DKR-ICF: A Radioactivity and Dose Rate Calculation Code Package - Volume 2: Sample Problems for the DKR, CONVERT and DOSE Codes

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November 1986
(revised April 1987)

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Available from the Radiation Information Shielding Center at ORNL, Report CCC-323/DKR.

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DKR-ICF: A RADIOACTIVITY AND DOSE RATE CALCULATION CODE PACKAGE

VOLUME 2: SAMPLE PROBLEMS FOR THE DKR, CONVERT AND DOSE CODES

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*Note: Users that have received the DKR-ICF code package through the Radiation Shielding Information Center at Oak Ridge National Laboratory, ignore sample problems B.2, B.3 and C.3 as no input and output data is provided for these sample problems on the magnetic tape containing the DKR-ICF code package.

INTRODUCTION

This is Volume 2 of the DKR-ICF documentation. It contains the Appendix for the DKR-ICF code package which is described in Volume 1 of the documentation. The Appendix consists of sample problems for the DKR, CONVERT and DOSE codes and code listings for the CONVERT and DOSE programs.

APPENDIX A. SAMPLE PROBLEMS FOR DKR

Sample Problem A.1

The first sample problem consists of a one-dimensional activation calculation of a 1 m radius spherical target chamber made of Al-6061-T6. The chamber has a 1 cm thick graphite (H-451) liner on its interior surface and is surrounded by a 300 cm thick borated water shield. The pulsed sequential operation mode is chosen for the calculation. The operational pulse sequence chosen for the ICF target chamber is 12 shots a day (1 hour interval between shots) for 5 days a week for 4 weeks.

For this sample problem, the composition of the graphite liner is taken to be 100% pure carbon. The impurities are neglected. Also, the composition of the aluminum chamber is considered to be 96.5 wt.% aluminum with the other constituents and impurity elements being neglected. The borated water shield contains 5 grams of boric acid (H_3BO_3) for every 100 cc of water. The zoning of the problem is 11 mesh intervals for the void region; 1 mesh interval for the graphite liner; 5 mesh intervals for the chamber wall; and 50 mesh intervals for the borated water shield amounting to 67 total mesh intervals. For this problem the zonewise output has been chosen.

Table A-1. Input for Sample Problem A.1

```
1
2
3
4
5         TEST RUN for 1m radius tdf aluminum sphere pulse seq. calc.
6       10      3      3      1      5     67      1      0     10      4      4
7        0      1      1      1      1      2      1      0      0
8       1.000000       1.0000         1.000       1.0000     7.093e+1
9         100.00       100.00           0.0       4.0e-4     1.000e-4
10  'spulse'
11   12     3.600e+3      5     4.680e+4      4     2.196e+5
12  'one-d'
13        5
14        0.00          0.50        100.00       101.00       106.00       300.00
15        1     10      1      5     50
16        1      1      1
17        2     10      1
18        3      1      1
19        4      5      1
20        5     50      1
21  'void'
22  'c-liner'
23  'alum-fw'
24  'b-h2o'
25        1      1      2      3      4
26      0.0    0.0    0.0   1.00
27      0.0  8.8-5    0.0   1.00
28      0.0    0.0   1.00    0.0
29      0.0   1.00    0.0    0.0
30        1   1001      1    6.849e+22
31        1   1002      1    1.027e+19
32        2   5010      1    4.426e+20
33        2   5011      1    4.918e+19
34        4   6012      1    8.628e+22
35        4   6013      1    9.685e+20
36        1   8016      1    3.492e+22
37        1   8017      1    1.295e+19
38        1   8018      1    7.140e+19
39        3  13027      1    5.819e+22
40  10-6 s     1.000e-6
41    tdf 1m cavity test run:liner-aluminum-borated water          pulse mode
42    5.2922e-01   4.8064e-02   2.4431e-02   1.6094e-02   1.1164e-02   7.8296e-03
43    5.7997e-03   4.6398e-03   4.1324e-03   4.0599e-03   4.2411e-03   4.2411e-03
44    4.8936e-03   4.8936e-03   4.2919e-03   4.2919e-03   3.9005e-03   3.9005e-03
45    1.0513e-02   1.0513e-02   7.3228e-03   7.3228e-03   5.2276e-03   5.2275e-03
46    2.7192e-03   2.7191e-03   2.7190e-03   2.8424e-03   2.8427e-03   2.8422e-03
47    1.0590e-03   1.0588e-03   1.0588e-03   2.6853e-04   2.6852e-04   2.6851e-04
48    6.6246e-05   6.6236e-05   6.6227e-05   1.5324e-05   1.5310e-05   1.5292e-05
49    2.9462e-06   2.9223e-06   2.8933e-06   5.9736e-07
```

* ignore blank lines

Table A-2. Output for Sample Problem A.1

```
TEST RUN for 1m radius tdf aluminum sphere pulse seq. calc.

                problem run id      10
 lnk    link to the other solution          3
 lge    1/2/3  = slab/cylinder/sphere        3
 lfx    1/2    = dkr/anisn (formatted)      1
 izm    number of zones                      5
 int    number of intervals                 67
 nop    number of operating times            1
 nas    number of after shutdown times      12
 nnc    number of materials(nuclides)       10
 ncmp   number of composition table          4
 nmix   number of mixtures                   4
 ign    number of neutron groups           * 46
 igg    number of photon groups            * 43


              reactor system parameters

 radius of the plasma       100.00          cm
 radius of the first wall   100.00          cm
 radius of the torus          0.00          cm


 first wall area             1.257e+01      m2
 neutron wall loading        1.000e+00      mw/m2
 total operating power       8.912e-01      mw
 flux conversion factor      7.093e+01
 accurcy limit               4.000e-04
 test irradiation time       1.000e-04


      operating time    1

                                          after shutdown time  12

 10-6 s    1.000e-06  second

                                      0       0.          second
                                      1 m     6.000e+01   second
                                     10 m     6.000e+02   second
                                      1 h     3.600e+03   second
                                      6 h     2.160e+04   second
                                      1 d     8.640e+04   second
                                      1 w     6.048e+05   second
```

Table A-2. (continued)

```
 1 mo    2.630e+06  second
 1 yr    3.156e+07  second
10 yr    3.156e+08  second
100 yr   3.156e+09  second
1000 y   3.156e+10  second

pulse sequence radioactivity calculation

the pulse sequence is as follows:
the number of pulses per day              12
time interval between pulses              3.600e+03 second
the number of operating days per week      5
time interval between daily pulse bins    4.680e+04 second
the number of operating weeks per year     4
time interval between weekly pulse bins   2.196e+05 second

                coarse mesh zone boundaries and fine mesh divisions

r - coarse mesh:       0.000       0.500     100.000     101.000     106.000     300.000
r - fine mesh div:     1    10     1     5    50

                volume of zone

      zone   1   5.236e-01  cm3
      zone   2   4.189e+06  cm3
      zone   3   1.269e+05  cm3
      zone   4   6.732e+05  cm3
      zone   5   1.081e+08  cm3


                zone   1   2   3   4   5
     void             *   *
     c-liner                  *
     alum-fw                      *
     b-h2o                            *
```

Table A-2. (continued)

nuclide no. density

kza	mixture	void	c-liner	alum-fw	b-h2o
1001		0.	0.	0.	6.849e+22
1002		0.	0.	0.	1.027e+19
5010		0.	3.895e+16	0.	4.426e+20
5011		0.	4.328e+15	0.	4.918e+19
6012		0.	8.628e+22	0.	0.
6013		0.	9.685e+20	0.	0.
8016		0.	0.	0.	3.492e+22
8017		0.	0.	0.	1.295e+19
8018		0.	0.	0.	7.140e+19
13027		0.	0.	5.819e+22	0.

reference flux
tdf 1m cavity test run:liner-aluminum-borated water pulse mode

a one here indicates collapsing of fluxes 0 0

flux reading

67 intervals read from flux (67, 46)
67 intervals have been collapsed to 67 intervals

Table A-2. (continued)

nuclear data table

① lkza	② nkt	④ kt= ③	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	③	21	22	23	24	25	26	27	28	29
10010	2	s	x	x																			r	o	o							
10020	2	s	x	x																			r	o	o							
10030	4	s	x			x																	r	o	o							
20030	4	s	x	x	x		x																r	o	o							
20060	2																						r	o	o							
20080	2																						r	o	o							
30060	6	s	x	x	x			x		x		x											r	o	o							
30070	6	s	x	x		x	x				x	x											r	o	o							
30080	2																						r	o	o							
30090	2																						r	o	o							
40070	5	s	x		x					x													r	o		o						
40090	7	s	x	x	x	x	x	x		x																						
40100	2																						r	o	o							
50100	7	s	x	x	x		x			x			x			x																
50110	6	s	x	x	x	x		x		x																						
60120	6	s	x	x	x		x			x					x																	
60130	7	s	x	x	x	x		x		x	x																					
60140	7	s	x			x				x	x										x		r	o	o							
70140	8	s	x	x	x	x	x	x		x			x																			
70160	2																						r	o	o							
80160	7	s	x	x	x	x	x			x	x																					
80170	2	s	x							x																						
80190	2																						r	o	o							
90180	2																						r	o		o						
90190	8	s	x	x	x	x	x	x		x	x																					
90200	2																						r	o	o							
100230	2																						r	o	o							
110230	7	s	x	x	x	x	x			x	x																					
110240	2																						r	o	o							
110250	2																						r	o	o							
110260	2																						r	o	o							
120230	8	s	x	x	x	x	x			x													r	o		o						
120240	6	s	x	x	x	x	x			x																						
120250	5	s	x	x	x	x				x																						
120260	6	s	x	x	x	x				x											x											
120270	7	s	x	x		x				x											x		r	o	o							
130260	2																						r	o		o						
130270	8	s	x	x	x	x	x	x		x									x													
130280	2																						r	o	o							
130290	2																						r	o	o							
130300	2																						r	o	o							

** Note **

① LKZA: Nuclide Identification number
(= 10·KZA + LIS)
KZA: 1000·Z + A
LIS: Isomeric State of a nuclide

② NKT: Total Number of Transmutation types

③ R: Radioisotope
S: Stable Nuclide

④ KT: Transmutation type Number
1-20; Reaction type ('X')
21-29; Radioactive Decay Type ('O')

Table A-2. (continued)

index table

tdf 1m cavity test run:liner-aluminum-borated water pulse mode

lkza	① sr	nkt	product	t ② rate	kt	③
10010	1	2				
			10010	2.786e-03	1	totx
			10020	2.786e-03	2	g
10020	1	2				
			10020	1.559e-03	1	totx
			10030	1.559e-03	2	g
10030	11	4				
			10030	2.124e+00	1	totx
			10020	2.124e+00	4	2n
			10030	1.787e-09	21	*tot
			20030	1.787e-09	22	*b-
20030	1	4				
			20030	2.109e+01	1	totx
			20040	2.256e-03	2	g
			10030	1.795e+01	3	p
			10020	3.132e+00	5	np
20060	10	2				
			20060	8.557e-01	21	*tot
			30060	8.557e-01	22	*b-
20080	10	2				
			20080	5.682e+00	21	*tot
			30080	5.682e+00	22	*b-
30060	1	6				
			30060	1.271e+01	1	totx
			30070	7.313e-04	2	g
			20060	3.663e-01	3	p
			20040	4.248e+00	6	t
			10030	5.086e+00	8	a
			10010	3.012e+00	10	a2n
30070	1	6				
			30070	2.137e+01	1	totx
			30080	5.733e-04	2	g
			30060	3.362e+00	4	2n
			20060	4.251e-01	5	np
			10030	1.619e+01	9	na
			10020	1.392e+00	10	a2n
30080	10	2				
			30080	8.232e-01	21	*tot
			40080	8.232e-01	22	*b-

** Note **

① SR: Flag for an isotope
- 1 - Stable Nuclide
- 10 - Radioisotope without cross sections
- 11 - Radioisotope with cross sections

② T. Rate : Transmutation Rate

③ Reaction Index
- totx - total cross section
- g - (n,γ)
- 2n - $(n,2n)$
- a - (n,α)
- :
- *tot - total decay constant
- *b⁻ - λ_{β^-}
- *b⁺ - λ_{β^+}
- :

Table A-2. (continued)

```
              chain construction procedures


1001 chain
                                                  10020 - 1
                                   10020- pretest stable nuclide  1
                                   10020- test stable nuclide     0

 $ yes         number of chains =  0

1002 chain
  <- H_1^2 (KZA No.)                              10030 - 1
                                   10030- radionuclide with x-sections
                  Combined ID No.         pass radioactive part; test x-section part
                    of SR and KT   10030- test stable nuclide     0
                    (SR·100 + KT)                 20030 - 1
    <- Chain No.                   20030- pretest stable nuclide  1
                                   20030- test stable nuclide     0
 201                  (σφ+λ)^i_{i-1}  (σφ+λ)_T    λ^i_{i-1}     λ_T
     10020   102  0.          1.5590e-03  0.           0.              201  1
     10030  1122  1.5590e-03  2.1243e+00  0.           1.7870e-09      201  2

 $ yes         number of chains =  1

5010 chain
                                       Reaction   { 50110 - 6
                                                  { 40100 - 5
                                        Products->{ 40090 - 4
                                                  { 30070 - 3
                                                  { 10030 - 2
                                                  {     0 - 1
                                       0- no data found in actllib
                                   10030- radionuclide with x-sections
                                          pass radioactive part; test x-section part
                                   10030- test stable nuclide     1
                                   30070- pretest stable nuclide  1
                                   30070- test stable nuclide     1
                                   40090- pretest stable nuclide  1
                                   40090- test stable nuclide     0
                                   40100- pass pure radionuclide  2
                                   50110- pretest stable nuclide  1
                                   50110- test stable nuclide     0
                                                  10020 - 1
                                                  20030 - 2
                                                  30080 - 7
```

Table A-2. (continued)

executing procedures for zone 3

lkza	lrz	ai	ak	bi	bk	yo	yt	z,i	op
	$(=100\cdot SR+KT)$	$(\Gamma\varphi+\lambda)^{i}_{i-1}$	$(\Gamma\varphi+\lambda)_{T}$	λ^{i}_{i-1}	λ_T	$y(0)$	$y(t)$	zone interval	operation time
mxc = 6									
								< 3,	1>10−6 s
50100	111	0.	6.132e−02	0.	0.	3.895e+16	3.895e+16		
10030	1104	8.234e−05	2.729e−05	0.	1.787e−09	0.	3.207e+06		
								< 3,	1>10−6 s
50100	111	0.	6.132e−02	0.	0.	3.895e+16	3.895e+16		
10030	1122	8.234e−05	1.787e−09	0.	1.787e−09	0.	3.207e+06		
								< 3,	1>10−6 s
50100	103	1.357e−14	6.132e−02	1.357e−14	0.	3.895e+16	3.895e+16		
40100	1022	2.693e−05	1.357e−14	0.	1.357e−14	0.	1.049e+06		
								< 3,	1>10−6 s
50100	108	0.	6.132e−02	0.	0.	3.895e+16	3.895e+16		
30070	109	6.110e−02	3.150e−04	0.	0.	0.	2.380e+09		
10030	1122	2.513e−04	1.787e−09	0.	1.787e−09	0.	2.990e−01		
								< 3,	1>10−6 s
50100	108	0.	6.132e−02	0.	0.	3.895e+16	3.895e+16		
30070	105	6.110e−02	3.150e−04	0.	0.	0.	2.380e+09		
20060	1022	5.108e−06	8.557e−01	0.	8.557e−01	0.	6.078e−03		
								< 3,	1>10−6 s
50100	108	0.	6.132e−02	0.	0.	3.895e+16	3.895e+16		
30070	102	6.110e−02	3.150e−04	0.	0.	0.	2.380e+09		
30080	1022	5.324e−07	8.232e−01	0.	8.232e−01	0.	6.335e−04		
mxc = 1									
								< 3,	1>10−6 s
50110	108	0.	4.435e−05	0.	0.	4.328e+15	4.328e+15		
30080	1022	1.546e−05	8.232e−01	0.	8.232e−01	0.	6.691e+04		
mxc = 2									
								< 3,	1>10−6 s
60130	108	0.	9.837e−05	0.	0.	9.685e+20	9.685e+20		
40100	1022	3.955e−05	1.357e−14	0.	1.357e−14	0.	3.830e+10		
								< 3,	1>10−6 s
60130	102	0.	9.837e−05	0.	0.	9.685e+20	9.685e+20		
60140	1122	5.284e−08	3.833e−12	0.	3.833e−12	0.	5.118e+07		

Table A-2. (continued)

interval activity

3 - 1 (zone-int) 10-6 s operating

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y	
10030	1.373e+00	1.373e+00	1.373e+00	1.373e+00	1.373e+00	1.372e+00	1.37e+00	1.37e+00	1.30e+00	7.81e-01	4.88e-03	4.41e-25	
40100	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01	
20060	5.201e-03	2.621e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
30080	5.508e+04	1.951e-17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
60140	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.71e-02	4.71e-02	4.71e-02	4.70e-02	4.65e-02	4.17e-02	
total	5.508e+04	1.545e+00	1.545e+00	1.544e+00	1.544e+00	1.544e+00	1.54e+00	1.54e+00	1.47e+00	9.53e-01	1.76e-01	1.66e-01	dps/cm3

Table A-2. (continued)

zone 3 activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	4.709e-06	4.709e-06	4.709e-06	4.709e-06	4.709e-06	4.708e-06	4.70e-06	4.69e-06	4.45e-06	2.68e-06	1.67e-08	1.51e-30
40100	be 10	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07
20060	he 6	1.784e-08	8.992e-31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	1.889e-01	6.694e-23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.62e-07	1.62e-07	1.61e-07	1.61e-07	1.60e-07	1.43e-07
	total	1.890e-01	5.298e-06	5.298e-06	5.298e-06	5.298e-06	5.298e-06	5.29e-06	5.28e-06	5.04e-06	3.27e-06	6.04e-07	5.71e-07

Table A-2. (continued)

zone 3 bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.642e-11	2.642e-11	2.642e-11	2.642e-11	2.642e-11	2.641e-11	2.64e-11	2.63e-11	2.50e-11	1.50e-11	9.39e-14	8.49e-36
40100	be 10	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09
20060	he 6	6.672e-13	3.363e-35	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	7.067e-06	2.504e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.81e-12	1.81e-12	1.81e-12	1.81e-12	1.79e-12	1.61e-12
	total	7.072e-06	4.830e-09	4.830e-09	4.830e-09	4.830e-09	4.830e-09	4.83e-09	4.83e-09	4.83e-09	4.82e-09	4.80e-09	4.80e-09

Table A-2. (continued)

zone 3 afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.33e-16	2.33e-16	2.21e-16	1.33e-16	8.30e-19	7.50e-41
40100	be 10	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.56e-16
20060	he 6	1.663e-16	8.380e-39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	7.132e-09	2.527e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.50e-17	4.50e-17	4.50e-17	4.49e-17	4.45e-17	3.99e-17
	total	7.132e-09	7.353e-16	7.353e-16	7.353e-16	7.353e-16	7.353e-16	7.35e-16	7.34e-16	7.22e-16	6.35e-16	5.02e-16	4.96e-16

Table A-2. (continued)

zone 3 beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.33e-16	2.33e-16	2.21e-16	1.33e-16	8.30e-19	7.50e-41
40100	be 10	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.56e-16
20060	he 6	1.663e-16	8.380e-39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	7.033e-09	2.492e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.50e-17	4.50e-17	4.50e-17	4.49e-17	4.45e-17	3.99e-17
	total	7.033e-09	7.353e-16	7.353e-16	7.353e-16	7.353e-16	7.353e-16	7.35e-16	7.34e-16	7.22e-16	6.35e-16	5.02e-16	4.96e-16

Table A-2. (continued)

zone 4 activity 10−6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	1.010e+04	1.010e+04	1.003e+04	9.647e+03	7.652e+03	3.323e+03	4.21e+00	2.02e−11	0.	0.	0.	0.
120270	mg 27	5.210e+04	4.842e+04	2.504e+04	6.425e+02	1.832e−07	7.965e−42	0.	0.	0.	0.	0.	0.
130260	al 26	1.399e−04	1.399e−04	1.399e−04	1.399e−04	1.399e−04	1.399e−04	1.40e−04	1.40e−04	1.40e−04	1.40e−04	1.40e−04	1.40e−04
130280	al 28	3.092e+04	2.269e+04	1.401e+03	2.676e−04	1.299e−44	0.	0.	0.	0.	0.	0.	0.
	total	9.312e+04	8.120e+04	3.647e+04	1.029e+04	7.652e+03	3.323e+03	4.21e+00	1.40e−04	1.40e−04	1.40e−04	1.40e−04	1.40e−04

Table A-2. (continued)

zone 4 bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.267e+00	2.266e+00	2.250e+00	2.165e+00	1.717e+00	7.458e-01	9.44e-04	4.52e-15	0.	0.	0.	0.
120270	mg 27	1.949e+00	1.811e+00	9.366e-01	2.403e-02	6.852e-12	2.979e-46	0.	0.	0.	0.	0.	0.
130260	al 26	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06
130280	al 28	1.156e+00	8.486e-01	5.239e-02	1.001e-08	4.858e-49	0.	0.	0.	0.	0.	0.	0.
	total	5.372e+00	4.925e+00	3.239e+00	2.189e+00	1.717e+00	7.458e-01	9.46e-04	1.57e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06

Table A-2. (continued)

zone 4 afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.804e-04	2.802e-04	2.783e-04	2.677e-04	2.124e-04	9.224e-05	1.17e-07	5.60e-19	0.	0.	0.	0.
120270	mg 27	4.877e-04	4.532e-04	2.344e-04	6.014e-06	1.715e-15	7.456e-50	0.	0.	0.	0.	0.	0.
130260	al 26	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12
130280	al 28	5.320e-04	3.905e-04	2.411e-05	4.605e-12	2.235e-52	0.	0.	0.	0.	0.	0.	0.
	total	1.300e-03	1.124e-03	5.368e-04	2.738e-04	2.124e-04	9.224e-05	1.17e-07	2.75e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12

Table A-2. (continued)

zone 4 beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	3.354e-05	3.352e-05	3.328e-05	3.202e-05	2.540e-05	1.103e-05	1.40e-08	6.69e-20	0.	0.	0.	0.
120270	mg 27	2.125e-04	1.975e-04	1.021e-04	2.620e-06	7.472e-16	3.249e-50	0.	0.	0.	0.	0.	0.
130260	al 26	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.85e-13	3.85e-13	3.85e-13	3.85e-13	3.85e-13	3.84e-13
130280	al 28	2.058e-04	1.510e-04	9.326e-06	1.781e-12	8.648e-53	0.	0.	0.	0.	0.	0.	0.
	total	4.519e-04	3.820e-04	1.447e-04	3.464e-05	2.540e-05	1.103e-05	1.40e-08	3.85e-13	3.85e-13	3.85e-13	3.85e-13	3.84e-13

Table A-2. (continued)

note: listed below are isotopes for which gamma source data exists in [block data]

	nuclide
110240	na 24
120270	mg 27
130260	al 26
130280	al 28

no. of isotopes in 5 is 7 50 67

Table A-2. (continued)

zone 5 activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	6.338e-01	6.338e-01	6.338e-01	6.338e-01	6.337e-01	6.337e-01	6.33e-01	6.31e-01	5.99e-01	3.61e-01	2.25e-03	2.04e-25
40100	be 10	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06
20060	he 6	7.035e-04	3.546e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	2.227e+04	7.890e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	2.041e+06	5.998e+03	9.821e-20	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.71e-05	8.71e-05	8.71e-05	8.70e-05	8.61e-05	7.72e-05
	total	2.063e+06	5.999e+03	6.338e-01	6.338e-01	6.338e-01	6.338e-01	6.33e-01	6.31e-01	5.99e-01	3.61e-01	2.34e-03	7.87e-05

Table A-2. (continued)

zone 5 bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	3.556e-06	3.556e-06	3.556e-06	3.556e-06	3.555e-06	3.555e-06	3.55e-06	3.54e-06	3.36e-06	2.02e-06	1.26e-08	1.14e-30
40100	be 10	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08
20060	he 6	2.631e-08	1.326e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	8.330e-01	2.951e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	7.632e+01	2.243e-01	3.673e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.78e-10	9.78e-10	9.78e-10	9.77e-10	9.66e-10	8.66e-10
	total	7.716e+01	2.243e-01	3.573e-06	3.573e-06	3.573e-06	3.572e-06	3.57e-06	3.56e-06	3.38e-06	2.04e-06	3.01e-08	1.74e-08

Table A-2. (continued)

zone 5 afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.144e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.12e-13	1.01e-35
40100	be 10	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15
20060	he 6	6.556e-12	3.304e-34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	8.406e-04	2.978e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	1.115e-01	3.278e-04	5.368e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.43e-14	2.43e-14	2.43e-14	2.43e-14	2.40e-14	2.15e-14
	total	1.124e-01	3.278e-04	3.147e-11	3.147e-11	3.147e-11	3.147e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.37e-13	2.31e-14

Table A-2. (continued)

zone 5 beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.144e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.12e-13	1.01e-35
40100	be 10	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15
20060	he 6	6.556e-12	3.304e-34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	8.290e-04	2.937e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	3.133e-02	9.209e-05	1.508e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.43e-14	2.43e-14	2.43e-14	2.43e-14	2.40e-14	2.15e-14
	total	3.216e-02	9.209e-05	3.147e-11	3.147e-11	3.147e-11	3.147e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.37e-13	2.31e-14

Table A-2. (continued)

summary of TEST RUN for 1m radius tdf aluminum sphere pulse seq. calc.

10-6 s operation time 1.000e-06 sec

after shutdown sec		total act ci	total bhp km3/kw	total aht mw	beta aht mw	per act ci/w	% aht %
0.	0	2.156e+06	8.253e+01	1.137e-01	3.261e-02	2.419e+00	1.276e+01
6.000e+01	1 m	8.720e+04	5.150e+00	1.452e-03	4.741e-04	9.784e-02	1.629e-01
6.000e+02	10 m	3.647e+04	3.239e+00	5.368e-04	1.447e-04	4.092e-02	6.023e-02
3.600e+03	1 h	1.029e+04	2.189e+00	2.738e-04	3.464e-05	1.155e-02	3.072e-02
2.160e+04	6 h	7.652e+03	1.717e+00	2.124e-04	2.540e-05	8.586e-03	2.383e-02
8.640e+04	1 d	3.324e+03	7.458e-01	9.224e-05	1.103e-05	3.730e-03	1.035e-02
6.048e+05	1 w	4.841e+00	9.494e-04	1.168e-07	1.400e-08	5.432e-06	1.311e-05
2.630e+06	1 mo	6.310e-01	5.131e-06	3.407e-11	3.171e-11	7.080e-07	3.823e-09
3.156e+07	1 yr	5.992e-01	4.953e-06	3.250e-11	3.013e-11	6.724e-07	3.646e-09
3.156e+08	10 yr	3.608e-01	3.615e-06	2.067e-11	1.830e-11	4.048e-07	2.319e-09
3.156e+09	100 yr	2.480e-03	1.605e-06	2.886e-12	5.226e-13	2.783e-09	3.239e-10
3.156e+10	1000 y	2.190e-04	1.591e-06	2.770e-12	4.081e-13	2.458e-10	3.108e-10

Sample Problem A.2

This sample problem consists of the 1 m radius spherical chamber with graphite liner and borated water shield as described for sample problem A.1. The input to the problem has been changed. The impurities contained in the graphite liner are now included as are the impurities and other constituents of the Al-6061-T6 chamber material. In this problem the LCPLS option has been used to collapse the first 11 mesh intervals contained in the void region. As will be noticed by a comparison of the results, the inclusion of the impurities and other constituents of the aluminum results in a higher level of activity as that obtained in sample problem A.1.

Table A-3. Input for Sample Problem A.2

```
1
2
3
4
5        TEST TEST  TEST tdf/scav 1m radius pulse seq. calc.
6       10     3     3     1     3    56     1     0    70     8     3
7        1     0     0     0     0     2     1     1    11
8       1.000000      1.0000       1.000      1.0000    7.093e+1
9         100.00      100.00         0.0      4.0e-4    1.000e-4
10   'spulse'
11    12    3.600e+3     5    4.680e+4     4    2.196e+5
12   'one-d'
13        3
14      100.00      101.00      106.00      300.00
15        1     5    50
16        1     1     1     1
17        2     5     1     1
18        3    50     1     1
19   'c-liner'
20   'al-fw'
21   'b-h2o'
22        1     2     3
23      0.0   0.0  1.00
24    8.8-5   0.0  1.00
25      0.0  1.00   0.0
26     1.00   0.0   0.0
27    6.4-5  1.00   0.0
28    2.3-3  1.00   0.0
29    4.3-4  1.00   0.0
30    2.8-4  1.00   0.0
31        1  1001     1   6.849e+22
32        1  1002     1   1.027e+19
33        2  5010     1   4.426e+20
34        2  5011     1   4.918e+19
35        4  6012     1   8.628e+22
36        4  6013     1   9.685e+20
37        1  8016     1   3.492e+22
38        1  8017     1   1.295e+19
39        1  8018     1   7.140e+19
40        4 11023     1   4.559e+17
41        5 12024     1   5.284e+20
42        5 12025     1   6.689e+19
43        5 12026     1   7.365e+19
44        3 13027     1   5.819e+22
45        6 14028     1   3.204e+20
46        6 14029     1   1.622e+19
47        6 14030     1   1.077e+19
48        4 16032     3   3.106e+16
49        4 16033     3   2.485e+16
50        4 16034     3   1.376e+15
51        4 16036     3   4.477e+14
52        3 19039     3   1.435e+15
53        3 19040     3   1.847e+11
54        3 19041     3   1.036e+14
55        4 20040     3   5.576e+17
56        4 20042     3   3.722e+15
57        4 20043     3   8.333e+14
58        4 20044     3   1.202e+16
59        4 20046     3   1.898e+13
60        4 20048     3   1.076e+15
61        7 22046     1   4.201e+18
62        7 22047     1   3.794e+18
63        7 22048     1   3.753e+19
64        7 22049     1   2.750e+18
```

* ignore blank lines

Table A-3. (continued)

```
      7 22050     1   2.648e+18
      4 23050     3   4.937e+13
      4 23051     3   2.052e+16
      3 24050     1   4.081e+18
      3 24052     1   7.862e+19
      3 24053     1   8.914e+18
      3 24054     1   2.214e+18
      3 25055     1   4.440e+19
      8 26054     1   1.182e+19
      8 26056     1   1.871e+20
      8 26057     1   4.280e+18
      8 26058     1   6.115e+17
      3 28058     3   8.116e+15
      3 28060     3   3.101e+15
      3 28061     3   1.307e+14
      3 28062     3   4.278e+14
      3 28064     3   1.069e+14
      3 29063     1   5.313e+19
      3 29065     1   2.365e+19
      3 30064     1   3.026e+19
      3 30066     1   1.735e+19
      3 30067     1   2.550e+18
      3 30068     1   1.169e+19
      3 30070     1   3.856e+17
      3 41093     3   1.225e+14
      3 42092     3   5.720e+13
      3 42094     3   3.594e+13
      3 42095     3   6.145e+13
      3 42096     3   6.454e+13
      3 42097     3   3.710e+13
      3 42098     3   9.314e+13
      3 42100     3   3.710e+13
      4 82204     3   5.351e+13
      4 82206     3   8.533e+15
      4 82207     3   7.825e+15
      4 82208     3   1.855e+16
10-6 s    1.000e-6
  tdf 1m cavity test run:liner-aluminum-borated water          pulse mode
  5.2922e-01  4.8064e-02  2.4431e-02  1.6094e-02  1.1164e-02  7.8296e-03
  5.7997e-03  4.6398e-03  4.1324e-03  4.0599e-03  4.2411e-03  4.2411e-03
  4.8936e-03  4.8936e-03  4.2919e-03  4.2919e-03  3.9005e-03  3.9005e-03
  1.0513e-02  1.0513e-02  7.3228e-03  7.3228e-03  5.2276e-03  5.2275e-03
  2.7192e-03  2.7191e-03  2.7190e-03  2.8424e-03  2.8427e-03  2.8422e-03
  1.0590e-03  1.0588e-03  1.0588e-03  2.6853e-04  2.6852e-04  2.6851e-04
  6.6246e-05  6.6236e-05  6.6227e-05  1.5324e-05  1.5310e-05  1.5292e-05
  2.9462e-06  2.9223e-06  2.8933e-06  5.9736e-07
```

Table A-4. Output for Sample Problem A-2

```
TEST TEST  TEST tdf/scav 1m radius pulse seq. calc.

                problem run id      10
 lnk    link to the other solution          3
 lge    1/2/3  = slab/cylinder/sphere        3
 lfx    1/2    = dkr/anisn (formatted)      1
 izm    number of zones                      3
 int    number of intervals                 56
 nop    number of operating times            1
 nas    number of after shutdown times      12
 nnc    number of materials(nuclides)       70
 ncmp   number of composition table          8
 nmix   number of mixtures                   3
 ign    number of neutron groups           * 46
 igg    number of photon groups            * 43


              reactor system parameters

 radius of the plasma      100.00          cm
 radius of the first wall  100.00          cm
 radius of the torus         0.00          cm


 first wall area            1.257e+01      m2
 neutron wall loading       1.000e+00      mw/m2
 total operating power      8.912e-01      mw
 flux conversion factor     7.093e+01
 accurcy limit              4.000e-04
 test irradiation time      1.000e-04


      operating time    1

                                        after shutdown time  12

 10-6 s    1.000e-06  second

                                     0       0.          second
                                     1 m     6.000e+01   second
                                    10 m     6.000e+02   second
                                     1 h     3.600e+03   second
                                     6 h     2.160e+04   second
                                     1 d     8.640e+04   second
                                     1 w     6.048e+05   second
```

Table A-4. (continued)

```
                                  1 mo    2.630e+06  second
                                  1 yr    3.156e+07  second
                                 10 yr    3.156e+08  second
                                100 yr    3.156e+09  second
                               1000 y     3.156e+10  second

pulse sequence radioactivity calculation

the pulse sequence is as follows:
the number of pulses per day                12
time interval between pulses                3.600e+03 second
the number of operating days per week        5
time interval between daily pulse bins      4.680e+04 second
the number of operating weeks per year       4
time interval between weekly pulse bins     2.196e+05 second

                coarse mesh zone boundaries and fine mesh divisions

r - coarse mesh:      100.000      101.000      106.000      300.000
r - fine mesh div:      1      5     50

                volume of zone

      zone   1    1.269e+05  cm3
      zone   2    6.732e+05  cm3
      zone   3    1.081e+08  cm3


              zone   1   2   3
     c-liner         *
     al-fw               *
     b-h2o                   *
```

Table A-4. (continued)

kza	mixture	nuclide no. density c-liner	al-fw	b-h2o
1001		0.	0.	6.849e+22
1002		0.	0.	1.027e+19
5010		3.895e+16	0.	4.426e+20
5011		4.328e+15	0.	4.918e+19
6012		8.628e+22	0.	0.
6013		9.685e+20	0.	0.
8016		0.	0.	3.492e+22
8017		0.	0.	1.295e+19
8018		0.	0.	7.140e+19
11023		4.559e+17	0.	0.
12024		3.382e+16	5.284e+20	0.
12025		4.281e+15	6.689e+19	0.
12026		4.714e+15	7.365e+19	0.
13027		0.	5.819e+22	0.
14028		7.369e+17	3.204e+20	0.
14029		3.731e+16	1.622e+19	0.
14030		2.477e+16	1.077e+19	0.
16032		3.106e+16	0.	0.
16033		2.485e+16	0.	0.
16034		1.376e+15	0.	0.
16036		4.477e+14	0.	0.
19039		0.	1.435e+15	0.
19040		0.	1.847e+11	0.
19041		0.	1.036e+14	0.
20040		5.576e+17	0.	0.
20042		3.722e+15	0.	0.
20043		8.333e+14	0.	0.
20044		1.202e+16	0.	0.
20046		1.898e+13	0.	0.
20048		1.076e+15	0.	0.
22046		1.806e+15	4.201e+18	0.
22047		1.631e+15	3.794e+18	0.
22048		1.614e+16	3.753e+19	0.
22049		1.182e+15	2.750e+18	0.
22050		1.139e+15	2.648e+18	0.
23050		4.937e+13	0.	0.
23051		2.052e+16	0.	0.
24050		0.	4.081e+18	0.
24052		0.	7.862e+19	0.
24053		0.	8.914e+18	0.
24054		0.	2.214e+18	0.
25055		0.	4.440e+19	0.

Table A-4. (continued)

```
26054           3.310e+15  1.182e+19  0.
26056           5.239e+16  1.871e+20  0.
26057           1.198e+15  4.280e+18  0.
26058           1.712e+14  6.115e+17  0.
28058           0.         8.116e+15  0.
28060           0.         3.101e+15  0.
28061           0.         1.307e+14  0.
28062           0.         4.278e+14  0.
28064           0.         1.069e+14  0.
29063           0.         5.313e+19  0.
29065           0.         2.365e+19  0.
30064           0.         3.026e+19  0.
30066           0.         1.735e+19  0.
30067           0.         2.550e+18  0.
30068           0.         1.169e+19  0.
30070           0.         3.856e+17  0.
41093           0.         1.225e+14  0.
42092           0.         5.720e+13  0.
42094           0.         3.594e+13  0.
42095           0.         6.145e+13  0.
42096           0.         6.454e+13  0.
42097           0.         3.710e+13  0.
42098           0.         9.314e+13  0.
42100           0.         3.710e+13  0.
82204           5.351e+13  0.         0.
82206           8.533e+15  0.         0.
82207           7.825e+15  0.         0.
82208           1.855e+16  0.         0.


        reference flux
tdf 1m cavity test run:liner-aluminum-borated water        pulse mode

a one here indicates collapsing of fluxes  1 11

        flux reading

           67 intervals read from flux ( 67, 46)
67 intervals have been collapsed to  56 intervals
```

Table A-4. (continued)

interval activity

1 - 1 (zone-int) 10-6 s operating

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	1.373e+00	1.373e+00	1.373e+00	1.373e+00	1.373e+00	1.372e+00	1.37e+00	1.37e+00	1.30e+00	7.81e-01	4.88e-03	4.41e-25
40100	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.248e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01	1.25e-01
20060	5.201e-03	2.621e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	5.508e+04	1.951e-17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.708e-02	4.71e-02	4.71e-02	4.71e-02	4.70e-02	4.65e-02	4.17e-02
90200	2.617e+06	5.961e+04	9.854e-11	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	2.713e+05	8.977e+04	4.275e+00	4.157e-24	0.	0.	0.	0.	0.	0.	0.	0.
110240	1.589e+03	1.588e+03	1.577e+03	1.517e+03	1.204e+03	5.228e+02	6.62e-01	3.17e-12	0.	0.	0.	0.
120230	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	1.431e+03	7.154e+02	1.399e+00	1.252e-15	0.	0.	0.	0.	0.	0.	0.	0.
110260	8.511e+04	1.249e-12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	1.508e+03	1.401e+03	7.247e+02	1.859e+01	5.301e-09	2.305e-43	0.	0.	0.	0.	0.	0.
130280	7.122e+05	5.227e+05	3.227e+04	6.164e-03	2.992e-43	0.	0.	0.	0.	0.	0.	0.
140270	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	1.165e+04	1.048e+04	4.050e+03	2.056e+01	3.523e-13	0.	0.	0.	0.	0.	0.	0.
130300	5.925e+05	7.434e+00	5.731e-44	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	5.061e+01	5.039e+01	4.843e+01	3.885e+01	1.035e+01	8.868e-02	2.57e-18	0.	0.	0.	0.	0.
160310	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350	5.800e-01	5.800e-01	5.800e-01	5.798e-01	5.789e-01	5.755e-01	5.49e-01	4.56e-01	3.26e-02	1.85e-13	0.	0.
160370	7.110e+00	6.200e+00	1.807e+00	1.916e-03	2.726e-21	0.	0.	0.	0.	0.	0.	0.
180370	2.609e+03	2.609e+03	2.609e+03	2.607e+03	2.596e+03	2.558e+03	2.27e+03	1.43e+03	1.88e+00	1.00e-28	0.	0.
190380	2.242e+02	2.049e+02	9.114e+01	1.013e+00	1.903e-12	0.	0.	0.	0.	0.	0.	0.
190400	8.978e-07	8.978e-07	8.978e-07	8.978e-07	8.978e-07	8.978e-07	8.98e-07	8.98e-07	8.98e-07	8.98e-07	8.98e-07	8.98e-07
200390	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	3.583e-04	3.583e-04	3.583e-04	3.583e-04	3.583e-04	3.583e-04	3.58e-04	3.58e-04	3.58e-04	3.58e-04	3.58e-04	3.55e-04
170360	5.459e-14	5.459e-14	5.459e-14	5.459e-14	5.459e-14	5.459e-14	5.46e-14	5.46e-14	5.46e-14	5.46e-14	5.46e-14	5.45e-14
180390	5.932e-03	5.932e-03	5.932e-03	5.932e-03	5.932e-03	5.932e-03	5.93e-03	5.93e-03	5.92e-03	5.78e-03	4.58e-03	4.51e-04
170390	1.171e-10	1.171e-10	1.171e-10	1.170e-10	1.165e-10	1.148e-10	1.02e-10	6.41e-11	8.49e-14	3.67e-16	3.67e-16	3.67e-16
190420	8.252e+01	8.245e+01	8.176e+01	7.804e+01	5.901e+01	2.157e+01	6.88e-03	5.82e-13	5.71e-13	4.72e-13	7.13e-14	4.36e-22
180420	1.588e-12	1.588e-12	1.588e-12	1.588e-12	1.588e-12	1.588e-12	1.59e-12	1.58e-12	1.55e-12	1.29e-12	1.94e-13	1.19e-21
190430	1.276e+01	1.275e+01	1.269e+01	1.237e+01	1.060e+01	6.071e+00	7.05e-02	1.94e-09	0.	0.	0.	0.
170400	2.105e-20	2.105e-20	2.105e-20	2.105e-20	2.105e-20	2.105e-20	2.10e-20	2.10e-20	2.10e-20	2.10e-20	2.10e-20	2.10e-20
180410	2.131e+02	2.118e+02	2.001e+02	1.459e+02	2.197e+01	2.406e-02	4.97e-26	0.	0.	0.	0.	0.
190440	3.035e+02	2.941e+02	2.215e+02	4.584e+01	3.601e-03	6.010e-18	0.	0.	0.	0.	0.	0.
200450	6.141e+00	6.141e+00	6.141e+00	6.140e+00	6.135e+00	6.115e+00	5.96e+00	5.40e+00	1.30e+00	1.10e-06	0.	0.
190460	3.729e+00	2.537e+00	7.929e-02	3.446e-10	0.	0.	0.	0.	0.	0.	0.	0.
180430	1.710e+02	1.487e-16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190450	8.336e-11	7.983e-11	5.405e-11	6.197e-12	1.406e-17	6.750e-38	0.	0.	0.	0.	0.	0.
200470	6.663e+01	6.662e+01	6.656e+01	6.621e+01	6.413e+01	5.718e+01	2.28e+01	6.34e-01	3.66e-23	0.	0.	0.

Table A-4. (continued)

210470	8.882e+01	8.882e+01	8.879e+01	8.864e+01	8.767e+01	8.384e+01	4.89e+01	2.20e+00	1.49e-22	0.	0.	0.
200490	1.824e+01	1.685e+01	8.294e+00	1.615e-01	8.790e-12	0.	0.	0.	0.	0.	0.	0.
210490	1.293e+01	1.299e+01	1.289e+01	7.845e+00	2.117e-01	4.698e-07	0.	0.	0.	0.	0.	0.
210440	3.818e-03	3.807e-03	3.708e-03	3.200e-03	1.322e-03	5.480e-05	4.79e-16	0.	0.	0.	0.	0.
210460	6.242e+00	6.242e+00	6.242e+00	6.240e+00	6.229e+00	6.191e+00	5.89e+00	4.85e+00	3.04e-01	4.65e-13	0.	0.
220450	6.595e+00	6.571e+00	6.353e+00	5.266e+00	1.709e+00	2.976e-02	2.51e-16	0.	0.	0.	0.	0.
210480	1.632e+02	1.631e+02	1.627e+02	1.606e+02	1.483e+02	1.115e+02	1.13e+01	1.51e-03	0.	0.	0.	0.
210500	7.319e+01	4.881e+01	1.274e+00	2.032e-09	0.	0.	0.	0.	0.	0.	0.	0.
220510	1.112e+03	9.873e+02	3.371e+02	8.610e-01	2.391e-16	0.	0.	0.	0.	0.	0.	0.
230490	1.014e-01	1.014e-01	1.014e-01	1.014e-01	1.014e-01	1.012e-01	9.99e-02	9.51e-02	4.71e-02	4.72e-05	4.85e-35	0.
230480	9.967e-11	9.967e-11	9.964e-11	9.949e-11	9.860e-11	9.544e-11	7.36e-11	2.66e-11	1.31e-17	0.	0.	0.
230520	5.972e+03	4.964e+03	9.409e+02	9.134e-02	7.645e-26	0.	0.	0.	0.	0.	0.	0.
240510	8.958e+00	8.958e+00	8.956e+00	8.949e+00	8.902e+00	8.737e+00	7.52e+00	4.19e+00	9.80e-04	2.19e-39	0.	0.
250520	1.597e-02	1.597e-02	1.596e-02	1.589e-02	1.549e-02	1.412e-02	6.75e-03	3.76e-04	4.70e-22	0.	0.	0.
250530	6.016e-07	6.016e-07	6.017e-07	6.017e-07	6.017e-07	6.017e-07	6.02e-07	6.02e-07	6.02e-07	6.02e-07	6.02e-07	6.02e-07
250540	5.795e+00	5.795e+00	5.795e+00	5.794e+00	5.791e+00	5.782e+00	5.71e+00	5.42e+00	2.57e+00	1.71e-03	2.85e-35	0.
260550	2.420e+01	2.420e+01	2.420e+01	2.420e+01	2.419e+01	2.418e+01	2.41e+01	2.37e+01	1.87e+01	1.83e+00	1.46e-10	0.
260530	2.860e+01	2.637e+01	1.269e+01	2.185e-01	5.685e-12	0.	0.	0.	0.	0.	0.	0.
250560	1.052e+03	1.047e+03	1.005e+03	8.037e+02	2.096e+02	1.660e+00	2.56e-17	0.	0.	0.	0.	0.
240550	5.814e+00	4.776e+00	8.130e-01	4.344e-05	1.012e-30	0.	0.	0.	0.	0.	0.	0.
240560	5.493e-08	4.884e-08	1.697e-08	4.770e-11	2.357e-26	0.	0.	0.	0.	0.	0.	0.
250570	3.107e+02	1.984e+02	3.500e+00	6.345e-10	0.	0.	0.	0.	0.	0.	0.	0.
250580	2.229e+01	1.176e+01	3.718e-02	4.804e-16	0.	0.	0.	0.	0.	0.	0.	0.
260590	2.345e-01	2.345e-01	2.345e-01	2.344e-01	2.336e-01	2.310e-01	2.11e-01	1.47e-01	8.52e-04	9.40e-26	0.	0.
812020	5.224e-05	5.224e-05	5.222e-05	5.212e-05	5.151e-05	4.936e-05	3.51e-05	9.27e-06	5.07e-14	0.	0.	0.
812040	2.532e-04	2.532e-04	2.532e-04	2.532e-04	2.532e-04	2.531e-04	2.52e-04	2.49e-04	2.11e-04	4.03e-05	2.67e-12	0.
822030	7.600e+00	7.599e+00	7.584e+00	7.500e+00	7.017e+00	5.521e+00	8.11e-01	4.52e-04	0.	0.	0.	0.
822010	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822020	1.338e-08	1.319e-08	1.158e-08	5.604e-09	7.216e-11	1.131e-17	0.	0.	0.	0.	0.	0.
822050	3.387e-06	3.387e-06	3.387e-06	3.387e-06	3.387e-06	3.387e-06	3.39e-06	3.39e-06	3.39e-06	3.39e-06	3.39e-06	3.39e-06
802030	6.767e-02	6.766e-02	6.766e-02	6.762e-02	6.741e-02	6.667e-02	6.10e-02	4.30e-02	2.97e-04	1.80e-25	0.	0.
802050	1.122e+01	9.820e+00	2.958e+00	3.767e-03	1.607e-20	0.	0.	0.	0.	0.	0.	0.
812060	2.502e-19	2.502e-19	2.502e-19	2.502e-19	2.502e-19	2.502e-19	2.50e-19	2.50e-19	2.50e-19	2.50e-19	2.50e-19	2.50e-19
812070	2.911e-18	2.911e-18	2.911e-18	2.911e-18	2.911e-18	2.911e-18	2.91e-18	2.91e-18	2.91e-18	2.91e-18	2.91e-18	2.91e-18
822090	1.907e+01	1.901e+01	1.841e+01	1.544e+01	5.367e+00	1.196e-01	7.28e-15	0.	0.	0.	0.	0.
total	4.362e+06	6.975e+05	4.463e+04	5.696e+03	4.480e+03	3.422e+03	2.41e+03	1.48e+03	2.63e+01	2.79e+00	1.81e-01	1.67e-01	dps/cm3

no. of isotopes in 2 is 44 5 6

no. of isotopes in 3 is 7 50 56

Table A-4. (continued)

c-liner activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	4.709e-06	4.709e-06	4.709e-06	4.709e-06	4.709e-06	4.708e-06	4.70e-06	4.69e-06	4.45e-06	2.68e-06	1.67e-08	1.51e-30
40100	be 10	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.279e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07	4.28e-07
20060	he 6	1.784e-08	8.992e-31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	1.889e-01	6.694e-23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.615e-07	1.62e-07	1.62e-07	1.61e-07	1.61e-07	1.60e-07	1.43e-07
90200	f 20	8.976e+00	2.045e-01	3.380e-16	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	9.306e-01	3.080e-01	1.467e-05	1.426e-29	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	5.452e-03	5.448e-03	5.410e-03	5.205e-03	4.129e-03	1.793e-03	2.27e-06	1.09e-17	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	4.907e-03	2.454e-03	4.799e-06	4.294e-21	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	2.919e-01	4.286e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	5.172e-03	4.807e-03	2.486e-03	6.378e-05	1.819e-14	7.907e-49	0.	0.	0.	0.	0.	0.
130280	al 28	2.443e+00	1.793e+00	1.107e-01	2.114e-08	1.026e-48	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	3.997e-02	3.596e-02	1.389e-02	7.054e-05	1.208e-18	0.	0.	0.	0.	0.	0.	0.
130300	al 30	2.032e+00	2.550e-05	1.966e-49	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	1.736e-04	1.729e-04	1.661e-04	1.333e-04	3.552e-05	3.042e-07	8.80e-24	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		1.990e-06	1.990e-06	1.990e-06	1.989e-06	1.986e-06	1.974e-06	1.88e-06	1.57e-06	1.12e-07	6.35e-19	0.	0.
160370		2.439e-05	2.127e-05	6.199e-06	6.574e-09	9.353e-27	0.	0.	0.	0.	0.	0.	0.
180370	ar 37	8.951e-03	8.951e-03	8.950e-03	8.944e-03	8.907e-03	8.776e-03	7.79e-03	4.90e-03	6.46e-06	3.44e-34	0.	0.
190380	k 38	7.690e-04	7.028e-04	3.127e-04	3.473e-06	6.528e-18	0.	0.	0.	0.	0.	0.	0.
190400	k 40	3.080e-12	3.080e-12	3.080e-12	3.080e-12	3.080e-12	3.080e-12	3.08e-12	3.08e-12	3.08e-12	3.08e-12	3.08e-12	3.08e-12
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	1.229e-09	1.229e-09	1.229e-09	1.229e-09	1.229e-09	1.229e-09	1.23e-09	1.23e-09	1.23e-09	1.23e-09	1.23e-09	1.22e-09
170360	cl 36	1.873e-19	1.873e-19	1.873e-19	1.873e-19	1.873e-19	1.873e-19	1.87e-19	1.87e-19	1.87e-19	1.87e-19	1.87e-19	1.87e-19
180390	ar 39	2.035e-08	2.035e-08	2.035e-08	2.035e-08	2.035e-08	2.035e-08	2.03e-08	2.03e-08	2.03e-08	1.98e-08	1.57e-08	1.55e-09
170390		4.016e-16	4.016e-16	4.015e-16	4.013e-16	3.996e-16	3.937e-16	3.50e-16	2.20e-16	2.91e-19	1.26e-21	1.26e-21	1.26e-21
190420	k 42	2.831e-04	2.828e-04	2.805e-04	2.677e-04	2.024e-04	7.399e-05	2.36e-08	2.00e-18	1.96e-18	1.62e-18	2.44e-19	1.50e-27
180420		5.446e-18	5.446e-18	5.446e-18	5.446e-18	5.446e-18	5.446e-18	5.44e-18	5.44e-18	5.33e-18	4.41e-18	6.66e-19	4.08e-27
190430	k 43	4.376e-05	4.374e-05	4.354e-05	4.243e-05	3.635e-05	2.082e-05	2.42e-07	6.65e-15	0.	0.	0.	0.
170400		7.221e-26	7.221e-26	7.221e-26	7.221e-26	7.221e-26	7.221e-26	7.22e-26	7.22e-26	7.22e-26	7.22e-26	7.22e-26	7.22e-26
180410	ar 41	7.312e-04	7.266e-04	6.864e-04	5.007e-04	7.536e-05	8.253e-08	1.71e-31	0.	0.	0.	0.	0.
190440	k 44	1.041e-03	1.009e-03	7.598e-04	1.572e-04	1.235e-08	2.062e-23	0.	0.	0.	0.	0.	0.
200450	ca 45	2.107e-05	2.107e-05	2.107e-05	2.106e-05	2.104e-05	2.098e-05	2.04e-05	1.85e-05	4.46e-06	3.78e-12	0.	0.
190460	k 46	1.279e-05	8.703e-06	2.720e-07	1.182e-15	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	5.865e-04	5.102e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190450		2.860e-16	2.738e-16	1.854e-16	2.126e-17	4.824e-23	2.316e-43	0.	0.	0.	0.	0.	0.
200470	ca 47	2.286e-04	2.285e-04	2.283e-04	2.271e-04	2.200e-04	1.962e-04	7.84e-05	2.17e-06	1.26e-28	0.	0.	0.
210470	sc 47	3.047e-04	3.047e-04	3.046e-04	3.041e-04	3.007e-04	2.876e-04	1.68e-04	7.56e-06	5.13e-28	0.	0.	0.
200490	ca 49	6.255e-05	5.782e-05	2.845e-05	5.539e-07	3.015e-17	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

210490	sc 49	4.437e-05	4.456e-05	4.421e-05	2.691e-05	7.262e-07	1.612e-12	0.	0.	0.	0.	0.	0.
210440	sc 44	1.310e-08	1.306e-08	1.272e-08	1.098e-08	4.534e-09	1.880e-10	1.64e-21	0.	0.	0.	0.	0.
210460	sc 46	2.141e-05	2.141e-05	2.141e-05	2.141e-05	2.137e-05	2.124e-05	2.02e-05	1.66e-05	1.04e-06	1.59e-18	0.	0.
220450	ti 45	2.262e-05	2.254e-05	2.179e-05	1.807e-05	5.864e-06	1.021e-07	8.62e-22	0.	0.	0.	0.	0.
210480	sc 48	5.597e-04	5.596e-04	5.582e-04	5.509e-04	5.089e-04	3.824e-04	3.89e-05	5.17e-09	0.	0.	0.	0.
210500	sc 50	2.511e-04	1.674e-04	4.369e-06	6.972e-15	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	3.816e-03	3.387e-03	1.156e-03	2.954e-06	8.202e-22	0.	0.	0.	0.	0.	0.	0.
230490	v 49	3.479e-07	3.479e-07	3.479e-07	3.478e-07	3.477e-07	3.471e-07	3.43e-07	3.26e-07	1.62e-07	1.62e-10	1.66e-40	0.
230480	v 48	3.419e-16	3.419e-16	3.418e-16	3.413e-16	3.382e-16	3.274e-16	2.52e-16	9.13e-17	4.49e-23	0.	0.	0.
230520	v 52	2.049e-02	1.703e-02	3.228e-03	3.133e-07	2.623e-31	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	3.073e-05	3.073e-05	3.072e-05	3.070e-05	3.054e-05	2.997e-05	2.58e-05	1.44e-05	3.36e-09	7.52e-45	0.	0.
250520	mn 52	5.479e-08	5.479e-08	5.475e-08	5.451e-08	5.313e-08	4.845e-08	2.31e-08	1.29e-09	1.61e-27	0.	0.	0.
250530	mn 53	2.064e-12	2.064e-12	2.064e-12	2.064e-12	2.064e-12	2.064e-12	2.06e-12	2.06e-12	2.06e-12	2.06e-12	2.06e-12	2.06e-12
250540	mn 54	1.988e-05	1.988e-05	1.988e-05	1.988e-05	1.987e-05	1.983e-05	1.96e-05	1.86e-05	8.82e-06	5.86e-09	9.79e-41	0.
260550	fe 55	8.301e-05	8.301e-05	8.301e-05	8.301e-05	8.299e-05	8.295e-05	8.26e-05	8.12e-05	6.41e-05	6.27e-06	5.00e-16	0.
260530	fe 53	9.810e-05	9.044e-05	4.354e-05	7.494e-07	1.950e-17	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	3.607e-03	3.591e-03	3.449e-03	2.757e-03	7.190e-04	5.693e-06	8.80e-23	0.	0.	0.	0.	0.
240550	cr 55	1.995e-05	1.638e-05	2.789e-06	1.490e-10	3.470e-36	0.	0.	0.	0.	0.	0.	0.
240560		1.884e-13	1.675e-13	5.820e-14	1.636e-16	8.084e-32	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	1.066e-03	6.806e-04	1.201e-05	2.176e-15	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	7.646e-05	4.033e-05	1.276e-07	1.648e-21	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	8.045e-07	8.045e-07	8.044e-07	8.040e-07	8.014e-07	7.923e-07	7.22e-07	5.04e-07	2.92e-09	3.22e-31	0.	0.
812020	tl 202	1.792e-10	1.792e-10	1.791e-10	1.788e-10	1.767e-10	1.693e-10	1.20e-10	3.18e-11	1.74e-19	0.	0.	0.
812040	tl 204	8.687e-10	8.687e-10	8.686e-10	8.686e-10	8.685e-10	8.682e-10	8.66e-10	8.55e-10	7.23e-10	1.38e-10	9.16e-18	0.
822030	pb 203	2.607e-05	2.607e-05	2.601e-05	2.573e-05	2.407e-05	1.894e-05	2.78e-06	1.55e-09	0.	0.	0.	0.
822010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822020		4.591e-14	4.525e-14	3.971e-14	1.923e-14	2.475e-16	3.880e-23	0.	0.	0.	0.	0.	0.
822050	pb 205	1.162e-11	1.162e-11	1.162e-11	1.162e-11	1.162e-11	1.162e-11	1.16e-11	1.16e-11	1.16e-11	1.16e-11	1.16e-11	1.16e-11
802030	hg 203	2.321e-07	2.321e-07	2.321e-07	2.320e-07	2.313e-07	2.287e-07	2.09e-07	1.48e-07	1.02e-09	6.18e-31	0.	0.
802050	hg 205	3.849e-05	3.369e-05	1.015e-05	1.292e-08	5.512e-26	0.	0.	0.	0.	0.	0.	0.
812060	tl 206	8.582e-25	8.582e-25	8.582e-25	8.582e-25	8.582e-25	8.582e-25	8.58e-25	8.58e-25	8.58e-25	8.58e-25	8.58e-25	8.58e-25
812070	tl 207	9.985e-24	9.985e-24	9.985e-24	9.985e-24	9.985e-24	9.985e-24	9.98e-24	9.98e-24	9.98e-24	9.98e-24	9.98e-24	9.98e-24
822090	pb 209	6.543e-05	6.520e-05	6.316e-05	5.296e-05	1.841e-05	4.103e-07	2.50e-20	0.	0.	0.	0.	0.
	total	1.496e+01	2.393e+00	1.531e-01	1.954e-02	1.537e-02	1.174e-02	8.26e-03	5.07e-03	9.02e-05	9.56e-06	6.21e-07	5.74e-07

