CS135	SR95	MD146	CS134	SR89	CS135	MD143		MD146	CS134	CS134	SR93	PU240	CS135
	MD144	CM244	SR89	SR93	MD143	MD95	MD144	CM244	SR93	MD144	SR89	CS133	MD144	CM244	MD144	EU155	MD143	SR89
	U234		MD144	NP237	U234	CS133	U234		NP237	EU155	MD145	SM147	U234		NP237		CS133	MD145
			EU155		MD145	SR89					SR93	I129					SR93	SM147
					SR93	I129					U234						I129	
-10 TO -5	RU106	PD107	U234	SM151	PM147	PU239	RU106	PD107	CM242	SM151	PM147	PU239	RU106	PD107	SM151	U234	PM147	U234
	SE79		PU238		SE79	NP237	SE79		U234	PU238	SE79	NP237	SE79		PU238		PU239	SE79
																	NP237	
-20 TO -10	PU240		CM243	PU240	EU155	EU154	PU240		CM243	PU240	EU155	EU154	PU240		CM243	PU240	EU155	EU154
			EU154	SE79	SM149	SB125			EU154	SE79	SM149	PU238			EU154	SE79	SM149	PU238
			SM126	AM242	PU238	SM152			SM126	AM242	SM125	CM242			SM126	CM242	SB125	SM152
			SM152						SM152		SM152				AM242	SM152		
-30 TO -20	SM126		SM148		SM151		SM126		SM148		SM151		SM126		SM148		SM151	
-30	SM148	SB125	SB125		AM242		SM148	SB125	SB125		AM242		SM148	SB125	SB125		CM242	AM242
	CM243						CM243						CM243					

CASE: PWR, 3.10 MT & U-235, 3.443 AT & BURNUP (33.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	20 YR	50 YR	100 YR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
-30	CM242 AM242 CM245 CM246 CM243 CM245 PM147	CM242 AM242 CM245 CM246 CM243 CM245 PM147	AM242 CM242 CM245 CM246 CM243 CM245 PM147
20 TO 30	SM147 SM149 AM243 PM147 CM246 CM244 CM244 SM147 PU242	SM147 SM149 AM243 PM147 CM246 CM244 CM244 SM147 PU242	SM147 PU241 AM243 PU241 CM246 CM244 SM149 PM147 CM244 SM147 PU242
10 TO 20	SM151 PU241 PU241 ER95 PU242 AM243 AM241 CS135 NB95 AM241 SM126 ER95 PU239 AM243 EU153 CS135 NB95 SM148 PD107	SM151 AM241 PU241 AM241 PU242 AM243 CS135 PU239 EU153 CS135 SM126 SM148 AM243 PD107	SM151 AM241 AM241 EU153 PU242 AM243 CS135 PU239 CS135 AM243 SM126 SM148 PD107
5 TO 10	PU238 EU155 SM149 U235 EU153 RU106 CM245 ND143 CM246 NP237	PU238 EU155 SM149 U235 EU153 RU106 CM245 NP237 ND143 CM246	PU238 EU155 SM149 U235 EU153 RU106 NP237 CM245 ND143 CM246
1 TO 5	I129 U235 PU239 ND143 U235 CS137 SM150 ND145 CS137 PD107 Y90 SR90 EU153 CS133 TC99 SM150 ND146 TC99 PU242 SR90 Y90 CE144	I129 U235 PU239 ND143 U235 CS137 SM150 ND145 CS137 CE144 Y90 SR90 EU153 CS133 PD107 TC99 CE144 ND146 TC99 PU242 SM150 Y90 SR90	I129 U235 PU239 CE144 U235 CE144 SM150 ND145 CS137 ND143 CS137 SR90 EU153 CS133 PD107 TC99 Y90 ND146 TC99 PU242 SM150 Y90 CE137 CE144 SR90
-1 TO 1	ER93 CE144 Y91 I129 KR85 CE144 Y91 EU154 KR85 ND145 CS134 U238 SM152 CS137 CS133 ND146 Y91 ND144 ER95 NB95 U238 U236 AM241 PU241 U236 U238 TC99 SM150 SR90 KR85 U236 Y90	ER93 CE144 I129 KR85 KR85 CS134 CS137 EU154 ND145 CS133 U238 ND144 SM152 U236 ND146 U238 PU241 TC99 U238 SR90 U236 AM241 SM150 Y90 KR85 U236	ER93 SM152 I129 KR85 KR85 CS134 EU154 U234 ND145 CS133 U238 ND144 U236 U238 ND146 U238 PU241 TC99 Y90 SR90 AM241 SM150 KR85
-5 TO -1	ND146 CS134 CS134 ER93 PU240 CS135 ND144 U234 ND144 RU106 ND143 CS133 CM244 EU155 ND145 ER93 SM147 I129	U234 ND146 CS134 ER93 CS135 PU240 CS134 ND144 ND144 RU106 ND143 CS133 CM244 EU155 ND145 ER93 SM147 I129	ND146 CE134 U236 CE134 U236 CE135 ND144 CM244 ER93 RU106 ND143 PU240 ND144 EU155 CS133 ND145 ER93 SM147 I129
-10 TO -5	PD107 SE79 SM151 NP237 PM147 PU239 RU106 PU238 SE79 U234	PD107 SE79 SM151 PU238 PM147 PU239 RU106 SE79	PD107 SE79 SM151 PU238 PM147 PU239 RU106 SE79
-20 TO -10	PU240 CM243 PU240 EU155 NP237 EU154 U234 EU154 SM149 SE79 SM126 PU238 SB125 CM242 AM242 SM152	PU240 CM243 EU154 EU155 EU154 PU240 NP237 SM149 PU238 SE79 U234 SB125 U234 SM126 CM242 SM152 NP237 AM242 SM152	PU240 CM243 EU154 EU155 EU154 PU240 SE79 SM149 PU238 SM126 CM242 SB125 SM152 AM242 SM152
-30 TO -20	SM126 SM148 SM151	SM126 SM148 SM151	SM126 U234 SM148 SM151 U234 NP237
-30	SM148 SB125 SB125 CM242 AM242 CM243	SM148 SB125 SB125 CM242 AM242 CM243	SM148 SB125 SB125 NP237 CM242 CM243 AM242

CASE: PMR, 3.10 MT & U-235, 3.443 AT & BURNUP (33.0 GMD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR						1 KYR						10 KYR					
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1
-30	CH242	AM242	CM245	CM246	CM243	CM245	AM242	CM242	CM245	CM246	CM243	CM245	CM242	PU238	CM245	CM246	CM245	
													AM242					
20 TO 30	SM147	SM149	AM243	CM244	CM246	CM244	SM147	SM149	AM243	SM147	CM246	CM244	SM147	SM149	AM243	SM147	CM246	
	PU241		SM147	PU242					PU242						PU242			
10 TO 20	SM151	AM241	AM241	EU153	PU242	AM243	SM151	PU238	CS137	AM241	PU242	AM243	SM151	CS135	EU153	CS135	PU242	AM243
	CS135	PU239	CS135		SM126	SM148	AM241	CS137	EU153	CS135	SM126	SM148	PU239	MP237			SM126	SM148
	AM243				PD107		CS135	PU239			PD107		AM241	AM243			PD107	
							NP237	AM243										
5 TO 10	MP237	PU238	SM149	CS137	EU153		PU241	CM245	SM149		EU153		PU241	CM245	SM149		EU153	
	EU155	CM245	U235				ND143	CM246					ND143	CM246				
	ND143	CM246																
1 TO 5	CS137	I129	PU239	ND143	U235	CS137	I129	U235	PU239	U235	CS137	Y90	I129	U235	ND143	PU239	ND146	
	U235	SM150	PD107	TC99	SR90	Y90	SM150	ND145	ND143	PD107	SR90	U235	SM150	ND145	PD107	TC99		
	ND145	EU153	SM150	SR90	ND146		EU153	CS133	TC99	SM150	ND146		EU153	CS133	SM150			
	CS133	TC99	Y90				TC99	PU242	Y90	SR90			TC99	PU242				
	PU242	U234					U234						U234					
-1 TO 1	ER93	SM152	I129	KR85	KR85	U238	ER93	SM152	I129	ND145	KR85	U238	ER93	SM152	I129	ND145	U238	ND144
	EU154	U236	ND145	CS133	ND144	TC99	U238	U236	CS133	ND146	ND144	TC99	U238		CS133	ND146	TC99	SM150
	U238	KR85	ND146	U238	AM241	SM150	KR85	Y90	KR85	U238	AM241	SM150			U238			
	Y90	SR90					SR90											
-5 TO -1	ND146	ND144	ER93	ND144	CS135	ND143	ND146	ND144	ER93	ND144	CS135	ND143	ND146	ND144	ER93	ND144	CS135	PU240
	CM244		U236	EU155	PU240	CS133					PU240	CS133	U236				ND143	CS133
					ND145	U236					ND145	ER93					ND145	ER93
					ER93	SM147					SM147	I129					SM147	I129
					I129													
-10 TO -5	PD107	SE79	SM151	PU238	PU239	SE79	PD107	SE79	SM151	U236	U236	PU239	PD107	SE79	SM151	U235	PU239	SE79
											SE79							
-20 TO -10	PU240		CM243	EU154	EU155	EU154	PU240		PU238	CM243	SM149	SM152	PU240		PU240	SE79	U235	SM149
			PU240	SE79	SM149	PU238			PU240	SE79					SM126	PU238	SM152	
			SM126	CM242	SM152				SM126	CM242					SM152	AM242		
			AM242	SM152					AM242	SM152					CM242			
-30 TO -20	SM126		SM148		SM151		SM126		SM148		SM151	PU238	SM126		SM148	U236	SM151	U236
-30	SM148	CM243	U234	MP237	U234	CM242	SM148	CM243	U234	MP237	U234	CM242	SM148		U234	MP237	U234	PU238
			PU241		AM242	MP237	CM244		CM244		PU241	AM242	MP237		AM241		AM242	CM242
					PU241							PU241					MP237	AM241

