

HQX.19880405.0023

DOE/RW-0184

VOLUME 2 of 6

UC-70, -71, and -85

Office of Civilian Radioactive Waste Management

**CHARACTERISTICS OF SPENT FUEL,
HIGH-LEVEL WASTE, AND OTHER
RADIOACTIVE WASTES WHICH MAY
REQUIRE LONG-TERM ISOLATION**

DECEMBER 1987

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Washington, D.C. 20585

APPENDIX 1A

ORIGEN2 OVERVIEW

ORIGEN2 is a computer code developed to model the composition and characteristics of various kinds of spent nuclear fuels as a function of burnup and age. To do this, the code performs two major computational functions, isotope generation and isotope depletion, both within the core of an operating reactor and after shutdown. The name derives from "Oak Ridge Isotope Generation and Depletion Code." The original version was called ORIGEN and a later, improved version is called ORIGEN2. There is also another improved version called ORIGEN-S. All three versions perform the two basic functions cited above and described below.

Generation: The generation of individual nuclides resulting from neutron-induced fission or from neutron capture reactions or other transmutation reactions.

Depletion: The depletion (and concurrent buildup) of nuclides resulting from natural decay processes.

Both of these functions can deal with the 1400 or so potentially relevant nuclides. Many of these nuclides have very short half-lives and exist only within the reactor core or as transient intermediates in a decay chain.

Neutron-induced fission and transmutation are highly dependent on both neutron flux and neutron energy. Neutron flux itself depends on the number of induced fissions. Neutron energy depends on the moderators that are present. The cross sections (propensity for neutron interaction) are highly sensitive to neutron energy. Decay processes are governed by invariant constants: the half-lives and branching ratios. In a real-time situation, some transmutation may occur while decay is also taking place.

Thus, during generation there is a competition between transmutation and decay which is governed by the relative magnitudes of the cross sections and the decay constants, with the former highly sensitive to the neutron moderation within the particular system being modeled. This is handled mathematically by calculating a set of effective cross sections which are applicable to the reactor scenario being modeled.

This is accomplished by first computing a set of effective one-group cross sections; i.e. a weighted-average value for each nuclide that is appropriate for the moderated neutron energies in that particular reactor model. Once this effective cross section library has been developed it can be used for variations on that particular reactor model. For example, ORIGEN2 cross section libraries have been developed for LMFBRs and LWRs. The latter requires different models and libraries for PWRs and BWRs, and also for standard burnup and high burnup fuel designs. For a given LWR case, the appropriate model must be used:

PWR Standard: burnup of 33,000 MWd/MTIHM

PWR High Burnup: burnup of 50,000 MWd/MTIHM

BWR Standard: burnup of 27,500 MWd/MTIHM

BWR High Burnup: burnup of 40,000 MWd/MTIHM

For the above cross section libraries, initial enrichments and cycle times can be varied; also variations in structural materials (both quantities and compositions) may be used.

The neutron fluxes and energies, and the effective cross sections, have been developed for the reactor core region since this is where the fuel resides, along with the fuel cladding and some of the assembly hardware. However, much of the hardware is outside the core region, where the flux falls off very rapidly with distance, and where the moderation is also quite different. These latter effects have a profound influence on the quantities of activation products formed within these hardware components.

The major steps required in ORIGEN2 modeling and computation are shown on the schematic drawing. The center column, boxes 1,2,3 and 4, are the major steps involved in running the ORIGEN2 code. Box 2 requires complex, multidimensional computations which apply to the generic reactor model defined in box 1; once done the resulting library is used for all specific cases for that generic reactor model. Boxes A and B are independent data libraries that ORIGEN2 utilizes. Box X is the required input data to conduct a run for a specific case; this includes initial enrichment and cycle specifications, and also the desired output data and format. In the past, the near-core region was modeled by an approximation method to estimate hardware activation.

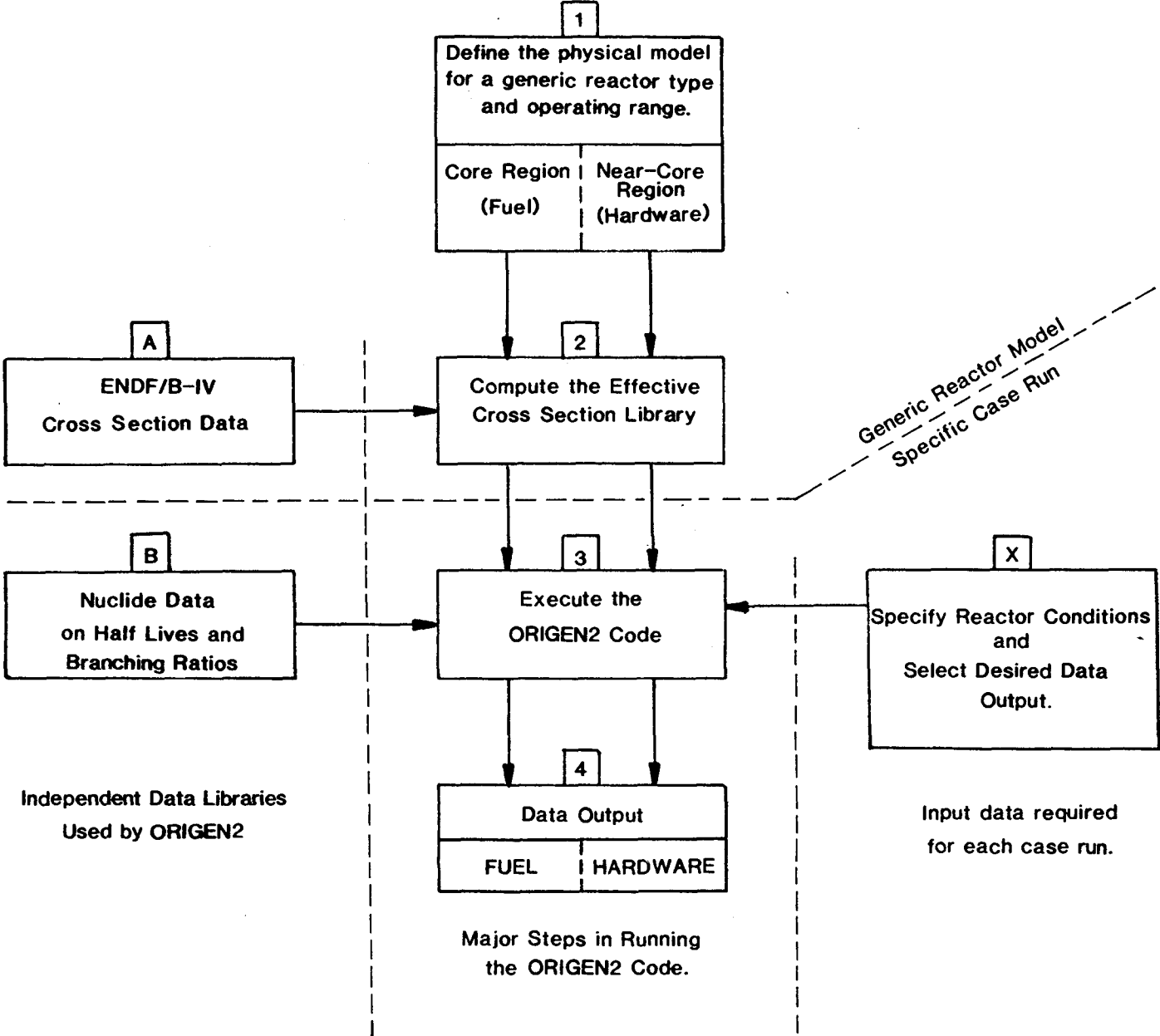
Now, with increased interest in activated metal, this aspect is being re-examined. Overall, work in process on ORIGEN2 validation and verification is critically examining boxes 1,2, and 3 and reviewing input data from boxes A and B.

ORIGEN-S, mentioned earlier, is a variant of ORIGEN in which the effective cross sections are computed for each specific input scenario, but by a simplified, one-dimensional procedure. The "S" stands for SCALE, a code system used for these calculations. In general, the two approaches give very similar results.

The basic data output from ORIGEN2 is in terms of the gram atoms of each nuclide, at specified times. From this, the derived quantities and radiological properties are calculated, including thermal output, alpha activity, beta and gamma activities, neutron production from spontaneous fission and from alpha-induced reaction, and the photon energy spectra. These quantities can be outputted for individual nuclides or elements or for all nuclides or elements within one or more of the three major categories: fission products, activation products, and actinides. Each group also includes decay daughters. The fission products derive from nuclear fission of fissionable isotopes. The activation products derive from neutron activation (transmutation) of structural materials and components. The actinides derive from neutron capture (often multiple or sequential neutron captures) of the initially-present heavy metal isotopes (mainly U-238 and U-235 for LWRs).

Following is a reprint of a more technical explanation of ORIGEN2 and the internal mathematical procedures that are employed by the code.

APPLICATION OF THE ORIGEN2 CODE



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SPECIAL INSTRUCTION SHEET

1. QA: N/A
Page: 1 of: 1

Complete Only Applicable Items

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2. Record Date
09/01/83

3. Accession Number
ATT-TO: HQX.19880405.0023

4. Author Name(s)
CROFF, AG

5. Author Organization
OAK RIDGE NATIONAL LABORATORY

6. Title
ORIGEN2: A VERSATILE COMPUTER CODE FOR CALCULATING THE NUCLIDE COMPOSITIONS AND CHARACTERISTICS OF NUCLEAR MATERIALS. (NUCLEAR TECHNOLOGY, VOL. 62)

7. Document Number(s)
N/A

8. Version
N/A

9. Document Type
PUBLICATION

10. Medium
PAPER

11. Access Control Code
COP

12. Traceability Designator
N/A

13. Comments
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APPENDIX 1B. ORIGEN2 LIBRARY DATA

This Appendix describes the data libraries used by ORIGEN2 for the calculations described elsewhere in this report. All data libraries accessed for the calculations herein are maintained at the Oak Ridge National Laboratory as partitioned data sets on an IBM-3033. As described in Appendix 1A, ORIGEN2 may read three different data libraries - decay data, photon production data, and cross section data.

The decay data library gives nuclide half-lives, decay modes, recoverable energy, natural abundances, and toxicities. Table 1.B.1 lists the half-lives from the decay data set CHEMTECH.14198.ORIGEN2.DECAYDAT (O2INPT) which was used for all decay calculations except for those of the spent PWR and BWR. For these latter two cases, a data set with the fission product nuclides listed in a different order, CHEMTECH.RAA14198.ORIGEN2.DECAYDAT.D84180, was used.

The cross-section library gives effective, one group cross sections and fission yields. The cross section library selected is based on the type of reactor being modeled. The following cross-section data sets were used: for PWRs with burnup < 33,000 MWD/t, CHEMTECH.AGC14198.ORIGEN2.XSECTION(PWRU); for PWRs with greater burnups, CHEMTECH.AGC14198.ORIGEN2.XSECTION(PWRU50); and for BWRs, CHEMTECH.AGC14198.ORIGEN2.XSECTION(BWRU).

The photon library supplies the number of photons per decay in an 18-energy-group structure. All ORIGEN2 results presented in this work used CHEMTECH.AGC14198.ORIGEN2.PHOTON (GXUO2BRM), which includes bremsstrahlung from a UO2 matrix.

Table 1B.1. Half-lives from the ORIGEN2 decay library used in this study.