Table A-4. (continued)

c-liner bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.642e-11	2.642e-11	2.642e-11	2.642e-11	2.642e-11	2.641e-11	2.64e-11	2.63e-11	2.50e-11	1.50e-11	9.39e-14	8.49e-36
40100	be 10	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.802e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09	4.80e-09
20060	he 6	6.672e-13	3.363e-35	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	7.067e-06	2.504e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.812e-12	1.81e-12	1.81e-12	1.81e-12	1.81e-12	1.79e-12	1.61e-12
90200	f 20	3.357e-04	7.648e-06	1.264e-20	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	3.480e-05	1.152e-05	5.485e-10	5.334e-34	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	1.224e-06	1.223e-06	1.214e-06	1.168e-06	9.266e-07	4.024e-07	5.10e-10	2.44e-21	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	1.835e-07	9.178e-08	1.795e-10	1.606e-25	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	1.092e-05	1.603e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	1.934e-07	1.798e-07	9.298e-08	2.385e-09	6.802e-19	2.957e-53	0.	0.	0.	0.	0.	0.
130280	al 28	9.138e-05	6.706e-05	4.140e-06	7.908e-13	3.839e-53	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	1.495e-06	1.345e-06	5.197e-07	2.638e-09	4.519e-23	0.	0.	0.	0.	0.	0.	0.
130300	al 30	7.602e-05	9.538e-10	7.352e-54	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	6.494e-09	6.465e-09	6.214e-09	4.985e-09	1.329e-09	1.138e-11	3.29e-28	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		2.232e-08	2.232e-08	2.232e-08	2.232e-08	2.228e-08	2.215e-08	2.11e-08	1.76e-08	1.26e-09	7.12e-21	0.	0.
160370		2.737e-07	2.386e-07	6.956e-08	7.376e-11	1.049e-28	0.	0.	0.	0.	0.	0.	0.
180370	ar 37	1.004e-10	1.004e-10	1.004e-10	1.004e-10	9.994e-11	9.847e-11	8.74e-11	5.50e-11	7.25e-14	3.86e-42	0.	0.
190380	k 38	2.876e-08	2.629e-08	1.169e-08	1.299e-10	2.442e-22	0.	0.	0.	0.	0.	0.	0.
190400	k 40	3.456e-14	3.456e-14	3.456e-14	3.456e-14	3.456e-14	3.456e-14	3.46e-14	3.46e-14	3.46e-14	3.46e-14	3.46e-14	3.46e-14
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	1.379e-11	1.379e-11	1.379e-11	1.379e-11	1.379e-11	1.379e-11	1.38e-11	1.38e-11	1.38e-11	1.38e-11	1.38e-11	1.37e-11
170360	cl 36	2.627e-22	2.627e-22	2.627e-22	2.627e-22	2.627e-22	2.627e-22	2.63e-22	2.63e-22	2.63e-22	2.63e-22	2.63e-22	2.62e-22
180390	ar 39	2.283e-10	2.283e-10	2.283e-10	2.283e-10	2.283e-10	2.283e-10	2.28e-10	2.28e-10	2.28e-10	2.23e-10	1.76e-10	1.74e-11
170390		4.506e-18	4.506e-18	4.506e-18	4.502e-18	4.484e-18	4.418e-18	3.92e-18	2.47e-18	3.27e-21	1.41e-23	1.41e-23	1.41e-23
190420	k 42	7.941e-08	7.933e-08	7.867e-08	7.509e-08	5.678e-08	2.076e-08	6.62e-12	5.60e-22	5.49e-22	4.54e-22	6.86e-23	4.20e-31
180420		6.111e-20	6.111e-20	6.111e-20	6.111e-20	6.111e-20	6.111e-20	6.11e-20	6.10e-20	5.98e-20	4.95e-20	7.47e-21	4.58e-29
190430	k 43	6.137e-09	6.135e-09	6.107e-09	5.951e-09	5.098e-09	2.921e-09	3.39e-11	9.33e-19	0.	0.	0.	0.
170400		8.102e-28	8.102e-28	8.102e-28	8.102e-28	8.102e-28	8.102e-28	8.10e-28	8.10e-28	8.10e-28	8.10e-28	8.10e-28	8.10e-28
180410	ar 41	2.051e-08	2.038e-08	1.926e-08	1.404e-08	2.114e-09	2.315e-12	4.79e-36	0.	0.	0.	0.	0.
190440	k 44	3.894e-08	3.774e-08	2.842e-08	5.881e-09	4.620e-13	7.711e-28	0.	0.	0.	0.	0.	0.
200450	ca 45	2.364e-08	2.364e-08	2.364e-08	2.363e-08	2.361e-08	2.354e-08	2.29e-08	2.08e-08	5.00e-09	4.24e-15	0.	0.
190460	k 46	4.784e-10	3.255e-10	1.017e-11	4.421e-20	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	2.194e-08	1.908e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190450		3.209e-18	3.073e-18	2.081e-18	2.385e-19	5.413e-25	2.598e-45	0.	0.	0.	0.	0.	0.
200470	ca 47	4.274e-08	4.274e-08	4.270e-08	4.247e-08	4.114e-08	3.668e-08	1.47e-08	4.07e-10	2.35e-32	0.	0.	0.
210470	sc 47	1.709e-08	1.709e-08	1.709e-08	1.706e-08	1.687e-08	1.613e-08	9.41e-09	4.24e-10	2.88e-32	0.	0.	0.
200490	ca 49	2.340e-09	2.162e-09	1.064e-09	2.072e-11	1.128e-21	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

210490	sc 49	3.830e-11	3.846e-11	3.816e-11	2.323e-11	6.268e-13	1.391e-18	0.	0.	0.	0.	0.	0.
210440	sc 44	1.470e-12	1.465e-12	1.427e-12	1.232e-12	5.087e-13	2.109e-14	1.84e-25	0.	0.	0.	0.	0.
210460	sc 46	3.003e-08	3.003e-08	3.003e-08	3.002e-08	2.997e-08	2.978e-08	2.83e-08	2.33e-08	1.46e-09	2.24e-21	0.	0.
220450	ti 45	7.466e-11	7.439e-11	7.192e-11	5.962e-11	1.935e-11	3.369e-13	2.85e-27	0.	0.	0.	0.	0.
210480	sc 48	1.256e-07	1.256e-07	1.253e-07	1.236e-07	1.142e-07	8.582e-08	8.73e-09	1.16e-12	0.	0.	0.	0.
210500	sc 50	2.561e-09	1.708e-09	4.457e-11	7.111e-20	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	5.038e-09	4.471e-09	1.526e-09	3.899e-12	1.083e-27	0.	0.	0.	0.	0.	0.	0.
230490	v 49	1.561e-12	1.561e-12	1.561e-12	1.561e-12	1.561e-12	1.558e-12	1.54e-12	1.46e-12	7.25e-13	7.27e-16	7.47e-46	0.
230480	v 48	1.918e-19	1.918e-19	1.918e-19	1.915e-19	1.898e-19	1.837e-19	1.42e-19	5.12e-20	2.52e-26	0.	0.	0.
230520	v 52	6.568e-08	5.459e-08	1.035e-08	1.004e-12	8.407e-37	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	4.310e-10	4.310e-10	4.309e-10	4.305e-10	4.283e-10	4.204e-10	3.62e-10	2.02e-10	4.71e-14	1.05e-49	0.	0.
250520	mn 52	1.537e-11	1.537e-11	1.536e-11	1.529e-11	1.490e-11	1.359e-11	6.49e-12	3.62e-13	4.52e-31	0.	0.	0.
250530	mn 53	2.316e-14	2.316e-14	2.316e-14	2.316e-14	2.316e-14	2.316e-14	2.32e-14	2.32e-14	2.32e-14	2.32e-14	2.32e-14	2.32e-14
250540	mn 54	2.230e-08	2.230e-08	2.230e-08	2.230e-08	2.229e-08	2.225e-08	2.20e-08	2.08e-08	9.89e-09	6.57e-12	1.10e-43	0.
260550	fe 55	3.105e-09	3.105e-09	3.105e-09	3.105e-09	3.104e-09	3.102e-09	3.09e-09	3.04e-09	2.40e-09	2.34e-10	1.87e-20	0.
260530	fe 53	3.669e-09	3.383e-09	1.628e-09	2.803e-11	7.295e-22	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	2.024e-07	2.015e-07	1.935e-07	1.547e-07	4.034e-08	3.194e-10	4.93e-27	0.	0.	0.	0.	0.
240550	cr 55	7.460e-10	6.128e-10	1.043e-10	5.574e-15	1.298e-40	0.	0.	0.	0.	0.	0.	0.
240560		2.114e-15	1.880e-15	6.531e-16	1.836e-18	9.071e-34	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	3.987e-08	2.546e-08	4.491e-10	8.140e-20	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	2.860e-09	1.508e-09	4.771e-12	6.164e-26	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	4.514e-10	4.514e-10	4.513e-10	4.511e-10	4.496e-10	4.445e-10	4.05e-10	2.83e-10	1.64e-12	1.81e-34	0.	0.
812020	tl 202	2.514e-14	2.514e-14	2.513e-14	2.508e-14	2.478e-14	2.375e-14	1.69e-14	4.46e-15	2.44e-23	0.	0.	0.
812040	tl 204	1.083e-12	1.083e-12	1.083e-12	1.083e-12	1.083e-12	1.082e-12	1.08e-12	1.07e-12	9.01e-13	1.73e-13	1.14e-20	0.
822030	pb 203	4.876e-10	4.875e-10	4.865e-10	4.811e-10	4.501e-10	3.542e-10	5.20e-11	2.90e-14	0.	0.	0.	0.
822010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822020		5.151e-16	5.077e-16	4.456e-16	2.157e-16	2.778e-18	4.354e-25	0.	0.	0.	0.	0.	0.
822050	pb 205	1.304e-13	1.304e-13	1.304e-13	1.304e-13	1.304e-13	1.304e-13	1.30e-13	1.30e-13	1.30e-13	1.30e-13	1.30e-13	1.30e-13
802030	hg 203	1.302e-10	1.302e-10	1.302e-10	1.301e-10	1.297e-10	1.283e-10	1.17e-10	8.28e-11	5.72e-13	3.47e-34	0.	0.
802050	hg 205	1.440e-09	1.260e-09	3.795e-10	4.833e-13	2.062e-30	0.	0.	0.	0.	0.	0.	0.
812060	tl 206	3.210e-29	3.210e-29	3.210e-29	3.210e-29	3.210e-29	3.210e-29	3.21e-29	3.21e-29	3.21e-29	3.21e-29	3.21e-29	3.21e-29
812070	tl 207	3.734e-28	3.734e-28	3.734e-28	3.734e-28	3.734e-28	3.734e-28	3.73e-28	3.73e-28	3.73e-28	3.73e-28	3.73e-28	3.73e-28
822090	pb 209	7.341e-07	7.315e-07	7.087e-07	5.943e-07	2.066e-07	4.604e-09	2.80e-22	0.	0.	0.	0.	0.
	total	5.608e-04	9.080e-05	7.399e-06	2.320e-06	1.519e-06	6.771e-07	1.37e-07	9.21e-08	2.51e-08	5.30e-09	4.99e-09	4.83e-09

Table A-4. (continued)

c-liner afterheat 10-6 s operating (in mw)

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030 t	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.33e-16	2.33e-16	2.21e-16	1.33e-16	8.30e-19	7.50e-41
40100 be 10	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.56e-16
20060 he 6	1.663e-16	8.380e-39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080 li 8	7.132e-09	2.527e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140 c 14	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.50e-17	4.50e-17	4.50e-17	4.49e-17	4.45e-17	3.99e-17
90200 f 20	2.192e-07	4.993e-09	8.254e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230 ne 23	1.175e-08	3.890e-09	1.852e-13	1.801e-37	0.	0.	0.	0.	0.	0.	0.	0.
110240 na 24	1.513e-10	1.512e-10	1.502e-10	1.445e-10	1.146e-10	4.977e-11	6.30e-14	3.02e-25	0.	0.	0.	0.
120230 mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250 na 25	6.119e-11	3.060e-11	5.984e-14	5.354e-29	0.	0.	0.	0.	0.	0.	0.	0.
110260 na 26	8.565e-09	1.257e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270 mg 27	4.841e-11	4.499e-11	2.327e-11	5.970e-13	1.702e-22	7.401e-57	0.	0.	0.	0.	0.	0.
130280 al 28	4.204e-08	3.086e-08	1.905e-09	3.639e-16	1.766e-56	0.	0.	0.	0.	0.	0.	0.
140270 si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290 al 29	5.642e-10	5.076e-10	1.961e-10	9.957e-13	1.706e-26	0.	0.	0.	0.	0.	0.	0.
130300 al 30	3.284e-08	4.121e-13	3.177e-57	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310 si 31	5.074e-13	5.052e-13	4.855e-13	3.895e-13	1.038e-13	8.890e-16	2.57e-32	0.	0.	0.	0.	0.
160310	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180370 ar 37	2.706e-11	2.706e-11	2.706e-11	2.704e-11	2.693e-11	2.653e-11	2.36e-11	1.48e-11	1.95e-14	1.04e-42	0.	0.
190380 k 38	2.005e-11	1.832e-11	8.152e-12	9.056e-14	1.702e-25	0.	0.	0.	0.	0.	0.	0.
190400 k 40	1.145e-20	1.145e-20	1.145e-20	1.145e-20	1.145e-20	1.145e-20	1.14e-20	1.14e-20	1.14e-20	1.14e-20	1.14e-20	1.14e-20
200390 ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410 ca 41	3.716e-18	3.716e-18	3.716e-18	3.716e-18	3.716e-18	3.716e-18	3.72e-18	3.72e-18	3.72e-18	3.72e-18	3.71e-18	3.68e-18
170360 cl 36	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.80e-28	2.80e-28	2.80e-28	2.80e-28	2.80e-28	2.79e-28
180390 ar 39	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.32e-17	2.32e-17	2.31e-17	2.26e-17	1.79e-17	1.76e-18
170390	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190420 k 42	2.938e-12	2.936e-12	2.911e-12	2.779e-12	2.101e-12	7.680e-13	2.45e-16	2.07e-26	2.03e-26	1.68e-26	2.54e-27	1.55e-35
180420	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190430 k 43	3.435e-13	3.433e-13	3.417e-13	3.330e-13	2.853e-13	1.635e-13	1.90e-15	5.22e-23	0.	0.	0.	0.
170400	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180410 ar 41	7.520e-12	7.473e-12	7.060e-12	5.149e-12	7.751e-13	8.488e-16	1.75e-39	0.	0.	0.	0.	0.
190440 k 44	1.133e-11	1.098e-11	8.266e-12	1.711e-12	1.344e-16	2.243e-31	0.	0.	0.	0.	0.	0.
200450 ca 45	8.030e-15	8.030e-15	8.030e-15	8.029e-15	8.022e-15	7.996e-15	7.79e-15	7.06e-15	1.70e-15	1.44e-21	0.	0.
190460 k 46	4.362e-13	2.968e-13	9.274e-15	4.031e-23	0.	0.	0.	0.	0.	0.	0.	0.
180430 ar 43	1.738e-12	1.512e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190450	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470 ca 47	1.795e-12	1.795e-12	1.793e-12	1.784e-12	1.728e-12	1.541e-12	6.16e-13	1.71e-14	9.86e-37	0.	0.	0.
210470 sc 47	4.971e-13	4.971e-13	4.969e-13	4.960e-13	4.906e-13	4.692e-13	2.74e-13	1.23e-14	8.36e-37	0.	0.	0.
200490 ca 49	1.464e-12	1.353e-12	6.657e-13	1.296e-14	7.055e-25	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

210490	sc 49	2.181e-13	2.191e-13	2.173e-13	1.323e-13	3.570e-15	7.923e-21	0.	0.	0.	0.	0.	0.
210440	sc 44	1.475e-16	1.470e-16	1.432e-16	1.236e-16	5.104e-17	2.116e-18	1.85e-29	0.	0.	0.	0.	0.
210460	sc 46	2.654e-13	2.654e-13	2.654e-13	2.653e-13	2.649e-13	2.632e-13	2.50e-13	2.06e-13	1.29e-14	1.98e-26	0.	0.
220450	ti 45	5.110e-14	5.091e-14	4.922e-14	4.080e-14	1.324e-14	2.306e-16	1.95e-30	0.	0.	0.	0.	0.
210480	sc 48	1.168e-11	1.168e-11	1.165e-11	1.150e-11	1.062e-11	7.981e-12	8.12e-13	1.08e-16	0.	0.	0.	0.
210500	sc 50	7.106e-12	4.739e-12	1.237e-13	1.973e-22	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	1.980e-11	1.757e-11	5.998e-12	1.532e-14	4.255e-30	0.	0.	0.	0.	0.	0.	0.
230490	v 49	3.712e-16	3.712e-16	3.712e-16	3.712e-16	3.710e-16	3.704e-16	3.66e-16	3.48e-16	1.72e-16	1.73e-19	1.78e-49	0.
230480	v 48	6.608e-25	6.608e-25	6.606e-25	6.596e-25	6.536e-25	6.327e-25	4.88e-25	1.76e-25	8.67e-32	0.	0.	0.
230520	v 52	3.037e-10	2.525e-10	4.785e-11	4.646e-15	3.888e-39	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	5.283e-15	5.283e-15	5.282e-15	5.277e-15	5.250e-15	5.153e-15	4.44e-15	2.47e-15	5.78e-19	1.29e-54	0.	0.
250520	mn 52	1.045e-15	1.045e-15	1.044e-15	1.040e-15	1.014e-15	9.242e-16	4.42e-16	2.46e-17	3.07e-35	0.	0.	0.
250530	mn 53	2.178e-21	2.178e-21	2.178e-21	2.178e-21	2.178e-21	2.178e-21	2.18e-21	2.18e-21	2.18e-21	2.18e-21	2.18e-21	2.18e-21
250540	mn 54	9.840e-14	9.840e-14	9.839e-14	9.839e-14	9.834e-14	9.818e-14	9.69e-14	9.20e-14	4.36e-14	2.90e-17	4.85e-49	0.
260550	fe 55	3.445e-14	3.445e-14	3.445e-14	3.445e-14	3.444e-14	3.442e-14	3.43e-14	3.37e-14	2.66e-14	2.60e-15	2.08e-25	0.
260530	fe 53	1.319e-12	1.216e-12	5.853e-13	1.008e-14	2.622e-25	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	5.410e-11	5.386e-11	5.173e-11	4.135e-11	1.078e-11	8.538e-14	1.32e-30	0.	0.	0.	0.	0.
240550	cr 55	1.259e-13	1.034e-13	1.761e-14	9.409e-19	2.191e-44	0.	0.	0.	0.	0.	0.	0.
240560		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	6.939e-12	4.430e-12	7.815e-14	1.417e-23	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.848e-12	9.748e-13	3.083e-15	3.983e-29	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	6.200e-15	6.200e-15	6.200e-15	6.196e-15	6.176e-15	6.106e-15	5.57e-15	3.88e-15	2.25e-17	2.48e-39	0.	0.
812020	tl 202	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
812040	tl 204	1.854e-18	1.854e-18	1.854e-18	1.854e-18	1.854e-18	1.853e-18	1.85e-18	1.83e-18	1.54e-18	2.95e-19	1.95e-26	0.
822030	pb 203	1.915e-13	1.915e-13	1.911e-13	1.890e-13	1.768e-13	1.391e-13	2.04e-14	1.14e-17	0.	0.	0.	0.
822010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822020		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822050	pb 205	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
802030	hg 203	5.367e-16	5.366e-16	5.366e-16	5.363e-16	5.347e-16	5.287e-16	4.84e-16	3.41e-16	2.36e-18	1.43e-39	0.	0.
802050	hg 205	2.083e-13	1.823e-13	5.492e-14	6.994e-17	2.983e-34	0.	0.	0.	0.	0.	0.	0.
812060	tl 206	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33
812070	tl 207	2.842e-31	2.842e-31	2.842e-31	2.842e-31	2.842e-31	2.842e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31
822090	pb 209	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	3.228e-07	4.089e-08	2.451e-09	2.395e-10	1.690e-10	8.787e-11	2.57e-11	1.52e-11	1.05e-13	3.29e-15	5.24e-16	5.02e-16

Table A-4. (continued)

c-liner beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.336e-16	2.33e-16	2.33e-16	2.21e-16	1.33e-16	8.30e-19	7.50e-41
40100	be 10	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.566e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.57e-16	4.56e-16
20060	he 6	1.663e-16	8.380e-39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	7.033e-09	2.492e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.500e-17	4.50e-17	4.50e-17	4.50e-17	4.49e-17	4.45e-17	3.99e-17
90200	f 20	1.324e-07	3.017e-09	4.988e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.087e-08	3.598e-09	1.714e-13	1.666e-37	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	1.810e-11	1.809e-11	1.796e-11	1.728e-11	1.371e-11	5.953e-12	7.54e-15	3.61e-26	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	5.015e-11	2.508e-11	4.905e-14	4.389e-29	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	5.415e-09	7.950e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	2.109e-11	1.960e-11	1.014e-11	2.601e-13	7.417e-23	3.225e-57	0.	0.	0.	0.	0.	0.
130280	al 28	1.626e-08	1.194e-08	7.370e-10	1.408e-16	6.833e-57	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	2.182e-10	1.963e-10	7.586e-11	3.852e-13	6.597e-27	0.	0.	0.	0.	0.	0.	0.
130300	al 30	2.759e-08	3.462e-13	2.669e-57	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	5.074e-13	5.052e-13	4.855e-13	3.895e-13	1.038e-13	8.890e-16	2.57e-32	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180370	ar 37	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190380	k 38	5.498e-12	5.025e-12	2.235e-12	2.483e-14	4.667e-26	0.	0.	0.	0.	0.	0.	0.
190400	k 40	8.508e-21	8.508e-21	8.508e-21	8.508e-21	8.508e-21	8.508e-21	8.51e-21	8.51e-21	8.51e-21	8.51e-21	8.51e-21	8.51e-21
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
170360	cl 36	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.798e-28	2.80e-28	2.80e-28	2.80e-28	2.80e-28	2.80e-28	2.79e-28
180390	ar 39	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.316e-17	2.32e-17	2.32e-17	2.31e-17	2.26e-17	1.79e-17	1.76e-18
170390		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190420	k 42	2.455e-12	2.453e-12	2.432e-12	2.322e-12	1.755e-12	6.417e-13	2.05e-16	1.73e-26	1.70e-26	1.40e-26	2.12e-27	1.30e-35
180420		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190430	k 43	9.883e-14	9.880e-14	9.834e-14	9.584e-14	8.210e-14	4.704e-14	5.46e-16	1.50e-23	0.	0.	0.	0.
170400		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180410	ar 41	1.972e-12	1.960e-12	1.852e-12	1.350e-12	2.033e-13	2.226e-16	4.60e-40	0.	0.	0.	0.	0.
190440	k 44	5.278e-12	5.114e-12	3.851e-12	7.970e-13	6.260e-17	1.045e-31	0.	0.	0.	0.	0.	0.
200450	ca 45	8.030e-15	8.030e-15	8.030e-15	8.029e-15	8.022e-15	7.996e-15	7.79e-15	7.06e-15	1.70e-15	1.44e-21	0.	0.
190460	k 46	2.154e-13	1.465e-13	4.579e-15	1.990e-23	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190450		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	3.957e-13	3.956e-13	3.952e-13	3.931e-13	3.808e-13	3.395e-13	1.36e-13	3.76e-15	2.17e-37	0.	0.	0.
210470	sc 47	2.861e-13	2.861e-13	2.860e-13	2.855e-13	2.824e-13	2.701e-13	1.57e-13	7.10e-15	4.81e-37	0.	0.	0.
200490	ca 49	3.059e-13	2.828e-13	1.392e-13	2.709e-15	1.475e-25	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

210490	sc 49	2.179e-13	2.188e-13	2.171e-13	1.321e-13	3.566e-15	7.913e-21	0.	0.	0.	0.	0.	0.
210440	sc 44	5.669e-17	5.652e-17	5.504e-17	4.750e-17	1.962e-17	8.135e-19	7.10e-30	0.	0.	0.	0.	0.
210460	sc 46	1.156e-14	1.156e-14	1.156e-14	1.156e-14	1.154e-14	1.147e-14	1.09e-14	8.99e-15	5.63e-16	8.61e-28	0.	0.
220450	ti 45	5.110e-14	5.091e-14	4.922e-14	4.080e-14	1.324e-14	2.306e-16	1.95e-30	0.	0.	0.	0.	0.
210480	sc 48	5.717e-13	5.715e-13	5.702e-13	5.627e-13	5.198e-13	3.906e-13	3.98e-14	5.28e-18	0.	0.	0.	0.
210500	sc 50	2.358e-12	1.572e-12	4.103e-14	6.547e-23	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	1.980e-11	1.757e-11	5.998e-12	1.532e-14	4.255e-30	0.	0.	0.	0.	0.	0.	0.
230490	v 49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
230480	v 48	6.608e-25	6.608e-25	6.606e-25	6.596e-25	6.536e-25	6.327e-25	4.88e-25	1.76e-25	8.67e-32	0.	0.	0.
230520	v 52	1.278e-10	1.062e-10	2.013e-11	1.954e-15	1.636e-39	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250520	mn 52	2.599e-17	2.598e-17	2.596e-17	2.585e-17	2.520e-17	2.298e-17	1.10e-17	6.13e-19	7.64e-37	0.	0.	0.
250530	mn 53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260550	fe 55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260530	fe 53	6.560e-13	6.048e-13	2.911e-13	5.011e-15	1.304e-25	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	1.606e-11	1.599e-11	1.536e-11	1.227e-11	3.201e-12	2.535e-14	3.92e-31	0.	0.	0.	0.	0.
240550	cr 55	1.259e-13	1.034e-13	1.761e-14	9.409e-19	2.191e-44	0.	0.	0.	0.	0.	0.	0.
240560		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	9.573e-13	5.050e-13	1.597e-15	2.063e-29	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	5.628e-16	5.628e-16	5.627e-16	5.624e-16	5.606e-16	5.542e-16	5.05e-16	3.52e-16	2.04e-18	2.25e-40	0.	0.
812020	tl 202	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
812040	tl 204	1.854e-18	1.854e-18	1.854e-18	1.854e-18	1.854e-18	1.853e-18	1.85e-18	1.83e-18	1.54e-18	2.95e-19	1.95e-26	0.
822030	pb 203	1.484e-13	1.483e-13	1.481e-13	1.464e-13	1.370e-13	1.078e-13	1.58e-14	8.82e-18	0.	0.	0.	0.
822010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822020		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
822050	pb 205	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
802030	hg 203	1.527e-16	1.527e-16	1.527e-16	1.526e-16	1.522e-16	1.505e-16	1.38e-16	9.72e-17	6.71e-19	4.06e-40	0.	0.
802050	hg 205	1.620e-13	1.418e-13	4.271e-14	5.439e-17	2.320e-34	0.	0.	0.	0.	0.	0.	0.
812060	tl 206	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.578e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33	2.58e-33
812070	tl 207	2.841e-31	2.841e-31	2.841e-31	2.841e-31	2.841e-31	2.841e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31	2.84e-31
822090	pb 209	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	2.001e-07	1.897e-08	8.958e-10	3.679e-11	2.041e-11	7.798e-12	3.77e-13	2.81e-14	3.01e-15	6.57e-16	5.20e-16	4.98e-16

Table A-4. (continued)

note: listed below are c-liner isotopes for which gamma source data exists in [block data]

	nuclide
90200	f 20
100230	ne 23
110240	na 24
120230	mg 23
110250	na 25
110260	na 26
120270	mg 27
130280	al 28
140270	si 27
130290	al 29
130300	al 30
140310	si 31
190380	k 38
190400	k 40
190420	k 42
190430	k 43
180410	ar 41
190440	k 44
190460	k 46
200470	ca 47
210470	sc 47
200490	ca 49
210490	sc 49
210440	sc 44
210460	sc 46
220450	ti 45
210480	sc 48
210500	sc 50
220510	ti 51
230490	v 49
230480	v 48
230520	v 52
240510	cr 51
250520	mn 52
250540	mn 54
260530	fe 53
250560	mn 56
250570	mn 57
260590	fe 59
812020	tl 202
822030	pb 203
812070	tl 207

Table A-4. (continued)

al-fw activity 10-6 s operating (in curies)

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240 na 24	1.025e+04	1.024e+04	1.017e+04	9.784e+03	7.761e+03	3.371e+03	4.27e+00	2.04e-11	0.	0.	0.	0.
120230 mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250 na 25	3.138e+02	1.569e+02	3.069e-01	2.746e-16	0.	0.	0.	0.	0.	0.	0.	0.
100230 ne 23	8.607e+02	2.848e+02	1.356e-02	1.319e-26	0.	0.	0.	0.	0.	0.	0.	0.
110260 na 26	1.831e+04	2.689e-13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270 mg 27	5.211e+04	4.843e+04	2.505e+04	6.426e+02	1.832e-07	7.967e-42	0.	0.	0.	0.	0.	0.
130260 al 26	1.399e-04	1.399e-04	1.399e-04	1.399e-04	1.399e-04	1.399e-04	1.40e-04	1.40e-04	1.40e-04	1.40e-04	1.40e-04	1.40e-04
130280 al 28	3.523e+04	2.585e+04	1.596e+03	3.049e-04	1.480e-44	0.	0.	0.	0.	0.	0.	0.
140270 si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290 al 29	7.055e+01	6.348e+01	2.453e+01	1.245e-01	2.133e-15	0.	0.	0.	0.	0.	0.	0.
130300 al 30	3.545e+03	4.447e-02	3.428e-46	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310 si 31	2.274e-01	2.264e-01	2.176e-01	1.746e-01	4.653e-02	3.984e-04	1.15e-20	0.	0.	0.	0.	0.
170360 cl 36	3.325e-11	3.325e-11	3.325e-11	3.325e-11	3.325e-11	3.325e-11	3.32e-11	3.32e-11	3.32e-11	3.32e-11	3.32e-11	3.32e-11
180370 ar 37	4.480e-09	4.480e-09	4.479e-09	4.476e-09	4.458e-09	4.392e-09	3.90e-09	2.45e-09	3.23e-12	1.72e-40	0.	0.
180390 ar 39	1.104e-07	1.104e-07	1.104e-07	1.104e-07	1.104e-07	1.104e-07	1.10e-07	1.10e-07	1.10e-07	1.08e-07	8.53e-08	8.39e-09
190380 k 38	4.389e-05	4.011e-05	1.784e-05	1.982e-07	3.725e-19	0.	0.	0.	0.	0.	0.	0.
190400 k 40	1.539e-08	1.539e-08	1.539e-08	1.539e-08	1.539e-08	1.539e-08	1.54e-08	1.54e-08	1.54e-08	1.54e-08	1.54e-08	1.54e-08
160350	2.553e-15	2.553e-15	2.553e-15	2.552e-15	2.548e-15	2.533e-15	2.42e-15	2.01e-15	1.44e-16	8.15e-28	0.	0.
170380 cl 38	1.416e-05	1.389e-05	1.175e-05	4.640e-06	1.757e-08	3.359e-17	0.	0.	0.	0.	0.	0.
170400	1.367e-17	1.341e-17	1.135e-17	4.480e-18	1.696e-20	3.243e-29	0.	0.	0.	0.	0.	0.
160370	5.656e-17	4.932e-17	1.438e-17	1.525e-20	2.169e-38	0.	0.	0.	0.	0.	0.	0.
180410 ar 41	2.518e-05	2.503e-05	2.364e-05	1.724e-05	2.596e-06	2.843e-09	5.88e-33	0.	0.	0.	0.	0.
190420 k 42	1.409e-05	1.407e-05	1.396e-05	1.332e-05	1.007e-05	3.682e-06	1.17e-09	2.57e-23	0.	0.	0.	0.
210440 sc 44	1.202e-04	1.198e-04	1.167e-04	1.007e-04	4.159e-05	1.724e-06	1.51e-17	0.	0.	0.	0.	0.
210460 sc 46	2.021e-01	2.021e-01	2.021e-01	2.020e-01	2.017e-01	2.004e-01	1.91e-01	1.57e-01	9.84e-03	1.51e-14	0.	0.
220450 ti 45	2.079e-01	2.071e-01	2.002e-01	1.660e-01	5.388e-02	9.382e-04	7.92e-18	0.	0.	0.	0.	0.
190430 k 43	1.444e-11	1.443e-11	1.436e-11	1.400e-11	1.199e-11	6.870e-12	7.97e-14	2.19e-21	0.	0.	0.	0.
210470 sc 47	7.871e-01	7.869e-01	7.860e-01	7.806e-01	7.490e-01	6.456e-01	1.98e-01	2.16e-03	3.74e-26	0.	0.	0.
190440 k 44	5.666e-11	5.491e-11	4.135e-11	8.557e-12	6.722e-16	1.122e-30	0.	0.	0.	0.	0.	0.
200470 ca 47	1.665e-02	1.665e-02	1.663e-02	1.655e-02	1.603e-02	1.429e-02	5.71e-03	1.58e-04	9.15e-27	0.	0.	0.
210480 sc 48	3.200e+00	3.199e+00	3.192e+00	3.150e+00	2.909e+00	2.186e+00	2.23e-01	2.95e-05	0.	0.	0.	0.
200450 ca 45	1.322e-01	1.322e-01	1.322e-01	1.322e-01	1.321e-01	1.317e-01	1.28e-01	1.16e-01	2.80e-02	2.37e-08	0.	0.
210490 sc 49	3.204e-01	3.165e-01	2.840e-01	1.554e-01	4.179e-03	9.274e-09	0.	0.	0.	0.	0.	0.
210500 sc 50	2.342e+00	1.562e+00	4.075e-02	6.502e-11	0.	0.	0.	0.	0.	0.	0.	0.
220510 ti 51	8.235e-01	7.308e-01	2.495e-01	6.373e-04	1.770e-19	0.	0.	0.	0.	0.	0.	0.
230480 v 48	1.427e-04	1.427e-04	1.427e-04	1.424e-04	1.412e-04	1.366e-04	1.05e-04	3.81e-05	1.87e-11	0.	0.	0.
230490 v 49	3.039e-02	3.039e-02	3.039e-02	3.040e-02	3.039e-02	3.034e-02	3.00e-02	2.85e-02	1.41e-02	1.42e-05	1.46e-35	0.
240510 cr 51	9.993e+00	9.993e+00	9.991e+00	9.982e+00	9.931e+00	9.746e+00	8.39e+00	4.67e+00	1.09e-03	2.45e-39	0.	0.
240490 cr 49	2.090e-01	2.056e-01	1.772e-01	7.765e-02	5.500e-04	1.003e-11	0.	0.	0.	0.	0.	0.
230520 v 52	2.154e+02	1.790e+02	3.394e+01	3.294e-03	2.757e-27	0.	0.	0.	0.	0.	0.	0.
230530	5.959e-12	5.959e-12	5.958e-12	5.953e-12	5.922e-12	5.812e-12	5.00e-12	2.79e-12	6.52e-16	0.	0.	0.

Table A-4. (continued)

240550	cr 55	4.848e+01	3.982e+01	6.779e+00	3.622e-04	8.435e-30	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	1.764e+00	1.764e+00	1.764e+00	1.764e+00	1.763e+00	1.760e+00	1.74e+00	1.65e+00	7.82e-01	5.20e-04	8.69e-36	0.
250560	mn 56	1.557e+02	1.550e+02	1.488e+02	1.190e+02	3.102e+01	2.457e-01	3.80e-18	0.	0.	0.	0.	0.
250530	mn 53	2.930e-08	2.931e-08	2.931e-08	2.931e-08	2.931e-08	2.931e-08	2.93e-08	2.93e-08	2.93e-08	2.93e-08	2.93e-08	2.93e-08
250520	mn 52	7.751e-04	7.751e-04	7.745e-04	7.712e-04	7.516e-04	6.853e-04	3.27e-04	1.83e-05	2.28e-23	0.	0.	0.
260550	fe 55	1.190e+00	1.190e+00	1.190e+00	1.190e+00	1.189e+00	1.189e+00	1.18e+00	1.16e+00	9.19e-01	8.98e-02	7.17e-12	0.
260530	fe 53	1.382e+00	1.274e+00	6.133e-01	1.056e-02	2.748e-13	0.	0.	0.	0.	0.	0.	0.
240560		2.131e-09	1.895e-09	6.583e-10	1.851e-12	9.143e-28	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	1.541e+01	9.837e+00	1.735e-01	3.145e-11	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.095e+00	5.778e-01	1.827e-03	2.361e-17	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	1.468e-02	1.468e-02	1.468e-02	1.467e-02	1.462e-02	1.445e-02	1.32e-02	9.19e-03	5.33e-05	5.88e-27	0.	0.
270570	co 57	2.433e-04	2.433e-04	2.433e-04	2.433e-04	2.433e-04	2.432e-04	2.40e-04	2.27e-04	9.64e-05	2.19e-08	8.20e-45	0.
270580	co 58	8.691e-04	8.691e-04	8.693e-04	8.703e-04	8.744e-04	8.776e-04	8.31e-04	6.61e-04	2.51e-05	2.89e-19	0.	0.
270581	co 58m	3.796e-03	3.791e-03	3.748e-03	3.519e-03	2.410e-03	6.163e-04	1.13e-08	3.53e-27	0.	0.	0.	0.
280590	ni 59	1.342e-09	1.342e-09	1.342e-09	1.342e-09	1.342e-09	1.342e-09	1.34e-09	1.34e-09	1.34e-09	1.34e-09	1.34e-09	1.33e-09
280570	ni 57	2.783e-04	2.782e-04	2.774e-04	2.730e-04	2.480e-04	1.753e-04	1.09e-05	2.16e-10	0.	0.	0.	0.
270600	co 60	6.124e-03	6.124e-03	6.124e-03	6.124e-03	6.124e-03	6.122e-03	6.11e-03	6.06e-03	5.37e-03	1.64e-03	1.18e-08	4.07e-15
270601	co 60m	1.983e-03	1.857e-03	1.025e-03	3.781e-05	9.518e-14	1.052e-44	0.	0.	0.	0.	0.	0.
270610	co 61	8.908e-02	8.846e-02	8.304e-02	5.846e-02	7.116e-03	3.627e-06	1.65e-32	0.	0.	0.	0.	0.
270620	co 62	1.596e+01	1.005e+01	1.570e-01	1.450e-11	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	6.055e-05	5.760e-05	3.679e-05	3.045e-06	9.803e-13	4.161e-36	0.	0.	0.	0.	0.	0.
280630	ni 63	3.695e-03	3.695e-03	3.695e-03	3.695e-03	3.695e-03	3.695e-03	3.69e-03	3.69e-03	3.67e-03	3.45e-03	1.85e-03	3.62e-06
270640	co 64	7.018e-03	4.878e-48	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	1.550e+00	1.543e+00	1.481e+00	1.177e+00	2.976e-01	2.107e-03	1.33e-20	0.	0.	0.	0.	0.
260600	fe 60	4.079e-15	4.079e-15	4.079e-15	4.079e-15	4.079e-15	4.079e-15	4.08e-15	4.08e-15	4.08e-15	4.08e-15	4.08e-15	4.07e-15
270630	co 63	1.857e-06	4.069e-07	4.744e-13	5.166e-46	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	2.516e+02	2.344e+02	1.239e+02	3.595e+00	2.145e-09	1.329e-42	0.	0.	0.	0.	0.	0.
290640	cu 64	7.018e+01	7.011e+01	6.955e+01	6.648e+01	5.071e+01	1.914e+01	7.87e-03	4.65e-16	0.	0.	0.	0.
280620		2.572e-13	2.576e-13	2.583e-13	2.583e-13	2.583e-13	2.582e-13	2.58e-13	2.55e-13	2.26e-13	6.93e-14	4.99e-19	0.
290660	cu 66	9.316e+01	8.135e+01	2.401e+01	2.728e-02	5.871e-20	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	1.246e+01	1.223e+01	1.038e+01	4.172e+00	1.756e-02	4.923e-11	0.	0.	0.	0.	0.	0.
300650	zn 65	7.658e-01	7.658e-01	7.658e-01	7.658e-01	7.653e-01	7.637e-01	7.51e-01	7.02e-01	2.71e-01	2.39e-05	6.57e-46	0.
290670	cu 67	1.017e-01	1.017e-01	1.016e-01	1.006e-01	9.515e-02	7.781e-02	1.56e-02	2.89e-05	2.81e-44	0.	0.	0.
290680		5.118e+01	1.280e+01	4.895e-05	3.919e-35	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	7.444e+00	7.361e+00	6.654e+00	3.865e+00	5.215e-01	1.763e-01	1.28e-04	6.86e-17	0.	0.	0.	0.
300691	zn 69m	5.481e-01	5.476e-01	5.435e-01	5.212e-01	4.055e-01	1.642e-01	1.19e-04	6.39e-17	0.	0.	0.	0.
300710	zn 71	3.572e-01	2.692e-01	2.111e-02	1.523e-08	2.148e-45	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	2.124e-03	2.118e-03	2.062e-03	1.780e-03	7.353e-04	3.051e-05	2.68e-16	0.	0.	0.	0.	0.
280670	ni 67	1.188e+00	1.179e-01	1.097e-10	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	1.128e-06	1.128e-06	1.126e-06	1.116e-06	1.057e-06	8.699e-07	1.83e-07	4.14e-10	6.66e-48	0.	0.	0.
400930	zr 93	1.307e-13	1.307e-13	1.307e-13	1.307e-13	1.307e-13	1.307e-13	1.31e-13	1.31e-13	1.31e-13	1.31e-13	1.31e-13	1.31e-13
410920	nb 92	1.713e-13	1.713e-13	1.713e-13	1.713e-13	1.713e-13	1.713e-13	1.71e-13	1.71e-13	1.71e-13	1.71e-13	1.71e-13	1.71e-13
410921	nb 92m	4.493e-05	4.493e-05	4.491e-05	4.480e-05	4.417e-05	4.196e-05	2.78e-05	5.61e-06	6.47e-16	0.	0.	0.
410912		6.933e-13	4.368e-13	6.823e-15	6.298e-25	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	6.668e-09	6.668e-09	6.668e-09	6.668e-09	6.667e-09	6.667e-09	6.66e-09	6.65e-09	6.43e-09	4.77e-09	1.92e-09	1.58e-09

Table A-4. (continued)

410940	nb 94	2.100e-10	2.101e-10	2.101e-10	2.102e-10	2.102e-10	2.102e-10	2.10e-10	2.10e-10	2.10e-10	2.10e-10	2.09e-10	2.03e-10
410911	nb 91m	5.617e-15	5.617e-15	5.617e-15	5.615e-15	5.602e-15	5.555e-15	5.19e-15	4.00e-15	9.46e-17	1.03e-32	0.	0.
410941	nb 94m	2.831e-04	2.534e-04	9.357e-05	3.692e-07	1.394e-21	0.	0.	0.	0.	0.	0.	0.
400880		6.621e-09	6.621e-09	6.620e-09	6.618e-09	6.607e-09	6.566e-09	6.25e-09	5.14e-09	3.18e-10	4.37e-22	0.	0.
400890	zr 89	1.840e-06	1.839e-06	1.837e-06	1.823e-06	1.745e-06	1.488e-06	4.17e-07	2.88e-09	4.00e-40	0.	0.	0.
390880	y 88	9.947e-22	9.947e-22	9.947e-22	9.947e-22	9.947e-22	9.947e-22	9.95e-22	9.94e-22	9.88e-22	9.28e-22	4.98e-22	9.75e-25
420910	mo 91	4.944e-05	4.728e-05	3.161e-05	3.373e-06	4.988e-12	5.122e-33	0.	0.	0.	0.	0.	0.
420930	mo 93	6.463e-10	6.463e-10	6.463e-10	6.463e-10	6.463e-10	6.464e-10	6.46e-10	6.46e-10	6.46e-10	6.45e-10	6.34e-10	5.30e-10
420900		1.713e-15	1.709e-15	1.678e-15	1.515e-15	8.224e-16	9.107e-17	2.06e-24	0.	0.	0.	0.	0.
390910	y 91	3.191e-18	3.190e-18	3.190e-18	3.189e-18	3.181e-18	3.153e-18	2.94e-18	2.23e-18	4.31e-20	6.43e-37	0.	0.
410950	nb 95	2.353e-06	2.353e-06	2.353e-06	2.352e-06	2.346e-06	2.325e-06	2.13e-06	1.40e-06	7.26e-09	1.94e-24	0.	0.
420931	mo 93m	3.385e-07	3.379e-07	3.329e-07	3.064e-07	1.861e-07	3.091e-08	1.79e-14	7.78e-39	0.	0.	0.	0.
410951	nb 95m	9.059e-07	9.057e-07	9.047e-07	8.987e-07	8.634e-07	7.477e-07	2.36e-07	2.63e-09	3.28e-37	0.	0.	0.
410960	nb 96	5.478e-06	5.475e-06	5.451e-06	5.318e-06	4.584e-06	2.687e-06	3.74e-08	2.10e-15	0.	0.	0.	0.
420950		3.215e-21	3.216e-21	3.217e-21	3.225e-21	3.274e-21	3.448e-21	4.75e-21	8.59e-21	1.51e-20	1.50e-20	1.48e-20	1.24e-20
410970	nb 97	3.420e-06	3.565e-06	3.499e-06	2.467e-06	7.797e-07	3.309e-07	9.31e-10	1.01e-19	0.	0.	0.	0.
410971	nb 97m	2.454e-05	1.239e-05	2.627e-08	3.686e-23	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.292e-06	1.274e-06	1.118e-06	5.411e-07	6.967e-09	1.092e-15	0.	0.	0.	0.	0.	0.
400950	zr 95	1.355e-07	1.355e-07	1.354e-07	1.354e-07	1.351e-07	1.340e-07	1.26e-07	9.74e-08	2.59e-09	8.79e-25	0.	0.
420990	mo 99	8.792e-05	8.791e-05	8.777e-05	8.701e-05	8.261e-05	6.851e-05	1.53e-05	4.43e-08	2.37e-44	0.	0.	0.
430991	tc 99m	8.063e-05	8.064e-05	8.076e-05	8.137e-05	8.278e-05	7.429e-05	1.69e-05	4.87e-08	2.60e-44	0.	0.	0.
430990	tc 99	1.368e-11	1.368e-11	1.368e-11	1.371e-11	1.386e-11	1.439e-11	1.65e-11	1.71e-11	1.71e-11	1.71e-11	1.71e-11	1.70e-11
411000	nb 100	1.584e-04	2.679e-10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410990	nb 99	1.966e-16	1.947e-16	1.786e-16	1.103e-16	6.138e-18	1.867e-22	0.	0.	0.	0.	0.	0.
400970	zr 97	8.185e-07	8.180e-07	8.130e-07	7.858e-07	6.408e-07	3.075e-07	8.65e-10	9.38e-20	0.	0.	0.	0.
421010	mo 101	7.120e-05	6.790e-05	4.429e-05	4.124e-06	2.688e-12	1.447e-34	0.	0.	0.	0.	0.	0.
431010	tc 101	1.232e-05	1.502e-05	2.894e-05	1.232e-05	3.996e-11	5.475e-33	0.	0.	0.	0.	0.	0.
441010		2.282e-05	2.273e-05	2.279e-05	2.284e-05	1.514e-06	4.605e-11	3.38e-47	0.	0.	0.	0.	0.
	total	1.217e+05	8.587e+04	3.728e+04	1.064e+04	7.862e+03	3.407e+03	1.72e+01	8.51e+00	2.03e+00	9.56e-02	1.99e-03	1.43e-04

Table A-4. (continued)

al-fw bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.300e+00	2.298e+00	2.282e+00	2.196e+00	1.742e+00	7.564e-01	9.58e-04	4.59e-15	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	1.174e-02	5.870e-03	1.148e-05	1.027e-20	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	3.219e-02	1.065e-02	5.073e-07	4.934e-31	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	6.850e-01	1.006e-17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	1.949e+00	1.811e+00	9.368e-01	2.403e-02	6.853e-12	2.980e-46	0.	0.	0.	0.	0.	0.
130260	al 26	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.570e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06	1.57e-06
130280	al 28	1.318e+00	9.670e-01	5.970e-02	1.140e-08	5.536e-49	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	2.639e-03	2.374e-03	9.173e-04	4.657e-06	7.978e-20	0.	0.	0.	0.	0.	0.	0.
130300	al 30	1.326e-01	1.663e-06	1.282e-50	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	8.506e-06	8.468e-06	8.139e-06	6.529e-06	1.740e-06	1.490e-08	4.31e-25	0.	0.	0.	0.	0.
170360	cl 36	4.663e-14	4.663e-14	4.663e-14	4.663e-14	4.663e-14	4.663e-14	4.66e-14	4.66e-14	4.66e-14	4.66e-14	4.66e-14	4.65e-14
180370	ar 37	5.027e-17	5.027e-17	5.026e-17	5.023e-17	5.002e-17	4.928e-17	4.38e-17	2.75e-17	3.63e-20	1.93e-48	0.	0.
180390	ar 39	1.239e-09	1.239e-09	1.239e-09	1.239e-09	1.239e-09	1.239e-09	1.24e-09	1.24e-09	1.24e-09	1.21e-09	9.57e-10	9.42e-11
190380	k 38	1.641e-09	1.500e-09	6.673e-10	7.413e-12	1.393e-23	0.	0.	0.	0.	0.	0.	0.
190400	k 40	1.727e-10	1.727e-10	1.727e-10	1.727e-10	1.727e-10	1.727e-10	1.73e-10	1.73e-10	1.73e-10	1.73e-10	1.73e-10	1.73e-10
160350		2.865e-17	2.865e-17	2.865e-17	2.864e-17	2.859e-17	2.842e-17	2.71e-17	2.25e-17	1.61e-18	9.14e-30	0.	0.
170380	cl 38	2.269e-10	2.227e-10	1.884e-10	7.438e-11	2.816e-13	5.385e-22	0.	0.	0.	0.	0.	0.
170400		1.533e-19	1.505e-19	1.273e-19	5.026e-20	1.903e-22	3.639e-31	0.	0.	0.	0.	0.	0.
160370		6.346e-19	5.534e-19	1.613e-19	1.711e-22	2.434e-40	0.	0.	0.	0.	0.	0.	0.
180410	ar 41	7.065e-10	7.020e-10	6.632e-10	4.837e-10	7.282e-11	7.974e-14	1.65e-37	0.	0.	0.	0.	0.
190420	k 42	3.951e-09	3.948e-09	3.915e-09	3.736e-09	2.825e-09	1.033e-09	3.29e-13	7.22e-27	0.	0.	0.	0.
210440	sc 44	1.348e-08	1.344e-08	1.309e-08	1.130e-08	4.666e-09	1.935e-10	1.69e-21	0.	0.	0.	0.	0.
210460	sc 46	2.835e-04	2.835e-04	2.835e-04	2.834e-04	2.829e-04	2.811e-04	2.68e-04	2.20e-04	1.38e-05	2.11e-17	0.	0.
220450	ti 45	6.861e-07	6.835e-07	6.608e-07	5.478e-07	1.778e-07	3.096e-09	2.61e-23	0.	0.	0.	0.	0.
190430	k 43	2.025e-15	2.024e-15	2.015e-15	1.963e-15	1.682e-15	9.635e-16	1.12e-17	3.08e-25	0.	0.	0.	0.
210470	sc 47	4.416e-05	4.415e-05	4.409e-05	4.379e-05	4.202e-05	3.622e-05	1.11e-05	1.21e-07	2.10e-30	0.	0.	0.
190440	k 44	2.119e-15	2.054e-15	1.547e-15	3.201e-16	2.514e-20	4.196e-35	0.	0.	0.	0.	0.	0.
200470	ca 47	3.114e-06	3.114e-06	3.111e-06	3.094e-06	2.997e-06	2.672e-06	1.07e-06	2.96e-08	1.71e-30	0.	0.	0.
210480	sc 48	7.181e-04	7.179e-04	7.162e-04	7.068e-04	6.529e-04	4.907e-04	4.99e-05	6.63e-09	0.	0.	0.	0.
200450	ca 45	1.484e-04	1.484e-04	1.484e-04	1.484e-04	1.482e-04	1.477e-04	1.44e-04	1.30e-04	3.14e-05	2.66e-11	0.	0.
210490	sc 49	2.765e-07	2.732e-07	2.451e-07	1.342e-07	3.607e-09	8.005e-15	0.	0.	0.	0.	0.	0.
210500	sc 50	2.388e-05	1.593e-05	4.156e-07	6.632e-16	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	1.087e-06	9.647e-07	3.294e-07	8.413e-10	2.336e-25	0.	0.	0.	0.	0.	0.	0.
230480	v 48	8.005e-08	8.005e-08	8.003e-08	7.991e-08	7.919e-08	7.666e-08	5.91e-08	2.14e-08	1.05e-14	0.	0.	0.
230490	v 49	1.364e-07	1.364e-07	1.364e-07	1.364e-07	1.364e-07	1.362e-07	1.34e-07	1.28e-07	6.34e-08	6.35e-11	6.53e-41	0.
240510	cr 51	1.402e-04	1.402e-04	1.401e-04	1.400e-04	1.393e-04	1.367e-04	1.18e-04	6.55e-05	1.53e-08	3.43e-44	0.	0.
240490	cr 49	7.816e-06	7.688e-06	6.627e-06	2.904e-06	2.057e-08	3.751e-16	0.	0.	0.	0.	0.	0.
230520	v 52	6.905e-04	5.740e-04	1.088e-04	1.056e-08	8.839e-33	0.	0.	0.	0.	0.	0.	0.
230530		6.687e-14	6.687e-14	6.686e-14	6.680e-14	6.645e-14	6.522e-14	5.61e-14	3.13e-14	7.31e-18	0.	0.	0.