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	30 DAY	5 YR	10 YR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
30	AM242 PM147 CM245 CM246 CM243 CM245 CM244 PM147 CM246 CM244 AM243	AM242 PM147 CM245 CM246 CM243 CM245 CM244 PM147 CM246 CM244 AM243	AM242 CM242 CM245 CM246 CM243 CM245 PM147 SM147 CM244 PM147 CM246 CM244 AM243
20 TO 30	SM149 SM151	SM149 SM147 SM147 SM151	SM149 SM151 SM147
10 TO 20	CM246 PU238 PU242 AM241 AM243 SM126 AM243 CS135 SM147 U235 PD107 SM148 PU239 PU241 SM149 AM241 RU106	CM242 CM246 PU242 U235 AM243 SM126 AM243 PU238 PU241 SM149 PD107 SM148 PU241 CS135 AM241 RU106 PU239	CM246 PU241 PU242 PU241 AM243 SM126 PU238 AM243 U235 SM149 PD107 SM148 CS135 PU239 SR95 AM241 RU106 NR95
5 TO 10	PU241 SM152 CS135 SM150 RU153 SM147 ND143 RU155 ND143 CM242 U235 CM245 SM147 RU153 I129 U235 SM150	SM152 ND143 CS135 SR95 RU153 U235 RU155 AM241 NR95 SM150 SR95 CM245 I129 ND143 RU153 U235 SM150	SM152 AM241 CS135 SM150 SR95 NR95 ND143 RU155 ND143 RU153 RU153 U235 CM245 I129 U235 SM150
1 TO 5	NP237 CM242 Y91 RU106 CS134 CR144 AM241 CS133 SR89 SR95 CS137 ND146 TC99 ND145 CR144 CS137 Y91 PU241 SR89 Y91 PD107 NR95 SR90 Y90 RU154 SR95 TC99 SR90 SR95 NR95 U234 Y90 I129	NP237 CS133 Y91 SR89 CS134 NR95 TC99 ND145 RU106 CR144 AM241 CR144 SR89 Y91 CS137 PD107 ND146 U234 RU154 TC99 Y90 Y91 PU241 NR95 SR95 SR90 I129 Y90 SR90 SR89	NP237 CS133 Y91 CR144 CS134 CR144 TC99 ND145 SR89 RU106 AM241 CS137 U234 SR89 CS137 PD107 Y91 ND146 Y91 RU154 TC99 SR90 PU241 Y90 NR95 SR95 Y90 I129 SR90 SR89
-1 TO 1	SR93 U236 CS133 ND146 SR89 NR95 CR144 CS137 NP237 U238 CM242 SM150 U238 KR85 KR85 ND145 KR85 U238 SR90 Y90 U236 PU239 TC99 ND144 U236	SR93 CR144 CS133 ND146 SM150 KR85 U236 CS137 U238 KR85 U238 ND144 U238 KR85 NP237 ND145 TC99 U236 SR90 Y90 U236 PU239	SR93 CR144 CS133 ND146 SM150 KR85 U236 CS137 U238 KR85 U238 ND144 U238 KR85 ND145 U236 TC99 U236 SR90 Y90 PU239 NP237
-5 TO -1	CM244 RU153 U234 CS134 ND143 CS135 ND146 ND144 SR93 RU155 U234 SR93 PU240 PU242 ND144 CS133 ND145 NP237	CM244 RU153 CM242 CS134 ND143 CS135 ND146 ND144 RU155 SR93 SR93 CS133 PU240 PU242 ND144 PU238 ND145 SM147 U234 NP237	CM244 RU153 CS134 RU155 ND143 CS135 ND146 ND144 SR93 ND144 SR93 CS133 PU240 PU242 PU238 ND145 SM147
-10 TO -5	CS134 RU106 PU238 SM151 I129 PU240 SE79 PD107 CM243 SE79 RU155 PM147 PU239	CS134 RU106 SM151 CM243 I129 U234 PU240 SE79 RU155 PM147 PU239	CS134 RU106 U234 SM151 I129 NP237 SE79 PD107 CM243 SE79 RU155 PM147 PU240 PU239
-20 TO -10	RU154 PU240 RU154 SM149 SE79 SM126 PU238 SB125 AM242	RU154 PU240 RU154 SM149 SE79 SM126 PU238 CM242 AM242 SB125	RU154 PU240 U234 RU154 SE79 SM126 SM149 PU238 CM242 AM242 SB125
-30 TO -20	SM126 SM152 SM148 SM151 SM152	SM126 SM152 SM148 SM151 SM152	SM126 SM152 SM148 SM151 SM152
-30	SB125 SM148 SB125 AM242 CM243	SB125 SM148 SB125 AM242 CM243	SB125 SM148 SB125 CM242 AM242 CM243

G-ATOMS PER MTU

DELTA	20 YR						50 YR						100 YR					
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1			
30	AM242 CM242 PM147 SM147 AM243	CM245 CM246 CM244 PM147 AM243	CM243 CM245 CM246 CM244	AM242 CM242 PM147 SM147 AM243	CM245 CM246 CM244 PM147 AM243	CM243 CM245 CM246 CM244	AM242 CM242 PM147 SM147 AM243	CM245 CM246 CM244 PM147 AM243	CM243 CM245 CM246 CM244	AM242 CM242 PM147 SM147 AM243	CM245 CM246 CM244 PM147 AM243	CM243 CM245 CM246 CM244	AM242 CM242 PM147 SM147 AM243	CM245 CM246 CM244 PM147 AM243	CM243 CM245 CM246 CM244			
20 TO 30	SM149 SM151 SM147	PU242		SM149 SM151 SM147	PU242		SM149 SM151 SM147	PU242		SM149 SM151 SM147	PU242		SM149 SM151 SM147	PU242				
10 TO 20	CM246 PU241 PU238 AM243 CS135 PU239 AM241	ER95 NB95 PU242 PU241 U235 SM149 AM241	AM243 ER95 NB95 SM126 PD107 SM148 RU106	PU241 CM246 PU238 AM243 CS135 PU239 SM149	PU241 PU242 U235 AM241 SM149	AM243 SM126 PD107 SM148 RU106	CM246 PU238 AM243 CS135 PU239	PU242 U235 AM241 SM149 RU106	AM243 SM126 PD107 SM148 RU106	CM246 PU238 AM243 CS135 PU239	PU242 U235 AM241 SM149 RU106	AM243 SM126 PD107 SM148 RU106	CM246 PU238 AM243 CS135 PU239	PU242 U235 AM241 SM149 RU106	AM243 SM126 PD107 SM148 RU106			
5 TO 10	SM152 AM241 ND143 EU155 CM245 I129 U235 SM150 MP237	CS135 SM150 ND143 EU153	EU153 U235	SM152 AM241 ND143 EU155 CM245 I129 U235 SM150 MP237	CS135 SM150 ND143 EU153	EU153 U235	SM152 AM241 ND143 EU155 CM245 I129 U235 SM150 MP237	CS135 SM150 ND143 EU153	EU153 U235	SM152 AM241 ND143 EU155 CM245 I129 U235 SM150 MP237	CS135 SM150 ND143 EU153	EU153 U235	SM152 AM241 ND143 EU155 CM245 I129 U235 SM150 MP237	CS135 SM150 ND143 EU153	EU153 U235			
1 TO 5	CS133 U234 TC99 ND145 EU154 Y91	Y91 CE144 CS137 PD107 TC99 SR90 Y90 I129 SR90	CS134 CE144 Y91 CS137 ND146 AM241 Y90 U241 SR90	U234 CS133 TC99 ND145 EU154 SR90 I129	CS137 PD107 CE144 Y90 CS137 ND146 AM241 U241 SR90	CS134 CE144 Y91 CS137 ND146 AM241 Y90 U241 SR90	U234 CS133 TC99 ND145 EU154 SR90 I129	CS137 PD107 CE144 Y90 CS137 ND146 AM241 U241 SR90	CS134 CE144 Y91 CS137 ND146 AM241 Y90 U241 SR90	U234 CS133 TC99 ND145 EU154 SR90 I129	CS137 PD107 CE144 Y90 CS137 ND146 AM241 U241 SR90	CS134 CE144 Y91 CS137 ND146 AM241 Y90 U241 SR90	U234 CS133 TC99 ND145 EU154 SR90 I129	CS137 PD107 CE144 Y90 CS137 ND146 AM241 U241 SR90	CS134 CE144 Y91 CS137 ND146 AM241 Y90 U241 SR90			
-1 TO 1	NB95 ER95 ER93 CE144 CS137 U236 U238 KR85 SR90 Y90	CS133 RU106 ND146 U238 KR85 ND145 U236 PU239	SM150 KR85 U238 ND144 TC99 U236	CS137 ER93 CE144 U236 U238 KR85 SR90 Y90	CS133 RU106 ND146 U238 KR85 ND145 U236 PU239	SM150 KR85 U238 ND144 TC99 U236	CS137 ER93 CE144 U236 U238 KR85 SR90 Y90	CS133 RU106 ND146 U238 KR85 ND145 U236 PU239	SM150 KR85 U238 ND144 TC99 U236	CS137 ER93 CE144 U236 U238 KR85 SR90 Y90	CS133 RU106 ND146 U238 KR85 ND145 U236 PU239	SM150 KR85 U238 ND144 TC99 U236	CS137 ER93 CE144 U236 U238 KR85 SR90 Y90	CS133 RU106 ND146 U238 KR85 ND145 U236 PU239	SM150 KR85 U238 ND144 TC99 U236			
-5 TO -1	CM244 EU153 ND146 ND144 PU240 PU242	CS134 EU155 ER93 MP237 ND144 PU238	ND143 CS135 ER93 CS133 ND145 SM147	CM244 EU153 ND146 ND144 PU240 PU242	CS134 EU155 ER93 ND144 PU238	ND143 CS135 ER93 CS133 ND145 SM147	CM244 EU153 ND146 ND144 PU240 PU242	CS134 EU155 ER93 ND144 PU238	ND143 CS135 ER93 CS133 ND145 SM147	CM244 EU153 ND146 ND144 PU240 PU242	CS134 EU155 ER93 ND144 PU238	ND143 CS135 ER93 CS133 ND145 SM147	CM244 EU153 ND146 ND144 PU240 PU242	CS134 EU155 ER93 ND144 PU238	ND143 CS135 ER93 CS133 ND145 SM147			
-10 TO -5	CS134 SE79 PD107 RU106	SM151 CM243 I129 SE79 SM147 PU240 PU239	MP237 EU155 EU155 PU240 PU239	CS134 SE79 PD107 RU106	SM151 CM243 I129 SE79 SM147 PU240 PU239	MP237 EU155 EU155 PU240 PU239	CS134 SE79 PD107 RU106	SM151 CM243 I129 SE79 SM147 PU240 PU239	MP237 EU155 EU155 PU240 PU239	CS134 SE79 PD107 RU106	SM151 CM243 I129 SE79 SM147 PU240 PU239	MP237 EU155 EU155 PU240 PU239	CS134 SE79 PD107 RU106	SM151 CM243 I129 SE79 SM147 PU240 PU239	MP237 EU155 EU155 PU240 PU239			