Isotope	Half-life	Units
H 1	Stable	
H 2	Stable	
H 3	3.897E 08	seconds
H 4	1.000E-03	seconds
He 3	Stable	
He 4	Stable	
He 6	8.081E-01	seconds
Li 6	Stable	
Li 7	Stable	
Li 8	8.420E-01	seconds
Be 8	2.000E-06	seconds
Be 9	Stable	
Be 10	5.049E 13	seconds
Be 11	1.360E 01	seconds
B 10	Stable	
B 11	Stable	
B 12	2.030E-02	seconds
C 12	Stable	
C 13	Stable	
C 14	1.808E 11	seconds
C 15	2.449E 00	seconds
N 13	5.982E 02	seconds
N 14	Stable	
N 15	Stable	
N 16	7.120E 00	seconds
O 16	Stable	
O 17	Stable	
O 18	Stable	
O 19	2.900E 01	seconds
F 19	Stable	
F 20	1.140E 01	seconds
Ne 20	Stable	
Ne 21	Stable	
Ne 22	Stable	
Ne 23	3.724E 01	seconds
Na 22	8.211E 07	seconds
Na 23	Stable	
Na 24	5.400E 04	seconds
Na 24m	1.990E-02	seconds
Na 25	5.960E 01	seconds
Mg 24	Stable	
Mg 25	Stable	
Mg 26	Stable	
Mg 27	5.677E 02	seconds
Mg 28	7.528E 04	seconds
Al 27	Stable	
Al 28	1.344E 02	seconds
Al 29	3.912E 02	seconds
Al 30	3.685E 00	seconds
Si 28	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Si 29	Stable	
Si 30	Stable	
Si 31	9.438E 03	seconds
Si 32	6.500E 02	years
P 31	Stable	
P 32	1.430E 01	days
P 33	2.500E 01	days
P 34	1.240E 01	seconds
S 32	Stable	
S 33	Stable	
S 34	Stable	
S 35	8.800E 01	days
S 36	Stable	
S 37	5.060E 00	minutes
S250	Stable	
Cl 35	Stable	
Cl 36	9.499E 12	seconds
Cl 37	Stable	
Cl 38	2.233E 03	seconds
Cl 38m	7.160E-01	seconds
Ar 36	Stable	
Ar 37	3.026E 06	seconds
Ar 38	Stable	
Ar 39	2.690E 02	years
Ar 40	Stable	
Ar 41	6.577E 03	seconds
Ar 42	3.300E 01	years
K 39	Stable	
K 40	4.039E 16	seconds
K 41	Stable	
K 42	4.450E 04	seconds
K 43	8.136E 04	seconds
K 44	2.200E 01	minutes
Ca 40	Stable	
Ca 41	8.100E 01	thousand years
Ca 42	Stable	
Ca 43	Stable	
Ca 44	Stable	
Ca 45	1.408E 07	seconds
Ca 46	Stable	
Ca 47	3.919E 05	seconds
Ca 48	Stable	
Ca 49	8.800E 00	minutes
Sc 45	Stable	
Sc 46	7.240E 06	seconds
Sc 46m	1.867E 01	seconds
Sc 47	2.895E 05	seconds
Sc 48	1.577E 05	seconds
Sc 49	5.750E 01	minutes
Sc 50	1.025E 02	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ti 46	Stable	
Ti 47	Stable	
Ti 48	Stable	
Ti 49	Stable	
Ti 50	Stable	
Ti 51	3.456E 02	seconds
V 49	2.851E 07	seconds
V 50	4.000E 16	years
V 51	Stable	
V 52	2.250E 02	seconds
V 53	9.660E 01	seconds
V 54	5.500E 01	seconds
Cr 50	Stable	
Cr 51	2.394E 06	seconds
Cr 52	Stable	
Cr 53	Stable	
Cr 54	Stable	
Cr 55	2.130E 02	seconds
Mn 54	2.700E 07	seconds
Mn 55	Stable	
Mn 56	9.283E 03	seconds
Mn 57	9.660E 01	seconds
Mn 58	6.530E 01	seconds
Fe 54	Stable	
Fe 55	2.600E 00	years
Fe 56	Stable	
Fe 57	Stable	
Fe 58	Stable	
Fe 59	4.500E 01	days
Co 58	6.115E 06	seconds
Co 58m	3.294E 04	seconds
Co 59	Stable	
Co 60	1.663E 08	seconds
Co 60m	6.282E 02	seconds
Co 61	5.940E 03	seconds
Co 62	9.000E 01	seconds
Co 72	1.227E-01	seconds
Co 73	1.155E-01	seconds
Co 74	1.075E-01	seconds
Co 75	8.016E-02	seconds
Ni 58	Stable	
Ni 59	8.000E 01	thousand years
Ni 60	Stable	
Ni 61	Stable	
Ni 62	Stable	
Ni 63	9.200E 01	years
Ni 64	Stable	
Ni 65	9.072E 03	seconds
Ni 66	1.966E 05	seconds
Ni 72	2.419E 00	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ni 73	3.935E-01	seconds
Ni 74	6.483E-01	seconds
Ni 75	1.796E-01	seconds
Ni 76	2.684E-01	seconds
Ni 77	1.028E-01	seconds
Ni 78	1.376E-01	seconds
Cu 62	5.844E 02	seconds
Cu 63	Stable	
Cu 64	4.572E 04	seconds
Cu 65	Stable	
Cu 66	3.060E 02	seconds
Cu 67	2.227E 05	seconds
Cu 72	6.002E 00	seconds
Cu 73	3.948E 00	seconds
Cu 74	5.731E-01	seconds
Cu 75	7.666E-01	seconds
Cu 76	2.211E-01	seconds
Cu 77	2.946E-01	seconds
Cu 78	1.206E-01	seconds
Cu 79	1.474E-01	seconds
Cu 80	9.110E-02	seconds
Cu 81	7.447E-02	seconds
Zn 63	3.850E 01	minutes
Zn 64	Stable	
Zn 65	2.107E 07	seconds
Zn 66	Stable	
Zn 67	Stable	
Zn 68	Stable	
Zn 69	3.420E 03	seconds
Zn 69m	4.954E 04	seconds
Zn 70	Stable	
Zn 71	2.400E 00	minutes
Zn 71m	3.920E 00	hours
Zn 72	1.674E 05	seconds
Zn 73	2.350E 01	seconds
Zn 74	9.500E 01	seconds
Zn 75	9.000E 00	seconds
Zn 76	5.400E 00	seconds
Zn 77	1.400E 00	seconds
Zn 78	2.429E 00	seconds
Zn 79	3.821E-01	seconds
Zn 80	7.113E-01	seconds
Zn 81	1.294E-01	seconds
Zn 82	1.353E-01	seconds
Zn 83	8.386E-02	seconds
Ga 69	Stable	
Ga 70	1.266E 03	seconds
Ga 71	Stable	
Ga 72	5.076E 04	seconds
Ga 72m	3.968E-02	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ga 73	1.757E 04	seconds
Ga 74	4.860E 02	seconds
Ga 75	1.140E 02	seconds
Ga 76	2.710E 01	seconds
Ga 77	1.300E 01	seconds
Ga 78	4.900E 00	seconds
Ga 79	2.860E 00	seconds
Ga 80	1.700E 00	seconds
Ga 81	7.053E-01	seconds
Ga 82	1.538E-01	seconds
Ga 83	1.477E-01	seconds
Ga 84	9.887E-02	seconds
Ga 85	9.197E-02	seconds
Ge 70	Stable	
Ge 71	1.180E 01	days
Ge 71m	2.190E-02	seconds
Ge 72	Stable	
Ge 73	Stable	
Ge 73m	5.300E-01	seconds
Ge 74	Stable	
Ge 75	4.968E 03	seconds
Ge 75m	4.890E 01	seconds
Ge 76	Stable	
Ge 77	4.068E 04	seconds
Ge 77m	5.430E 01	seconds
Ge 78	5.220E 03	seconds
Ge 79	4.300E 01	seconds
Ge 80	2.400E 01	seconds
Ge 81	1.010E 01	seconds
Ge 82	4.600E 00	seconds
Ge 83	1.900E 00	seconds
Ge 84	1.200E 00	seconds
Ge 85	2.342E-01	seconds
Ge 86	2.589E-01	seconds
Ge 87	1.255E-01	seconds
Ge 88	1.427E-01	seconds
As 75	Stable	
As 76	9.475E 04	seconds
As 77	1.397E 05	seconds
As 78	5.442E 03	seconds
As 79	5.400E 02	seconds
As 80	1.650E 01	seconds
As 81	3.200E 01	seconds
As 82	2.100E 01	seconds
As 82m	1.300E 01	seconds
As 83	1.350E 01	seconds
As 84	5.800E 00	seconds
As 85	2.030E 00	seconds
As 86	9.000E-01	seconds
As 87	3.000E-01	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
As 88	1.299E-01	seconds
As 89	1.294E-01	seconds
As 90	9.009E-02	seconds
Se 74	Stable	
Se 75	1.035E 07	seconds
Se 76	Stable	
Se 77	Stable	
Se 77m	1.750E 01	seconds
Se 78	Stable	
Se 79	2.050E 12	seconds
Se 79m	2.334E 02	seconds
Se 80	Stable	
Se 81	1.110E 03	seconds
Se 81m	3.438E 03	seconds
Se 82	Stable	
Se 83	1.350E 03	seconds
Se 83m	7.000E 01	seconds
Se 84	1.980E 02	seconds
Se 85	3.900E 01	seconds
Se 85m	1.900E 01	seconds
Se 86	1.660E 01	seconds
Se 87	5.600E 00	seconds
Se 88	1.500E 00	seconds
Se 89	4.100E-01	seconds
Se 90	5.545E-01	seconds
Se 91	1.845E-01	seconds
Se 92	2.478E-01	seconds
Se 93	1.068E-01	seconds
Br 79	Stable	
Br 79m	4.860E 00	seconds
Br 80	1.044E 03	seconds
Br 80m	1.591E 04	seconds
Br 81	Stable	
Br 82	1.271E 05	seconds
Br 82m	3.678E 02	seconds
Br 83	8.604E 03	seconds
Br 84	1.908E 03	seconds
Br 84m	3.600E 02	seconds
Br 85	1.720E 02	seconds
Br 86	5.500E 01	seconds
Br 86m	4.500E 00	seconds
Br 87	5.580E 01	seconds
Br 88	1.630E 01	seconds
Br 89	4.500E 00	seconds
Br 90	1.600E 00	seconds
Br 91	6.000E-01	seconds
Br 92	3.000E-01	seconds
Br 93	2.012E-01	seconds
Br 94	1.105E-01	seconds
Br 95	1.166E-01	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Br 96	8.379E-02	seconds
Kr 78	Stable	
Kr 79	3.490E 01	hours
Kr 79m	5.500E 01	seconds
Kr 80	Stable	
Kr 81	6.623E 12	seconds
Kr 81m	1.330E 01	seconds
Kr 82	Stable	
Kr 83	Stable	
Kr 83m	6.588E 03	seconds
Kr 84	Stable	
Kr 85	3.383E 08	seconds
Kr 85m	1.613E 04	seconds
Kr 86	Stable	
Kr 87	4.578E 03	seconds
Kr 88	1.022E 04	seconds
Kr 89	1.902E 02	seconds
Kr 90	3.232E 01	seconds
Kr 91	8.700E 00	seconds
Kr 92	1.840E 00	seconds
Kr 93	1.270E 00	seconds
Kr 94	2.100E-01	seconds
Kr 95	5.000E-01	seconds
Kr 96	4.404E-01	seconds
Kr 97	1.485E-01	seconds
Kr 98	2.243E-01	seconds
Rb 85	Stable	
Rb 86	1.612E 06	seconds
Rb 86m	6.108E 01	seconds
Rb 87	1.482E 18	seconds
Rb 88	1.068E 03	seconds
Rb 89	9.120E 02	seconds
Rb 90	1.530E 02	seconds
Rb 90m	2.580E 02	seconds
Rb 91	5.820E 01	seconds
Rb 92	4.480E 00	seconds
Rb 93	5.800E 00	seconds
Rb 94	2.690E 00	seconds
Rb 95	3.600E-01	seconds
Rb 96	2.070E-01	seconds
Rb 97	1.700E-01	seconds
Rb 98	1.400E-01	seconds
Rb 99	7.600E-02	seconds
Rb100	1.006E-01	seconds
Rb101	1.133E-01	seconds
Sr 84	Stable	
Sr 85	5.602E 06	seconds
Sr 85m	7.000E 01	minutes
Sr 86	Stable	
Sr 87	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Pd107	2.050E 14	seconds
Pd107m	2.130E 01	seconds
Pd108	Stable	
Pd109	4.846E 04	seconds
Pd109m	2.814E 02	seconds
Pd110	Stable	
Pd111	1.320E 03	seconds
Pd111m	1.980E 04	seconds
Pd112	7.236E 04	seconds
Pd113	9.000E 01	seconds
Pd114	1.440E 02	seconds
Pd115	3.800E 01	seconds
Pd116	1.400E 01	seconds
Pd117	5.000E 00	seconds
Pd118	3.100E 00	seconds
Pd119	1.712E 00	seconds
Pd120	4.272E 00	seconds
Pd121	6.221E-01	seconds
Pd122	1.270E 00	seconds
Pd123	3.100E-01	seconds
Pd124	5.601E-01	seconds
Pd125	1.831E-01	seconds
Pd126	2.870E-01	seconds
Ag106	8.500E 00	days
Ag107	Stable	
Ag108	1.422E 02	seconds
Ag108m	4.008E 09	seconds
Ag109	Stable	
Ag109m	3.960E 01	seconds
Ag110	2.460E 01	seconds
Ag110m	2.159E 07	seconds
Ag111	6.437E 05	seconds
Ag111m	6.500E 01	seconds
Ag112	1.127E 04	seconds
Ag113	1.908E 04	seconds
Ag113m	6.600E 01	seconds
Ag114	4.520E 00	seconds
Ag115	1.200E 03	seconds
Ag115m	1.700E 01	seconds
Ag116	1.608E 02	seconds
Ag116m	1.040E 01	seconds
Ag117	7.320E 01	seconds
Ag117m	5.300E 00	seconds
Ag118	3.700E 00	seconds
Ag118m	2.800E 00	seconds
Ag119	6.000E 00	seconds
Ag120	1.170E 00	seconds
Ag121	3.000E 00	seconds
Ag122	1.000E-01	seconds
Ag123	8.627E-01	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ag124	2.685E-01	seconds
Ag125	3.820E-01	seconds
Ag126	1.555E-01	seconds
Ag127	2.052E-01	seconds
Ag128	1.024E-01	seconds
Cd106	Stable	
Cd107	2.336E 04	seconds
Cd108	Stable	
Cd109	4.009E 07	seconds
Cd110	Stable	
Cd111	Stable	
Cd111m	2.922E 03	seconds
Cd112	Stable	
Cd113	Stable	
Cd113m	4.604E 08	seconds
Cd114	Stable	
Cd115	1.925E 05	seconds
Cd115m	3.853E 06	seconds
Cd116	Stable	
Cd117	9.360E 03	seconds
Cd117m	1.224E 04	seconds
Cd118	3.018E 03	seconds
Cd119	5.640E 02	seconds
Cd119m	1.920E 02	seconds
Cd120	5.080E 01	seconds
Cd121	1.280E 01	seconds
Cd122	5.500E 00	seconds
Cd123	8.404E 00	seconds
Cd124	1.717E 01	seconds
Cd125	1.622E 00	seconds
Cd126	3.766E 00	seconds
Cd127	6.590E-01	seconds
Cd128	1.290E 00	seconds
Cd129	3.377E-01	seconds
Cd130	5.240E-01	seconds
Cd131	1.193E-01	seconds
Cd132	1.448E-01	seconds
In113	Stable	
In113m	5.969E 03	seconds
In114	7.190E 01	seconds
In114m	4.278E 06	seconds
In115	1.577E 22	seconds
In115m	1.548E 04	seconds
In116	1.410E 01	seconds
In116m	3.249E 03	seconds
In117	2.640E 03	seconds
In117m	6.984E 03	seconds
In118	5.000E 00	seconds
In118m	2.670E 02	seconds
In119	1.500E 02	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
In119m	1.080E 03	seconds
In120	4.440E 01	seconds
In120m	3.080E 00	seconds
In121	2.800E 01	seconds
In121m	1.980E 02	seconds
In122	1.000E 01	seconds
In122m	1.500E 00	seconds
In123	5.970E 00	seconds
In123m	4.800E 01	seconds
In124	3.200E 00	seconds
In125	2.330E 00	seconds
In125m	1.200E 01	seconds
In126	1.530E 00	seconds
In127	2.000E 00	seconds
In127m	3.640E 00	seconds
In128	3.700E 00	seconds
In129	8.000E-01	seconds
In130	5.300E-01	seconds
In131	3.000E-01	seconds
In132	1.200E-01	seconds
In133	1.139E-01	seconds
In134	7.754E-02	seconds
Sn112	Stable	
Sn113	9.945E 06	seconds
Sn113m	2.000E 01	minutes
Sn114	Stable	
Sn115	Stable	
Sn116	Stable	
Sn117	Stable	
Sn117m	1.210E 06	seconds
Sn118	Stable	
Sn119	Stable	
Sn119m	2.117E 07	seconds
Sn120	Stable	
Sn121	9.648E 04	seconds
Sn121m	1.577E 09	seconds
Sn122	Stable	
Sn123	1.116E 07	seconds
Sn123m	2.405E 03	seconds
Sn124	Stable	
Sn125	8.329E 05	seconds
Sn125m	5.712E 02	seconds
Sn126	3.156E 12	seconds
Sn127	7.560E 03	seconds
Sn127m	2.480E 02	seconds
Sn128	3.540E 03	seconds
Sn129	4.500E 02	seconds
Sn129m	1.500E 02	seconds
Sn130	2.232E 02	seconds
Sn131	6.300E 01	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Sn132	4.000E 01	seconds
Sn133	1.470E 00	seconds
Sn134	8.447E-01	seconds
Sn135	2.911E-01	seconds
Sn136	4.130E-01	seconds
Sb121	Stable	
Sb122	2.333E 05	seconds
Sb122m	2.520E 02	seconds
Sb123	Stable	
Sb124	5.201E 06	seconds
Sb124m	9.300E 01	seconds
Sb125	8.741E 07	seconds
Sb126	1.071E 06	seconds
Sb126m	1.140E 03	seconds
Sb127	3.326E 05	seconds
Sb128	3.244E 04	seconds
Sb128m	6.240E 02	seconds
Sb129	1.555E 04	seconds
Sb130	2.400E 03	seconds
Sb130m	3.780E 02	seconds
Sb131	1.380E 03	seconds
Sb132	1.680E 02	seconds
Sb132m	2.520E 02	seconds
Sb133	1.440E 02	seconds
Sb134	1.100E 01	seconds
Sb134m	1.070E 01	seconds
Sb135	1.700E 00	seconds
Sb136	2.313E-01	seconds
Sb137	2.837E-01	seconds
Sb138	1.304E-01	seconds
Sb139	1.719E-01	seconds
Tel20	Stable	
Tel21	1.469E 06	seconds
Tel21m	1.331E 07	seconds
Tel22	Stable	
Tel23	3.156E 20	seconds
Tel23m	1.034E 07	seconds
Tel24	Stable	
Tel25	Stable	
Tel25m	5.011E 06	seconds
Tel26	Stable	
Tel27	3.366E 04	seconds
Tel27m	9.418E 06	seconds
Tel28	Stable	
Tel29	4.176E 03	seconds
Tel29m	2.903E 06	seconds
Tel30	Stable	
Tel31	1.500E 03	seconds
Tel31m	1.080E 05	seconds
Tel32	2.815E 05	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Mo100	Stable	
Mo101	8.772E 02	seconds
Mo102	6.660E 02	seconds
Mo103	6.000E 01	seconds
Mo104	9.600E 01	seconds
Mo105	5.400E 01	seconds
Mo106	9.000E 00	seconds
Mo107	6.391E 00	seconds
Mo108	1.500E 00	seconds
Mo109	1.033E 00	seconds
Mo110	1.892E 00	seconds
Mo111	3.917E-01	seconds
Mo112	6.892E-01	seconds
Mo113	1.971E-01	seconds
Mo114	3.215E-01	seconds
Mo115	1.160E-01	seconds
Tc 97	2.600E 00	million years
Tc 97m	9.000E 01	days
Tc 98	1.325E 14	seconds
Tc 99	6.722E 12	seconds
Tc 99m	2.167E 04	seconds
Tc100	1.580E 01	seconds
Tc101	8.520E 02	seconds
Tc102	5.280E 00	seconds
Tc102m	2.610E 02	seconds
Tc103	5.000E 01	seconds
Tc104	1.092E 03	seconds
Tc105	4.800E 02	seconds
Tc106	3.700E 01	seconds
Tc107	2.900E 01	seconds
Tc108	5.200E 00	seconds
Tc109	5.100E 01	seconds
Tc110	8.300E-01	seconds
Tc111	1.336E 00	seconds
Tc112	3.553E-01	seconds
Tc113	4.583E-01	seconds
Tc114	1.734E-01	seconds
Tc115	2.225E-01	seconds
Tc116	1.062E-01	seconds
Tc117	1.352E-01	seconds
Tc118	7.722E-02	seconds
Ru 96	Stable	
Ru 97	2.506E 05	seconds
Ru 98	Stable	
Ru 99	Stable	
Ru100	Stable	
Ru101	Stable	
Ru102	Stable	
Ru103	3.394E 06	seconds
Ru104	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Ru105	1.598E 04	seconds
Ru106	3.181E 07	seconds
Ru107	2.520E 02	seconds
Ru108	2.700E 02	seconds
Ru109	3.500E 01	seconds
Ru110	1.600E 01	seconds
Ru111	1.542E 01	seconds
Ru112	7.000E-01	seconds
Ru113	2.766E 00	seconds
Ru114	5.053E 00	seconds
Ru115	7.294E-01	seconds
Ru116	1.405E 00	seconds
Ru117	3.089E-01	seconds
Ru118	6.163E-01	seconds
Ru119	1.771E-01	seconds
Ru120	2.932E-01	seconds
Rh102	2.900E 00	years
Rh103	Stable	
Rh103m	3.367E 03	seconds
Rh104	4.230E 01	seconds
Rh104m	2.604E 02	seconds
Rh105	1.273E 05	seconds
Rh105m	4.500E 01	seconds
Rh106	2.990E 01	seconds
Rh106m	7.920E 03	seconds
Rh107	1.302E 03	seconds
Rh108	1.680E 01	seconds
Rh108m	3.540E 02	seconds
Rh109	9.000E 01	seconds
Rh109m	5.000E 01	seconds
Rh110	2.900E 01	seconds
Rh110m	3.000E 00	seconds
Rh111	6.300E 01	seconds
Rh112	4.700E 00	seconds
Rh113	9.000E-01	seconds
Rh114	1.700E 00	seconds
Rh115	6.022E 00	seconds
Rh116	8.333E-01	seconds
Rh117	1.076E 00	seconds
Rh118	2.953E-01	seconds
Rh119	4.477E-01	seconds
Rh120	1.624E-01	seconds
Rh121	2.210E-01	seconds
Rh122	1.053E-01	seconds
Rh123	1.335E-01	seconds
Pd102	Stable	
Pd103	1.465E 06	seconds
Pd104	Stable	
Pd105	Stable	
Pd106	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Sr 87m	1.010E 04	seconds
Sr 88	Stable	
Sr 89	4.363E 06	seconds
Sr 90	9.190E 08	seconds
Sr 91	3.420E 04	seconds
Sr 92	9.756E 03	seconds
Sr 93	4.500E 02	seconds
Sr 94	7.560E 01	seconds
Sr 95	2.600E 01	seconds
Sr 96	4.000E 00	seconds
Sr 97	2.000E-01	seconds
Sr 98	8.500E-01	seconds
Sr 99	5.600E-01	seconds
Sr100	1.046E 00	seconds
Sr101	2.519E-01	seconds
Sr102	4.147E-01	seconds
Sr103	1.386E-01	seconds
Sr104	1.925E-01	seconds
Y 89	Stable	
Y 89m	1.606E 01	seconds
Y 90	2.304E 05	seconds
Y 90m	1.116E 04	seconds
Y 91	5.055E 06	seconds
Y 91m	2.983E 03	seconds
Y 92	1.274E 04	seconds
Y 93	3.636E 04	seconds
Y 94	1.146E 03	seconds
Y 95	6.300E 02	seconds
Y 96	1.380E 02	seconds
Y 97	1.110E 00	seconds
Y 98	3.000E-01	seconds
Y 99	8.000E-01	seconds
Y100	7.563E-01	seconds
Y101	9.762E-01	seconds
Y102	2.726E-01	seconds
Y103	3.660E-01	seconds
Y104	1.442E-01	seconds
Y105	1.736E-01	seconds
Y106	9.292E-02	seconds
Y107	1.046E-01	seconds
Zr 89	2.824E 05	seconds
Zr 90	Stable	
Zr 90m	8.300E-01	seconds
Zr 91	Stable	
Zr 92	Stable	
Zr 93	4.828E 13	seconds
Zr 94	Stable	
Zr 95	5.528E 06	seconds
Zr 96	Stable	
Zr 97	6.084E 04	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Zr 98	3.100E 01	seconds
Zr 99	2.400E 00	seconds
Zr100	7.100E 00	seconds
Zr101	3.300E 00	seconds
Zr102	2.862E 01	seconds
Zr103	1.770E 00	seconds
Zr104	3.783E 00	seconds
Zr105	5.586E-01	seconds
Zr106	9.801E-01	seconds
Zr107	2.485E-01	seconds
Zr108	4.076E-01	seconds
Zr109	1.387E-01	seconds
Nb 91	1.000E 04	years
Nb 92	1.016E 01	days
Nb 93	Stable	
Nb 93m	4.292E 08	seconds
Nb 94	6.406E 11	seconds
Nb 94m	3.756E 02	seconds
Nb 95	3.037E 06	seconds
Nb 95m	3.118E 05	seconds
Nb 96	8.406E 04	seconds
Nb 97	4.326E 03	seconds
Nb 97m	6.000E 01	seconds
Nb 98	2.800E 00	seconds
Nb 98m	3.090E 03	seconds
Nb 99	1.430E 01	seconds
Nb 99m	1.560E 02	seconds
Nb100	2.400E 00	seconds
Nb100m	2.410E 00	seconds
Nb101	7.000E 00	seconds
Nb102	3.000E 00	seconds
Nb103	1.567E 01	seconds
Nb104	1.000E 00	seconds
Nb105	1.800E 00	seconds
Nb106	5.352E-01	seconds
Nb107	6.694E-01	seconds
Nb108	2.220E-01	seconds
Nb109	2.861E-01	seconds
Nb110	1.258E-01	seconds
Nb111	1.561E-01	seconds
Nb112	8.510E-02	seconds
Mo 92	Stable	
Mo 93	1.104E 11	seconds
Mo 93m	2.466E 04	seconds
Mo 94	Stable	
Mo 95	Stable	
Mo 96	Stable	
Mo 97	Stable	
Mo 98	Stable	
Mo 99	2.376E 05	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Xe133m	1.892E 05	seconds
Xe134	Stable	
Xe134m	2.900E-01	seconds
Xe135	3.272E 04	seconds
Xe135m	9.174E 02	seconds
Xe136	Stable	
Xe137	2.298E 02	seconds
Xe138	8.502E 02	seconds
Xe139	3.950E 01	seconds
Xe140	1.360E 01	seconds
Xe141	1.720E 00	seconds
Xe142	1.220E 00	seconds
Xe143	3.000E-01	seconds
Xe144	1.000E 00	seconds
Xe145	9.000E-01	seconds
Xe146	9.372E-01	seconds
Xe147	2.638E-01	seconds
Cs131	9.700E 00	days
Cs132	5.594E 05	seconds
Cs133	Stable	
Cs134	6.507E 07	seconds
Cs134m	1.044E 04	seconds
Cs135	7.258E 13	seconds
Cs135m	5.300E 01	minutes
Cs136	1.132E 06	seconds
Cs137	9.467E 08	seconds
Cs138	1.932E 03	seconds
Cs138m	1.740E 02	seconds
Cs139	5.640E 02	seconds
Cs140	6.380E 01	seconds
Cs141	2.500E 01	seconds
Cs142	1.700E 00	seconds
Cs143	1.700E 00	seconds
Cs144	1.020E 00	seconds
Cs145	5.600E-01	seconds
Cs146	1.900E-01	seconds
Cs147	5.578E-01	seconds
Cs148	2.016E-01	seconds
Cs149	2.782E-01	seconds
Cs150	1.244E-01	seconds
Ba130	Stable	
Ba131	1.020E 06	seconds
Ba131m	1.500E 01	minutes
Ba132	Stable	
Ba133	3.389E 08	seconds
Ba133m	1.400E 05	seconds
Ba134	Stable	
Ba135	Stable	
Ba135m	1.033E 05	seconds
Ba136	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Te133	7.470E 02	seconds
Te133m	3.324E 03	seconds
Te134	2.508E 03	seconds
Te135	1.920E 01	seconds
Te136	2.100E 01	seconds
Te137	3.500E 00	seconds
Te138	1.640E 00	seconds
Te139	4.237E-01	seconds
Te140	7.519E-01	seconds
Te141	2.358E-01	seconds
Te142	4.913E-01	seconds
I125	5.970E 01	days
I126	1.125E 06	seconds
I127	Stable	
I128	1.499E 03	seconds
I129	4.954E 14	seconds
I130	4.450E 04	seconds
I130m	5.400E 02	seconds
I131	6.947E 05	seconds
I132	8.280E 03	seconds
I133	7.488E 04	seconds
I133m	9.000E 00	seconds
I134	3.156E 03	seconds
I134m	2.220E 02	seconds
I135	2.380E 04	seconds
I136	8.300E 01	seconds
I136m	4.600E 01	seconds
I137	2.460E 01	seconds
I138	6.400E 00	seconds
I139	2.400E 00	seconds
I140	8.600E-01	seconds
I141	4.000E-01	seconds
I142	1.960E-01	seconds
I143	3.281E-01	seconds
I144	1.327E-01	seconds
I145	1.867E-01	seconds
Xe124	Stable	
Xe125	1.700E 01	hours
Xe125m	5.700E 01	seconds
Xe126	Stable	
Xe127	3.146E 06	seconds
Xe127m	7.000E 01	seconds
Xe128	Stable	
Xe129	Stable	
Xe129m	6.912E 05	seconds
Xe130	Stable	
Xe131	Stable	
Xe131m	1.028E 06	seconds
Xe132	Stable	
Xe133	4.532E 05	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ce147	7.000E 01	seconds
Ce148	4.300E 01	seconds
Ce149	1.000E 00	seconds
Ce150	1.000E 00	seconds
Ce151	1.000E 00	seconds
Ce152	1.403E 01	seconds
Ce153	1.725E 00	seconds
Ce154	3.591E 00	seconds
Ce155	7.125E-01	seconds
Ce156	1.162E 00	seconds
Ce157	3.617E-01	seconds
Pr139	4.400E 00	hours
Pr140	3.390E 00	minutes
Pr141	Stable	
Pr142	6.887E 04	seconds
Pr142m	8.760E 02	seconds
Pr143	1.172E 06	seconds
Pr144	1.037E 03	seconds
Pr144m	4.320E 02	seconds
Pr145	2.153E 04	seconds
Pr146	1.452E 03	seconds
Pr147	7.200E 02	seconds
Pr148	1.380E 02	seconds
Pr149	1.380E 02	seconds
Pr150	1.240E 01	seconds
Pr151	4.000E 00	seconds
Pr152	8.318E 00	seconds
Pr153	7.743E 00	seconds
Pr154	1.307E 00	seconds
Pr155	1.891E 00	seconds
Pr156	5.104E-01	seconds
Pr157	6.779E-01	seconds
Pr158	2.629E-01	seconds
Pr159	3.141E-01	seconds
Nd141	2.500E 00	hours
Nd142	Stable	
Nd143	Stable	
Nd144	6.623E 22	seconds
Nd145	Stable	
Nd146	Stable	
Nd147	9.556E 05	seconds
Nd148	Stable	
Nd149	6.228E 03	seconds
Nd150	Stable	
Nd151	7.440E 02	seconds
Nd152	6.900E 02	seconds
Nd153	6.754E 01	seconds
Nd154	4.000E 01	seconds
Nd155	2.606E 01	seconds
Nd156	5.849E 01	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Ba136m	3.080E-01	seconds
Ba137	Stable	
Ba137m	1.531E 02	seconds
Ba138	Stable	
Ba139	4.962E 03	seconds
Ba140	1.105E 06	seconds
Ba141	1.096E 03	seconds
Ba142	6.420E 02	seconds
Ba143	1.360E 01	seconds
Ba144	1.100E 01	seconds
Ba145	6.200E 00	seconds
Ba146	2.200E 00	seconds
Ba147	2.227E 00	seconds
Ba148	5.901E 00	seconds
Ba149	9.175E-01	seconds
Ba150	1.797E 00	seconds
Ba151	4.368E-01	seconds
Ba152	7.548E-01	seconds
La137	1.893E 12	seconds
La138	4.260E 18	seconds
La139	Stable	
La140	1.448E 05	seconds
La141	1.415E 04	seconds
La142	5.562E 03	seconds
La143	8.400E 02	seconds
La144	4.000E 01	seconds
La145	2.900E 01	seconds
La146	8.300E 00	seconds
La147	1.000E 01	seconds
La148	1.300E 00	seconds
La149	2.864E 00	seconds
La150	6.485E-01	seconds
La151	9.536E-01	seconds
La152	3.094E-01	seconds
La153	4.371E-01	seconds
La154	1.753E-01	seconds
La155	2.215E-01	seconds
Ce136	Stable	
Ce137	3.240E 04	seconds
Ce137m	1.238E 05	seconds
Ce138	Stable	
Ce139	1.189E 07	seconds
Ce139m	5.620E 01	seconds
Ce140	Stable	
Ce141	2.809E 06	seconds
Ce142	3.311E 18	seconds
Ce143	1.188E 05	seconds
Ce144	2.456E 07	seconds
Ce145	1.800E 02	seconds
Ce146	8.520E 02	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Eu151	Stable	
Eu152	4.292E 08	seconds
Eu152m	3.355E 04	seconds
Eu153	Stable	
Eu154	2.714E 08	seconds
Eu155	1.565E 08	seconds
Eu156	1.312E 06	seconds
Eu157	5.472E 04	seconds
Eu158	2.754E 03	seconds
Eu159	1.086E 03	seconds
Eu160	5.100E 01	seconds
Eu161	4.206E 01	seconds
Eu162	2.698E 02	seconds
Eu163	1.484E 01	seconds
Eu164	2.170E 00	seconds
Eu165	2.548E 00	seconds
Gd152	3.408E 21	seconds
Gd153	2.091E 07	seconds
Gd154	Stable	
Gd155	Stable	
Gd155m	3.100E-02	seconds
Gd156	Stable	
Gd157	Stable	
Gd158	Stable	
Gd159	6.696E 04	seconds
Gd160	Stable	
Gd161	2.220E 02	seconds
Gd162	6.000E 02	seconds
Gd163	9.277E 01	seconds
Gd164	1.301E 03	seconds
Gd165	1.002E 02	seconds
Tb157	4.734E 09	seconds
Tb159	Stable	
Tb160	6.247E 06	seconds
Tb161	5.979E 05	seconds
Tb162	4.482E 02	seconds
Tb162m	8.028E 03	seconds
Tb163	1.170E 03	seconds
Tb163m	7.000E 00	minutes
Tb164	1.800E 02	seconds
Tb165	3.275E 01	seconds
Dy156	Stable	
Dy157	2.916E 04	seconds
Dy158	Stable	
Dy159	1.440E 02	days
Dy160	Stable	
Dy161	Stable	
Dy162	Stable	
Dy163	Stable	
Dy164	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Nd157	4.149E 00	seconds
Nd158	7.889E 00	seconds
Nd159	1.408E 00	seconds
Nd160	2.121E 00	seconds
Nd161	5.558E-01	seconds
Pm145	5.586E 08	seconds
Pm146	5.500E 00	years
Pm147	8.279E 07	seconds
Pm148	4.640E 05	seconds
Pm148m	3.568E 06	seconds
Pm149	1.911E 05	seconds
Pm150	9.648E 03	seconds
Pm151	1.022E 05	seconds
Pm152	2.460E 02	seconds
Pm152m	4.500E 02	seconds
Pm153	3.240E 02	seconds
Pm154	1.680E 02	seconds
Pm154m	1.080E 02	seconds
Pm155	3.656E 01	seconds
Pm156	1.310E 01	seconds
Pm157	6.802E 01	seconds
Pm158	3.801E 00	seconds
Pm159	4.230E 00	seconds
Pm160	9.963E-01	seconds
Pm161	1.188E 00	seconds
Pm162	3.999E-01	seconds
Sm144	Stable	
Sm145	2.938E 07	seconds
Sm146	7.000E 01	million years
Sm147	3.377E 18	seconds
Sm148	2.525E 23	seconds
Sm149	3.154E 23	seconds
Sm150	Stable	
Sm151	2.840E 09	seconds
Sm152	Stable	
Sm153	1.681E 05	seconds
Sm154	Stable	
Sm155	1.332E 03	seconds
Sm156	3.384E 04	seconds
Sm157	4.800E 02	seconds
Sm158	2.639E 03	seconds
Sm159	1.622E 02	seconds
Sm160	3.491E 02	seconds
Sm161	1.288E 01	seconds
Sm162	1.959E 01	seconds
Sm163	2.563E 00	seconds
Sm164	4.247E 00	seconds
Sm165	9.274E-01	seconds
Eu149	9.310E 01	days
Eu150	3.600E 01	years