Table A-4. (continued)

240550	cr 55	1.813e-03	1.489e-03	2.535e-04	1.355e-08	3.155e-34	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	1.979e-03	1.979e-03	1.979e-03	1.979e-03	1.978e-03	1.975e-03	1.95e-03	1.85e-03	8.78e-04	5.83e-07	9.75e-39	0.
250560	mn 56	8.733e-03	8.694e-03	8.350e-03	6.674e-03	1.741e-03	1.378e-05	2.13e-22	0.	0.	0.	0.	0.
250530	mn 53	3.288e-10	3.288e-10	3.289e-10	3.289e-10	3.289e-10	3.289e-10	3.29e-10	3.29e-10	3.29e-10	3.29e-10	3.29e-10	3.29e-10
250520	mn 52	2.174e-07	2.174e-07	2.172e-07	2.163e-07	2.108e-07	1.922e-07	9.18e-08	5.13e-09	6.39e-27	0.	0.	0.
260550	fe 55	4.449e-05	4.449e-05	4.449e-05	4.449e-05	4.448e-05	4.446e-05	4.43e-05	4.35e-05	3.44e-05	3.36e-06	2.68e-16	0.
260530	fe 53	5.169e-05	4.765e-05	2.294e-05	3.949e-07	1.028e-17	0.	0.	0.	0.	0.	0.	0.
240560		2.391e-11	2.126e-11	7.386e-12	2.077e-14	1.026e-29	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	5.762e-04	3.679e-04	6.490e-06	1.176e-15	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	4.097e-05	2.161e-05	6.834e-08	8.830e-22	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	8.235e-06	8.235e-06	8.234e-06	8.230e-06	8.203e-06	8.109e-06	7.39e-06	5.16e-06	2.99e-08	3.30e-30	0.	0.
270570	co 57	2.730e-07	2.730e-07	2.730e-07	2.730e-07	2.730e-07	2.729e-07	2.70e-07	2.54e-07	1.08e-07	2.46e-11	9.21e-48	0.
270580	co 58	4.876e-07	4.876e-07	4.877e-07	4.882e-07	4.906e-07	4.924e-07	4.66e-07	3.71e-07	1.41e-08	1.62e-22	0.	0.
270581	co 58m	1.420e-08	1.418e-08	1.402e-08	1.316e-08	9.012e-09	2.305e-09	4.22e-14	1.32e-32	0.	0.	0.	0.
280590	ni 59	7.528e-14	7.528e-14	7.528e-14	7.528e-14	7.528e-14	7.528e-14	7.53e-14	7.53e-14	7.53e-14	7.53e-14	7.52e-14	7.46e-14
280570	ni 57	3.123e-06	3.122e-06	3.113e-06	3.063e-06	2.782e-06	1.967e-06	1.23e-07	2.42e-12	0.	0.	0.	0.
270600	co 60	2.291e-05	2.291e-05	2.291e-05	2.290e-05	2.290e-05	2.290e-05	2.28e-05	2.27e-05	2.01e-05	6.14e-06	4.42e-11	1.52e-17
270601	co 60m	7.417e-08	6.944e-08	3.834e-08	1.414e-09	3.560e-18	3.935e-49	0.	0.	0.	0.	0.	0.
270610	co 61	3.332e-06	3.308e-06	3.106e-06	2.186e-06	2.661e-07	1.357e-10	6.18e-37	0.	0.	0.	0.	0.
270620	co 62	8.953e-05	5.640e-05	8.811e-07	8.132e-17	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	6.794e-10	6.463e-10	4.128e-10	3.417e-11	1.100e-17	4.669e-41	0.	0.	0.	0.	0.	0.
280630	ni 63	2.073e-06	2.073e-06	2.073e-06	2.073e-06	2.073e-06	2.073e-06	2.07e-06	2.07e-06	2.06e-06	1.93e-06	1.04e-06	2.03e-09
270640	co 64	2.625e-07	1.824e-52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	8.696e-05	8.657e-05	8.307e-05	6.605e-05	1.670e-05	1.182e-07	7.45e-25	0.	0.	0.	0.	0.
260600	fe 60	1.526e-19	1.526e-19	1.526e-19	1.526e-19	1.526e-19	1.526e-19	1.53e-19	1.53e-19	1.53e-19	1.53e-19	1.53e-19	1.52e-19
270630	co 63	6.944e-11	1.522e-11	1.774e-17	1.932e-50	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	9.408e-05	8.765e-05	4.635e-05	1.345e-06	8.021e-16	4.970e-49	0.	0.	0.	0.	0.	0.
290640	cu 64	1.969e-03	1.967e-03	1.951e-03	1.865e-03	1.423e-03	5.368e-04	2.21e-07	1.30e-20	0.	0.	0.	0.
280620		2.886e-15	2.891e-15	2.898e-15	2.898e-15	2.898e-15	2.897e-15	2.89e-15	2.87e-15	2.54e-15	7.78e-16	5.60e-21	0.
290660	cu 66	1.045e-05	9.128e-06	2.694e-06	3.061e-09	6.588e-27	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	4.660e-04	4.575e-04	3.883e-04	1.560e-04	6.569e-07	1.841e-15	0.	0.	0.	0.	0.	0.
300650	zn 65	4.297e-04	4.297e-04	4.296e-04	4.296e-04	4.294e-04	4.284e-04	4.21e-04	3.94e-04	1.52e-04	1.34e-08	3.69e-49	0.
290670	cu 67	3.802e-06	3.804e-06	3.798e-06	3.763e-06	3.559e-06	2.910e-06	5.82e-07	1.08e-09	1.05e-48	0.	0.	0.
290680		5.743e-01	1.436e-01	5.493e-07	4.397e-37	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	4.176e-05	4.130e-05	3.733e-05	2.168e-05	2.925e-06	9.893e-07	7.16e-10	3.85e-22	0.	0.	0.	0.
300691	zn 69m	6.149e-05	6.144e-05	6.098e-05	5.848e-05	4.550e-05	1.842e-05	1.33e-08	7.17e-21	0.	0.	0.	0.
300710	zn 71	1.336e-05	1.007e-05	7.897e-07	5.697e-13	8.034e-50	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	2.383e-05	2.376e-05	2.314e-05	1.997e-05	8.250e-06	3.423e-07	3.01e-18	0.	0.	0.	0.	0.
280670	ni 67	4.445e-05	4.409e-06	4.103e-15	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	4.219e-10	4.218e-10	4.211e-10	4.174e-10	3.954e-10	3.253e-10	6.84e-11	1.55e-13	2.49e-51	0.	0.	0.
400930	zr 93	3.665e-17	3.665e-17	3.665e-17	3.665e-17	3.665e-17	3.665e-17	3.67e-17	3.67e-17	3.67e-17	3.67e-17	3.67e-17	3.66e-17
410920	nb 92	5.491e-19	5.491e-19	5.491e-19	5.491e-19	5.491e-19	5.491e-19	5.49e-19	5.49e-19	5.49e-19	5.49e-19	5.49e-19	5.49e-19
410921	nb 92m	1.362e-10	1.362e-10	1.362e-10	1.359e-10	1.339e-10	1.272e-10	8.44e-11	1.70e-11	1.96e-21	0.	0.	0.
410912		7.780e-15	4.901e-15	7.656e-17	7.066e-27	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	1.870e-12	1.870e-12	1.870e-12	1.870e-12	1.870e-12	1.870e-12	1.87e-12	1.86e-12	1.80e-12	1.34e-12	5.39e-13	4.44e-13

Table A-4. (continued)

410940	nb 94	1.178e-13	1.178e-13	1.179e-13	1.179e-13	1.179e-13	1.179e-13	1.18e-13	1.18e-13	1.18e-13	1.18e-13	1.18e-13	1.14e-13
410911	nb 91m	6.303e-17	6.303e-17	6.302e-17	6.300e-17	6.285e-17	6.233e-17	5.83e-17	4.48e-17	1.06e-18	1.16e-34	0.	0.
410941	nb 94m	1.588e-12	1.422e-12	5.249e-13	2.072e-15	7.823e-30	0.	0.	0.	0.	0.	0.	0.
400880		7.429e-11	7.429e-11	7.428e-11	7.426e-11	7.413e-11	7.367e-11	7.01e-11	5.77e-11	3.57e-12	4.91e-24	0.	0.
400890	zr 89	2.064e-08	2.064e-08	2.061e-08	2.046e-08	1.958e-08	1.670e-08	4.67e-09	3.23e-11	4.49e-42	0.	0.	0.
390880	y 88	1.116e-23	1.116e-23	1.116e-23	1.116e-23	1.116e-23	1.116e-23	1.12e-23	1.12e-23	1.11e-23	1.04e-23	5.58e-24	1.09e-26
420910	mo 91	1.849e-09	1.768e-09	1.182e-09	1.262e-10	1.866e-16	1.916e-37	0.	0.	0.	0.	0.	0.
420930	mo 93	1.960e-15	1.960e-15	1.960e-15	1.960e-15	1.960e-15	1.960e-15	1.96e-15	1.96e-15	1.96e-15	1.96e-15	1.92e-15	1.61e-15
420900		1.922e-17	1.918e-17	1.883e-17	1.700e-17	9.227e-18	1.022e-18	2.31e-26	0.	0.	0.	0.	0.
390910	y 91	3.580e-21	3.580e-21	3.580e-21	3.578e-21	3.569e-21	3.538e-21	3.30e-21	2.50e-21	4.83e-23	7.22e-40	0.	0.
410950	nb 95	8.800e-10	8.799e-10	8.799e-10	8.795e-10	8.775e-10	8.697e-10	7.96e-10	5.22e-10	2.71e-12	7.25e-28	0.	0.
420931	mo 93m	1.899e-11	1.896e-11	1.868e-11	1.719e-11	1.044e-11	1.734e-12	1.01e-18	4.36e-43	0.	0.	0.	0.
410951	nb 95m	3.630e-12	3.630e-12	3.625e-12	3.601e-12	3.460e-12	2.996e-12	9.47e-13	1.05e-14	1.31e-42	0.	0.	0.
410960	nb 96	6.146e-08	6.143e-08	6.116e-08	5.967e-08	5.144e-08	3.015e-08	4.20e-10	2.36e-17	0.	0.	0.	0.
420950		3.608e-23	3.608e-23	3.610e-23	3.619e-23	3.674e-23	3.869e-23	5.33e-23	9.64e-23	1.69e-22	1.69e-22	1.66e-22	1.39e-22
410970	nb 97	1.919e-11	2.000e-11	1.963e-11	1.384e-11	4.374e-12	1.856e-12	5.22e-15	5.66e-25	0.	0.	0.	0.
410971	nb 97m	9.180e-10	4.632e-10	9.824e-13	1.378e-27	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	4.833e-11	4.763e-11	4.180e-11	2.024e-11	2.606e-13	4.084e-20	0.	0.	0.	0.	0.	0.
400950	zr 95	1.520e-10	1.520e-10	1.520e-10	1.519e-10	1.516e-10	1.503e-10	1.41e-10	1.09e-10	2.90e-12	9.86e-28	0.	0.
420990	mo 99	1.409e-08	1.409e-08	1.407e-08	1.395e-08	1.324e-08	1.098e-08	2.46e-09	7.10e-12	3.79e-48	0.	0.	0.
430991	tc 99m	1.809e-10	1.810e-10	1.812e-10	1.826e-10	1.858e-10	1.667e-10	3.78e-11	1.09e-13	5.83e-50	0.	0.	0.
430990	tc 99	7.672e-15	7.673e-15	7.675e-15	7.689e-15	7.775e-15	8.075e-15	9.25e-15	9.59e-15	9.59e-15	9.59e-15	9.59e-15	9.56e-15
411000	nb 100	5.924e-09	1.002e-14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410990	nb 99	7.354e-21	7.283e-21	6.679e-21	4.126e-21	2.296e-22	6.983e-27	0.	0.	0.	0.	0.	0.
400970	zr 97	3.061e-10	3.059e-10	3.041e-10	2.939e-10	2.397e-10	1.150e-10	3.24e-13	3.51e-23	0.	0.	0.	0.
421010	mo 101	2.663e-09	2.539e-09	1.656e-09	1.542e-10	1.005e-16	5.412e-39	0.	0.	0.	0.	0.	0.
431010	tc 101	4.608e-10	5.619e-10	1.082e-09	4.608e-10	1.495e-15	2.048e-37	0.	0.	0.	0.	0.	0.
441010		2.561e-07	2.551e-07	2.557e-07	2.563e-07	1.698e-08	5.167e-13	3.79e-49	0.	0.	0.	0.	0.
	total	7.024e+00	5.257e+00	3.295e+00	2.232e+00	1.749e+00	7.606e-01	4.00e-03	2.74e-03	1.13e-03	1.36e-05	2.61e-06	1.57e-06

Table A-4. (continued)

al-fw afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.845e-04	2.842e-04	2.823e-04	2.716e-04	2.154e-04	9.356e-05	1.18e-07	5.67e-19	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	3.913e-06	1.957e-06	3.827e-09	3.424e-24	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.087e-05	3.598e-06	1.713e-10	1.666e-34	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	5.373e-04	7.888e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	4.878e-04	4.533e-04	2.345e-04	6.015e-06	1.715e-15	7.457e-50	0.	0.	0.	0.	0.	0.
130260	al 26	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.749e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12	2.75e-12
130280	al 28	6.063e-04	4.449e-04	2.747e-05	5.247e-12	2.547e-52	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	9.958e-07	8.960e-07	3.462e-07	1.758e-09	3.011e-23	0.	0.	0.	0.	0.	0.	0.
130300	al 30	5.728e-05	7.187e-10	5.540e-54	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	6.646e-10	6.617e-10	6.360e-10	5.102e-10	1.360e-10	1.164e-12	3.37e-29	0.	0.	0.	0.	0.
170360	cl 36	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.97e-20	4.97e-20	4.97e-20	4.97e-20	4.97e-20	4.96e-20
180370	ar 37	1.354e-17	1.354e-17	1.354e-17	1.353e-17	1.348e-17	1.328e-17	1.18e-17	7.41e-18	9.78e-21	5.21e-49	0.	0.
180390	ar 39	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.26e-16	1.26e-16	1.25e-16	1.22e-16	9.71e-17	9.55e-18
190380	k 38	1.144e-12	1.046e-12	4.652e-13	5.168e-15	9.713e-27	0.	0.	0.	0.	0.	0.	0.
190400	k 40	5.720e-17	5.720e-17	5.720e-17	5.720e-17	5.720e-17	5.720e-17	5.72e-17	5.72e-17	5.72e-17	5.72e-17	5.72e-17	5.72e-17
160350		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
170380	cl 38	3.221e-13	3.161e-13	2.674e-13	1.056e-13	3.997e-16	7.644e-25	0.	0.	0.	0.	0.	0.
170400		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180410	ar 41	2.590e-13	2.574e-13	2.432e-13	1.774e-13	2.670e-14	2.924e-17	6.04e-41	0.	0.	0.	0.	0.
190420	k 42	1.462e-13	1.461e-13	1.449e-13	1.383e-13	1.045e-13	3.822e-14	1.22e-17	2.67e-31	0.	0.	0.	0.
210440	sc 44	1.353e-12	1.349e-12	1.313e-12	1.133e-12	4.682e-13	1.941e-14	1.70e-25	0.	0.	0.	0.	0.
210460	sc 46	2.505e-09	2.505e-09	2.505e-09	2.505e-09	2.500e-09	2.485e-09	2.36e-09	1.95e-09	1.22e-10	1.87e-22	0.	0.
220450	ti 45	4.696e-10	4.678e-10	4.523e-10	3.749e-10	1.217e-10	2.119e-12	1.79e-26	0.	0.	0.	0.	0.
190430	k 43	1.133e-19	1.133e-19	1.127e-19	1.099e-19	9.412e-20	5.392e-20	6.26e-22	1.72e-29	0.	0.	0.	0.
210470	sc 47	1.284e-09	1.284e-09	1.282e-09	1.273e-09	1.222e-09	1.053e-09	3.22e-10	3.52e-12	6.09e-35	0.	0.	0.
190440	k 44	6.164e-19	5.973e-19	4.498e-19	9.309e-20	7.312e-24	1.220e-38	0.	0.	0.	0.	0.	0.
200470	ca 47	1.308e-10	1.308e-10	1.307e-10	1.300e-10	1.259e-10	1.123e-10	4.48e-11	1.24e-12	7.18e-35	0.	0.	0.
210480	sc 48	6.678e-08	6.676e-08	6.660e-08	6.573e-08	6.071e-08	4.563e-08	4.64e-09	6.16e-13	0.	0.	0.	0.
200450	ca 45	5.041e-11	5.041e-11	5.041e-11	5.040e-11	5.035e-11	5.019e-11	4.89e-11	4.43e-11	1.07e-11	9.04e-18	0.	0.
210490	sc 49	1.575e-09	1.556e-09	1.396e-09	7.642e-10	2.054e-11	4.559e-17	0.	0.	0.	0.	0.	0.
210500	sc 50	6.627e-08	4.419e-08	1.153e-09	1.840e-18	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	4.272e-09	3.791e-09	1.294e-09	3.306e-12	9.181e-28	0.	0.	0.	0.	0.	0.	0.
230480	v 48	2.758e-13	2.758e-13	2.757e-13	2.753e-13	2.728e-13	2.641e-13	2.04e-13	7.36e-14	3.62e-20	0.	0.	0.
230490	v 49	3.243e-11	3.243e-11	3.243e-11	3.244e-11	3.243e-11	3.238e-11	3.20e-11	3.04e-11	1.51e-11	1.51e-14	1.55e-44	0.
240510	cr 51	1.718e-09	1.718e-09	1.718e-09	1.716e-09	1.707e-09	1.676e-09	1.44e-09	8.03e-10	1.88e-13	4.20e-49	0.	0.
240490	cr 49	1.879e-09	1.849e-09	1.593e-09	6.983e-10	4.946e-12	9.019e-20	0.	0.	0.	0.	0.	0.
230520	v 52	3.193e-06	2.655e-06	5.031e-07	4.884e-11	4.088e-35	0.	0.	0.	0.	0.	0.	0.
230530		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

240550	cr 55	3.061e-07	2.514e-07	4.280e-08	2.287e-12	5.325e-38	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	8.732e-09	8.732e-09	8.732e-09	8.731e-09	8.727e-09	8.713e-09	8.60e-09	8.16e-09	3.87e-09	2.57e-12	4.30e-44	0.
250560	mn 56	2.335e-06	2.324e-06	2.232e-06	1.784e-06	4.653e-07	3.684e-09	5.69e-26	0.	0.	0.	0.	0.
250530	mn 53	3.092e-17	3.092e-17	3.093e-17	3.093e-17	3.093e-17	3.093e-17	3.09e-17	3.09e-17	3.09e-17	3.09e-17	3.09e-17	3.09e-17
250520	mn 52	1.479e-11	1.479e-11	1.477e-11	1.471e-11	1.434e-11	1.307e-11	6.25e-12	3.49e-13	4.35e-31	0.	0.	0.
260550	fe 55	4.936e-10	4.936e-10	4.936e-10	4.936e-10	4.936e-10	4.933e-10	4.91e-10	4.83e-10	3.81e-10	3.73e-11	2.97e-21	0.
260530	fe 53	1.858e-08	1.713e-08	8.246e-09	1.419e-10	3.694e-21	0.	0.	0.	0.	0.	0.	0.
240560		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	1.003e-07	6.403e-08	1.129e-09	2.047e-19	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	2.647e-08	1.397e-08	4.416e-11	5.706e-25	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	1.131e-10	1.131e-10	1.131e-10	1.130e-10	1.127e-10	1.114e-10	1.02e-10	7.08e-11	4.11e-13	4.53e-35	0.	0.
270570	co 57	3.620e-13	3.620e-13	3.620e-13	3.620e-13	3.620e-13	3.619e-13	3.58e-13	3.37e-13	1.43e-13	3.27e-17	1.22e-53	0.
270580	co 58	5.337e-12	5.337e-12	5.338e-12	5.344e-12	5.369e-12	5.389e-12	5.10e-12	4.06e-12	1.54e-13	1.78e-27	0.	0.
270581	co 58m	5.626e-13	5.618e-13	5.555e-13	5.215e-13	3.571e-13	9.134e-14	1.67e-18	5.23e-37	0.	0.	0.	0.
280590	ni 59	2.561e-18	2.561e-18	2.561e-18	2.561e-18	2.561e-18	2.561e-18	2.56e-18	2.56e-18	2.56e-18	2.56e-18	2.56e-18	2.54e-18
280570	ni 57	2.396e-12	2.395e-12	2.388e-12	2.350e-12	2.134e-12	1.509e-12	9.42e-14	1.86e-18	0.	0.	0.	0.
270600	co 60	9.461e-11	9.461e-11	9.461e-11	9.461e-11	9.460e-11	9.458e-11	9.44e-11	9.36e-11	8.29e-11	2.54e-11	1.83e-16	6.29e-23
270601	co 60m	9.876e-13	9.245e-13	5.104e-13	1.883e-14	4.739e-23	5.239e-54	0.	0.	0.	0.	0.	0.
270610	co 61	2.894e-10	2.874e-10	2.698e-10	1.899e-10	2.312e-11	1.178e-14	5.37e-41	0.	0.	0.	0.	0.
270620	co 62	2.481e-07	1.563e-07	2.442e-09	2.254e-19	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	1.328e-12	1.264e-12	8.069e-13	6.680e-14	2.150e-20	9.127e-44	0.	0.	0.	0.	0.	0.
280630	ni 63	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.38e-13	4.38e-13	4.35e-13	4.09e-13	2.19e-13	4.30e-16
270640	co 64	1.386e-10	9.636e-56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	2.958e-08	2.945e-08	2.826e-08	2.247e-08	5.680e-09	4.020e-11	2.53e-28	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	1.751e-14	3.837e-15	4.474e-21	4.873e-54	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	3.436e-06	3.201e-06	1.693e-06	4.911e-08	2.929e-17	1.815e-50	0.	0.	0.	0.	0.	0.
290640	cu 64	1.241e-07	1.239e-07	1.229e-07	1.175e-07	8.965e-08	3.383e-08	1.39e-11	8.22e-25	0.	0.	0.	0.
280620		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
290660	cu 66	6.343e-07	5.539e-07	1.635e-07	1.857e-10	3.997e-28	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	1.571e-07	1.542e-07	1.309e-07	5.260e-08	2.215e-10	6.207e-19	0.	0.	0.	0.	0.	0.
300650	zn 65	3.213e-09	3.213e-09	3.213e-09	3.213e-09	3.211e-09	3.204e-09	3.15e-09	2.95e-09	1.14e-09	1.00e-13	2.76e-54	0.
290670	cu 67	1.705e-10	1.707e-10	1.704e-10	1.688e-10	1.596e-10	1.305e-10	2.61e-11	4.85e-14	4.72e-53	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	1.428e-08	1.412e-08	1.276e-08	7.411e-09	1.000e-09	3.382e-10	2.45e-13	1.32e-25	0.	0.	0.	0.
300691	zn 69m	1.355e-09	1.354e-09	1.344e-09	1.289e-09	1.003e-09	4.060e-10	2.94e-13	1.58e-25	0.	0.	0.	0.
300710	zn 71	2.592e-09	1.953e-09	1.532e-10	1.105e-16	1.559e-53	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	2.356e-11	2.349e-11	2.288e-11	1.974e-11	8.157e-12	3.384e-13	2.97e-24	0.	0.	0.	0.	0.
280670	ni 67	1.760e-08	1.746e-09	1.624e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	6.527e-15	6.526e-15	6.515e-15	6.456e-15	6.116e-15	5.033e-15	1.06e-15	2.39e-18	3.86e-56	0.	0.	0.
400930	zr 93	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23
410920	nb 92	1.519e-21	1.519e-21	1.519e-21	1.519e-21	1.519e-21	1.519e-21	1.52e-21	1.52e-21	1.52e-21	1.52e-21	1.52e-21	1.52e-21
410921	nb 92m	7.457e-14	7.457e-14	7.454e-14	7.436e-14	7.331e-14	6.965e-14	4.62e-14	9.31e-15	1.07e-24	0.	0.	0.
410912		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	1.186e-19	1.186e-19	1.186e-19	1.186e-19	1.186e-19	1.186e-19	1.18e-19	1.18e-19	1.14e-19	8.49e-20	3.42e-20	2.82e-20

Table A-4. (continued)

410940	nb 94	2.209e-18	2.209e-18	2.210e-18	2.211e-18	2.211e-18	2.211e-18	2.21e-18	2.21e-18	2.21e-18	2.21e-18	2.20e-18	2.14e-18
410911	nb 91m	4.562e-24	4.562e-24	4.562e-24	4.560e-24	4.549e-24	4.511e-24	4.22e-24	3.25e-24	7.68e-26	8.38e-42	0.	0.
410941	nb 94m	6.964e-14	6.234e-14	2.302e-14	9.084e-17	3.431e-31	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	4.337e-14	4.337e-14	4.331e-14	4.299e-14	4.113e-14	3.508e-14	9.82e-15	6.79e-17	9.43e-48	0.	0.	0.
390880	y 88	1.722e-29	1.722e-29	1.722e-29	1.722e-29	1.722e-29	1.722e-29	1.72e-29	1.72e-29	1.71e-29	1.61e-29	8.61e-30	1.69e-32
420910	mo 91	7.708e-13	7.371e-13	4.928e-13	5.259e-14	7.777e-20	7.985e-41	0.	0.	0.	0.	0.	0.
420930	mo 93	1.149e-19	1.149e-19	1.149e-19	1.149e-19	1.149e-19	1.150e-19	1.15e-19	1.15e-19	1.15e-19	1.15e-19	1.13e-19	9.43e-20
420900		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
390910	y 91	1.171e-26	1.171e-26	1.171e-26	1.170e-26	1.167e-26	1.157e-26	1.08e-26	8.18e-27	1.58e-28	2.36e-45	0.	0.
410950	nb 95	1.123e-14	1.123e-14	1.123e-14	1.123e-14	1.120e-14	1.110e-14	1.02e-14	6.66e-15	3.47e-17	9.26e-33	0.	0.
420931	mo 93m	4.629e-15	4.622e-15	4.553e-15	4.190e-15	2.545e-15	4.228e-16	2.45e-22	1.06e-46	0.	0.	0.	0.
410951	nb 95m	1.266e-15	1.266e-15	1.264e-15	1.256e-15	1.206e-15	1.045e-15	3.30e-16	3.68e-18	4.58e-46	0.	0.	0.
410960	nb 96	8.284e-14	8.280e-14	8.243e-14	8.042e-14	6.933e-14	4.064e-14	5.66e-16	3.18e-23	0.	0.	0.	0.
420950		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410970	nb 97	2.297e-14	2.395e-14	2.350e-14	1.657e-14	5.237e-15	2.223e-15	6.25e-18	6.78e-28	0.	0.	0.	0.
410971	nb 97m	1.081e-13	5.455e-14	1.157e-16	1.623e-31	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	2.663e-14	2.625e-14	2.304e-14	1.115e-14	1.436e-16	2.251e-23	0.	0.	0.	0.	0.	0.
400950	zr 95	1.474e-15	1.474e-15	1.474e-15	1.474e-15	1.470e-15	1.458e-15	1.37e-15	1.06e-15	2.82e-17	9.57e-33	0.	0.
420990	mo 99	3.179e-13	3.179e-13	3.174e-13	3.147e-13	2.987e-13	2.478e-13	5.55e-14	1.60e-16	8.55e-53	0.	0.	0.
430991	tc 99m	6.691e-15	6.693e-15	6.703e-15	6.753e-15	6.870e-15	6.165e-15	1.40e-15	4.04e-18	2.16e-54	0.	0.	0.
430990	tc 99	7.215e-21	7.216e-21	7.218e-21	7.231e-21	7.312e-21	7.594e-21	8.70e-21	9.02e-21	9.02e-21	9.02e-21	9.01e-21	8.99e-21
411000	nb 100	1.944e-12	3.289e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410990	nb 99	1.608e-24	1.593e-24	1.461e-24	9.026e-25	5.021e-26	1.527e-30	0.	0.	0.	0.	0.	0.
400970	zr 97	7.055e-15	7.051e-15	7.008e-15	6.773e-15	5.524e-15	2.651e-15	7.46e-18	8.08e-28	0.	0.	0.	0.
421010	mo 101	1.006e-12	9.596e-13	6.259e-13	5.828e-14	3.799e-20	2.045e-42	0.	0.	0.	0.	0.	0.
431010	tc 101	5.799e-14	7.072e-14	1.362e-13	5.799e-14	1.881e-19	2.577e-41	0.	0.	0.	0.	0.	0.
441010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	2.000e-03	1.199e-03	5.496e-04	2.797e-04	2.161e-04	9.366e-05	1.40e-07	1.46e-08	5.63e-09	6.85e-11	2.97e-12	2.75e-12

Table A-4. (continued)

al-fw beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	3.402e-05	3.400e-05	3.376e-05	3.248e-05	2.577e-05	1.119e-05	1.42e-08	6.79e-20	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	3.208e-06	1.604e-06	3.137e-09	2.807e-24	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.006e-05	3.328e-06	1.585e-10	1.541e-34	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	3.397e-04	4.987e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	2.125e-04	1.975e-04	1.022e-04	2.621e-06	7.473e-16	3.249e-50	0.	0.	0.	0.	0.	0.
130260	al 26	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.849e-13	3.85e-13	3.85e-13	3.85e-13	3.85e-13	3.85e-13	3.84e-13
130280	al 28	2.345e-04	1.721e-04	1.063e-05	2.030e-12	9.854e-53	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	3.852e-07	3.466e-07	1.339e-07	6.799e-10	1.165e-23	0.	0.	0.	0.	0.	0.	0.
130300	al 30	4.812e-05	6.038e-10	4.654e-54	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	6.646e-10	6.617e-10	6.360e-10	5.102e-10	1.360e-10	1.164e-12	3.37e-29	0.	0.	0.	0.	0.
170360	cl 36	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.967e-20	4.97e-20	4.97e-20	4.97e-20	4.97e-20	4.97e-20	4.96e-20
180370	ar 37	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180390	ar 39	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.257e-16	1.26e-16	1.26e-16	1.25e-16	1.22e-16	9.71e-17	9.55e-18
190380	k 38	3.137e-13	2.867e-13	1.276e-13	1.417e-15	2.663e-27	0.	0.	0.	0.	0.	0.	0.
190400	k 40	4.251e-17	4.251e-17	4.251e-17	4.251e-17	4.251e-17	4.251e-17	4.25e-17	4.25e-17	4.25e-17	4.25e-17	4.25e-17	4.25e-17
160350		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
170380	cl 38	1.854e-13	1.820e-13	1.540e-13	6.079e-14	2.302e-16	4.401e-25	0.	0.	0.	0.	0.	0.
170400		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180410	ar 41	6.793e-14	6.750e-14	6.378e-14	4.651e-14	7.002e-15	7.667e-18	1.59e-41	0.	0.	0.	0.	0.
190420	k 42	1.222e-13	1.221e-13	1.210e-13	1.155e-13	8.735e-14	3.193e-14	1.02e-17	2.23e-31	0.	0.	0.	0.
210440	sc 44	5.200e-13	5.185e-13	5.049e-13	4.357e-13	1.800e-13	7.462e-15	6.52e-26	0.	0.	0.	0.	0.
210460	sc 46	1.092e-10	1.092e-10	1.091e-10	1.091e-10	1.089e-10	1.083e-10	1.03e-10	8.48e-11	5.31e-12	8.13e-24	0.	0.
220450	ti 45	4.696e-10	4.678e-10	4.523e-10	3.749e-10	1.217e-10	2.119e-12	1.79e-26	0.	0.	0.	0.	0.
190430	k 43	3.261e-20	3.259e-20	3.244e-20	3.162e-20	2.708e-20	1.552e-20	1.80e-22	4.95e-30	0.	0.	0.	0.
210470	sc 47	7.391e-10	7.390e-10	7.380e-10	7.330e-10	7.033e-10	6.062e-10	1.85e-10	2.03e-12	3.51e-35	0.	0.	0.
190440	k 44	2.872e-19	2.783e-19	2.096e-19	4.337e-20	3.407e-24	5.686e-39	0.	0.	0.	0.	0.	0.
200470	ca 47	2.883e-11	2.882e-11	2.879e-11	2.864e-11	2.774e-11	2.474e-11	9.88e-12	2.74e-13	1.58e-35	0.	0.	0.
210480	sc 48	3.269e-09	3.268e-09	3.260e-09	3.217e-09	2.972e-09	2.233e-09	2.27e-10	3.02e-14	0.	0.	0.	0.
200450	ca 45	5.041e-11	5.041e-11	5.041e-11	5.040e-11	5.035e-11	5.019e-11	4.89e-11	4.43e-11	1.07e-11	9.04e-18	0.	0.
210490	sc 49	1.573e-09	1.554e-09	1.394e-09	7.632e-10	2.052e-11	4.554e-17	0.	0.	0.	0.	0.	0.
210500	sc 50	2.199e-08	1.466e-08	3.826e-10	6.105e-19	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	4.272e-09	3.791e-09	1.294e-09	3.306e-12	9.181e-28	0.	0.	0.	0.	0.	0.	0.
230480	v 48	2.758e-13	2.758e-13	2.757e-13	2.753e-13	2.728e-13	2.641e-13	2.04e-13	7.36e-14	3.62e-20	0.	0.	0.
230490	v 49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
240490	cr 49	1.054e-09	1.037e-09	8.939e-10	3.917e-10	2.775e-12	5.060e-20	0.	0.	0.	0.	0.	0.
230520	v 52	1.343e-06	1.117e-06	2.116e-07	2.054e-11	1.720e-35	0.	0.	0.	0.	0.	0.	0.
230530		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

240550	cr 55	3.061e-07	2.514e-07	4.280e-08	2.287e-12	5.325e-38	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	6.930e-07	6.899e-07	6.626e-07	5.296e-07	1.381e-07	1.094e-09	1.69e-26	0.	0.	0.	0.	0.
250530	mn 53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250520	mn 52	3.676e-13	3.676e-13	3.673e-13	3.657e-13	3.565e-13	3.250e-13	1.55e-13	8.66e-15	1.08e-32	0.	0.	0.
260550	fe 55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260530	fe 53	9.241e-09	8.520e-09	4.101e-09	7.060e-11	1.837e-21	0.	0.	0.	0.	0.	0.	0.
240560		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.371e-08	7.234e-09	2.288e-11	2.956e-25	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	1.027e-11	1.027e-11	1.027e-11	1.026e-11	1.023e-11	1.011e-11	9.22e-12	6.43e-12	3.73e-14	4.11e-36	0.	0.
270570	co 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270580	co 58	1.050e-12	1.050e-12	1.050e-12	1.051e-12	1.056e-12	1.060e-12	1.00e-12	7.98e-13	3.04e-14	3.49e-28	0.	0.
270581	co 58m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280590	ni 59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280570	ni 57	1.092e-12	1.092e-12	1.089e-12	1.071e-12	9.731e-13	6.880e-13	4.30e-14	8.46e-19	0.	0.	0.	0.
270600	co 60	3.848e-12	3.848e-12	3.848e-12	3.848e-12	3.848e-12	3.847e-12	3.84e-12	3.81e-12	3.37e-12	1.03e-12	7.43e-18	2.56e-24
270601	co 60m	2.822e-13	2.641e-13	1.458e-13	5.379e-15	1.354e-23	1.497e-54	0.	0.	0.	0.	0.	0.
270610	co 61	2.540e-10	2.522e-10	2.368e-10	1.667e-10	2.029e-11	1.034e-14	4.71e-41	0.	0.	0.	0.	0.
270620	co 62	9.612e-08	6.055e-08	9.459e-10	8.730e-20	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	3.844e-13	3.657e-13	2.336e-13	1.934e-14	6.224e-21	2.642e-44	0.	0.	0.	0.	0.	0.
280630	ni 63	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.381e-13	4.38e-13	4.38e-13	4.35e-13	4.09e-13	2.19e-13	4.30e-16
270640	co 64	1.310e-10	9.109e-56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	1.093e-08	1.088e-08	1.044e-08	8.299e-09	2.098e-09	1.485e-11	9.36e-29	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	1.751e-14	3.837e-15	4.474e-21	4.873e-54	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	1.937e-06	1.805e-06	9.543e-07	2.769e-08	1.651e-17	1.023e-50	0.	0.	0.	0.	0.	0.
290640	cu 64	4.044e-08	4.040e-08	4.007e-08	3.831e-08	2.922e-08	1.103e-08	4.53e-12	2.68e-25	0.	0.	0.	0.
280620		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
290660	cu 66	5.827e-07	5.088e-07	1.501e-07	1.706e-10	3.672e-28	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	7.777e-08	7.636e-08	6.481e-08	2.604e-08	1.096e-10	3.073e-19	0.	0.	0.	0.	0.	0.
300650	zn 65	6.538e-10	6.538e-10	6.538e-10	6.537e-10	6.533e-10	6.519e-10	6.41e-10	6.00e-10	2.32e-10	2.04e-14	5.61e-55	0.
290670	cu 67	1.133e-10	1.134e-10	1.132e-10	1.121e-10	1.060e-10	8.671e-11	1.73e-11	3.22e-14	3.14e-53	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	1.428e-08	1.412e-08	1.276e-08	7.411e-09	1.000e-09	3.382e-10	2.45e-13	1.32e-25	0.	0.	0.	0.
300691	zn 69m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300710	zn 71	2.376e-09	1.791e-09	1.404e-10	1.013e-16	1.429e-53	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	7.169e-12	7.148e-12	6.961e-12	6.007e-12	2.482e-12	1.030e-13	9.04e-25	0.	0.	0.	0.	0.
280670	ni 67	1.300e-08	1.289e-09	1.200e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	6.527e-15	6.526e-15	6.515e-15	6.456e-15	6.116e-15	5.033e-15	1.06e-15	2.39e-18	3.86e-56	0.	0.	0.
400930	zr 93	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.208e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23	1.21e-23
410920	nb 92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410921	nb 92m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410912		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Table A-4. (continued)

410940	nb 94	2.490e-19	2.490e-19	2.492e-19	2.492e-19	2.492e-19	2.492e-19	2.49e-19	2.49e-19	2.49e-19	2.49e-19	2.48e-19	2.41e-19
410911	nb 91m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410941	nb 94m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	3.091e-14	3.090e-14	3.086e-14	3.063e-14	2.931e-14	2.500e-14	7.00e-15	4.84e-17	6.72e-48	0.	0.	0.
390880	y 88	1.524e-30	1.524e-30	1.524e-30	1.524e-30	1.524e-30	1.524e-30	1.52e-30	1.52e-30	1.51e-30	1.42e-30	7.62e-31	1.49e-33
420910	mo 91	4.719e-13	4.512e-13	3.016e-13	3.220e-14	4.761e-20	4.888e-41	0.	0.	0.	0.	0.	0.
420930	mo 93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
420900		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
390910	y 91	1.103e-26	1.103e-26	1.103e-26	1.102e-26	1.099e-26	1.090e-26	1.02e-26	7.70e-27	1.49e-28	2.22e-45	0.	0.
410950	nb 95	5.635e-16	5.635e-16	5.634e-16	5.632e-16	5.619e-16	5.569e-16	5.10e-16	3.34e-16	1.74e-18	4.64e-34	0.	0.
420931	mo 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410951	nb 95m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410960	nb 96	7.891e-15	7.887e-15	7.852e-15	7.660e-15	6.604e-15	3.871e-15	5.39e-17	3.03e-24	0.	0.	0.	0.
420950		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410970	nb 97	9.589e-15	9.997e-15	9.810e-15	6.917e-15	2.186e-15	9.279e-16	2.61e-18	2.83e-28	0.	0.	0.	0.
410971	nb 97m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.023e-14	1.009e-14	8.852e-15	4.285e-15	5.518e-17	8.649e-24	0.	0.	0.	0.	0.	0.
400950	zr 95	9.716e-17	9.716e-17	9.716e-17	9.712e-17	9.690e-17	9.612e-17	9.01e-17	6.99e-17	1.86e-18	6.31e-34	0.	0.
420990	mo 99	2.372e-13	2.371e-13	2.367e-13	2.347e-13	2.228e-13	1.848e-13	4.14e-14	1.20e-16	6.38e-53	0.	0.	0.
430991	tc 99m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430990	tc 99	7.215e-21	7.216e-21	7.218e-21	7.231e-21	7.312e-21	7.594e-21	8.70e-21	9.02e-21	9.02e-21	9.02e-21	9.01e-21	8.99e-21
411000	nb 100	1.442e-12	2.439e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410990	nb 99	1.608e-24	1.593e-24	1.461e-24	9.026e-25	5.021e-26	1.527e-30	0.	0.	0.	0.	0.	0.
400970	zr 97	3.707e-15	3.705e-15	3.682e-15	3.559e-15	2.902e-15	1.393e-15	3.92e-18	4.25e-28	0.	0.	0.	0.
421010	mo 101	3.858e-13	3.679e-13	2.400e-13	2.234e-14	1.457e-20	7.841e-43	0.	0.	0.	0.	0.	0.
431010	tc 101	3.433e-14	4.186e-14	8.063e-14	3.433e-14	1.113e-19	1.526e-41	0.	0.	0.	0.	0.	0.
441010		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	8.877e-04	4.135e-04	1.488e-04	3.575e-05	2.594e-05	1.121e-05	1.54e-08	7.43e-10	2.52e-10	1.85e-12	6.04e-13	3.85e-13

Table A-4. (continued)

note: listed below are al-fw isotopes for which gamma source data exists in [block data]

	nuclide
110240	na 24
120230	mg 23
110250	na 25
100230	ne 23
110260	na 26
120270	mg 27
130260	al 26
130280	al 28
140270	si 27
130290	al 29
130300	al 30
140310	si 31
190380	k 38
190400	k 40
170380	cl 38
180410	ar 41
190420	k 42
210440	sc 44
210460	sc 46
220450	ti 45
190430	k 43
210470	sc 47
190440	k 44
200470	ca 47
210480	sc 48
210490	sc 49
210500	sc 50
220510	ti 51
230480	v 48
230490	v 49
240510	cr 51
240490	cr 49
240490	cr 49
230520	v 52
250540	mn 54
250560	mn 56
250520	mn 52
260530	fe 53
250570	mn 57
260590	fe 59
270570	co 57
270580	co 58

Table A-4. (continued)

280570	ni	57
270600	co	60
270601	co	60m
270610	co	61
270620	co	62
270621	co	62m
270640	co	64
280650	ni	65
290620	cu	62
290640	cu	64
290660	cu	66
410920	nb	92
410921	nb	92m
410940	nb	94
400880		
400890	zr	89
420910	mo	91
420930	mo	93
390910	y	91
410950	nb	95
420931	mo	93m
410951	nb	95m
410960	nb	96
410970	nb	97
410971	nb	97m
410980	nb	98
400950	zr	95
420990	mo	99
430991	tc	99m
430990	tc	99
400970	zr	97
421010	mo	101
431010	tc	101

Table A-4. (continued)

b-h2o activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	6.338e-01	6.338e-01	6.338e-01	6.338e-01	6.337e-01	6.337e-01	6.33e-01	6.31e-01	5.99e-01	3.61e-01	2.25e-03	2.04e-25
40100	be 10	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.472e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06	1.47e-06
20060	he 6	7.035e-04	3.546e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	2.227e+04	7.890e-18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	2.041e+06	5.998e+03	9.821e-20	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.715e-05	8.71e-05	8.71e-05	8.71e-05	8.70e-05	8.61e-05	7.72e-05
	total	2.063e+06	5.999e+03	6.338e-01	6.338e-01	6.338e-01	6.338e-01	6.33e-01	6.31e-01	5.99e-01	3.61e-01	2.34e-03	7.87e-05

Table A-4. (continued)

b-h2o bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	3.556e-06	3.556e-06	3.556e-06	3.556e-06	3.555e-06	3.555e-06	3.55e-06	3.54e-06	3.36e-06	2.02e-06	1.26e-08	1.14e-30
40100	be 10	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.651e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08	1.65e-08
20060	he 6	2.631e-08	1.326e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	8.330e-01	2.951e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	7.632e+01	2.243e-01	3.673e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.778e-10	9.78e-10	9.78e-10	9.78e-10	9.77e-10	9.66e-10	8.66e-10
	total	7.716e+01	2.243e-01	3.573e-06	3.573e-06	3.573e-06	3.572e-06	3.57e-06	3.56e-06	3.38e-06	2.04e-06	3.01e-08	1.74e-08

Table A-4. (continued)

b-h2o afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.144e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.12e-13	1.01e-35
40100	be 10	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15
20060	he 6	6.556e-12	3.304e-34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080	li 8	8.406e-04	2.978e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160	n 16	1.115e-01	3.278e-04	5.368e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.43e-14	2.43e-14	2.43e-14	2.43e-14	2.40e-14	2.15e-14
	total	1.124e-01	3.278e-04	3.147e-11	3.147e-11	3.147e-11	3.147e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.37e-13	2.31e-14

Table A-4. (continued)

b-h2o beta heat 10-6 s operating (in mw)

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030 t	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.145e-11	3.144e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.12e-13	1.01e-35
40100 be 10	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.570e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15	1.57e-15
20060 he 6	6.556e-12	3.304e-34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30080 li 8	8.290e-04	2.937e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70160 n 16	3.133e-02	9.209e-05	1.508e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140 c 14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.428e-14	2.43e-14	2.43e-14	2.43e-14	2.43e-14	2.40e-14	2.15e-14
total	3.216e-02	9.209e-05	3.147e-11	3.147e-11	3.147e-11	3.147e-11	3.14e-11	3.13e-11	2.97e-11	1.79e-11	1.37e-13	2.31e-14

Table A-4. (continued)

summary of TEST TEST TEST tdf/scav 1m radius pulse seq. calc.

10-6 s operation time 1.000e-06 sec

after shutdown sec		total act ci	total bhp km3/kw	total aht mw	beta aht mw	per act ci/w	% aht %
0.	0	2.185e+06	8.418e+01	1.144e-01	3.305e-02	2.451e+00	1.283e+01
6.000e+01	1 m	9.187e+04	5.481e+00	1.527e-03	5.056e-04	1.031e-01	1.713e-01
6.000e+02	10 m	3.729e+04	3.295e+00	5.496e-04	1.488e-04	4.184e-02	6.166e-02
3.600e+03	1 h	1.065e+04	2.232e+00	2.797e-04	3.575e-05	1.194e-02	3.138e-02
2.160e+04	6 h	7.863e+03	1.749e+00	2.161e-04	2.594e-05	8.822e-03	2.424e-02
8.640e+04	1 d	3.408e+03	7.606e-01	9.366e-05	1.121e-05	3.824e-03	1.051e-02
6.048e+05	1 w	1.779e+01	4.003e-03	1.399e-07	1.545e-08	1.997e-05	1.570e-05
2.630e+06	1 mo	9.148e+00	2.740e-03	1.464e-08	7.744e-10	1.026e-05	1.643e-06
3.156e+07	1 yr	2.634e+00	1.137e-03	5.657e-09	2.816e-10	2.955e-06	6.347e-07
3.156e+08	10 yr	4.563e-01	1.565e-05	8.642e-11	1.976e-11	5.120e-07	9.697e-09
3.156e+09	100 yr	4.329e-03	2.643e-06	3.106e-12	7.419e-13	4.857e-09	3.485e-10
3.156e+10	1000 y	2.227e-04	1.593e-06	2.770e-12	4.086e-13	2.499e-10	3.108e-10

Sample Problem A.3

Sample problem A.3 is part II of the two-dimensional cylindrical geometry radioactivity calculation of the diode region of the Light Ion Beam Target Development Facility. The calculation consists of a 5 cm thick Al-6061-T6 chamber wall sandwiched between two 1 cm thick boral sheets. Following the second boral sheet are two 1 cm thick aluminum grounding plates which are attached to the diode's aluminum casing. Detailed information of the calculations can be found elsewhere.* The pulse operational mode scheme is used for the calculations. The zoning of the problem is 32 mesh intervals in the radial direction and 20 mesh intervals in the z-direction amounting to 640 total mesh intervals. For this problem the mixture-wise output has been chosen.

*D.L. Henderson, M.E. Sawan and G.A. Moses, "Radiological Dose Calculations for the Diode Region of the Light Ion Fusion Target Development Facility," University of Wisconsin Fusion Technology Institute Report UWFDM-707.

Table A-5. Input for Sample Problem A.3

```
1
2
3
4
5    tdf ss diode with 10cm opening: boral and aluminum first wall   part-2
6        1     3     2     1    59   640     1     0    70     6     5
7        1     0     0     0     1     2     1     0     0
8      2.862e+6       12.882        4.215       17.097    7.093e+1
9          1.00          1.00          0.0       4.0e-4    1.000e-4
10   'spulse'
11    12    3.600e+3      5    4.680e+4      4    2.196e+5
12   ' two-d'
13       16
14        0.00          1.00          8.00          9.00         10.00         12.00
15       14.00         22.00         24.00         28.00         29.00         30.00
16       33.00         35.00         45.00         46.00         70.00
17        1     3     1     1     1     1     3     1     2     1     1     1
18        1     3     1    10
19        9
20      100.00        101.00        106.00        107.00        111.00        112.00
21      117.00        118.00        156.00        163.00
22        1     2     1     1     1     1     1    10     2
23        1     6     1
24        2    26     1
25        3     6     1
26        4    26     1
27        5     6     1
28        6    26     1
29        7    21     1
30        8     1     1
31        9    10     1
32       10    21     1
33       11     1     1
34       12    10     1
35       13     6     1
36       14    16     1
37       15    10     1
38       16    21     1
39       17     1     1
40       18    10     1
41       19     6     1
42       20    16     1
43       21    10     1
44       22    21     1
45       23     1     1
46       24    10     1
47       25    21     1
48       26     1     1
49       27    10     1
50       28    21     1
51       29     1     1
52       30    10     1
53       31    21     1
54       32     1     1
55       33    10     1
56       34    21     1
57       35     1     1
58       36    10     1
59       37    21     1
60       38     1     1
61       39    10     1
62       40    21     1
63       41     1     1
64       42    10     1
```

* ignore blank lines

Table A-5. (continued)

```
      43    21     1
      44     1     1
      45    10     1
      46    21     1
      47     1     1
      48    10     1
      49    21     1
      50     1     1
      51    10     1
      52    16     1
      53     5     1
      54     1     1
      55    10     1
      56    16     1
      57     5     1
      58     1     1
      59    10     1
'void'
'boral'
'aluminum'
'water'
'plastic'
    1     2     1     3     1     3     1     3     2     1     3     4
    1     3     4     1     3     4     1     3     4     1     3     4
    1     3     4     1     3     4     1     3     4     1     3     4
    1     3     4     1     3     4     1     3     4     1     3     4
    1     3     4     1     5     3     4     1     5     3     4
  0.0  1.00   0.0   0.0   0.0
  0.0  1.00   0.0   0.0 4.248
  0.0 .7764  1.00   0.0   0.0
  0.0   0.0   0.0 1.443  1.00
  0.0   0.0   0.0 2.164  1.00
  0.0  1.00   0.0   0.0   0.0
    4  1001     1   4.634e+22
    4  1002     1   6.951e+18
    1  5010     1   4.426e+21
    1  5011     1   1.770e+22
    2  6012     1   5.395e+21
    2  6013     1   6.055e+19
    5  8016     1   1.541e+22
    5  8017     1   5.870e+18
    5  8018     1   3.151e+19
    6 11023     3   2.850e+16
    3 12024     1   5.284e+20
    3 12025     1   6.689e+19
    3 12026     1   7.365e+19
    3 13027     1   5.819e+22
    3 14028     1   3.204e+20
    3 14029     1   1.622e+19
    3 14030     1   1.077e+19
    6 16032     3   1.942e+15
    6 16033     3   1.533e+13
    6 16034     3   8.603e+13
    6 16036     3   3.474e+11
    3 19039     3   1.435e+15
    3 19040     3   1.847e+11
    3 19041     3   1.036e+14
    6 20040     3   3.487e+16
    6 20042     3   2.327e+14
    6 20043     3   4.855e+13
    6 20044     3   7.517e+14
    6 20046     3   1.259e+12
    6 20048     3   6.726e+13
    3 22046     1   4.201e+18
    3 22047     1   3.794e+18
```

Table A-5. (continued)

```
        3 22048     1   3.753e+19
        3 22049     1   2.750e+18
        3 22050     1   2.648e+18
        6 23050     3   3.216e+12
        6 23051     3   1.283e+15
        3 24050     1   4.081e+18
        3 24052     1   7.862e+19
        3 24053     1   8.914e+18
        3 24054     1   2.214e+18
        3 25055     1   4.440e+19
        3 26054     1   1.182e+19
        3 26056     1   1.871e+20
        3 26057     1   4.280e+18
        3 26058     1   6.115e+17
        3 28058     3   8.116e+15
        3 28060     3   3.101e+15
        3 28061     3   1.307e+14
        3 28062     3   4.278e+14
        3 28064     3   1.069e+14
        3 29063     1   5.313e+19
        3 29065     1   2.365e+19
        3 30064     1   3.026e+19
        3 30066     1   1.735e+19
        3 30067     1   2.550e+18
        3 30068     1   1.169e+19
        3 30070     1   3.856e+17
        3 41093     3   1.225e+14
        3 42092     3   5.720e+13
        3 42094     3   3.594e+13
        3 42095     3   6.145e+13
        3 42096     3   6.454e+13
        3 42097     3   3.710e+13
        3 42098     3   9.314e+13
        3 42100     3   3.710e+13
        6 82204     3   3.144e+13
        6 82206     3   5.335e+14
        6 82207     3   4.892e+14
        6 82208     3   1.160e+15
10-6 s    1.000e-6
 tdf ss diode with 10cm opening: boral and aluminum first wall   pulse
  1.7091e-07  4.5874e-08  2.0591e-08  1.5218e-08  1.6928e-08  1.6929e-08
  1.5102e-08  1.3296e-08  1.3269e-08  9.8344e-09  9.8330e-09  9.8349e-09
  9.8343e-09  9.8358e-09  1.0390e-08  1.0391e-08  1.2702e-08  1.5056e-08
  5.0550e-08  5.5074e-08  5.0231e-08  4.9427e-08  4.7897e-08  4.5110e-08
  4.3701e-08  3.4519e-08  3.3900e-08  3.2748e-08  6.5464e-08  7.7155e-08
  6.8166e-08  6.3270e-08  6.2456e-08  6.0912e-08  5.9667e-08  5.8789e-08
  5.8270e-08  5.6649e-08  5.5497e-08  5.4345e-08  5.3181e-08  5.1513e-08
  5.0636e-08  4.9841e-08  4.9147e-08  4.3374e-06
```

Table A-6. Output for Sample Problem A.3

```
tdf ss diode with 10cm opening: boral and aluminum first wall   part-2

                problem run id        1
 lnk   link to the other solution              3
 lge   1/2/3  = slab/cylinder/sphere           2
 lfx   1/2    = dkr/anisn (formatted)          1
 izm   number of zones                        59
 int   number of intervals                   640
 nop   number of operating times               1
 nas   number of after shutdown times         12
 nnc   number of materials(nuclides)          70
 ncmp  number of composition table             6
 nmix  number of mixtures                      5
 ign   number of neutron groups              * 46
 igg   number of photon groups               * 43


            reactor system parameters

radius of the plasma        1.00          cm
radius of the first wall    1.00          cm
radius of the torus         0.00          cm


first wall area           6.283e-04       m2
neutron wall loading      2.862e+06       mw/m2
total operating power     2.180e+03       mw
flux conversion factor    7.093e+01
accurcy limit             4.000e-04
test irradiation time     1.000e-04


     operating time    1

                                        after shutdown time  12

 10-6 s   1.000e-06  second

                                    0       0.          second
                                    1 m     6.000e+01   second
                                   10 m     6.000e+02   second
                                    1 h     3.600e+03   second
                                    6 h     2.160e+04   second
                                    1 d     8.640e+04   second
                                    1 w     6.048e+05   second
```

Table A-6. (continued)

```
 1 mo   2.630e+06  second
 1 yr   3.156e+07  second
10 yr   3.156e+08  second
100 yr  3.156e+09  second
1000 y  3.156e+10  second

pulse sequence radioactivity calculation

the pulse sequence is as follows:
the number of pulses per day             12
time interval between pulses             3.600e+03 second
the number of operating days per week     5
time interval between daily pulse bins   4.680e+04 second
the number of operating weeks per year    4
time interval between weekly pulse bins  2.196e+05 second

                coarse mesh zone boundaries and fine mesh divisions

r - coarse mesh:      0.000      1.000      8.000      9.000     10.000     12.000     14.000     22.000     24.000
                     28.000     29.000     30.000     33.000     35.000     45.000     46.000     70.000
r - fine mesh div:     1    3     1    1     1    1     3    1     2    1     1    1     1    3     1   10

z - coarse mesh:    100.000    101.000    106.000    107.000    111.000    112.000    117.000    118.000    156.000
                    163.000
z - fine mesh div:     1    2     1    1     1    1     1   10     2

                volume of zone

      zone   1   3.142e+02  cm3
      zone   2   1.508e+04  cm3
      zone   3   7.854e+02  cm3
      zone   4   3.770e+04  cm3
      zone   5   7.854e+02  cm3
      zone   6   3.770e+04  cm3
      zone   7   6.362e+03  cm3
      zone   8   2.859e+02  cm3
      zone   9   8.746e+03  cm3
      zone  10   2.545e+04  cm3
      zone  11   1.144e+03  cm3
      zone  12   3.498e+04  cm3
      zone  13   3.142e+02  cm3
      zone  14   6.333e+03  cm3
      zone  15   8.746e+03  cm3
      zone  16   3.181e+04  cm3
```

Table A-6. (continued)

```
zone  17   1.429e+03  cm3
zone  18   4.373e+04  cm3
zone  19   3.142e+02  cm3
zone  20   6.333e+03  cm3
zone  21   8.746e+03  cm3
zone  22   2.417e+04  cm3
zone  23   1.086e+03  cm3
zone  24   3.324e+04  cm3
zone  25   2.417e+04  cm3
zone  26   1.086e+03  cm3
zone  27   3.324e+04  cm3
zone  28   2.417e+04  cm3
zone  29   1.086e+03  cm3
zone  30   3.324e+04  cm3
zone  31   2.417e+04  cm3
zone  32   1.086e+03  cm3
zone  33   3.324e+04  cm3
zone  34   2.417e+04  cm3
zone  35   1.086e+03  cm3
zone  36   3.324e+04  cm3
zone  37   2.417e+04  cm3
zone  38   1.086e+03  cm3
zone  39   3.324e+04  cm3
zone  40   2.417e+04  cm3
zone  41   1.086e+03  cm3
zone  42   3.324e+04  cm3
zone  43   2.417e+04  cm3
zone  44   1.086e+03  cm3
zone  45   3.324e+04  cm3
zone  46   2.417e+04  cm3
zone  47   1.086e+03  cm3
zone  48   3.324e+04  cm3
zone  49   2.417e+04  cm3
zone  50   1.086e+03  cm3
zone  51   3.324e+04  cm3
zone  52   9.896e+03  cm3
zone  53   1.237e+04  cm3
zone  54   1.001e+03  cm3
zone  55   3.061e+04  cm3
zone  56   9.896e+03  cm3
zone  57   1.237e+04  cm3
zone  58   1.001e+03  cm3
zone  59   3.061e+04  cm3
```

Table A-6. (continued)

	zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
void		*		*		*		*			*			*			*			*			*			*
boral			*							*																
aluminum					*		*		*			*			*			*			*			*		
water													*			*			*			*			*	
plastic																										

	zone	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
void				*			*			*			*			*			*			*			*	
boral																										
aluminum		*			*			*			*			*			*			*			*			*
water			*			*			*			*			*			*			*			*		
plastic																										

	zone	51	52	53	54	55	56	57	58	59
void			*				*			
boral										
aluminum					*				*	
water		*				*				*
plastic				*				*		

Table A-6. (continued)

		nuclide no. density				
kza	mixture	void	boral	aluminum	water	plastic
1001		0.	0.	0.	6.687e+22	4.634e+22
1002		0.	0.	0.	1.003e+19	6.951e+18
5010		0.	4.426e+21	0.	0.	0.
5011		0.	1.770e+22	0.	0.	0.
6012		0.	5.395e+21	0.	0.	2.292e+22
6013		0.	6.055e+19	0.	0.	2.572e+20
8016		0.	0.	0.	3.335e+22	1.541e+22
8017		0.	0.	0.	1.270e+19	5.870e+18
8018		0.	0.	0.	6.819e+19	3.151e+19
11023		0.	2.850e+16	0.	0.	0.
12024		0.	4.102e+20	5.284e+20	0.	0.
12025		0.	5.193e+19	6.689e+19	0.	0.
12026		0.	5.718e+19	7.365e+19	0.	0.
13027		0.	4.518e+22	5.819e+22	0.	0.
14028		0.	2.488e+20	3.204e+20	0.	0.
14029		0.	1.259e+19	1.622e+19	0.	0.
14030		0.	8.362e+18	1.077e+19	0.	0.
16032		0.	1.942e+15	0.	0.	0.
16033		0.	1.533e+13	0.	0.	0.
16034		0.	8.603e+13	0.	0.	0.
16036		0.	3.474e+11	0.	0.	0.
19039		0.	1.114e+15	1.435e+15	0.	0.
19040		0.	1.434e+11	1.847e+11	0.	0.
19041		0.	8.044e+13	1.036e+14	0.	0.
20040		0.	3.487e+16	0.	0.	0.
20042		0.	2.327e+14	0.	0.	0.
20043		0.	4.855e+13	0.	0.	0.
20044		0.	7.517e+14	0.	0.	0.
20046		0.	1.259e+12	0.	0.	0.
20048		0.	6.726e+13	0.	0.	0.
22046		0.	3.262e+18	4.201e+18	0.	0.
22047		0.	2.946e+18	3.794e+18	0.	0.
22048		0.	2.914e+19	3.753e+19	0.	0.
22049		0.	2.135e+18	2.750e+18	0.	0.
22050		0.	2.056e+18	2.648e+18	0.	0.
23050		0.	3.216e+12	0.	0.	0.
23051		0.	1.283e+15	0.	0.	0.
24050		0.	3.168e+18	4.081e+18	0.	0.
24052		0.	6.104e+19	7.862e+19	0.	0.
24053		0.	6.921e+18	8.914e+18	0.	0.
24054		0.	1.719e+18	2.214e+18	0.	0.
25055		0.	3.447e+19	4.440e+19	0.	0.