CASE: PWR, 4.50 WT % U-235, 5.206 AT % BURNUP (50.0 GWD/MTU, APPROX.)

G- TONS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR						1 KYR						10 KYR					
	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1	QRS/OR2-1	CIN/OR2-1	CIN/ORS-1
30	AM242 CM242	CM245 CM246	CM243 CM245	AM242 CM242	CM245 CM246	CM243 CM245	AM242 CM242	CM245 CM246	CM243 CM245	PU238 AM242	CM245 CM246	CM243 CM245	PU238 AM242	CM245 CM246	CM243 CM245	PU238 AM242	CM245 CM246	CM243 CM245
	SM147	CM244 AM243	CM246 CM244	SM147	AM243	CM246 CM244	SM147	AM243	CM246 CM244	CM242 SM147	AM243	CM246 CM244	CM242 SM147	AM243	CM246 CM244	CM242 SM147	AM243	CM246 CM244
20 TO 30	SM149 SM151	SM147	PU242	SM149 SM151	SM147	PU242	SM149 SM151	SM147	PU242	SM149 SM151	SM147	PU242	SM149 SM151	SM147	PU242	SM149 SM151	SM147	PU242
10 TO 20	PU241 CM246	PU242 U235	AM243 SM126	PU238 CS137	CS137 PU242	AM243 SM126	PU238 CS137	CS137 PU242	AM243 SM126	CM246 AM241	PU242 SM149	AM243 SM126	CM246 AM241	PU242 SM149	AM243 SM126	CM246 AM241	PU242 SM149	AM243 SM126
	PU238 AM243	AM241 SM149	PD107 SM148	CM246 AM243	AM241 SM149	PD107 SM148	CM246 AM243	AM241 SM149	PD107 SM148	AM243 CS135		PD107 SM148	AM243 CS135		PD107 SM148	AM243 CS135		PD107 SM148
	CS135 PU239			CS135 PU239	U235		CS135 PU239	U235		PU239			PU239			PU239		
5 TO 10	SM152 AM241	CS135 CS137	BU153 U235	SM152 AM241	CS135 SM150	BU153	SM152 AM241	CS135 SM150	BU153	SM152	PU241	CS135 SM150	BU153	SM152	PU241	CS135 SM150	BU153	SM150
	EU155 ND143	SM150 ND143		EU155 ND143	SM150 ND143		EU155 ND143	SM150 ND143		MP237	ND143	ND143	EU153	MP237	ND143	ND143	EU153	
	CH245 U234	EU153		CH245 U234	EU153		CH245 U234	EU153		U234	CH245			U234	CH245			
	NP237 U235			NP237 U235			NP237 U235			U235	I129			U235	I129			
	I129 SM150			I129 SM150			I129 SM150			SM150				SM150				
1 TO 5	CS137 CS133	PD107 TC99	CS137 ND146	CS133 TC99	PD107 TC99	U235 CS137	CS133 TC99	PD107 TC99	U235 CS137	CS133 TC99	PD107 TC99	ND146	CS133 TC99	PD107 TC99	ND146	CS133 TC99	PD107 TC99	ND146
	TC99 ND145	Y90 SR90	AM241 Y90	TC99 ND145	Y90 SR90	AM241 Y90	TC99 ND145	Y90 SR90	AM241 Y90	ND145			ND145			ND145		
	EU154	I129	SR90	EU154	I129	SR90	EU154	I129	SR90	Y90			Y90			Y90		
-1 TO 1	ER93 U236	CS133 ND146	SM150 KR85	ER93 U236	CS133 ND146	SM150 KR85	ER93 U236	CS133 ND146	SM150 KR85	ER93 U236	CS133 ND146	SM150 KR85	ER93 U236	CS133 ND146	SM150 KR85	ER93 U236	CS133 ND146	SM150 KR85
	U238 KR85	U238 KR85	U238 ND144	U238 KR85	U238 ND144	U238 ND144	U238 KR85	U238 ND144	U238 ND144	U236			U236			U236		
	Y90 SR90	ND145 PU239	TC99	Y90 SR90	ND145 PU239	TC99	Y90 SR90	ND145 PU239	TC99	Y90			Y90			Y90		
-5 TO -1	CM244 EU153	EU155 ER93	ND143 U236	CM244 EU153	EU155 ER93	ND143 U236	CM244 EU153	EU155 ER93	ND143 U236	EU153 ND146	PU239 ER93	ND143 CS135	EU153 ND146	ER93 ND144	ND143 CS135	EU153 ND146	ER93 ND144	ND143 CS135
	ND146 ND144	U236 ND144	CS135 ER93	ND146 ND144	U236 ND144	CS135 ER93	ND146 ND144	U236 ND144	CS135 ER93	ND144 PU240	ND144 U236	ER93 CS133	ND144 PU240	PU239 U235	ER93 CS133	ND144 PU240	PU239 U235	ER93 CS133
	PU240 PU242	PU238	CS133 ND145	PU240 PU242	PU238	CS133 ND145	PU240 PU242	PU238	CS133 ND145	PU242			PU242			PU242		
			SM147			SM147			SM147									
-10 TO -5	SE79 PD107	SM151 CM243	I129 SE79	SE79 PD107	SM151 CM243	I129 SE79	SE79 PD107	SM151 CM243	I129 SE79	SE79 PD107	SM151 CM243	I129 SE79	SE79 PD107	SM151 CM243	I129 SE79	SE79 PD107	SM151 CM243	I129 SE79
			EU155			EU155			EU155									
-20 TO -10		EU154 PU240	PU239 PU240			EU154 PU240			EU154 PU240									
		SE79 SM126	EU154 SM149			SE79 SM126			SE79 SM126									
		CM242 AM242	PU238			CM242 AM242			CM242 AM242									
-30 TO -20	SM126	SM152 SM148	SM151 SM152	SM126	SM152 SM148	SM151 SM152	SM126	SM152 SM148	SM151 SM152	SM126	SM152 SM148	SM151 SM152	SM126	SM152 SM148	SM151 SM152	SM126	SM152 SM148	SM151 SM152
-30	SM148 CM243	U234 MP237	U234 MP237	SM148 CM243	U234 MP237	U234 MP237	SM148 CM243	U234 MP237	U234 MP237	SM148	U234 MP237	U234 MP237	SM148	U234 MP237	U234 MP237	SM148	U234 MP237	U234 MP237
		PU241	CM242 AM242			PU241			PU241									
			PU241			PU241			PU241									