Table 1b.1. (continued)

Isotope	Half-life	Units
Hf180m	5.500E 00	hours
Hf181	3.663E 06	seconds
Hf182	9.000E 00	million years
Ta180	1.600E 13	years
Ta181	Stable	
Ta182	9.936E 06	seconds
Ta182m	1.650E 01	minutes
Ta183	5.100E 00	days
W180	Stable	
W181	1.047E 07	seconds
W182	Stable	
W183	Stable	
W183m	5.200E 00	seconds
W184	Stable	
W185	7.510E 01	days
W185m	1.670E 00	minutes
W186	Stable	
W187	8.604E 04	seconds
W188	5.996E 06	seconds
W189	1.150E 01	minutes
Re185	Stable	
Re186	9.064E 01	hours
Re187	5.000E 01	billion years
Re188	6.113E 04	seconds
Re188m	1.870E 01	minutes
Re189	2.430E 01	hours
Os184	Stable	
Os185	9.400E 01	days
Os186	Stable	
Os187	Stable	
Os188	Stable	
Os189	Stable	
Os190	Stable	
Os190m	9.900E 00	minutes
Os191	1.331E 06	seconds
Os191m	1.300E 01	hours
Os192	Stable	
Os193	3.100E 01	hours
Os194	6.000E 00	years
Ir191	Stable	
Ir192	6.395E 06	seconds
Ir192m	2.410E 02	years
Ir193	Stable	
Ir194	6.894E 04	seconds
Ir194m	3.200E-02	seconds
Pt190	6.000E 02	billion years
Pt191	3.000E 00	days
Pt192	Stable	
Pt193	5.000E 02	years
Pt193m	4.300E 00	days

Table 1b.1. (continued)

Isotope	Half-life	Units
Dy165	8.460E 03	seconds
Dy165m	7.536E 01	seconds
Dy166	2.934E 05	seconds
Ho163	3.300E 01	years
Ho165	Stable	
Ho166	9.648E 04	seconds
Ho166m	3.787E 10	seconds
Er162	Stable	
Er163	7.500E 01	minutes
Er164	Stable	
Er165	1.030E 01	hours
Er166	Stable	
Er167	Stable	
Er167m	2.300E 00	seconds
Er168	Stable	
Er169	9.400E 00	days
Er170	Stable	
Er171	2.707E 04	seconds
Er172	4.900E 01	hours
Tm169	Stable	
Tm170	1.111E 07	seconds
Tm170m	4.100E-06	seconds
Tm171	6.059E 07	seconds
Tm172	6.360E 01	hours
Tm173	8.240E 00	hours
Yb168	Stable	
Yb169	2.766E 06	seconds
Yb170	Stable	
Yb171	Stable	
Yb172	Stable	
Yb173	Stable	
Yb174	Stable	
Yb175	3.620E 05	seconds
Yb175m	6.700E-02	seconds
Yb176	Stable	
Yb177	1.900E 00	hours
Lu175	Stable	
Lu176	3.000E 01	billion years
Lu176m	3.690E 00	hours
Lu177	5.797E 05	seconds
Lu177m	1.550E 02	days
Hf174	Stable	
Hf175	7.000E 01	days
Hf176	Stable	
Hf177	Stable	
Hf178	Stable	
Hf178m	4.000E 00	seconds
Hf179	Stable	
Hf179m	1.860E 01	seconds
Hf180	Stable	

Table 1b.1. (continued)

Isotope	Half-life	Units
Po210	1.196E 07	seconds
Po211	5.600E-01	seconds
Po211m	2.500E 01	seconds
Po212	3.000E-07	seconds
Po213	4.200E-06	seconds
Po214	1.643E-04	seconds
Po215	1.780E-03	seconds
Po216	1.500E-01	seconds
Po218	1.830E 02	seconds
At217	3.230E-02	seconds
Rn218	3.500E-02	seconds
Rn219	3.960E 00	seconds
Rn220	5.560E 01	seconds
Rn222	3.304E 05	seconds
Fr221	2.880E 02	seconds
Fr223	1.308E 03	seconds
Ra222	3.800E 01	seconds
Ra223	9.879E 05	seconds
Ra224	3.162E 05	seconds
Ra225	1.279E 06	seconds
Ra226	5.049E 10	seconds
Ra228	6.700E 00	years
Ac225	8.640E 05	seconds
Ac227	6.871E 08	seconds
Ac228	2.207E 04	seconds
Th226	3.100E 01	minutes
Th227	1.617E 06	seconds
Th228	6.037E 07	seconds
Th229	2.316E 11	seconds
Th230	2.430E 12	seconds
Th231	9.187E 04	seconds
Th232	4.434E 17	seconds
Th233	2.210E 01	minutes
Th234	2.082E 06	seconds
Pa231	1.034E 12	seconds
Pa232	1.132E 05	seconds
Pa233	2.333E 06	seconds
Pa234	2.412E 04	seconds
Pa234m	7.020E 01	seconds
Pa235	2.410E 01	minutes
U230	2.080E 01	days
U231	3.629E 05	seconds
U232	2.272E 09	seconds
U233	5.002E 12	seconds
U234	7.716E 12	seconds
U235	2.221E 16	seconds
U236	7.389E 14	seconds
U237	5.832E 05	seconds
U238	1.410E 17	seconds
U239	1.412E 03	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Pt194	Stable	
Pt195	Stable	
Pt195m	2.713E 05	seconds
Pt196	Stable	
Pt197	1.800E 01	hours
Pt197m	8.000E 01	minutes
Pt198	Stable	
Pt199	3.000E 01	minutes
Pt199m	1.410E 01	seconds
Au197	Stable	
Au198	2.698E 00	days
Au199	2.713E 05	seconds
Au200	4.840E 01	minutes
Hg196	Stable	
Hg197	6.500E 01	hours
Hg197m	2.400E 01	hours
Hg198	Stable	
Hg199	Stable	
Hg199m	4.300E 01	minutes
Hg200	Stable	
Hg201	Stable	
Hg202	Stable	
Hg203	4.025E 06	seconds
Hg204	Stable	
Hg205	5.500E 00	minutes
Tl203	Stable	
Tl204	3.800E 00	years
Tl205	Stable	
Tl206	4.190E 00	minutes
Tl207	2.862E 02	seconds
Tl208	1.842E 02	seconds
Tl209	1.320E 02	seconds
Pb204	1.400E 17	years
Pb205	3.000E 01	million years
Pb206	Stable	
Pb207	Stable	
Pb208	Stable	
Pb209	3.300E 00	hours
Pb210	7.037E 08	seconds
Pb211	2.166E 03	seconds
Pb212	3.830E 04	seconds
Pb214	1.608E 03	seconds
Bi208	3.680E 02	thousand years
Bi209	Stable	
Bi210	4.330E 05	seconds
Bi210m	3.000E 00	million years
Bi211	1.278E 02	seconds
Bi212	3.633E 03	seconds
Bi213	2.739E 03	seconds
Bi214	1.194E 03	seconds

Table 1b.1. (continued)

Isotope	Half-life	Units
Cf253	1.539E 06	seconds
Cf254	6.050E 01	days
Cf255	1.500E 00	hours
Es253	2.047E 01	days
Es254	2.757E 02	days
Es254m	3.930E 01	hours
Es255	3.900E 01	days

Table 1b.1. (continued)

Isotope	Half-life	Units
U240	5.076E 04	seconds
U241	1.000E 00	seconds
Np235	3.422E 07	seconds
Np236	3.629E 12	seconds
Np236m	8.100E 04	seconds
Np237	6.753E 13	seconds
Np238	1.829E 05	seconds
Np239	2.035E 05	seconds
Np240	3.900E 03	seconds
Np240m	4.440E 02	seconds
Np241	1.600E 01	minutes
Pu236	8.997E 07	seconds
Pu237	4.560E 01	days
Pu238	2.769E 09	seconds
Pu239	7.594E 11	seconds
Pu240	2.063E 11	seconds
Pu241	4.544E 08	seconds
Pu242	1.221E 13	seconds
Pu243	1.784E 04	seconds
Pu244	2.607E 15	seconds
Pu245	1.060E 01	hours
Pu246	1.085E 01	days
Am239	4.284E 04	seconds
Am240	1.829E 05	seconds
Am241	1.364E 10	seconds
Am242	5.767E 04	seconds
Am242m	4.797E 09	seconds
Am243	2.329E 11	seconds
Am244	1.010E 01	hours
Am244m	2.600E 01	minutes
Am245	2.070E 00	hours
Am246	2.500E 01	minutes
Cm241	3.600E 01	days
Cm242	1.410E 07	seconds
Cm243	8.994E 08	seconds
Cm244	5.715E 08	seconds
Cm245	2.682E 11	seconds
Cm246	1.493E 11	seconds
Cm247	4.923E 14	seconds
Cm248	1.070E 13	seconds
Cm249	3.849E 03	seconds
Cm250	1.740E 01	thousand years
Cm251	1.000E 00	seconds
Bk249	2.765E 07	seconds
Bk250	1.160E 04	seconds
Bk251	5.700E 01	minutes
Cf249	1.106E 10	seconds
Cf250	4.128E 08	seconds
Cf251	2.834E 10	seconds
Cf252	8.325E 07	seconds

APPENDIX 1C.
ORIGEN2 INTERPOLATION FUNCTIONS

1.0 PURPOSE

ORIGEN2 provides detailed spent fuel characteristics such as curie, photon, neutron and thermal output for previously-specified cooling times and discharge burnups. However, when spent fuel characteristics are needed, it will typically not be at the exact burnup and/or cooling time for which previously-calculated data are available. This appendix provides a reasonable method for interpolating in either or both burnup and cooling time when spent fuel characteristics are needed between the discrete burnups and/or cooling times at which characteristics data are available. In addition, summary tables of curies/MTU, neutrons/sec.MTU, thermal power (watts/MTU) and energy (watt-years/MTU), as well as related coefficients for interpolation in both burnup and cooling time are provided. Because of the 18 different energy levels needed to represent photon data, specific tables are not provided, but the interpolation method is directly usable. The data used in this appendix are from two data bases that are available on PC diskettes. The Watts and Curies are from the Totals Reports System diskette (TOTALS.DBF of 5/7/86) The Neutron data are from the Spent Fuel Photon and Neutron Data Base System Data diskette (NEUTOTAL.DBF of 1/13/87).

2.0 INTERPOLATION METHOD

After testing several methods, the one that appears the most appropriate for interpolating characteristics with respect to both burnup and cooling time is power scaling. Specifically the ratio of characteristics is assumed to be equal to the ratio of burnups and/or times raised to an appropriate power. That power is chosen such that the relationship is exact at the two end-points bounding the range. For a characteristic, C, relative to a reference characteristic, C₀, at burnup B₀, the basic relationship for interpolation in burnup (at constant time) is:

$$\frac{C}{C_0} = \left(\frac{B}{B_0} \right)^p \quad \text{Eq (1)}$$

where p is chosen for an exact fit with characteristic C₁,

at burnup B_1 : i.e. $p = \ln (C_1/C_0) / \ln (B_1/B_0)$
and where C lies between C_0 and C_1 .

For interpolation in time relative to time t_0 (at constant burnup):

$$\frac{C}{C_0} = \left(\frac{t}{t_0} \right)^{-m} \quad \text{Eq (2)}$$

where m is chosen for an exact fit with characteristic C_1
at time t_1 : i.e. $m = \ln (C_0/C_1) / \ln (t_1/t_0)$

The selection of power scaling for burnup interpolation is appropriate because many waste characteristics, at least with 5 or more years' cooling are "approximately" proportional to burnup, which means that the "p" factor in Eq (1) is "approximately" unity. Power scaling was selected for time interpolation because it is significantly more accurate than an exponential decay relationship over most of the time range and is not significantly less accurate in those portions of the time range in which exponential decay gives slightly greater accuracy.

3.0 DATA AND INTERPOLATION OF CURIES/MTU

Table 1C.1 provides a listing of curies/MTU for 38 different cooling times from one year to one million years at burnup increments of 5000 Mwd/MTU for both PWR and BWR. Table 1C.2 provides the "p" coefficient for interpolating curies/MTU in burnup, at constant time in accordance with Eq (1). Each coefficient is to be used from the burnup shown, to the next-highest burnup. For example, the coefficients shown for the PWR at 55,000 Mwd/MTU (such as 1.202 E+00 at one year) are to be used for interpolation between 55,000 and 60,000 Mwd/MTU for 1-year cooling. If needed, a coefficient of 1.0 could be used for interpolation between 0 and 5,000 Mwd/MTU. Table 1C.3 provides the "m" coefficient for interpolating curies/MTU in time, at constant burnup, in accordance with Eq (2). Each coefficient is to be used from the time shown, to the next-highest time.

4.0 DATA AND INTERPOLATION OF NEUTRONS/MTU

Tables 1C.4, 1C.5 and 1C.6 provide: neutrons/sec. MTU; the "p" coefficient for interpolating neutrons/sec. MTU in burnup, at constant time in accordance with Eq (1); and the "m" coefficient for interpolating neutrons/sec. MTU in time, at constant burnup in accordance with Eq (2).

5.0 DATA AND INTERPOLATION OF WATTS/MTU

Tables 1C.7, 1C.8 and 1C.9 provide: watts/MTU; the "p" coefficient for interpolating watts/MTU in burnup at constant time in accordance with Eq (1); and the "m" coefficient for interpolating watts/MTU at constant burnup in accordance with Eq (2).

6.0 ENERGY OUTPUT AND INTERPOLATION

Table 1C.10 uses the "m" coefficient in Table 1C.9 to provide the time-integrated power (i.e. energy) deposited between the time shown, and the next higher time. For example, the 6.875 E+03 watt-yrs/MTU shown at 1 year for the PWR at 33,000 Mwd/MTU is the energy output from year 1 to year 2. The data in Table 1C.10 is calculated from the time integral of Eq (2), which is:

$$E \text{ (from } t_0 \text{ to } t) = \frac{W_0 t_0}{(1-m)} \left[\left(\frac{t}{t_0} \right)^{1-m} - 1 \right] \quad m \neq 1 \quad (\text{Eq 3})$$
$$= W_0 t_0 \left[\ln \left(\frac{t}{t_0} \right) \right] \quad m = 1 \quad (\text{Eq 4})$$

where E = energy in watt-years/MTU, from t_0 to t
 W_0 = power in watts/MTU, from Table 1C.7
 t_0 = cooling time, corresponding to W_0
 m = coefficient from Table 1C.9, corresponding to W_0 and t_0

Table 1C.11 provides the total energy output in watt-years/MTU from 10 years' cooling, that is, starting with 10-year old fuel. It is based on the energy increments in Table 1C.10 with the zero-energy reference at 10 years. For interpolation of the values in Table 1C.11, Eq (3) is used (or (4) if $m=1$), along with the appropriate W_0 from Table 1C.7 and "m" from Table 1C.9.

The resulting energy increment is added to the value in Table 1C.11. For energy outputs between any two times, neither of which is 10 years, the energy relative to 10 years for the smaller time is subtracted from the energy relative to 10 years for the larger time. For example the energy output from 5 years to 25 years for a PWR with 33,000 Mwd/MTU is 13,980 watt-years/MTU - (-6825 watt years/MTU) = 20,805 watt-years/MTU.

7.0 DOUBLE INTERPOLATION (IN BURNUP AND TIME)

The preceding tables have provided coefficients for interpolating in burnup at constant time, or in time at constant burnup. However, many situations will involve interpolation of characteristics in both burnup and time. Conceptually, this can be done either by first interpolating in burnup using adjacent "P" coefficients, and then in time; or by first interpolating in time, using adjacent "m" coefficients and then in burnup. These alternative approaches give identical results within the extrapolation space, and on all boundaries. Using either of the preceding approaches, a characteristic, C, at a burnup, B, between B_i and B_{i+1} , and at time, t, between t_j and t_{j+1} is given by

$$\frac{C}{C_{i,j}} = \left(\frac{B}{B_i}\right)^{p'} \left(\frac{t}{t_j}\right)^{-m'}$$

$$\text{where } p' = (P_{i,j} + (P_{i,j+1} - P_{i,j}) \frac{\ln(\frac{t}{t_j})}{\ln(\frac{t_{j+1}}{t_j})}) ; \text{ and } m' = m_{i,j}$$

$$\underline{\text{or:}} \quad m' = m_{i,j} + (m_{i+1,j} - m_{i,j}) \frac{\ln(\frac{B}{B_i})}{\ln(\frac{B_{i+1}}{B_i})} ; \text{ and } p' = P_{i,j}$$

In application, the double interpolation would use all three tables for each set of particular characteristics: the first of the three tables would provide the reference characteristics ($C_{i,j}$); the second would provide

the adjacent $P_{i,j}$ and $P_{i,j+1}$ coefficients; and the third would provide the adjacent $m_{i,j}$ and $m_{i+1,j}$ coefficients.