Table A-6. (continued)

26054	0.	9.177e+18	1.182e+19	0.	0.
26056	0.	1.453e+20	1.871e+20	0.	0.
26057	0.	3.323e+18	4.280e+18	0.	0.
26058	0.	4.748e+17	6.115e+17	0.	0.
28058	0.	6.301e+15	8.116e+15	0.	0.
28060	0.	2.408e+15	3.101e+15	0.	0.
28061	0.	1.015e+14	1.307e+14	0.	0.
28062	0.	3.321e+14	4.278e+14	0.	0.
28064	0.	8.300e+13	1.069e+14	0.	0.
29063	0.	4.125e+19	5.313e+19	0.	0.
29065	0.	1.836e+19	2.365e+19	0.	0.
30064	0.	2.349e+19	3.026e+19	0.	0.
30066	0.	1.347e+19	1.735e+19	0.	0.
30067	0.	1.980e+18	2.550e+18	0.	0.
30068	0.	9.076e+18	1.169e+19	0.	0.
30070	0.	2.994e+17	3.856e+17	0.	0.
41093	0.	9.511e+13	1.225e+14	0.	0.
42092	0.	4.441e+13	5.720e+13	0.	0.
42094	0.	2.790e+13	3.594e+13	0.	0.
42095	0.	4.771e+13	6.145e+13	0.	0.
42096	0.	5.011e+13	6.454e+13	0.	0.
42097	0.	2.880e+13	3.710e+13	0.	0.
42098	0.	7.231e+13	9.314e+13	0.	0.
42100	0.	2.880e+13	3.710e+13	0.	0.
82204	0.	3.144e+13	0.	0.	0.
82206	0.	5.335e+14	0.	0.	0.
82207	0.	4.892e+14	0.	0.	0.
82208	0.	1.160e+15	0.	0.	0.

reference flux
tdf ss diode with 10cm opening: boral and aluminum first wall pulse

a one here indicates collapsing of fluxes 0 0

flux reading

640 intervals read from flux (640, 46)
640 intervals have been collapsed to 640 intervals

Table A-6. (continued)

boral activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	9.094e-04	9.094e-04	9.094e-04	9.094e-04	9.094e-04	9.093e-04	9.08e-04	9.05e-04	8.60e-04	5.17e-04	3.23e-06	2.92e-28
40100	be 10	2.101e-09	2.101e-09	2.101e-09	2.101e-09	2.101e-09	2.101e-09	2.10e-09	2.10e-09	2.10e-09	2.10e-09	2.10e-09	2.10e-09
30080	li 8	8.476e+02	3.003e-19	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	6.791e-11	6.791e-11	6.791e-11	6.791e-11	6.791e-11	6.791e-11	6.79e-11	6.79e-11	6.79e-11	6.78e-11	6.71e-11	6.02e-11
90200	f 20	4.402e-04	1.003e-05	1.657e-20	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.396e-01	4.621e-02	2.200e-06	2.140e-30	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	1.824e+00	1.822e+00	1.810e+00	1.741e+00	1.381e+00	5.999e-01	7.60e-04	3.64e-15	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	7.426e-02	3.714e-02	7.263e-05	6.499e-20	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	2.598e+00	3.814e-17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	1.280e+01	1.189e+01	6.150e+00	1.578e-01	4.499e-11	1.956e-45	0.	0.	0.	0.	0.	0.
130260	al 26	1.303e-08	1.303e-08	1.303e-08	1.303e-08	1.303e-08	1.303e-08	1.30e-08	1.30e-08	1.30e-08	1.30e-08	1.30e-08	1.30e-08
130280	al 28	6.387e+01	4.687e+01	2.894e+00	5.528e-07	2.684e-47	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	1.474e-02	1.326e-02	5.123e-03	2.601e-05	4.456e-19	0.	0.	0.	0.	0.	0.	0.
130300	al 30	4.863e-01	6.102e-06	4.704e-50	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	4.109e-04	4.091e-04	3.932e-04	3.154e-04	8.407e-05	7.199e-07	2.08e-23	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		8.145e-10	8.145e-10	8.144e-10	8.142e-10	8.129e-10	8.081e-10	7.71e-10	6.41e-10	4.58e-11	2.60e-22	0.	0.
160370		2.273e-10	1.982e-10	5.778e-11	6.128e-14	8.718e-32	0.	0.	0.	0.	0.	0.	0.
170360	cl 36	9.661e-15	9.661e-15	9.661e-15	9.661e-15	9.661e-15	9.661e-15	9.66e-15	9.66e-15	9.66e-15	9.66e-15	9.66e-15	9.64e-15
180370	ar 37	1.237e-06	1.237e-06	1.237e-06	1.236e-06	1.231e-06	1.213e-06	1.08e-06	6.77e-07	8.93e-10	4.76e-38	0.	0.
180390	ar 39	2.890e-11	2.890e-11	2.890e-11	2.890e-11	2.890e-11	2.890e-11	2.89e-11	2.89e-11	2.88e-11	2.82e-11	2.23e-11	2.20e-12
190380	k 38	2.862e-08	2.616e-08	1.164e-08	1.293e-10	2.430e-22	0.	0.	0.	0.	0.	0.	0.
190400	k 40	4.229e-10	4.229e-10	4.229e-10	4.229e-10	4.229e-10	4.229e-10	4.23e-10	4.23e-10	4.23e-10	4.23e-10	4.23e-10	4.23e-10
170380	cl 38	2.717e-09	2.667e-09	2.256e-09	8.907e-10	3.372e-12	6.448e-21	0.	0.	0.	0.	0.	0.
180410	ar 41	4.105e-08	4.079e-08	3.854e-08	2.811e-08	4.231e-09	4.634e-12	9.58e-36	0.	0.	0.	0.	0.
190420	k 42	4.702e-08	4.697e-08	4.658e-08	4.446e-08	3.362e-08	1.229e-08	3.92e-12	8.59e-26	0.	0.	0.	0.
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	9.423e-13	9.423e-13	9.423e-13	9.423e-13	9.423e-13	9.423e-13	9.42e-13	9.42e-13	9.42e-13	9.42e-13	9.41e-13	9.34e-13
190430	k 43	2.314e-09	2.313e-09	2.303e-09	2.244e-09	1.922e-09	1.101e-09	1.28e-11	3.52e-19	0.	0.	0.	0.
190440	k 44	5.001e-08	4.846e-08	3.650e-08	7.553e-09	5.933e-13	9.902e-28	0.	0.	0.	0.	0.	0.
200450	ca 45	2.176e-05	2.176e-05	2.176e-05	2.176e-05	2.174e-05	2.167e-05	2.11e-05	1.91e-05	4.60e-06	3.90e-12	0.	0.
190460	k 46	5.689e-10	3.871e-10	1.210e-11	5.257e-20	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	2.674e-08	2.326e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	2.076e-06	2.076e-06	2.074e-06	2.063e-06	1.998e-06	1.782e-06	7.12e-07	1.98e-08	1.14e-30	0.	0.	0.
210470	sc 47	2.088e-04	2.087e-04	2.085e-04	2.070e-04	1.986e-04	1.709e-04	5.14e-05	5.02e-07	4.66e-30	0.	0.	0.
200490	ca 49	5.597e-08	5.173e-08	2.546e-08	4.956e-10	2.698e-20	0.	0.	0.	0.	0.	0.	0.
210490	sc 49	6.683e-05	6.603e-05	5.924e-05	3.243e-05	8.718e-07	1.935e-12	0.	0.	0.	0.	0.	0.
210440	sc 44	1.119e-08	1.115e-08	1.086e-08	9.373e-09	3.872e-09	1.605e-10	1.40e-21	0.	0.	0.	0.	0.
210460	sc 46	4.185e-05	4.184e-05	4.184e-05	4.183e-05	4.176e-05	4.150e-05	3.95e-05	3.25e-05	2.04e-06	3.12e-18	0.	0.

Table A-6. (continued)

220450	ti	45	1.984e-05	1.977e-05	1.911e-05	1.585e-05	5.143e-06	8.955e-08	7.56e-22	0.	0.	0.	0.	0.
210480	sc	48	6.697e-04	6.696e-04	6.680e-04	6.592e-04	6.089e-04	4.576e-04	4.66e-05	6.18e-09	0.	0.	0.	0.
210500	sc	50	3.235e-04	2.158e-04	5.630e-06	8.983e-15	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti	51	8.340e-04	7.401e-04	2.527e-04	6.455e-07	1.792e-22	0.	0.	0.	0.	0.	0.	0.
230490	v	49	3.000e-06	3.000e-06	3.000e-06	3.001e-06	3.000e-06	2.995e-06	2.96e-06	2.82e-06	1.39e-06	1.40e-09	1.44e-39	0.
230520	v	52	3.885e-02	3.230e-02	6.121e-03	5.943e-07	4.974e-31	0.	0.	0.	0.	0.	0.	0.
230480	v	48	1.561e-08	1.561e-08	1.561e-08	1.559e-08	1.545e-08	1.495e-08	1.15e-08	4.17e-09	2.05e-15	0.	0.	0.
240510	cr	51	3.331e-03	3.331e-03	3.331e-03	3.328e-03	3.311e-03	3.249e-03	2.80e-03	1.56e-03	3.64e-07	8.15e-43	0.	0.
240490	cr	49	2.008e-05	1.976e-05	1.703e-05	7.463e-06	5.286e-08	9.638e-16	0.	0.	0.	0.	0.	0.
240550	cr	55	1.254e-02	1.030e-02	1.753e-03	9.366e-08	2.181e-33	0.	0.	0.	0.	0.	0.	0.
250540	mn	54	2.863e-04	2.863e-04	2.863e-04	2.863e-04	2.862e-04	2.857e-04	2.82e-04	2.68e-04	1.27e-04	8.44e-08	1.41e-39	0.
250560	mn	56	2.250e-01	2.240e-01	2.152e-01	1.720e-01	4.486e-02	3.552e-04	5.49e-21	0.	0.	0.	0.	0.
250520	mn	52	7.670e-08	7.669e-08	7.663e-08	7.631e-08	7.437e-08	6.781e-08	3.24e-08	1.81e-09	2.26e-27	0.	0.	0.
250530	mn	53	3.072e-12	3.072e-12	3.072e-12	3.073e-12	3.073e-12	3.073e-12	3.07e-12	3.07e-12	3.07e-12	3.07e-12	3.07e-12	3.07e-12
260550	fe	55	1.753e-04	1.753e-04	1.753e-04	1.753e-04	1.752e-04	1.751e-04	1.74e-04	1.72e-04	1.35e-04	1.32e-05	1.06e-15	0.
260530	fe	53	1.286e-04	1.186e-04	5.709e-05	9.828e-07	2.558e-17	0.	0.	0.	0.	0.	0.	0.
250570	mn	57	3.022e-03	1.929e-03	3.404e-05	6.170e-15	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn	58	1.579e-04	8.327e-05	2.634e-07	3.403e-21	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe	59	2.957e-05	2.957e-05	2.957e-05	2.955e-05	2.946e-05	2.912e-05	2.66e-05	1.85e-05	1.07e-07	1.18e-29	0.	0.
270570	co	57	3.201e-08	3.201e-08	3.201e-08	3.201e-08	3.200e-08	3.199e-08	3.16e-08	2.98e-08	1.27e-08	2.88e-12	1.08e-48	0.
270580	co	58	2.887e-07	2.887e-07	2.888e-07	2.891e-07	2.905e-07	2.915e-07	2.76e-07	2.20e-07	8.35e-09	9.60e-23	0.	0.
280590	ni	59	1.915e-12	1.915e-12	1.915e-12	1.915e-12	1.915e-12	1.915e-12	1.91e-12	1.91e-12	1.91e-12	1.91e-12	1.91e-12	1.90e-12
270581	co	58m	1.261e-06	1.259e-06	1.245e-06	1.169e-06	8.004e-07	2.047e-07	3.75e-12	1.17e-30	0.	0.	0.	0.
280570	ni	57	3.086e-08	3.085e-08	3.076e-08	3.027e-08	2.749e-08	1.944e-08	1.21e-09	2.39e-14	0.	0.	0.	0.
270600	co	60	1.216e-06	1.216e-06	1.216e-06	1.216e-06	1.216e-06	1.215e-06	1.21e-06	1.20e-06	1.07e-06	3.26e-07	2.35e-12	4.01e-19
270601	co	60m	4.533e-07	4.243e-07	2.343e-07	8.641e-09	2.175e-17	2.405e-48	0.	0.	0.	0.	0.	0.
270610	co	61	8.527e-06	8.467e-06	7.949e-06	5.596e-06	6.811e-07	3.472e-10	1.58e-36	0.	0.	0.	0.	0.
270620	co	62	2.444e-03	1.539e-03	2.405e-05	2.220e-15	0.	0.	0.	0.	0.	0.	0.	0.
270621	co	62m	8.852e-09	8.422e-09	5.378e-09	4.452e-10	1.433e-16	6.083e-40	0.	0.	0.	0.	0.	0.
280630	ni	63	1.011e-06	1.011e-06	1.011e-06	1.011e-06	1.011e-06	1.011e-06	1.01e-06	1.01e-06	1.00e-06	9.43e-07	5.06e-07	9.91e-10
270640	co	64	9.075e-07	2.746e-52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni	65	2.885e-04	2.872e-04	2.755e-04	2.191e-04	5.539e-05	3.921e-07	2.47e-24	0.	0.	0.	0.	0.
260600	fe	60	4.016e-19	4.016e-19	4.016e-19	4.016e-19	4.016e-19	4.016e-19	4.02e-19	4.02e-19	4.02e-19	4.02e-19	4.02e-19	4.01e-19
270630	co	63	1.726e-10	3.782e-11	4.410e-17	4.803e-50	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu	62	3.087e-02	2.876e-02	1.521e-02	4.412e-04	2.631e-13	1.630e-46	0.	0.	0.	0.	0.	0.
290640	cu	64	6.954e-02	6.948e-02	6.892e-02	6.588e-02	5.025e-02	1.896e-02	7.80e-06	4.61e-19	0.	0.	0.	0.
290660	cu	66	1.551e-01	1.354e-01	3.996e-02	4.540e-05	9.772e-23	0.	0.	0.	0.	0.	0.	0.
300630	zn	63	1.312e-03	1.288e-03	1.093e-03	4.392e-04	1.849e-06	5.183e-15	0.	0.	0.	0.	0.	0.
300650	zn	65	4.901e-04	4.901e-04	4.900e-04	4.900e-04	4.897e-04	4.887e-04	4.80e-04	4.49e-04	1.74e-04	1.53e-08	4.21e-49	0.
290670	cu	67	2.394e-05	2.394e-05	2.391e-05	2.368e-05	2.240e-05	1.832e-05	3.66e-06	6.80e-09	6.62e-48	0.	0.	0.
290680			8.079e-03	2.020e-03	7.728e-09	6.187e-39	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn	69	1.280e-02	1.265e-02	1.138e-02	6.404e-03	5.264e-04	1.507e-04	1.09e-07	5.86e-20	0.	0.	0.	0.
300691	zn	69m	4.684e-04	4.680e-04	4.645e-04	4.455e-04	3.466e-04	1.403e-04	1.02e-07	5.46e-20	0.	0.	0.	0.
300710	zn	71	4.341e-04	3.272e-04	2.566e-05	1.851e-11	2.610e-48	0.	0.	0.	0.	0.	0.	0.
300711	zn	71m	2.601e-06	2.594e-06	2.526e-06	2.180e-06	9.006e-07	3.736e-08	3.28e-19	0.	0.	0.	0.	0.

Table A-6. (continued)

280670	ni 67	1.550e-04	1.538e-05	1.431e-14	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	1.867e-10	1.867e-10	1.864e-10	1.847e-10	1.750e-10	1.440e-10	3.03e-11	6.85e-14	9.16e-52	0.	0.	0.
400930	zr 93	2.412e-17	2.412e-17	2.412e-17	2.412e-17	2.412e-17	2.412e-17	2.41e-17	2.41e-17	2.41e-17	2.41e-17	2.41e-17	2.41e-17
410920	nb 92	2.955e-17	2.955e-17	2.955e-17	2.955e-17	2.955e-17	2.955e-17	2.95e-17	2.95e-17	2.95e-17	2.95e-17	2.95e-17	2.95e-17
410921	nb 92m	6.691e-09	6.690e-09	6.688e-09	6.672e-09	6.577e-09	6.249e-09	4.15e-09	8.36e-10	9.63e-20	0.	0.	0.
410931	nb 93m	5.202e-12	5.202e-12	5.202e-12	5.201e-12	5.201e-12	5.201e-12	5.20e-12	5.19e-12	5.01e-12	3.67e-12	1.36e-12	1.12e-12
410940	nb 94	3.809e-13	3.810e-13	3.812e-13	3.813e-13	3.813e-13	3.813e-13	3.81e-13	3.81e-13	3.81e-13	3.81e-13	3.80e-13	3.68e-13
410941	nb 94m	6.278e-07	5.620e-07	2.075e-07	8.189e-10	3.092e-24	0.	0.	0.	0.	0.	0.	0.
400880		8.005e-13	8.005e-13	8.005e-13	8.003e-13	7.989e-13	7.939e-13	7.55e-13	6.22e-13	3.85e-14	5.29e-26	0.	0.
400890	zr 89	2.594e-10	2.594e-10	2.590e-10	2.571e-10	2.460e-10	2.098e-10	5.87e-11	4.06e-13	5.64e-44	0.	0.	0.
420910	mo 91	4.880e-09	4.666e-09	3.119e-09	3.330e-10	4.923e-16	5.055e-37	0.	0.	0.	0.	0.	0.
420930	mo 93	4.561e-13	4.561e-13	4.561e-13	4.561e-13	4.561e-13	4.561e-13	4.56e-13	4.56e-13	4.56e-13	4.55e-13	4.47e-13	3.74e-13
420931	mo 93m	3.588e-11	3.582e-11	3.529e-11	3.247e-11	1.972e-11	3.277e-12	1.90e-18	8.24e-43	0.	0.	0.	0.
410950	nb 95	4.235e-10	4.235e-10	4.235e-10	4.233e-10	4.222e-10	4.181e-10	3.81e-10	2.48e-10	1.06e-12	2.62e-28	0.	0.
410951	nb 95m	1.429e-10	1.429e-10	1.427e-10	1.418e-10	1.362e-10	1.180e-10	3.73e-11	4.15e-13	5.17e-41	0.	0.	0.
410960	nb 96	8.483e-10	8.479e-10	8.441e-10	8.235e-10	7.099e-10	4.161e-10	5.80e-12	3.25e-19	0.	0.	0.	0.
410970	nb 97	4.974e-10	5.187e-10	5.081e-10	3.526e-10	1.010e-10	4.193e-11	1.18e-13	1.28e-23	0.	0.	0.	0.
410971	nb 97m	3.618e-09	1.826e-09	3.871e-12	5.433e-27	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.706e-10	1.681e-10	1.475e-10	7.143e-11	9.197e-13	1.442e-19	0.	0.	0.	0.	0.	0.
400950	zr 95	1.828e-11	1.828e-11	1.828e-11	1.828e-11	1.823e-11	1.809e-11	1.69e-11	1.31e-11	3.49e-13	1.19e-28	0.	0.
420990	mo 99	6.718e-08	6.717e-08	6.706e-08	6.649e-08	6.312e-08	5.235e-08	1.17e-08	3.39e-11	1.81e-47	0.	0.	0.
430991	tc 99m	6.161e-08	6.162e-08	6.171e-08	6.218e-08	6.325e-08	5.676e-08	1.29e-08	3.72e-11	1.99e-47	0.	0.	0.
430990	tc 99	1.045e-14	1.045e-14	1.045e-14	1.047e-14	1.059e-14	1.100e-14	1.26e-14	1.31e-14	1.31e-14	1.31e-14	1.31e-14	1.30e-14
411000	nb 100	1.858e-08	3.143e-14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	1.037e-10	1.037e-10	1.030e-10	9.958e-11	8.121e-11	3.897e-11	1.10e-13	1.19e-23	0.	0.	0.	0.
421010	mo 101	1.318e-07	1.257e-07	8.197e-08	7.633e-09	4.976e-15	2.678e-37	0.	0.	0.	0.	0.	0.
431010	tc 101	2.280e-08	2.781e-08	5.356e-08	2.280e-08	7.397e-14	1.013e-35	0.	0.	0.	0.	0.	0.
812020	tl 202	5.983e-14	5.982e-14	5.980e-14	5.969e-14	5.898e-14	5.652e-14	4.02e-14	1.06e-14	5.80e-23	0.	0.	0.
812040	tl 204	1.743e-13	1.743e-13	1.743e-13	1.743e-13	1.743e-13	1.742e-13	1.74e-13	1.72e-13	1.45e-13	2.78e-14	1.84e-21	0.
822030	pb 203	1.167e-08	1.166e-08	1.164e-08	1.151e-08	1.077e-08	8.475e-09	1.24e-09	6.93e-13	0.	0.	0.	0.
822050	pb 205	5.865e-16	5.865e-16	5.865e-16	5.865e-16	5.865e-16	5.865e-16	5.86e-16	5.86e-16	5.86e-16	5.86e-16	5.86e-16	5.86e-16
802030	hg 203	8.499e-12	8.499e-12	8.498e-12	8.494e-12	8.468e-12	8.374e-12	7.66e-12	5.41e-12	3.73e-14	2.26e-35	0.	0.
802050	hg 205	1.964e-09	1.719e-09	5.178e-10	6.594e-13	2.813e-30	0.	0.	0.	0.	0.	0.	0.
822090	pb 209	2.958e-08	2.947e-08	2.855e-08	2.394e-08	8.324e-09	1.855e-10	1.13e-23	0.	0.	0.	0.	0.
	total	9.299e+02	6.121e+01	1.123e+01	2.152e+00	1.483e+00	6.254e-01	5.61e-03	3.43e-03	1.31e-03	5.32e-04	3.75e-06	1.66e-08

Table A-6. (continued)

boral bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.085e-12	2.085e-12	2.085e-12	2.085e-12	2.085e-12	2.085e-12	2.08e-12	2.08e-12	1.97e-12	1.19e-12	7.41e-15	6.70e-37
40100	be 10	9.635e-15	9.635e-15	9.635e-15	9.635e-15	9.635e-15	9.635e-15	9.63e-15	9.63e-15	9.63e-15	9.63e-15	9.63e-15	9.63e-15
30080	li 8	1.296e-05	4.590e-27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	3.114e-19	3.114e-19	3.114e-19	3.114e-19	3.114e-19	3.114e-19	3.11e-19	3.11e-19	3.11e-19	3.11e-19	3.08e-19	2.76e-19
90200	f 20	6.729e-12	1.533e-13	2.534e-28	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	2.134e-09	7.064e-10	3.364e-14	3.271e-38	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	1.673e-07	1.672e-07	1.660e-07	1.597e-07	1.267e-07	5.502e-08	6.97e-11	3.34e-22	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	1.135e-09	5.677e-10	1.110e-12	9.934e-28	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	3.972e-08	5.831e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	1.956e-07	1.818e-07	9.402e-08	2.412e-09	6.878e-19	2.991e-53	0.	0.	0.	0.	0.	0.
130260	al 26	5.974e-14	5.974e-14	5.974e-14	5.974e-14	5.974e-14	5.974e-14	5.97e-14	5.97e-14	5.97e-14	5.97e-14	5.97e-14	5.97e-14
130280	al 28	9.764e-07	7.166e-07	4.424e-08	8.450e-15	4.103e-55	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	2.253e-10	2.027e-10	7.832e-11	3.977e-13	6.811e-27	0.	0.	0.	0.	0.	0.	0.
130300	al 30	7.435e-09	9.329e-14	7.191e-58	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	6.281e-12	6.254e-12	6.011e-12	4.822e-12	1.285e-12	1.101e-14	3.18e-31	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		3.735e-15	3.735e-15	3.735e-15	3.734e-15	3.728e-15	3.706e-15	3.54e-15	2.94e-15	2.10e-16	1.19e-27	0.	0.
160370		1.043e-15	9.092e-16	2.650e-16	2.810e-19	3.998e-37	0.	0.	0.	0.	0.	0.	0.
170360	cl 36	5.538e-21	5.538e-21	5.538e-21	5.538e-21	5.538e-21	5.538e-21	5.54e-21	5.54e-21	5.54e-21	5.54e-21	5.54e-21	5.53e-21
180370	ar 37	5.674e-18	5.674e-18	5.673e-18	5.669e-18	5.646e-18	5.563e-18	4.94e-18	3.11e-18	4.10e-21	2.18e-49	0.	0.
180390	ar 39	1.326e-16	1.326e-16	1.326e-16	1.326e-16	1.326e-16	1.326e-16	1.33e-16	1.33e-16	1.32e-16	1.29e-16	1.02e-16	1.01e-17
190380	k 38	4.376e-16	3.999e-16	1.779e-16	1.976e-18	3.714e-30	0.	0.	0.	0.	0.	0.	0.
190400	k 40	1.939e-15	1.939e-15	1.939e-15	1.939e-15	1.939e-15	1.939e-15	1.94e-15	1.94e-15	1.94e-15	1.94e-15	1.94e-15	1.94e-15
170380	cl 38	1.780e-17	1.747e-17	1.478e-17	5.835e-18	2.209e-20	4.225e-29	0.	0.	0.	0.	0.	0.
180410	ar 41	4.707e-16	4.677e-16	4.419e-16	3.223e-16	4.852e-17	5.313e-20	1.10e-43	0.	0.	0.	0.	0.
190420	k 42	5.390e-15	5.385e-15	5.340e-15	5.097e-15	3.854e-15	1.409e-15	4.49e-19	9.85e-33	0.	0.	0.	0.
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	4.321e-18	4.321e-18	4.321e-18	4.321e-18	4.321e-18	4.321e-18	4.32e-18	4.32e-18	4.32e-18	4.32e-18	4.32e-18	4.28e-18
190430	k 43	1.327e-16	1.326e-16	1.320e-16	1.286e-16	1.102e-16	6.314e-17	7.33e-19	2.02e-26	0.	0.	0.	0.
190440	k 44	7.646e-16	7.409e-16	5.579e-16	1.155e-16	9.069e-21	1.514e-35	0.	0.	0.	0.	0.	0.
200450	ca 45	9.981e-12	9.981e-12	9.981e-12	9.979e-12	9.970e-12	9.939e-12	9.69e-12	8.77e-12	2.11e-12	1.79e-18	0.	0.
190460	k 46	8.696e-18	5.917e-18	1.849e-19	8.036e-28	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	4.088e-16	3.556e-34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	1.587e-13	1.587e-13	1.585e-13	1.577e-13	1.527e-13	1.362e-13	5.44e-14	1.51e-15	8.72e-38	0.	0.	0.
210470	sc 47	4.787e-12	4.787e-12	4.781e-12	4.748e-12	4.553e-12	3.918e-12	1.18e-12	1.15e-14	1.07e-37	0.	0.	0.
200490	ca 49	8.557e-16	7.908e-16	3.892e-16	7.577e-18	4.124e-28	0.	0.	0.	0.	0.	0.	0.
210490	sc 49	2.358e-14	2.329e-14	2.090e-14	1.144e-14	3.076e-16	6.826e-22	0.	0.	0.	0.	0.	0.
210440	sc 44	5.130e-16	5.115e-16	4.981e-16	4.298e-16	1.776e-16	7.362e-18	6.43e-29	0.	0.	0.	0.	0.
210460	sc 46	2.399e-11	2.399e-11	2.399e-11	2.398e-11	2.394e-11	2.379e-11	2.26e-11	1.86e-11	1.17e-12	1.79e-24	0.	0.

Table A-6. (continued)

220450	ti 45	2.677e-14	2.667e-14	2.578e-14	2.137e-14	6.938e-15	1.208e-16	1.02e-30	0.	0.	0.	0.	0.
210480	sc 48	6.143e-11	6.141e-11	6.127e-11	6.046e-11	5.585e-11	4.197e-11	4.27e-12	5.67e-16	0.	0.	0.	0.
210500	sc 50	1.349e-12	8.995e-13	2.347e-14	3.745e-23	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	4.500e-13	3.993e-13	1.363e-13	3.483e-16	9.671e-32	0.	0.	0.	0.	0.	0.	0.
230490	v 49	5.503e-15	5.503e-15	5.504e-15	5.505e-15	5.504e-15	5.495e-15	5.43e-15	5.17e-15	2.56e-15	2.56e-18	2.64e-48	0.
230520	v 52	5.091e-11	4.232e-11	8.021e-12	7.787e-16	6.517e-40	0.	0.	0.	0.	0.	0.	0.
230480	v 48	3.580e-15	3.580e-15	3.579e-15	3.574e-15	3.542e-15	3.428e-15	2.64e-15	9.56e-16	4.70e-22	0.	0.	0.
240510	cr 51	1.910e-11	1.910e-11	1.909e-11	1.908e-11	1.898e-11	1.863e-11	1.60e-11	8.93e-12	2.09e-15	4.67e-51	0.	0.
240490	cr 49	3.070e-13	3.020e-13	2.603e-13	1.141e-13	8.081e-16	1.473e-23	0.	0.	0.	0.	0.	0.
240550	cr 55	1.916e-10	1.574e-10	2.679e-11	1.432e-15	3.334e-41	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	1.313e-10	1.313e-10	1.313e-10	1.313e-10	1.312e-10	1.310e-10	1.29e-10	1.23e-10	5.82e-11	3.87e-14	6.47e-46	0.
250560	mn 56	5.161e-09	5.137e-09	4.934e-09	3.944e-09	1.029e-09	8.144e-12	1.26e-28	0.	0.	0.	0.	0.
250520	mn 52	8.794e-15	8.793e-15	8.786e-15	8.749e-15	8.527e-15	7.775e-15	3.71e-15	2.07e-16	2.59e-34	0.	0.	0.
250530	mn 53	1.409e-17	1.409e-17	1.409e-17	1.409e-17	1.409e-17	1.409e-17	1.41e-17	1.41e-17	1.41e-17	1.41e-17	1.41e-17	1.41e-17
260550	fe 55	2.679e-12	2.679e-12	2.679e-12	2.679e-12	2.679e-12	2.677e-12	2.67e-12	2.62e-12	2.07e-12	2.02e-13	1.61e-23	0.
260530	fe 53	1.967e-12	1.813e-12	8.728e-13	1.502e-14	3.910e-25	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	4.620e-11	2.950e-11	5.203e-13	9.432e-23	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	2.413e-12	1.273e-12	4.026e-15	5.201e-29	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	6.781e-12	6.781e-12	6.780e-12	6.777e-12	6.755e-12	6.678e-12	6.09e-12	4.25e-12	2.46e-14	2.72e-36	0.	0.
270570	co 57	1.468e-14	1.468e-14	1.468e-14	1.468e-14	1.468e-14	1.467e-14	1.45e-14	1.37e-14	5.81e-15	1.32e-18	4.95e-55	0.
270580	co 58	6.620e-14	6.620e-14	6.622e-14	6.629e-14	6.661e-14	6.685e-14	6.33e-14	5.03e-14	1.92e-15	2.20e-29	0.	0.
280590	ni 59	4.390e-20	4.390e-20	4.390e-20	4.390e-20	4.390e-20	4.390e-20	4.39e-20	4.39e-20	4.39e-20	4.39e-20	4.39e-20	4.35e-20
270581	co 58m	1.928e-15	1.925e-15	1.903e-15	1.787e-15	1.224e-15	3.130e-16	5.74e-21	1.79e-39	0.	0.	0.	0.
280570	ni 57	1.415e-13	1.415e-13	1.411e-13	1.388e-13	1.261e-13	8.915e-14	5.57e-15	1.10e-19	0.	0.	0.	0.
270600	co 60	1.859e-12	1.859e-12	1.859e-12	1.859e-12	1.858e-12	1.858e-12	1.85e-12	1.84e-12	1.63e-12	4.99e-13	3.59e-18	6.13e-25
270601	co 60m	6.930e-15	6.487e-15	3.582e-15	1.321e-16	3.326e-25	3.676e-56	0.	0.	0.	0.	0.	0.
270610	co 61	1.304e-13	1.294e-13	1.215e-13	8.554e-14	1.041e-14	5.308e-18	2.42e-44	0.	0.	0.	0.	0.
270620	co 62	5.604e-12	3.530e-12	5.514e-14	5.090e-24	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	4.060e-17	3.862e-17	2.466e-17	2.042e-18	6.573e-25	2.790e-48	0.	0.	0.	0.	0.	0.
280630	ni 63	2.318e-13	2.318e-13	2.318e-13	2.318e-13	2.318e-13	2.318e-13	2.32e-13	2.32e-13	2.30e-13	2.16e-13	1.16e-13	2.27e-16
270640	co 64	1.387e-14	4.198e-60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	6.615e-12	6.585e-12	6.319e-12	5.024e-12	1.270e-12	8.990e-15	5.66e-32	0.	0.	0.	0.	0.
260600	fe 60	6.140e-27	6.140e-27	6.140e-27	6.140e-27	6.140e-27	6.140e-27	6.14e-27	6.14e-27	6.14e-27	6.14e-27	6.14e-27	6.13e-27
270630	co 63	2.638e-18	5.782e-19	6.742e-25	7.342e-58	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	4.719e-12	4.396e-12	2.325e-12	6.744e-14	4.023e-23	2.493e-56	0.	0.	0.	0.	0.	0.
290640	cu 64	7.974e-10	7.966e-10	7.902e-10	7.553e-10	5.762e-10	2.174e-10	8.94e-14	5.29e-27	0.	0.	0.	0.
290660	cu 66	7.111e-12	6.209e-12	1.832e-12	2.082e-15	4.481e-33	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	2.005e-11	1.969e-11	1.671e-11	6.714e-12	2.827e-14	7.923e-23	0.	0.	0.	0.	0.	0.
300650	zn 65	1.124e-10	1.124e-10	1.124e-10	1.124e-10	1.123e-10	1.121e-10	1.10e-10	1.03e-10	3.98e-11	3.50e-15	9.64e-56	0.
290670	cu 67	3.659e-13	3.661e-13	3.655e-13	3.621e-13	3.424e-13	2.800e-13	5.60e-14	1.04e-16	1.01e-55	0.	0.	0.
290680		3.705e-08	9.266e-09	3.544e-14	2.837e-44	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	2.934e-11	2.900e-11	2.610e-11	1.468e-11	1.207e-12	3.456e-13	2.50e-16	1.34e-28	0.	0.	0.	0.
300691	zn 69m	2.148e-11	2.147e-11	2.130e-11	2.043e-11	1.589e-11	6.436e-12	4.66e-15	2.50e-27	0.	0.	0.	0.
300710	zn 71	6.637e-12	5.002e-12	3.923e-13	2.830e-19	3.991e-56	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	1.193e-11	1.190e-11	1.158e-11	9.997e-12	4.130e-12	1.714e-13	1.50e-24	0.	0.	0.	0.	0.

Table A-6. (continued)

280670	ni 67	2.370e-12	2.351e-13	2.188e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	2.854e-17	2.854e-17	2.849e-17	2.824e-17	2.675e-17	2.201e-17	4.63e-18	1.05e-20	1.40e-58	0.	0.	0.
400930	zr 93	2.766e-24	2.766e-24	2.766e-24	2.766e-24	2.766e-24	2.766e-24	2.77e-24	2.77e-24	2.77e-24	2.77e-24	2.77e-24	2.76e-24
410920	nb 92	3.872e-26	3.872e-26	3.872e-26	3.872e-26	3.872e-26	3.872e-26	3.87e-26	3.87e-26	3.87e-26	3.87e-26	3.87e-26	3.87e-26
410921	nb 92m	8.293e-18	8.293e-18	8.289e-18	8.270e-18	8.153e-18	7.745e-18	5.14e-18	1.04e-18	1.19e-28	0.	0.	0.
410931	nb 93m	5.964e-19	5.964e-19	5.964e-19	5.964e-19	5.964e-19	5.963e-19	5.96e-19	5.95e-19	5.74e-19	4.20e-19	1.56e-19	1.28e-19
410940	nb 94	8.735e-20	8.736e-20	8.740e-20	8.743e-20	8.743e-20	8.743e-20	8.74e-20	8.74e-20	8.74e-20	8.74e-20	8.71e-20	8.45e-20
410941	nb 94m	1.440e-18	1.289e-18	4.758e-19	1.878e-21	7.091e-36	0.	0.	0.	0.	0.	0.	0.
400880		3.671e-18	3.671e-18	3.671e-18	3.670e-18	3.664e-18	3.641e-18	3.46e-18	2.85e-18	1.77e-19	2.43e-31	0.	0.
400890	zr 89	1.190e-15	1.190e-15	1.188e-15	1.179e-15	1.128e-15	9.623e-16	2.69e-16	1.86e-18	2.59e-49	0.	0.	0.
420910	mo 91	7.460e-17	7.134e-17	4.769e-17	5.090e-18	7.526e-24	7.728e-45	0.	0.	0.	0.	0.	0.
420930	mo 93	5.653e-22	5.653e-22	5.653e-22	5.653e-22	5.653e-22	5.653e-22	5.65e-22	5.65e-22	5.65e-22	5.64e-22	5.54e-22	4.64e-22
420931	mo 93m	8.228e-19	8.214e-19	8.092e-19	7.447e-19	4.523e-19	7.514e-20	4.36e-26	1.89e-50	0.	0.	0.	0.
410950	nb 95	6.475e-17	6.475e-17	6.474e-17	6.471e-17	6.455e-17	6.392e-17	5.82e-17	3.78e-17	1.62e-19	4.00e-35	0.	0.
410951	nb 95m	2.341e-19	2.341e-19	2.338e-19	2.323e-19	2.231e-19	1.932e-19	6.11e-20	6.80e-22	8.47e-50	0.	0.	0.
410960	nb 96	3.890e-15	3.888e-15	3.871e-15	3.777e-15	3.256e-15	1.908e-15	2.66e-17	1.49e-24	0.	0.	0.	0.
410970	nb 97	1.141e-18	1.190e-18	1.165e-18	8.086e-19	2.317e-19	9.615e-20	2.70e-22	2.93e-32	0.	0.	0.	0.
410971	nb 97m	5.531e-17	2.791e-17	5.918e-20	8.305e-35	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	2.608e-18	2.570e-18	2.256e-18	1.092e-18	1.406e-20	2.204e-27	0.	0.	0.	0.	0.	0.
400950	zr 95	8.385e-18	8.385e-18	8.385e-18	8.381e-18	8.362e-18	8.295e-18	7.77e-18	6.03e-18	1.60e-19	5.44e-35	0.	0.
420990	mo 99	4.401e-15	4.401e-15	4.394e-15	4.356e-15	4.135e-15	3.430e-15	7.68e-16	2.22e-18	1.18e-54	0.	0.	0.
430991	tc 99m	5.651e-17	5.652e-17	5.660e-17	5.703e-17	5.802e-17	5.206e-17	1.18e-17	3.41e-20	1.82e-56	0.	0.	0.
430990	tc 99	2.396e-21	2.396e-21	2.397e-21	2.401e-21	2.428e-21	2.522e-21	2.89e-21	2.99e-21	2.99e-21	2.99e-21	2.99e-21	2.98e-21
411000	nb 100	2.841e-16	4.805e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	1.586e-17	1.585e-17	1.575e-17	1.522e-17	1.241e-17	5.958e-18	1.68e-20	1.82e-30	0.	0.	0.	0.
421010	mo 101	2.015e-15	1.921e-15	1.253e-15	1.167e-16	7.606e-23	4.094e-45	0.	0.	0.	0.	0.	0.
431010	tc 101	3.486e-16	4.251e-16	8.188e-16	3.486e-16	1.131e-21	1.549e-43	0.	0.	0.	0.	0.	0.
812020	tl 202	3.430e-21	3.430e-21	3.428e-21	3.422e-21	3.381e-21	3.240e-21	2.30e-21	6.08e-22	3.33e-30	0.	0.	0.
812040	tl 204	8.883e-20	8.883e-20	8.883e-20	8.883e-20	8.882e-20	8.879e-20	8.85e-20	8.75e-20	7.39e-20	1.42e-20	9.36e-28	0.
822030	pb 203	8.918e-17	8.916e-17	8.898e-17	8.800e-17	8.233e-17	6.478e-17	9.51e-18	5.30e-21	0.	0.	0.	0.
822050	pb 205	2.690e-21	2.690e-21	2.690e-21	2.690e-21	2.690e-21	2.690e-21	2.69e-21	2.69e-21	2.69e-21	2.69e-21	2.69e-21	2.69e-21
802030	hg 203	1.949e-18	1.949e-18	1.949e-18	1.948e-18	1.942e-18	1.920e-18	1.76e-18	1.24e-18	8.56e-21	5.19e-42	0.	0.
802050	hg 205	3.003e-17	2.628e-17	7.916e-18	1.008e-20	4.300e-38	0.	0.	0.	0.	0.	0.	0.
822090	pb 209	1.356e-13	1.352e-13	1.310e-13	1.098e-13	3.817e-14	8.508e-16	5.18e-29	0.	0.	0.	0.	0.
	total	1.439e-05	1.083e-06	3.106e-07	1.673e-07	1.287e-07	5.561e-08	3.76e-10	2.73e-10	1.07e-10	2.22e-12	1.95e-13	7.15e-14

Table A-6. (continued)

boral afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.51e-14	4.49e-14	4.26e-14	2.57e-14	1.60e-16	1.45e-38
40100	be 10	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18
30080	li 8	3.199e-05	1.133e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.89e-20	1.89e-20	1.89e-20	1.89e-20	1.87e-20	1.68e-20
90200	f 20	1.075e-11	2.448e-13	4.047e-28	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.763e-09	5.836e-10	2.779e-14	2.703e-38	0.	0.	0.	0.	0.	0.	0.	0.
110240	na 24	5.062e-08	5.058e-08	5.023e-08	4.833e-08	3.834e-08	1.665e-08	2.11e-11	1.01e-22	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	9.260e-10	4.631e-10	9.056e-13	8.103e-28	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	7.623e-08	1.119e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	1.198e-07	1.113e-07	5.757e-08	1.477e-09	4.212e-19	1.831e-53	0.	0.	0.	0.	0.	0.
130260	al 26	2.559e-16	2.559e-16	2.559e-16	2.559e-16	2.559e-16	2.559e-16	2.56e-16	2.56e-16	2.56e-16	2.56e-16	2.56e-16	2.56e-16
130280	al 28	1.099e-06	8.067e-07	4.981e-08	9.513e-15	4.618e-55	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	2.080e-10	1.872e-10	7.232e-11	3.672e-13	6.289e-27	0.	0.	0.	0.	0.	0.	0.
130300	al 30	7.859e-09	9.862e-14	7.602e-58	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	1.201e-12	1.196e-12	1.149e-12	9.218e-13	2.457e-13	2.104e-15	6.09e-32	0.	0.	0.	0.	0.
160310		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
170360	cl 36	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23
180370	ar 37	3.740e-15	3.740e-15	3.740e-15	3.737e-15	3.722e-15	3.667e-15	3.26e-15	2.05e-15	2.70e-18	1.44e-46	0.	0.
180390	ar 39	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.29e-20	3.29e-20	3.28e-20	3.21e-20	2.54e-20	2.50e-21
190380	k 38	7.462e-16	6.820e-16	3.034e-16	3.370e-18	6.335e-30	0.	0.	0.	0.	0.	0.	0.
190400	k 40	1.572e-18	1.572e-18	1.572e-18	1.572e-18	1.572e-18	1.572e-18	1.57e-18	1.57e-18	1.57e-18	1.57e-18	1.57e-18	1.57e-18
170380	cl 38	6.182e-17	6.068e-17	5.133e-17	2.026e-17	7.673e-20	1.467e-28	0.	0.	0.	0.	0.	0.
180410	ar 41	4.222e-16	4.196e-16	3.964e-16	2.891e-16	4.352e-17	4.766e-20	9.85e-44	0.	0.	0.	0.	0.
190420	k 42	4.880e-16	4.876e-16	4.835e-16	4.615e-16	3.489e-16	1.276e-16	4.07e-20	8.92e-34	0.	0.	0.	0.
200390	ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410	ca 41	2.849e-21	2.849e-21	2.849e-21	2.849e-21	2.849e-21	2.849e-21	2.85e-21	2.85e-21	2.85e-21	2.85e-21	2.85e-21	2.82e-21
190430	k 43	1.816e-17	1.816e-17	1.807e-17	1.761e-17	1.509e-17	8.644e-18	1.00e-19	2.76e-27	0.	0.	0.	0.
190440	k 44	5.441e-16	5.272e-16	3.970e-16	8.216e-17	6.454e-21	1.077e-35	0.	0.	0.	0.	0.	0.
200450	ca 45	8.296e-15	8.296e-15	8.295e-15	8.294e-15	8.287e-15	8.260e-15	8.05e-15	7.29e-15	1.75e-15	1.49e-21	0.	0.
190460	k 46	1.940e-17	1.320e-17	4.124e-19	1.793e-27	0.	0.	0.	0.	0.	0.	0.	0.
180430	ar 43	7.927e-17	6.895e-35	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	1.631e-14	1.631e-14	1.629e-14	1.620e-14	1.570e-14	1.400e-14	5.59e-15	1.55e-16	8.96e-39	0.	0.	0.
210470	sc 47	3.406e-13	3.406e-13	3.401e-13	3.378e-13	3.239e-13	2.787e-13	8.39e-14	8.19e-16	7.60e-39	0.	0.	0.
200490	ca 49	1.310e-15	1.210e-15	5.957e-16	1.160e-17	6.313e-28	0.	0.	0.	0.	0.	0.	0.
210490	sc 49	3.285e-13	3.246e-13	2.912e-13	1.594e-13	4.286e-15	9.512e-21	0.	0.	0.	0.	0.	0.
210440	sc 44	1.259e-16	1.256e-16	1.223e-16	1.055e-16	4.358e-17	1.807e-18	1.58e-29	0.	0.	0.	0.	0.
210460	sc 46	5.187e-13	5.187e-13	5.187e-13	5.185e-13	5.177e-13	5.145e-13	4.90e-13	4.03e-13	2.52e-14	3.86e-26	0.	0.

Table A-6. (continued)

220450	ti 45	4.482e-14	4.465e-14	4.317e-14	3.579e-14	1.162e-14	2.023e-16	1.71e-30	0.	0.	0.	0.	0.
210480	sc 48	1.398e-11	1.397e-11	1.394e-11	1.376e-11	1.271e-11	9.550e-12	9.72e-13	1.29e-16	0.	0.	0.	0.
210500	sc 50	9.156e-12	6.106e-12	1.593e-13	2.542e-22	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	4.326e-12	3.839e-12	1.311e-12	3.348e-15	9.298e-31	0.	0.	0.	0.	0.	0.	0.
230490	v 49	3.201e-15	3.201e-15	3.201e-15	3.202e-15	3.201e-15	3.196e-15	3.16e-15	3.00e-15	1.49e-15	1.49e-18	1.53e-48	0.
230520	v 52	5.761e-10	4.789e-10	9.076e-11	8.811e-15	7.374e-39	0.	0.	0.	0.	0.	0.	0.
230480	v 48	3.017e-17	3.017e-17	3.017e-17	3.012e-17	2.985e-17	2.889e-17	2.23e-17	8.06e-18	3.96e-24	0.	0.	0.
240510	cr 51	5.727e-13	5.727e-13	5.726e-13	5.721e-13	5.691e-13	5.586e-13	4.81e-13	2.68e-13	6.26e-17	1.40e-52	0.	0.
240490	cr 49	1.806e-13	1.777e-13	1.531e-13	6.711e-14	4.754e-16	8.668e-24	0.	0.	0.	0.	0.	0.
240550	cr 55	7.914e-11	6.501e-11	1.107e-11	5.913e-16	1.377e-41	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	1.417e-12	1.417e-12	1.417e-12	1.417e-12	1.417e-12	1.414e-12	1.40e-12	1.32e-12	6.29e-13	4.18e-16	6.98e-48	0.
250560	mn 56	3.375e-09	3.360e-09	3.227e-09	2.580e-09	6.727e-10	5.327e-12	8.23e-29	0.	0.	0.	0.	0.
250520	mn 52	1.463e-15	1.463e-15	1.462e-15	1.456e-15	1.419e-15	1.294e-15	6.18e-16	3.45e-17	4.30e-35	0.	0.	0.
250530	mn 53	3.242e-21	3.242e-21	3.242e-21	3.242e-21	3.242e-21	3.242e-21	3.24e-21	3.24e-21	3.24e-21	3.24e-21	3.24e-21	3.24e-21
260550	fe 55	7.273e-14	7.273e-14	7.273e-14	7.273e-14	7.272e-14	7.268e-14	7.24e-14	7.12e-14	5.62e-14	5.49e-15	4.38e-25	0.
260530	fe 53	1.730e-12	1.595e-12	7.676e-13	1.321e-14	3.439e-25	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	1.967e-11	1.256e-11	2.215e-13	4.016e-23	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	3.815e-12	2.013e-12	6.365e-15	8.224e-29	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	2.279e-13	2.279e-13	2.279e-13	2.278e-13	2.270e-13	2.244e-13	2.05e-13	1.43e-13	8.28e-16	9.13e-38	0.	0.
270570	co 57	4.762e-17	4.762e-17	4.762e-17	4.762e-17	4.762e-17	4.760e-17	4.70e-17	4.43e-17	1.89e-17	4.29e-21	1.60e-57	0.
270580	co 58	1.773e-15	1.773e-15	1.773e-15	1.775e-15	1.784e-15	1.790e-15	1.69e-15	1.35e-15	5.13e-17	5.90e-31	0.	0.
280590	ni 59	3.655e-21	3.655e-21	3.655e-21	3.655e-21	3.655e-21	3.655e-21	3.65e-21	3.65e-21	3.65e-21	3.65e-21	3.65e-21	3.62e-21
270581	co 58m	1.869e-16	1.866e-16	1.845e-16	1.732e-16	1.186e-16	3.034e-17	5.56e-22	1.74e-40	0.	0.	0.	0.
280570	ni 57	2.657e-16	2.656e-16	2.648e-16	2.606e-16	2.367e-16	1.673e-16	1.04e-17	2.06e-22	0.	0.	0.	0.
270600	co 60	1.878e-14	1.878e-14	1.878e-14	1.878e-14	1.878e-14	1.878e-14	1.87e-14	1.86e-14	1.65e-14	5.04e-15	3.63e-20	6.19e-27
270601	co 60m	2.257e-16	2.113e-16	1.167e-16	4.303e-18	1.083e-26	1.197e-57	0.	0.	0.	0.	0.	0.
270610	co 61	2.770e-14	2.751e-14	2.582e-14	1.818e-14	2.213e-15	1.128e-18	5.14e-45	0.	0.	0.	0.	0.
270620	co 62	3.800e-11	2.394e-11	3.739e-13	3.451e-23	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	1.942e-16	1.847e-16	1.180e-16	9.766e-18	3.144e-24	1.334e-47	0.	0.	0.	0.	0.	0.
280630	ni 63	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.20e-16	1.20e-16	1.19e-16	1.12e-16	6.00e-17	1.18e-19
270640	co 64	1.793e-14	5.425e-60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	5.505e-12	5.480e-12	5.258e-12	4.181e-12	1.057e-12	7.481e-15	4.71e-32	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	1.628e-18	3.567e-19	4.159e-25	4.530e-58	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	4.216e-10	3.928e-10	2.077e-10	6.026e-12	3.594e-21	2.227e-54	0.	0.	0.	0.	0.	0.
290640	cu 64	1.229e-10	1.228e-10	1.218e-10	1.165e-10	8.884e-11	3.352e-11	1.38e-14	8.15e-28	0.	0.	0.	0.
290660	cu 66	1.056e-09	9.218e-10	2.720e-10	3.091e-13	6.653e-31	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	1.654e-11	1.624e-11	1.378e-11	5.538e-12	2.332e-14	6.535e-23	0.	0.	0.	0.	0.	0.
300650	zn 65	2.056e-12	2.056e-12	2.056e-12	2.056e-12	2.054e-12	2.050e-12	2.02e-12	1.89e-12	7.28e-13	6.40e-17	1.76e-57	0.
290670	cu 67	4.016e-14	4.017e-14	4.011e-14	3.973e-14	3.757e-14	3.073e-14	6.14e-15	1.14e-17	1.11e-56	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	2.454e-11	2.425e-11	2.183e-11	1.228e-11	1.010e-12	2.890e-13	2.09e-16	1.12e-28	0.	0.	0.	0.
300691	zn 69m	1.158e-12	1.157e-12	1.149e-12	1.102e-12	8.569e-13	3.470e-13	2.51e-16	1.35e-28	0.	0.	0.	0.
300710	zn 71	3.150e-12	2.374e-12	1.862e-13	1.343e-19	1.894e-56	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	2.886e-14	2.877e-14	2.802e-14	2.418e-14	9.991e-15	4.145e-16	3.64e-27	0.	0.	0.	0.	0.