CASE: BMR, 2.64 WT & U-235, 2.866 AT & BURNUP (27.5 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	30 DAY					5 YR					10 YR				
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1
30	PM147		CM243				PM147		CM243				PM147		CM243
20 TO 30		PM147 SM147	PU242		SM147	PM147 SM147	PU242		SM147		PM147 SM147	PU242		SM147	PU242
10 TO 20	AM242 SM147	PU242		SM126		AM242	PU242		SM126		AM242 CM242	PU242		SM126	
5 TO 10	SM149	EU153 ND144 SR90 Y90	CM244 AM243 EU153 SM147 CM246 PD107		SM149	EU153 Y90 SR90 ND144	CM244 AM243 EU153 CM246 PD107		SM149		EU153 ER95 NB95 Y90 SR90 ND144	CM244 AM243 EU153 ER95 PD107 CM246 NB95		SM149	EU153 ER95 CM244 AM243 EU153 ER95 PD107 CM246 NB95
1 TO 5	SR89 Y91 ND145 ER93 ND144 CS133 SM152 I129 NB95 ER95 TC99 SR90 Y90 CM144 KR85 U236 ND143	KR85 Y91 SR89 CS133 U236 TC99 CB144 ND145 CS137 SM148 U236 ND146	SR90 Y90 ND144 RU106 KR85 CM245 CS137 SM148 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146		SR89 Y91 ND145 ER93 NB95 Y91 RU106 ND144 CB133 SM152 SR89 CB137 KR85 ER95 I129 ND144 U236 CM144 CB137 CM245 TC99 Y90 SM148 NB95 U236 ND146
-1 TO 1	PU239 SM150 EU153 U238 CS137 ND146 CS135 U234	ER93 CS133 SR95 ND146 U238 NB95 U234 AM243	U234 U238 CB144 Y91 TC99 PU240		U236 PU239 SM150 EU153 ND146 U238 U238 CS137 ND146 CB135 U234	ER93 CB133 SM147 U238 Y91 TC99 PU240 SR89		U236 PU239 SM150 EU153 ND146 U238 U238 CS137 ND146 CB135 U234	ER93 CB133 SM147 U238 Y91 TC99 PU240 SR89		U236 PU239 SM150 EU153 ND146 U238 U238 CS137 ND146 CB135 U234	ER93 CB133 SM147 U238 Y91 TC99 PU240 SR89		U236 PU239 SM150 EU153 ND146 U238 U238 CS137 ND146 CB135 U234	ER93 CB133 SM147 U238 Y91 TC99 PU240 SR89
-5 TO -1	PU238 NP237 EU155 PU241	SM150 I129 ND143	SR89 ER95 ER93 CS133 ND145 NB95 CM242 SM150 PM147 CS134 I129		NP237 PU238 EU155 PU241	SM150 U234 ND143 CB133 Y91 ND145 SM150 PM147 CB134 I129		NP237 PU238 EU155 PU241	SM150 U234 ND143 CB133 Y91 ND145 SM150 PM147 CB134 I129		NP237 PU238 EU155 U234 ND143 ND145 SM150 U234 CB134 I129		NP237 PU238 EU155 U234 ND143 ND145 SM150 U234 CB134 I129		NP237 PU238 EU155 U234 ND143 ND145 SM150 U234 CB134 I129
-10 TO -5	CS134 EU154 U235 AM241 PU242 SE79 SM151 RU106 AM243	RU106 PD107 CS134 CS135 U235 CS135	ND143 SE79 U235 CS135		CS134 CM242 EU154 AM241 U235 PU242 SE79 SM151 RU106 AM243	RU106 PD107 CB134 CB135 U235 CB135		CS134 CM242 EU154 AM241 U235 PU242 SE79 SM151 RU106 AM243	RU106 PD107 CB134 CB135 U235 CB135		CS134 EU154 AM241 U235 CB134 CB135 U235 CB135		CS134 EU154 AM241 U235 CB134 CB135 U235 CB135		CS134 EU154 AM241 U235 CB134 CB135 U235 CB135
-20 TO -10	PD107 PU240 CM242 CM246	CM246 PU240 SM152 SE79 U235 CM242 SM149 CM244 PU241 SM126	SM152 PU241 EU154 AM241 SB125		PD107 PU240 CM246	CM246 SM152 SM152 PU241 EU154 AM241 U235 SM149 SB125 CM244 PU241 SM126		PD107 PU240 CM246	CM246 SM152 SM152 PU241 EU154 AM241 U235 SM149 SB125 CM244 PU241 SM126		PD107 PU240 CM246	CM246 SM152 SM152 PU241 EU154 AM241 U235 SM149 SB125 CM244 PU241 SM126		PD107 PU240 CM246	CM246 SM152 SM152 PU241 EU154 AM241 U235 SM149 SB125 CM244 PU241 SM126
-30 TO -20	CM244 CM245 SM126	EU154 AM241 NP237 CM245 SM151 EU155 EU155 PU238 PU239 SM151 SM148	SM149 NP237 SM151 EU155 EU155 PU238 PU239 SM151 SM148		CM244 CM245 SM126	AM241 EU154 NP237 CM245 SM151 NP237 EU155 EU155 PU238 PU239 SM151 SM148		CM244 CM245 SM126	AM241 EU154 NP237 CM245 SM151 NP237 EU155 EU155 PU238 PU239 SM151 SM148		CM244 CM245 SM126	AM241 EU154 NP237 CM245 SM151 NP237 EU155 EU155 PU238 PU239 SM151 SM148		CM244 CM245 SM126	AM241 EU154 NP237 CM245 SM151 NP237 EU155 EU155 PU238 PU239 SM151 SM148
-30	SM148 SB125 CM243	CM243 SB125 AM242	AM242		SM148 SB125 CM243	CM243 SB125 AM242		SM148 SB125 CM243	CM243 SB125 AM242		SM148 SB125 CM243	CM243 SB125 AM242		SM148 SB125 CM243	CM243 SB125 AM242

CASE: BWR, 2.64 WT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	20 YR					50 YR					100 YR				
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1			
30	PM147		CM242				PM147		CM242			PM147		CM242	
20 TO 30	SM147	PM147 SM147	PU242				SM147	PM147 SM147	PU242			SM147	PM147 SM147	PU242	
10 TO 20	CM242 AM242	ER95 NB95 PU242	ER95 NB95 SM126				AM242 CM242	PU242	SM126			AM242 CM242	PU242	SM126	
5 TO 10	SM149	EU153 Y90 SR90 ND144	CM244 AM243 EU153 CM246 PD107				SM149	EU153 Y90 SR90 ND144	CM244 AM243 EU153 CM246 PD107			SM149 PU241	EU153 CE144 Y90 SR90 ND144	AM243 CM244 EU153 CM246 PD107	
1 TO 5	Y91 ND145 ER93 CS133 SM152 I129 ND14 TC99 Y90 CE144 SR90 KR85 ND143	KR85 Y91 CS137 CE144 U236 TC99 ND145	SR90 Y90 RU106 ND144 KR85 CM245 CS137 SM148 U236 ND146				ND145 ER93 CS133 SM152 I129 ND144 CE144 TC99 Y90 SR90 KR85 ND143	KR85 CE144 SR90 Y90 RU106 ND144 CS137 CM245 SM148 CE144 ND146	SR90 Y90 RU106 ND144 CS137 CM245 SM148 CE144 ND146			ND145 ER93 CS133 SM152 I129 CE144 ND144 TC99 Y90 SR90 CE137 KR85 ND143	SR90 Y90 RU106 ND144 CS137 CM245 SM148 CE137 KR85 ND143	Y90 SR90 U236 RU106 CE144 ND145 TC99 SM148 ND146	
1 TO 1	ER95 NB95 U236 PU239 SM150 EU153 CS137 U238 ND146 CS135 U234	ER93 CS133 ND146 U238 AM243	CE144 Y91 U238 TC99 SM147 PU240				U236 PU239 SM150 PU241 CS137 EU153 U238 ND146 CE135 U234	ER93 CS133 ND146 U238 TC99 PU240	U236 U238 SM147			U236 PU239 SM150 EU153 U238 ND146 CE135	ER93 CS133 ND146 U238 TC99 PU240	U236 U238 SM147	
5 TO -1	NP237 PU238 PU241 EU155	SM150 I129 ND143	ER93 CS133 ND145 SM150 CS134 PM147 I129				NP237 PU238 EU155 AM241	SM150 I129 ND143	ER93 CS133 ND145 SM150 PM147 CE134 I129			U234 PU238 NP237 EU155 AM241	SM150 I129 ND143	ER93 CS133 ND145 SM150 CE134 PM147 I129	
-10 TO 5	CS134 EU154 AM241 U235 PU242 SE79 SM151 AM242	U234 PD107 RU106 CS134 CS135	ND143 U234 SE79 U235 CS135				CS134 EU154 U235 PU242 SE79 SM151 AM242	PD107 RU106 CE134 CS135 U235	ND143 SE79 CE135			EU154 CE134 U235 PU242 SE79 SM151 AM242	PD107 RU106 CE135 U235 PU241	ND143 SE79 CE135	
20 TO 10	RU106 PD107 PU240 CM246	CM246 SM152 PU240 SE79 U235 SM149 CM244 PU241 SM126 AM241	SM152 PU241 AM241 EU154 SB125				RU106 PD107 PU240 CM246	CM246 SM152 U234 PU240 PU241 SE79 U235 SM149 CM244 AM241 SM126	SM152 U234 PU241 SE79 EU154 SB125			RU106 PD107 PU240 CM246	CM246 SM152 PU240 SE79 U235 SM149 CM244 AM241 SM126 U234	SM152 PU241 AM241 EU154 SB125 U234	
-30 TO -20	CM244 CM245 SM126	EU154 CM245 PU238 EU155 NP237 PU239 SM151 SM148	SM149 SM151 EU155 PU238 NP237 PU239				CM244 CM245 SM126	EU154 CM245 PU238 EU155 PU239 SM151	SM149 SM151 PU238			CM244 CM245 SM126	EU154 CM245 PU238 EU155 PU239 SM151	SM149 SM151 PU238	
-30	SM148 SB125 CM243	CM243 SB125 CM242 AM242	CM242 AM242				SM148 SB125 CM243	CM243 NP237 SB125 CM242	NP237 CM242			SM148 SB125 CM243	CM243 NP237 SB125 CM242	NP237 CM242	