The above discussion applies to double interpolation for curies, neutrons/sec. and watts per MTU, but applies only partially to double interpolation for "watt-years per MTU from 10 years ". The procedure for the latter case is as follows.

First, add an appropriate amount of energy to each of the "watt-years per MTU from 10 years (E10)" from Table 1C.11 for the two E10 points that bracket B, the burnup of interest, and are just below t, the time point of interest. This is done using the energy formula of Eq (3) (or Eq (4) if $m=1$), as follows:

$$E10'_{i,j} = E10_{i,j} + \frac{W_{i,j} t_j}{1-m_{i,j}} \left[\left(\frac{t}{t_j} \right)^{1-m_{i,j}} - 1 \right]$$

$$E10'_{i+1,j} = E10_{i+1,j} + \frac{W_{i+1,j} t_j}{1-m_{i+1,j}} \left[\left(\frac{t}{t_j} \right)^{1-m_{i+1,j}} - 1 \right]$$

where W = the appropriate watts/MTU from Table 1C.7

m = the appropriate "m" coefficient from Table 1C.9

t_j = the time, just below time t , for which data is available.

The burnup interpolation coefficient, p , is then calculated from:

$$p = \frac{\ln \left(E10'_{i+1,j} / E10'_{i,j} \right)}{\ln \left(B_{i+1} / B_i \right)}$$

And finally, the interpolated value of E10 corresponding to burnup B, and time t is:

$$E10 = E10'_{i,j} \left(\frac{B}{B_i} \right)^p$$

As was stated earlier in Section 6.0, when energy outputs are needed between any two times, neither of which is 10 years, the E10 for the smaller time is subtracted from the E10 for the larger time.

Note:

The following tables have been reduced in size for inclusion in this Appendix. Full size reproductions are available on request to the program office at ORNL. The computer software for producing these tables is also available on request.

CURIES/MTU VS COOLING

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	6.770E+05	2.900E+05	1.710E+05	1.180E+05	9.160E+04	7.770E+04	6.940E+04	6.400E+04	6.000E+04	5.690E+04	4.550E+04	4.290E+04	4.060E+04	3.860E+04	3.150E+04	2.470E+04	1.950E+04	1.540E+04	1.220E+04
10000	1.160E+06	5.430E+05	3.310E+05	2.340E+05	1.860E+05	1.600E+05	1.440E+05	1.330E+05	1.250E+05	1.190E+05	9.550E+04	8.990E+04	8.490E+04	7.410E+04	6.510E+04	5.070E+04	3.970E+04	3.130E+04	2.480E+04
15000	1.360E+06	6.980E+05	4.480E+05	3.300E+05	2.700E+05	2.360E+05	2.150E+05	2.010E+05	1.900E+05	1.810E+05	1.450E+05	1.370E+05	1.290E+05	1.120E+05	9.840E+04	7.620E+04	5.950E+04	4.650E+04	3.750E+04
20000	1.740E+06	9.100E+05	5.910E+05	4.590E+05	3.610E+05	3.170E+05	2.890E+05	2.700E+05	2.550E+05	2.430E+05	1.950E+05	1.840E+05	1.730E+05	1.510E+05	1.320E+05	1.020E+05	7.920E+04	6.220E+04	4.920E+04
25000	1.780E+06	9.930E+05	6.720E+05	5.160E+05	4.330E+05	3.850E+05	3.540E+05	3.320E+05	3.150E+05	3.000E+05	2.420E+05	2.280E+05	2.150E+05	1.870E+05	1.630E+05	1.260E+05	9.780E+04	7.670E+04	6.070E+04
30000	2.140E+06	1.190E+06	8.050E+05	6.170E+05	5.170E+05	4.590E+05	4.210E+05	3.950E+05	3.740E+05	3.570E+05	2.880E+05	2.710E+05	2.550E+05	2.220E+05	1.930E+05	1.490E+05	1.160E+05	9.110E+04	7.210E+04
35000	2.320E+06	1.300E+06	8.810E+05	6.760E+05	5.660E+05	5.030E+05	4.610E+05	4.320E+05	4.090E+05	3.910E+05	3.150E+05	2.960E+05	2.790E+05	2.420E+05	2.120E+05	1.630E+05	1.270E+05	9.960E+04	7.890E+04
35000	2.160E+06	1.250E+06	8.770E+05	6.900E+05	5.890E+05	5.290E+05	4.890E+05	4.600E+05	4.370E+05	4.180E+05	3.380E+05	3.180E+05	3.000E+05	2.600E+05	2.270E+05	1.750E+05	1.360E+05	1.070E+05	8.450E+04
40000	2.470E+06	1.430E+06	1.000E+06	7.860E+05	6.700E+05	6.000E+05	5.540E+05	5.210E+05	4.940E+05	4.730E+05	3.820E+05	3.600E+05	3.390E+05	2.940E+05	2.570E+05	1.980E+05	1.540E+05	1.210E+05	9.560E+04
45000	2.830E+06	1.470E+06	1.060E+06	8.450E+05	7.280E+05	6.560E+05	6.080E+05	5.720E+05	5.440E+05	5.200E+05	4.220E+05	3.970E+05	3.740E+05	3.250E+05	2.840E+05	2.190E+05	1.700E+05	1.340E+05	1.060E+05
50000	2.760E+06	1.650E+06	1.180E+06	9.370E+05	8.030E+05	7.220E+05	6.680E+05	6.280E+05	5.970E+05	5.710E+05	4.620E+05	4.350E+05	4.100E+05	3.560E+05	3.110E+05	2.400E+05	1.870E+05	1.470E+05	1.160E+05
35000	2.720E+06	1.680E+06	1.220E+06	9.880E+05	8.550E+05	7.730E+05	7.170E+05	6.750E+05	6.420E+05	6.140E+05	4.980E+05	4.690E+05	4.420E+05	3.840E+05	3.360E+05	2.590E+05	2.020E+05	1.590E+05	1.260E+05
40000	3.020E+06	1.850E+06	1.340E+06	1.080E+06	9.300E+05	8.390E+05	7.760E+05	7.310E+05	6.940E+05	6.640E+05	5.380E+05	5.060E+05	4.770E+05	4.150E+05	3.620E+05	2.790E+05	2.180E+05	1.710E+05	1.360E+05

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	9.740E+03	7.780E+03	6.220E+03	9.110E+02	3.610E+02	2.830E+02	2.580E+02	2.110E+02	1.790E+02	1.670E+02	1.530E+02	1.260E+02	6.960E+01	5.470E+01	4.440E+01	2.260E+01	1.650E+01	1.180E+01	7.530E+00
10000	1.970E+04	1.580E+04	1.270E+04	2.120E+03	9.980E+02	8.000E+02	7.140E+02	4.970E+02	3.520E+02	3.090E+02	2.740E+02	2.170E+02	1.090E+02	8.360E+01	6.630E+01	2.990E+01	1.940E+01	1.390E+01	9.330E+00
15000	2.950E+04	2.360E+04	1.900E+04	3.440E+03	1.740E+03	1.400E+03	1.230E+03	7.980E+02	5.090E+02	4.310E+02	3.740E+02	2.880E+02	1.630E+02	1.220E+02	9.820E+01	3.990E+01	2.780E+01	1.670E+01	1.160E+01
20000	3.920E+04	3.140E+04	2.530E+04	4.790E+03	2.500E+03	2.010E+03	1.760E+03	1.090E+03	6.550E+02	5.400E+02	4.610E+02	3.480E+02	1.560E+02	1.180E+02	9.270E+01	4.150E+01	2.860E+01	1.990E+01	1.400E+01
25000	4.940E+04	3.880E+04	3.130E+04	6.120E+03	3.240E+03	2.600E+03	2.260E+03	1.370E+03	7.840E+02	6.340E+02	5.340E+02	3.970E+02	1.720E+02	1.290E+02	1.020E+02	4.700E+01	3.090E+01	2.320E+01	1.650E+01
30000	5.740E+04	4.610E+04	3.730E+04	7.340E+03	3.900E+03	3.110E+03	2.690E+03	1.600E+03	9.030E+02	7.230E+02	6.050E+02	4.440E+02	1.860E+02	1.390E+02	1.090E+02	5.240E+01	3.540E+01	2.650E+01	1.870E+01
35000	6.280E+04	5.040E+04	4.080E+04	8.120E+03	4.300E+03	3.420E+03	2.950E+03	1.740E+03	9.690E+02	7.770E+02	6.430E+02	4.690E+02	1.940E+02	1.450E+02	1.150E+02	5.570E+01	3.830E+01	2.870E+01	2.020E+01
35000	6.730E+04	5.400E+04	4.370E+04	8.620E+03	4.560E+03	3.620E+03	3.120E+03	1.810E+03	9.690E+02	7.610E+02	6.330E+02	4.720E+02	2.050E+02	1.550E+02	1.230E+02	6.010E+01	4.190E+01	3.150E+01	2.190E+01
40000	7.620E+04	6.120E+04	4.950E+04	9.830E+03	5.170E+03	4.080E+03	3.500E+03	2.010E+03	1.070E+03	8.330E+02	6.920E+02	5.100E+02	2.180E+02	1.650E+02	1.310E+02	6.570E+01	4.570E+01	3.500E+01	2.420E+01
45000	8.440E+04	6.780E+04	5.490E+04	1.100E+04	5.730E+03	4.490E+03	3.840E+03	2.190E+03	1.160E+03	9.010E+02	7.460E+02	5.470E+02	2.300E+02	1.740E+02	1.390E+02	7.160E+01	5.190E+01	3.870E+01	2.640E+01
50000	9.270E+04	7.450E+04	6.030E+04	1.2800E+04	6.220E+03	4.840E+03	4.120E+03	2.330E+03	1.240E+03	9.640E+02	8.020E+02	5.840E+02	2.430E+02	1.830E+02	1.470E+02	7.740E+01	5.710E+01	4.220E+01	2.830E+01
25000	1.000E+05	8.070E+04	6.540E+04	1.310E+04	6.710E+03	5.180E+03	4.390E+03	2.490E+03	1.320E+03	1.030E+03	8.540E+02	6.190E+02	2.540E+02	1.920E+02	1.540E+02	8.330E+01	6.250E+01	4.580E+01	3.030E+01
40000	1.080E+05	8.720E+04	7.070E+04	1.410E+04	7.170E+03	5.300E+03	4.640E+03	2.630E+03	1.400E+03	1.090E+03	9.030E+02	6.520E+02	2.650E+02	2.000E+02	1.620E+02	8.910E+01	6.780E+01	4.930E+01	3.220E+01

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	6.300E+05	2.800E+05	1.670E+05	1.160E+05	9.110E+04	7.760E+04	6.960E+04	6.430E+04	6.040E+04	5.730E+04	4.590E+04	4.330E+04	4.090E+04	3.590E+04	3.170E+04	2.480E+04	1.950E+04	1.550E+04	1.230E+04
10000	9.250E+05	4.670E+05	2.960E+05	2.180E+05	1.780E+05	1.550E+05	1.410E+05	1.320E+05	1.240E+05	1.180E+05	9.520E+04	8.970E+04	8.470E+04	7.390E+04	6.490E+04	5.040E+04	3.940E+04	3.100E+04	2.460E+04
15000	1.080E+06	6.020E+05	4.060E+05	3.110E+05	2.610E+05	2.320E+05	2.130E+05	2.000E+05	1.890E+05	1.810E+05	1.460E+05	1.370E+05	1.300E+05	1.130E+05	9.850E+04	7.600E+04	5.920E+04	4.650E+04	3.680E+04
20000	1.450E+06	8.030E+05	5.430E+05	4.160E+05	3.490E+05	3.110E+05	2.850E+05	2.680E+05	2.540E+05	2.420E+05	1.950E+05	1.840E+05	1.730E+05	1.500E+05	1.310E+05	1.010E+05	7.850E+04	6.160E+04	4.870E+04
25000	1.570E+06	9.030E+05	6.300E+05	4.940E+05	4.210E+05	3.770E+05	3.480E+05	3.270E+05	3.110E+05	2.970E+05	2.400E+05	2.260E+05	2.130E+05	1.850E+05	1.610E+05	1.240E+05	9.840E+04	7.560E+04	5.980E+04
27500	1.720E+06	9.930E+05	6.920E+05	5.430E+05	4.620E+05	4.140E+05	3.820E+05	3.590E+05	3.410E+05	3.260E+05	2.630E+05	2.470E+05	2.330E+05	2.020E+05	1.760E+05	1.360E+05	1.050E+05	8.270E+04	6.540E+04
30000	1.610E+06	9.600E+05	6.890E+05	5.320E+05	4.770E+05	4.320E+05	4.010E+05	3.780E+05	3.600E+05	3.450E+05	2.800E+05	2.640E+05	2.490E+05	2.170E+05	1.900E+05	1.460E+05	1.140E+05	8.950E+04	7.080E+04
35000	1.660E+06	1.040E+06	7.620E+05	6.220E+05	5.430E+05	4.940E+05	4.600E+05	4.350E+05	4.150E+05	3.970E+05	3.230E+05	3.050E+05	2.870E+05	2.500E+05	2.180E+05	1.680E+05	1.310E+05	1.030E+05	8.150E+04
40000	1.990E+06	1.220E+06	8.880E+05	7.180E+05	6.230E+05	5.650E+05	5.250E+05	4.950E+05	4.720E+05	4.520E+05	3.670E+05	3.460E+05	3.260E+05	2.830E+05	2.470E+05	1.910E+05	1.480E+05	1.170E+05	9.230E+04

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	9.750E+03	7.780E+03	6.240E+03	9.520E+02	4.070E+02	3.280E+02	3.000E+02	2.390E+02	1.960E+02	1.810E+02	1.640E+02	1.340E+02	7.230E+01	5.620E+01	4.500E+01	2.130E+01	1.470E+01	1.080E+01	7.350E+00
10000	1.950E+04	1.560E+04	1.260E+04	2.190E+03	1.080E+03	8.850E+02	7.920E+02	5.460E+02	3.800E+02	3.320E+02	2.920E+02	2.290E+02	1.110E+02	8.460E+01	6.650E+01	2.850E+01	1.770E+01	1.320E+01	9.310E+00
15000	2.930E+04	2.340E+04	1.890E+04	3.610E+03	1.970E+03	1.570E+03	1.390E+03	8.830E+02	5.460E+02	4.560E+02	3.920E+02	2.990E+02	1.370E+02	1.030E+02	8.080E+01	3.450E+01	2.150E+01	1.640E+01	1.190E+01
20000	3.880E+04	3.110E+04	2.510E+04	4.980E+03	2.710E+03	2.210E+03	1.930E+03	1.190E+03	6.930E+02	5.650E+02	4.780E+02	3.570E+02	1.560E+02	1.160E+02	9.110E+01	4.000E+01	2.560E+01	1.980E+01	1.450E+01
25000	4.760E+04	3.820E+04	3.090E+04	6.270E+03	3.450E+03	2.780E+03	2.420E+03	1.450E+03	8.230E+02	6.610E+02	5.540E+02	4.070E+02	1.710E+02	1.270E+02	9.960E+01	4.540E+01	3.020E+01	2.340E+01	1.700E+01
27500	5.210E+04	4.180E+04	3.390E+04	6.920E+03	3.790E+03	3.060E+03	2.660E+03	1.580E+03	8.830E+02	7.040E+02	5.880E								