Table A-6. (continued)

280670	ni 67	2.296e-12	2.278e-13	2.119e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	1.080e-18	1.080e-18	1.078e-18	1.069e-18	1.012e-18	8.331e-19	1.75e-19	3.96e-22	5.30e-60	0.	0.	0.
400930	zr 93	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27
410920	nb 92	2.620e-25	2.620e-25	2.620e-25	2.620e-25	2.620e-25	2.620e-25	2.62e-25	2.62e-25	2.62e-25	2.62e-25	2.62e-25	2.62e-25
410921	nb 92m	1.111e-17	1.111e-17	1.110e-17	1.107e-17	1.092e-17	1.037e-17	6.88e-18	1.39e-18	1.60e-28	0.	0.	0.
410931	nb 93m	9.251e-23	9.251e-23	9.251e-23	9.251e-23	9.250e-23	9.250e-23	9.24e-23	9.22e-23	8.91e-23	6.52e-23	2.42e-23	1.99e-23
410940	nb 94	4.006e-21	4.006e-21	4.008e-21	4.010e-21	4.010e-21	4.010e-21	4.01e-21	4.01e-21	4.01e-21	4.01e-21	4.00e-21	3.88e-21
410941	nb 94m	1.544e-16	1.383e-16	5.105e-17	2.015e-19	7.608e-34	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	6.116e-18	6.115e-18	6.107e-18	6.063e-18	5.800e-18	4.947e-18	1.38e-18	9.58e-21	1.33e-51	0.	0.	0.
420910	mo 91	7.608e-17	7.275e-17	4.864e-17	5.191e-18	7.676e-24	7.881e-45	0.	0.	0.	0.	0.	0.
420930	mo 93	8.111e-23	8.111e-23	8.111e-23	8.111e-23	8.111e-23	8.111e-23	8.11e-23	8.11e-23	8.11e-23	8.09e-23	7.95e-23	6.65e-23
420931	mo 93m	4.907e-19	4.899e-19	4.826e-19	4.441e-19	2.698e-19	4.482e-20	2.60e-26	1.13e-50	0.	0.	0.	0.
410950	nb 95	2.022e-18	2.022e-18	2.022e-18	2.021e-18	2.016e-18	1.996e-18	1.82e-18	1.18e-18	5.05e-21	1.25e-36	0.	0.
410951	nb 95m	1.997e-19	1.997e-19	1.995e-19	1.981e-19	1.904e-19	1.648e-19	5.21e-20	5.80e-22	7.22e-50	0.	0.	0.
410960	nb 96	1.283e-17	1.282e-17	1.277e-17	1.245e-17	1.074e-17	6.293e-18	8.77e-20	4.92e-27	0.	0.	0.	0.
410970	nb 97	3.341e-18	3.484e-18	3.413e-18	2.368e-18	6.786e-19	2.816e-19	7.92e-22	8.59e-32	0.	0.	0.	0.
410971	nb 97m	1.594e-17	8.041e-18	1.705e-20	2.393e-35	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	3.516e-18	3.465e-18	3.041e-18	1.472e-18	1.896e-20	2.971e-27	0.	0.	0.	0.	0.	0.
400950	zr 95	1.990e-19	1.990e-19	1.990e-19	1.989e-19	1.985e-19	1.969e-19	1.84e-19	1.43e-19	3.80e-21	1.29e-36	0.	0.
420990	mo 99	2.429e-16	2.429e-16	2.425e-16	2.404e-16	2.283e-16	1.893e-16	4.24e-17	1.22e-19	6.54e-56	0.	0.	0.
430991	tc 99m	5.113e-18	5.114e-18	5.122e-18	5.160e-18	5.250e-18	4.711e-18	1.07e-18	3.09e-21	1.65e-57	0.	0.	0.
430990	tc 99	5.513e-24	5.513e-24	5.515e-24	5.525e-24	5.587e-24	5.802e-24	6.65e-24	6.89e-24	6.89e-24	6.89e-24	6.89e-24	6.87e-24
411000	nb 100	2.281e-16	3.859e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	8.941e-19	8.935e-19	8.880e-19	8.583e-19	7.000e-19	3.359e-19	9.45e-22	1.02e-31	0.	0.	0.	0.
421010	mo 101	1.862e-15	1.776e-15	1.158e-15	1.079e-16	7.032e-23	3.785e-45	0.	0.	0.	0.	0.	0.
431010	tc 101	1.073e-16	1.309e-16	2.521e-16	1.073e-16	3.482e-22	4.770e-44	0.	0.	0.	0.	0.	0.
812020	tl 202	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
812040	tl 204	3.720e-22	3.720e-22	3.720e-22	3.720e-22	3.720e-22	3.718e-22	3.71e-22	3.66e-22	3.10e-22	5.93e-23	3.92e-30	0.
822030	pb 203	8.569e-17	8.567e-17	8.550e-17	8.456e-17	7.911e-17	6.224e-17	9.14e-18	5.09e-21	0.	0.	0.	0.
822050	pb 205	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
802030	hg 203	1.965e-20	1.965e-20	1.965e-20	1.964e-20	1.958e-20	1.936e-20	1.77e-20	1.25e-20	8.63e-23	5.23e-44	0.	0.
802050	hg 205	1.063e-17	9.304e-18	2.803e-18	3.569e-21	1.522e-38	0.	0.	0.	0.	0.	0.	0.
822090	pb 209	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	3.335e-05	9.753e-07	1.617e-07	5.255e-08	3.912e-08	1.670e-08	2.69e-11	4.17e-12	1.50e-12	3.71e-14	4.80e-16	2.60e-16

Table A-6. (continued)

boral beta heat 10-6 s operating (in mw)

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030 t	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.512e-14	4.51e-14	4.49e-14	4.26e-14	2.57e-14	1.60e-16	1.45e-38
40100 be 10	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.242e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18	2.24e-18
30080 li 8	3.155e-05	1.118e-26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140 c 14	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.892e-20	1.89e-20	1.89e-20	1.89e-20	1.89e-20	1.87e-20	1.68e-20
90200 f 20	6.494e-12	1.480e-13	2.446e-28	0.	0.	0.	0.	0.	0.	0.	0.	0.
100230 ne 23	1.631e-09	5.399e-10	2.571e-14	2.500e-38	0.	0.	0.	0.	0.	0.	0.	0.
110240 na 24	6.055e-09	6.050e-09	6.008e-09	5.781e-09	4.585e-09	1.991e-09	2.52e-12	1.21e-23	0.	0.	0.	0.
120230 mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250 na 25	7.590e-10	3.796e-10	7.423e-13	6.642e-28	0.	0.	0.	0.	0.	0.	0.	0.
110260 na 26	4.820e-08	7.075e-25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270 mg 27	5.219e-08	4.850e-08	2.508e-08	6.436e-10	1.835e-19	7.979e-54	0.	0.	0.	0.	0.	0.
130260 al 26	3.583e-17	3.583e-17	3.583e-17	3.583e-17	3.583e-17	3.583e-17	3.58e-17	3.58e-17	3.58e-17	3.58e-17	3.58e-17	3.58e-17
130280 al 28	4.252e-07	3.121e-07	1.927e-08	3.680e-15	1.787e-55	0.	0.	0.	0.	0.	0.	0.
140270 si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290 al 29	8.047e-11	7.240e-11	2.797e-11	1.420e-13	2.433e-27	0.	0.	0.	0.	0.	0.	0.
130300 al 30	6.602e-09	8.284e-14	6.386e-58	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310 si 31	1.201e-12	1.196e-12	1.149e-12	9.218e-13	2.457e-13	2.104e-15	6.09e-32	0.	0.	0.	0.	0.
160310	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160350	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
160370	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
170360 cl 36	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.443e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23	1.44e-23
180370 ar 37	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180390 ar 39	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.290e-20	3.29e-20	3.29e-20	3.28e-20	3.21e-20	2.54e-20	2.50e-21
190380 k 38	2.046e-16	1.870e-16	8.320e-17	9.242e-19	1.737e-30	0.	0.	0.	0.	0.	0.	0.
190400 k 40	1.168e-18	1.168e-18	1.168e-18	1.168e-18	1.168e-18	1.168e-18	1.17e-18	1.17e-18	1.17e-18	1.17e-18	1.17e-18	1.17e-18
170380 cl 38	3.560e-17	3.494e-17	2.956e-17	1.167e-17	4.418e-20	8.448e-29	0.	0.	0.	0.	0.	0.
180410 ar 41	1.107e-16	1.100e-16	1.040e-16	7.582e-17	1.141e-17	1.250e-20	2.58e-44	0.	0.	0.	0.	0.
190420 k 42	4.078e-16	4.074e-16	4.040e-16	3.856e-16	2.916e-16	1.066e-16	3.40e-20	7.45e-34	0.	0.	0.	0.
200390 ca 39	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200410 ca 41	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190430 k 43	5.227e-18	5.225e-18	5.201e-18	5.068e-18	4.342e-18	2.488e-18	2.89e-20	7.94e-28	0.	0.	0.	0.
190440 k 44	2.535e-16	2.456e-16	1.850e-16	3.828e-17	3.007e-21	5.019e-36	0.	0.	0.	0.	0.	0.
200450 ca 45	8.296e-15	8.296e-15	8.295e-15	8.294e-15	8.287e-15	8.260e-15	8.05e-15	7.29e-15	1.75e-15	1.49e-21	0.	0.
190460 k 46	9.577e-18	6.516e-18	2.036e-19	8.850e-28	0.	0.	0.	0.	0.	0.	0.	0.
180430 ar 43	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
200470 ca 47	3.594e-15	3.594e-15	3.590e-15	3.571e-15	3.459e-15	3.084e-15	1.23e-15	3.42e-17	1.97e-39	0.	0.	0.
210470 sc 47	1.960e-13	1.960e-13	1.958e-13	1.944e-13	1.865e-13	1.604e-13	4.83e-14	4.71e-16	4.37e-39	0.	0.	0.
200490 ca 49	2.737e-16	2.530e-16	1.245e-16	2.424e-18	1.319e-28	0.	0.	0.	0.	0.	0.	0.
210490 sc 49	3.281e-13	3.242e-13	2.909e-13	1.592e-13	4.281e-15	9.500e-21	0.	0.	0.	0.	0.	0.
210440 sc 44	4.841e-17	4.826e-17	4.700e-17	4.056e-17	1.675e-17	6.947e-19	6.07e-30	0.	0.	0.	0.	0.
210460 sc 46	2.260e-14	2.260e-14	2.260e-14	2.259e-14	2.255e-14	2.241e-14	2.13e-14	1.76e-14	1.10e-15	1.68e-27	0.	0.

Table A-6. (continued)

220450	ti 45	4.482e-14	4.465e-14	4.317e-14	3.579e-14	1.162e-14	2.023e-16	1.71e-30	0.	0.	0.	0.	0.
210480	sc 48	6.841e-13	6.839e-13	6.823e-13	6.733e-13	6.220e-13	4.674e-13	4.76e-14	6.31e-18	0.	0.	0.	0.
210500	sc 50	3.038e-12	2.026e-12	5.286e-14	8.435e-23	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	4.326e-12	3.839e-12	1.311e-12	3.348e-15	9.298e-31	0.	0.	0.	0.	0.	0.	0.
230490	v 49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
230520	v 52	2.423e-10	2.014e-10	3.818e-11	3.706e-15	3.102e-39	0.	0.	0.	0.	0.	0.	0.
230480	v 48	3.017e-17	3.017e-17	3.017e-17	3.012e-17	2.985e-17	2.889e-17	2.23e-17	8.06e-18	3.96e-24	0.	0.	0.
240510	cr 51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
240490	cr 49	1.013e-13	9.966e-14	8.591e-14	3.765e-14	2.667e-16	4.862e-24	0.	0.	0.	0.	0.	0.
240550	cr 55	7.914e-11	6.501e-11	1.107e-11	5.913e-16	1.377e-41	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	1.002e-09	9.974e-10	9.580e-10	7.658e-10	1.997e-10	1.581e-12	2.44e-29	0.	0.	0.	0.	0.
250520	mn 52	3.637e-17	3.637e-17	3.634e-17	3.619e-17	3.527e-17	3.216e-17	1.54e-17	8.57e-19	1.07e-36	0.	0.	0.
250530	mn 53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260550	fe 55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260530	fe 53	8.603e-13	7.931e-13	3.818e-13	6.572e-15	1.710e-25	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.976e-12	1.043e-12	3.297e-15	4.260e-29	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	2.069e-14	2.069e-14	2.068e-14	2.067e-14	2.061e-14	2.037e-14	1.86e-14	1.30e-14	7.52e-17	8.29e-39	0.	0.
270570	co 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270580	co 58	3.488e-16	3.488e-16	3.489e-16	3.493e-16	3.509e-16	3.522e-16	3.33e-16	2.65e-16	1.01e-17	1.16e-31	0.	0.
280590	ni 59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270581	co 58m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280570	ni 57	1.211e-16	1.211e-16	1.207e-16	1.188e-16	1.079e-16	7.629e-17	4.76e-18	9.39e-23	0.	0.	0.	0.
270600	co 60	7.640e-16	7.640e-16	7.640e-16	7.640e-16	7.639e-16	7.637e-16	7.62e-16	7.56e-16	6.70e-16	2.05e-16	1.48e-21	2.52e-28
270601	co 60m	6.449e-17	6.037e-17	3.333e-17	1.229e-18	3.095e-27	3.421e-58	0.	0.	0.	0.	0.	0.
270610	co 61	2.431e-14	2.414e-14	2.267e-14	1.596e-14	1.942e-15	9.900e-19	4.51e-45	0.	0.	0.	0.	0.
270620	co 62	1.472e-11	9.272e-12	1.448e-13	1.337e-23	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	5.620e-17	5.347e-17	3.415e-17	2.827e-18	9.100e-25	3.862e-48	0.	0.	0.	0.	0.	0.
280630	ni 63	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.199e-16	1.20e-16	1.20e-16	1.19e-16	1.12e-16	6.00e-17	1.18e-19
270640	co 64	1.695e-14	5.128e-60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	2.033e-12	2.024e-12	1.942e-12	1.544e-12	3.904e-13	2.763e-15	1.74e-32	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	1.628e-18	3.567e-19	4.159e-25	4.530e-58	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	2.377e-10	2.215e-10	1.171e-10	3.397e-12	2.026e-21	1.256e-54	0.	0.	0.	0.	0.	0.
290640	cu 64	4.007e-11	4.004e-11	3.971e-11	3.796e-11	2.896e-11	1.093e-11	4.49e-15	2.66e-28	0.	0.	0.	0.
290660	cu 66	9.698e-10	8.468e-10	2.499e-10	2.839e-13	6.111e-31	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	8.188e-12	8.040e-12	6.823e-12	2.742e-12	1.154e-14	3.235e-23	0.	0.	0.	0.	0.	0.
300650	zn 65	4.183e-13	4.183e-13	4.183e-13	4.183e-13	4.180e-13	4.171e-13	4.10e-13	3.84e-13	1.48e-13	1.30e-17	3.59e-58	0.
290670	cu 67	2.668e-14	2.669e-14	2.664e-14	2.640e-14	2.496e-14	2.041e-14	4.08e-15	7.58e-18	7.38e-57	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	2.454e-11	2.425e-11	2.183e-11	1.228e-11	1.010e-12	2.890e-13	2.09e-16	1.12e-28	0.	0.	0.	0.
300691	zn 69m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300710	zn 71	2.888e-12	2.176e-12	1.707e-13	1.231e-19	1.736e-56	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	8.781e-15	8.755e-15	8.526e-15	7.358e-15	3.040e-15	1.261e-16	1.11e-27	0.	0.	0.	0.	0.

Table A-6. (continued)

280670	ni 67	1.696e-12	1.682e-13	1.565e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	1.080e-18	1.080e-18	1.078e-18	1.069e-18	1.012e-18	8.331e-19	1.75e-19	3.96e-22	5.30e-60	0.	0.	0.
400930	zr 93	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.231e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27	2.23e-27
410920	nb 92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410921	nb 92m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410940	nb 94	4.516e-22	4.517e-22	4.519e-22	4.521e-22	4.521e-22	4.521e-22	4.52e-22	4.52e-22	4.52e-22	4.52e-22	4.51e-22	4.37e-22
410941	nb 94m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	4.359e-18	4.358e-18	4.352e-18	4.320e-18	4.133e-18	3.525e-18	9.87e-19	6.83e-21	9.48e-52	0.	0.	0.
420910	mo 91	4.658e-17	4.454e-17	2.977e-17	3.178e-18	4.699e-24	4.825e-45	0.	0.	0.	0.	0.	0.
420930	mo 93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
420931	mo 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410950	nb 95	1.014e-19	1.014e-19	1.014e-19	1.014e-19	1.011e-19	1.001e-19	9.12e-20	5.93e-20	2.53e-22	6.27e-38	0.	0.
410951	nb 95m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410960	nb 96	1.222e-18	1.221e-18	1.216e-18	1.186e-18	1.023e-18	5.994e-19	8.35e-21	4.69e-28	0.	0.	0.	0.
410970	nb 97	1.395e-18	1.455e-18	1.425e-18	9.888e-19	2.833e-19	1.176e-19	3.31e-22	3.58e-32	0.	0.	0.	0.
410971	nb 97m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.351e-18	1.332e-18	1.169e-18	5.657e-19	7.284e-21	1.142e-27	0.	0.	0.	0.	0.	0.
400950	zr 95	1.311e-20	1.311e-20	1.311e-20	1.311e-20	1.308e-20	1.297e-20	1.22e-20	9.43e-21	2.51e-22	8.51e-38	0.	0.
420990	mo 99	1.812e-16	1.812e-16	1.809e-16	1.793e-16	1.703e-16	1.412e-16	3.16e-17	9.13e-20	4.88e-56	0.	0.	0.
430991	tc 99m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430990	tc 99	5.513e-24	5.513e-24	5.515e-24	5.525e-24	5.587e-24	5.802e-24	6.65e-24	6.89e-24	6.89e-24	6.89e-24	6.89e-24	6.87e-24
411000	nb 100	1.692e-16	2.862e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	4.698e-19	4.695e-19	4.666e-19	4.510e-19	3.678e-19	1.765e-19	4.97e-22	5.38e-32	0.	0.	0.	0.
421010	mo 101	7.140e-16	6.809e-16	4.441e-16	4.136e-17	2.696e-23	1.451e-45	0.	0.	0.	0.	0.	0.
431010	tc 101	6.353e-17	7.748e-17	1.492e-16	6.353e-17	2.061e-22	2.824e-44	0.	0.	0.	0.	0.	0.
812020	tl 202	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
812040	tl 204	3.720e-22	3.720e-22	3.720e-22	3.720e-22	3.720e-22	3.718e-22	3.71e-22	3.66e-22	3.10e-22	5.93e-23	3.92e-30	0.
822030	pb 203	6.640e-17	6.638e-17	6.625e-17	6.552e-17	6.130e-17	4.823e-17	7.08e-18	3.94e-21	0.	0.	0.	0.
822050	pb 205	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
802030	hg 203	5.593e-21	5.593e-21	5.592e-21	5.589e-21	5.572e-21	5.510e-21	5.04e-21	3.56e-21	2.46e-23	1.49e-44	0.	0.
802050	hg 205	8.267e-18	7.235e-18	2.179e-18	2.775e-21	1.184e-38	0.	0.	0.	0.	0.	0.	0.
822090	pb 209	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	3.209e-05	3.700e-07	5.184e-08	7.251e-09	4.817e-09	2.005e-09	3.13e-12	4.68e-13	1.95e-13	2.60e-14	2.60e-16	3.93e-17

Table A-6. (continued)

note: listed below are boral isotopes for which gamma source data exists in [block data]

	nuclide
90200	f 20
100230	ne 23
110240	na 24
120230	mg 23
110250	na 25
110260	na 26
120270	mg 27
130260	al 26
130280	al 28
140270	si 27
130290	al 29
130300	al 30
140310	si 31
190380	k 38
190400	k 40
170380	cl 38
180410	ar 41
190420	k 42
190430	k 43
190440	k 44
190460	k 46
200470	ca 47
210470	sc 47
200490	ca 49
210490	sc 49
210440	sc 44
210460	sc 46
220450	ti 45
210480	sc 48
210500	sc 50
220510	ti 51
230490	v 49
230520	v 52
230480	v 48
240510	cr 51
240490	cr 49
240490	cr 49
250540	mn 54
250560	mn 56
250520	mn 52
260530	fe 53
250570	mn 57

Table A-6. (continued)

260590	fe	59
270570	co	57
270580	co	58
280570	ni	57
270600	co	60
270601	co	60m
270610	co	61
270620	co	62
270621	co	62m
270640	co	64
280650	ni	65
290620	cu	62
290640	cu	64
290660	cu	66
410920	nb	92
410921	nb	92m
410940	nb	94
400880		
400890	zr	89
420910	mo	91
420930	mo	93
420931	mo	93m
410950	nb	95
410951	nb	95m
410960	nb	96
410970	nb	97
410971	nb	97m
410980	nb	98
400950	zr	95
420990	mo	99
430991	tc	99m
430990	tc	99
400970	zr	97
421010	mo	101
431010	tc	101
812020	tl	202
822030	pb	203

Table A-6. (continued)

aluminum activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	8.757e+00	8.750e+00	8.689e+00	8.360e+00	6.631e+00	2.880e+00	3.65e-03	1.75e-14	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	3.497e-01	1.749e-01	3.420e-04	3.060e-19	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	6.742e-01	2.231e-01	1.063e-05	1.033e-29	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	1.275e+01	1.871e-16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	6.021e+01	5.596e+01	2.894e+01	7.425e-01	2.117e-10	9.206e-45	0.	0.	0.	0.	0.	0.
130260	al 26	6.709e-08	6.709e-08	6.709e-08	6.709e-08	6.709e-08	6.709e-08	6.71e-08	6.71e-08	6.71e-08	6.71e-08	6.71e-08	6.70e-08
130280	al 28	7.645e+02	5.611e+02	3.464e+01	6.616e-06	3.212e-46	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	6.991e-02	6.290e-02	2.430e-02	1.234e-04	2.114e-18	0.	0.	0.	0.	0.	0.	0.
130300	al 30	2.394e+00	3.004e-05	2.316e-49	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	4.212e-03	4.194e-03	4.031e-03	3.234e-03	8.618e-04	7.381e-06	2.14e-22	0.	0.	0.	0.	0.
170360	cl 36	4.545e-14	4.545e-14	4.545e-14	4.545e-14	4.545e-14	4.545e-14	4.55e-14	4.55e-14	4.55e-14	4.55e-14	4.54e-14	4.53e-14
180370	ar 37	2.297e-12	2.297e-12	2.296e-12	2.295e-12	2.285e-12	2.252e-12	2.00e-12	1.26e-12	1.66e-15	8.83e-44	0.	0.
180390	ar 39	1.309e-10	1.309e-10	1.309e-10	1.309e-10	1.309e-10	1.309e-10	1.31e-10	1.31e-10	1.31e-10	1.28e-10	1.01e-10	9.95e-12
190380	k 38	2.147e-08	1.962e-08	8.729e-09	9.697e-11	1.823e-22	0.	0.	0.	0.	0.	0.	0.
190400	k 40	2.373e-09	2.373e-09	2.373e-09	2.373e-09	2.373e-09	2.373e-09	2.37e-09	2.37e-09	2.37e-09	2.37e-09	2.37e-09	2.37e-09
170380	cl 38	1.297e-08	1.273e-08	1.077e-08	4.251e-09	1.609e-11	3.077e-20	0.	0.	0.	0.	0.	0.
180410	ar 41	2.631e-08	2.614e-08	2.470e-08	1.801e-08	2.712e-09	2.969e-12	6.14e-36	0.	0.	0.	0.	0.
190420	k 42	3.878e-07	3.875e-07	3.842e-07	3.668e-07	2.773e-07	1.014e-07	3.23e-11	7.09e-25	0.	0.	0.	0.
210440	sc 44	5.762e-08	5.745e-08	5.594e-08	4.828e-08	1.994e-08	8.268e-10	7.22e-21	0.	0.	0.	0.	0.
210460	sc 46	1.986e-04	1.986e-04	1.986e-04	1.985e-04	1.982e-04	1.970e-04	1.87e-04	1.54e-04	9.66e-06	1.48e-17	0.	0.
220450	ti 45	1.019e-04	1.015e-04	9.816e-05	8.137e-05	2.641e-05	4.599e-07	3.88e-21	0.	0.	0.	0.	0.
210470	sc 47	9.863e-04	9.861e-04	9.849e-04	9.781e-04	9.381e-04	8.072e-04	2.43e-04	2.38e-06	2.31e-29	0.	0.	0.
200450	ca 45	1.051e-04	1.051e-04	1.051e-04	1.051e-04	1.050e-04	1.047e-04	1.02e-04	9.24e-05	2.22e-05	1.89e-11	0.	0.
210480	sc 48	3.177e-03	3.177e-03	3.169e-03	3.127e-03	2.889e-03	2.171e-03	2.21e-04	2.93e-08	0.	0.	0.	0.
210490	sc 49	3.171e-04	3.133e-04	2.811e-04	1.538e-04	4.136e-06	9.179e-12	0.	0.	0.	0.	0.	0.
210500	sc 50	1.591e-03	1.061e-03	2.769e-05	4.418e-14	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	1.038e-02	9.208e-03	3.144e-03	8.030e-06	2.230e-21	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	1.030e-05	1.029e-05	1.028e-05	1.023e-05	9.909e-06	8.835e-06	3.53e-06	9.79e-08	5.65e-30	0.	0.	0.
230480	v 48	7.895e-08	7.895e-08	7.893e-08	7.881e-08	7.810e-08	7.560e-08	5.83e-08	2.11e-08	1.04e-14	0.	0.	0.
230490	v 49	1.534e-05	1.534e-05	1.534e-05	1.535e-05	1.534e-05	1.532e-05	1.51e-05	1.44e-05	7.13e-06	7.15e-09	7.35e-39	0.
240510	cr 51	3.809e-02	3.809e-02	3.809e-02	3.805e-02	3.786e-02	3.715e-02	3.20e-02	1.78e-02	4.17e-06	9.32e-42	0.	0.
240490	cr 49	1.031e-04	1.014e-04	8.738e-05	3.829e-05	2.712e-07	4.946e-15	0.	0.	0.	0.	0.	0.
230520	v 52	1.862e-01	1.548e-01	2.934e-02	2.849e-06	2.384e-30	0.	0.	0.	0.	0.	0.	0.
240550	cr 55	7.640e-02	6.276e-02	1.068e-02	5.709e-07	1.329e-32	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	1.392e-03	1.392e-03	1.392e-03	1.392e-03	1.391e-03	1.389e-03	1.37e-03	1.30e-03	6.18e-04	4.10e-07	6.86e-39	0.
250560	mn 56	2.178e+00	2.169e+00	2.083e+00	1.665e+00	4.342e-01	3.438e-03	5.31e-20	0.	0.	0.	0.	0.
250520	mn 52	3.922e-07	3.922e-07	3.919e-07	3.902e-07	3.803e-07	3.468e-07	1.66e-07	9.24e-09	1.15e-26	0.	0.	0.
250530	mn 53	1.560e-11	1.560e-11	1.561e-11	1.561e-11	1.561e-11	1.561e-11	1.56e-11	1.56e-11	1.56e-11	1.56e-11	1.56e-11	1.56e-11
260550	fe 55	1.210e-03	1.210e-03	1.210e-03	1.210e-03	1.210e-03	1.210e-03	1.20e-03	1.18e-03	9.35e-04	9.14e-05	7.29e-15	0.

Table A-6. (continued)

260530	fe 53	6.627e-04	6.110e-04	2.941e-04	5.063e-06	1.317e-16	0.	0.	0.	0.	0.	0.	0.	
250570	mn 57	1.439e-02	9.191e-03	1.621e-04	2.939e-14	0.	0.	0.	0.	0.	0.	0.	0.	
250580	mn 58	7.726e-04	4.075e-04	1.289e-06	1.665e-20	0.	0.	0.	0.	0.	0.	0.	0.	
260590	fe 59	3.039e-04	3.039e-04	3.039e-04	3.038e-04	3.028e-04	2.993e-04	2.73e-04	1.90e-04	1.10e-06	1.22e-28	0.	0.	
270570	co 57	1.583e-07	1.583e-07	1.583e-07	1.583e-07	1.583e-07	1.582e-07	1.56e-07	1.47e-07	6.27e-08	1.43e-11	5.33e-48	0.	
270580	co 58	1.348e-06	1.348e-06	1.349e-06	1.350e-06	1.357e-06	1.362e-06	1.29e-06	1.03e-06	3.90e-08	4.49e-22	0.	0.	
280590	ni 59	2.638e-11	2.638e-11	2.638e-11	2.638e-11	2.638e-11	2.638e-11	2.64e-11	2.64e-11	2.64e-11	2.64e-11	2.64e-11	2.61e-11	
270581	co 58m	5.889e-06	5.882e-06	5.815e-06	5.460e-06	3.738e-06	9.563e-07	1.75e-11	5.47e-30	0.	0.	0.	0.	
280570	ni 57	1.558e-07	1.557e-07	1.553e-07	1.528e-07	1.388e-07	9.811e-08	6.13e-09	1.21e-13	0.	0.	0.	0.	
270600	co 60	5.785e-06	5.785e-06	5.785e-06	5.785e-06	5.784e-06	5.783e-06	5.77e-06	5.72e-06	5.07e-06	1.55e-06	1.12e-11	2.05e-18	
270601	co 60m	2.142e-06	2.006e-06	1.107e-06	4.084e-08	1.028e-16	1.136e-47	0.	0.	0.	0.	0.	0.	
270610	co 61	4.377e-05	4.347e-05	4.081e-05	2.873e-05	3.497e-06	1.782e-09	8.13e-36	0.	0.	0.	0.	0.	
270620	co 62	1.189e-02	7.492e-03	1.170e-04	1.080e-14	0.	0.	0.	0.	0.	0.	0.	0.	
270621	co 62m	4.327e-08	4.117e-08	2.629e-08	2.177e-09	7.006e-16	2.974e-39	0.	0.	0.	0.	0.	0.	
280630	ni 63	4.770e-06	4.770e-06	4.770e-06	4.770e-06	4.770e-06	4.770e-06	4.77e-06	4.77e-06	4.74e-06	4.45e-06	2.39e-06	4.68e-09	
270640	co 64	4.496e-06	2.062e-51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
280650	ni 65	1.383e-03	1.377e-03	1.321e-03	1.051e-03	2.656e-04	1.880e-06	1.18e-23	0.	0.	0.	0.	0.	
260600	fe 60	2.055e-18	2.055e-18	2.055e-18	2.055e-18	2.055e-18	2.055e-18	2.05e-18	2.05e-18	2.05e-18	2.05e-18	2.05e-18	2.05e-18	
270630	co 63	8.890e-10	1.948e-10	2.272e-16	2.474e-49	0.	0.	0.	0.	0.	0.	0.	0.	
290620	cu 62	1.540e-01	1.435e-01	7.589e-02	2.202e-03	1.313e-12	8.137e-46	0.	0.	0.	0.	0.	0.	
290640	cu 64	6.167e-01	6.161e-01	6.112e-01	5.842e-01	4.456e-01	1.682e-01	6.91e-05	4.09e-18	0.	0.	0.	0.	
290660	cu 66	1.308e+00	1.142e+00	3.370e-01	3.830e-04	8.242e-22	0.	0.	0.	0.	0.	0.	0.	
300630	zn 63	6.660e-03	6.539e-03	5.550e-03	2.230e-03	9.389e-06	2.631e-14	0.	0.	0.	0.	0.	0.	
300650	zn 65	3.505e-03	3.505e-03	3.505e-03	3.504e-03	3.502e-03	3.495e-03	3.44e-03	3.21e-03	1.24e-03	1.09e-07	3.01e-48	0.	
290670	cu 67	1.128e-04	1.128e-04	1.126e-04	1.116e-04	1.055e-04	8.628e-05	1.73e-05	3.21e-08	3.12e-47	0.	0.	0.	
290680		3.917e-02	9.797e-03	3.747e-08	3.000e-38	0.	0.	0.	0.	0.	0.	0.	0.	
300690	zn 69	8.920e-02	8.816e-02	7.935e-02	4.460e-02	3.599e-03	1.022e-03	7.39e-07	3.97e-19	0.	0.	0.	0.	
300691	zn 69m	3.176e-03	3.173e-03	3.149e-03	3.020e-03	2.349e-03	9.514e-04	6.88e-07	3.70e-19	0.	0.	0.	0.	
300710	zn 71	3.023e-03	2.278e-03	1.787e-04	1.289e-10	1.818e-47	0.	0.	0.	0.	0.	0.	0.	
300711	zn 71m	1.815e-05	1.809e-05	1.762e-05	1.521e-05	6.282e-06	2.606e-07	2.29e-18	0.	0.	0.	0.	0.	
280670	ni 67	7.681e-04	7.619e-05	7.089e-14	0.	0.	0.	0.	0.	0.	0.	0.	0.	
390900	y 90	9.024e-10	9.022e-10	9.008e-10	8.927e-10	8.456e-10	6.959e-10	1.46e-10	3.31e-13	5.08e-51	0.	0.	0.	
400930	zr 93	1.155e-16	1.155e-16	1.155e-16	1.155e-16	1.155e-16	1.155e-16	1.15e-16	1.15e-16	1.15e-16	1.15e-16	1.15e-16	1.15e-16	
410920	nb 92	1.422e-16	1.422e-16	1.422e-16	1.422e-16	1.422e-16	1.422e-16	1.42e-16	1.42e-16	1.42e-16	1.42e-16	1.42e-16	1.42e-16	
410921	nb 92m	3.264e-08	3.263e-08	3.262e-08	3.254e-08	3.208e-08	3.048e-08	2.02e-08	4.08e-09	4.70e-19	0.	0.	0.	
410931	nb 93m	2.464e-11	2.464e-11	2.464e-11	2.464e-11	2.464e-11	2.464e-11	2.46e-11	2.46e-11	2.38e-11	1.77e-11	7.35e-12	6.06e-12	
410940	nb 94	2.691e-12	2.691e-12	2.694e-12	2.695e-12	2.695e-12	2.695e-12	2.70e-12	2.70e-12	2.69e-12	2.69e-12	2.69e-12	2.60e-12	
410941	nb 94m	7.748e-06	6.936e-06	2.561e-06	1.011e-08	3.817e-23	0.	0.	0.	0.	0.	0.	0.	
400880		3.994e-12	3.994e-12	3.993e-12	3.992e-12	3.985e-12	3.961e-12	3.77e-12	3.10e-12	1.92e-13	2.64e-25	0.	0.	
400890	zr 89	1.273e-09	1.273e-09	1.271e-09	1.262e-09	1.207e-09	1.030e-09	2.88e-10	1.99e-12	2.77e-43	0.	0.	0.	
420910	mo 91	2.496e-08	2.387e-08	1.596e-08	1.703e-09	2.518e-15	2.586e-36	0.	0.	0.	0.	0.	0.	
420930	mo 93	2.474e-12	2.474e-12	2.474e-12	2.474e-12	2.474e-12	2.474e-12	2.47e-12	2.47e-12	2.47e-12	2.47e-12	2.43e-12	2.03e-12	
420931	mo 93m	1.820e-10	1.816e-10	1.790e-10	1.647e-10	1.000e-10	1.662e-11	9.64e-18	4.18e-42	0.	0.	0.	0.	
410950	nb 95	2.031e-09	2.031e-09	2.031e-09	2.030e-09	2.025e-09	2.006e-09	1.83e-09	1.19e-09	5.17e-12	1.29e-27	0.	0.	
410951	nb 95m	6.936e-10	6.936e-10	6.927e-10	6.881e-10	6.612e-10	5.725e-10	1.81e-10	2.02e-12	2.51e-40	0.	0.	0.	

Table A-6. (continued)

410960	nb 96	4.122e-09	4.120e-09	4.101e-09	4.001e-09	3.449e-09	2.022e-09	2.82e-11	1.58e-18	0.	0.	0.	0.
410970	nb 97	2.438e-09	2.542e-09	2.490e-09	1.731e-09	5.010e-10	2.084e-10	5.86e-13	6.35e-23	0.	0.	0.	0.
410971	nb 97m	1.767e-08	8.917e-09	1.891e-11	2.654e-26	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	8.442e-10	8.320e-10	7.302e-10	3.535e-10	4.552e-12	7.135e-19	0.	0.	0.	0.	0.	0.
400950	zr 95	9.021e-11	9.021e-11	9.020e-11	9.017e-11	8.997e-11	8.924e-11	8.36e-11	6.49e-11	1.72e-12	5.85e-28	0.	0.
420990	mo 99	3.226e-07	3.225e-07	3.220e-07	3.192e-07	3.031e-07	2.514e-07	5.63e-08	1.63e-10	8.68e-47	0.	0.	0.
430991	tc 99m	2.958e-07	2.959e-07	2.963e-07	2.985e-07	3.037e-07	2.725e-07	6.18e-08	1.79e-10	9.54e-47	0.	0.	0.
430990	tc 99	5.017e-14	5.017e-14	5.019e-14	5.028e-14	5.085e-14	5.280e-14	6.05e-14	6.27e-14	6.27e-14	6.27e-14	6.27e-14	6.25e-14
411000	nb 100	9.318e-08	1.576e-13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	5.156e-10	5.153e-10	5.121e-10	4.950e-10	4.037e-10	1.937e-10	5.45e-13	5.91e-23	0.	0.	0.	0.
421010	mo 101	6.556e-07	6.252e-07	4.078e-07	3.797e-08	2.475e-14	1.332e-36	0.	0.	0.	0.	0.	0.
431010	tc 101	1.134e-07	1.383e-07	2.665e-07	1.134e-07	3.680e-13	5.041e-35	0.	0.	0.	0.	0.	0.
	total	8.545e+02	6.307e+02	7.559e+01	1.146e+01	7.567e+00	3.101e+00	4.28e-02	2.40e-02	2.85e-03	9.80e-05	2.46e-06	7.41e-08

Table A-6. (continued)

aluminum bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	8.032e-07	8.026e-07	7.970e-07	7.668e-07	6.083e-07	2.642e-07	3.34e-10	1.60e-21	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	5.346e-09	2.673e-09	5.228e-12	4.678e-27	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	1.031e-08	3.411e-09	1.624e-13	1.580e-37	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	1.948e-07	2.860e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	9.205e-07	8.555e-07	4.424e-07	1.135e-08	3.237e-18	1.407e-52	0.	0.	0.	0.	0.	0.
130260	al 26	3.077e-13	3.077e-13	3.077e-13	3.077e-13	3.077e-13	3.077e-13	3.08e-13	3.08e-13	3.08e-13	3.08e-13	3.08e-13	3.07e-13
130280	al 28	1.169e-05	8.577e-06	5.296e-07	1.011e-13	4.911e-54	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	1.069e-09	9.615e-10	3.715e-10	1.886e-12	3.231e-26	0.	0.	0.	0.	0.	0.	0.
130300	al 30	3.660e-08	4.593e-13	3.540e-57	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	6.440e-11	6.411e-11	6.162e-11	4.943e-11	1.317e-11	1.128e-13	3.26e-30	0.	0.	0.	0.	0.
170360	cl 36	2.606e-20	2.606e-20	2.606e-20	2.606e-20	2.606e-20	2.606e-20	2.61e-20	2.61e-20	2.61e-20	2.61e-20	2.61e-20	2.60e-20
180370	ar 37	1.053e-23	1.053e-23	1.053e-23	1.052e-23	1.048e-23	1.033e-23	9.17e-24	5.76e-24	7.60e-27	4.05e-55	0.	0.
180390	ar 39	6.001e-16	6.001e-16	6.001e-16	6.001e-16	6.001e-16	6.001e-16	6.00e-16	6.00e-16	5.99e-16	5.85e-16	4.64e-16	4.56e-17
190380	k 38	3.282e-16	3.000e-16	1.334e-16	1.482e-18	2.786e-30	0.	0.	0.	0.	0.	0.	0.
190400	k 40	1.088e-14	1.088e-14	1.088e-14	1.088e-14	1.088e-14	1.088e-14	1.09e-14	1.09e-14	1.09e-14	1.09e-14	1.09e-14	1.09e-14
170380	cl 38	8.495e-17	8.339e-17	7.054e-17	2.785e-17	1.054e-19	2.016e-28	0.	0.	0.	0.	0.	0.
180410	ar 41	3.016e-16	2.997e-16	2.832e-16	2.065e-16	3.109e-17	3.405e-20	7.04e-44	0.	0.	0.	0.	0.
190420	k 42	4.447e-14	4.443e-14	4.406e-14	4.205e-14	3.180e-14	1.162e-14	3.71e-18	8.12e-32	0.	0.	0.	0.
210440	sc 44	2.642e-15	2.635e-15	2.566e-15	2.214e-15	9.146e-16	3.792e-17	3.31e-28	0.	0.	0.	0.	0.
210460	sc 46	1.138e-10	1.138e-10	1.138e-10	1.138e-10	1.136e-10	1.129e-10	1.07e-10	8.85e-11	5.54e-12	8.48e-24	0.	0.
220450	ti 45	1.375e-13	1.369e-13	1.324e-13	1.098e-13	3.563e-14	6.203e-16	5.24e-30	0.	0.	0.	0.	0.
210470	sc 47	2.262e-11	2.261e-11	2.258e-11	2.243e-11	2.151e-11	1.851e-11	5.58e-12	5.47e-14	5.30e-37	0.	0.	0.
200450	ca 45	4.822e-11	4.822e-11	4.822e-11	4.821e-11	4.817e-11	4.802e-11	4.68e-11	4.24e-11	1.02e-11	8.65e-18	0.	0.
210480	sc 48	2.914e-10	2.914e-10	2.907e-10	2.869e-10	2.650e-10	1.991e-10	2.03e-11	2.69e-15	0.	0.	0.	0.
210490	sc 49	1.119e-13	1.105e-13	9.916e-14	5.427e-14	1.459e-15	3.238e-21	0.	0.	0.	0.	0.	0.
210500	sc 50	6.633e-12	4.424e-12	1.154e-13	1.842e-22	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	5.598e-12	4.968e-12	1.696e-12	4.333e-15	1.203e-30	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	7.869e-13	7.868e-13	7.861e-13	7.819e-13	7.574e-13	6.753e-13	2.70e-13	7.49e-15	4.32e-37	0.	0.	0.
230480	v 48	1.810e-14	1.810e-14	1.810e-14	1.807e-14	1.791e-14	1.734e-14	1.34e-14	4.83e-15	2.38e-21	0.	0.	0.
230490	v 49	2.815e-14	2.815e-14	2.815e-14	2.815e-14	2.815e-14	2.810e-14	2.78e-14	2.64e-14	1.31e-14	1.31e-17	1.35e-47	0.
240510	cr 51	2.184e-10	2.184e-10	2.183e-10	2.182e-10	2.170e-10	2.130e-10	1.83e-10	1.02e-10	2.39e-14	5.34e-50	0.	0.
240490	cr 49	1.575e-12	1.550e-12	1.336e-12	5.854e-13	4.146e-15	7.561e-23	0.	0.	0.	0.	0.	0.
230520	v 52	2.440e-10	2.029e-10	3.845e-11	3.733e-15	3.124e-39	0.	0.	0.	0.	0.	0.	0.
240550	cr 55	1.168e-09	9.594e-10	1.633e-10	8.727e-15	2.032e-40	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	6.385e-10	6.385e-10	6.385e-10	6.384e-10	6.382e-10	6.371e-10	6.29e-10	5.97e-10	2.83e-10	1.88e-13	3.15e-45	0.
250560	mn 56	4.995e-08	4.973e-08	4.776e-08	3.818e-08	9.956e-09	7.883e-11	1.22e-27	0.	0.	0.	0.	0.
250520	mn 52	4.497e-14	4.496e-14	4.493e-14	4.474e-14	4.360e-14	3.976e-14	1.90e-14	1.06e-15	1.32e-33	0.	0.	0.
250530	mn 53	7.156e-17	7.156e-17	7.157e-17	7.157e-17	7.157e-17	7.157e-17	7.16e-17	7.16e-17	7.16e-17	7.16e-17	7.16e-17	7.16e-17
260550	fe 55	1.850e-11	1.850e-11	1.850e-11	1.850e-11	1.850e-11	1.849e-11	1.84e-11	1.81e-11	1.43e-11	1.40e-12	1.12e-22	0.

Table A-6. (continued)

260530	fe 53	1.013e-11	9.340e-12	4.496e-12	7.739e-14	2.014e-24	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	2.201e-10	1.405e-10	2.479e-12	4.493e-22	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.181e-11	6.230e-12	1.970e-14	2.546e-28	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	6.970e-11	6.970e-11	6.969e-11	6.965e-11	6.943e-11	6.863e-11	6.26e-11	4.36e-11	2.53e-13	2.79e-35	0.	0.
270570	co 57	7.258e-14	7.258e-14	7.258e-14	7.258e-14	7.258e-14	7.254e-14	7.17e-14	6.75e-14	2.87e-14	6.54e-18	2.45e-54	0.
270580	co 58	3.092e-13	3.092e-13	3.093e-13	3.096e-13	3.111e-13	3.122e-13	2.96e-13	2.35e-13	8.94e-15	1.03e-28	0.	0.
280590	ni 59	6.050e-19	6.050e-19	6.050e-19	6.050e-19	6.050e-19	6.050e-19	6.05e-19	6.05e-19	6.05e-19	6.05e-19	6.04e-19	5.99e-19
270581	co 58m	9.003e-15	8.992e-15	8.890e-15	8.346e-15	5.715e-15	1.462e-15	2.68e-20	8.37e-39	0.	0.	0.	0.
280570	ni 57	7.143e-13	7.141e-13	7.120e-13	7.007e-13	6.364e-13	4.499e-13	2.81e-14	5.54e-19	0.	0.	0.	0.
270600	co 60	8.843e-12	8.843e-12	8.843e-12	8.843e-12	8.842e-12	8.840e-12	8.82e-12	8.75e-12	7.75e-12	2.37e-12	1.71e-17	3.13e-24
270601	co 60m	3.275e-14	3.066e-14	1.693e-14	6.243e-16	1.572e-24	1.737e-55	0.	0.	0.	0.	0.	0.
270610	co 61	6.692e-13	6.645e-13	6.238e-13	4.391e-13	5.345e-14	2.725e-17	1.24e-43	0.	0.	0.	0.	0.
270620	co 62	2.727e-11	1.718e-11	2.684e-13	2.477e-23	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	1.985e-16	1.888e-16	1.206e-16	9.982e-18	3.213e-24	1.364e-47	0.	0.	0.	0.	0.	0.
280630	ni 63	1.094e-12	1.094e-12	1.094e-12	1.094e-12	1.094e-12	1.094e-12	1.09e-12	1.09e-12	1.09e-12	1.02e-12	5.47e-13	1.07e-15
270640	co 64	6.873e-14	3.153e-59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	3.172e-11	3.158e-11	3.030e-11	2.409e-11	6.090e-12	4.311e-14	2.72e-31	0.	0.	0.	0.	0.
260600	fe 60	3.141e-26	3.141e-26	3.141e-26	3.141e-26	3.141e-26	3.141e-26	3.14e-26	3.14e-26	3.14e-26	3.14e-26	3.14e-26	3.13e-26
270630	co 63	1.359e-17	2.978e-18	3.473e-24	3.782e-57	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	2.355e-11	2.194e-11	1.160e-11	3.366e-13	2.008e-22	1.244e-55	0.	0.	0.	0.	0.	0.
290640	cu 64	7.071e-09	7.064e-09	7.007e-09	6.698e-09	5.109e-09	1.928e-09	7.93e-13	4.69e-26	0.	0.	0.	0.
290660	cu 66	5.998e-11	5.238e-11	1.546e-11	1.756e-14	3.780e-32	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	1.018e-10	9.997e-11	8.484e-11	3.409e-11	1.435e-13	4.023e-22	0.	0.	0.	0.	0.	0.
300650	zn 65	8.036e-10	8.036e-10	8.036e-10	8.036e-10	8.031e-10	8.014e-10	7.88e-10	7.37e-10	2.85e-10	2.50e-14	6.90e-55	0.
290670	cu 67	1.724e-12	1.725e-12	1.722e-12	1.706e-12	1.613e-12	1.319e-12	2.64e-13	4.90e-16	4.77e-55	0.	0.	0.
290680		1.797e-07	4.493e-08	1.718e-13	1.376e-43	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	2.046e-10	2.022e-10	1.820e-10	1.023e-10	8.254e-12	2.343e-12	1.69e-15	9.11e-28	0.	0.	0.	0.
300691	zn 69m	1.456e-10	1.455e-10	1.444e-10	1.385e-10	1.077e-10	4.363e-11	3.16e-14	1.70e-26	0.	0.	0.	0.
300710	zn 71	4.622e-11	3.483e-11	2.732e-12	1.971e-18	2.779e-55	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	8.322e-11	8.298e-11	8.081e-11	6.974e-11	2.881e-11	1.195e-12	1.05e-23	0.	0.	0.	0.	0.
280670	ni 67	1.174e-11	1.165e-12	1.084e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	1.380e-16	1.379e-16	1.377e-16	1.365e-16	1.293e-16	1.064e-16	2.24e-17	5.06e-20	7.77e-58	0.	0.	0.
400930	zr 93	1.324e-23	1.324e-23	1.324e-23	1.324e-23	1.324e-23	1.324e-23	1.32e-23	1.32e-23	1.32e-23	1.32e-23	1.32e-23	1.32e-23
410920	nb 92	1.863e-25	1.863e-25	1.863e-25	1.863e-25	1.863e-25	1.863e-25	1.86e-25	1.86e-25	1.86e-25	1.86e-25	1.86e-25	1.86e-25
410921	nb 92m	4.045e-17	4.045e-17	4.043e-17	4.034e-17	3.977e-17	3.778e-17	2.51e-17	5.05e-18	5.82e-28	0.	0.	0.
410931	nb 93m	2.826e-18	2.826e-18	2.826e-18	2.826e-18	2.826e-18	2.825e-18	2.82e-18	2.82e-18	2.73e-18	2.03e-18	8.43e-19	6.95e-19
410940	nb 94	6.170e-19	6.171e-19	6.177e-19	6.180e-19	6.180e-19	6.180e-19	6.18e-19	6.18e-19	6.18e-19	6.18e-19	6.16e-19	5.97e-19
410941	nb 94m	1.777e-17	1.590e-17	5.873e-18	2.317e-20	8.752e-35	0.	0.	0.	0.	0.	0.	0.
400880		1.832e-17	1.832e-17	1.831e-17	1.831e-17	1.828e-17	1.816e-17	1.73e-17	1.42e-17	8.81e-19	1.21e-30	0.	0.
400890	zr 89	5.839e-15	5.838e-15	5.831e-15	5.788e-15	5.538e-15	4.723e-15	1.32e-15	9.14e-18	1.27e-48	0.	0.	0.
420910	mo 91	3.816e-16	3.649e-16	2.439e-16	2.604e-17	3.850e-23	3.953e-44	0.	0.	0.	0.	0.	0.
420930	mo 93	3.066e-21	3.066e-21	3.066e-21	3.066e-21	3.066e-21	3.066e-21	3.07e-21	3.07e-21	3.07e-21	3.06e-21	3.01e-21	2.52e-21
420931	mo 93m	4.172e-18	4.165e-18	4.104e-18	3.776e-18	2.294e-18	3.811e-19	2.21e-25	9.58e-50	0.	0.	0.	0.
410950	nb 95	3.106e-16	3.105e-16	3.105e-16	3.104e-16	3.096e-16	3.066e-16	2.79e-16	1.82e-16	7.91e-19	1.97e-34	0.	0.
410951	nb 95m	1.136e-18	1.136e-18	1.135e-18	1.127e-18	1.083e-18	9.378e-19	2.97e-19	3.30e-21	4.11e-49	0.	0.	0.

Table A-6. (continued)

410960	nb 96	1.890e-14	1.889e-14	1.881e-14	1.835e-14	1.582e-14	9.272e-15	1.29e-16	7.25e-24	0.	0.	0.	0.
410970	nb 97	5.591e-18	5.830e-18	5.711e-18	3.969e-18	1.149e-18	4.780e-19	1.34e-21	1.46e-31	0.	0.	0.	0.
410971	nb 97m	2.702e-16	1.363e-16	2.891e-19	4.057e-34	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.291e-17	1.272e-17	1.116e-17	5.404e-18	6.958e-20	1.091e-26	0.	0.	0.	0.	0.	0.
400950	zr 95	4.137e-17	4.137e-17	4.137e-17	4.135e-17	4.126e-17	4.093e-17	3.84e-17	2.97e-17	7.91e-19	2.69e-34	0.	0.
420990	mo 99	2.113e-14	2.113e-14	2.110e-14	2.092e-14	1.986e-14	1.647e-14	3.69e-15	1.07e-17	5.69e-54	0.	0.	0.
430991	tc 99m	2.713e-16	2.714e-16	2.718e-16	2.738e-16	2.786e-16	2.500e-16	5.67e-17	1.64e-19	8.75e-56	0.	0.	0.
430990	tc 99	1.151e-20	1.151e-20	1.151e-20	1.153e-20	1.166e-20	1.211e-20	1.39e-20	1.44e-20	1.44e-20	1.44e-20	1.44e-20	1.43e-20
411000	nb 100	1.424e-15	2.409e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	7.882e-17	7.877e-17	7.829e-17	7.567e-17	6.171e-17	2.962e-17	8.33e-20	9.03e-30	0.	0.	0.	0.
421010	mo 101	1.002e-14	9.557e-15	6.234e-15	5.805e-16	3.784e-22	2.037e-44	0.	0.	0.	0.	0.	0.
431010	tc 101	1.734e-15	2.115e-15	4.073e-15	1.734e-15	5.625e-21	7.707e-43	0.	0.	0.	0.	0.	0.
	total	1.390e-05	1.035e-05	1.827e-06	8.257e-07	6.257e-07	2.684e-07	2.21e-09	1.64e-09	6.07e-10	5.32e-12	8.66e-13	3.19e-13

Table A-6. (continued)

aluminum afterheat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.430e-07	2.429e-07	2.412e-07	2.320e-07	1.841e-07	7.994e-08	1.01e-10	4.85e-22	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	4.360e-09	2.180e-09	4.264e-12	3.815e-27	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	8.516e-09	2.818e-09	1.342e-13	1.305e-37	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	3.739e-07	5.490e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	5.636e-07	5.238e-07	2.709e-07	6.950e-09	1.982e-18	8.617e-53	0.	0.	0.	0.	0.	0.
130260	al 26	1.318e-15	1.318e-15	1.318e-15	1.318e-15	1.318e-15	1.318e-15	1.32e-15	1.32e-15	1.32e-15	1.32e-15	1.32e-15	1.32e-15
130280	al 28	1.316e-05	9.655e-06	5.962e-07	1.139e-13	5.528e-54	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	9.868e-10	8.878e-10	3.430e-10	1.742e-12	2.983e-26	0.	0.	0.	0.	0.	0.	0.
130300	al 30	3.869e-08	4.855e-13	3.743e-57	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	1.231e-11	1.226e-11	1.178e-11	9.450e-12	2.519e-12	2.157e-14	6.24e-31	0.	0.	0.	0.	0.
170360	cl 36	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.79e-23	6.79e-23	6.79e-23	6.79e-23	6.79e-23	6.77e-23
180370	ar 37	6.943e-21	6.943e-21	6.942e-21	6.938e-21	6.909e-21	6.807e-21	6.04e-21	3.80e-21	5.01e-24	2.67e-52	0.	0.
180390	ar 39	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.49e-19	1.49e-19	1.49e-19	1.45e-19	1.15e-19	1.13e-20
190380	k 38	5.598e-16	5.116e-16	2.276e-16	2.528e-18	4.752e-30	0.	0.	0.	0.	0.	0.	0.
190400	k 40	8.819e-18	8.819e-18	8.819e-18	8.819e-18	8.819e-18	8.819e-18	8.82e-18	8.82e-18	8.82e-18	8.82e-18	8.82e-18	8.82e-18
170380	cl 38	2.950e-16	2.896e-16	2.450e-16	9.671e-17	3.662e-19	7.002e-28	0.	0.	0.	0.	0.	0.
180410	ar 41	2.706e-16	2.689e-16	2.540e-16	1.853e-16	2.789e-17	3.054e-20	6.31e-44	0.	0.	0.	0.	0.
190420	k 42	4.026e-15	4.022e-15	3.989e-15	3.807e-15	2.879e-15	1.052e-15	3.36e-19	7.35e-33	0.	0.	0.	0.
210440	sc 44	6.486e-16	6.467e-16	6.298e-16	5.435e-16	2.245e-16	9.308e-18	8.13e-29	0.	0.	0.	0.	0.
210460	sc 46	2.462e-12	2.462e-12	2.462e-12	2.461e-12	2.457e-12	2.441e-12	2.32e-12	1.91e-12	1.20e-13	1.83e-25	0.	0.
220450	ti 45	2.302e-13	2.293e-13	2.217e-13	1.838e-13	5.966e-14	1.039e-15	8.77e-30	0.	0.	0.	0.	0.
210470	sc 47	1.609e-12	1.609e-12	1.607e-12	1.596e-12	1.530e-12	1.317e-12	3.97e-13	3.89e-15	3.77e-38	0.	0.	0.
200450	ca 45	4.008e-14	4.008e-14	4.008e-14	4.007e-14	4.004e-14	3.991e-14	3.89e-14	3.52e-14	8.48e-15	7.19e-21	0.	0.
210480	sc 48	6.631e-11	6.629e-11	6.613e-11	6.527e-11	6.029e-11	4.531e-11	4.61e-12	6.12e-16	0.	0.	0.	0.
210490	sc 49	1.559e-12	1.540e-12	1.382e-12	7.563e-13	2.033e-14	4.513e-20	0.	0.	0.	0.	0.	0.
210500	sc 50	4.503e-11	3.003e-11	7.835e-13	1.250e-21	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	5.382e-11	4.776e-11	1.631e-11	4.165e-14	1.157e-29	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	8.087e-14	8.086e-14	8.078e-14	8.035e-14	7.783e-14	6.940e-14	2.77e-14	7.69e-16	4.44e-38	0.	0.	0.
230480	v 48	1.526e-16	1.526e-16	1.525e-16	1.523e-16	1.509e-16	1.461e-16	1.13e-16	4.07e-17	2.00e-23	0.	0.	0.
230490	v 49	1.637e-14	1.637e-14	1.637e-14	1.638e-14	1.637e-14	1.635e-14	1.61e-14	1.54e-14	7.61e-15	7.63e-18	7.84e-48	0.
240510	cr 51	6.549e-12	6.549e-12	6.548e-12	6.542e-12	6.508e-12	6.387e-12	5.50e-12	3.06e-12	7.16e-16	1.60e-51	0.	0.
240490	cr 49	9.268e-13	9.116e-13	7.858e-13	3.444e-13	2.439e-15	4.448e-23	0.	0.	0.	0.	0.	0.
230520	v 52	2.761e-09	2.295e-09	4.350e-10	4.223e-14	3.535e-38	0.	0.	0.	0.	0.	0.	0.
240550	cr 55	4.824e-10	3.962e-10	6.745e-11	3.604e-15	8.392e-41	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	6.892e-12	6.892e-12	6.892e-12	6.891e-12	6.888e-12	6.876e-12	6.79e-12	6.44e-12	3.06e-12	2.03e-15	3.39e-47	0.
250560	mn 56	3.267e-08	3.253e-08	3.124e-08	2.497e-08	6.512e-09	5.156e-11	7.97e-28	0.	0.	0.	0.	0.
250520	mn 52	7.482e-15	7.481e-15	7.476e-15	7.444e-15	7.255e-15	6.615e-15	3.16e-15	1.76e-16	2.20e-34	0.	0.	0.
250530	mn 53	1.646e-20	1.647e-20	1.647e-20	1.647e-20	1.647e-20	1.647e-20	1.65e-20	1.65e-20	1.65e-20	1.65e-20	1.65e-20	1.65e-20
260550	fe 55	5.023e-13	5.023e-13	5.023e-13	5.023e-13	5.022e-13	5.020e-13	5.00e-13	4.92e-13	3.88e-13	3.79e-14	3.03e-24	0.