CASE: BWR, 2.64 MT % U-235, 2.866 AT % BURNUP (27.5 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR	1 KYR	10 KYR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
30	CM243	CM243	
20 TO 30	SM147 SM147 PU242	SM147 SM147 PU242	SM147 SM147 PU242
10 TO 20	AM242 CM242 PU242 CM126	AM242 CM242 CS137 PU242 SM126	CM242 AM242 PU242 SM126
5 TO 10	SM149 EU153 CS137 CM244 AM243 SR90 Y90 EU153 CM246 ND144 PD107	SM149 EU153 Y90 CM244 AM243 SR90 ND144 EU153 CM246 PD107	SM149 EU153 ND144 AM243 EU153 PD107 CM246
1 TO 5	CS137 ND145 KR85 TC99 SR90 Y90 ND144 KR85 CS133 ND145 SM152 I129 ND144 TC99 Y90 SR90 KR85 ND143	ND145 SR93 KR85 TC99 Y90 SR90 ND144 KR85 CS133 SM152 I129 ND144 PU238 TC99 SR90 Y90 ND143 KR85	ND145 SR93 TC99 ND145 ND144 SM148 CM245 ND146
-1 TO 1	PU239 U236 SR93 CS133 U238 TC99 SM150 EU153 ND146 U238 SM147 U236 U238 ND146 U236 AM243 PU240 CS135	PU239 SM150 SR93 CS133 U238 TC99 EU153 U236 ND146 U238 SM147 PU240 U238 ND146 AM243 CS135	PU239 SM150 SR93 CS133 U238 TC99 EU153 U238 ND146 U238 SM147 PU240 ND146 CS135 AM243
-5 TO -1	U234 PU238 SM150 I129 SR93 CS133 EU155 NP237 ND143 I129 AM241 PU241	U234 NP237 SM150 I129 SR93 CS133 U236 ND143 I129 AM241	U234 U236 SM150 I129 SR93 CS133 NP237 U235 ND143 I129
-10 TO -5	EU154 U235 PD107 CS135 ND143 SE79 PU242 SE79 SM151 AM243	U235 PU242 PD107 CS135 ND143 SE79 SE79 SM151 AM243	PU242 SE79 PD107 CS135 ND143 SE79 SM151 AM243
-20 TO -10	PD107 PU240 CM246 SM152 SM152 AM241 CM246 U235 SM149 CM244 AM241 SM126	PD107 PU240 CM246 SM152 U235 SM149 U235 AM241 SM126	PD107 PU240 CM246 SM152 SM152 PU240 SE79 SM149 SM126
-30 TO -20	CM244 CM245 EU154 CM245 SM149 SM151 EU155 PU238 EU155 PU238 PU239 U234 U234 PU239 SM151 SM148	PU241 CM245 CM245 PU239 SM149 SM151 U234 SM151 PU239 U234 PU238 SM148	AM241 PU241 CM245 U235 SM149 SM151 CM245 SM126 PU239 SM151 U235 U236 U236 U234 PU239 U234 SM148
-30	SM148 CM243 CM243 CM242 PU241 CM242 AM242 PU241 AM242 NP237 NP237	SM148 CM243 CM243 CM242 PU238 CM242 AM242 NP237 AM242 NP237 CM244 PU241 PU241	SM148 PU238 AM242 PU238 AM242 CM242 NP237 CM242 NP237 AM241 AM241

CASE: BWR, 4.15 WT % U-235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	30 DAY	5 YR	10 YR
	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>AM242 PM147 CM246 CM245 CM243</p> <p>SM149 CM246 PM147 PU242 PU242</p> <p>AM241 CM245 AM243 CM244</p> <p>PU239 SM151 EU153 SM147 CM244 CM246</p> <p>PU241 AM243 CM245 SM147</p> <p>U235 CS135</p> <p>PU238 CM242</p> <p>EU155</p> <p>I129 CM244 AM241</p> <p>ND143</p> <p>EU153 SM152 U235 Y91 Y90 SR90</p> <p>SM150 SR89 SR89 CM242 RU106 ND144</p> <p>PU242 Y91 SR90 CS137 SM148 KR85</p> <p>ND145 ER95 Y90 CS135 CS137 ND146</p> <p>CS133 NB95 SM150 I129 U234</p> <p>SM147 EU154 KR85</p> <p>U236 TC99 U236 ER95 Y91 CE144</p> <p>CE144 CS137 CE144 TC99 U236</p> <p>ER93 U238 ND146 PD107 TC99 CS134</p> <p>ND143 U238 SR89 PU240</p> <p>NB95 ND145 ER95</p> <p>ND144 CS133</p> <p>KR85 ND146 ER93 RU106 SM150 ER93</p> <p>SR90 Y90 U234 CS134 NB95 CS133</p> <p>CS134 NP237 SM149 PU241 ND145 I129</p> <p>U234 ND144</p> <p>PD107 RU106 PU240 CM243 ND143 PM147</p> <p>SE79 PU240 U235 CM242</p> <p>SE79 CE135</p> <p>EU155 EU154 AM241 EU154</p> <p>SE79 SM126 PU241 NP237</p> <p>PU239 PU238 SB125</p> <p>SM151 SM152</p> <p>NP237</p> <p>SM126 SM148 SM148 AM242 EU155 SM152</p> <p>SB125 SM149 PU238</p> <p>SM151 PU239</p> <p>CM243</p> <p>SB125</p> <p>AM242</p>	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>AM242 PM147 CM246 CM245 CM243</p> <p>CM242</p> <p>SM149 CM246 PM147 PU242 PU242</p> <p>CM245 AM243 CM244</p> <p>PU239 SM147 SM147 EU153 CM246 CM244</p> <p>SM151 PU241 CM245 SM126</p> <p>AM241 AM243</p> <p>U235 CS135</p> <p>PU238 EU155</p> <p>I129 CM244</p> <p>ND143</p> <p>EU153 SM152 ER95 U235 Y90 SR90</p> <p>SM150 SR89 NB95 Y91 RU106 SM148</p> <p>PU242 Y91 SR89 CS137 ND144 ER95</p> <p>ND145 CS133 SR90 Y90 KR85 CS137</p> <p>ER95 NB95 CS135 SM150 NB95 ND146</p> <p>EU154 I129 KR85 SM147</p> <p>U236 TC99 U236 CE144 Y91 CE144</p> <p>CE144 CS137 TC99 ND146 U236</p> <p>ER93 U238 PD107 ND143 TC99 CS134</p> <p>U238 ND144 SR89</p> <p>CS133 ND145</p> <p>KR85 ND146 ER93 RU106 SM150 ER93</p> <p>SR90 Y90 CS134 SM149 PU240 U234</p> <p>CS134 NP237 PU241 U234 CS133 ND145</p> <p>U234 ND144 AM241 I129 ND143</p> <p>PD107 RU106 CM242 CM243 PM147 U235</p> <p>SE79 PU240 PU240</p> <p>SE79 CS135</p> <p>EU155 EU154 EU154 AM241</p> <p>SE79 SM126 PU241 NP237</p> <p>PU239 PU238 SB125</p> <p>SM151 SM152</p> <p>NP237</p> <p>SM126 SM148 SM148 AM242 EU155 SM152</p> <p>SB125 SM149 PU241</p> <p>CM242 SM151</p> <p>PU239</p> <p>SB125</p> <p>AM242</p>	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>AM242 CM242 CM246 CM245 CM243</p> <p>PM147</p> <p>SM149 CM246 PM147 PU242 PU242</p> <p>CM245 AM243 CM244</p> <p>SM147</p> <p>SM147 PU239 EU153 CM246 CM244</p> <p>SM151 PU241 CM245</p> <p>AM241 AM243</p> <p>U235 CS135</p> <p>PU238 EU155</p> <p>I129 CM244 ER95 NB95</p> <p>ND143</p> <p>ER95 I129 KR85</p> <p>EU154</p> <p>U236 TC99 CE144 U236 Y91 CE144</p> <p>CE144 CS137 TC99 ND146 SM147 U238</p> <p>ER93 U238 PD107 ND143 U236 TC99</p> <p>ND144 U238 SR89</p> <p>CS133 ND145</p> <p>KR85 ND146 ER93 RU106 SM150 ER93</p> <p>Y90 SR90 CS134 SM149 PU240 CS133</p> <p>NP237 CS134 PU241 AM241 ND145 U234</p> <p>U234 ND144 I129 ND143</p> <p>PD107 RU106 U234 CM243 PM147 U235</p> <p>SE79 PU240</p> <p>SE79 CS135</p> <p>PU240 EU155 EU154 AM241</p> <p>SE79 PU241 NP237</p> <p>PU239 SM126 SB125</p> <p>PU238 SM151</p> <p>SM152 NP237</p> <p>SM126 SM148 SM148 CM242 EU155 SM152</p> <p>SB125 AM242</p> <p>AM242</p> <p>CM242</p> <p>SB125</p> <p>CM242 AM242</p>