P COEFFT FOR CURIES ON BURNUP AT CONST COOLING

BAR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	7.76E-01	9.04E-01	9.52E-01	9.37E-01	1.02E+00	1.04E+00	1.05E+00	1.05E+00	1.05E+00	1.06E+00	1.07E+00	1.07E+00	1.06E+00	1.05E+00	1.04E+00	1.03E+00	1.02E+00	1.02E+00	1.02E+00
10000	3.92E-01	6.12E-01	7.46E-01	8.47E-01	9.19E-01	9.58E-01	9.88E-01	1.01E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00
15000	8.56E-01	9.31E-01	9.62E-01	9.92E-01	1.01E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00
20000	1.01E-01	3.91E-01	5.75E-01	7.24E-01	8.15E-01	8.70E-01	9.09E-01	9.26E-01	9.47E-01	9.43E-01	9.67E-01	9.69E-01	9.74E-01	9.58E-01	9.45E-01	9.47E-01	9.45E-01	9.39E-01	9.41E-01
25000	1.01E+00	9.92E-01	9.95E-01	9.85E-01	9.72E-01	9.63E-01	9.50E-01	9.33E-01	9.47E-01	9.54E-01	9.47E-01	9.35E-01	9.41E-01	9.26E-01	9.19E-01	9.16E-01	9.16E-01	9.15E-01	9.14E-01
30000	8.47E-01	9.27E-01	9.46E-01	9.58E-01	9.50E-01	9.40E-01	9.23E-01	9.39E-01	9.38E-01	9.54E-01	9.40E-01	9.25E-01	9.47E-01	9.05E-01	9.85E-01	9.42E-01	9.50E-01	9.35E-01	9.52E-01
33000	-1.21E+00	-6.66E-01	-7.75E-02	3.48E-01	6.77E-01	8.56E-01	1.00E+00	1.06E+00	1.12E+00	1.13E+00	1.18E+00	1.21E+00	1.23E+00	1.21E+00	1.16E+00	1.20E+00	1.14E+00	1.21E+00	1.18E+00
35000	1.00E+00	1.00E+00	9.82E-01	9.73E-01	9.65E-01	9.43E-01	9.34E-01	9.32E-01	9.18E-01	9.25E-01	9.16E-01	9.29E-01	9.13E-01	9.20E-01	9.29E-01	9.29E-01	9.30E-01	9.28E-01	9.24E-01
40000	-6.90E-02	2.34E-01	4.94E-01	6.14E-01	7.04E-01	7.57E-01	7.87E-01	7.92E-01	8.18E-01	8.04E-01	8.45E-01	8.30E-01	8.34E-01	8.51E-01	8.48E-01	8.55E-01	8.37E-01	8.66E-01	8.76E-01
45000	1.13E+00	1.09E+00	1.01E+00	9.80E-01	9.30E-01	9.09E-01	8.93E-01	8.84E-01	8.82E-01	8.80E-01	8.59E-01	8.47E-01	8.72E-01	8.44E-01	8.62E-01	8.69E-01	9.04E-01	8.78E-01	8.55E-01
50000	-1.52E-01	1.89E-01	3.49E-01	5.51E-01	6.58E-01	7.16E-01	7.42E-01	7.57E-01	7.62E-01	7.61E-01	7.87E-01	7.89E-01	7.88E-01	7.94E-01	8.11E-01	7.99E-01	8.09E-01	8.23E-01	8.67E-01
55000	1.20E+00	1.10E+00	1.07E+00	1.02E+00	9.66E-01	9.41E-01	9.08E-01	9.14E-01	8.91E-01	8.97E-01	8.87E-01	8.97E-01	8.72E-01	8.75E-01	8.92E-01	8.56E-01	8.59E-01	8.71E-01	8.77E-01
BAR	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.01E+00	1.02E+00	1.03E+00	1.21E+00	1.46E+00	1.49E+00	1.46E+00	1.23E+00	9.75E-01	8.87E-01	8.40E-01	7.84E-01	6.47E-01	6.12E-01	5.78E-01	4.03E-01	2.33E-01	2.34E-01	3.09E-01
10000	9.93E-01	9.89E-01	9.93E-01	1.19E+00	1.37E+00	1.38E+00	1.34E+00	1.16E+00	9.09E-01	8.20E-01	7.67E-01	6.98E-01	5.45E-01	5.14E-01	5.00E-01	4.51E-01	3.96E-01	4.52E-01	5.37E-01
15000	9.82E-01	9.92E-01	9.95E-01	1.15E+00	1.26E+00	1.25E+00	1.24E+00	1.09E+00	8.76E-01	7.87E-01	7.27E-01	6.57E-01	4.78E-01	4.72E-01	4.64E-01	5.03E-01	5.35E-01	5.91E-01	6.53E-01
20000	9.44E-01	9.48E-01	9.53E-01	1.09E+00	1.16E+00	1.15E+00	1.12E+00	1.02E+00	8.05E-01	7.19E-01	6.59E-01	5.90E-01	4.37E-01	4.28E-01	3.99E-01	4.28E-01	4.28E-01	4.28E-01	4.36E-01
25000	9.35E-01	9.43E-01	9.41E-01	1.01E+00	1.01E+00	9.82E-01	9.53E-01	8.51E-01	7.31E-01	7.20E-01	6.84E-01	6.13E-01	4.28E-01	4.05E-01	4.14E-01	5.96E-01	7.43E-01	7.29E-01	6.86E-01
30000	9.43E-01	9.35E-01	9.41E-01	1.03E+00	1.02E+00	9.96E-01	9.68E-01	8.80E-01	7.40E-01	6.74E-01	6.39E-01	5.74E-01	4.41E-01	4.43E-01	4.64E-01	6.40E-01	8.26E-01	8.36E-01	8.09E-01
35000	1.17E+00	1.17E+00	1.16E+00	1.01E+00	1.13E+00	1.09E-01	9.52E-01	8.70E-01	0.00E+00	-2.12E-01	-2.12E-01	-1.08E-01	9.37E-01	1.13E+00	1.14E+00	1.13E+00	1.38E+00	1.57E+00	1.57E+00
35000	9.30E-01	9.37E-01	9.33E-01	9.83E-01	9.40E-01	8.95E-01	8.60E-01	7.84E-01	7.42E-01	6.77E-01	6.43E-01	5.79E-01	4.60E-01	4.62E-01	4.71E-01	6.67E-01	8.12E-01	7.89E-01	7.47E-01
40000	8.67E-01	8.69E-01	8.79E-01	9.54E-01	8.73E-01	8.13E-01	7.87E-01	7.28E-01	6.85E-01	6.66E-01	6.57E-01	6.54E-01	5.49E-01	4.50E-01	5.03E-01	7.30E-01	8.93E-01	8.53E-01	7.58E-01
45000	8.90E-01	8.94E-01	8.90E-01	8.28E-01	7.78E-01	7.12E-01	6.68E-01	6.43E-01	6.30E-01	6.47E-01	6.20E-01	6.21E-01	5.21E-01	4.78E-01	5.31E-01	7.37E-01	9.06E-01	8.59E-01	8.59E-01
50000	7.93E-01	8.38E-01	8.51E-01	9.20E-01	7.95E-01	7.12E-01	6.66E-01	6.07E-01	6.56E-01	6.40E-01	6.59E-01	6.10E-01	4.64E-01	5.03E-01	4.88E-01	7.70E-01	9.48E-01	8.59E-01	7.16E-01
55000	8.84E-01	8.90E-01	8.95E-01	8.45E-01	7.62E-01	6.88E-01	6.38E-01	6.28E-01	6.78E-01	6.59E-01	6.41E-01	5.96E-01	4.87E-01	4.69E-01	5.82E-01	7.73E-01	9.35E-01	8.46E-01	6.99E-01
BAR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	5.54E-01	7.38E-01	8.33E-01	9.10E-01	9.64E-01	9.98E-01	1.01E+00	1.03E+00	1.03E+00	1.04E+00	1.05E+00	1.05E+00	1.05E+00	1.04E+00	1.03E+00	1.02E+00	1.01E+00	1.00E+00	1.00E+00
10000	3.82E-01	6.26E-01	7.62E-01	8.76E-01	9.43E-01	9.94E-01	1.01E+00	1.02E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00
15000	1.02E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.02E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00
20000	3.56E-01	5.26E-01	6.64E-01	7.70E-01	8.40E-01	8.62E-01	8.93E-01	9.17E-01	9.07E-01	9.17E-01	9.30E-01	9.21E-01	9.32E-01	9.39E-01	9.24E-01	9.19E-01	9.20E-01	9.17E-01	9.20E-01
25000	9.57E-01	9.96E-01	9.84E-01	9.92E-01	9.75E-01	9.82E-01	9.78E-01	9.79E-01	9.66E-01	9.77E-01	9.60E-01	9.32E-01	9.41E-01	9.22E-01	9.34E-01	9.69E-01	8.96E-01	9.41E-01	9.39E-01
27500	-7.59E-01	-3.88E-01	-4.99E-02	1.88E-01	3.67E-01	4.89E-01	5.57E-01	5.92E-01	6.23E-01	6.51E-01	7.19E-01	7.65E-01	7.63E-01	8.23E-01	8.79E-01	8.15E-01	9.45E-01	9.08E-01	9.18E-01
30000	1.90E-01	5.12E-01	6.53E-01	7.74E-01	8.40E-01	8.70E-01	8.90E-01	9.11E-01	9.22E-01	9.10E-01	9.26E-01	9.36E-01	9.21E-01	9.18E-01	8.91E-01	9.10E-01	9.01E-01	9.11E-01	9.13E-01
35000	1.33E+00	1.19E+00	1.14E+00	1.07E+00	1.02E+00	1.00E+00	9.89E-01	9.67E-01	9.63E-01	9.71E-01	9.56E-01	9.44E-01	9.54E-01	9.28E-01	9.35E-01	9.60E-01	9.13E-01	9.54E-01	9.31E-01
BAR	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.00E+00	1.00E+00	1.01E+00	1.20E+00	1.40E+00	1.43E+00	1.40E+00	1.17E+00	9.55E-01	8.75E-01	8.32E-01	7.73E-01	6.18E-01	5.90E-01	5.63E-01	4.20E-01	2.67E-01	2.89E-01	3.41E-01
10000	1.00E+00	1.00E+00	1.00E+00	1.23E+00	1.41E+00	1.41E+00	1.38E+00	1.18E+00	8.93E-01	7.82E-01	7.26E-01	6.57E-01	5.19E-01	4.85E-01	4.80E-01	4.12E-01	4.79E-01	5.33E-01	6.05E-01
15000	9.76E-01	9.88E-01	9.86E-01	1.11E+00	1.19E+00	1.18E+00	1.14E+00	1.03E+00	8.28E-01	7.45E-01	6.89E-01	6.16E-01	4.51E-01	4.13E-01	4.17E-01	5.14E-01	6.07E-01	6.89E-01	7.73E-01
20000	9.16E-01	9.21E-01	9.31E-01	1.03E+00	1.05E+00	1.02E+00	1.01E+00	0.85E+00	7.70E-01	7.03E-01	6.41E-01	5.87E-01	4.11E-01	4.06E-01	3.99E-01	5.67E-01	7.40E-01	7.86E-01	7.12E-01
25000	9.47E-01	9.44E-01	9.72E-01	1.03E+00	1.04E+00	1.00E+00	9.92E-01	9.69E-01	7.38E-01	6.61E-01	6.24E-01	5.76E-01	4.20E-01	4.05E-01	4.53E-01	6.27E-01	8.02E-01	8.19E-01	7.75E-01
27500	9.11E-01	8.98E-01	8.49E-01	8.27E-02	-5.39E-01	-6.96E-01	-7.13E-01	-5.97E-01	-4.10E-01	-3.14E-01	-2.78E-01	-2.43E-01	-6.47E-02	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01
30000	9.20E-01	9.21E-01	9.25E-01	1.09E+00	1.16E+00	1.11E+00	1.07E+00	9.62E-01	7.47E-01	6.56E-01	6.03E-01	5.46E-01	4.23E-01	3.78E-01	4.18E-01	6.91E-01	9.07E-01	9.05E-01	8.74E-01
35000	9.30E-01	9.44E-01	9.50E-01	1.04E+00	1.05E+00	1.00E+00	9.52E-01	8.18E-01	7.02E-01	5.97E-01	5.69E-01	5.21E-01	4.23E-01	4.63E-01	5.16E-01	7.45E-01	9.67E-01	9.38E-01	8.27E-01

TABLE 1C.2

M COEFFT FOR CURIES ON COOLING AT CONST BURNUP

FWR	1	2	3	4	5	6	7	8	9	10	15	18	20	25	30	40	50	60	70
5000	1.222E+00	1.300E+00	1.290E+00	1.133E+00	9.627E-01	7.323E-01	6.366E-01	5.479E-01	5.032E-01	4.757E-01	4.994E-01	5.220E-01	5.890E-01	6.711E-01	8.453E-01	1.057E+00	1.279E+00	1.511E+00	1.686E+00
10000	1.095E+00	1.221E+00	1.205E+00	1.029E+00	8.259E-01	6.833E-01	5.951E-01	5.267E-01	4.689E-01	4.68E-01	5.130E-01	5.451E-01	6.097E-01	7.192E-01	8.690E-01	1.084E+00	1.304E+00	1.510E+00	1.724E+00
15000	9.664E-01	1.087E+00	1.063E+00	8.993E-01	7.382E-01	6.046E-01	5.042E-01	4.778E-01	4.606E-01	4.818E-01	4.606E-01	5.711E-01	6.333E-01	7.101E-01	8.888E-01	1.107E+00	1.317E+00	1.524E+00	1.692E+00
20000	9.351E-01	1.065E+00	1.033E+00	8.767E-01	7.129E-01	5.999E-01	5.093E-01	4.853E-01	4.573E-01	4.682E-01	4.970E-01	5.851E-01	6.093E-01	7.376E-01	8.962E-01	1.134E+00	1.325E+00	1.521E+00	1.702E+00
25000	8.420E-01	9.630E-01	9.182E-01	7.859E-01	6.444E-01	5.446E-01	4.805E-01	4.463E-01	4.631E-01	4.571E-01	5.059E-01	5.572E-01	6.253E-01	7.534E-01	8.950E-01	1.133E+00	1.333E+00	1.518E+00	1.696E+00
30000	8.466E-01	9.640E-01	9.245E-01	7.924E-01	6.527E-01	5.606E-01	4.774E-01	4.463E-01	4.415E-01	4.570E-01	5.166E-01	5.776E-01	6.211E-01	7.678E-01	8.994E-01	1.122E+00	1.322E+00	1.517E+00	1.708E+00
35000	8.356E-01	9.595E-01	9.207E-01	7.959E-01	6.472E-01	5.656E-01	4.866E-01	4.645E-01	4.272E-01	4.599E-01	5.282E-01	5.614E-01	6.376E-01	7.299E-01	9.136E-01	1.118E+00	1.333E+00	1.520E+00	1.700E+00
35000	7.891E-01	8.740E-01	8.336E-01	7.093E-01	5.893E-01	5.101E-01	4.578E-01	4.335E-01	4.219E-01	4.520E-01	5.179E-01	5.530E-01	6.413E-01	7.445E-01	9.043E-01	1.130E+00	1.315E+00	1.531E+00	1.704E+00
40000	7.885E-01	8.821E-01	8.370E-01	7.156E-01	6.052E-01	5.174E-01	4.599E-01	4.518E-01	4.123E-01	4.546E-01	5.056E-01	5.705E-01	6.382E-01	7.377E-01	9.066E-01	1.124E+00	1.322E+00	1.528E+00	1.697E+00
45000	7.370E-01	8.065E-01	7.880E-01	6.679E-01	5.712E-01	4.929E-01	4.571E-01	4.261E-01	4.282E-01	4.443E-01	5.183E-01	5.664E-01	6.292E-01	7.396E-01	9.034E-01	1.133E+00	1.308E+00	1.521E+00	1.707E+00
50000	7.422E-01	8.289E-01	8.015E-01	6.916E-01	5.832E-01	5.043E-01	4.624E-01	4.298E-01	4.226E-01	4.507E-01	5.113E-01	5.618E-01	6.329E-01	7.412E-01	9.008E-01	1.118E+00	1.320E+00	1.534E+00	1.679E+00
55000	6.951E-01	7.891E-01	7.332E-01	6.479E-01	5.530E-01	4.879E-01	4.521E-01	4.256E-01	4.232E-01	4.435E-01	5.094E-01	5.628E-01	6.304E-01	7.324E-01	9.043E-01	1.114E+00	1.313E+00	1.509E+00	1.731E+00
60000	7.070E-01	7.954E-01	7.498E-01	6.701E-01	5.648E-01	5.044E-01	4.474E-01	4.410E-01	4.194E-01	4.477E-01	5.206E-01	5.602E-01	6.240E-01	7.494E-01	9.053E-01	1.106E+00	1.332E+00	1.486E+00	1.726E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000
5000	1.908E+00	2.124E+00	2.771E+00	2.283E+00	8.462E-01	4.145E-01	2.901E-01	2.573E-01	1.711E-01	1.714E-01	2.801E-01	5.402E-01	8.374E-01	9.349E-01	9.742E-01	4.539E-01	3.659E-01	6.481E-01
10000	1.873E+00	2.073E+00	2.583E+00	1.858E+00	7.687E-01	5.097E-01	5.227E-01	4.977E-01	3.213E-01	2.353E-01	3.365E-01	6.267E-01	9.222E-01	1.039E+00	1.149E+00	6.241E-01	3.638E-01	5.751E-01
15000	1.895E+00	2.058E+00	2.466E+00	1.681E+00	7.357E-01	6.487E-01	6.242E-01	6.487E-01	4.102E-01	2.777E-01	4.803E-01	6.830E-01	9.661E-01	1.066E+00	1.177E+00	6.350E-01	3.398E-01	5.257E-01
20000	1.884E+00	2.050E+00	2.401E+00	1.604E+00	7.583E-01	5.952E-01	6.912E-01	7.348E-01	4.742E-01	3.094E-01	4.057E-01	7.303E-01	9.704E-01	1.081E+00	1.159E+00	6.417E-01	3.222E-01	5.001E-01
25000	1.877E+00	2.039E+00	2.335E+00	1.569E+00	7.649E-01	6.281E-01	7.221E-01	8.053E-01	5.257E-01	3.360E-01	4.277E-01	7.614E-01	1.000E+00	1.052E+00	1.118E+00	6.051E-01	3.128E-01	4.917E-01
30000	1.861E+00	2.010E+00	2.341E+00	1.566E+00	7.868E-01	6.302E-01	7.495E-01	8.253E-01	5.483E-01	3.488E-01	4.448E-01	7.920E-01	1.012E+00	1.049E+00	1.070E+00	5.659E-01	3.140E-01	5.030E-01
35000	1.848E+00	2.006E+00	2.329E+00	1.568E+00	7.959E-01	6.625E-01	7.616E-01	8.445E-01	5.637E-01	3.554E-01	4.552E-01	8.033E-01	1.012E+00	1.039E+00	1.046E+00	5.403E-01	3.149E-01	5.067E-01
35000	1.869E+00	2.009E+00	2.342E+00	1.570E+00	8.024E-01	6.661E-01	7.856E-01	9.014E-01	5.959E-01	3.543E-01	4.280E-01	7.991E-01	1.036E+00	1.033E+00	1.036E+00	5.204E-01	3.114E-01	5.244E-01
40000	1.861E+00	2.014E+00	2.352E+00	1.583E+00	8.230E-01	6.872E-01	8.002E-01	9.096E-01	6.175E-01	3.630E-01	4.403E-01	8.736E-01	1.094E+00	1.096E+00	9.956E-01	4.925E-01	3.147E-01	5.292E-01
45000	1.859E+00	2.003E+00	2.319E+00	1.608E+00	8.477E-01	7.008E-01	8.102E-01	9.168E-01	6.232E-01	3.696E-01	4.476E-01	7.986E-01	9.699E-01	1.006E+00	9.571E-01	4.642E-01	3.203E-01	5.318E-01
50000	1.856E+00	2.007E+00	2.329E+00	1.621E+00	8.720E-01	7.218E-01	8.100E-01	9.222E-01	6.082E-01	3.703E-01	4.576E-01	7.981E-01	9.857E-01	9.817E-01	9.254E-01	4.388E-01	3.300E-01	5.764E-01
55000	1.821E+00	1.995E+00	2.320E+00	1.650E+00	8.996E-01	7.416E-01	8.181E-01	9.156E-01	6.118E-01	3.668E-01	4.643E-01	8.106E-01	9.727E-01	9.883E-01	9.883E-01	4.183E-01	3.393E-01	5.906E-01
60000	1.816E+00	1.991E+00	2.326E+00	1.668E+00	9.217E-01	7.620E-01	8.191E-01	9.096E-01	6.173E-01	3.684E-01	4.699E-01	8.193E-01	9.782E-01	9.443E-01	8.625E-01	3.941E-01	3.477E-01	6.143E-01

FWR	1	2	3	4	5	6	7	8	9	10	15	18	20	25	30	40	50	60	70
5000	1.170E+00	1.273E+00	1.267E+00	1.083E+00	8.797E-01	7.058E-01	5.932E-01	5.312E-01	5.001E-01	4.720E-01	4.931E-01	5.412E-01	5.843E-01	6.824E-01	8.533E-01	1.077E+00	1.299E+00	1.500E+00	1.740E+00
10000	9.860E-01	1.108E+00	1.087E+00	9.084E-01	7.589E-01	6.141E-01	4.940E-01	5.308E-01	4.707E-01	4.568E-01	5.052E-01	5.444E-01	6.113E-01	7.123E-01	8.787E-01	1.103E+00	1.315E+00	1.500E+00	1.740E+00
15000	8.432E-01	9.715E-01	9.266E-01	7.853E-01	6.460E-01	5.543E-01	4.716E-01	4.803E-01	4.105E-01	4.572E-01	5.402E-01	4.978E-01	6.281E-01	7.532E-01	9.014E-01	1.120E+00	1.324E+00	1.518E+00	1.707E+00
20000	8.526E-01	9.649E-01	9.261E-01	7.870E-01	6.323E-01	5.644E-01	4.604E-01	4.535E-01	4.593E-01	4.594E-01	4.930E-01	5.851E-01	6.393E-01	7.429E-01	9.040E-01	1.129E+00	1.330E+00	1.524E+00	1.702E+00
25000	7.980E-01	8.879E-01	8.453E-01	7.164E-01	6.055E-01	5.192E-01	4.661E-01	4.259E-01	4.572E-01	4.534E-01	5.103E-01	5.623E-01	6.316E-01	7.621E-01	9.077E-01	1.128E+00	1.333E+00	1.521E+00	1.709E+00
27500	7.923E-01	8.907E-01	8.429E-01	7.239E-01	6.017E-01	5.219E-01	4.650E-01	4.367E-01	4.270E-01	4.539E-01	5.329E-01	5.538E-01	6.398E-01	7.557E-01	8.962E-01	1.159E+00	1.309E+00	1.523E+00	1.703E+00
30000	7.460E-01	8.181E-01	7.706E-01	6.544E-01	5.433E-01	4.833E-01	4.423E-01	4.142E-01	4.039E-01	4.442E-01	4.998E-01	5.552E-01	6.164E-01	7.288E-01	9.157E-01	1.109E+00	1.327E+00	1.520E+00	1.703E+00
35000	6.744E-01	7.671E-01	7.057E-01	6.087E-01	5.187E-01	4.626E-01	4.185E-01	3.996E-01	4.207E-01	4.389E-01	4.868E-01	5.773E-01	6.183E-01	7.512E-01	9.056E-01	1.115E+00	1.319E+00	1.519E+00	1.694E+00
40000	7.059E-01	7.854E-01	7.387E-01	6.360E-01	5.340E-01	4.743E-01	4.406E-01	4.040E-01	4.109E-01	4.432E-01	5.003E-01	5.651E-01	6.339E-01	7.463E-01	8.937E-01	1.143E+00	1.289E+00	1.538E+00	1.693E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000
5000	1.916E+00	2.094E+00	2.713E+00	2.096E+00	7.501E-01	3.999E-01	3.280E-01	2.862E-01	1.944E-01	1.931E-01	2.915E-01	5.616E-01	8.756E-01	9.960E-01	1.079E+00	5.350E-01	3.365E-01	5.352E-01
10000	1.895E+00	2.027E+00	2.524E+00	1.744E+00	6.922E-01	4.976E-01	5.366E-01	5.229E-01	3.330E-01	2.513E-01	3.906E-01	6.992E-01	9.441E-01	1.079E+00	1.222E+00	6.872E-01	3.201E-01	5.037E-01
15000	1.909E+00	2.027E+00	2.388E+00	1.557E+00	6.996E-01	6.357E-01	6.546E-01	6.933E-01	4.442E-01	4.611E-01	5.907E-01	7.104E-01	9.916E-01	1.088E+00	1.228E+00	6.823E-01	2.953E-01	4.627E-01
20000	1.878E+00	2.034E+00	2.333E+00	1.501E+00	7.090E-01	6.071E-01	6.976E-01	7.800E-01	5.036E-01	3.275E-01	4.211E-01	7.336E-01	1.030E+00	1.083E+00	1.187E+00	6.439E-01	2.804E-01	4.494E-01
25000	1.868E+00	2.013E+00	2.301E+00	1.488E+00	7.304E-01	6.213E-01	7.390E-01	8.171E-01	5.406E-01	3.457E-01	4.449E-01	7.893E-01	1.034E+00	1.089E+00	1.133E+00	5.881E-01	2.784E-01	4.610E-01
27500	1.870E+00	1.988E+00	2.292E+00	1.485E+00	7.437E-01	6.278E-01	7.515E-01	8.394E-01	5.987E-01	3.525E-01	4.515E-01	8.028E-01	1.039E+00	1.068E+00	1.109E+00	5.642E-01	2.767E-01	4.673E-01
30000	1.879E+00	2.029E+00	2.389E+00	1.623E+00	7.370E-01	6.341E-01	7.370E-01	8.160E-01	5.381E-01	3.461E-01	4.472E-01	7.887E-01	9.935E-01	1.050E+00	1.050E+00	5.223E-01	3.047E-01	5.138E-01
35000	1.878E+00	2.023E+00	2.351E+00	1.596E+00	8.121E-01													