Table A-6. (continued)

260530	fe 53	8.910e-12	8.214e-12	3.954e-12	6.807e-14	1.771e-24	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	9.369e-11	5.982e-11	1.055e-12	1.913e-22	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	1.867e-11	9.850e-12	3.115e-14	4.024e-28	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	2.342e-12	2.342e-12	2.342e-12	2.341e-12	2.333e-12	2.307e-12	2.10e-12	1.47e-12	8.51e-15	9.38e-37	0.	0.
270570	co 57	2.355e-16	2.355e-16	2.355e-16	2.355e-16	2.355e-16	2.354e-16	2.33e-16	2.19e-16	9.32e-17	2.12e-20	7.93e-57	0.
270580	co 58	8.280e-15	8.280e-15	8.282e-15	8.291e-15	8.330e-15	8.361e-15	7.92e-15	6.30e-15	2.40e-16	2.75e-30	0.	0.
280590	ni 59	5.036e-20	5.036e-20	5.036e-20	5.036e-20	5.036e-20	5.036e-20	5.04e-20	5.04e-20	5.04e-20	5.04e-20	5.03e-20	4.99e-20
270581	co 58m	8.728e-16	8.717e-16	8.619e-16	8.091e-16	5.540e-16	1.417e-16	2.60e-21	8.11e-40	0.	0.	0.	0.
280570	ni 57	1.341e-15	1.340e-15	1.336e-15	1.315e-15	1.194e-15	8.445e-16	5.27e-17	1.04e-21	0.	0.	0.	0.
270600	co 60	8.937e-14	8.937e-14	8.937e-14	8.936e-14	8.936e-14	8.933e-14	8.91e-14	8.84e-14	7.83e-14	2.40e-14	1.73e-19	3.17e-26
270601	co 60m	1.067e-15	9.987e-16	5.514e-16	2.034e-17	5.120e-26	5.659e-57	0.	0.	0.	0.	0.	0.
270610	co 61	1.422e-13	1.412e-13	1.326e-13	9.332e-14	1.136e-14	5.790e-18	2.64e-44	0.	0.	0.	0.	0.
270620	co 62	1.849e-10	1.165e-10	1.820e-12	1.680e-22	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	9.492e-16	9.030e-16	5.767e-16	4.774e-17	1.537e-23	6.523e-47	0.	0.	0.	0.	0.	0.
280630	ni 63	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.65e-16	5.65e-16	5.62e-16	5.28e-16	2.83e-16	5.55e-19
270640	co 64	8.880e-14	4.074e-59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	2.640e-11	2.628e-11	2.521e-11	2.005e-11	5.068e-12	3.588e-14	2.26e-31	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	8.385e-18	1.838e-18	2.142e-24	2.333e-57	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	2.104e-09	1.960e-09	1.037e-09	3.007e-11	1.794e-20	1.111e-53	0.	0.	0.	0.	0.	0.
290640	cu 64	1.090e-09	1.089e-09	1.080e-09	1.033e-09	7.878e-10	2.973e-10	1.22e-13	7.23e-27	0.	0.	0.	0.
290660	cu 66	8.905e-09	7.776e-09	2.295e-09	2.607e-12	5.612e-30	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	8.397e-11	8.246e-11	6.998e-11	2.812e-11	1.184e-13	3.318e-22	0.	0.	0.	0.	0.	0.
300650	zn 65	1.470e-11	1.470e-11	1.470e-11	1.470e-11	1.469e-11	1.466e-11	1.44e-11	1.35e-11	5.21e-12	4.58e-16	1.26e-56	0.
290670	cu 67	1.892e-13	1.893e-13	1.889e-13	1.872e-13	1.770e-13	1.448e-13	2.89e-14	5.38e-17	5.24e-56	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	1.711e-10	1.691e-10	1.522e-10	8.553e-11	6.903e-12	1.959e-12	1.42e-15	7.62e-28	0.	0.	0.	0.
300691	zn 69m	7.852e-12	7.846e-12	7.787e-12	7.468e-12	5.809e-12	2.353e-12	1.70e-15	9.15e-28	0.	0.	0.	0.
300710	zn 71	2.194e-11	1.653e-11	1.297e-12	9.354e-19	1.319e-55	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	2.013e-13	2.007e-13	1.955e-13	1.687e-13	6.969e-14	2.891e-15	2.54e-26	0.	0.	0.	0.	0.
280670	ni 67	1.137e-11	1.128e-12	1.050e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	5.221e-18	5.220e-18	5.212e-18	5.165e-18	4.893e-18	4.026e-18	8.47e-19	1.91e-21	2.94e-59	0.	0.	0.
400930	zr 93	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26
410920	nb 92	1.261e-24	1.261e-24	1.261e-24	1.261e-24	1.261e-24	1.261e-24	1.26e-24	1.26e-24	1.26e-24	1.26e-24	1.26e-24	1.26e-24
410921	nb 92m	5.417e-17	5.417e-17	5.415e-17	5.402e-17	5.325e-17	5.059e-17	3.36e-17	6.77e-18	7.80e-28	0.	0.	0.
410931	nb 93m	4.383e-22	4.383e-22	4.383e-22	4.383e-22	4.383e-22	4.382e-22	4.38e-22	4.37e-22	4.23e-22	3.15e-22	1.31e-22	1.08e-22
410940	nb 94	2.829e-20	2.830e-20	2.833e-20	2.834e-20	2.834e-20	2.834e-20	2.83e-20	2.83e-20	2.83e-20	2.83e-20	2.82e-20	2.74e-20
410941	nb 94m	1.906e-15	1.706e-15	6.301e-16	2.486e-18	9.390e-33	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	3.002e-17	3.001e-17	2.997e-17	2.975e-17	2.847e-17	2.428e-17	6.80e-18	4.70e-20	6.53e-51	0.	0.	0.
420910	mo 91	3.892e-16	3.721e-16	2.488e-16	2.655e-17	3.926e-23	4.031e-44	0.	0.	0.	0.	0.	0.
420930	mo 93	4.399e-22	4.399e-22	4.399e-22	4.399e-22	4.399e-22	4.399e-22	4.40e-22	4.40e-22	4.40e-22	4.39e-22	4.31e-22	3.61e-22
420931	mo 93m	2.488e-18	2.484e-18	2.447e-18	2.252e-18	1.368e-18	2.273e-19	1.32e-25	5.72e-50	0.	0.	0.	0.
410950	nb 95	9.699e-18	9.699e-18	9.698e-18	9.694e-18	9.669e-18	9.576e-18	8.73e-18	5.68e-18	2.47e-20	6.17e-36	0.	0.
410951	nb 95m	9.692e-19	9.691e-19	9.679e-19	9.615e-19	9.238e-19	8.000e-19	2.53e-19	2.82e-21	3.50e-49	0.	0.	0.

Table A-6. (continued)

410960	nb 96	6.233e-17	6.230e-17	6.202e-17	6.051e-17	5.216e-17	3.057e-17	4.26e-19	2.39e-26	0.	0.	0.	0.
410970	nb 97	1.638e-17	1.708e-17	1.673e-17	1.163e-17	3.365e-18	1.400e-18	3.94e-21	4.27e-31	0.	0.	0.	0.
410971	nb 97m	7.784e-17	3.928e-17	8.330e-20	1.169e-34	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	1.740e-17	1.715e-17	1.505e-17	7.287e-18	9.382e-20	1.471e-26	0.	0.	0.	0.	0.	0.
400950	zr 95	9.819e-19	9.819e-19	9.818e-19	9.814e-19	9.792e-19	9.713e-19	9.10e-19	7.06e-19	1.88e-20	6.37e-36	0.	0.
420990	mo 99	1.166e-15	1.166e-15	1.164e-15	1.154e-15	1.096e-15	9.090e-16	2.04e-16	5.88e-19	3.14e-55	0.	0.	0.
430991	tc 99m	2.455e-17	2.455e-17	2.459e-17	2.478e-17	2.521e-17	2.262e-17	5.13e-18	1.48e-20	7.91e-57	0.	0.	0.
430990	tc 99	2.647e-23	2.647e-23	2.648e-23	2.653e-23	2.683e-23	2.786e-23	3.19e-23	3.31e-23	3.31e-23	3.31e-23	3.31e-23	3.30e-23
411000	nb 100	1.144e-15	1.935e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	4.444e-18	4.441e-18	4.414e-18	4.267e-18	3.480e-18	1.670e-18	4.70e-21	5.09e-31	0.	0.	0.	0.
421010	mo 101	9.265e-15	8.835e-15	5.763e-15	5.366e-16	3.498e-22	1.883e-44	0.	0.	0.	0.	0.	0.
431010	tc 101	5.339e-16	6.512e-16	1.254e-15	5.339e-16	1.732e-21	2.373e-43	0.	0.	0.	0.	0.	0.
	total	1.444e-05	1.047e-05	1.145e-06	2.653e-07	1.915e-07	8.037e-08	1.38e-10	2.70e-11	8.88e-12	6.63e-14	1.61e-15	1.33e-15

Table A-6. (continued)

aluminum beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
110240	na 24	2.907e-08	2.905e-08	2.885e-08	2.775e-08	2.201e-08	9.561e-09	1.21e-11	5.80e-23	0.	0.	0.	0.
120230	mg 23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
110250	na 25	3.574e-09	1.787e-09	3.495e-12	3.127e-27	0.	0.	0.	0.	0.	0.	0.	0.
100230	ne 23	7.878e-09	2.607e-09	1.242e-13	1.207e-37	0.	0.	0.	0.	0.	0.	0.	0.
110260	na 26	2.364e-07	3.471e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120270	mg 27	2.456e-07	2.282e-07	1.180e-07	3.028e-09	8.635e-19	3.755e-53	0.	0.	0.	0.	0.	0.
130260	al 26	1.845e-16	1.845e-16	1.845e-16	1.845e-16	1.845e-16	1.845e-16	1.85e-16	1.85e-16	1.85e-16	1.85e-16	1.85e-16	1.84e-16
130280	al 28	5.090e-06	3.735e-06	2.306e-07	4.405e-14	2.138e-54	0.	0.	0.	0.	0.	0.	0.
140270	si 27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
130290	al 29	3.817e-10	3.434e-10	1.327e-10	6.737e-13	1.154e-26	0.	0.	0.	0.	0.	0.	0.
130300	al 30	3.251e-08	4.079e-13	3.144e-57	0.	0.	0.	0.	0.	0.	0.	0.	0.
140310	si 31	1.231e-11	1.226e-11	1.178e-11	9.450e-12	2.519e-12	2.157e-14	6.24e-31	0.	0.	0.	0.	0.
170360	cl 36	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.790e-23	6.79e-23	6.79e-23	6.79e-23	6.79e-23	6.79e-23	6.77e-23
180370	ar 37	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
180390	ar 39	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.489e-19	1.49e-19	1.49e-19	1.49e-19	1.45e-19	1.15e-19	1.13e-20
190380	k 38	1.535e-16	1.403e-16	6.241e-17	6.933e-19	1.303e-30	0.	0.	0.	0.	0.	0.	0.
190400	k 40	6.555e-18	6.555e-18	6.555e-18	6.555e-18	6.555e-18	6.555e-18	6.55e-18	6.55e-18	6.55e-18	6.55e-18	6.55e-18	6.55e-18
170380	cl 38	1.699e-16	1.667e-16	1.411e-16	5.569e-17	2.109e-19	4.032e-28	0.	0.	0.	0.	0.	0.
180410	ar 41	7.096e-17	7.052e-17	6.662e-17	4.859e-17	7.314e-18	8.010e-21	1.66e-44	0.	0.	0.	0.	0.
190420	k 42	3.364e-15	3.361e-15	3.332e-15	3.181e-15	2.405e-15	8.792e-16	2.80e-19	6.15e-33	0.	0.	0.	0.
210440	sc 44	2.493e-16	2.486e-16	2.421e-16	2.089e-16	8.630e-17	3.578e-18	3.13e-29	0.	0.	0.	0.	0.
210460	sc 46	1.072e-13	1.072e-13	1.072e-13	1.072e-13	1.070e-13	1.064e-13	1.01e-13	8.34e-14	5.22e-15	7.99e-27	0.	0.
220450	ti 45	2.302e-13	2.293e-13	2.217e-13	1.838e-13	5.966e-14	1.039e-15	8.77e-30	0.	0.	0.	0.	0.
210470	sc 47	9.261e-13	9.260e-13	9.248e-13	9.184e-13	8.809e-13	7.580e-13	2.28e-13	2.24e-15	2.17e-38	0.	0.	0.
200450	ca 45	4.008e-14	4.008e-14	4.008e-14	4.007e-14	4.004e-14	3.991e-14	3.89e-14	3.52e-14	8.48e-15	7.19e-21	0.	0.
210480	sc 48	3.246e-12	3.245e-12	3.237e-12	3.194e-12	2.951e-12	2.218e-12	2.26e-13	3.00e-17	0.	0.	0.	0.
210490	sc 49	1.557e-12	1.538e-12	1.380e-12	7.554e-13	2.031e-14	4.507e-20	0.	0.	0.	0.	0.	0.
210500	sc 50	1.494e-11	9.963e-12	2.600e-13	4.148e-22	0.	0.	0.	0.	0.	0.	0.	0.
220510	ti 51	5.382e-11	4.776e-11	1.631e-11	4.165e-14	1.157e-29	0.	0.	0.	0.	0.	0.	0.
200470	ca 47	1.782e-14	1.782e-14	1.780e-14	1.771e-14	1.715e-14	1.529e-14	6.11e-15	1.70e-16	9.79e-39	0.	0.	0.
230480	v 48	1.526e-16	1.526e-16	1.525e-16	1.523e-16	1.509e-16	1.461e-16	1.13e-16	4.07e-17	2.00e-23	0.	0.	0.
230490	v 49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
240510	cr 51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
240490	cr 49	5.199e-13	5.114e-13	4.408e-13	1.932e-13	1.368e-15	2.495e-23	0.	0.	0.	0.	0.	0.
230520	v 52	1.161e-09	9.655e-10	1.830e-10	1.776e-14	1.487e-38	0.	0.	0.	0.	0.	0.	0.
240550	cr 55	4.824e-10	3.962e-10	6.745e-11	3.604e-15	8.392e-41	0.	0.	0.	0.	0.	0.	0.
250540	mn 54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250560	mn 56	9.698e-09	9.655e-09	9.273e-09	7.412e-09	1.933e-09	1.531e-11	2.36e-28	0.	0.	0.	0.	0.
250520	mn 52	1.860e-16	1.860e-16	1.858e-16	1.851e-16	1.804e-16	1.645e-16	7.86e-17	4.38e-18	5.47e-36	0.	0.	0.
250530	mn 53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
260550	fe 55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Table A-6. (continued)

260530	fe 53	4.431e-12	4.085e-12	1.967e-12	3.385e-14	8.810e-25	0.	0.	0.	0.	0.	0.	0.
250570	mn 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
250580	mn 58	9.673e-12	5.102e-12	1.614e-14	2.085e-28	0.	0.	0.	0.	0.	0.	0.	0.
260590	fe 59	2.126e-13	2.126e-13	2.126e-13	2.125e-13	2.118e-13	2.094e-13	1.91e-13	1.33e-13	7.72e-16	8.52e-38	0.	0.
270570	co 57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270580	co 58	1.629e-15	1.629e-15	1.629e-15	1.631e-15	1.639e-15	1.645e-15	1.56e-15	1.24e-15	4.71e-17	5.42e-31	0.	0.
280590	ni 59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270581	co 58m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280570	ni 57	6.113e-16	6.111e-16	6.093e-16	5.996e-16	5.445e-16	3.850e-16	2.40e-17	4.74e-22	0.	0.	0.	0.
270600	co 60	3.635e-15	3.635e-15	3.635e-15	3.635e-15	3.635e-15	3.634e-15	3.63e-15	3.60e-15	3.19e-15	9.75e-16	7.02e-21	1.29e-27
270601	co 60m	3.048e-16	2.853e-16	1.575e-16	5.811e-18	1.463e-26	1.617e-57	0.	0.	0.	0.	0.	0.
270610	co 61	1.248e-13	1.239e-13	1.164e-13	8.191e-14	9.971e-15	5.082e-18	2.32e-44	0.	0.	0.	0.	0.
270620	co 62	7.163e-11	4.512e-11	7.049e-13	6.506e-23	0.	0.	0.	0.	0.	0.	0.	0.
270621	co 62m	2.747e-16	2.614e-16	1.669e-16	1.382e-17	4.448e-24	1.888e-47	0.	0.	0.	0.	0.	0.
280630	ni 63	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.655e-16	5.65e-16	5.65e-16	5.62e-16	5.28e-16	2.83e-16	5.55e-19
270640	co 64	8.395e-14	3.851e-59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
280650	ni 65	9.750e-12	9.706e-12	9.313e-12	7.406e-12	1.872e-12	1.325e-14	8.35e-32	0.	0.	0.	0.	0.
260600	fe 60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
270630	co 63	8.385e-18	1.838e-18	2.142e-24	2.333e-57	0.	0.	0.	0.	0.	0.	0.	0.
290620	cu 62	1.186e-09	1.105e-09	5.844e-10	1.696e-11	1.011e-20	6.266e-54	0.	0.	0.	0.	0.	0.
290640	cu 64	3.553e-10	3.550e-10	3.522e-10	3.366e-10	2.568e-10	9.690e-11	3.98e-14	2.36e-27	0.	0.	0.	0.
290660	cu 66	8.180e-09	7.143e-09	2.108e-09	2.395e-12	5.155e-30	0.	0.	0.	0.	0.	0.	0.
300630	zn 63	4.157e-11	4.082e-11	3.464e-11	1.392e-11	5.861e-14	1.643e-22	0.	0.	0.	0.	0.	0.
300650	zn 65	2.992e-12	2.992e-12	2.992e-12	2.991e-12	2.990e-12	2.983e-12	2.93e-12	2.74e-12	1.06e-12	9.32e-17	2.57e-57	0.
290670	cu 67	1.257e-13	1.257e-13	1.255e-13	1.244e-13	1.176e-13	9.616e-14	1.92e-14	3.57e-17	3.48e-56	0.	0.	0.
290680		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300690	zn 69	1.711e-10	1.691e-10	1.522e-10	8.553e-11	6.903e-12	1.959e-12	1.42e-15	7.62e-28	0.	0.	0.	0.
300691	zn 69m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
300710	zn 71	2.011e-11	1.515e-11	1.189e-12	8.575e-19	1.209e-55	0.	0.	0.	0.	0.	0.	0.
300711	zn 71m	6.125e-14	6.107e-14	5.947e-14	5.133e-14	2.120e-14	8.798e-16	7.72e-27	0.	0.	0.	0.	0.
280670	ni 67	8.401e-12	8.334e-13	7.754e-22	0.	0.	0.	0.	0.	0.	0.	0.	0.
390900	y 90	5.221e-18	5.220e-18	5.212e-18	5.165e-18	4.893e-18	4.026e-18	8.47e-19	1.91e-21	2.94e-59	0.	0.	0.
400930	zr 93	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.068e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26	1.07e-26
410920	nb 92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410921	nb 92m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410931	nb 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410940	nb 94	3.190e-21	3.191e-21	3.194e-21	3.195e-21	3.195e-21	3.195e-21	3.20e-21	3.20e-21	3.20e-21	3.19e-21	3.18e-21	3.09e-21
410941	nb 94m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400880		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400890	zr 89	2.139e-17	2.139e-17	2.136e-17	2.120e-17	2.029e-17	1.730e-17	4.84e-18	3.35e-20	4.65e-51	0.	0.	0.
420910	mo 91	2.382e-16	2.278e-16	1.523e-16	1.625e-17	2.403e-23	2.468e-44	0.	0.	0.	0.	0.	0.
420930	mo 93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
420931	mo 93m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410950	nb 95	4.865e-19	4.865e-19	4.865e-19	4.863e-19	4.850e-19	4.804e-19	4.38e-19	2.85e-19	1.24e-21	3.09e-37	0.	0.
410951	nb 95m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Table A-6. (continued)

410960	nb 96	5.937e-18	5.935e-18	5.908e-18	5.764e-18	4.969e-18	2.912e-18	4.06e-20	2.28e-27	0.	0.	0.	0.
410970	nb 97	6.837e-18	7.129e-18	6.983e-18	4.854e-18	1.405e-18	5.845e-19	1.64e-21	1.78e-31	0.	0.	0.	0.
410971	nb 97m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
410980	nb 98	6.686e-18	6.590e-18	5.783e-18	2.800e-18	3.605e-20	5.651e-27	0.	0.	0.	0.	0.	0.
400950	zr 95	6.471e-20	6.471e-20	6.470e-20	6.468e-20	6.453e-20	6.401e-20	6.00e-20	4.65e-20	1.24e-21	4.20e-37	0.	0.
420990	mo 99	8.701e-16	8.699e-16	8.686e-16	8.611e-16	8.175e-16	6.780e-16	1.52e-16	4.39e-19	2.34e-55	0.	0.	0.
430991	tc 99m	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430990	tc 99	2.647e-23	2.647e-23	2.648e-23	2.653e-23	2.683e-23	2.786e-23	3.19e-23	3.31e-23	3.31e-23	3.31e-23	3.31e-23	3.30e-23
411000	nb 100	8.484e-16	1.435e-21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
400970	zr 97	2.335e-18	2.334e-18	2.319e-18	2.242e-18	1.828e-18	8.774e-19	2.47e-21	2.67e-31	0.	0.	0.	0.
421010	mo 101	3.552e-15	3.387e-15	2.209e-15	2.057e-16	1.341e-22	7.219e-45	0.	0.	0.	0.	0.	0.
431010	tc 101	3.161e-16	3.855e-16	7.424e-16	3.161e-16	1.025e-21	1.405e-43	0.	0.	0.	0.	0.	0.
	total	5.667e-06	4.017e-06	3.904e-07	3.868e-08	2.422e-08	9.682e-09	1.59e-11	3.00e-12	1.08e-12	1.79e-15	4.74e-16	1.91e-16

Table A-6. (continued)

note: listed below are aluminum isotopes for which gamma source data exists in [block data]

	nuclide
110240	na 24
120230	mg 23
110250	na 25
100230	ne 23
110260	na 26
120270	mg 27
130260	al 26
130280	al 28
140270	si 27
130290	al 29
130300	al 30
140310	si 31
190380	k 38
190400	k 40
170380	cl 38
180410	ar 41
190420	k 42
210440	sc 44
210460	sc 46
220450	ti 45
210470	sc 47
210480	sc 48
210490	sc 49
210500	sc 50
220510	ti 51
200470	ca 47
230480	v 48
230490	v 49
240510	cr 51
240490	cr 49
240490	cr 49
230520	v 52
250540	mn 54
250560	mn 56
250520	mn 52
260530	fe 53
250570	mn 57
260590	fe 59
270570	co 57
270580	co 58
280570	ni 57
270600	co 60

Table A-6. (continued)

270601	co 60m
270610	co 61
270620	co 62
270621	co 62m
270640	co 64
280650	ni 65
290620	cu 62
290640	cu 64
290660	cu 66
410920	nb 92
410921	nb 92m
410940	nb 94
400880	
400890	zr 89
420910	mo 91
420930	mo 93
420931	mo 93m
410950	nb 95
410951	nb 95m
410960	nb 96
410970	nb 97
410971	nb 97m
410980	nb 98
400950	zr 95
420990	mo 99
430991	tc 99m
430990	tc 99
400970	zr 97
421010	mo 101
431010	tc 101

Table A-6. (continued)

water activity 10-6 s operating (in curies)

	nuclide		0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t		1.174e-07	1.174e-07	1.174e-07	1.174e-07	1.174e-07	1.174e-07	1.17e-07	1.17e-07	1.11e-07	6.68e-08	4.17e-10	3.77e-32
70160	n	16	4.745e+02	1.395e+00	2.283e-23	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c	14	1.710e-07	1.710e-07	1.710e-07	1.710e-07	1.710e-07	1.710e-07	1.71e-07	1.71e-07	1.71e-07	1.71e-07	1.69e-07	1.52e-07
	total		4.745e+02	1.395e+00	2.884e-07	2.884e-07	2.884e-07	2.884e-07	2.88e-07	2.88e-07	2.82e-07	2.38e-07	1.69e-07	1.52e-07

Table A-6. (continued)

water bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.691e-16	2.691e-16	2.691e-16	2.691e-16	2.691e-16	2.691e-16	2.69e-16	2.68e-16	2.54e-16	1.53e-16	9.56e-19	8.64e-41
70160	n 16	7.253e-06	2.132e-08	3.491e-31	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c 14	7.844e-16	7.844e-16	7.844e-16	7.844e-16	7.844e-16	7.844e-16	7.84e-16	7.84e-16	7.84e-16	7.83e-16	7.75e-16	6.95e-16
	total	7.253e-06	2.132e-08	1.054e-15	1.054e-15	1.054e-15	1.053e-15	1.05e-15	1.05e-15	1.04e-15	9.37e-16	7.76e-16	6.95e-16

Table A-6. (continued)

water afterheat 10-6 s operating (in mw)

	nuclide		0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t		5.824e-18	5.824e-18	5.824e-18	5.824e-18	5.824e-18	5.823e-18	5.82e-18	5.80e-18	5.50e-18	3.31e-18	2.07e-20	1.87e-42
70160	n	16	2.593e-05	7.623e-08	1.248e-30	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c	14	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.77e-17	4.77e-17	4.76e-17	4.76e-17	4.71e-17	4.22e-17
	total		2.593e-05	7.623e-08	5.348e-17	5.348e-17	5.348e-17	5.348e-17	5.35e-17	5.34e-17	5.32e-17	5.09e-17	4.71e-17	4.22e-17

Table A-6. (continued)

water beta heat 10-6 s operating (in mw)

	nuclide		0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t		5.824e-18	5.824e-18	5.824e-18	5.824e-18	5.824e-18	5.823e-18	5.82e-18	5.80e-18	5.50e-18	3.31e-18	2.07e-20	1.87e-42
70160	n	16	7.285e-06	2.141e-08	3.506e-31	0.	0.	0.	0.	0.	0.	0.	0.	0.
60140	c	14	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.765e-17	4.77e-17	4.77e-17	4.76e-17	4.76e-17	4.71e-17	4.22e-17
	total		7.285e-06	2.141e-08	5.348e-17	5.348e-17	5.348e-17	5.348e-17	5.35e-17	5.34e-17	5.32e-17	5.09e-17	4.71e-17	4.22e-17

Table A-6. (continued)

plastic activity 10-6 s operating (in curies)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	9.610e-09	9.610e-09	9.609e-09	9.609e-09	9.609e-09	9.608e-09	9.60e-09	9.56e-09	9.08e-09	5.47e-09	3.41e-11	3.09e-33
40100	be 10	4.095e-11	4.095e-11	4.095e-11	4.095e-11	4.095e-11	4.095e-11	4.09e-11	4.09e-11	4.09e-11	4.09e-11	4.09e-11	4.09e-11
60140	c 14	1.040e-08	1.040e-08	1.040e-08	1.040e-08	1.040e-08	1.040e-08	1.04e-08	1.04e-08	1.04e-08	1.04e-08	1.03e-08	9.21e-09
70160	n 16	2.393e+01	7.033e-02	1.152e-24	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	2.393e+01	7.033e-02	2.005e-08	2.005e-08	2.005e-08	2.005e-08	2.00e-08	2.00e-08	1.95e-08	1.59e-08	1.03e-08	9.25e-09

Table A-6. (continued)

plastic bhp 10-6 s operating (in km3/kw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	2.204e-17	2.204e-17	2.204e-17	2.204e-17	2.203e-17	2.203e-17	2.20e-17	2.19e-17	2.08e-17	1.25e-17	7.83e-20	7.08e-42
40100	be 10	1.878e-16	1.878e-16	1.878e-16	1.878e-16	1.878e-16	1.878e-16	1.88e-16	1.88e-16	1.88e-16	1.88e-16	1.88e-16	1.88e-16
60140	c 14	4.768e-17	4.768e-17	4.768e-17	4.768e-17	4.768e-17	4.768e-17	4.77e-17	4.77e-17	4.77e-17	4.76e-17	4.71e-17	4.22e-17
70160	n 16	3.658e-07	1.075e-09	1.760e-32	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	3.658e-07	1.075e-09	2.575e-16	2.575e-16	2.575e-16	2.575e-16	2.57e-16	2.57e-16	2.56e-16	2.48e-16	2.35e-16	2.30e-16

Table A-6. (continued)

plastic afterheat 10-6 s operating (in mw)

nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030 t	4.768e-19	4.768e-19	4.768e-19	4.768e-19	4.768e-19	4.767e-19	4.76e-19	4.75e-19	4.51e-19	2.71e-19	1.69e-21	1.53e-43
40100 be 10	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20
60140 c 14	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.90e-18	2.90e-18	2.90e-18	2.89e-18	2.86e-18	2.57e-18
70160 n 16	1.308e-06	3.844e-09	6.294e-32	0.	0.	0.	0.	0.	0.	0.	0.	0.
total	1.308e-06	3.844e-09	3.417e-18	3.417e-18	3.417e-18	3.417e-18	3.42e-18	3.42e-18	3.39e-18	3.21e-18	2.91e-18	2.61e-18

Table A-6. (continued)

plastic beta heat 10-6 s operating (in mw)

	nuclide	0	1 m	10 m	1 h	6 h	1 d	1 w	1 mo	1 yr	10 yr	100 yr	1000 y
10030	t	4.768e-19	4.768e-19	4.768e-19	4.768e-19	4.768e-19	4.767e-19	4.76e-19	4.75e-19	4.51e-19	2.71e-19	1.69e-21	1.53e-43
40100	be 10	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.369e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20	4.37e-20
60140	c 14	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.897e-18	2.90e-18	2.90e-18	2.90e-18	2.89e-18	2.86e-18	2.57e-18
70160	n 16	3.674e-07	1.080e-09	1.768e-32	0.	0.	0.	0.	0.	0.	0.	0.	0.
	total	3.674e-07	1.080e-09	3.417e-18	3.417e-18	3.417e-18	3.417e-18	3.42e-18	3.42e-18	3.39e-18	3.21e-18	2.91e-18	2.61e-18

Table A-6. (continued)

summary of tdf ss diode with 10cm opening: boral and aluminum first wall part-2

10-6 s operation time 1.000e-06 sec

after shutdown sec		total act ci	total bhp km3/kw	total aht mw	beta aht mw	per act ci/w	% aht %
0.	0	2.283e+03	3.591e-05	9.563e-04	4.541e-05	1.047e-06	4.386e-05
6.000e+01	1 m	6.934e+02	1.145e-05	1.327e-05	4.410e-06	3.180e-07	6.087e-07
6.000e+02	10 m	8.682e+01	2.138e-06	5.902e-02	4.423e-07	3.982e-08	2.707e-03
3.600e+03	1 h	1.361e+01	9.930e-07	7.971e-01	4.593e-08	6.242e-09	3.655e-02
2.160e+04	6 h	9.050e+00	7.544e-07	1.673e-02	2.904e-08	4.151e-09	7.671e-04
8.640e+04	1 d	3.726e+00	3.240e-07	1.853e-06	1.169e-08	1.709e-09	8.499e-08
6.048e+05	1 w	4.839e-02	2.584e-09	3.499e-05	1.903e-11	2.219e-11	1.605e-06
2.630e+06	1 mo	2.741e-02	1.912e-09	7.327e-09	3.472e-12	1.257e-11	3.360e-10
3.156e+07	1 yr	4.155e-03	7.148e-10	1.038e-11	1.273e-12	1.905e-12	4.761e-13
3.156e+08	10 yr	6.303e-04	8.045e+00	1.034e-13	2.788e-14	2.891e-13	4.741e-15
3.156e+09	100 yr	6.388e-06	2.035e+00	2.140e-15	7.837e-16	2.930e-15	9.815e-17
3.156e+10	1000 y	2.515e-07	1.009e-03	1.631e-15	2.757e-16	1.154e-16	7.479e-17

APPENDIX B. SAMPLE PROBLEMS FOR CONVERT

Sample Problem B.1

This sample problem is a continuation of sample problem A.1 for which the binary γ-ray source file created by DKR is now rewritten in FIDO format for use in the DOSE code.

Note. The output file created has the following format (I2,A1,E9.3). Thus, the output looks like the following examples 12R__.XXX+XXX or _0_.XXX_XXX. If the input to ANISN is read format free, the 0 on the second example must be removed or one will obtain an error for the ANISN source read. The 0 can be removed by an editor using a global _0_ change to ___ command (_ refers to a blank space).

Table B-1. Input for Sample Problem B.1

```
1    0
1
4    67
```

Table B-2. Output for Sample Problem B.1

```
          ------ input values ------

          number of binary files to be read - "nf"                1
          number of values to be inserted - "isrt"                0
          0/1 - overlay/sequential read - "iswtch"                1

          file number units - "nt(i)"
                 4

          file names - "fnam(i)"
              gam1

          last interval to be read on files - "intr(i)"
                67

          reading of binary file  4 completed.         67 intervals have been read  total no. of intervals is     67

          the gamma source file for after shutdown time no. 1 is given below

 group =   1
67r0.
 group =   2
67r0.
 group =   3
67r0.
 group =   4
67r0.
 group =   5
17r0.         0 1.701e+09 0 1.195e+09 0 8.389e+08 0 5.852e+08 0 4.068e+08
 0 2.819e+08 0 1.949e+08 0 1.345e+08 0 9.269e+07 0 6.381e+07 0 4.390e+07
 0 3.018e+07 0 2.074e+07 0 1.425e+07 0 9.790e+06 0 6.724e+06 0 4.618e+06
 0 3.172e+06 0 2.178e+06 0 1.496e+06 0 1.027e+06 0 7.058e+05 0 4.848e+05
 0 3.331e+05 0 2.288e+05 0 1.572e+05 0 1.081e+05 0 7.427e+04 0 5.105e+04
 0 3.509e+04 0 2.413e+04 0 1.659e+04 0 1.141e+04 0 7.845e+03 0 5.396e+03
 0 3.712e+03 0 2.553e+03 0 1.757e+03 0 1.209e+03 0 8.318e+02 0 5.725e+02
 0 3.940e+02 0 2.712e+02 0 1.867e+02 0 1.285e+02 0 8.849e+01 0 6.091e+01
 0 4.191e+01 0 2.879e+01 0 1.961e+01
 group =   6
67r0.
 group =   7
17r0.         0 2.347e+10 0 1.649e+10 0 1.158e+10 0 8.075e+09 0 5.614e+09
 0 3.890e+09 0 2.689e+09 0 1.856e+09 0 1.279e+09 0 8.806e+08 0 6.058e+08
 0 4.165e+08 0 2.863e+08 0 1.967e+08 0 1.351e+08 0 9.280e+07 0 6.373e+07
 0 4.377e+07 0 3.006e+07 0 2.064e+07 0 1.418e+07 0 9.739e+06 0 6.690e+06
 0 4.596e+06 0 3.158e+06 0 2.170e+06 0 1.491e+06 0 1.025e+06 0 7.045e+05
```

Table B-2. (continued)

```
 0 4.843e+05 0 3.329e+05 0 2.289e+05 0 1.574e+05 0 1.083e+05 0 7.446e+04
 0 5.122e+04 0 3.524e+04 0 2.424e+04 0 1.668e+04 0 1.148e+04 0 7.900e+03
 0 5.437e+03 0 3.743e+03 0 2.577e+03 0 1.774e+03 0 1.221e+03 0 8.406e+02
 0 5.783e+02 0 3.973e+02 0 2.706e+02
 group =   8
67r0.
 group =   9
67r0.
 group =  10
67r0.
 group =  11
67r0.
 group =  12
67r0.
 group =  13
67r0.
 group =  14
12r0.        0 6.656e+08 0 6.056e+08 0 5.525e+08 0 5.040e+08 0 4.589e+08
 0 3.401e+08 0 2.390e+08 0 1.678e+08 0 1.170e+08 0 8.136e+07 0 5.638e+07
 0 3.898e+07 0 2.690e+07 0 1.854e+07 0 1.276e+07 0 8.780e+06 0 6.037e+06
 0 4.149e+06 0 2.851e+06 0 1.958e+06 0 1.345e+06 0 9.236e+05 0 6.343e+05
 0 4.356e+05 0 2.992e+05 0 2.055e+05 0 1.412e+05 0 9.696e+04 0 6.661e+04
 0 4.577e+04 0 3.145e+04 0 2.161e+04 0 1.485e+04 0 1.021e+04 0 7.018e+03
 0 4.825e+03 0 3.318e+03 0 2.281e+03 0 1.569e+03 0 1.079e+03 0 7.423e+02
 0 5.107e+02 0 3.514e+02 0 2.418e+02 0 1.664e+02 0 1.145e+02 0 7.880e+01
 0 5.424e+01 0 3.734e+01 0 2.571e+01 0 1.770e+01 0 1.218e+01 0 8.382e+00
 0 5.758e+00 0 3.922e+00
 group =  15
67r0.
 group =  16
12r0.        0 1.776e+09 0 1.735e+09 0 1.698e+09 0 1.663e+09 0 1.631e+09
50r0.
 group =  17
12r0.        0 1.686e+09 0 1.540e+09 0 1.409e+09 0 1.288e+09 0 1.173e+09
50r0.
 group =  18
12r0.        0 2.381e+09 0 2.181e+09 0 1.999e+09 0 1.830e+09 0 1.666e+09
50r0.
 group =  19
67r0.
 group =  20
67r0.
 group =  21
67r0.
```

Sample Problem B.2

Sample problem B.2 is a continuation of sample problem A.2 for which a FIDO formatted file is created for use in the DOSE code. Since the 11 void mesh intervals were removed in the DKR calculation, they must now be restored in the γ-ray source file before the dose rate calculation. Thus, eleven additional mesh intervals are inserted via the ISRT parameter. The inserted mesh intervals are for position 1.

Table B-3. Input for Sample Problem B.2

```
1    11
1
4    56
0     1
0     1
0     1
0     1
0     1
0     1
0     1
0     1
0     1
0     1
0     1
```

Table B-4. Output for Sample Problem B.3

```
------ input values ------

number of binary files to be read - "nf"                1
number of values to be inserted - "isrt"               11
0/1 - overlay/sequential read - "iswtch"                1

file number units - "nt(i)"
       4

file names - "fnam(i)"
    gam1

last interval to be read on files - "intr(i)"
      56

reading of binary file  4 completed.          56 intervals have been read  total no. of intervals is      56

insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1


insert values for after shutdown no.  0 and position  1
```

Table B-4. (continued)

```
          insert values for after shutdown no.  0 and position  1

          the gamma source file for after shutdown time no. 1 is given below

 group =   1
67r0.
 group =   2
67r0.
 group =   3
67r0.
 group =   4
67r0.
 group =   5
17r0.        0 1.701e+09 0 1.195e+09 0 8.389e+08 0 5.852e+08 0 4.068e+08
 0 2.819e+08 0 1.949e+08 0 1.345e+08 0 9.269e+07 0 6.381e+07 0 4.390e+07
 0 3.018e+07 0 2.074e+07 0 1.425e+07 0 9.790e+06 0 6.724e+06 0 4.618e+06
 0 3.172e+06 0 2.178e+06 0 1.496e+06 0 1.027e+06 0 7.058e+05 0 4.848e+05
 0 3.331e+05 0 2.288e+05 0 1.572e+05 0 1.081e+05 0 7.427e+04 0 5.105e+04
 0 3.509e+04 0 2.413e+04 0 1.659e+04 0 1.141e+04 0 7.845e+03 0 5.396e+03
 0 3.712e+03 0 2.553e+03 0 1.757e+03 0 1.209e+03 0 8.318e+02 0 5.725e+02
 0 3.940e+02 0 2.712e+02 0 1.867e+02 0 1.285e+02 0 8.849e+01 0 6.091e+01
 0 4.191e+01 0 2.879e+01 0 1.961e+01
 group =   6
67r0.
 group =   7
17r0.        0 2.347e+10 0 1.649e+10 0 1.158e+10 0 8.075e+09 0 5.614e+09
 0 3.890e+09 0 2.689e+09 0 1.856e+09 0 1.279e+09 0 8.806e+08 0 6.058e+08
 0 4.165e+08 0 2.863e+08 0 1.967e+08 0 1.351e+08 0 9.280e+07 0 6.373e+07
 0 4.377e+07 0 3.006e+07 0 2.064e+07 0 1.418e+07 0 9.739e+06 0 6.690e+06
 0 4.596e+06 0 3.158e+06 0 2.170e+06 0 1.491e+06 0 1.025e+06 0 7.045e+05
 0 4.843e+05 0 3.329e+05 0 2.289e+05 0 1.574e+05 0 1.083e+05 0 7.446e+04
 0 5.122e+04 0 3.524e+04 0 2.424e+04 0 1.668e+04 0 1.148e+04 0 7.900e+03
 0 5.437e+03 0 3.743e+03 0 2.577e+03 0 1.774e+03 0 1.221e+03 0 8.406e+02
 0 5.783e+02 0 3.973e+02 0 2.706e+02
 group =   8
67r0.
 group =   9
67r0.
 group =  10
67r0.
 group =  11
11r0.        0 1.276e+0055r0.
```

Table B-4. (continued)

```
 group =  12
11r0.        0 2.311e+05 0 9.134e+07 0 8.298e+07 0 7.555e+07 0 6.880e+07
 0 6.259e+0750r0.
 group =  13
11r0.        0 1.711e+01 0 8.427e+03 0 7.660e+03 0 6.979e+03 0 6.359e+03
 0 5.785e+0350r0.
 group =  14
11r0.        0 3.661e+03 0 7.041e+08 0 6.407e+08 0 5.844e+08 0 5.331e+08
 0 4.854e+08 0 3.401e+08 0 2.390e+08 0 1.678e+08 0 1.170e+08 0 8.136e+07
 0 5.638e+07 0 3.898e+07 0 2.690e+07 0 1.854e+07 0 1.276e+07 0 8.780e+06
 0 6.037e+06 0 4.149e+06 0 2.851e+06 0 1.958e+06 0 1.345e+06 0 9.236e+05
 0 6.343e+05 0 4.356e+05 0 2.992e+05 0 2.055e+05 0 1.412e+05 0 9.696e+04
 0 6.661e+04 0 4.577e+04 0 3.145e+04 0 2.161e+04 0 1.485e+04 0 1.021e+04
 0 7.018e+03 0 4.825e+03 0 3.318e+03 0 2.281e+03 0 1.569e+03 0 1.079e+03
 0 7.423e+02 0 5.107e+02 0 3.514e+02 0 2.418e+02 0 1.664e+02 0 1.145e+02
 0 7.880e+01 0 5.424e+01 0 3.734e+01 0 2.571e+01 0 1.770e+01 0 1.218e+01
 0 8.382e+00 0 5.758e+00 0 3.922e+00
 group =  15
11r0.        0 3.623e+05 0 1.446e+08 0 1.314e+08 0 1.197e+08 0 1.091e+08
 0 9.934e+0750r0.
 group =  16
11r0.        0 3.418e+06 0 3.285e+09 0 3.107e+09 0 2.949e+09 0 2.803e+09
 0 2.668e+0950r0.
 group =  17
11r0.        0 2.735e+04 0 1.823e+09 0 1.665e+09 0 1.523e+09 0 1.392e+09
 0 1.267e+0950r0.
 group =  18
11r0.        0 9.283e+04 0 2.448e+09 0 2.242e+09 0 2.056e+09 0 1.881e+09
 0 1.714e+0950r0.
 group =  19
11r0.        0 1.285e+03 0 2.829e+06 0 2.588e+06 0 2.371e+06 0 2.170e+06
 0 1.978e+0650r0.
 group =  20
11r0.        0 1.101e+02 0 1.672e+05 0 1.528e+05 0 1.397e+05 0 1.276e+05
 0 1.161e+0550r0.
 group =  21
12r0.        0 1.111e+04 0 1.006e+04 0 9.128e+03 0 8.286e+03 0 7.518e+03
50r0.
```

Sample Problem B.3

Sample problem B.3 consists of stacking or sequentially adding the DKR created binary γ-ray source files of parts II through V of the Target Development Facility Diode problem. The ISWTCH parameter is used to switch on the sequential addition option. The FIDO formatted file created is for use in the DOSE code.

Table B-5. Input for Sample Problem B.3

```
4     0
1
3   640
4   256
7   224
8   352
```

Table B-6. Output for Sample Problem B.3

```
 ——— input values ———

 number of binary files to be read - "nf"                4
 number of values to be inserted - "isrt"                0
 0/1 - overlay/sequential read - "iswtch"                1

 file number units - "nt(i)"
        3       4       7       8

 file names - "fnam(i)"
     gam1    gam2    gam3    gam4

 last interval to be read on files - "intr(i)"
      640     256     224     352

 reading of binary file  3 completed.        640 intervals have been read  total no. of intervals is    640

 reading of binary file  4 completed.        256 intervals have been read  total no. of intervals is    896

 reading of binary file  7 completed.        224 intervals have been read  total no. of intervals is   1120

 reading of binary file  8 completed.        352 intervals have been read  total no. of intervals is   1472

 the gamma source file for after shutdown time no. 1 is given below

  group =   1
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
  group =   2
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
  group =   3
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
  group =   4
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
  group =   5
99r0.       51r0.        0 6.215e+06 0 6.050e+06 0 5.951e+06 0 5.886e+06
 0 5.839e+06 0 5.806e+06 0 5.763e+06 0 5.766e+06 0 5.733e+06 0 5.735e+06
22r0.        0 5.315e+06 0 4.735e+06 0 4.904e+06 0 4.635e+06 0 4.630e+06
```

Table B-6. (continued)

```
 0 4.544e+06 0 4.616e+06 0 4.488e+06 0 4.529e+06 0 4.517e+0622r0.
 0 4.522e+06 0 3.973e+06 0 3.909e+06 0 3.793e+06 0 3.666e+06 0 3.659e+06
 0 3.643e+06 0 3.588e+06 0 3.591e+06 0 3.585e+0622r0.        0 4.004e+06
 0 3.138e+06 0 3.110e+06 0 2.922e+06 0 2.818e+06 0 2.861e+06 0 2.714e+06
 0 2.797e+06 0 2.726e+06 0 2.731e+0622r0.        0 3.451e+06 0 2.857e+06
 0 2.601e+06 0 2.543e+06 0 2.363e+06 0 2.358e+06 0 2.303e+06 0 2.284e+06
 0 2.290e+06 0 2.261e+0622r0.        0 3.084e+06 0 2.337e+06 0 2.090e+06
 0 1.934e+06 0 1.870e+06 0 1.694e+06 0 1.753e+06 0 1.651e+06 0 1.686e+06
 0 1.647e+0622r0.        0 2.962e+06 0 2.008e+06 0 1.739e+06 0 1.516e+06
 0 1.474e+06 0 1.329e+06 0 1.252e+06 0 1.309e+06 0 1.189e+06 0 1.234e+06
22r0.        0 2.522e+06 0 1.948e+06 0 1.359e+06 0 1.326e+06 0 1.092e+06
 0 1.088e+06 0 9.628e+05 0 9.618e+05 0 9.316e+05 0 9.161e+0522r0.
 0 2.441e+06 0 1.718e+06 0 1.271e+06 0 1.026e+06 0 9.763e+05 0 8.023e+05
 0 8.010e+05 0 7.217e+05 0 7.111e+05 0 6.988e+0522r0.        0 2.578e+06
 0 1.511e+06 0 1.195e+06 0 9.191e+05 0 8.075e+05 0 6.865e+05 0 6.176e+05
 0 5.744e+05 0 5.530e+05 0 5.428e+0522r0.        0 2.388e+06 0 1.517e+06
 0 1.063e+06 0 8.874e+05 0 6.430e+05 0 6.271e+05 0 4.910e+05 0 4.996e+05
 0 4.316e+05 0 4.360e+0522r0.        0 1.993e+06 0 1.565e+06 0 9.954e+05
 0 7.632e+05 0 6.319e+05 0 4.849e+05 0 4.711e+05 0 3.760e+05 0 3.935e+05
 0 3.469e+0522r0.        0 1.987e+06 0 1.384e+06 0 9.945e+05 0 6.942e+05
 0 5.556e+05 0 4.537e+05 0 3.926e+05 0 3.273e+05 0 3.181e+05 0 2.994e+05
22r0.        0 2.231e+06 0 1.181e+06 0 9.581e+05 0 6.471e+05 0 5.025e+05
 0 4.177e+05 0 3.230e+05 0 3.196e+05 0 2.479e+05 0 2.561e+0516r0.
 0 3.473e+06 0 2.195e+06 0 1.646e+06 0 1.822e+06 0 1.309e+06 0 0.
 0 2.259e+06 0 1.173e+06 0 8.468e+05 0 6.386e+05 0 4.574e+05 0 3.843e+05
 0 2.964e+05 0 2.557e+05 0 2.440e+05 0 2.140e+0516r0.        0 2.972e+06
 0 1.933e+06 0 1.233e+06 0 1.289e+06 0 1.150e+06 0 0.        0 1.828e+06
 0 1.308e+06 0 7.647e+05 0 6.318e+05 0 4.332e+05 0 3.349e+05 0 2.930e+05
 0 2.230e+05 0 2.115e+05 0 1.951e+0518r0.        0 1.076e+06 0 9.531e+05
 0 1.027e+06 0 0.        0 1.308e+06 0 1.357e+06 0 7.655e+05 0 5.688e+05
 0 4.637e+05 0 3.004e+05 0 2.820e+05 0 2.164e+05 0 1.954e+05 0 1.785e+05
12r0.        0 4.813e+02 0 3.675e+02 4r0.        0 9.635e+05 0 8.577e+05
 0 8.903e+05 0 0.        0 1.143e+06 0 1.148e+06 0 7.933e+05 0 5.607e+05
 0 4.106e+05 0 3.346e+05 0 2.556e+05 0 2.107e+05 0 1.951e+05 0 1.660e+05
12r0.        0 3.469e+02 0 3.082e+02 4r0.        0 8.796e+05 0 7.054e+05
 0 7.783e+05 0 0.        0 1.001e+06 0 9.190e+05 0 7.304e+05 0 5.631e+05
 0 4.058e+05 0 2.863e+05 0 2.610e+05 0 2.047e+05 0 1.704e+05 0 1.637e+05
18r0.        0 7.933e+05 0 6.288e+05 0 6.767e+05 0 0.        0 8.752e+05
 0 8.101e+05 0 6.594e+05 0 5.200e+05 0 4.456e+05 0 2.590e+05 0 2.326e+05
 0 2.197e+05 0 1.397e+05 0 1.691e+0518r0.        0 6.558e+05 0 6.000e+05
 0 5.610e+05 0 0.        0 8.333e+05 0 6.845e+05 0 6.191e+05 0 4.682e+05
 0 4.193e+05 0 2.890e+05 0 2.062e+05 0 1.979e+05 0 1.644e+05 0 1.441e+05
18r0.        0 5.572e+05 0 5.486e+05 0 4.796e+05 0 0.        0 8.099e+05
 0 5.876e+05 0 5.617e+05 0 4.199e+05 0 3.832e+05 0 3.004e+05 0 2.108e+05
 0 1.694e+05 0 1.751e+05 0 1.316e+05 5r0.        0 1.782e+02 0 1.895e+02
```

Table B-6. (continued)

```
11r0.        0 5.085e+05 0 4.504e+05 0 4.336e+05 0 0.        0 7.741e+05
 0 4.902e+05 0 4.836e+05 0 3.682e+05 0 3.217e+05 0 2.870e+05 0 2.175e+05
 0 1.626e+05 0 1.434e+05 0 1.431e+0518r0.         0 4.717e+05 0 3.561e+05
 0 3.934e+05 0 0.        0 6.852e+05 0 4.383e+05 0 3.840e+05 0 3.480e+05
 0 2.529e+05 0 2.577e+05 0 2.156e+05 0 1.599e+05 0 1.389e+05 0 1.332e+05
18r0.        0 4.249e+05 0 3.285e+05 0 3.358e+05 0 0.        0 5.584e+05
 0 4.404e+05 0 3.270e+05 0 3.137e+05 0 2.390e+05 0 2.209e+05 0 1.968e+05
 0 1.678e+05 0 1.308e+05 0 1.245e+0518r0.         0 3.559e+05 0 3.028e+05
 0 2.684e+05 0 0.        0 4.845e+05 0 3.784e+05 0 2.911e+05 0 2.646e+05
 0 2.165e+05 0 1.881e+05 0 1.800e+05 0 1.522e+05 0 1.302e+05 0 1.125e+05
18r0.        0 3.093e+05 0 2.788e+05 0 2.329e+05 0 0.        0 4.656e+05
 0 3.241e+05 0 2.704e+05 0 2.334e+05 0 1.909e+05 0 1.739e+05 0 1.690e+05
 0 1.327e+05 0 1.426e+05 0 9.961e+0418r0.         0 2.871e+05 0 2.619e+05
 0 2.137e+05 0 0.        0 4.568e+05 0 2.982e+05 0 2.597e+05 0 2.061e+05
 0 1.836e+05 0 1.638e+05 0 1.516e+05 0 1.403e+05 0 1.258e+05 0 1.016e+05
18r0.        0 2.171e+05 0 2.088e+05 0 1.639e+05 0 0.        0 3.223e+05
 0 2.516e+05 0 1.833e+05 0 1.631e+05 0 1.357e+05 0 1.198e+05 0 1.101e+05
 0 1.055e+05 0 9.767e+04 0 9.325e+0422r0.         0 1.887e+05 0 1.845e+05
 0 1.206e+05 0 1.038e+05 0 9.082e+04 0 7.436e+04 0 6.768e+04 0 6.226e+04
 0 6.754e+04 0 7.492e+0422r0.         0 1.771e+05 0 1.602e+05 0 1.168e+05
 0 8.304e+04 0 8.955e+04 0 6.379e+04 0 5.777e+04 0 5.518e+04 0 6.294e+04
 0 6.305e+0422r0.         0 1.638e+05 0 1.490e+05 0 1.131e+05 0 7.894e+04
 0 7.671e+04 0 6.200e+04 0 5.193e+04 0 5.634e+04 0 5.656e+04 0 5.173e+04
22r0.        0 1.612e+05 0 1.217e+05 0 1.085e+05 0 7.017e+04 0 5.775e+04
 0 5.647e+04 0 5.197e+04 0 4.977e+04 0 4.496e+04 0 4.117e+0422r0.
 0 1.670e+05 0 1.129e+05 0 9.959e+04 0 6.422e+04 0 5.047e+04 0 4.974e+04
 0 4.774e+04 0 4.032e+04 0 3.800e+04 0 3.568e+0422r0.         0 2.088e+05
 0 1.147e+05 0 9.875e+04 0 6.512e+04 0 4.919e+04 0 4.755e+04 0 3.796e+04
 0 3.304e+04 0 3.130e+04 0 2.870e+0422r0.         0 2.490e+05 0 1.311e+05
 0 9.498e+04 0 7.516e+04 0 4.711e+04 0 3.959e+04 0 3.481e+04 0 2.705e+04
 0 2.508e+04 0 2.304e+0422r0.         0 2.547e+05 0 1.440e+05 0 9.759e+04
 0 8.220e+04 0 4.493e+04 0 3.632e+04 0 3.114e+04 0 2.957e+04 0 2.181e+04
 0 2.251e+0417r0.         0 2.243e+05 0 2.504e+05 0 3.067e+05 0 2.527e+05
 0 2.302e+05 0 2.324e+05 0 1.368e+05 0 1.010e+05 0 8.359e+04 0 5.238e+04
 0 3.557e+04 0 2.976e+04 0 2.466e+04 0 2.216e+04 0 2.012e+0417r0.
 0 2.344e+05 0 1.597e+05 0 1.956e+05 0 1.762e+05 0 1.450e+05 0 1.665e+05
 0 1.316e+05 0 7.862e+04 0 7.464e+04 0 6.238e+04 0 3.809e+04 0 2.940e+04
 0 2.298e+04 0 1.832e+04 0 1.790e+0417r0.         0 2.979e+05 0 1.180e+05
 0 1.330e+05 0 1.208e+05 0 8.749e+04 0 1.055e+05 0 1.149e+05 0 6.922e+04
 0 4.692e+04 0 4.980e+04 0 4.200e+04 0 2.947e+04 0 2.473e+04 0 1.810e+04
 0 1.639e+0417r0.         0 3.078e+05 0 1.014e+05 0 8.911e+04 0 9.595e+04
 0 6.336e+04 0 5.544e+04 0 7.684e+04 0 7.100e+04 0 4.380e+04 0 2.899e+04
 0 2.818e+04 0 2.736e+04 0 2.326e+04 0 2.032e+04 0 1.605e+0417r0.
 0 2.639e+05 0 9.860e+04 0 6.000e+04 0 7.075e+04 0 6.232e+04 0 3.848e+04
 0 3.659e+04 0 5.015e+04 0 4.361e+04 0 3.291e+04 0 1.920e+04 0 1.498e+04
```