CASE: BWR, 4.15 MT % U 235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	20 YR					50 YR					100 YR				
	ORS/OR2-1	CIN/OR2-1	CIN/ORS-1			ORS/OR2-1	CIN/OR2-1	CIN/ORS-1			ORS/OR2-1	CIN/OR2-1	CIN/ORS-1		
-30	AM242 CM242 CM246 CM245 CM243 PM147					AM242 CM242 CM246 CM245 CM243 PM147					AM242 CM242 CM246 CM245 CM243 PM147				
20 TO 30	SM149 CM246 PM147 PU242 PU242 CM245 SM147 AM243 CM244 SM147					SM149 CM246 PM147 PU242 PU242 CM245 SM147 AM243 CM244 SM147					SM149 CM246 PM147 PU242 PU242 PU241 CM245 AM243 CM244 SM147 SM147				
10 TO 20	PU239 PU241 ER95 NB95 ER95 CM246 SM151 AM241 BU153 CM244 NB95 AM243 U235 CM245 AM243 CS135 PU238 AM243 U235 BU155					PU239 PU241 BU153 CM246 CM244 SM151 AM241 CM245 AM243 U235 CS135 PU238 BU155					PU239 SM151 BU153 CM246 CM244 AM241 AM243 U235 CS135 PU238 BU155				
5 TO 10	I129 CM244 ND143					I129 CM244 ND143					I129 CM244 PU241 CR144 SM126 AM243 ND143 BU153 PD107				
1 TO 5	BU153 SM152 U235 Y91 Y90 SR90 SM150 PU242 CS137 Y90 RU106 SM148 Y91 ND145 SR90 CS135 ND144 KR85 CS133 BU154 SM150 CR144 CS137 ND146 ER95 NB95 I129 KR85 Y91 CR144					BU153 SM152 U235 CS137 RU106 SR90 SM150 PU242 CR144 Y90 Y90 SM148 ND145 CS133 SR90 CS135 ND144 KR85 BU154 SM150 I129 CS137 CR144 KR85					BU153 SM152 U235 CS137 RU106 SR90 SM150 PU242 Y90 SR90 Y90 CR144 ND145 CS133 CS135 SM150 SM148 ND144 U234 CS137 I129 KR85 KR85 CS137 BU154 ND146				
-1 TO 1	U236 TC99 U236 TC99 U238 SM147 CR144 CS137 ND146 PD107 U236 TC99 ER93 U238 ND143 ND144 CS134 U238 CS133 ND145					U236 CS137 U236 PU241 U238 SM147 CR144 TC99 TC99 ND146 TC99 U236 U234 ER93 PD107 ND143 CS134 U238 NP237 ND144 U238 CS133 ND145					CR144 NP237 TC99 U236 U238 SM147 U236 TC99 ND146 PD107 TC99 CS134 ER93 U238 ND143 ND144 U236 U238 CS133 ND145				
-5 TO -1	KR85 ND146 ER93 PU241 SM150 ER93 U234 Y90 CS134 SM149 PU240 CS133 SR90 NP237 RU106 AM241 ND145 I129 CS134 ND144					KR85 ND146 ER93 CS134 SM150 ER93 Y90 SR90 SM149 RU106 CS133 ND145 CS134 ND144 AM241 PU240 I129 ND143					KR85 ND146 ER93 CS134 SM150 ER93 Y90 SR90 SM149 RU106 CS133 ND145 CS134 ND144 AM241 PU240 I129 ND143				
-10 TO -5	PD107 SE79 U234 CM243 PM147 U235 RU106 PU240 SE79 U234 CS135					PD107 SE79 CM243 PM147 U235 RU106 PU240 SE79 CS135					PD107 SE79 CM243 PM147 U235 RU106 PU240 SE79 CS135				
-20 TO -10															
-30 TO -20	SM126 SM148 NP237 SM148 BU155 SM152 SB125 CM242 AM242 PU238 SM149 SM151 PU239					SM126 SM148 SM148 NP237 BU155 SM152 SB125 CM242 AM242 PU238 SM149 NP237 SM151 PU239					SM126 SM148 SM148 U234 BU155 SM152 SB125 CM242 AM242 PU238 U234 SM149 SM151 PU239				
-30	CM243 SB125 CM242 AM242					CM243 SB125 CM242 AM242					CM243 NP237 SB125 NP237 CM242 AM242				

CASE: BWR, 4.15 MT % U 235, 4.172 AT % BURNUP (40.0 GWD/MTU, APPROX.)

G-ATOMS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR	1 KYR	10 KYR
	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>AM242 CM242 CM246 CM245 CM243</p> <p>PU241</p>	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>CM242 AM242 CM246 CM245 CM243</p> <p>SM149 CM246 PU242 AM243 PU242</p> <p>PU241 CM245 SM147</p> <p>SM147 PU238</p>	<p>QRS/OR2-1 CIN/OR2-1 CIN/QRS-1</p> <p>CM242 AM242 CM246 CM245</p> <p>PU238</p> <p>SM149 AM241 PU242 AM243 PU242</p> <p>CM246 PU241 SM147</p> <p>CM245 SM147</p>
30			
20 TO 30	<p>SM149 CM246 PU242 AM243 PU242</p> <p>CM245 SM147 CM244 SM147</p>	<p>SM149 CM246 PU242 AM243 PU242</p> <p>PU241 CM245 SM147</p> <p>SM147 PU238</p>	<p>SM149 AM241 PU242 AM243 PU242</p> <p>CM246 PU241 SM147</p> <p>CM245 SM147</p>
10 TO 20	<p>PU239 SM151 EU153</p> <p>AM241 AM243</p> <p>U235 CS135</p> <p>PU238 EU155</p>	<p>CM244 CM246</p> <p>CM245 SM126</p> <p>PU239 SM151 CS137 EU153 CM244 CM246</p> <p>CS137 AM241</p> <p>AM243 U235</p> <p>CS135</p>	<p>PU239 SM151 EU153</p> <p>CM246 CM245</p> <p>U235 AM243</p> <p>CS135</p>
5 TO 10	<p>I129 CM244 CS137</p> <p>ND143</p>	<p>AM243 EU153</p> <p>PD107</p> <p>NP237 I129</p> <p>ND143</p>	<p>SM126 EU153</p> <p>PD107</p> <p>NP237 I129</p> <p>ND143</p> <p>SM126 AM243</p> <p>EU153 PD107</p>
1 TO 5	<p>NP237 EU153 U235 SR90 Y90 SR90</p> <p>CS137 SM152 Y90 CS135 SM148 ND144</p> <p>SM150 U234 SM150 I129 KR85 CS137</p> <p>PU242 ND145 KR85</p> <p>CS133</p>	<p>NP237 EU153 U235 SR90 Y90 SR90</p> <p>U234 SM150 SM150 Y90 SM148 ND144</p> <p>PU242 ND145 SR90 I129 CS137 KR85</p> <p>CS133</p>	<p>EU153 SM152 CS135 SM150 SM148 ND144</p> <p>U234 SM150 I129</p> <p>PU242 ND145</p> <p>CS133</p>
-1 TO 1	<p>EU154 U236 TC99 ND146 U238 SM147</p> <p>TC99 ER93 PD107 ND143 TC99</p> <p>U238</p> <p>ND144 U238</p> <p>CS133 ND145</p> <p>U236</p>	<p>TC99 U236 KR85 TC99 U238 SM147</p> <p>ER93 U238 ND146 PD107 TC99</p> <p>ND143 ND144</p> <p>U238 CS133</p> <p>ND145</p>	<p>TC99 ER93 TC99 ND146 U238 SM147</p> <p>U238</p> <p>PD107 ND143 TC99</p> <p>ND144 U238</p> <p>CS133 ND145</p>
-5 TO -1	<p>ND146 KR85 ER93 SM149 SM150 U236</p> <p>SR90 Y90 AM241 ER93 CS133</p> <p>ND144 ND145 PU240</p> <p>I129 ND143</p>	<p>ND146 KR85 ER93 SM149 SM150 ER93</p> <p>Y90 SR90 U236 AM241 CS133 ND145</p> <p>ND144 PU240 U236</p> <p>I129 ND143</p>	<p>U236 ND146 ER93 SM149 SM150 ER93</p> <p>ND144</p> <p>CS133 ND145</p> <p>PU240 I129</p> <p>ND143</p>
-10 TO -5	<p>PD107 SE79 CM243</p> <p>PU240</p>	<p>PD107 SE79 CM243</p> <p>PU240</p>	<p>PD107 SE79 U235</p> <p>PU240</p>
-20 TO -10	<p>PU240 EU155 EU154 AM241</p> <p>EU154 SE79</p> <p>SM126 PU239</p> <p>PU238 SM151</p> <p>SM152</p>	<p>PU240 SE79 AM241</p> <p>SM126 PU239</p> <p>PU238 SM151</p> <p>SM152</p>	<p>PU240 SE79 U235</p> <p>SM126 PU239</p> <p>SM151 SM152</p>
-30 TO -20	<p>SM126 SM148 SM148 CM242 EU155 SM152</p> <p>AM242 PU238 SM149</p> <p>SM151 PU239</p>	<p>SM126 SM148 SM148 CM242 SM152 SM149</p> <p>AM242 SM151 PU239</p>	<p>SM126 SM148 U236 SM148 U236 SM152</p> <p>SM149 SM151</p>
-30	<p>CM243</p> <p>U234 NP237 U234 NP237</p> <p>PU241 CM242 AM242</p> <p>PU241</p>	<p>CM243 CM244 U234 NP237 PU238 U234</p> <p>CM244 PU241 CM242 AM242</p> <p>NP237 PU241</p>	<p>PU238 AM242 PU239 U234</p> <p>CM242 U234 PU238 AM242</p> <p>NP237 AM241 CM242 NP237</p> <p>AM241</p>