NEUTS/MTU VS COOLING

PMR	1	2	3	4	5	6	7	8	9	10	15	18	20	25	30	40	50	60	70
5000	4.431E+05	4.008E+05	3.954E+05	3.981E+05	4.022E+05	4.066E+05	4.107E+05	4.147E+05	4.184E+05	4.220E+05	4.377E+05	4.444E+05	4.465E+05	4.571E+05	4.634E+05	4.71E+05	4.744E+05	4.752E+05	4.743E+05
10000	2.816E+06	1.804E+06	1.598E+06	1.563E+06	1.563E+06	1.569E+06	1.577E+06	1.585E+06	1.592E+06	1.599E+06	1.627E+06	1.634E+06	1.639E+06	1.649E+06	1.663E+06	1.692E+06	1.611E+06	1.592E+06	1.592E+06
15000	1.598E+07	8.463E+06	6.766E+06	6.346E+06	6.171E+06	6.053E+06	5.954E+06	5.858E+06	5.766E+06	5.676E+06	5.194E+06	5.053E+06	4.920E+06	4.622E+06	4.367E+06	3.962E+06	3.664E+06	3.443E+06	3.277E+06
20000	4.561E+07	2.827E+07	2.405E+07	2.264E+07	2.184E+07	2.119E+07	2.059E+07	2.001E+07	1.946E+07	1.892E+07	1.609E+07	1.525E+07	1.452E+07	1.285E+07	1.146E+07	9.326E+06	7.634E+06	6.786E+06	6.045E+06
25000	1.098E+08	7.647E+07	6.763E+07	6.404E+07	6.164E+07	5.954E+07	5.757E+07	5.569E+07	5.387E+07	5.212E+07	4.289E+07	4.025E+07	3.780E+07	3.241E+07	2.794E+07	1.847E+07	1.323E+07	1.098E+07	9.798E+06
30000	2.366E+08	1.776E+08	1.606E+08	1.527E+08	1.468E+08	1.416E+08	1.366E+08	1.318E+08	1.272E+08	1.228E+08	9.954E+07	9.288E+07	8.671E+07	7.318E+07	6.198E+07	4.503E+07	3.337E+07	2.537E+07	1.988E+07
35000	3.472E+08	2.734E+08	2.505E+08	2.388E+08	2.297E+08	2.214E+08	2.133E+08	2.057E+08	1.984E+08	1.915E+08	1.543E+08	1.437E+08	1.341E+08	1.126E+08	9.480E+07	6.793E+07	4.946E+07	3.682E+07	2.813E+07
35000	2.580E+08	1.926E+08	1.737E+08	1.633E+08	1.590E+08	1.533E+08	1.479E+08	1.428E+08	1.378E+08	1.331E+08	1.080E+08	1.008E+08	9.414E+07	7.954E+07	6.744E+07	4.913E+07	3.655E+07	2.789E+07	2.192E+07
40000	4.572E+08	3.614E+08	3.316E+08	3.161E+08	3.040E+08	2.929E+08	2.824E+08	2.723E+08	2.624E+08	2.533E+08	2.041E+08	1.900E+08	1.770E+08	1.484E+08	1.248E+08	8.904E+07	6.435E+07	4.776E+07	3.622E+07
45000	7.398E+08	6.133E+08	5.722E+08	5.470E+08	5.262E+08	5.069E+08	4.885E+08	4.708E+08	4.537E+08	4.373E+08	3.511E+08	3.265E+08	3.037E+08	2.536E+08	2.123E+08	1.498E+08	1.071E+08	7.782E+07	5.776E+07
50000	1.161E+09	9.940E+08	9.311E+08	8.913E+08	8.574E+08	8.258E+08	7.956E+08	7.665E+08	7.385E+08	7.116E+08	5.701E+08	5.297E+08	4.923E+08	4.103E+08	3.426E+08	2.402E+08	1.703E+08	1.225E+08	8.970E+07
55000	1.687E+09	1.489E+09	1.405E+09	1.347E+09	1.294E+09	1.243E+09	1.202E+09	1.158E+09	1.116E+09	1.075E+09	8.603E+08	7.990E+08	7.423E+08	6.181E+08	5.154E+08	3.605E+08	2.546E+08	1.823E+08	1.338E+08
60000	2.413E+09	2.163E+09	2.047E+09	1.946E+09	1.889E+09	1.819E+09	1.751E+09	1.687E+09	1.625E+09	1.565E+09	1.252E+09	1.183E+09	1.080E+09	8.968E+08	7.492E+08	5.234E+08	3.692E+08	2.633E+08	1.918E+08

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	4.726E+05	4.703E+05	4.678E+05	4.422E+05	4.217E+05	4.049E+05	3.908E+05	3.631E+05	2.974E+05	2.719E+05	2.345E+05	1.688E+05	6.942E+04	5.342E+04	4.411E+04	2.728E+04	2.299E+04	1.983E+04	1.684E+04
10000	1.573E+06	1.554E+06	1.537E+06	1.292E+06	1.249E+06	1.209E+06	1.140E+06	9.186E+05	7.328E+05	6.524E+05	5.501E+05	3.781E+05	1.346E+05	1.012E+05	8.328E+04	5.251E+04	4.199E+04	3.151E+04	2.624E+04
15000	3.150E+06	3.051E+06	2.972E+06	2.576E+06	2.351E+06	2.177E+06	2.035E+06	1.586E+06	1.252E+06	1.088E+06	9.153E+05	6.294E+05	2.335E+05	1.853E+05	1.594E+05	1.151E+05	9.344E+04	6.236E+04	3.564E+04
20000	5.517E+06	5.133E+06	4.853E+06	3.880E+06	3.505E+06	3.228E+06	3.005E+06	2.317E+06	1.785E+06	1.575E+06	1.328E+06	9.247E+05	3.790E+05	3.122E+05	2.785E+05	2.190E+05	1.799E+05	1.138E+05	5.748E+04
25000	9.413E+06	8.313E+06	7.531E+06	5.310E+06	4.748E+06	4.357E+06	4.057E+06	3.120E+06	2.408E+06	2.127E+06	1.800E+06	1.270E+06	5.881E+05	4.857E+05	4.441E+05	3.649E+05	3.037E+05	1.870E+05	8.820E+04
30000	1.608E+07	1.344E+07	1.160E+07	6.940E+06	6.160E+06	5.656E+06	5.271E+06	4.123E+06	3.200E+06	2.818E+06	2.418E+06	1.706E+06	7.994E+05	6.980E+05	6.477E+05	5.501E+05	4.571E+05	2.774E+05	1.258E+05
35000	2.214E+07	1.801E+07	1.519E+07	8.185E+06	7.242E+06	6.662E+06	6.223E+06	4.924E+06	3.894E+06	3.451E+06	2.902E+06	2.028E+06	9.568E+05	8.428E+05	7.849E+05	6.758E+05	5.624E+05	3.593E+05	1.515E+05
35000	1.779E+07	1.492E+07	1.291E+07	7.724E+06	6.783E+06	6.174E+06	5.710E+06	4.346E+06	3.321E+06	2.928E+06	2.477E+06	1.784E+06	8.360E+05	7.520E+05	6.995E+05	5.943E+05	4.941E+05	2.998E+05	1.337E+05
40000	2.827E+07	2.278E+07	1.898E+07	9.754E+06	8.533E+06	7.798E+06	7.248E+06	5.652E+06	4.413E+06	3.896E+06	3.273E+06	2.292E+06	1.115E+06	9.914E+05	9.298E+05	8.024E+05	6.683E+05	4.023E+05	1.782E+05
45000	4.398E+07	3.449E+07	2.794E+07	1.267E+07	1.109E+07	1.021E+07	9.568E+06	7.699E+06	6.160E+06	5.436E+06	4.699E+06	3.037E+06	1.406E+06	1.254E+06	1.182E+06	1.030E+06	8.590E+05	5.141E+05	2.242E+05
50000	6.724E+07	5.183E+07	4.121E+07	1.710E+07	1.509E+07	1.406E+07	1.330E+07	1.109E+07	9.089E+06	8.004E+06	6.899E+06	4.617E+06	1.741E+06	1.546E+06	1.459E+06	1.279E+06	1.068E+06	6.360E+05	2.741E+05
55000	9.888E+07	7.563E+07	5.964E+07	2.392E+07	2.017E+07	1.827E+07	1.727E+07	1.656E+07	1.382E+07	1.213E+07	9.665E+06	5.868E+06	2.128E+06	1.866E+06	1.760E+06	1.529E+06	1.294E+06	7.674E+05	3.274E+05
60000	1.425E+08	1.088E+08	8.561E+07	3.441E+07	3.120E+07	2.971E+07	2.863E+07	2.519E+07	2.128E+07	1.862E+07	1.461E+07	8.450E+06	2.609E+06	2.248E+06	2.112E+06	1.864E+06	1.555E+06	9.180E+05	3.876E+05

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	5.839E+05	4.840E+05	4.684E+05	4.703E+05	4.757E+05	4.816E+05	4.873E+05	4.928E+05	4.985E+05	5.029E+05	5.274E+05	5.339E+05	5.397E+05	5.513E+05	5.602E+05	5.709E+05	5.737E+05	5.769E+05	5.760E+05
10000	5.843E+06	2.954E+06	2.537E+06	2.204E+06	2.175E+06	2.164E+06	2.160E+06	2.156E+06	2.151E+06	2.147E+06	2.117E+06	2.106E+06	2.095E+06	2.067E+06	2.039E+06	1.987E+06	1.937E+06	1.898E+06	1.861E+06
15000	2.253E+07	1.291E+07	1.068E+07	1.003E+07	9.718E+06	9.483E+06	9.274E+06	9.073E+06	8.879E+06	8.692E+06	7.696E+06	7.407E+06	7.137E+06	6.537E+06	6.032E+06	5.247E+06	4.685E+06	4.282E+06	3.968E+06
20000	7.263E+07	4.575E+07	3.910E+07	3.677E+07	3.538E+07	3.423E+07	3.316E+07	3.214E+07	3.116E+07	3.021E+07	2.521E+07	2.377E+07	2.244E+07	1.951E+07	1.707E+07	1.336E+07	1.078E+07	8.992E+06	7.740E+06
25000	1.734E+08	1.230E+08	1.094E+08	1.034E+08	9.960E+07	9.608E+07	9.277E+07	8.959E+07	8.654E+07	8.359E+07	6.809E+07	6.366E+07	5.955E+07	5.053E+07	4.305E+07	3.173E+07	2.394E+07	1.858E+07	1.488E+07
27500	2.532E+08	1.884E+08	1.701E+08	1.616E+08	1.554E+08	1.498E+08	1.443E+08	1.394E+08	1.346E+08	1.299E+08	1.051E+08	9.807E+07	9.151E+07	7.714E+07	6.524E+07	4.724E+07	3.487E+07	2.641E+07	2.057E+07
30000	1.902E+08	1.368E+08	1.222E+08	1.159E+08	1.114E+08	1.075E+08	1.037E+08	1.002E+08	9.675E+07	9.345E+07	7.604E+07	7.109E+07	6.647E+07	5.633E+07	4.797E+07	3.526E+07	2.653E+07	2.051E+07	1.636E+07
35000	3.537E+08	2.813E+08	2.588E+08	2.448E+08	2.374E+08	2.288E+08	2.207E+08	2.128E+08	2.053E+08	1.980E+08	1.597E+08	1.488E+08	1.387E+08	1.164E+08	9.805E+07	7.024E+07	5.118E+07	3.811E+07	2.912E+07
40000	6.574E+08	5.388E+08	4.991E+08	4.767E+08	4.583E+08	4.417E+08	4.256E+08	4.102E+08	3.954E+08	3.811E+08	3.060E+08	2.846E+08	2.647E+08	2.212E+08	1.853E+08	1.308E+08	9.357E+07	6.807E+07	5.061E+07

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	5.738E+05	5.709E+05	5.677E+05	5.340E+05	5.064E+05	4.837E+05	4.643E+05	4.000E+05	3.406E+05	3.096E+05	2.658E+05	1.892E+05	7.482E+04	5.673E+04	4.662E+04	2.802E+04	2.307E+04	1.995E+04	1.701E+04
10000	1.830E+06	1.801E+06	1.776E+06	1.604E+06	1.483E+06	1.387E+06	1.307E+06	1.049E+06	8.371E+05	7.445E+05	6.269E+05	4.296E+05	1.527E+05	1.157E+05	9.608E+04	6.251E+04	4.989E+04	3.623E+04	2.434E+04
15000	3.772E+06	3.610E+06	3.486E+06	2.957E+06	2.692E+06	2.488E+06	2.321E+06	1.794E+06	1.386E+06	1.222E+06	1.029E+06	7.104E+05	2.747E+05	2.200E+05	1.920E+05	1.169E+05	7.631E+04	4.164E+04	2.639E+04
20000	6.860E+06	6.233E+06	5.785E+06	4.395E+06	3.958E+06	3.640E+06	3.387E+06	2.608E+06	2.008E+06	1.772E+06	1.497E+06	1.051E+06	4.508E+05	3.785E+05	3.421E+05	2.762E+05	2.277E+05	1.419E+05	6.931E+04
25000	1.232E+07	1.053E+07	9.280E+06	5.992E+06	5.342E+06	4.906E+06	4.567E+06	3.547E+06	2.760E+06	2.443E+06	2.066E+06	1.463E+06	6.779E+05	5.874E+05	5.422E+05	4.538E+05	3.781E+05	2.307E+05	1.063E+05
27500	1.634E+07	1.375E+07	1.180E+07	6.941E+06	6.163E+06	5.663E+06	5.278E+06												

P COEFF FOR NEUTRONS ON BURNUP

PWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	2.661E+00	2.170E+00	2.015E+00	1.973E+00	1.959E+00	1.948E+00	1.941E+00	1.935E+00	1.928E+00	1.922E+00	1.898E+00	1.878E+00	1.869E+00	1.848E+00	1.831E+00	1.802E+00	1.780E+00	1.761E+00	1.747E+00
10000	4.283E+00	3.813E+00	3.567E+00	3.456E+00	3.387E+00	3.331E+00	3.277E+00	3.228E+00	3.174E+00	3.124E+00	2.863E+00	2.784E+00	2.711E+00	2.546E+00	2.402E+00	2.171E+00	1.999E+00	1.873E+00	1.781E+00
15000	3.645E+00	4.192E+00	4.398E+00	4.421E+00	4.393E+00	4.354E+00	4.313E+00	4.270E+00	4.228E+00	4.185E+00	3.930E+00	3.846E+00	3.762E+00	3.554E+00	3.354E+00	2.978E+00	2.642E+00	2.357E+00	2.128E+00
20000	3.937E+00	4.497E+00	4.633E+00	4.660E+00	4.650E+00	4.630E+00	4.608E+00	4.587E+00	4.565E+00	4.541E+00	4.394E+00	4.341E+00	4.288E+00	4.146E+00	3.994E+00	3.670E+00	3.330E+00	2.992E+00	2.675E+00
25000	4.211E+00	4.622E+00	4.744E+00	4.766E+00	4.760E+00	4.753E+00	4.739E+00	4.725E+00	4.712E+00	4.701E+00	4.618E+00	4.586E+00	4.554E+00	4.467E+00	4.370E+00	4.143E+00	3.876E+00	3.575E+00	3.256E+00
30000	4.024E+00	4.526E+00	4.664E+00	4.692E+00	4.697E+00	4.690E+00	4.686E+00	4.681E+00	4.675E+00	4.662E+00	4.613E+00	4.594E+00	4.575E+00	4.521E+00	4.459E+00	4.309E+00	4.122E+00	3.900E+00	3.642E+00
33000	-5.047E+00	-5.954E+00	-6.203E+00	-6.253E+00	-6.252E+00	-6.247E+00	-6.239E+00	-6.219E+00	-6.212E+00	-6.183E+00	-6.085E+00	-6.050E+00	-6.013E+00	-5.907E+00	-5.787E+00	-5.699E+00	-5.614E+00	-4.721E+00	-4.239E+00
35000	4.285E+00	4.713E+00	4.834E+00	4.853E+00	4.854E+00	4.849E+00	4.844E+00	4.834E+00	4.827E+00	4.819E+00	4.767E+00	4.747E+00	4.728E+00	4.670E+00	4.607E+00	4.453E+00	4.257E+00	4.028E+00	3.761E+00
40000	4.086E+00	4.518E+00	4.632E+00	4.654E+00	4.658E+00	4.657E+00	4.653E+00	4.649E+00	4.642E+00	4.636E+00	4.606E+00	4.597E+00	4.589E+00	4.549E+00	4.511E+00	4.417E+00	4.299E+00	4.143E+00	3.962E+00
45000	4.277E+00	4.552E+00	4.621E+00	4.634E+00	4.634E+00	4.632E+00	4.629E+00	4.626E+00	4.621E+00	4.621E+00	4.601E+00	4.593E+00	4.585E+00	4.547E+00	4.542E+00	4.481E+00	4.402E+00	4.306E+00	4.178E+00
50000	3.921E+00	4.240E+00	4.317E+00	4.333E+00	4.333E+00	4.333E+00	4.330E+00	4.329E+00	4.329E+00	4.329E+00	4.317E+00	4.313E+00	4.309E+00	4.299E+00	4.285E+00	4.260E+00	4.219E+00	4.171E+00	4.117E+00
55000	4.123E+00	4.291E+00	4.323E+00	4.334E+00	4.330E+00	4.330E+00	4.328E+00	4.328E+00	4.318E+00	4.316E+00	4.312E+00	4.310E+00	4.309E+00	4.303E+00	4.299E+00	4.285E+00	4.271E+00	4.247E+00	4.225E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.733E+00	1.724E+00	1.716E+00	1.699E+00	1.615E+00	1.578E+00	1.545E+00	1.418E+00	1.301E+00	1.263E+00	1.230E+00	1.163E+00	9.333E-01	9.218E-01	9.169E-01	9.447E-01	8.690E-01	6.667E-01	4.013E-01
10000	1.713E+00	1.644E+00	1.626E+00	1.511E+00	1.476E+00	1.451E+00	1.429E+00	1.333E+00	1.281E+00	1.261E+00	1.254E+00	1.257E+00	1.390E+00	1.492E+00	1.601E+00	1.936E+00	1.973E+00	1.694E+00	1.163E+00
15000	1.948E+00	1.810E+00	1.706E+00	1.624E+00	1.388E+00	1.349E+00	1.355E+00	1.318E+00	1.289E+00	1.284E+00	1.294E+00	1.337E+00	1.654E+00	1.813E+00	1.940E+00	2.234E+00	2.277E+00	2.091E+00	1.661E+00
20000	2.395E+00	2.159E+00	1.967E+00	1.906E+00	1.360E+00	1.344E+00	1.337E+00	1.333E+00	1.342E+00	1.346E+00	1.343E+00	1.422E+00	1.818E+00	1.981E+00	2.091E+00	2.312E+00	2.347E+00	2.226E+00	1.919E+00
25000	2.934E+00	2.632E+00	2.369E+00	1.648E+00	1.428E+00	1.431E+00	1.445E+00	1.529E+00	1.611E+00	1.611E+00	1.629E+00	1.619E+00	1.619E+00	1.869E+00	2.070E+00	2.221E+00	2.243E+00	2.163E+00	1.948E+00
30000	3.355E+00	3.071E+00	2.794E+00	1.731E+00	1.698E+00	1.718E+00	1.742E+00	1.863E+00	1.962E+00	1.964E+00	1.914E+00	1.814E+00	1.884E+00	1.978E+00	2.043E+00	2.159E+00	2.175E+00	2.113E+00	1.950E+00
33000	-3.718E+00	-3.199E+00	-2.708E+00	-9.852E-01	-1.113E+00	-1.293E+00	-1.462E+00	-2.122E+00	-2.702E+00	-2.806E+00	-2.691E+00	-2.370E+00	-1.892E+00	-1.437E+00	-2.001E+00	-2.184E+00	-2.200E+00	-2.103E+00	-1.872E+00
35000	3.449E+00	3.169E+00	2.884E+00	1.749E+00	1.719E+00	1.749E+00	1.780E+00	1.969E+00	2.144E+00	2.087E+00	1.968E+00	1.961E+00	1.980E+00	2.288E+00	2.070E+00	2.131E+00	2.202E+00	2.202E+00	2.040E+00
40000	3.752E+00	3.522E+00	3.283E+00	2.219E+00	2.223E+00	2.288E+00	2.358E+00	2.624E+00	2.832E+00	2.828E+00	2.701E+00	2.390E+00	1.969E+00	1.995E+00	2.038E+00	2.120E+00	2.131E+00	2.082E+00	1.950E+00
45000	4.029E+00	3.866E+00	3.688E+00	2.946E+00	2.923E+00	3.037E+00	3.126E+00	3.464E+00	3.692E+00	3.672E+00	3.491E+00	3.002E+00	2.023E+00	1.987E+00	1.998E+00	2.053E+00	2.067E+00	2.020E+00	1.907E+00
50000	4.044E+00	3.965E+00	3.882E+00	3.532E+00	3.670E+00	3.786E+00	3.890E+00	4.207E+00	4.397E+00	4.362E+00	4.164E+00	3.592E+00	2.106E+00	1.982E+00	1.968E+00	2.016E+00	2.014E+00	1.971E+00	1.864E+00
55000	4.200E+00	4.179E+00	4.150E+00	4.143E+00	4.328E+00	4.451E+00	4.530E+00	4.821E+00	4.961E+00	4.925E+00	4.749E+00	4.191E+00	2.342E+00	2.128E+00	2.095E+00	2.120E+00	2.112E+00	2.057E+00	1.940E+00

PWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	3.325E+00	2.610E+00	2.328E+00	2.230E+00	2.193E+00	2.169E+00	2.148E+00	2.129E+00	2.111E+00	2.094E+00	2.005E+00	1.980E+00	1.957E+00	1.906E+00	1.864E+00	1.799E+00	1.752E+00	1.718E+00	1.692E+00
10000	3.329E+00	3.637E+00	3.745E+00	3.733E+00	3.672E+00	3.642E+00	3.594E+00	3.544E+00	3.497E+00	3.449E+00	3.183E+00	3.102E+00	3.023E+00	2.840E+00	2.675E+00	2.395E+00	2.176E+00	2.007E+00	1.880E+00
15000	4.069E+00	4.398E+00	4.512E+00	4.514E+00	4.492E+00	4.461E+00	4.429E+00	4.397E+00	4.364E+00	4.330E+00	4.124E+00	4.053E+00	3.982E+00	3.801E+00	3.616E+00	3.249E+00	2.897E+00	2.579E+00	2.305E+00
20000	3.900E+00	4.432E+00	4.611E+00	4.642E+00	4.638E+00	4.622E+00	4.610E+00	4.594E+00	4.578E+00	4.561E+00	4.433E+00	4.415E+00	4.374E+00	4.265E+00	4.145E+00	3.876E+00	3.574E+00	3.252E+00	2.929E+00
25000	3.972E+00	4.485E+00	4.631E+00	4.665E+00	4.667E+00	4.660E+00	4.650E+00	4.639E+00	4.632E+00	4.622E+00	4.554E+00	4.534E+00	4.508E+00	4.439E+00	4.362E+00	4.176E+00	3.952E+00	3.690E+00	3.397E+00
27500	-3.288E+00	-3.690E+00	-3.801E+00	-3.820E+00	-3.826E+00	-3.813E+00	-3.813E+00	-3.793E+00	-3.793E+00	-3.783E+00	-3.717E+00	-3.698E+00	-3.674E+00	-3.609E+00	-3.534E+00	-3.362E+00	-3.148E+00	-2.906E+00	-2.632E+00
30000	4.024E+00	4.681E+00	4.868E+00	4.903E+00	4.906E+00	4.900E+00	4.900E+00	4.886E+00	4.881E+00	4.871E+00	4.812E+00	4.792E+00	4.772E+00	4.706E+00	4.638E+00	4.471E+00	4.263E+00	4.019E+00	3.740E+00
35000	4.642E+00	4.862E+00	4.918E+00	4.930E+00	4.929E+00	4.926E+00	4.918E+00	4.913E+00	4.908E+00	4.904E+00	4.870E+00	4.856E+00	4.840E+00	4.808E+00	4.763E+00	4.636E+00	4.518E+00	4.346E+00	4.139E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.673E+00	1.657E+00	1.645E+00	1.587E+00	1.550E+00	1.520E+00	1.493E+00	1.391E+00	1.296E+00	1.265E+00	1.238E+00	1.183E+00	1.029E+00	1.023E+00	1.043E+00	1.158E+00	1.113E+00	8.608E-01	5.169E-01
10000	1.784E+00	1.715E+00	1.663E+00	1.509E+00	1.470E+00	1.441E+00	1.416E+00	1.326E+00	1.244E+00	1.222E+00	1.222E+00	1.240E+00	1.448E+00	1.885E+00	1.707E+00	2.050E+00	2.100E+00	1.837E+00	1.324E+00
15000	2.079E+00	1.900E+00	1.761E+00	1.378E+00	1.340E+00	1.332E+00	1.314E+00	1.297E+00	1.289E+00	1.292E+00	1.303E+00	1.361E+00	1.722E+00	1.886E+00	2.008E+00	2.274E+00	2.318E+00	2.156E+00	1.771E+00
20000	2.629E+00	2.348E+00	2.118E+00	1.389E+00	1.344E+00	1.338E+00	1.340E+00	1.378E+00	1.424E+00	1.439E+00	1.448E+00	1.482E+00	1.828E+00	1.970E+00	2.024E+00	2.245E+00	2.273E+00	2.178E+00	1.917E+00
25000	3.091E+00	2.799E+00	2.521E+00	1.543E+00	1.500E+00	1.506E+00	1.518E+00	1.597E+00	1.669E+00	1.679E+00	1.662E+00	1.637E+00	1.844E+00	1.958E+00	2.033E+00	2.166E+00	2.184E+00	2.114E+00	1.924E+00
27500	-2.351E+00	-2.084E+00	-1.853E+00	-1.019E+00	-1.042E+00	-1.078E+00	-1.098E+00	-1.152E+00	-1.189E+00	-1.199E+00	-1.199E+00	-1.233E+00	-1.602E+00	-1.735E+00	-1.814E+00	-1.927E+00	-1.923E+00	-1.857E+00	-1.683E+00
30000	3.443E+00	3.150E+00	2.871E+00	1.804E+00	1.753E+00	1.759E+00	1.773E+00	1.862E+00	1.934E+00	1.939E+00	1.898E+00	1.834E+00	2.014E+00	2.132E+00	2.212E+00	2.348E+00	2.352E+00	2.297E+00	2.110E+00
35000	3.905E+00	3.651E+00	3.397E+00	2.252E+00	2.244E+00	2.292E+00	2.341E+00	2.541E+00	2.688E+00	2.673E+00	2.565E+00	2.309E+00	2.073E+00	2.131E+00	2.185E+00	2.284E+00	2.298E+00	2.245E+00	2.099E+00

TABLE IC.5

M COEFFT FOR NEUTRONS ON COOLING

PWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	1.512E-01	3.345E-02	-2.366E-02	-4.572E-02	-5.968E-02	-6.599E-02	-7.258E-02	-7.541E-02	-8.131E-02	-8.742E-02	-9.027E-02	-9.728E-02	-8.412E-02	-7.508E-02	-5.723E-02	-3.128E-02	-9.241E-03	1.230E-02	2.689E-02
10000	6.424E-01	2.990E-01	7.693E-02	0.000E+00	-2.101E-02	-3.299E-02	-3.789E-02	-3.741E-02	-4.184E-02	-3.632E-02	-3.645E-02	-2.903E-02	-1.910E-02	-9.986E-03	1.267E-02	3.833E-02	6.094E-02	7.694E-02	8.991E-02
15000	9.167E-01	5.453E-01	2.330E-01	1.253E-01	1.041E-01	1.091E-01	1.217E-01	1.344E-01	1.473E-01	1.808E-01	2.337E-01	2.533E-01	2.800E-01	3.113E-01	3.383E-01	3.504E-01	3.412E-01	3.266E-01	2.963E-01
20000	6.901E-01	3.957E-01	2.100E-01	1.612E-01	1.657E-01	1.863E-01	2.140E-01	2.366E-01	2.671E-01	3.447E-01	4.332E-01	4.842E-01	5.476E-01	6.279E-01	7.163E-01	7.813E-01	7.877E-01	7.501E-01	6.845E-01
25000	5.219E-01	3.030E-01	1.894E-01	1.712E-01	1.901E-01	2.183E-01	2.484E-01	2.821E-01	3.134E-01	4.147E-01	5.394E-01	5.961E-01	6.894E-01	8.140E-01	9.678E-01	1.121E+00	1.201E+00	1.209E+00	1.132E+00
30000	4.138E-01	2.482E-01	1.753E-01	1.766E-01	1.978E-01	2.332E-01	2.679E-01	3.016E-01	3.341E-01	4.466E-01	5.880E-01	6.524E-01	7.603E-01	9.111E-01	1.111E+00	1.340E+00	1.502E+00	1.587E+00	1.589E+00
35000	3.446E-01	2.157E-01	1.663E-01	1.741E-01	2.019E-01	2.357E-01	2.714E-01	3.063E-01	3.453E-01	4.568E-01	6.034E-01	6.894E-01	7.851E-01	9.438E-01	1.160E+00	1.420E+00	1.619E+00	1.746E+00	1.793E+00
35000	4.218E-01	2.519E-01	1.763E-01	1.741E-01	2.002E-01	2.324E-01	2.628E-01	3.026E-01	3.294E-01	4.446E-01	5.858E-01	6.488E-01	7.552E-01	9.051E-01	1.101E+00	1.326E+00	1.483E+00	1.563E+00	1.563E+00
40000	3.392E-01	2.122E-01	1.664E-01	1.749E-01	2.040E-01	2.368E-01	2.727E-01	3.080E-01	3.422E-01	4.595E-01	6.078E-01	6.727E-01	7.898E-01	9.500E-01	1.174E+00	1.441E+00	1.652E+00	1.794E+00	1.858E+00
45000	2.658E-01	1.791E-01	1.566E-01	1.737E-01	2.050E-01	2.399E-01	2.764E-01	3.141E-01	3.494E-01	4.671E-01	6.167E-01	6.871E-01	8.079E-01	9.750E-01	1.212E+00	1.504E+00	1.752E+00	1.934E+00	2.041E+00
50000	2.241E-01	1.612E-01	1.519E-01	1.738E-01	2.060E-01	2.417E-01	2.790E-01	3.159E-01	3.522E-01	4.717E-01	6.240E-01	6.950E-01	8.165E-01	9.890E-01	1.234E+00	1.541E+00	1.807E+00	2.022E+00	2.158E+00
55000	1.801E-01	1.452E-01	1.463E-01	1.730E-01	2.070E-01	2.456E-01	2.793E-01	3.137E-01	3.533E-01	4.740E-01	6.276E-01	6.984E-01	8.206E-01	9.966E-01	1.243E+00	1.539E+00	1.832E+00	2.055E+00	2.209E+00
60000	1.590E-01	1.359E-01	1.439E-01	1.745E-01	2.071E-01	2.472E-01	2.789E-01	3.179E-01	3.571E-01	4.748E-01	6.261E-01	7.027E-01	8.230E-01	9.985E-01	1.247E+00	1.548E+00	1.844E+00	2.068E+00	2.222E+00

80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	
5000	4.142E-02	3.059E-02	8.119E-02	1.171E-01	1.413E-01	1.588E-01	1.878E-01	2.062E-01	2.211E-01	2.897E-01	4.743E-01	8.088E-01	9.107E-01	8.582E-01	6.933E-01	2.468E-01	1.603E-01	2.372E-01
10000	1.032E-01	1.044E-01	1.388E-01	1.997E-01	2.308E-01	2.634E-01	3.143E-01	3.227E-01	3.286E-01	3.339E-01	3.409E-01	3.401E-01	3.414E-01	3.414E-01	3.414E-01	3.414E-01	3.414E-01	3.414E-01
15000	2.711E-01	2.499E-01	2.063E-01	2.254E-01	2.673E-01	3.023E-01	3.594E-01	3.644E-01	3.646E-01	3.394E-01	3.403E-01	3.948E-01	3.333E-01	3.474E-01	4.698E-01	3.008E-01	4.413E-01	8.071E-01
20000	6.092E-01	5.322E-01	3.234E-01	2.507E-01	2.862E-01	3.208E-01	3.751E-01	3.763E-01	3.087E-01	3.339E-01	3.222E-01	3.119E-01	3.740E-01	5.119E-01	3.467E-01	2.837E-01	4.998E-01	9.854E-01
25000	1.057E+00	9.377E-01	5.041E-01	2.759E-01	2.907E-01	3.274E-01	3.764E-01	3.737E-01	3.067E-01	3.032E-01	2.532E-01	7.313E-01	5.478E-01	4.013E-01	2.735E-01	2.735E-01	2.735E-01	2.735E-01
30000	1.523E+00	1.397E+00	7.411E-01	2.940E-01	2.967E-01	3.159E-01	3.544E-01	3.522E-01	2.963E-01	3.300E-01	3.032E-01	6.900E-01	4.715E-01	3.352E-01	2.356E-01	2.672E-01	5.451E-01	1.141E+00
35000	1.753E+00	1.648E+00	8.873E-01	3.019E-01	2.902E-01	3.053E-01	3.378E-01	3.386E-01	2.979E-01	3.392E-01	5.170E-01	6.838E-01	4.410E-01	3.076E-01	2.194E-01	2.650E-01	5.515E-01	1.163E+00
35000	1.494E+00	1.373E+00	7.411E-01	3.204E-01	3.270E-01	3.501E-01	3.938E-01	3.881E-01	3.122E-01	4.877E-01	6.877E-01	6.582E-01	4.503E-01	3.243E-01	2.351E-01	2.664E-01	5.433E-01	1.144E+00
40000	1.833E+00	1.732E+00	9.601E-01	3.303E-01	3.131E-01	3.278E-01	3.588E-01	3.570E-01	3.073E-01	3.411E-01	5.140E-01	6.539E-01	4.084E-01	2.875E-01	2.126E-01	2.638E-01	5.539E-01	1.173E+00
45000	2.064E+00	1.999E+00	1.141E+00	3.283E-01	2.874E-01	2.910E-01	3.133E-01	3.217E-01	3.084E-01	3.704E-01	5.670E-01	7.010E-01	3.977E-01	2.630E-01	1.984E-01	2.619E-01	5.602E-01	1.197E+00
50000	2.210E+00	2.176E+00	1.289E+00	3.084E-01	2.453E-01	2.490E-01	2.622E-01	2.871E-01	3.133E-01	4.078E-01	6.412E-01	7.944E-01	4.129E-01	2.596E-01	1.900E-01	2.601E-01	5.637E-01	1.214E+00
55000	2.276E+00	2.251E+00	1.317E+00	2.763E-01	2.074E-01	2.046E-01	2.187E-01	2.609E-01	3.217E-01	4.447E-01	7.199E-01	9.233E-01	4.530E-01	2.669E-01	1.833E-01	2.604E-01	5.702E-01	1.229E+00
60000	2.291E+00	2.275E+00	1.313E+00	2.415E-01	1.701E-01	1.659E-01	1.847E-01	2.434E-01	3.293E-01	4.748E-01	7.899E-01	1.070E+00	5.177E-01	2.797E-01	1.802E-01	2.615E-01	5.752E-01	1.244E+00

BWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	2.707E-01	8.080E-02	-1.407E-02	-5.116E-02	-6.761E-02	-7.633E-02	-8.409E-02	-8.912E-02	-9.293E-02	-1.012E-01	-1.040E-01	-1.026E-01	-9.493E-02	-8.585E-02	-6.577E-02	-3.752E-02	-1.142E-02	1.013E-02	2.864E-02
10000	9.840E-01	5.757E-01	2.033E-01	6.342E-02	2.274E-02	1.800E-02	1.388E-02	1.971E-02	1.767E-02	2.994E-02	4.423E-02	4.970E-02	6.030E-02	7.481E-02	8.980E-02	1.094E-01	1.172E-01	1.277E-01	1.238E-01
15000	8.034E-01	4.677E-01	2.183E-01	1.416E-01	1.331E-01	1.439E-01	1.441E-01	1.833E-01	2.020E-01	2.589E-01	3.250E-01	3.524E-01	3.933E-01	4.410E-01	4.846E-01	5.077E-01	4.933E-01	4.614E-01	4.170E-01
20000	6.668E-01	3.874E-01	2.134E-01	1.727E-01	1.812E-01	2.060E-01	2.340E-01	2.629E-01	2.939E-01	3.850E-01	4.994E-01	5.465E-01	6.270E-01	7.328E-01	8.518E-01	9.614E-01	9.947E-01	9.726E-01	9.039E-01
25000	4.954E-01	2.890E-01	1.894E-01	1.763E-01	1.973E-01	2.274E-01	2.612E-01	2.941E-01	3.292E-01	4.364E-01	5.712E-01	6.334E-01	7.361E-01	8.787E-01	1.061E+00	1.262E+00	1.390E+00	1.441E+00	1.414E+00
27500	4.249E-01	2.544E-01	1.782E-01	1.753E-01	2.013E-01	2.337E-01	2.691E-01	2.975E-01	3.373E-01	4.507E-01	5.878E-01	6.571E-01	7.633E-01	9.190E-01	1.122E+00	1.338E+00	1.527E+00	1.621E+00	1.633E+00
30000	4.754E-01	2.783E-01	1.840E-01	1.775E-01	1.953E-01	2.333E-01	2.571E-01	2.974E-01	3.294E-01	4.381E-01	5.737E-01	6.378E-01	7.402E-01	8.831E-01	1.070E+00	1.275E+00	1.412E+00	1.467E+00	1.450E+00
35000	3.294E-01	2.074E-01	1.650E-01	1.740E-01	2.024E-01	2.358E-01	2.730E-01	3.046E-01	3.436E-01	4.574E-01	6.002E-01	6.671E-01	7.853E-01	9.409E-01	1.159E+00	1.419E+00	1.617E+00	1.743E+00	1.793E+00
40000	2.870E-01	1.888E-01	1.594E-01	1.744E-01	2.047E-01	2.409E-01	2.766E-01	3.120E-01	3.496E-01	4.670E-01	6.133E-01	6.880E-01	8.043E-01	9.743E-01	1.209E+00	1.501E+00	1.744E+00	1.923E+00	2.027E+00
80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000		
5000	4.302E-02	3.333E-02	8.829E-02	1.309E-01	1.594E-01	1.815E-01	2.157E-01	2.311E-01	2.332E-01	2.999E-01	4.904E-01	8.444E-01	9.499E-01	8.954E-01	7.343E-01	2.804E-01	1.586E-01	2.300E-01	
10000	1.356E-01	1.327E-01	1.470E-01	1.954E-01	2.326E-01	2.662E-01	3.172E-01	3.233E-01	3.289E-01	3.366E-01	3.452E-01	3.452E-01	3.452E-01	3.452E-01	3.452E-01	3.452E-01	3.452E-01	3.452E-01	
15000	3.727E-01	3.317E-01	2.374E-01	2.316E-01	2.739E-01	3.114E-01	3.700E-01	3.739E-01	3.106E-01	3.345E-01	5.345E-01	8.649E-01	7.719E-01	6.101E-01	4.201E-01	2.938E-01	4.633E-01	8.739E-01	
20000	8.111E-01	7.110E-01	3.965E-01	2.583E-01	2.911E-01	3.228E-01	3.771E-01	3.772E-01	3.084E-01	3.301E-01	5.103E-01	7.703E-01	6.076E-01	4.531E-01	3.087E-01	2.786E-01	5.161E-01	1.034E+00	
25000	1.333E+00	1.199E+00	6.311E-01	2.832E-01	3.209E-01	3.297E-01	3.644E-01	3.619E-01	3.009E-01	3.262E-01	4.993E-01	7.002E-01	5.981E-01	4.981E-01	3.588E-01	2.504E-01	5.392E-01	1.118E+00	
27500	1.569E+00	1.452E+00	7.656E-01	2.932E-01	2.941E-01	3.133E-01	3.538E-01	3.519E-01	2.984E-01	3.294E-01	5.028E-01	6.821E-01	4.610E-01	3.269E-01	2.321E-01	2.671E-01	5.465E-01	1.144E+00	
30000	1.371E+00	1.245E+00	6.433E-01	2.980E-01	3.051E-01	3.234E-01	3.604E-01	3.563E-01	3.008E-01	3.294E-01	5.071E-01	7.113E-01	5.012E-01	3.577E-01	2.463E-01	2.672E-01			

WATTS/MTU VS COOLING

PMR	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70	
5000	2.59E+03	1.00E+03	5.42E+02	2.43E+02	2.53E+02	2.09E+02	1.86E+02	1.73E+02	1.64E+02	1.58E+02	1.32E+02	1.26E+02	1.20E+02	1.07E+02	9.62E+01	7.81E+01	6.39E+01	5.27E+01	4.38E+01
10000	4.42E+03	1.89E+03	1.06E+03	6.85E+02	5.12E+02	4.26E+02	3.79E+02	3.52E+02	3.33E+02	3.19E+02	2.69E+02	2.57E+02	2.46E+02	2.22E+02	2.01E+02	1.67E+02	1.40E+02	1.18E+02	1.01E+02
15000	5.19E+03	2.44E+03	1.43E+03	9.71E+02	7.49E+02	6.34E+02	5.70E+02	5.30E+02	5.02E+02	4.81E+02	4.07E+02	3.89E+02	3.73E+02	3.39E+02	3.09E+02	2.59E+02	2.19E+02	1.86E+02	1.62E+02
20000	6.82E+03	3.28E+03	1.95E+03	1.33E+03	1.03E+03	8.71E+02	7.80E+02	7.22E+02	6.82E+02	6.53E+02	5.50E+02	5.26E+02	5.05E+02	4.59E+02	4.20E+02	3.55E+02	3.03E+02	2.61E+02	2.27E+02
25000	7.09E+03	3.63E+03	2.25E+03	1.60E+03	1.27E+03	1.09E+03	9.82E+02	9.12E+02	8.62E+02	8.25E+02	6.94E+02	6.65E+02	6.39E+02	5.81E+02	5.32E+02	4.51E+02	3.95E+02	3.52E+02	2.93E+02
30000	8.82E+03	4.53E+03	2.85E+03	2.01E+03	1.59E+03	1.36E+03	1.22E+03	1.13E+03	1.07E+03	1.02E+03	8.50E+02	8.13E+02	7.80E+02	7.09E+02	6.49E+02	5.50E+02	4.71E+02	4.08E+02	3.58E+02
35000	9.74E+03	5.05E+03	3.12E+03	2.27E+03	1.80E+03	1.53E+03	1.37E+03	1.27E+03	1.20E+03	1.14E+03	9.49E+02	9.08E+02	8.71E+02	7.91E+02	7.25E+02	6.12E+02	5.25E+02	4.55E+02	3.98E+02
40000	1.05E+04	5.61E+03	3.63E+03	2.66E+03	2.15E+03	1.85E+03	1.67E+03	1.55E+03	1.46E+03	1.39E+03	1.16E+03	1.11E+03	1.07E+03	9.72E+02	8.90E+02	7.54E+02	6.46E+02	5.60E+02	4.91E+02
45000	1.07E+04	5.95E+03	3.95E+03	2.97E+03	2.44E+03	2.12E+03	1.92E+03	1.78E+03	1.69E+03	1.61E+03	1.34E+03	1.28E+03	1.23E+03	1.11E+03	1.02E+03	8.61E+02	7.37E+02	6.38E+02	5.59E+02
50000	1.25E+04	6.92E+03	4.62E+03	3.47E+03	2.84E+03	2.47E+03	2.23E+03	2.07E+03	1.95E+03	1.86E+03	1.54E+03	1.47E+03	1.41E+03	1.27E+03	1.16E+03	9.75E+02	8.31E+02	7.18E+02	6.27E+02
55000	1.26E+04	7.24E+03	4.97E+03	3.82E+03	3.17E+03	2.78E+03	2.52E+03	2.34E+03	2.21E+03	2.11E+03	1.74E+03	1.66E+03	1.59E+03	1.43E+03	1.30E+03	1.09E+03	9.28E+02	7.99E+02	6.96E+02
60000	1.44E+04	8.31E+03	5.72E+03	4.39E+03	3.64E+03	3.19E+03	2.89E+03	2.68E+03	2.53E+03	2.41E+03	1.98E+03	1.88E+03	1.80E+03	1.62E+03	1.47E+03	1.22E+03	1.03E+03	8.86E+02	7.69E+02