Table B-6. (continued)

```
 0 1.748e+04 0 1.759e+04 0 1.648e+04
 group =   6
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
 group =   7
99r0.       51r0.        0 8.576e+07 0 8.349e+07 0 8.212e+07 0 8.122e+07
 0 8.058e+07 0 8.013e+07 0 7.953e+07 0 7.957e+07 0 7.912e+07 0 7.914e+07
22r0.        0 7.334e+07 0 6.534e+07 0 6.767e+07 0 6.397e+07 0 6.389e+07
 0 6.271e+07 0 6.371e+07 0 6.193e+07 0 6.250e+07 0 6.234e+0722r0.
 0 6.240e+07 0 5.483e+07 0 5.394e+07 0 5.234e+07 0 5.059e+07 0 5.050e+07
 0 5.027e+07 0 4.951e+07 0 4.956e+07 0 4.947e+0722r0.        0 5.525e+07
 0 4.331e+07 0 4.291e+07 0 4.033e+07 0 3.888e+07 0 3.948e+07 0 3.745e+07
 0 3.860e+07 0 3.762e+07 0 3.769e+0722r0.        0 4.763e+07 0 3.943e+07
 0 3.589e+07 0 3.509e+07 0 3.261e+07 0 3.254e+07 0 3.178e+07 0 3.151e+07
 0 3.161e+07 0 3.120e+0722r0.        0 4.256e+07 0 3.226e+07 0 2.884e+07
 0 2.668e+07 0 2.581e+07 0 2.338e+07 0 2.420e+07 0 2.279e+07 0 2.327e+07
 0 2.273e+0722r0.        0 4.087e+07 0 2.771e+07 0 2.400e+07 0 2.093e+07
 0 2.034e+07 0 1.833e+07 0 1.727e+07 0 1.806e+07 0 1.641e+07 0 1.703e+07
22r0.        0 3.480e+07 0 2.689e+07 0 1.875e+07 0 1.830e+07 0 1.507e+07
 0 1.502e+07 0 1.329e+07 0 1.327e+07 0 1.286e+07 0 1.264e+0722r0.
 0 3.369e+07 0 2.370e+07 0 1.755e+07 0 1.416e+07 0 1.347e+07 0 1.107e+07
 0 1.105e+07 0 9.960e+06 0 9.813e+06 0 9.644e+0622r0.        0 3.558e+07
 0 2.085e+07 0 1.649e+07 0 1.268e+07 0 1.114e+07 0 9.474e+06 0 8.522e+06
 0 7.927e+06 0 7.632e+06 0 7.490e+0622r0.        0 3.295e+07 0 2.093e+07
 0 1.467e+07 0 1.225e+07 0 8.874e+06 0 8.654e+06 0 6.776e+06 0 6.894e+06
 0 5.956e+06 0 6.016e+0622r0.        0 2.750e+07 0 2.159e+07 0 1.374e+07
 0 1.053e+07 0 8.720e+06 0 6.691e+06 0 6.502e+06 0 5.189e+06 0 5.431e+06
 0 4.787e+0622r0.        0 2.742e+07 0 1.909e+07 0 1.372e+07 0 9.580e+06
 0 7.667e+06 0 6.261e+06 0 5.419e+06 0 4.517e+06 0 4.390e+06 0 4.131e+06
22r0.        0 3.078e+07 0 1.629e+07 0 1.322e+07 0 8.930e+06 0 6.934e+06
 0 5.764e+06 0 4.458e+06 0 4.411e+06 0 3.422e+06 0 3.534e+0616r0.
 0 4.792e+07 0 3.029e+07 0 2.272e+07 0 2.515e+07 0 1.806e+07 0 0.
 0 3.117e+07 0 1.619e+07 0 1.169e+07 0 8.812e+06 0 6.312e+06 0 5.304e+06
 0 4.091e+06 0 3.528e+06 0 3.368e+06 0 2.954e+0616r0.        0 4.102e+07
 0 2.667e+07 0 1.702e+07 0 1.778e+07 0 1.587e+07 0 0.        0 2.523e+07
 0 1.805e+07 0 1.055e+07 0 8.719e+06 0 5.978e+06 0 4.622e+06 0 4.044e+06
 0 3.078e+06 0 2.918e+06 0 2.693e+0618r0.        0 1.484e+07 0 1.315e+07
 0 1.418e+07 0 0.        0 1.805e+07 0 1.873e+07 0 1.056e+07 0 7.849e+06
 0 6.398e+06 0 4.146e+06 0 3.891e+06 0 2.987e+06 0 2.696e+06 0 2.463e+06
12r0.        0 6.643e+03 0 5.071e+03 4r0.        0 1.330e+07 0 1.184e+07
 0 1.229e+07 0 0.        0 1.577e+07 0 1.584e+07 0 1.095e+07 0 7.738e+06
 0 5.666e+06 0 4.617e+06 0 3.527e+06 0 2.907e+06 0 2.692e+06 0 2.291e+06
12r0.        0 4.788e+03 0 4.253e+03 4r0.        0 1.214e+07 0 9.734e+06
 0 1.074e+07 0 0.        0 1.381e+07 0 1.268e+07 0 1.008e+07 0 7.771e+06
```

Table B-6. (continued)

```
 0 5.600e+06 0 3.951e+06 0 3.601e+06 0 2.825e+06 0 2.352e+06 0 2.259e+06
18r0.        0 1.095e+07 0 8.677e+06 0 9.338e+06 0 0.        0 1.208e+07
 0 1.118e+07 0 9.100e+06 0 7.176e+06 0 6.150e+06 0 3.574e+06 0 3.209e+06
 0 3.032e+06 0 1.928e+06 0 2.333e+0618r0.        0 9.050e+06 0 8.280e+06
 0 7.742e+06 0 0.        0 1.150e+07 0 9.446e+06 0 8.544e+06 0 6.461e+06
 0 5.786e+06 0 3.988e+06 0 2.846e+06 0 2.731e+06 0 2.268e+06 0 1.988e+06
18r0.        0 7.689e+06 0 7.570e+06 0 6.618e+06 0 0.        0 1.118e+07
 0 8.108e+06 0 7.752e+06 0 5.795e+06 0 5.289e+06 0 4.145e+06 0 2.909e+06
 0 2.338e+06 0 2.416e+06 0 1.816e+06 5r0.        0 2.459e+03 0 2.615e+03
11r0.        0 7.018e+06 0 6.215e+06 0 5.984e+06 0 0.        0 1.068e+07
 0 6.765e+06 0 6.674e+06 0 5.081e+06 0 4.440e+06 0 3.960e+06 0 3.002e+06
 0 2.244e+06 0 1.979e+06 0 1.974e+0618r0.        0 6.510e+06 0 4.914e+06
 0 5.429e+06 0 0.        0 9.456e+06 0 6.048e+06 0 5.299e+06 0 4.803e+06
 0 3.491e+06 0 3.556e+06 0 2.976e+06 0 2.207e+06 0 1.917e+06 0 1.838e+06
18r0.        0 5.864e+06 0 4.533e+06 0 4.634e+06 0 0.        0 7.706e+06
 0 6.078e+06 0 4.513e+06 0 4.329e+06 0 3.298e+06 0 3.048e+06 0 2.716e+06
 0 2.316e+06 0 1.805e+06 0 1.718e+0618r0.        0 4.912e+06 0 4.179e+06
 0 3.704e+06 0 0.        0 6.686e+06 0 5.222e+06 0 4.017e+06 0 3.651e+06
 0 2.988e+06 0 2.596e+06 0 2.484e+06 0 2.100e+06 0 1.797e+06 0 1.552e+06
18r0.        0 4.268e+06 0 3.848e+06 0 3.214e+06 0 0.        0 6.425e+06
 0 4.473e+06 0 3.731e+06 0 3.220e+06 0 2.635e+06 0 2.399e+06 0 2.332e+06
 0 1.831e+06 0 1.968e+06 0 1.375e+0618r0.        0 3.962e+06 0 3.614e+06
 0 2.950e+06 0 0.        0 6.304e+06 0 4.115e+06 0 3.584e+06 0 2.845e+06
 0 2.534e+06 0 2.261e+06 0 2.092e+06 0 1.935e+06 0 1.737e+06 0 1.402e+06
18r0.        0 2.997e+06 0 2.881e+06 0 2.262e+06 0 0.        0 4.447e+06
 0 3.473e+06 0 2.530e+06 0 2.250e+06 0 1.873e+06 0 1.653e+06 0 1.520e+06
 0 1.457e+06 0 1.348e+06 0 1.287e+0622r0.        0 2.603e+06 0 2.546e+06
 0 1.664e+06 0 1.433e+06 0 1.253e+06 0 1.026e+06 0 9.339e+05 0 8.591e+05
 0 9.320e+05 0 1.034e+0622r0.        0 2.444e+06 0 2.211e+06 0 1.612e+06
 0 1.146e+06 0 1.236e+06 0 8.803e+05 0 7.972e+05 0 7.615e+05 0 8.686e+05
 0 8.702e+0522r0.        0 2.260e+06 0 2.056e+06 0 1.560e+06 0 1.089e+06
 0 1.059e+06 0 8.556e+05 0 7.166e+05 0 7.775e+05 0 7.805e+05 0 7.139e+05
22r0.        0 2.225e+06 0 1.679e+06 0 1.497e+06 0 9.683e+05 0 7.969e+05
 0 7.792e+05 0 7.171e+05 0 6.868e+05 0 6.205e+05 0 5.682e+0522r0.
 0 2.304e+06 0 1.558e+06 0 1.374e+06 0 8.862e+05 0 6.964e+05 0 6.863e+05
 0 6.588e+05 0 5.564e+05 0 5.243e+05 0 4.924e+0522r0.        0 2.881e+06
 0 1.583e+06 0 1.363e+06 0 8.986e+05 0 6.789e+05 0 6.562e+05 0 5.238e+05
 0 4.560e+05 0 4.320e+05 0 3.961e+0522r0.        0 3.436e+06 0 1.809e+06
 0 1.311e+06 0 1.037e+06 0 6.502e+05 0 5.463e+05 0 4.804e+05 0 3.732e+05
 0 3.461e+05 0 3.180e+0522r0.        0 3.515e+06 0 1.987e+06 0 1.347e+06
 0 1.134e+06 0 6.201e+05 0 5.012e+05 0 4.297e+05 0 4.081e+05 0 3.010e+05
 0 3.106e+0517r0.        0 3.095e+06 0 3.456e+06 0 4.232e+06 0 3.487e+06
 0 3.177e+06 0 3.207e+06 0 1.888e+06 0 1.394e+06 0 1.154e+06 0 7.228e+05
 0 4.909e+05 0 4.107e+05 0 3.404e+05 0 3.058e+05 0 2.777e+0517r0.
 0 3.234e+06 0 2.204e+06 0 2.699e+06 0 2.432e+06 0 2.002e+06 0 2.298e+06
```

Table B-6. (continued)

```
 0 1.816e+06 0 1.085e+06 0 1.030e+06 0 8.609e+05 0 5.257e+05 0 4.057e+05
 0 3.171e+05 0 2.529e+05 0 2.471e+0517r0.        0 4.111e+06 0 1.629e+06
 0 1.835e+06 0 1.667e+06 0 1.207e+06 0 1.455e+06 0 1.586e+06 0 9.553e+05
 0 6.474e+05 0 6.872e+05 0 5.797e+05 0 4.068e+05 0 3.412e+05 0 2.497e+05
 0 2.261e+0517r0.        0 4.247e+06 0 1.400e+06 0 1.230e+06 0 1.324e+06
 0 8.744e+05 0 7.650e+05 0 1.060e+06 0 9.797e+05 0 6.045e+05 0 4.001e+05
 0 3.888e+05 0 3.776e+05 0 3.210e+05 0 2.805e+05 0 2.215e+0517r0.
 0 3.642e+06 0 1.361e+06 0 8.280e+05 0 9.763e+05 0 8.600e+05 0 5.310e+05
 0 5.050e+05 0 6.921e+05 0 6.018e+05 0 4.541e+05 0 2.650e+05 0 2.067e+05
 0 2.413e+05 0 2.428e+05 0 2.274e+05
 group =   8
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
 group =   9
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
 group =  10
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       86r0.
 group =  11
 6r0.        0 2.280e-02 0 1.162e-02 0 1.105e-02 0 9.858e-03 0 9.689e-03
 0 9.272e-03 0 9.369e-03 0 9.102e-03 0 9.282e-03 0 8.992e-03 0 9.086e-03
 0 8.973e-03 0 9.017e-03 0 8.923e-03 0 8.886e-03 0 8.731e-03 0 8.733e-03
 0 8.658e-03 0 8.633e-03 0 8.587e-03 0 8.598e-03 0 8.571e-03 0 8.580e-03
 0 8.565e-03 0 8.570e-03 0 8.566e-0386r0.        0 1.266e-03 0 1.093e-03
 0 1.076e-03 0 1.017e-03 0 1.006e-03 0 9.802e-04 0 9.773e-04 0 9.661e-04
 0 9.656e-04 0 9.622e-0499r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       99r0.       99r0.       99r0.
99r0.       99r0.       99r0.       57r0.
 group =  12
 6r0.        0 2.212e+06 0 1.701e+06 0 1.233e+06 0 8.164e+05 0 5.762e+05
 0 4.581e+05 0 4.229e+05 0 3.705e+05 0 3.530e+05 0 3.501e+05 0 3.265e+05
 0 3.301e+05 0 3.073e+05 0 3.161e+05 0 2.944e+05 0 3.216e+05 0 2.815e+05
 0 3.079e+05 0 2.805e+05 0 2.973e+05 0 2.826e+05 0 2.953e+05 0 2.786e+05
 0 2.920e+05 0 2.823e+05 0 2.862e+05 6r0.        0 2.549e+06 0 1.919e+06
 0 1.417e+06 0 9.388e+05 0 6.521e+05 0 5.145e+05 0 4.639e+05 0 4.169e+05
 0 3.874e+05 0 3.761e+05 0 3.639e+05 0 3.545e+05 0 3.432e+05 0 3.377e+05
 0 3.329e+05 0 3.155e+05 0 3.252e+05 0 3.194e+05 0 3.242e+05 0 3.136e+05
 0 3.182e+05 0 3.151e+05 0 3.138e+05 0 3.134e+05 0 3.129e+05 0 3.121e+05
 6r0.        0 2.194e+06 0 1.555e+06 0 1.191e+06 0 7.886e+05 0 5.419e+05
 0 4.270e+05 0 3.676e+05 0 3.452e+05 0 3.083e+05 0 3.036e+05 0 2.892e+05
 0 2.806e+05 0 2.754e+05 0 2.649e+05 0 2.665e+05 0 2.543e+05 0 2.543e+05
```

Table B-6. (continued)

```
 0 2.567e+05 0 2.561e+05 0 2.494e+05 0 2.534e+05 0 2.468e+05 0 2.508e+05
 0 2.493e+05 0 2.453e+05 0 2.484e+0521r0.         0 2.455e+05 0 1.566e+05
 0 1.797e+05 0 1.585e+05 0 1.705e+05 0 1.623e+05 0 1.656e+05 0 1.605e+05
 0 1.667e+05 0 1.590e+05 0 1.635e+0521r0.         0 1.944e+0516r0.
 0 1.904e+06 0 1.536e+06 0 9.980e+05 0 7.815e+05 0 5.032e+05 0 3.782e+05
 0 3.522e+05 0 2.878e+05 0 3.091e+05 0 2.747e+05 0 2.539e+05 0 2.524e+05
 0 2.357e+05 0 2.354e+05 0 2.106e+05 0 1.740e+0531r0.         0 1.589e+05
16r0.         0 1.553e+06 0 1.484e+06 0 1.060e+06 0 6.865e+05 0 5.641e+05
 0 3.627e+05 0 2.966e+05 0 3.118e+05 0 2.222e+05 0 2.616e+05 0 2.437e+05
 0 2.135e+05 0 2.174e+05 0 2.015e+05 0 1.760e+05 0 1.277e+0531r0.
 0 1.320e+0531r0.         0 1.246e+0531r0.         0 1.006e+0531r0.
 0 1.139e+0531r0.         0 1.218e+0531r0.         0 9.574e+0431r0.
 0 8.079e+0431r0.         0 1.012e+0531r0.         0 1.179e+0531r0.
 0 1.016e+0531r0.         0 7.199e+0431r0.         0 4.411e+0421r0.
 0 2.223e+06 0 1.844e+06 0 1.269e+06 0 8.457e+05 0 7.017e+05 0 5.346e+05
 0 3.338e+05 3r0.         0 4.002e+0421r0.         0 1.938e+06 2r0.
 0 7.069e+05 0 6.241e+05 0 4.520e+05 0 2.992e+05 3r0.         0 4.313e+04
21r0.         0 1.667e+06 2r0.         0 5.928e+05 0 4.860e+05 0 3.692e+05
 0 2.333e+05 3r0.         0 4.021e+0421r0.         0 1.529e+06 0 8.411e+05
 0 8.124e+05 0 5.642e+05 0 3.766e+05 0 3.189e+05 0 1.899e+0525r0.
 0 1.438e+06 3r0.         0 3.587e+05 0 2.613e+05 0 1.816e+05 3r0.
 0 4.226e+0411r0.         0 6.307e+05 0 6.209e+05 0 6.393e+05 0 6.940e+05
 0 7.313e+05 0 7.792e+05 0 8.921e+05 3r0.         0 1.367e+06 3r0.
 0 3.668e+05 0 2.100e+05 0 1.702e+05 3r0.         0 3.638e+0411r0.
 0 4.880e+05 0 4.543e+05 0 4.934e+05 0 5.198e+05 2r0.         0 6.842e+05
 3r0.         0 1.292e+06 3r0.         0 3.979e+05 0 1.747e+05 0 1.347e+05
15r0.         0 3.595e+05 0 3.155e+05 0 3.614e+05 0 3.708e+05 0 3.848e+05
 0 4.064e+05 0 5.029e+05 7r0.         0 4.176e+05 0 1.542e+05 0 9.485e+04
15r0.         0 3.018e+05 0 2.489e+05 0 2.962e+05 3r0.         0 4.222e+05
 7r0.         0 4.382e+05 0 1.472e+05 0 7.761e+04 3r0.         0 2.037e+04
11r0.         0 2.431e+05 0 1.811e+05 0 2.251e+05 3r0.         0 3.548e+05
 7r0.         0 5.186e+05 0 1.340e+05 0 6.483e+04 3r0.         0 2.040e+04
11r0.         0 2.022e+05 0 1.466e+05 0 1.812e+0511r0.         0 5.841e+05
 0 1.289e+05 0 5.774e+04 3r0.         0 1.738e+0411r0.         0 1.776e+05
 0 1.275e+05 0 1.618e+0511r0.         0 5.897e+05 0 1.319e+05 0 5.353e+04
 3r0.         0 1.450e+0411r0.         0 1.077e+05 0 7.951e+04 0 1.214e+05
 3r0.         0 2.656e+05 0 3.153e+05 0 5.754e+05 0 8.493e+05 0 9.059e+05
 3r0.         0 3.843e+05 0 1.503e+05 0 4.183e+04 3r0.         0 9.347e+03
11r0.         0 4.021e+04 0 4.181e+04 0 8.172e+04 3r0.         0 1.526e+05
 0 6.839e+04 0 8.975e+04 0 1.689e+05 0 2.512e+05 3r0.         0 1.847e+05
 0 1.340e+05 0 4.908e+04 3r0.         0 5.840e+0311r0.         0 3.092e+04
 0 4.144e+04 0 7.022e+04 0 8.926e+04 0 1.183e+05 0 1.542e+05 0 1.246e+05
 0 5.208e+04 0 5.284e+04 0 7.591e+04 0 1.346e+05 0 3.977e+05 0 8.374e+05
 0 7.825e+05 0 2.116e+05 0 9.701e+04 0 6.284e+04 3r0.         0 5.997e+03
11r0.         0 2.868e+04 0 3.723e+04 0 5.815e+04 3r0.         0 1.040e+05
```

Table B-6. (continued)

```
 0 4.519e+04 0 4.083e+04 0 5.442e+04 0 9.673e+04 9r0.        0 6.967e+03
11r0.        0 2.778e+04 0 2.820e+04 0 4.629e+04 3r0.        0 7.439e+04
 0 3.712e+04 0 2.670e+04 0 3.454e+04 0 5.790e+04 0 1.690e+05 0 4.324e+05
 0 6.510e+05 0 5.484e+05 0 1.085e+05 4r0.        0 7.943e+0310r0.
 0 2.127e+04 0 2.473e+04 0 1.948e+04 0 4.223e+0412r0.        0 1.290e+05
 4r0.        0 1.027e+0410r0.        0 1.792e+04 0 1.547e+04 0 1.487e+04
 0 3.867e+04 0 5.655e+04 0 4.758e+04 0 4.242e+04 0 4.680e+04 0 3.517e+04
 0 1.979e+04 0 2.440e+04 0 3.788e+04 4r0.        0 1.510e+05 4r0.
 0 1.099e+0410r0.        0 8.266e+03 0 8.034e+03 0 1.343e+04 0 2.891e+04
 0 2.683e+04 0 2.141e+04 0 1.975e+04 0 2.528e+04 0 2.539e+04 0 1.490e+04
 0 1.589e+04 0 2.702e+04 4r0.        0 1.660e+05 4r0.        0 1.070e+04
10r0.        0 5.373e+03 0 6.310e+03 0 1.373e+04 0 2.031e+04 0 1.612e+04
 0 1.256e+04 0 1.254e+04 0 1.634e+04 0 1.803e+04 0 1.424e+04 0 1.165e+04
 0 2.345e+04 4r0.        0 1.662e+05 0 7.906e+03 0 1.035e+04 0 1.200e+04
 0 9.238e+03 0 1.018e+0421r0.        0 2.192e+04 4r0.        0 1.541e+05
26r0.        0 2.101e+04 4r0.        0 1.268e+0526r0.        0 1.831e+04
 4r0.        0 9.268e+0426r0.        0 1.485e+04 4r0.        0 6.398e+04
26r0.        0 1.246e+04 4r0.        0 4.242e+0415r0.
 group =  13
 6r0.        0 2.098e+02 0 1.624e+02 0 1.192e+02 0 8.064e+01 0 5.827e+01
 0 4.716e+01 0 4.368e+01 0 3.871e+01 0 3.699e+01 0 3.664e+01 0 3.439e+01
 0 3.456e+01 0 3.242e+01 0 3.309e+01 0 3.105e+01 0 3.344e+01 0 2.980e+01
 0 3.216e+01 0 2.966e+01 0 3.112e+01 0 2.981e+01 0 3.091e+01 0 2.941e+01
 0 3.060e+01 0 2.972e+01 0 3.006e+01 6r0.        0 2.411e+02 0 1.827e+02
 0 1.363e+02 0 9.210e+01 0 6.549e+01 0 5.255e+01 0 4.768e+01 0 4.317e+01
 0 4.034e+01 0 3.924e+01 0 3.800e+01 0 3.700e+01 0 3.587e+01 0 3.526e+01
 0 3.474e+01 0 3.312e+01 0 3.397e+01 0 3.340e+01 0 3.382e+01 0 3.282e+01
 0 3.323e+01 0 3.292e+01 0 3.280e+01 0 3.273e+01 0 3.270e+01 0 3.260e+01
 6r0.        0 2.072e+02 0 1.477e+02 0 1.141e+02 0 7.687e+01 0 5.405e+01
 0 4.331e+01 0 3.768e+01 0 3.548e+01 0 3.200e+01 0 3.152e+01 0 3.010e+01
 0 2.922e+01 0 2.865e+01 0 2.763e+01 0 2.771e+01 0 2.660e+01 0 2.658e+01
 0 2.678e+01 0 2.670e+01 0 2.608e+01 0 2.640e+01 0 2.581e+01 0 2.614e+01
 0 2.601e+01 0 2.562e+01 0 2.591e+0121r0.        0 2.529e+01 0 1.655e+01
 0 1.862e+01 0 1.668e+01 0 1.774e+01 0 1.699e+01 0 1.727e+01 0 1.680e+01
 0 1.736e+01 0 1.664e+01 0 1.706e+0121r0.        0 2.035e+0116r0.
 0 1.791e+02 0 1.447e+02 0 9.510e+01 0 7.513e+01 0 4.956e+01 0 3.806e+01
 0 3.562e+01 0 2.958e+01 0 3.153e+01 0 2.830e+01 0 2.633e+01 0 2.613e+01
 0 2.449e+01 0 2.439e+01 0 2.186e+01 0 1.825e+0131r0.        0 1.659e+01
16r0.        0 1.463e+02 0 1.395e+02 0 1.002e+02 0 6.588e+01 0 5.469e+01
 0 3.617e+01 0 3.003e+01 0 3.140e+01 0 2.301e+01 0 2.668e+01 0 2.497e+01
 0 2.209e+01 0 2.238e+01 0 2.078e+01 0 1.820e+01 0 1.347e+0131r0.
 0 1.374e+0131r0.        0 1.294e+0131r0.        0 1.060e+0131r0.
 0 1.180e+0131r0.        0 1.247e+0131r0.        0 9.986e+0031r0.
 0 8.542e+0031r0.        0 1.043e+0131r0.        0 1.195e+0131r0.
 0 1.034e+0131r0.        0 7.521e+0031r0.        0 4.802e+0021r0.
```

Table B-6. (continued)

```
0 1.570e+03 0 1.303e+03 0 9.009e+02 0 6.065e+02 0 5.070e+02 0 3.883e+02
0 2.457e+02 3r0.        0 4.336e+0021r0.        0 1.370e+03 0 5.128e+04
0 3.925e+04 0 5.063e+02 0 4.496e+02 0 3.281e+02 0 2.195e+02 3r0.
0 4.562e+0021r0.        0 1.179e+03 0 3.692e+04 0 3.287e+04 0 4.230e+02
0 3.492e+02 0 2.672e+02 0 1.711e+02 3r0.        0 4.204e+0021r0.
0 1.081e+03 0 5.949e+02 0 5.751e+02 0 4.012e+02 0 2.705e+02 0 2.301e+02
0 1.392e+0225r0.        0 1.017e+03 3r0.        0 2.568e+02 0 1.886e+02
0 1.324e+02 3r0.        0 4.315e+0011r0.        0 4.625e+02 0 4.551e+02
0 4.678e+02 0 5.064e+02 0 5.324e+02 0 5.661e+02 0 6.456e+02 3r0.
0 9.674e+02 3r0.        0 2.618e+02 0 1.518e+02 0 1.237e+02 3r0.
0 3.703e+0011r0.        0 3.579e+02 0 3.334e+02 0 3.615e+02 0 3.796e+02
0 1.938e+04 0 2.058e+04 0 4.958e+02 3r0.        0 9.144e+02 3r0.
0 2.833e+02 0 1.264e+02 0 9.798e+0115r0.        0 2.641e+02 0 2.320e+02
0 2.650e+02 0 2.710e+02 0 2.809e+02 0 2.960e+02 0 3.648e+02 7r0.
0 2.972e+02 0 1.116e+02 0 6.953e+0115r0.        0 2.202e+02 0 1.820e+02
0 2.158e+02 3r0.        0 3.044e+02 7r0.        0 3.097e+02 0 1.059e+02
0 5.685e+01 3r0.        0 2.105e+0011r0.        0 1.771e+02 0 1.325e+02
0 1.642e+02 3r0.        0 2.567e+02 7r0.        0 3.648e+02 0 9.654e+01
0 4.764e+01 3r0.        0 2.074e+0011r0.        0 1.471e+02 0 1.071e+02
0 1.323e+0211r0.        0 4.088e+02 0 9.287e+01 0 4.242e+01 3r0.
0 1.774e+0011r0.        0 1.292e+02 0 9.309e+01 0 1.181e+0211r0.
0 4.119e+02 0 9.472e+01 0 3.938e+01 3r0.        0 1.502e+0011r0.
0 7.848e+01 0 5.825e+01 0 8.879e+01 3r0.        0 1.918e+02 0 2.270e+02
0 4.097e+02 0 6.010e+02 0 6.379e+02 3r0.        0 2.700e+02 0 1.070e+02
0 3.095e+01 3r0.        0 9.885e-0111r0.        0 2.957e+01 0 3.087e+01
0 5.971e+01 3r0.        0 1.097e+02 0 4.999e+01 0 6.553e+01 0 1.201e+02
0 1.774e+02 3r0.        0 1.315e+02 0 9.538e+01 0 3.556e+01 3r0.
0 6.242e-0111r0.        0 2.284e+01 0 3.034e+01 0 5.097e+01 0 6.478e+01
0 8.574e+01 0 1.110e+02 0 8.937e+01 0 3.790e+01 0 3.855e+01 0 5.423e+01
0 9.430e+01 0 2.787e+02 0 5.838e+02 0 5.436e+02 0 1.487e+02 0 6.957e+01
0 4.498e+01 3r0.        0 6.362e-0111r0.        0 2.108e+01 0 2.718e+01
0 4.222e+01 3r0.        0 7.453e+01 0 3.279e+01 0 2.972e+01 0 3.897e+01
0 6.811e+01 9r0.        0 7.216e-0111r0.        0 2.032e+01 0 2.063e+01
0 3.358e+01 3r0.        0 5.326e+01 0 2.676e+01 0 1.941e+01 0 2.485e+01
0 4.115e+01 0 1.185e+02 0 3.016e+02 0 4.529e+02 0 3.803e+02 0 7.680e+01
4r0.        0 8.073e-0110r0.        0 1.546e+01 0 1.797e+01 0 1.430e+01
0 3.054e+0112r0.        0 9.019e+01 4r0.        0 1.024e+0010r0.
0 1.299e+01 0 1.128e+01 0 1.091e+01 0 2.787e+01 0 4.069e+01 0 3.434e+01
0 3.067e+01 0 3.362e+01 0 2.521e+01 0 1.440e+01 0 1.769e+01 0 2.719e+01
4r0.        0 1.051e+02 4r0.        0 1.088e+0010r0.        0 6.087e+00
0 5.963e+00 0 9.765e+00 0 2.074e+01 0 1.929e+01 0 1.549e+01 0 1.429e+01
0 1.816e+01 0 1.813e+01 0 1.076e+01 0 1.151e+01 0 1.947e+01 4r0.
0 1.154e+02 4r0.        0 1.065e+0010r0.        0 4.029e+00 0 4.678e+00
0 9.897e+00 0 1.453e+01 0 1.164e+01 0 9.060e+00 0 9.086e+00 0 1.175e+01
0 1.287e+01 0 1.026e+01 0 8.466e+00 0 1.694e+01 4r0.        0 1.155e+02
```

Table B-6. (continued)

```
 0 7.901e-01 0 1.010e+00 0 1.166e+00 0 9.357e-01 0 1.027e+0021r0.
 0 1.581e+01 4r0.        0 1.070e+0226r0.        0 1.515e+01 4r0.
 0 8.806e+0126r0.        0 1.321e+01 4r0.        0 6.440e+0126r0.
 0 1.071e+01 4r0.        0 4.449e+0126r0.        0 8.961e+00 4r0.
 0 2.951e+0115r0.
 group =  14
 6r0.        0 1.817e+07 0 1.423e+07 0 1.061e+07 0 7.386e+06 0 5.489e+06
 0 4.534e+06 0 4.210e+06 0 3.778e+06 0 3.619e+06 0 3.579e+06 0 3.379e+06
 0 3.369e+06 0 3.188e+06 0 3.224e+06 0 3.051e+06 0 3.233e+06 0 2.938e+06
 0 3.124e+06 0 2.920e+06 0 3.030e+06 0 2.928e+06 0 3.008e+06 0 2.889e+06
 0 2.981e+06 0 2.911e+06 0 2.937e+06 6r0.        0 2.088e+07 0 1.599e+07
 0 1.210e+07 0 8.397e+06 0 6.150e+06 0 5.033e+06 0 4.598e+06 0 4.198e+06
 0 3.946e+06 0 3.846e+06 0 3.728e+06 0 3.626e+06 0 3.518e+06 0 3.455e+06
 0 3.399e+06 0 3.263e+06 0 3.328e+06 0 3.275e+06 0 3.308e+06 0 3.220e+06
 0 3.252e+06 0 3.223e+06 0 3.213e+06 0 3.203e+06 0 3.202e+06 0 3.192e+06
 6r0.        0 1.789e+07 0 1.289e+07 0 1.005e+07 0 6.947e+06 0 5.033e+06
 0 4.116e+06 0 3.624e+06 0 3.422e+06 0 3.120e+06 0 3.072e+06 0 2.942e+06
 0 2.855e+06 0 2.797e+06 0 2.703e+06 0 2.701e+06 0 2.608e+06 0 2.605e+06
 0 2.618e+06 0 2.607e+06 0 2.555e+06 0 2.576e+06 0 2.528e+06 0 2.551e+06
 0 2.541e+06 0 2.506e+06 0 2.530e+0621r0.        0 2.438e+06 0 1.637e+06
 0 1.803e+06 0 1.641e+06 0 1.726e+06 0 1.662e+06 0 1.683e+06 0 1.644e+06
 0 1.689e+06 0 1.629e+06 0 1.662e+0621r0.        0 1.997e+06 0 1.243e+06
 0 1.210e+06 0 1.190e+06 0 1.177e+06 0 1.168e+06 0 1.161e+06 0 1.153e+06
 0 1.153e+06 0 1.147e+06 0 1.147e+06 6r0.        0 1.537e+07 0 1.245e+07
 0 8.319e+06 0 6.652e+06 0 4.537e+06 0 3.582e+06 0 3.374e+06 0 2.857e+06
 0 3.014e+06 0 2.739e+06 0 2.565e+06 0 2.540e+06 0 2.388e+06 0 2.372e+06
 0 2.126e+06 0 1.796e+06 0 1.063e+06 0 9.469e+05 0 9.808e+05 0 9.271e+05
 0 9.260e+05 0 9.088e+05 0 9.233e+05 0 8.976e+05 0 9.059e+05 0 9.035e+05
21r0.        0 1.624e+06 0 9.043e+05 0 7.946e+05 0 7.818e+05 0 7.585e+05
 0 7.331e+05 0 7.318e+05 0 7.286e+05 0 7.176e+05 0 7.182e+05 0 7.169e+05
 6r0.        0 1.259e+07 0 1.194e+07 0 8.650e+06 0 5.818e+06 0 4.896e+06
 0 3.363e+06 0 2.842e+06 0 2.954e+06 0 2.236e+06 0 2.549e+06 0 2.397e+06
 0 2.144e+06 0 2.161e+06 0 2.008e+06 0 1.764e+06 0 1.332e+06 0 8.008e+05
 0 6.276e+05 0 6.219e+05 0 5.845e+05 0 5.635e+05 0 5.721e+05 0 5.427e+05
 0 5.594e+05 0 5.452e+05 0 5.462e+0521r0.        0 1.340e+06 0 6.902e+05
 0 5.714e+05 0 5.201e+05 0 5.086e+05 0 4.726e+05 0 4.716e+05 0 4.606e+05
 0 4.567e+05 0 4.581e+05 0 4.522e+0521r0.        0 1.260e+06 0 6.169e+05
 0 4.675e+05 0 4.179e+05 0 3.867e+05 0 3.740e+05 0 3.389e+05 0 3.507e+05
 0 3.302e+05 0 3.373e+05 0 3.294e+0521r0.        0 1.049e+06 0 5.923e+05
 0 4.016e+05 0 3.479e+05 0 3.033e+05 0 2.947e+05 0 2.657e+05 0 2.503e+05
 0 2.617e+05 0 2.378e+05 0 2.468e+0521r0.        0 1.148e+06 0 5.043e+05
 0 3.897e+05 0 2.717e+05 0 2.653e+05 0 2.183e+05 0 2.176e+05 0 1.926e+05
 0 1.924e+05 0 1.863e+05 0 1.832e+0521r0.        0 1.194e+06 0 4.882e+05
 0 3.435e+05 0 2.543e+05 0 2.052e+05 0 1.953e+05 0 1.605e+05 0 1.602e+05
 0 1.443e+05 0 1.422e+05 0 1.398e+0521r0.        0 9.772e+05 0 5.156e+05
```

Table B-6. (continued)

```
0 3.022e+05 0 2.390e+05 0 1.838e+05 0 1.615e+05 0 1.373e+05 0 1.235e+05
0 1.149e+05 0 1.106e+05 0 1.086e+0521r0.         0 8.479e+05 0 4.776e+05
0 3.034e+05 0 2.127e+05 0 1.775e+05 0 1.286e+05 0 1.254e+05 0 9.821e+04
0 9.992e+04 0 8.632e+04 0 8.719e+0421r0.         0 1.007e+06 0 3.985e+05
0 3.129e+05 0 1.991e+05 0 1.526e+05 0 1.264e+05 0 9.697e+04 0 9.423e+04
0 7.521e+04 0 7.870e+04 0 6.937e+0421r0.         0 1.132e+06 0 3.974e+05
0 2.767e+05 0 1.989e+05 0 1.388e+05 0 1.111e+05 0 9.073e+04 0 7.853e+04
0 6.547e+04 0 6.363e+04 0 5.988e+0421r0.         0 9.829e+05 0 4.461e+05
0 2.362e+05 0 1.916e+05 0 1.294e+05 0 1.005e+05 0 8.354e+04 0 6.461e+04
0 6.392e+04 0 4.959e+04 0 5.122e+0416r0.         0 6.945e+05 0 4.390e+05
0 3.293e+05 0 3.644e+05 0 2.618e+05 0 7.362e+05 0 4.518e+05 0 2.346e+05
0 1.694e+05 0 1.277e+05 0 9.148e+04 0 7.687e+04 0 5.928e+04 0 5.113e+04
0 4.881e+04 0 4.281e+0416r0.         0 5.944e+05 0 3.865e+05 0 2.466e+05
0 2.577e+05 0 2.299e+05 0 4.899e+05 0 3.656e+05 0 2.616e+05 0 1.529e+05
0 1.264e+05 0 8.664e+04 0 6.699e+04 0 5.860e+04 0 4.461e+04 0 4.230e+04
0 3.903e+0411r0.         0 2.075e+02 0 1.722e+02 0 1.191e+02 0 8.013e+01
0 6.695e+01 0 5.127e+01 0 3.242e+01 0 2.151e+05 0 1.906e+05 0 2.055e+05
0 3.469e+05 0 2.616e+05 0 2.715e+05 0 1.531e+05 0 1.138e+05 0 9.273e+04
0 6.009e+04 0 5.640e+04 0 4.329e+04 0 3.907e+04 0 3.569e+0411r0.
0 1.811e+02 0 9.629e+01 0 7.351e+01 0 6.690e+01 0 5.939e+01 0 4.332e+01
0 2.897e+01 0 1.927e+05 0 1.715e+05 0 1.781e+05 0 3.562e+05 0 2.285e+05
0 2.295e+05 0 1.587e+05 0 1.121e+05 0 8.212e+04 0 6.692e+04 0 5.112e+04
0 4.214e+04 0 3.902e+04 0 3.321e+0411r0.         0 1.559e+02 0 6.940e+01
0 6.166e+01 0 5.590e+01 0 4.612e+01 0 3.528e+01 0 2.258e+01 0 1.759e+05
0 1.411e+05 0 1.557e+05 0 3.237e+05 0 2.001e+05 0 1.838e+05 0 1.461e+05
0 1.126e+05 0 8.116e+04 0 5.726e+04 0 5.219e+04 0 4.095e+04 0 3.408e+04
0 3.274e+0411r0.         0 1.429e+02 0 7.864e+01 0 7.603e+01 0 5.303e+01
0 3.573e+01 0 3.039e+01 0 1.837e+01 0 1.587e+05 0 1.258e+05 0 1.353e+05
0 0.         0 1.750e+05 0 1.620e+05 0 1.319e+05 0 1.040e+05 0 8.913e+04
0 5.180e+04 0 4.651e+04 0 4.394e+04 0 2.794e+04 0 3.381e+0411r0.
0 1.345e+02 3r0.         0 3.393e+01 0 2.490e+01 0 1.748e+01 0 1.312e+05
0 1.200e+05 0 1.122e+05 0 3.247e+05 0 1.667e+05 0 1.369e+05 0 1.238e+05
0 9.364e+04 0 8.386e+04 0 5.780e+04 0 4.125e+04 0 3.958e+04 0 3.287e+04
0 2.881e+04 0 0.         0 6.103e+01 0 6.005e+01 0 6.173e+01 0 6.683e+01
0 7.028e+01 0 7.474e+01 0 8.525e+01 3r0.         0 1.279e+02 3r0.
0 3.460e+01 0 2.005e+01 0 1.633e+01 0 1.114e+05 0 1.097e+05 0 9.591e+04
0 2.769e+05 0 1.620e+05 0 1.175e+05 0 1.123e+05 0 8.398e+04 0 7.665e+04
0 6.008e+04 0 4.216e+04 0 3.388e+04 0 3.502e+04 0 2.632e+04 0 0.
0 4.723e+01 0 4.400e+01 0 4.770e+01 0 5.010e+01 0 3.564e+01 0 3.790e+01
0 6.546e+01 3r0.         0 1.209e+02 3r0.         0 3.744e+01 0 1.669e+01
0 1.293e+01 0 1.017e+05 0 9.008e+04 0 8.672e+04 0 0.         0 1.548e+05
0 9.805e+04 0 9.672e+04 0 7.364e+04 0 6.435e+04 0 5.740e+04 0 4.350e+04
0 3.252e+04 0 2.869e+04 0 2.861e+04 0 0.         0 3.485e+01 0 3.061e+01
0 3.496e+01 0 3.576e+01 0 3.707e+01 0 3.907e+01 0 4.816e+01 7r0.
0 3.928e+01 0 1.474e+01 0 9.175e+00 0 9.435e+04 0 7.122e+04 0 7.868e+04
```

Table B-6. (continued)

```
 0 0.        0 1.370e+05 0 8.765e+04 0 7.680e+04 0 6.961e+04 0 5.059e+04
 0 5.153e+04 0 4.312e+04 0 3.199e+04 0 2.778e+04 0 2.663e+04 0 0.
 0 2.904e+01 0 2.399e+01 0 2.846e+01 3r0.        0 4.016e+01 7r0.
 0 4.091e+01 0 1.397e+01 0 7.496e+00 0 8.498e+04 0 6.569e+04 0 6.715e+04
 0 2.043e+05 0 1.117e+05 0 8.808e+04 0 6.540e+04 0 6.274e+04 0 4.780e+04
 0 4.418e+04 0 3.936e+04 0 3.356e+04 0 2.615e+04 0 2.490e+04 0 0.
 0 2.335e+01 0 1.747e+01 0 2.166e+01 3r0.        0 3.387e+01 7r0.
 0 4.820e+01 0 1.274e+01 0 6.280e+00 0 7.119e+04 0 6.056e+04 0 5.368e+04
 0 1.972e+05 0 9.689e+04 0 7.568e+04 0 5.822e+04 0 5.292e+04 0 4.330e+04
 0 3.762e+04 0 3.600e+04 0 3.043e+04 0 2.605e+04 0 2.250e+04 0 0.
 0 1.940e+01 0 1.412e+01 0 1.744e+0111r0.        0 5.402e+01 0 1.225e+01
 0 5.592e+00 0 6.186e+04 0 5.577e+04 0 4.657e+04 0 1.692e+05 0 9.311e+04
 0 6.482e+04 0 5.407e+04 0 4.667e+04 0 3.819e+04 0 3.477e+04 0 3.380e+04
 0 2.654e+04 0 2.852e+04 0 1.992e+04 0 0.        0 1.703e+01 0 1.227e+01
 0 1.557e+0111r0.        0 5.443e+01 0 1.250e+01 0 5.190e+00 0 5.742e+04
 0 5.238e+04 0 4.275e+04 0 1.457e+05 0 9.137e+04 0 5.964e+04 0 5.195e+04
 0 4.123e+04 0 3.673e+04 0 3.277e+04 0 3.031e+04 0 2.805e+04 0 2.517e+04
 0 2.033e+04 0 0.        0 1.035e+01 0 7.678e+00 0 1.171e+01 3r0.
 0 2.530e+01 0 2.994e+01 0 5.409e+01 0 7.936e+01 0 8.426e+01 3r0.
 0 3.568e+01 0 1.413e+01 0 4.078e+00 0 4.343e+04 0 4.175e+04 0 3.279e+04
 0 9.808e+04 0 6.445e+04 0 5.033e+04 0 3.666e+04 0 3.261e+04 0 2.715e+04
 0 2.396e+04 0 2.202e+04 0 2.111e+04 0 1.953e+04 0 1.865e+04 0 0.
 0 3.897e+00 0 4.067e+00 0 7.872e+00 3r0.        0 1.448e+01 0 6.590e+00
 0 8.642e+00 0 1.585e+01 0 2.343e+01 3r0.        0 1.736e+01 0 1.259e+01
 0 4.690e+00 3r0.        0 6.285e+04 0 3.773e+04 0 3.690e+04 0 2.412e+04
 0 2.077e+04 0 1.816e+04 0 1.487e+04 0 1.354e+04 0 1.245e+04 0 1.351e+04
 0 1.498e+04 0 0.        0 3.009e+00 0 4.000e+00 0 6.722e+00 0 8.542e+00
 0 1.131e+01 0 1.465e+01 0 1.179e+01 0 4.997e+00 0 5.083e+00 0 7.156e+00
 0 1.245e+01 0 3.682e+01 0 7.715e+01 0 7.185e+01 0 1.965e+01 0 9.181e+00
 0 5.936e+00 3r0.        0 6.340e+04 0 3.542e+04 0 3.205e+04 0 2.337e+04
 0 1.661e+04 0 1.791e+04 0 1.276e+04 0 1.155e+04 0 1.104e+04 0 1.259e+04
 0 1.261e+04 0 0.        0 2.778e+00 0 3.583e+00 0 5.568e+00 3r0.
 0 9.834e+00 0 4.324e+00 0 3.920e+00 0 5.141e+00 0 8.990e+00 9r0.
 0 7.025e+04 0 3.275e+04 0 2.979e+04 0 2.261e+04 0 1.579e+04 0 1.534e+04
 0 1.240e+04 0 1.039e+04 0 1.127e+04 0 1.131e+04 0 1.035e+04 0 0.
 0 2.679e+00 0 2.719e+00 0 4.429e+00 3r0.        0 7.027e+00 0 3.530e+00
 0 2.559e+00 0 3.278e+00 0 5.430e+00 0 1.565e+01 0 3.986e+01 0 5.986e+01
 0 5.027e+01 0 1.014e+01 4r0.        0 7.709e+04 0 3.224e+04 0 2.433e+04
 0 2.170e+04 0 1.403e+04 0 1.155e+04 0 1.129e+04 0 1.039e+04 0 9.953e+03
 0 8.992e+03 0 8.234e+03 0 2.039e+00 0 2.370e+00 0 1.885e+00 0 4.027e+00
12r0.        0 1.192e+01 4r0.        0 9.570e+04 0 3.339e+04 0 2.258e+04
 0 1.992e+04 0 1.284e+04 0 1.009e+04 0 9.947e+03 0 9.547e+03 0 8.064e+03
 0 7.599e+03 0 7.136e+03 0 1.713e+00 0 1.488e+00 0 1.438e+00 0 3.677e+00
 0 5.368e+00 0 4.530e+00 0 4.046e+00 0 4.435e+00 0 3.326e+00 0 1.898e+00
 0 2.333e+00 0 3.587e+00 4r0.        0 1.389e+01 4r0.        0 1.008e+05
```

Table B-6. (continued)

```
 0 4.175e+04 0 2.294e+04 0 1.975e+04 0 1.302e+04 0 9.839e+03 0 9.510e+03
 0 7.591e+03 0 6.608e+03 0 6.261e+03 0 5.740e+03 0 8.019e-01 0 7.855e-01
 0 1.287e+00 0 2.737e+00 0 2.544e+00 0 2.042e+00 0 1.884e+00 0 2.396e+00
 0 2.393e+00 0 1.419e+00 0 1.517e+00 0 2.568e+00 4r0.        0 1.526e+01
 4r0.        0 9.904e+04 0 4.979e+04 0 2.622e+04 0 1.900e+04 0 1.503e+04
 0 9.423e+03 0 7.918e+03 0 6.962e+03 0 5.409e+03 0 5.016e+03 0 4.608e+03
 0 5.308e-01 0 6.162e-01 0 1.305e+00 0 1.917e+00 0 1.535e+00 0 1.195e+00
 0 1.198e+00 0 1.550e+00 0 1.699e+00 0 1.353e+00 0 1.116e+00 0 2.235e+00
 4r0.        0 1.527e+01 0 7.403e+04 0 9.141e+04 0 1.055e+05 0 8.899e+04
 0 9.695e+04 0 5.094e+04 0 2.880e+04 0 1.952e+04 0 1.644e+04 0 8.986e+03
 0 7.263e+03 0 6.228e+03 0 5.914e+03 0 4.362e+03 0 4.502e+0311r0.
 0 2.086e+00 4r0.        0 1.414e+01 0 4.485e+04 0 5.009e+04 0 6.134e+04
 0 5.053e+04 0 4.605e+04 0 4.647e+04 0 2.736e+04 0 2.020e+04 0 1.672e+04
 0 1.048e+04 0 7.115e+03 0 5.953e+03 0 4.933e+03 0 4.431e+03 0 4.024e+03
11r0.        0 1.999e+00 4r0.        0 1.164e+01 0 4.687e+04 0 3.194e+04
 0 3.912e+04 0 3.525e+04 0 2.901e+04 0 3.331e+04 0 2.632e+04 0 1.572e+04
 0 1.493e+04 0 1.248e+04 0 7.618e+03 0 5.880e+03 0 4.596e+03 0 3.665e+03
 0 3.581e+0311r0.        0 1.743e+00 4r0.        0 8.510e+00 0 5.959e+04
 0 2.360e+04 0 2.660e+04 0 2.416e+04 0 1.750e+04 0 2.109e+04 0 2.298e+04
 0 1.384e+04 0 9.383e+03 0 9.959e+03 0 8.401e+03 0 5.895e+03 0 4.946e+03
 0 3.619e+03 0 3.277e+0311r0.        0 1.413e+00 4r0.        0 5.879e+00
 0 6.155e+04 0 2.029e+04 0 1.782e+04 0 1.919e+04 0 1.267e+04 0 1.109e+04
 0 1.537e+04 0 1.420e+04 0 8.760e+03 0 5.798e+03 0 5.635e+03 0 5.473e+03
 0 4.652e+03 0 4.065e+03 0 3.210e+0311r0.        0 1.182e+00 4r0.
 0 3.899e+00 0 5.278e+04 0 1.972e+04 0 1.200e+04 0 1.415e+04 0 1.246e+04
 0 7.696e+03 0 7.318e+03 0 1.003e+04 0 8.721e+03 0 6.582e+03 0 3.840e+03
 0 2.996e+03 0 3.497e+03 0 3.518e+03 0 3.296e+03
group =  15
 6r0.        0 3.630e+06 0 2.764e+06 0 2.024e+06 0 1.360e+06 0 9.801e+05
 0 7.916e+05 0 7.362e+05 0 6.520e+05 0 6.252e+05 0 6.191e+05 0 5.821e+05
 0 5.871e+05 0 5.513e+05 0 5.647e+05 0 5.305e+05 0 5.724e+05 0 5.092e+05
 0 5.505e+05 0 5.073e+05 0 5.333e+05 0 5.102e+05 0 5.299e+05 0 5.036e+05
 0 5.246e+05 0 5.093e+05 0 5.154e+05 6r0.        0 4.748e+06 0 3.286e+06
 0 2.406e+06 0 1.612e+06 0 1.142e+06 0 9.177e+05 0 8.336e+05 0 7.560e+05
 0 7.076e+05 0 6.884e+05 0 6.655e+05 0 6.484e+05 0 6.280e+05 0 6.149e+05
 0 5.965e+05 0 5.592e+05 0 5.670e+05 0 5.486e+05 0 5.499e+05 0 5.305e+05
 0 5.360e+05 0 5.300e+05 0 5.273e+05 0 5.263e+05 0 5.254e+05 0 5.240e+05
 6r0.        0 4.481e+06 0 2.942e+06 0 2.123e+06 0 1.424e+06 0 1.010e+06
 0 8.192e+05 0 7.174e+05 0 6.779e+05 0 6.159e+05 0 6.065e+05 0 5.789e+05
 0 5.622e+05 0 5.502e+05 0 5.277e+05 0 5.167e+05 0 4.778e+05 0 4.504e+05
 0 4.413e+05 0 4.366e+05 0 4.240e+05 0 4.291e+05 0 4.181e+05 0 4.239e+05
 0 4.213e+05 0 4.149e+05 0 4.197e+0521r0.        0 4.815e+05 0 2.701e+05
 0 3.051e+05 0 2.713e+05 0 2.896e+05 0 2.765e+05 0 2.815e+05 0 2.735e+05
 0 2.831e+05 0 2.709e+05 0 2.781e+0521r0.        0 4.489e+0516r0.
 0 3.950e+06 0 3.046e+06 0 2.044e+06 0 1.583e+06 0 1.033e+06 0 7.540e+05
```

Table B-6. (continued)

```
 0 7.124e+05 0 6.030e+05 0 6.393e+05 0 5.832e+05 0 5.496e+05 0 5.451e+05
 0 5.187e+05 0 5.180e+05 0 4.886e+05 0 4.509e+0531r0.         0 4.255e+05
16r0.         0 3.192e+06 0 2.911e+06 0 2.029e+06 0 1.450e+06 0 1.199e+06
 0 8.546e+05 0 7.344e+05 0 6.980e+05 0 5.473e+05 0 5.953e+05 0 5.550e+05
 0 4.957e+05 0 4.992e+05 0 4.767e+05 0 4.425e+05 0 3.730e+0531r0.
 0 3.764e+0531r0.         0 3.690e+0531r0.         0 3.430e+0531r0.
 0 3.851e+0531r0.         0 4.193e+0531r0.         0 3.704e+0531r0.
 0 3.158e+0531r0.         0 3.428e+0531r0.         0 3.945e+0531r0.
 0 4.171e+0531r0.         0 3.635e+0531r0.         0 2.571e+0521r0.
 0 1.023e+07 0 6.727e+06 0 4.812e+06 0 4.000e+06 0 3.669e+06 0 3.307e+06
 0 3.461e+06 3r0.         0 2.060e+0521r0.         0 7.528e+06 0 1.077e+06
 0 8.243e+05 0 2.432e+06 0 2.312e+06 0 1.914e+06 0 2.283e+06 3r0.
 0 1.915e+0521r0.         0 6.015e+06 0 7.754e+05 0 6.904e+05 0 1.779e+06
 0 1.544e+06 0 1.284e+06 0 1.564e+06 3r0.         0 1.630e+0521r0.
 0 5.744e+06 0 2.735e+06 0 2.364e+06 0 1.790e+06 0 1.315e+06 0 1.117e+06
 0 1.286e+0625r0.         0 5.336e+06 3r0.         0 1.393e+06 0 9.955e+05
 0 1.164e+06 3r0.         0 1.400e+0511r0.         0 4.129e+06 0 4.460e+06
 0 5.158e+06 0 5.951e+06 0 6.448e+06 0 7.644e+06 0 8.177e+06 3r0.
 0 5.170e+06 3r0.         0 1.428e+06 0 8.790e+05 0 1.060e+06 3r0.
 0 1.207e+0511r0.         0 2.416e+06 0 2.334e+06 0 2.685e+06 0 2.902e+06
 0 4.070e+05 0 4.322e+05 0 3.826e+06 3r0.         0 4.686e+06 3r0.
 0 1.436e+06 0 7.821e+05 0 9.278e+0515r0.         0 1.444e+06 0 1.282e+06
 0 1.384e+06 0 1.386e+06 0 1.415e+06 0 1.447e+06 0 1.840e+06 7r0.
 0 1.442e+06 0 7.148e+05 0 7.950e+0515r0.         0 1.226e+06 0 1.069e+06
 0 1.184e+06 3r0.         0 1.656e+06 7r0.         0 1.502e+06 0 6.981e+05
 0 7.315e+05 3r0.         0 7.400e+0411r0.         0 1.009e+06 0 8.514e+05
 0 9.689e+05 3r0.         0 1.377e+06 7r0.         0 1.663e+06 0 6.603e+05
 0 6.733e+05 3r0.         0 6.948e+0411r0.         0 8.714e+05 0 7.387e+05
 0 8.347e+0511r0.         0 1.801e+06 0 6.390e+05 0 6.372e+05 3r0.
 0 6.186e+0411r0.         0 7.933e+05 0 6.755e+05 0 7.689e+0511r0.
 0 1.854e+06 0 6.365e+05 0 6.099e+05 3r0.         0 5.607e+0411r0.
 0 5.610e+05 0 5.042e+05 0 6.218e+05 3r0.         0 9.811e+05 0 1.155e+06
 0 1.787e+06 0 2.384e+06 0 2.419e+06 3r0.         0 1.263e+06 0 6.135e+05
 0 4.625e+05 3r0.         0 3.975e+0411r0.         0 3.221e+05 0 3.388e+05
 0 4.560e+05 3r0.         0 6.253e+05 0 4.517e+05 0 5.286e+05 0 6.950e+05
 0 8.428e+05 3r0.         0 6.832e+05 0 4.914e+05 0 3.587e+05 3r0.
 0 2.585e+0411r0.         0 2.721e+05 0 3.058e+05 0 3.834e+05 0 4.307e+05
 0 5.013e+05 0 5.731e+05 0 4.899e+05 0 3.161e+05 0 3.025e+05 0 3.414e+05
 0 4.902e+05 0 1.099e+06 0 2.061e+06 0 1.952e+06 0 6.924e+05 0 4.132e+05
 0 4.018e+05 3r0.         0 2.525e+0411r0.         0 2.430e+05 0 2.669e+05
 0 3.153e+05 3r0.         0 4.148e+05 0 2.787e+05 0 2.578e+05 0 2.780e+05
 0 3.907e+05 9r0.         0 2.637e+0411r0.         0 2.080e+05 0 2.076e+05
 0 2.533e+05 3r0.         0 3.082e+05 0 2.093e+05 0 1.775e+05 0 1.851e+05
 0 2.396e+05 0 4.911e+05 0 1.055e+06 0 1.518e+06 0 1.285e+06 0 4.369e+05
 4r0.         0 2.766e+0410r0.         0 1.653e+05 0 1.734e+05 0 1.621e+05
```