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU CURIES PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIO'S MINUS UNITY

DELTA	30 DAY	5 YR	10 YR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
5 TO 10			ER95 NB95 ER95 NB95
1 TO 5	PU242 SM147 PU242 SM147	PU242 SM147 ER95 NB95 ER95 NB95 PU242 SM147	PU242 SM147 PU242 SM147
-1 TO 1	SM148 ND144 SM148 AM242 AM242 CM245 SM149 CM242 CM245 ND144 I129 CM242 AM242 SM126 CM242 I129 SM147 CS134 CM245 CS134 TC99 CS134 AM243 CE144 U235 ER95 AM243 PM147 CS137 TC99 BU154 U238 SM126 CS135 PM147 AM241 U236 SM151 U238 CM246 CS135 U238 Y91 PM239 U236 SR90 CM246 SM126 SB125 CM246 KR05 SE79 U236 SM148 PM147 CM244 CM244 SR09 Y90 SR90 CM243 U234 RU106 ER93 KR05 PU238 AM243 ER93 SM151 U235 BU155 SE79 NP237 CS135 CM243 NP237 CM244 SR09 SR90 PU240 NB95 SB125 RU106 ER93 I129 SE79 Y91 BU155 SM151 U235 TC99 PD107 Y90 CE144 CM243 NP237 RU106 NB95 U234 PD107 NB95 SB125 KR05 SR09 PU238 BU154 Y91 PU241 BU155 Y90 ER95 PU239 ND144 U234 PU238 CE144 PU240 AM241 PD107 BU154 AM241 CS137 CS137 SM149 ER95 PU239 PU242 PU240 SM149	SM148 ND144 SM148 AM242 AM242 I129 CE144 SM149 I129 ND144 CM245 SR09 CM246 AM242 CM245 CE144 CE144 Y91 Y90 SM126 Y91 YC99 CM244 TC99 CS134 BU155 CM244 CM246 PD107 PM147 CM245 U238 SR09 CS135 CE135 BU155 U236 U235 Y90 BU155 U238 CM246 U234 PU239 U238 SM126 SM148 PU241 PU238 BU154 BU154 PU238 BU154 ER93 SM151 KR05 SR90 KR05 Y90 CM243 CM242 SB125 SE79 SR90 SB125 SB125 RU106 PM147 SE79 AM241 CM244 ER93 SM151 SM126 SM147 PU240 U235 AM243 RU106 CE137 I129 KR05 CM243 CE134 ER93 SM151 RU106 U236 U234 U235 AM243 PM147 PD107 PU239 ND144 CM243 Y91 NP237 PU240 CE134 U236 PD107 CE137 CM242 U234 PU239 NB95 SM149 PU242 NP237 PU240 CM242 SM149	SM148 ND144 SM148 CM242 CM242 AM242 CE144 SM149 AM242 CE144 SR09 CE144 AM242 CM246 ND144 I129 I129 CM245 CM245 Y91 Y91 U235 BU155 SR09 TC99 TC99 CM244 CM245 U238 CM246 RU106 PD107 CE135 U236 RU106 CE135 U238 SM151 PM147 NP237 PU239 SR90 SM126 U238 CM246 BU154 KR05 BU154 SR90 CE137 SM126 CE135 PU238 SE79 CE134 SM126 U234 Y90 ER93 PU241 SM148 SB125 CE134 U235 KR05 BU154 ER93 I129 AM243 SM151 PU238 SM147 Y90 PU240 PM147 BU155 SE79 Y90 KR05 SE79 CM243 CM244 ER93 U235 TC99 CE134 SB125 PD107 AM243 AM241 SM151 PM147 U236 U234 BU155 ND144 Y91 CM244 PU239 CE137 CM243 SB125 PD107 SR09 PU240 SM149 U236 U234 ER95 NB95 PU242 PU239 CE137 PU240 CM242 SM149
-5 TO -1	PU241	PU241	PU241 AM241 PU241 AM241 PU241 AM241 NP237 PU241 NP237 AM241

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PMR, 1.2 MT & 33 GWD/MTU CURIES PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	*****	20 YR	*****	50 YR	*****	100 YR	*****
		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1		ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	
10 TO 20		ER95 NR95					
5 TO 10						PU241	PU241
1 TO 5		PU242 SM147 PU242 SM147		PU242 PU241 PU241 PU242 CR144 SM147 SM147 CR144		PU242 SM147 CR144 PU242 SM147	
1 TO 1		SM148 ND144 SM148 CR144 CM242 CR144		SM148 ND144 SM148 CM242 CM242 AM242		SM148 CR137 SM148 CM242 CM242 RU106	
		RU106 CR144 CM242 AM242 AM242 I129		RU106 CR144 CM242 AM242 I129		ND144 RU106 CR137 RU106 AM242 I129	
		SM149 CM242 Y91 ND144 CM245 RU106		SM149 CM242 Y91 ND144 CM245 RU106		SM149 CM242 Y91 ND144 CM245 RU106	
		AM242 SM126 RU106 I129 CS134 TC99		AM242 SM126 RU106 I129 CS134 TC99		AM242 SM126 RU106 I129 CS134 TC99	
		U235 CM245 CM245 TC99 SB125 AM243		U235 CM245 CM245 TC99 SB125 AM243		U235 CM245 CM245 TC99 SB125 AM243	
		SR90 U238 AM243 Y90 PD107 PM147		SR90 U238 AM243 Y90 PD107 PM147		SR90 U238 AM243 Y90 PD107 PM147	
		PU238 CM246 SR79 BU155 Y90 CM244		PU238 CM246 SR79 BU155 Y90 CM244		PU238 CM246 SR79 BU155 Y90 CM244	
		SM151 U236 CS135 U238 SR79 BU155		SM151 U236 CS135 U238 SR79 BU155		SM151 U236 CS135 U238 SR79 BU155	
		CM243 ER93 CM246 SM151 CS135 CS137		CM243 ER93 CM246 SM151 CS135 CS137		CM243 ER93 CM246 SM151 CS135 CS137	
		AM243 BU154 KR85 SM126 U238 CM246		AM243 BU154 KR85 SM126 U238 CM246		AM243 BU154 KR85 SM126 U238 CM246	
		PU239 CS135 SR90 CM244 SM151 AM241		PU239 CS135 SR90 CM244 SM151 AM241		PU239 CS135 SR90 CM244 SM151 AM241	
		Y90 TC99 BU154 PU238 KR85 SM148		Y90 TC99 BU154 PU238 KR85 SM148		Y90 TC99 BU154 PU238 KR85 SM148	
		I129 SR79 CS134 ER93 PU241 SM147		I129 SR79 CS134 ER93 PU241 SM147		I129 SR79 CS134 ER93 PU241 SM147	
		U234 BU155 PM147 PD107 SR90 BU154		U234 BU155 PM147 PD107 SR90 BU154		U234 BU155 PM147 PD107 SR90 BU154	
		PU240 KR85 CM243 SB125 PU238 SM126		PU240 KR85 CM243 SB125 PU238 SM126		PU240 KR85 CM243 SB125 PU238 SM126	
		CM244 CS134 U235 PU241 ER93 ND144		CM244 CS134 U235 PU241 ER93 ND144		CM244 CS134 U235 PU241 ER93 ND144	
		PM147 NP237 U236 PU239 CM243 U235		PM147 NP237 U236 PU239 CM243 U235		PM147 NP237 U236 PU239 CM243 U235	
		PD107 SB125 U234 CS137 U236 PU242		PD107 SB125 U234 CS137 U236 PU242		PD107 SB125 U234 CS137 U236 PU242	
		PU241 CS137 PU240 SM149 PU239 U234		PU241 CS137 PU240 SM149 PU239 U234		PU241 CS137 PU240 SM149 PU239 U234	
				PU240 SM149			
5 TO -1		AM241		PU240		PU240	
-20 TO -10				NP237		NP237	
10 TO -20						NP237	

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % 33 GWD/MTU CURIERS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATION MINUS UNITY