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	3.67E+01	3.11E+01	2.67E+01	1.09E+01	8.87E+00	8.22E+00	7.78E+00	6.43E+00	5.40E+00	5.01E+00	4.56E+00	3.73E+00	1.98E+00	1.52E+00	1.19E+00	5.07E+01	3.26E+01	2.35E+01	1.49E+01
10000	8.67E+01	7.57E+01	6.88E+01	3.36E+01	2.75E+01	2.45E+01	2.23E+01	1.54E+01	1.07E+01	9.30E+00	8.18E+00	6.43E+00	3.08E+00	2.30E+00	1.77E+00	6.49E+01	3.51E+01	2.64E+01	1.80E+01
15000	1.42E+02	1.26E+02	1.12E+02	6.08E+01	4.96E+01	4.36E+01	3.90E+01	2.50E+01	1.55E+01	1.29E+01	1.11E+01	8.50E+00	3.80E+00	2.80E+00	2.13E+00	7.51E+01	3.89E+01	3.08E+01	2.23E+01
20000	2.00E+02	1.78E+02	1.60E+02	8.95E+01	7.26E+01	6.31E+01	5.99E+01	3.44E+01	1.99E+01	1.29E+01	1.17E+01	1.02E+01	4.32E+00	2.38E+00	1.87E+00	8.37E+01	4.40E+01	3.62E+01	2.69E+01
25000	2.59E+02	2.32E+02	2.09E+02	1.18E+02	9.71E+01	8.19E+01	7.21E+01	4.30E+01	2.38E+01	1.89E+01	1.58E+01	1.16E+01	4.70E+00	3.39E+00	2.56E+00	9.16E+01	5.02E+01	4.23E+01	3.18E+01
30000	3.17E+02	2.83E+02	2.56E+02	1.44E+02	1.14E+02	9.78E+01	8.56E+01	5.04E+01	2.73E+01	2.15E+01	1.78E+01	1.29E+01	5.02E+00	3.60E+00	2.72E+00	9.96E+01	5.71E+01	4.84E+01	3.63E+01
35000	3.53E+02	3.16E+02	2.86E+02	1.60E+02	1.26E+02	1.08E+02	9.38E+01	5.47E+01	2.92E+01	2.28E+01	1.88E+01	1.33E+01	5.19E+00	3.71E+00	2.80E+00	1.05E+02	6.18E+01	5.25E+01	3.92E+01
35000	3.75E+02	3.36E+02	3.04E+02	1.70E+02	1.35E+02	1.14E+02	9.96E+01	5.70E+01	2.93E+01	2.26E+01	1.84E+01	1.34E+01	5.53E+00	4.01E+00	3.05E+00	1.15E+02	6.87E+01	5.77E+01	4.24E+01
40000	4.35E+02	3.89E+02	3.52E+02	1.96E+02	1.53E+02	1.29E+02	1.12E+02	6.33E+01	3.21E+01	2.45E+01	2.01E+01	1.46E+01	5.82E+00	4.21E+00	3.20E+00	1.24E+02	7.67E+01	6.44E+01	4.69E+01
45000	4.94E+02	4.42E+02	4.00E+02	2.20E+02	1.69E+02	1.42E+02	1.22E+02	6.87E+01	3.46E+01	2.63E+01	2.15E+01	1.56E+01	6.09E+00	4.39E+00	3.35E+00	1.34E+02	8.56E+01	7.13E+01	5.12E+01
50000	5.53E+02	4.94E+02	4.46E+02	2.41E+02	1.83E+02	1.52E+02	1.31E+02	7.33E+01	3.70E+01	2.81E+01	2.30E+01	1.65E+01	6.37E+00	4.59E+00	3.58E+00	1.43E+02	9.43E+01	7.79E+01	5.50E+01
55000	6.13E+02	5.47E+02	4.92E+02	2.62E+02	1.97E+02	1.63E+02	1.39E+02	7.76E+01	3.91E+01	2.97E+01	2.42E+01	1.73E+01	6.61E+00	4.76E+00	3.64E+00	1.53E+02	1.04E+02	8.48E+01	5.87E+01
60000	6.75E+02	6.00E+02	5.39E+02	2.83E+02	2.10E+02	1.72E+02	1.47E+02	8.15E+01	4.11E+01	3.12E+01	2.54E+01	1.81E+01	6.84E+00	4.92E+00	3.77E+00	1.63E+02	1.14E+02	9.15E+01	6.23E+01

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	2.38E+03	9.58E+02	5.20E+02	3.31E+02	2.43E+02	2.04E+02	1.82E+02	1.69E+02	1.61E+02	1.55E+02	1.32E+02	1.26E+02	1.20E+02	1.08E+02	9.75E+01	7.97E+01	6.57E+01	5.47E+01	4.58E+01
10000	3.47E+03	1.59E+03	9.19E+02	6.18E+02	4.76E+02	4.04E+02	3.64E+02	3.40E+02	3.23E+02	3.11E+02	2.66E+02	2.55E+02	2.45E+02	2.22E+02	2.02E+02	1.69E+02	1.42E+02	1.21E+02	1.04E+02
15000	4.08E+03	2.05E+03	1.25E+03	8.82E+02	7.00E+02	6.04E+02	5.48E+02	5.13E+02	4.89E+02	4.71E+02	4.04E+02	3.88E+02	3.73E+02	3.41E+02	3.12E+02	2.64E+02	2.26E+02	1.95E+02	1.71E+02
20000	5.69E+03	2.85E+03	1.75E+03	1.23E+03	9.75E+02	8.36E+02	7.55E+02	7.04E+02	6.68E+02	6.41E+02	5.47E+02	5.25E+02	5.06E+02	4.62E+02	4.29E+02	3.62E+02	3.11E+02	2.70E+02	2.37E+02
25000	6.32E+03	3.29E+03	2.09E+03	1.52E+03	1.22E+03	1.06E+03	9.61E+02	8.96E+02	8.50E+02	8.15E+02	6.93E+02	6.66E+02	6.41E+02	5.86E+02	5.38E+02	4.59E+02	3.96E+02	3.45E+02	3.03E+02
27500	7.07E+03	3.70E+03	2.36E+03	1.71E+03	1.38E+03	1.19E+03	1.08E+03	1.00E+03	9.51E+02	9.11E+02	7.75E+02	7.42E+02	7.13E+02	6.52E+02	5.99E+02	5.11E+02	4.40E+02	3.83E+02	3.38E+02
30000	8.49E+03	3.50E+03	2.31E+03	1.72E+03	1.42E+03	1.24E+03	1.14E+03	1.06E+03	1.01E+03	9.71E+02	8.25E+02	7.91E+02	7.60E+02	6.92E+02	6.34E+02	5.36E+02	4.59E+02	3.96E+02	3.46E+02
35000	8.88E+03	3.88E+03	2.63E+03	2.01E+03	1.68E+03	1.48E+03	1.36E+03	1.27E+03	1.21E+03	1.16E+03	9.84E+02	9.44E+02	9.07E+02	8.26E+02	7.57E+02	6.41E+02	5.49E+02	4.76E+02	4.16E+02
40000	8.65E+03	4.81E+03	3.24E+03	2.46E+03	2.04E+03	1.79E+03	1.63E+03	1.52E+03	1.44E+03	1.38E+03	1.16E+03	1.12E+03	1.07E+03	9.74E+02	8.91E+02	7.54E+02	6.45E+02	5.59E+02	4.89E+02

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	3.88E+01	3.33E+01	2.88E+01	1.29E+01	1.07E+01	9.81E+00	9.21E+00	7.33E+00	5.94E+00	5.46E+00	4.94E+00	4.01E+00	2.08E+00	1.58E+00	1.23E+00	4.85E+01	2.86E+01	2.13E+01	1.44E+01
10000	9.05E+01	7.95E+01	7.07E+01	3.75E+01	3.09E+01	2.75E+01	2.50E+01	1.71E+01	1.16E+01	1.00E+01	8.77E+00	6.82E+00	3.19E+00	2.36E+00	1.80E+00	6.28E+01	3.50E+01	2.46E+01	1.78E+01
15000	1.50E+02	1.34E+02	1.21E+02	6.89E+01	5.64E+01	4.96E+01	4.42E+01	2.78E+01	1.67E+01	1.38E+01	1.18E+01	8.89E+00	3.89E+00	2.84E+00	2.15E+00	7.33E+01	3.63E+01	2.99E+01	2.27E+01
20000	2.11E+02	1.89E+02	1.71E+02	9.92E+01	8.07E+01	7.00E+01	6.19E+01	3.75E+01	2.12E+01	1.70E+01	1.43E+01	1.06E+01	4.36E+00	3.15E+00	2.38E+00	8.19E+01	4.21E+01	3.59E+01	2.77E+01
25000	2.70E+02	2.43E+02	2.20E+02	1.13E+02	9.05E+01	7.85E+01	7.70E+01	4.59E+01	2.50E+01	1.98E+01	1.64E+01	1.19E+01	4.72E+00	3.38E+00	2.55E+00	9.02E+01	4.91E+01	4.23E+01	3.26E+01
27500	3.00E+02	2.70E+02	2.45E+02	1.42E+02	1.14E+02	9.72E+01	8.50E+01	4.99E+01	2.68E+01	2.10E+01	1.74E+01	1.26E+01	4.88E+00	3.49E+00	2.63E+00	9.45E+01	5.30E+01	4.58E+01	3.51E+01
30000	3.05E+02	2.72E+02	2.																

P COEFFT FOR WATTS ON BURNUP AT CONST COOLING

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	7.71E-01	9.184E-01	9.677E-01	9.979E-01	1.017E+00	1.027E+00	1.027E+00	1.025E+00	1.022E+00	1.014E+00	1.027E+00	1.028E+00	1.036E+00	1.053E+00	1.062E+00	1.094E+00	1.132E+00	1.163E+00	1.203E+00
10000	3.981E-01	6.297E-01	7.384E-01	8.605E-01	9.382E-01	9.306E-01	1.006E+00	1.009E+00	1.012E+00	1.013E+00	1.021E+00	1.022E+00	1.027E+00	1.044E+00	1.061E+00	1.082E+00	1.103E+00	1.147E+00	1.185E+00
15000	9.494E-01	1.028E+00	1.078E+00	1.094E+00	1.107E+00	1.104E+00	1.090E+00	1.075E+00	1.065E+00	1.063E+00	1.047E+00	1.049E+00	1.053E+00	1.053E+00	1.067E+00	1.094E+00	1.129E+00	1.146E+00	1.172E+00
20000	1.740E-01	4.544E-01	6.413E-01	8.283E-01	9.387E-01	1.005E+00	1.032E+00	1.047E+00	1.050E+00	1.048E+00	1.042E+00	1.051E+00	1.055E+00	1.056E+00	1.059E+00	1.073E+00	1.097E+00	1.119E+00	1.144E+00
25000	1.198E+00	1.215E+00	1.258E+00	1.251E+00	1.235E+00	1.214E+00	1.190E+00	1.178E+00	1.186E+00	1.164E+00	1.112E+00	1.102E+00	1.094E+00	1.092E+00	1.090E+00	1.088E+00	1.077E+00	1.061E+00	1.095E+00
30000	1.041E+00	1.146E+00	1.190E+00	1.274E+00	1.302E+00	1.234E+00	1.217E+00	1.225E+00	1.203E+00	1.167E+00	1.156E+00	1.160E+00	1.153E+00	1.148E+00	1.133E+00	1.121E+00	1.139E+00	1.144E+00	1.111E+00
33000	-1.552E+00	-1.185E+00	-7.117E-01	-3.021E-01	0.000E+00	3.300E-01	4.891E-01	5.270E-01	5.537E-01	5.861E-01	6.044E-01	6.221E-01	6.361E-01	6.996E-01	9.374E-01	9.976E-01	1.006E+00	1.015E+00	1.032E+00
35000	1.247E+00	1.310E+00	1.328E+00	1.320E+00	1.331E+00	1.277E+00	1.267E+00	1.260E+00	1.223E+00	1.227E+00	1.149E+00	1.142E+00	1.164E+00	1.147E+00	1.143E+00	1.123E+00	1.110E+00	1.108E+00	1.116E+00
40000	1.602E-01	4.710E-01	7.173E-01	9.359E-01	1.074E+00	1.157E+00	1.184E+00	1.175E+00	1.192E+00	1.247E+00	1.223E+00	1.210E+00	1.183E+00	1.127E+00	1.138E+00	1.127E+00	1.119E+00	1.107E+00	1.101E+00
45000	1.478E+00	1.465E+00	1.487E+00	1.477E+00	1.441E+00	1.430E+00	1.421E+00	1.433E+00	1.413E+00	1.370E+00	1.320E+00	1.314E+00	1.294E+00	1.278E+00	1.221E+00	1.180E+00	1.139E+00	1.121E+00	1.090E+00
50000	8.368E-02	4.743E-01	7.662E-01	1.008E+00	1.153E+00	1.241E+00	1.283E+00	1.286E+00	1.313E+00	1.323E+00	1.281E+00	1.275E+00	1.261E+00	1.245E+00	1.196E+00	1.170E+00	1.158E+00	1.122E+00	1.095E+00
55000	1.533E+00	1.584E+00	1.615E+00	1.598E+00	1.589E+00	1.581E+00	1.574E+00	1.537E+00	1.534E+00	1.528E+00	1.483E+00	1.430E+00	1.426E+00	1.434E+00	1.412E+00	1.295E+00	1.198E+00	1.188E+00	1.146E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.240E+00	1.283E+00	1.323E+00	1.624E+00	1.632E+00	1.576E+00	1.519E+00	1.260E+00	9.864E-01	8.924E-01	8.431E-01	7.856E-01	6.374E-01	5.976E-01	5.728E-01	3.562E-01	1.044E-01	1.679E-01	2.727E-01
10000	1.217E+00	1.257E+00	1.275E+00	1.463E+00	1.432E+00	1.422E+00	1.379E+00	1.195E+00	9.146E-01	8.070E-01	7.528E-01	6.883E-01	5.181E-01	4.851E-01	4.566E-01	3.600E-01	2.533E-01	3.802E-01	5.172E-01
15000	1.191E+00	1.201E+00	1.240E+00	1.344E+00	1.324E+00	1.285E+00	1.251E+00	1.109E+00	8.686E-01	7.918E-01	7.313E-01	6.538E-01	4.838E-01	4.094E-01	3.838E-01	3.769E-01	4.282E-01	5.613E-01	6.675E-01
20000	1.158E+00	1.187E+00	1.197E+00	1.239E+00	1.210E+00	1.169E+00	1.140E+00	1.000E+00	8.020E-01	6.906E-01	6.391E-01	5.744E-01	3.778E-01	3.291E-01	3.267E-01	4.042E-01	5.908E-01	6.979E-01	7.499E-01
25000	1.108E+00	1.090E+00	1.113E+00	1.072E+00	9.942E-01	9.731E-01	9.414E-01	8.709E-01	7.525E-01	7.069E-01	6.537E-01	5.826E-01	3.613E-01	3.297E-01	3.323E-01	4.592E-01	7.064E-01	7.389E-01	7.259E-01
30000	1.129E+00	1.157E+00	1.163E+00	1.105E+00	1.050E+00	1.041E+00	9.978E-01	8.990E-01	7.099E-01	6.401E-01	5.733E-01	4.702E-01	3.494E-01	3.158E-01	3.041E-01	3.540E-01	6.299E-01	6.531E-01	8.064E-01
33000	1.027E+00	1.043E+00	1.037E+00	1.030E+00	1.173E+00	9.189E-01	1.020E+00	7.000E-01	5.810E-02	-1.497E-01	-1.818E-01	1.234E-01	1.078E+00	1.322E+00	1.433E+00	1.544E+00	1.799E+00	1.600E+00	1.334E+00
35000	1.111E+00	1.097E+00	1.098E+00	1.066E+00	9.373E-01	9.257E-01	8.787E-01	7.851E-01	6.833E-01	6.043E-01	5.808E-01	5.313E-01	3.828E-01	3.645E-01	3.595E-01	5.643E-01	8.249E-01	8.227E-01	7.554E-01
40000	1.080E+00	1.084E+00	1.083E+00	9.807E-01	8.444E-01	8.152E-01	7.261E-01	6.950E-01	6.367E-01	6.019E-01	5.717E-01	5.625E-01	3.850E-01	3.535E-01	3.889E-01	6.383E-01	8.442E-01	7.448E-01	7.448E-01
45000	1.071E+00	1.056E+00	1.033E+00	8.633E-01	7.354E-01	6.439E-01	6.756E-01	6.151E-01	6.363E-01	6.283E-01	6.401E-01	5.324E-01	4.264E-01	4.228E-01	4.157E-01	6.170E-01	9.388E-01	8.403E-01	6.795E-01
50000	1.081E+00	1.069E+00	1.030E+00	8.764E-01	7.734E-01	7.331E-01	6.219E-01	5.981E-01	5.792E-01	5.810E-01	5.334E-01	4.966E-01	3.880E-01	3.816E-01	4.115E-01	7.092E-01	1.003E+00	8.903E-01	6.831E-01
55000	1.107E+00	1.063E+00	1.049E+00	8.861E-01	7.344E-01	6.177E-01	6.431E-01	5.634E-01	5.733E-01	5.463E-01	5.662E-01	5.195E-01	3.931E-01	3.800E-01	4.033E-01	7.274E-01	1.033E+00	8.739E-01	6.841E-01

PMR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	5.440E-01	7.339E-01	8.216E-01	9.008E-01	9.382E-01	9.858E-01	1.000E+00	1.009E+00	1.004E+00	1.003E+00	1.011E+00	1.017E+00	1.030E+00	1.040E+00	1.051E+00	1.084E+00	1.112E+00	1.143E+00	1.183E+00
10000	3.994E-01	6.267E-01	7.587E-01	8.773E-01	9.312E-01	9.918E-01	1.009E+00	1.014E+00	1.023E+00	1.029E+00	1.031E+00	1.033E+00	1.037E+00	1.059E+00	1.072E+00	1.100E+00	1.146E+00	1.177E+00	1.226E+00
15000	1.156E+00	1.145E+00	1.170E+00	1.136E+00	1.132E+00	1.130E+00	1.114E+00	1.100E+00	1.084E+00	1.071E+00	1.053E+00	1.051E+00	1.066E+00	1.056E+00	1.074E+00	1.097E+00	1.110E+00	1.131E+00	1.135E+00
20000	4.706E-01	6.434E-01	7.937E-01	9.487E-01	1.003E+00	1.064E+00	1.081E+00	1.081E+00	1.080E+00	1.074E+00	1.060E+00	1.066E+00	1.060E+00	1.063E+00	1.057E+00	1.064E+00	1.083E+00	1.098E+00	1.101E+00
25000	1.177E+00	1.232E+00	1.273E+00	1.234E+00	1.293E+00	1.214E+00	1.225E+00	1.152E+00	1.178E+00	1.148E+00	1.144E+00	1.134E+00	1.117E+00	1.120E+00	1.127E+00	1.126E+00	1.105E+00	1.096E+00	1.147E+00
27500	-9.838E-01	-6.387E-01	-2.461E-01	6.701E-02	3.284E-01	4.730E-01	6.214E-01	6.697E-01	6.918E-01	7.338E-01	7.482E-01	7.349E-01	7.337E-01	6.843E-01	6.526E-01	5.489E-01	4.859E-01	3.836E-01	2.888E-01
30000	3.786E-01	6.686E-01	8.414E-01	1.011E+00	1.091E+00	1.148E+00	1.143E+00	1.173E+00	1.172E+00	1.154E+00	1.143E+00	1.147E+00	1.147E+00	1.148E+00	1.150E+00	1.161E+00	1.162E+00	1.194E+00	1.195E+00
35000	1.715E+00	1.609E+00	1.562E+00	1.513E+00	1.454E+00	1.424E+00	1.356E+00	1.346E+00	1.303E+00	1.301E+00	1.232E+00	1.280E+00	1.238E+00	1.234E+00	1.221E+00	1.216E+00	1.207E+00	1.204E+00	1.211E+00

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	1.222E+00	1.233E+00	1.296E+00	1.540E+00	1.530E+00	1.487E+00	1.441E+00	1.222E+00	9.656E-01	8.730E-01	8.281E-01	7.662E-01	6.170E-01	5.789E-01	5.493E-01	3.728E-01	1.373E-01	2.078E-01	3.058E-01
10000	1.246E+00	1.289E+00	1.323E+00	1.500E+00	1.493E+00	1.453E+00	1.403E+00	1.199E+00	8.987E-01	7.944E-01	7.319E-01	6.537E-01	4.893E-01	4.566E-01	4.382E-01	3.813E-01	3.498E-01	4.812E-01	5.977E-01
15000	1.186E+00	1.195E+00	1.202E+00	1.267E+00	1.233E+00	1.198E+00	1.171E+00	1.040E+00	8.294E-01	7.249E-01	6.680E-01	6.115E-01	3.965E-01	3.601E-01	3.533E-01	3.856E-01	3.153E-01	4.357E-01	6.920E-01
20000	1.103E+00	1.126E+00	1.129E+00	1.142E+00	1.093E+00	1.041E+00	1.007E+00	9.058E-01	7.389E-01	6.833E-01	6.141E-01	5.184E-01	3.833E-01	3.158E-01	3.092E-01	4.326E-01	6.893E-01	7.332E-01	7.299E-01
25000	1.103E+00	1.103E+00	1.129E+00	1.089E+00	1.063E+00	1.008E+00	9.692E-01	8.767E-01	7.285E-01	6.174E-01	6.210E-01	5.977E-01	3.498E-01	3.340E-01	3.241E-01	4.886E-01	8.019E-01	8.341E-01	7.529E-01
27500	1.900E-01	8.482E-02	0.000E+00	-5.810E-01	-7.283E-01	-7.197E-01	-7.111E-01	-6.130E-01	-3.926E-01	-3.331E-01	-2.673E-01	-2.							

WATT-YRS/MTU FROM 10 YEARS

Table with 20 columns (1-20) and 18 rows (5000-60000). Values range from -4.085E+04 to 6.000E+00.

Table with 20 columns (80-100000) and 18 rows (5000-60000). Values range from 0.632E+04 to 5.891E+05.

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Table with 20 columns (1-70) and 18 rows (5000-40000). Values range from -4.085E+04 to 5.891E+05.

Table with 20 columns (80-100000) and 18 rows (5000-40000). Values range from 0.632E+04 to 5.891E+05.

TABLE IC.11