DELTA, %	300 YR	1 KYR	10 KYR
10 TO 20	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/CM4-1 CIN/ORS-1
1 TO 5	PU241 CS137 PU242 SM147	CS137 PU242 SM147 PU242 SM147	AM241 PU242 PU242 SM147 SM147
-1 TO 1	SM148 EU155 SM148 CM242 CM242 AM242 ND144 AM241 AM242 EU155 I129 CM245 SM149 PU240 ND144 I129 EU154 KR85 SM126 U238 CM245 AM241 EU155 CM243 CM246 TC99 CS135 U238 SR90 Y90 I129 U235 CM246 SM126 CM244 PD107 AM242 SE79 PU238 SE79 CS137 SM151 U236 PU238 CM244 SR93 CS135 U238 CM242 SR93 SM151 AM243 CM246 AM241 AM243 CS135 TC99 KR85 SM148 PU238 U234 SM151 Y90 SR90 SE79 SM126 PU239 NP237 CM243 PD107 SR93 AM243 CM244 CM245 EU154 PU239 SM147 ND144 Y90 SR90 U234 U235 TC99 PU242 CM243 PD107 SM149 PU239 U234 KR85 EU154 U235 SM149	SM148 ND144 SM148 CM242 CM242 AM242 AM241 SM149 AM242 ND144 CM245 I129 PU240 U238 I129 CM245 PU238 CM244 U235 AM241 PU238 PD107 CS137 TC99 PU239 SR93 CS135 SR93 CS135 SM151 AM242 U238 CM246 SR90 Y90 U236 SM126 SE79 U238 CM246 U234 SM151 AM243 SM126 SM148 SE79 TC99 PD107 CM243 SE79 AM243 CM243 Y90 AM241 SM151 I129 NP237 SR90 KR85 SM147 KR85 PD107 PU238 SM149 CM243 Y90 PU239 U234 SM149	SM148 ND144 SM148 PU238 PU238 AM242 SM149 PU241 ND144 I129 CM242 I129 AM243 U238 AM242 CM242 CM245 TC99 CM246 U235 SM151 CM245 PD107 SE79 CM245 NP237 TC99 SE79 U238 SM148 SR93 SM126 U238 SM126 SM126 CM246 PU239 U236 AM243 CM246 SR93 CS135 U234 PU240 SR93 CS135 AM243 SM147 SE79 TC99 PD107 SM149 ND144 PU242 CS135 I129 U234 SM149 U234 PD107 PU238 AM242 CM242
-5 TO -1	PU240 U236 PU240 U236	PU240 U235 PU240 U235	PU240 PU239 PU240 PU239
-10 TO -5		U236 U236	
-20 TO -10			U235 U235
-30	NP237 PU241 NP237 PU241	CM244 NP237 CM244 NP237 PU241	NP237 AM241 NP237 AM241

CASE: DECAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT % & 33 GWD/MTU WATTS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	30 DAY	5 YR	10 YR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
5 TO 10	U235 U235	U235 U235	NB95 ER95 U235 U235
1 TO 5	PU242 SM147 PU242 SM147 PH147 AM242 PU241 PH147 AM242	PU242 SM147 NB95 ER95 NB95 ER95 PU241 PU242 SM147 PH147 AM242 PH147 AM242	PU242 SM147 PU242 SM147 PH147 AM242 PU241 PH147 AM242 PU241
-1 TO 1	SM151 AM242 SB125 PU239 SB125 PU239 PU239 SM126 EU155 PU241 EU155 U236 CM245 U238 U236 CM242 Y90 CM242 SB125 EU154 Y90 U234 AM241 U234 Y91 U236 TC99 CM245 TC99 CM245 U235 U234 SR89 SM151 SE79 SR89 ER95 AM243 CS135 KR85 CM244 ND144 CM246 NP237 CM244 SR90 CS135 KR85 CS135 CM243 AM243 NB95 SR90 AM243 CM242 KR85 Y91 EU154 PD107 SM147 CS134 PU240 PU238 U238 NB95 SM151 NB95 TC99 CS134 AM241 Y91 PU238 SR89 SR90 PU240 CM243 EU154 U238 CE144 PU238 ER95 CM246 CS134 PU242 CM244 PH147 PU240 CM243 EU155 Y90 ER95 PU241 PM147 SR89 ER93 I129 SM149 CM246 AM241 RU106 SM149 CS137	SM151 CM246 PU241 PU239 SB125 PU239 CE144 AM242 SB125 EU155 SR89 Y90 PU239 Y90 U236 U236 Y90 U238 PU238 U234 TC99 AM241 U234 SM126 U236 CM245 SR89 Y91 TC99 CM245 U234 Y91 SM151 CM245 SE79 EU155 SB125 CS135 KR85 ND144 CS135 EU154 CM242 SR90 CM244 KR85 U235 CM243 AM243 EU154 SR90 PD107 PU240 AM243 PU238 U238 AM243 SM147 KR85 TC99 CS134 PU240 SM151 EU154 I129 CS134 CM243 CM242 PU238 U238 SR90 CS135 CM246 CS134 PU242 NP237 CM244 ER93 Y91 PM147 SR89 NB95 ER95 RU106 SM149 CS137	CE144 SM151 CM242 PU239 CM242 SB125 AM242 PU239 SB125 EU155 PU239 EU155 SM126 U238 Y91 Y90 SR89 Y91 PU238 CM245 SR89 U236 Y90 U236 CM246 U236 TC99 CM245 AM241 TC99 U235 U234 U234 SM151 CM245 U234 EU155 AM243 KR85 CS135 SE79 KR85 EU154 CM242 SR90 CM244 CM244 CS135 CS135 CM243 AM243 PU238 SR90 PD107 PU240 I129 EU154 U238 AM243 ND144 KR85 TC99 CS134 CM243 SM147 SM151 SR90 Y90 PU240 CM246 PU238 EU154 CE144 NP237 U238 CS134 CM244 SB125 ER93 PM147 Y91 SR89 RU106 ER95 NB95 SM149 CS137
-5 TO -1	I129 NP237 I129 NP237	AM241 AM241 I129 CM246 I129 NP237 NP237	AM241 AM241 I129 I129
-10 TO -5	PD107 PD107	PD107 PD107	PD107 NP237 PD107 NP237
-10 TO -20	SR79 SR79	SR79 SR79	SR79 SR79

CASE: DELAY ONLY, OF ORIGEN2 DISCHARGE RESULTS FOR PWR, 3.2 WT & 4.33 GWD/MTU WATTS PER MTU

NUCLIDE DISTRIBUTIONS BY PERCENTAGE DELTAS REPRESENTING CODE-RESULT-RATIOS MINUS UNITY

DELTA, %	300 YR	1 KYR	10 KYR
	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1	ORS/OR2-1 CIN/OR2-1 CIN/ORS-1
10 TO 20	PU241	CS137	
1 TO 5	CS137 PU242 U235 PU242 U235 AM242 SM147 SM147 AM242 EU155	PU241 PU242 U235 PU242 U235 AM242 SM147 SM147 AM242	AM241 PU241 PU242 SM147 AM242 PU242 SM147 AM242
-1 TO 1	EU155 SM151 CM242 PU239 CM242 EU155 AM241 CM246 AM241 Y90 PU239 Y90 TC99 PU239 TC99 CM245 AM241 KR85 U238 ER93 SM151 CS135 TC99 CM245 SM126 PU238 CM244 AM243 CM244 SE79 AM242 CM245 KR85 SR90 EU154 SR90 CS135 U235 PU238 U238 CS135 AM243 CM242 I129 EU154 U234 ND144 PD107 AM243 U234 CM243 CM246 SM147 SM151 PU240 U236 PU238 U238 NP237 CM243 PU242 U234 SR90 CM244 CM243 SM149 Y90 KR85 CM246 SM148	SM151 AM241 CM242 PU239 CM242 PU239 CM245 CM246 AM241 TC99 Y90 AM241 PU239 SM126 CM245 Y90 TC99 PU238 U235 I129 SM151 AM243 SE79 CM245 AM243 U238 CS135 PU238 CM244 KR85 CS135 TC99 U238 KR85 SR90 PD107 CM242 U234 SR90 U234 AM243 ND144 PU240 U236 CM243 CM246 CS135 SM147 AM242 NP237 SM151 U238 ER93 Y90 PU242 U234 CM243 PU238 CM243 SM149 SM148 KR85 CM246	PU239 U238 PU238 SM151 PU238 CM242 SM126 ER93 CM242 TC99 TC99 SE79 U235 CM245 CS135 AM243 PD107 ND144 NP237 AM243 U238 CM245 CS135 SM147 U234 PU240 PU239 U234 AM243 U238 U236 TC99 CM245 PU242 CS135 CM246 PU239 U234 I129 AM242 SM149 CM246 PU238 CM242 SM148 CM246 PU240 PU240 I129 I129
-5 TO -1	PU240 U236 PU240 U236 I129 I129	PU240 I129 PU240 I129	CM246 PU240 PU240 I129 I129
-10 TO -5	PD107 PD107	PD107 U236 PD107 U236	PD107 PD107 U235 U235
-20 TO -10	SE79 SE79	SE79 SE79	SE79 SE79 U236 U236
-30	NP237 PU241 NP237 PU241	CM244 NP237 CM244 NP237 PU241	NP237 AM241 NP237 AM241

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