Table B-6. (continued)

```
 0 2.234e+0512r0.        0 4.359e+05 4r0.        0 3.097e+0410r0.
 0 1.255e+05 0 1.215e+05 0 1.232e+05 0 1.854e+05 0 2.359e+05 0 2.181e+05
 0 2.053e+05 0 2.066e+05 0 1.681e+05 0 1.254e+05 0 1.298e+05 0 1.513e+05
4r0.         0 4.785e+05 4r0.         0 3.164e+0410r0.         0 6.496e+04
 0 6.530e+04 0 7.959e+04 0 1.160e+05 0 1.112e+05 0 1.002e+05 0 9.610e+04
 0 1.063e+05 0 1.033e+05 0 7.703e+04 0 7.736e+04 0 1.029e+05 4r0.
 0 4.970e+05 4r0.        0 3.110e+0410r0.         0 3.360e+04 0 3.637e+04
 0 5.301e+04 0 6.698e+04 0 5.968e+04 0 5.071e+04 0 5.084e+04 0 5.975e+04
 0 6.407e+04 0 5.758e+04 0 5.554e+04 0 8.822e+04 4r0.         0 4.873e+05
 0 2.426e+04 0 3.021e+04 0 3.362e+04 0 2.930e+04 0 3.051e+0421r0.
 0 7.619e+04 4r0.        0 4.417e+0526r0.         0 6.943e+04 4r0.
 0 3.562e+0526r0.        0 5.979e+04 4r0.         0 2.611e+0526r0.
 0 4.787e+04 4r0.        0 1.793e+0526r0.         0 3.746e+04 4r0.
 0 1.096e+0515r0.
group =  16
6r0.         0 3.651e+08 0 2.082e+08 0 1.918e+08 0 1.680e+08 0 1.609e+08
 0 1.529e+08 0 1.530e+08 0 1.482e+08 0 1.500e+08 0 1.460e+08 0 1.465e+08
 0 1.448e+08 0 1.447e+08 0 1.435e+08 0 1.426e+08 0 1.409e+08 0 1.402e+08
 0 1.396e+08 0 1.386e+08 0 1.382e+08 0 1.379e+08 0 1.377e+08 0 1.374e+08
 0 1.374e+08 0 1.373e+08 0 1.373e+08 6r0.         0 1.988e+09 0 6.982e+08
 0 4.464e+08 0 3.299e+08 0 2.773e+08 0 2.541e+08 0 2.419e+08 0 2.316e+08
 0 2.261e+08 0 2.218e+08 0 2.118e+08 0 2.057e+08 0 1.982e+08 0 1.857e+08
 0 1.550e+08 0 1.269e+08 0 1.057e+08 0 7.992e+07 0 6.267e+07 0 5.518e+07
 0 5.074e+07 0 4.797e+07 0 4.631e+07 0 4.533e+07 0 4.480e+07 0 4.454e+07
6r0.         0 2.794e+09 0 1.331e+09 0 6.492e+08 0 4.651e+08 0 3.951e+08
 0 3.649e+08 0 3.424e+08 0 3.307e+08 0 3.200e+08 0 3.142e+08 0 3.008e+08
 0 2.918e+08 0 2.808e+08 0 2.636e+08 0 2.258e+08 0 1.704e+08 0 9.456e+07
 0 5.918e+07 0 4.910e+07 0 4.346e+07 0 4.067e+07 0 3.883e+07 0 3.791e+07
 0 3.730e+07 0 3.691e+07 0 3.681e+0721r0.         0 2.215e+08 0 3.403e+07
 0 3.159e+07 0 3.060e+07 0 2.979e+07 0 2.941e+07 0 2.904e+07 0 2.887e+07
 0 2.878e+07 0 2.862e+07 0 2.864e+0721r0.         0 3.567e+0816r0.
 0 2.601e+09 0 1.702e+09 0 1.278e+09 0 9.404e+08 0 6.290e+08 0 4.036e+08
 0 4.003e+08 0 3.781e+08 0 3.869e+08 0 3.798e+08 0 3.781e+08 0 3.720e+08
 0 3.720e+08 0 3.714e+08 0 3.992e+08 0 4.556e+0831r0.         0 4.562e+08
16r0.         0 2.040e+09 0 1.563e+09 0 9.687e+08 0 9.945e+08 0 8.280e+08
 0 7.489e+08 0 7.066e+08 0 5.397e+08 0 5.122e+08 0 4.763e+08 0 4.420e+08
 0 4.103e+08 0 4.041e+08 0 4.121e+08 0 4.308e+08 0 4.491e+0831r0.
 0 4.421e+0831r0.        0 4.548e+0831r0.         0 4.881e+0831r0.
 0 5.471e+0831r0.        0 6.090e+0831r0.         0 5.881e+0831r0.
 0 5.019e+0831r0.        0 4.876e+0831r0.         0 5.576e+0831r0.
 0 6.919e+0831r0.        0 6.782e+0831r0.         0 5.134e+0821r0.
 0 2.039e+07 0 1.354e+07 0 9.841e+06 0 8.314e+06 0 7.705e+06 0 6.930e+06
 0 7.133e+06 3r0.        0 3.055e+0821r0.         0 1.514e+07 0 1.486e+05
 0 1.137e+05 0 5.173e+06 0 4.974e+06 0 4.150e+06 0 4.788e+06 3r0.
 0 2.643e+0821r0.        0 1.216e+07 0 1.070e+05 0 9.526e+04 0 3.786e+06
```

Table B-6. (continued)

```
0 3.348e+06 0 2.824e+06 0 3.317e+06 3r0.         0 2.134e+0821r0.
0 1.160e+07 0 5.598e+06 0 4.868e+06 0 3.737e+06 0 2.824e+06 0 2.433e+06
0 2.725e+0625r0.         0 1.078e+07 3r0.         0 2.937e+06 0 2.154e+06
0 2.456e+06 3r0.         0 1.575e+0811r0.         0 8.796e+06 0 9.417e+06
0 1.076e+07 0 1.230e+07 0 1.326e+07 0 1.559e+07 0 1.663e+07 3r0.
0 1.045e+07 3r0.         0 2.979e+06 0 1.895e+06 0 2.224e+06 3r0.
0 1.360e+0811r0.         0 5.297e+06 0 5.107e+06 0 5.810e+06 0 6.221e+06
0 5.625e+04 0 5.974e+04 0 8.053e+06 3r0.         0 9.499e+06 3r0.
0 2.982e+06 0 1.683e+06 0 1.938e+0615r0.         0 3.266e+06 0 2.907e+06
0 3.136e+06 0 3.123e+06 0 3.189e+06 0 3.249e+06 0 4.058e+06 7r0.
0 2.996e+06 0 1.534e+06 0 1.658e+0615r0.         0 2.773e+06 0 2.415e+06
0 2.672e+06 3r0.         0 3.640e+06 7r0.         0 3.121e+06 0 1.498e+06
0 1.526e+06 3r0.         0 1.155e+0811r0.         0 2.270e+06 0 1.908e+06
0 2.177e+06 3r0.         0 3.060e+06 7r0.         0 3.415e+06 0 1.418e+06
0 1.402e+06 3r0.         0 1.030e+0811r0.         0 1.946e+06 0 1.641e+06
0 1.867e+0611r0.         0 3.646e+06 0 1.372e+06 0 1.322e+06 3r0.
0 9.505e+0711r0.         0 1.763e+06 0 1.490e+06 0 1.714e+0611r0.
0 3.728e+06 0 1.359e+06 0 1.265e+06 3r0.         0 9.162e+0711r0.
0 1.231e+06 0 1.099e+06 0 1.379e+06 3r0.         0 2.193e+06 0 2.562e+06
0 3.880e+06 0 5.083e+06 0 5.062e+06 3r0.         0 2.591e+06 0 1.301e+06
0 9.678e+05 3r0.         0 6.847e+0711r0.         0 6.914e+05 0 7.307e+05
0 1.000e+06 3r0.         0 1.367e+06 0 9.766e+05 0 1.148e+06 0 1.479e+06
0 1.771e+06 3r0.         0 1.454e+06 0 1.051e+06 0 7.543e+05 3r0.
0 4.452e+0711r0.         0 5.837e+05 0 6.572e+05 0 8.323e+05 0 9.460e+05
0 1.113e+06 0 1.268e+06 0 1.067e+06 0 6.815e+05 0 6.553e+05 0 7.286e+05
0 1.017e+06 0 2.243e+06 0 4.123e+06 0 3.865e+06 0 1.427e+06 0 8.894e+05
0 8.343e+05 3r0.         0 4.197e+0711r0.         0 5.185e+05 0 5.713e+05
0 6.841e+05 3r0.         0 8.989e+05 0 5.970e+05 0 5.532e+05 0 5.925e+05
0 8.179e+05 9r0.         0 4.086e+0711r0.         0 4.442e+05 0 4.442e+05
0 5.481e+05 3r0.         0 6.647e+05 0 4.474e+05 0 3.800e+05 0 3.974e+05
0 5.124e+05 0 1.017e+06 0 2.127e+06 0 3.017e+06 0 2.526e+06 0 9.075e+05
4r0.         0 4.018e+0710r0.         0 3.490e+05 0 3.692e+05 0 3.460e+05
0 4.823e+0512r0.         0 8.789e+05 4r0.         0 3.923e+0710r0.
0 2.661e+05 0 2.581e+05 0 2.627e+05 0 4.015e+05 0 5.156e+05 0 4.751e+05
0 4.467e+05 0 4.474e+05 0 3.605e+05 0 2.704e+05 0 2.828e+05 0 3.315e+05
4r0.         0 9.538e+05 4r0.         0 3.821e+0710r0.         0 1.405e+05
0 1.417e+05 0 1.723e+05 0 2.532e+05 0 2.430e+05 0 2.196e+05 0 2.102e+05
0 2.319e+05 0 2.228e+05 0 1.670e+05 0 1.697e+05 0 2.281e+05 4r0.
0 9.858e+05 4r0.         0 3.809e+0710r0.         0 7.567e+04 0 8.215e+04
0 1.184e+05 0 1.487e+05 0 1.340e+05 0 1.127e+05 0 1.142e+05 0 1.329e+05
0 1.402e+05 0 1.278e+05 0 1.238e+05 0 1.974e+05 4r0.         0 9.648e+05
0 3.135e+07 0 3.719e+07 0 3.951e+07 0 3.945e+07 0 3.863e+0721r0.
0 1.712e+05 4r0.         0 8.732e+0526r0.         0 1.567e+05 4r0.
0 7.059e+0526r0.         0 1.351e+05 4r0.         0 5.199e+0526r0.
0 1.085e+05 4r0.         0 3.594e+0526r0.         0 8.480e+04 4r0.
```

Table B-6. (continued)

```
 0 2.215e+0515r0.
 group =  17
 6r0.         0 4.923e+07 0 3.920e+07 0 2.992e+07 0 2.165e+07 0 1.671e+07
 0 1.418e+07 0 1.324e+07 0 1.207e+07 0 1.161e+07 0 1.147e+07 0 1.092e+07
 0 1.082e+07 0 1.033e+07 0 1.035e+07 0 9.893e+06 0 1.030e+07 0 9.576e+06
 0 1.001e+07 0 9.499e+06 0 9.744e+06 0 9.499e+06 0 9.671e+06 0 9.382e+06
 0 9.596e+06 0 9.426e+06 0 9.481e+06 6r0.         0 5.679e+07 0 4.411e+07
 0 3.407e+07 0 2.454e+07 0 1.869e+07 0 1.571e+07 0 1.449e+07 0 1.338e+07
 0 1.268e+07 0 1.239e+07 0 1.203e+07 0 1.170e+07 0 1.138e+07 0 1.117e+07
 0 1.098e+07 0 1.062e+07 0 1.076e+07 0 1.061e+07 0 1.067e+07 0 1.044e+07
 0 1.050e+07 0 1.042e+07 0 1.039e+07 0 1.035e+07 0 1.035e+07 0 1.032e+07
 6r0.         0 4.865e+07 0 3.557e+07 0 2.814e+07 0 2.015e+07 0 1.520e+07
 0 1.277e+07 0 1.143e+07 0 1.084e+07 0 1.003e+07 0 9.878e+06 0 9.496e+06
 0 9.224e+06 0 9.033e+06 0 8.760e+06 0 8.727e+06 0 8.487e+06 0 8.467e+06
 0 8.480e+06 0 8.433e+06 0 8.294e+06 0 8.322e+06 0 8.203e+06 0 8.245e+06
 0 8.218e+06 0 8.122e+06 0 8.182e+0621r0.         0 7.785e+06 0 5.384e+06
 0 5.769e+06 0 5.353e+06 0 5.546e+06 0 5.384e+06 0 5.422e+06 0 5.321e+06
 0 5.428e+06 0 5.276e+06 0 5.357e+0621r0.         0 6.529e+0616r0.
 0 4.143e+07 0 3.370e+07 0 2.311e+07 0 1.884e+07 0 1.346e+07 0 1.100e+07
 0 1.044e+07 0 9.064e+06 0 9.445e+06 0 8.718e+06 0 8.245e+06 0 8.139e+06
 0 7.700e+06 0 7.611e+06 0 6.851e+06 0 5.871e+0631r0.         0 5.281e+06
16r0.         0 3.403e+07 0 3.207e+07 0 2.352e+07 0 1.638e+07 0 1.406e+07
 0 1.017e+07 0 8.813e+06 0 9.058e+06 0 7.171e+06 0 7.973e+06 0 7.549e+06
 0 6.855e+06 0 6.852e+06 0 6.390e+06 0 5.645e+06 0 4.394e+0631r0.
 0 4.333e+0631r0.         0 4.062e+0631r0.         0 3.469e+0631r0.
 0 3.695e+0631r0.         0 3.785e+0631r0.         0 3.189e+0631r0.
 0 2.819e+0631r0.         0 3.220e+0631r0.         0 3.541e+0631r0.
 0 3.130e+0631r0.         0 2.445e+0631r0.         0 1.706e+0621r0.
 0 1.935e+07 0 1.596e+07 0 1.128e+07 0 7.959e+06 0 6.851e+06 0 5.380e+06
 0 3.652e+06 3r0.         0 1.195e+0621r0.         0 1.685e+07 0 2.806e+07
 0 1.957e+07 0 6.556e+06 0 5.951e+06 0 4.474e+06 0 3.171e+06 3r0.
 0 1.186e+0621r0.         0 1.450e+07 0 1.877e+07 0 1.395e+07 0 5.397e+06
 0 4.565e+06 0 3.589e+06 0 2.458e+06 3r0.         0 1.056e+0621r0.
 0 1.333e+07 0 7.366e+06 0 7.087e+06 0 5.057e+06 0 3.549e+06 0 3.065e+06
 0 2.004e+0625r0.         0 1.254e+07 3r0.         0 3.351e+06 0 2.527e+06
 0 1.871e+06 3r0.         0 1.013e+0611r0.         0 6.672e+06 0 6.589e+06
 0 6.776e+06 0 7.291e+06 0 7.630e+06 0 8.121e+06 0 9.073e+06 3r0.
 0 1.195e+07 3r0.         0 3.375e+06 0 2.057e+06 0 1.723e+06 3r0.
 0 8.609e+0511r0.         0 5.099e+06 0 4.775e+06 0 5.151e+06 0 5.365e+06
 0 2.870e+07 0 3.232e+07 0 6.808e+06 3r0.         0 1.129e+07 3r0.
 0 3.599e+06 0 1.729e+06 0 1.380e+0615r0.         0 3.752e+06 0 3.315e+06
 0 3.741e+06 0 3.789e+06 0 3.915e+06 0 4.086e+06 0 4.960e+06 7r0.
 0 3.756e+06 0 1.532e+06 0 1.016e+0615r0.         0 3.160e+06 0 2.641e+06
 0 3.081e+06 3r0.         0 4.204e+06 7r0.         0 3.938e+06 0 1.468e+06
 0 8.609e+05 3r0.         0 6.454e+0511r0.         0 2.539e+06 0 1.943e+06
```

Table B-6. (continued)

```
0 2.370e+06 3r0.        0 3.580e+06 7r0.        0 4.555e+06 0 1.350e+06
0 7.365e+05 3r0.        0 6.102e+0511r0.        0 2.109e+06 0 1.579e+06
0 1.926e+0611r0.        0 5.020e+06 0 1.299e+06 0 6.605e+05 3r0.
0 5.272e+0511r0.        0 1.856e+06 0 1.375e+06 0 1.725e+0611r0.
0 5.036e+06 0 1.308e+06 0 6.176e+05 3r0.        0 4.629e+0511r0.
0 1.146e+06 0 8.819e+05 0 1.309e+06 3r0.        0 2.676e+06 0 3.136e+06
0 5.399e+06 0 7.685e+06 0 7.981e+06 3r0.        0 3.381e+06 0 1.428e+06
0 4.926e+05 3r0.        0 3.209e+0511r0.        0 4.628e+05 0 4.885e+05
0 8.849e+05 3r0.        0 1.524e+06 0 7.540e+05 0 9.658e+05 0 1.618e+06
0 2.290e+06 3r0.        0 1.733e+06 0 1.265e+06 0 5.186e+05 3r0.
0 2.107e+0511r0.        0 3.664e+05 0 4.661e+05 0 7.418e+05 0 9.330e+05
0 1.219e+06 0 1.535e+06 0 1.228e+06 0 5.586e+05 0 5.633e+05 0 7.450e+05
0 1.220e+06 0 3.423e+06 0 6.995e+06 0 6.473e+06 0 1.869e+06 0 9.498e+05
0 6.243e+05 3r0.        0 2.115e+0511r0.        0 3.310e+05 0 4.114e+05
0 6.129e+05 3r0.        0 1.020e+06 0 4.802e+05 0 4.379e+05 0 5.468e+05
0 9.012e+05 9r0.        0 2.268e+0511r0.        0 3.094e+05 0 3.140e+05
0 4.870e+05 3r0.        0 7.301e+05 0 3.841e+05 0 2.889e+05 0 3.556e+05
0 5.597e+05 0 1.484e+06 0 3.636e+06 0 5.387e+06 0 4.490e+06 0 9.950e+05
4r0.        0 2.416e+0510r0.        0 2.328e+05 0 2.686e+05 0 2.238e+05
0 4.385e+0512r0.        0 1.111e+06 4r0.        0 2.893e+0510r0.
0 1.928e+05 0 1.727e+05 0 1.702e+05 0 3.942e+05 0 5.672e+05 0 4.849e+05
0 4.369e+05 0 4.685e+05 0 3.523e+05 0 2.147e+05 0 2.575e+05 0 3.769e+05
4r0.        0 1.275e+06 4r0.        0 3.007e+0510r0.        0 9.640e+04
0 9.545e+04 0 1.443e+05 0 2.870e+05 0 2.687e+05 0 2.214e+05 0 2.056e+05
0 2.531e+05 0 2.482e+05 0 1.549e+05 0 1.660e+05 0 2.707e+05 4r0.
0 1.389e+06 4r0.        0 2.986e+0510r0.        0 6.349e+04 0 7.298e+04
0 1.397e+05 0 1.983e+05 0 1.636e+05 0 1.282e+05 0 1.302e+05 0 1.634e+05
0 1.752e+05 0 1.449e+05 0 1.243e+05 0 2.373e+05 4r0.        0 1.386e+06
0 2.292e+05 0 2.690e+05 0 3.062e+05 0 2.763e+05 0 2.983e+0521r0.
0 2.193e+05 4r0.        0 1.281e+0626r0.        0 2.090e+05 4r0.
0 1.056e+0626r0.        0 1.820e+05 4r0.        0 7.761e+0526r0.
0 1.476e+05 4r0.        0 5.398e+0526r0.        0 1.220e+05 4r0.
0 3.589e+0515r0.
group =  18
6r0.        0 6.920e+07 0 5.553e+07 0 4.315e+07 0 3.211e+07 0 2.545e+07
0 2.197e+07 0 2.060e+07 0 1.897e+07 0 1.831e+07 0 1.807e+07 0 1.730e+07
0 1.707e+07 0 1.641e+07 0 1.637e+07 0 1.573e+07 0 1.622e+07 0 1.528e+07
0 1.581e+07 0 1.514e+07 0 1.542e+07 0 1.511e+07 0 1.531e+07 0 1.494e+07
0 1.520e+07 0 1.498e+07 0 1.504e+07 6r0.        0 8.336e+07 0 6.355e+07
0 4.958e+07 0 3.662e+07 0 2.863e+07 0 2.449e+07 0 2.273e+07 0 2.114e+07
0 2.014e+07 0 1.971e+07 0 1.915e+07 0 1.863e+07 0 1.813e+07 0 1.777e+07
0 1.741e+07 0 1.686e+07 0 1.697e+07 0 1.669e+07 0 1.673e+07 0 1.639e+07
0 1.645e+07 0 1.632e+07 0 1.627e+07 0 1.621e+07 0 1.621e+07 0 1.615e+07
6r0.        0 7.372e+07 0 5.291e+07 0 4.138e+07 0 3.034e+07 0 2.357e+07
0 2.019e+07 0 1.828e+07 0 1.739e+07 0 1.624e+07 0 1.600e+07 0 1.541e+07
```

Table B-6. (continued)

```
 0 1.498e+07 0 1.466e+07 0 1.423e+07 0 1.407e+07 0 1.363e+07 0 1.343e+07
 0 1.335e+07 0 1.325e+07 0 1.304e+07 0 1.305e+07 0 1.289e+07 0 1.292e+07
 0 1.289e+07 0 1.275e+07 0 1.283e+0721r0.         0 1.252e+07 0 8.546e+06
 0 9.007e+06 0 8.450e+06 0 8.679e+06 0 8.462e+06 0 8.499e+06 0 8.363e+06
 0 8.495e+06 0 8.295e+06 0 8.397e+0621r0.         0 1.101e+0716r0.
 0 6.289e+07 0 5.041e+07 0 3.543e+07 0 2.902e+07 0 2.125e+07 0 1.748e+07
 0 1.670e+07 0 1.477e+07 0 1.527e+07 0 1.427e+07 0 1.361e+07 0 1.341e+07
 0 1.277e+07 0 1.260e+07 0 1.151e+07 0 1.019e+0731r0.         0 9.236e+06
16r0.         0 5.155e+07 0 4.759e+07 0 3.483e+07 0 2.553e+07 0 2.213e+07
 0 1.683e+07 0 1.491e+07 0 1.484e+07 0 1.222e+07 0 1.321e+07 0 1.253e+07
 0 1.149e+07 0 1.143e+07 0 1.075e+07 0 9.670e+06 0 7.891e+0631r0.
 0 7.705e+0631r0.         0 7.301e+0631r0.         0 6.525e+0631r0.
 0 6.925e+0631r0.         0 7.142e+0631r0.         0 6.262e+0631r0.
 0 5.544e+0631r0.         0 6.040e+0631r0.         0 6.619e+0631r0.
 0 6.326e+0631r0.         0 5.319e+0631r0.         0 3.855e+0621r0.
 0 4.606e+07 0 2.660e+07 0 1.954e+07 0 1.829e+07 0 1.750e+07 0 1.672e+07
 0 1.966e+07 3r0.         0 2.741e+0621r0.         0 3.098e+07 0 1.998e+08
 0 1.513e+08 0 9.276e+06 0 9.288e+06 0 8.315e+06 0 1.222e+07 3r0.
 0 2.579e+0621r0.         0 2.361e+07 0 1.435e+08 0 1.273e+08 0 6.057e+06
 0 5.542e+06 0 4.952e+06 0 8.108e+06 3r0.         0 2.217e+0621r0.
 0 2.316e+07 0 9.956e+06 0 7.784e+06 0 6.397e+06 0 5.084e+06 0 4.328e+06
 0 6.684e+0625r0.         0 2.134e+07 3r0.         0 5.768e+06 0 4.083e+06
 0 5.959e+06 3r0.         0 1.957e+0611r0.         0 2.127e+07 0 2.355e+07
 0 2.797e+07 0 3.268e+07 0 3.559e+07 0 4.302e+07 0 4.544e+07 3r0.
 0 2.093e+07 3r0.         0 5.916e+06 0 3.808e+06 0 5.378e+06 3r0.
 0 1.665e+0611r0.         0 1.132e+07 0 1.111e+07 0 1.305e+07 0 1.421e+07
 0 6.881e+07 0 7.370e+07 0 1.872e+07 3r0.         0 1.846e+07 3r0.
 0 5.667e+06 0 3.509e+06 0 4.847e+0615r0.         0 6.137e+06 0 5.490e+06
 0 5.717e+06 0 5.630e+06 0 5.688e+06 0 5.689e+06 0 7.345e+06 7r0.
 0 5.519e+06 0 3.262e+06 0 4.354e+0615r0.         0 5.245e+06 0 4.713e+06
 0 5.015e+06 3r0.         0 6.908e+06 7r0.         0 5.714e+06 0 3.218e+06
 0 4.101e+06 3r0.         0 1.236e+0611r0.         0 4.370e+06 0 3.925e+06
 0 4.277e+06 3r0.         0 5.721e+06 7r0.         0 5.991e+06 0 3.096e+06
 0 3.839e+06 3r0.         0 1.144e+0611r0.         0 3.849e+06 0 3.508e+06
 0 3.811e+0611r0.         0 6.260e+06 0 3.002e+06 0 3.668e+06 3r0.
 0 1.005e+0611r0.         0 3.567e+06 0 3.272e+06 0 3.561e+0611r0.
 0 6.549e+06 0 2.955e+06 0 3.528e+06 3r0.         0 9.073e+0511r0.
 0 2.698e+06 0 2.596e+06 0 2.972e+06 3r0.         0 3.956e+06 0 4.628e+06
 0 6.282e+06 0 7.565e+06 0 7.229e+06 3r0.         0 4.643e+06 0 2.620e+06
 0 2.665e+06 3r0.         0 6.486e+0511r0.         0 1.763e+06 0 1.859e+06
 0 2.252e+06 3r0.         0 2.682e+06 0 2.353e+06 0 2.657e+06 0 2.984e+06
 0 3.155e+06 3r0.         0 2.751e+06 0 1.966e+06 0 1.905e+06 3r0.
 0 4.309e+0511r0.         0 1.519e+06 0 1.641e+06 0 1.876e+06 0 2.006e+06
 0 2.192e+06 0 2.318e+06 0 2.051e+06 0 1.604e+06 0 1.506e+06 0 1.535e+06
 0 1.946e+06 0 3.412e+06 0 5.488e+06 0 5.298e+06 0 2.540e+06 0 1.805e+06
```

Table B-6. (continued)

```
 0 2.054e+06 3r0.         0 4.262e+0511r0.         0 1.345e+06 0 1.421e+06
 0 1.539e+06 3r0.         0 1.751e+06 0 1.421e+06 0 1.325e+06 0 1.324e+06
 0 1.656e+06 9r0.         0 4.419e+0511r0.         0 1.120e+06 0 1.113e+06
 0 1.240e+06 3r0.         0 1.329e+06 0 1.036e+06 0 9.261e+05 0 8.992e+05
 0 1.032e+06 0 1.615e+06 0 2.779e+06 0 3.705e+06 0 3.165e+06 0 1.844e+06
 4r0.         0 4.573e+0510r0.         0 8.977e+05 0 9.176e+05 0 8.942e+05
 0 1.080e+0612r0.         0 1.633e+06 4r0.         0 5.188e+0510r0.
 0 6.639e+05 0 6.615e+05 0 6.792e+05 0 8.606e+05 0 1.022e+06 0 9.915e+05
 0 9.571e+05 0 9.219e+05 0 7.788e+05 0 6.455e+05 0 6.299e+05 0 6.411e+05
 4r0.         0 1.699e+06 4r0.         0 5.293e+0510r0.         0 3.544e+05
 0 3.591e+05 0 4.014e+05 0 4.923e+05 0 4.809e+05 0 4.609e+05 0 4.498e+05
 0 4.635e+05 0 4.418e+05 0 3.698e+05 0 3.624e+05 0 4.238e+05 4r0.
 0 1.673e+06 4r0.         0 5.286e+0510r0.         0 1.732e+05 0 1.825e+05
 0 2.206e+05 0 2.490e+05 0 2.417e+05 0 2.166e+05 0 2.179e+05 0 2.398e+05
 0 2.518e+05 0 2.462e+05 0 2.584e+05 0 3.609e+05 4r0.         0 1.606e+06
 0 4.161e+05 0 4.765e+05 0 5.322e+05 0 5.055e+05 0 5.348e+0521r0.
 0 2.955e+05 4r0.         0 1.422e+0626r0.         0 2.592e+05 4r0.
 0 1.123e+0626r0.         0 2.211e+05 4r0.         0 8.254e+0526r0.
 0 1.753e+05 4r0.         0 5.637e+0526r0.         0 1.288e+05 4r0.
 0 3.128e+0515r0.
 group =  19
 6r0.         0 8.285e+04 0 6.495e+04 0 5.053e+04 0 3.753e+04 0 2.983e+04
 0 2.575e+04 0 2.424e+04 0 2.234e+04 0 2.163e+04 0 2.132e+04 0 2.046e+04
 0 2.021e+04 0 1.946e+04 0 1.943e+04 0 1.870e+04 0 1.925e+04 0 1.815e+04
 0 1.877e+04 0 1.799e+04 0 1.832e+04 0 1.797e+04 0 1.820e+04 0 1.777e+04
 0 1.808e+04 0 1.782e+04 0 1.790e+04 6r0.         0 1.225e+05 0 8.100e+04
 0 6.136e+04 0 4.483e+04 0 3.496e+04 0 2.992e+04 0 2.778e+04 0 2.585e+04
 0 2.466e+04 0 2.412e+04 0 2.336e+04 0 2.270e+04 0 2.205e+04 0 2.148e+04
 0 2.063e+04 0 1.959e+04 0 1.942e+04 0 1.873e+04 0 1.852e+04 0 1.803e+04
 0 1.805e+04 0 1.787e+04 0 1.779e+04 0 1.771e+04 0 1.770e+04 0 1.764e+04
 6r0.         0 1.236e+05 0 7.846e+04 0 5.535e+04 0 4.001e+04 0 3.126e+04
 0 2.698e+04 0 2.450e+04 0 2.335e+04 0 2.190e+04 0 2.155e+04 0 2.071e+04
 0 2.011e+04 0 1.960e+04 0 1.886e+04 0 1.813e+04 0 1.680e+04 0 1.545e+04
 0 1.486e+04 0 1.460e+04 0 1.430e+04 0 1.427e+04 0 1.407e+04 0 1.410e+04
 0 1.405e+04 0 1.390e+04 0 1.398e+0421r0.         0 1.646e+04 0 9.409e+03
 0 9.937e+03 0 9.294e+03 0 9.562e+03 0 9.311e+03 0 9.355e+03 0 9.199e+03
 0 9.355e+03 0 9.122e+03 0 9.243e+0321r0.         0 1.684e+0416r0.
 0 1.089e+05 0 8.150e+04 0 5.813e+04 0 4.582e+04 0 3.232e+04 0 2.473e+04
 0 2.380e+04 0 2.129e+04 0 2.202e+04 0 2.077e+04 0 2.000e+04 0 1.971e+04
 0 1.900e+04 0 1.884e+04 0 1.808e+04 0 1.750e+0431r0.         0 1.652e+04
16r0.         0 8.787e+04 0 7.646e+04 0 5.318e+04 0 4.287e+04 0 3.650e+04
 0 2.925e+04 0 2.645e+04 0 2.394e+04 0 2.055e+04 0 2.118e+04 0 1.991e+04
 0 1.828e+04 0 1.815e+04 0 1.754e+04 0 1.665e+04 0 1.496e+0431r0.
 0 1.471e+0431r0.         0 1.448e+0431r0.         0 1.410e+0431r0.
 0 1.545e+0431r0.         0 1.664e+0431r0.         0 1.535e+0431r0.
```

Table B-6. (continued)

```
0 1.328e+0431r0.        0 1.364e+0431r0.        0 1.533e+0431r0.
0 1.698e+0431r0.        0 1.569e+0431r0.        0 1.170e+0421r0.
0 6.400e+05 0 3.808e+05 0 2.692e+05 0 2.344e+05 0 2.198e+05 0 2.108e+05
0 2.477e+05 3r0.        0 9.298e+0321r0.        0 4.408e+05 0 2.402e+04
0 1.869e+04 0 1.203e+05 0 1.173e+05 0 1.021e+05 0 1.516e+05 3r0.
0 8.347e+0321r0.        0 3.412e+05 0 1.744e+04 0 1.558e+04 0 7.994e+04
0 6.891e+04 0 5.935e+04 0 9.833e+04 3r0.        0 6.934e+0321r0.
0 3.304e+05 0 1.388e+05 0 1.128e+05 0 8.385e+04 0 5.889e+04 0 5.041e+04
0 7.930e+0425r0.        0 3.046e+05 3r0.        0 6.639e+04 0 4.518e+04
0 7.065e+04 3r0.        0 5.585e+0311r0.        0 2.444e+05 0 2.729e+05
0 3.304e+05 0 3.927e+05 0 4.320e+05 0 5.266e+05 0 5.635e+05 3r0.
0 2.964e+05 3r0.        0 6.870e+04 0 3.945e+04 0 6.341e+04 3r0.
0 4.790e+0311r0.        0 1.189e+05 0 1.154e+05 0 1.424e+05 0 1.605e+05
0 1.033e+04 0 1.087e+04 0 2.265e+05 3r0.        0 2.632e+05 3r0.
0 6.734e+04 0 3.437e+04 0 5.556e+0415r0.        0 5.526e+04 0 4.685e+04
0 5.270e+04 0 5.485e+04 0 5.734e+04 0 5.972e+04 0 8.297e+04 7r0.
0 6.672e+04 0 3.067e+04 0 4.786e+0415r0.        0 4.554e+04 0 3.825e+04
0 4.470e+04 3r0.        0 7.483e+04 7r0.        0 7.026e+04 0 2.998e+04
0 4.405e+04 3r0.        0 3.054e+0311r0.        0 3.660e+04 0 2.951e+04
0 3.523e+04 3r0.        0 5.797e+04 7r0.        0 7.844e+04 0 2.827e+04
0 4.047e+04 3r0.        0 2.773e+0311r0.        0 3.102e+04 0 2.509e+04
0 2.932e+0411r0.        0 8.631e+04 0 2.744e+04 0 3.823e+04 3r0.
0 2.501e+0311r0.        0 2.789e+04 0 2.256e+04 0 2.663e+0411r0.
0 9.095e+04 0 2.755e+04 0 3.640e+04 3r0.        0 2.342e+0311r0.
0 1.900e+04 0 1.632e+04 0 2.123e+04 3r0.        0 3.593e+04 0 4.247e+04
0 7.113e+04 0 1.002e+05 0 1.062e+05 3r0.        0 5.838e+04 0 2.623e+04
0 2.710e+04 3r0.        0 1.710e+0311r0.        0 1.016e+04 0 1.067e+04
0 1.554e+04 3r0.        0 2.300e+04 0 1.527e+04 0 1.848e+04 0 2.650e+04
0 3.504e+04 3r0.        0 2.892e+04 0 2.097e+04 0 2.104e+04 3r0.
0 1.111e+0311r0.        0 8.527e+03 0 9.883e+03 0 1.323e+04 0 1.529e+04
0 1.818e+04 0 2.154e+04 0 1.804e+04 0 1.069e+04 0 1.052e+04 0 1.251e+04
0 1.962e+04 0 4.999e+04 0 9.769e+04 0 9.384e+04 0 3.268e+04 0 2.008e+04
0 2.475e+04 3r0.        0 1.066e+0311r0.        0 7.685e+03 0 8.711e+03
0 1.082e+04 3r0.        0 1.532e+04 0 9.414e+03 0 8.760e+03 0 9.874e+03
0 1.601e+04 9r0.        0 1.069e+0311r0.        0 6.744e+03 0 6.766e+03
0 8.683e+03 3r0.        0 1.127e+04 0 7.178e+03 0 5.943e+03 0 6.567e+03
0 9.377e+03 0 2.151e+04 0 4.902e+04 0 7.190e+04 0 6.096e+04 0 2.390e+04
4r0.        0 1.079e+0310r0.        0 5.379e+03 0 5.693e+03 0 5.197e+03
0 7.723e+0312r0.        0 2.387e+04 4r0.        0 1.136e+0310r0.
0 4.138e+03 0 3.939e+03 0 3.953e+03 0 6.538e+03 0 8.583e+03 0 7.779e+03
0 7.238e+03 0 7.431e+03 0 5.967e+03 0 4.231e+03 0 4.569e+03 0 5.769e+03
4r0.        0 2.606e+04 4r0.        0 1.136e+0310r0.        0 2.105e+03
0 2.109e+03 0 2.704e+03 0 4.273e+03 0 4.066e+03 0 3.551e+03 0 3.380e+03
0 3.884e+03 0 3.819e+03 0 2.712e+03 0 2.798e+03 0 4.030e+03 4r0.
0 2.677e+04 4r0.        0 1.133e+0310r0.        0 1.146e+03 0 1.259e+03
```

Table B-6. (continued)

```
 0 1.987e+03 0 2.612e+03 0 2.267e+03 0 1.899e+03 0 1.890e+03 0 2.278e+03
 0 2.472e+03 0 2.149e+03 0 2.021e+03 0 3.435e+03 4r0.         0 2.620e+04
 0 9.046e+02 0 1.064e+03 0 1.163e+03 0 1.125e+03 0 1.145e+0321r0.
 0 3.058e+03 4r0.         0 2.346e+0426r0.         0 2.812e+03 4r0.
 0 1.873e+0426r0.         0 2.429e+03 4r0.         0 1.364e+0426r0.
 0 1.950e+03 4r0.         0 9.218e+0326r0.         0 1.551e+03 4r0.
 0 5.400e+0315r0.
 group =  20
 6r0.         0 4.486e+03 0 3.568e+03 0 2.720e+03 0 1.965e+03 0 1.516e+03
 0 1.285e+03 0 1.200e+03 0 1.094e+03 0 1.053e+03 0 1.040e+03 0 9.903e+02
 0 9.816e+02 0 9.367e+02 0 9.398e+02 0 8.975e+02 0 9.359e+02 0 8.687e+02
 0 9.087e+02 0 8.615e+02 0 8.844e+02 0 8.613e+02 0 8.777e+02 0 8.509e+02
 0 8.707e+02 0 8.549e+02 0 8.601e+02 6r0.         0 5.182e+03 0 4.022e+03
 0 3.103e+03 0 2.233e+03 0 1.699e+03 0 1.428e+03 0 1.317e+03 0 1.216e+03
 0 1.153e+03 0 1.127e+03 0 1.094e+03 0 1.064e+03 0 1.035e+03 0 1.016e+03
 0 9.990e+02 0 9.655e+02 0 9.785e+02 0 9.646e+02 0 9.702e+02 0 9.488e+02
 0 9.548e+02 0 9.472e+02 0 9.441e+02 0 9.411e+02 0 9.406e+02 0 9.377e+02
 6r0.         0 4.443e+03 0 3.246e+03 0 2.566e+03 0 1.835e+03 0 1.383e+03
 0 1.162e+03 0 1.040e+03 0 9.864e+02 0 9.123e+02 0 8.989e+02 0 8.641e+02
 0 8.395e+02 0 8.223e+02 0 7.977e+02 0 7.952e+02 0 7.733e+02 0 7.714e+02
 0 7.722e+02 0 7.676e+02 0 7.545e+02 0 7.572e+02 0 7.459e+02 0 7.499e+02
 0 7.473e+02 0 7.387e+02 0 7.440e+0221r0.         0 7.093e+02 0 4.893e+02
 0 5.237e+02 0 4.853e+02 0 5.028e+02 0 4.878e+02 0 4.914e+02 0 4.821e+02
 0 4.918e+02 0 4.780e+02 0 4.854e+0221r0.         0 5.930e+0216r0.
 0 3.785e+03 0 3.079e+03 0 2.110e+03 0 1.719e+03 0 1.225e+03 0 9.997e+02
 0 9.482e+02 0 8.230e+02 0 8.580e+02 0 7.915e+02 0 7.487e+02 0 7.388e+02
 0 6.991e+02 0 6.905e+02 0 6.216e+02 0 5.310e+0231r0.         0 4.776e+02
16r0.         0 3.107e+03 0 2.930e+03 0 2.147e+03 0 1.493e+03 0 1.280e+03
 0 9.231e+02 0 7.999e+02 0 8.215e+02 0 6.500e+02 0 7.226e+02 0 6.839e+02
 0 6.210e+02 0 6.204e+02 0 5.785e+02 0 5.109e+02 0 3.971e+0231r0.
 0 3.912e+0231r0.         0 3.672e+0231r0.         0 3.138e+0231r0.
 0 3.341e+0231r0.         0 3.428e+0231r0.         0 2.887e+0231r0.
 0 2.548e+0231r0.         0 2.915e+0231r0.         0 3.212e+0231r0.
 0 2.844e+0231r0.         0 2.213e+0231r0.         0 1.532e+0221r0.
 0 4.221e+05 0 3.500e+05 0 2.501e+05 0 1.794e+05 0 1.545e+05 0 1.198e+05
 0 7.984e+04 3r0.         0 1.342e+0221r0.         0 3.681e+05 0 2.811e+01
 0 2.165e+01 0 1.484e+05 0 1.348e+05 0 1.016e+05 0 7.100e+04 3r0.
 0 1.333e+0221r0.         0 3.164e+05 0 2.044e+01 0 1.815e+01 0 1.227e+05
 0 1.049e+05 0 8.264e+04 0 5.628e+04 3r0.         0 1.187e+0221r0.
 0 2.914e+05 0 1.652e+05 0 1.583e+05 0 1.159e+05 0 8.421e+04 0 7.189e+04
 0 4.697e+0425r0.         0 2.744e+05 3r0.         0 8.059e+04 0 6.091e+04
 0 4.417e+04 3r0.         0 1.138e+0211r0.         0 1.588e+05 0 1.573e+05
 0 1.611e+05 0 1.718e+05 0 1.787e+05 0 1.895e+05 0 2.082e+05 3r0.
 0 2.621e+05 3r0.         0 8.135e+04 0 5.145e+04 0 4.115e+04 3r0.
 0 9.679e+0111r0.         0 1.253e+05 0 1.186e+05 0 1.260e+05 0 1.296e+05
```

Table B-6. (continued)

```
0 1.194e+01 0 1.253e+01 0 1.579e+05 3r0.         0 2.476e+05 3r0.
0 8.609e+04 0 4.472e+04 0 3.413e+0415r0.         0 9.551e+04 0 8.605e+04
0 9.406e+04 0 9.366e+04 0 9.545e+04 0 9.818e+04 0 1.166e+05 7r0.
0 8.924e+04 0 4.062e+04 0 2.667e+0415r0.         0 8.109e+04 0 6.998e+04
0 7.833e+04 3r0.         0 1.002e+05 7r0.         0 9.227e+04 0 3.884e+04
0 2.314e+04 3r0.         0 5.744e+0111r0.         0 6.675e+04 0 5.430e+04
0 6.278e+04 3r0.         0 8.711e+04 7r0.         0 1.048e+05 0 3.622e+04
0 2.050e+04 3r0.         0 5.445e+0111r0.         0 5.703e+04 0 4.602e+04
0 5.312e+0411r0.         0 1.140e+05 0 3.491e+04 0 1.891e+04 3r0.
0 4.701e+0111r0.         0 5.134e+04 0 4.145e+04 0 4.852e+0411r0.
0 1.140e+05 0 3.488e+04 0 1.800e+04 3r0.         0 4.116e+0111r0.
0 3.477e+04 0 2.953e+04 0 3.850e+04 3r0.         0 6.742e+04 0 7.872e+04
0 1.266e+05 0 1.734e+05 0 1.765e+05 3r0.         0 7.896e+04 0 3.631e+04
0 1.431e+04 3r0.         0 2.865e+0111r0.         0 1.817e+04 0 1.900e+04
0 2.761e+04 3r0.         0 4.095e+04 0 2.556e+04 0 3.043e+04 0 4.322e+04
0 5.543e+04 3r0.         0 4.285e+04 0 3.094e+04 0 1.313e+04 3r0.
0 1.925e+0111r0.         0 1.520e+04 0 1.749e+04 0 2.328e+04 0 2.710e+04
0 3.306e+04 0 3.931e+04 0 3.275e+04 0 1.867e+04 0 1.811e+04 0 2.123e+04
0 3.097e+04 0 7.658e+04 0 1.501e+05 0 1.388e+05 0 4.326e+04 0 2.289e+04
0 1.465e+04 3r0.         0 1.951e+0111r0.         0 1.366e+04 0 1.539e+04
0 1.938e+04 3r0.         0 2.756e+04 0 1.633e+04 0 1.497e+04 0 1.665e+04
0 2.354e+04 9r0.         0 2.092e+0111r0.         0 1.205e+04 0 1.204e+04
0 1.560e+04 3r0.         0 2.026e+04 0 1.263e+04 0 1.028e+04 0 1.111e+04
0 1.497e+04 0 3.403e+04 0 7.825e+04 0 1.141e+05 0 9.547e+04 0 2.258e+04
4r0.         0 2.224e+0110r0.         0 9.519e+03 0 1.022e+04 0 9.256e+03
0 1.389e+0412r0.         0 2.435e+04 4r0.         0 2.654e+0110r0.
0 7.448e+03 0 7.069e+03 0 7.086e+03 0 1.191e+04 0 1.573e+04 0 1.412e+04
0 1.308e+04 0 1.345e+04 0 1.064e+04 0 7.452e+03 0 7.996e+03 0 9.985e+03
4r0.         0 2.762e+04 4r0.         0 2.756e+0110r0.         0 3.907e+03
0 3.911e+03 0 4.981e+03 0 7.950e+03 0 7.565e+03 0 6.620e+03 0 6.271e+03
0 7.164e+03 0 6.941e+03 0 4.875e+03 0 4.938e+03 0 6.943e+03 4r0.
0 2.981e+04 4r0.         0 2.736e+0110r0.         0 2.199e+03 0 2.403e+03
0 3.770e+03 0 4.945e+03 0 4.280e+03 0 3.530e+03 0 3.564e+03 0 4.254e+03
0 4.514e+03 0 3.922e+03 0 3.577e+03 0 6.017e+03 4r0.         0 2.960e+04
0 2.128e+01 0 2.481e+01 0 2.808e+01 0 2.523e+01 0 2.727e+0121r0.
0 5.354e+03 4r0.         0 2.735e+0426r0.         0 4.998e+03 4r0.
0 2.248e+0426r0.         0 4.332e+03 4r0.         0 1.654e+0426r0.
0 3.495e+03 4r0.         0 1.153e+0426r0.         0 2.814e+03 4r0.
0 7.605e+0315r0.
group =  21
6r0.         0 2.492e+02 0 1.866e+02 0 1.300e+02 0 7.967e+01 0 5.152e+01
0 3.810e+01 0 3.506e+01 0 2.922e+01 0 2.763e+01 0 2.762e+01 0 2.518e+01
0 2.648e+01 0 2.370e+01 0 2.544e+01 0 2.290e+01 0 2.679e+01 0 2.161e+01
0 2.516e+01 0 2.169e+01 0 2.414e+01 0 2.200e+01 0 2.402e+01 0 2.174e+01
0 2.360e+01 0 2.230e+01 0 2.288e+01 6r0.         0 2.876e+02 0 2.115e+02
```

Table B-6. (continued)

```
 0 1.508e+02 0 9.309e+01 0 5.924e+01 0 4.384e+01 0 3.866e+01 0 3.379e+01
 0 3.077e+01 0 2.964e+01 0 2.863e+01 0 2.814e+01 0 2.721e+01 0 2.692e+01
 0 2.673e+01 0 2.464e+01 0 2.603e+01 0 2.553e+01 0 2.613e+01 0 2.501e+01
 0 2.560e+01 0 2.533e+01 0 2.516e+01 0 2.526e+01 0 2.511e+01 0 2.512e+01
 6r0.        0 2.491e+02 0 1.725e+02 0 1.292e+02 0 8.030e+01 0 5.061e+01
 0 3.742e+01 0 3.096e+01 0 2.885e+01 0 2.471e+01 0 2.447e+01 0 2.312e+01
 0 2.246e+01 0 2.221e+01 0 2.124e+01 0 2.174e+01 0 2.027e+01 0 2.038e+01
 0 2.081e+01 0 2.083e+01 0 2.002e+01 0 2.078e+01 0 1.984e+01 0 2.049e+01
 0 2.025e+01 0 1.989e+01 0 2.022e+0121r0.        0 2.090e+01 0 1.208e+01
 0 1.508e+01 0 1.251e+01 0 1.409e+01 0 1.307e+01 0 1.358e+01 0 1.298e+01
 0 1.375e+01 0 1.283e+01 0 1.340e+0121r0.        0 1.547e+0116r0.
 0 2.195e+02 0 1.763e+02 0 1.104e+02 0 8.418e+01 0 4.965e+01 0 3.415e+01
 0 3.120e+01 0 2.379e+01 0 2.656e+01 0 2.252e+01 0 2.040e+01 0 2.045e+01
 0 1.897e+01 0 1.918e+01 0 1.727e+01 0 1.361e+0131r0.        0 1.265e+01
16r0.        0 1.781e+02 0 1.722e+02 0 1.211e+02 0 7.445e+01 0 5.916e+01
 0 3.413e+01 0 2.645e+01 0 2.830e+01 0 1.809e+01 0 2.259e+01 0 2.072e+01
 0 1.743e+01 0 1.815e+01 0 1.682e+01 0 1.459e+01 0 9.910e+0031r0.
 0 1.067e+0131r0.        0 1.013e+0131r0.        0 7.694e+0031r0.
 0 9.239e+0031r0.        0 1.046e+0131r0.        0 7.610e+0031r0.
 0 6.081e+0031r0.        0 8.479e+0031r0.        0 1.049e+0131r0.
 0 9.074e+0031r0.        0 5.777e+0031r0.        0 2.969e+0021r0.
 0 7.772e+05 0 4.434e+05 0 3.365e+05 0 3.330e+05 0 3.217e+05 0 3.030e+05
 0 3.522e+05 3r0.        0 2.679e+0021r0.        0 5.165e+05 0 3.047e+04
 0 2.287e+04 0 1.764e+05 0 1.754e+05 0 1.571e+05 0 2.228e+05 3r0.
 0 3.245e+0021r0.        0 3.898e+05 0 2.171e+04 0 1.929e+04 0 1.207e+05
 0 1.117e+05 0 9.837e+04 0 1.514e+05 3r0.        0 3.225e+0021r0.
 0 3.859e+05 0 1.819e+05 0 1.402e+05 0 1.258e+05 0 1.094e+05 0 8.962e+04
 0 1.283e+0525r0.        0 3.543e+05 3r0.        0 1.231e+05 0 8.832e+04
 0 1.151e+05 3r0.        0 3.630e+0011r0.        0 4.110e+05 0 4.552e+05
 0 5.362e+05 0 6.204e+05 0 6.719e+05 0 8.061e+05 0 8.376e+05 3r0.
 0 3.493e+05 3r0.        0 1.255e+05 0 8.659e+04 0 1.053e+05 3r0.
 0 3.232e+0011r0.        0 2.372e+05 0 2.368e+05 0 2.706e+05 0 2.920e+05
 0 8.958e+03 0 9.671e+03 0 3.581e+05 3r0.        0 3.054e+05 3r0.
 0 1.189e+05 0 8.291e+04 0 9.769e+0415r0.        0 1.453e+05 0 1.359e+05
 0 1.372e+05 0 1.338e+05 0 1.355e+05 0 1.322e+05 0 1.528e+05 7r0.
 0 1.143e+05 0 7.914e+04 0 9.111e+0415r0.        0 1.277e+05 0 1.203e+05
 0 1.225e+05 3r0.        0 1.470e+05 7r0.        0 1.156e+05 0 7.836e+04
 0 8.726e+04 3r0.        0 1.655e+0011r0.        0 1.093e+05 0 1.049e+05
 0 1.088e+05 3r0.        0 1.262e+05 7r0.        0 1.152e+05 0 7.627e+04
 0 8.301e+04 3r0.        0 1.791e+0011r0.        0 9.896e+04 0 9.619e+04
 0 1.009e+0511r0.        0 1.154e+05 0 7.410e+04 0 8.022e+04 3r0.
 0 1.521e+0011r0.        0 9.350e+04 0 9.154e+04 0 9.585e+0411r0.
 0 1.193e+05 0 7.238e+04 0 7.786e+04 3r0.        0 1.200e+0011r0.
 0 7.469e+04 0 7.554e+04 0 8.188e+04 3r0.        0 9.469e+04 0 1.098e+05
 0 1.298e+05 0 1.371e+05 0 1.185e+05 3r0.        0 9.288e+04 0 6.150e+04
```

Table B-6. (continued)

```
0 5.923e+04 3r0.        0 7.054e-0111r0.        0 5.273e+04 0 5.580e+04
0 6.315e+04 3r0.        0 6.820e+04 0 6.878e+04 0 7.641e+04 0 7.665e+04
0 7.000e+04 3r0.        0 6.270e+04 0 4.366e+04 0 3.933e+04 3r0.
0 4.042e-0111r0.        0 4.557e+04 0 4.847e+04 0 5.227e+04 0 5.371e+04
0 5.605e+04 0 5.549e+04 0 5.110e+04 0 4.635e+04 0 4.296e+04 0 4.095e+04
0 4.605e+04 0 5.827e+04 0 6.996e+04 0 6.863e+04 0 4.934e+04 0 3.763e+04
0 3.906e+04 3r0.        0 4.435e-0111r0.        0 4.022e+04 0 4.173e+04
0 4.275e+04 3r0.        0 4.397e+04 0 4.121e+04 0 3.857e+04 0 3.679e+04
0 3.986e+04 9r0.        0 5.581e-0111r0.        0 3.279e+04 0 3.259e+04
0 3.448e+04 3r0.        0 3.386e+04 0 2.916e+04 0 2.697e+04 0 2.478e+04
0 2.536e+04 0 2.993e+04 0 3.537e+04 0 3.880e+04 0 3.487e+04 0 3.360e+04
4r0.        0 6.763e-0110r0.        0 2.634e+04 0 2.652e+04 0 2.648e+04
0 2.975e+0412r0.        0 2.637e+04 4r0.        0 9.307e-0110r0.
0 1.903e+04 0 1.929e+04 0 2.002e+04 0 2.288e+04 0 2.582e+04 0 2.610e+04
0 2.569e+04 0 2.395e+04 0 2.079e+04 0 1.840e+04 0 1.719e+04 0 1.556e+04
4r0.        0 2.595e+04 4r0.        0 1.020e+0010r0.        0 1.013e+04
0 1.032e+04 0 1.103e+04 0 1.194e+04 0 1.185e+04 0 1.191e+04 0 1.179e+04
0 1.153e+04 0 1.090e+04 0 9.915e+03 0 9.485e+03 0 9.842e+03 4r0.
0 2.415e+04 4r0.        0 9.899e-0110r0.        0 4.589e+03 0 4.756e+03
0 5.041e+03 0 5.048e+03 0 5.368e+03 0 5.104e+03 0 5.134e+03 0 5.357e+03
0 5.607e+03 0 5.926e+03 0 6.634e+03 0 8.307e+03 4r0.        0 2.243e+04
0 7.155e-01 0 1.046e+00 0 1.194e+00 0 7.959e-01 0 9.050e-0121r0.
0 6.297e+03 4r0.        0 1.962e+0426r0.        0 5.280e+03 4r0.
0 1.508e+0426r0.        0 4.442e+03 4r0.        0 1.116e+0426r0.
0 3.462e+03 4r0.        0 7.646e+0326r0.        0 2.337e+03 4r0.
0 3.787e+0315r0.
```

Sample Problem B.4

As an example of the overly option (using the ISWTCH parameter), two DKR created binary γ-ray source files are combined in sample problem B.4. Also, one additional mesh interval is added at the inner edge (beginning) of the sphere. The inserted mesh intervals are for position 1.

Table B-7. Input for Sample Problem B.4

```
1       2       1
2       0
3       2      99
4       3      39
5       0       1
```

Table B-8. Output for Sample Problem B.4

```
          ------ input values ------

          number of binary files to be read - "nf"                2
          number of values to be inserted - "isrt"                1
          0/1 - overlay/sequential read - "iswtch"                0

          file number units - "nt(i)"
                 2       3

          file names - "fnam(i)"
              gam1     gam2

          last interval to be read on files - "intr(i)"
                99       39

          reading of binary file  2 completed.          99 intervals have been read  total no. of intervals is     99

          reading of binary file  3 completed.          39 intervals have been read  total no. of intervals is     99

          insert values for after shutdown no.  0 and position  1


          the gamma source file for after shutdown time no. 1 is given below

 group =   1
99r0.         1r0.
 group =   2
99r0.         1r0.
 group =   3
99r0.         1r0.
 group =   4
99r0.         1r0.
 group =   5
33r0.         0 7.396e+05 0 6.150e+05 0 5.125e+05 0 4.274e+05 0 3.566e+05
 0 2.976e+05 0 2.484e+05 0 2.074e+05 0 1.732e+05 0 1.446e+05 0 1.075e+05
 0 6.805e+04 0 4.309e+04 0 2.730e+04 0 1.729e+04 0 1.095e+04 0 6.934e+03
 0 4.391e+03 0 2.780e+03 0 1.760e+03 0 1.114e+03 0 7.050e+02 0 4.461e+02
 0 2.823e+02 0 1.786e+02 0 1.130e+02 0 7.146e+01 0 4.520e+01 0 2.858e+01
 0 1.808e+01 0 1.143e+01 0 7.226e+00 0 4.568e+00 0 2.888e+00 0 1.825e+00
 0 1.154e+00 0 7.293e-01 0 4.609e-01 0 2.913e-01 0 1.841e-01 0 1.163e-01
 0 7.350e-02 0 4.644e-02 0 2.934e-02 0 1.854e-02 0 1.171e-02 0 7.401e-03
 0 4.676e-03 0 2.954e-03 0 1.866e-03 0 1.179e-03 0 7.448e-04 0 4.705e-04
 0 2.972e-04 0 1.878e-04 0 1.186e-04 0 7.492e-05 0 4.733e-05 0 2.990e-05
 0 1.888e-05 0 1.193e-05 0 7.535e-06 0 4.759e-06 0 3.005e-06 0 1.895e-06
 0 1.185e-06 0 0.
```

Table B-8. (continued)

```
 group =   6
99r0.         1r0.
 group =   7
33r0.         0 1.021e+07 0 8.488e+06 0 7.072e+06 0 5.898e+06 0 4.921e+06
 0 4.107e+06 0 3.428e+06 0 2.862e+06 0 2.390e+06 0 1.996e+06 0 1.483e+06
 0 9.391e+05 0 5.947e+05 0 3.767e+05 0 2.386e+05 0 1.511e+05 0 9.569e+04
 0 6.059e+04 0 3.836e+04 0 2.429e+04 0 1.537e+04 0 9.729e+03 0 6.157e+03
 0 3.896e+03 0 2.465e+03 0 1.559e+03 0 9.862e+02 0 6.237e+02 0 3.945e+02
 0 2.494e+02 0 1.577e+02 0 9.972e+01 0 6.304e+01 0 3.985e+01 0 2.519e+01
 0 1.592e+01 0 1.006e+01 0 6.360e+00 0 4.020e+00 0 2.540e+00 0 1.605e+00
 0 1.014e+00 0 6.409e-01 0 4.050e-01 0 2.559e-01 0 1.617e-01 0 1.021e-01
 0 6.453e-02 0 4.077e-02 0 2.575e-02 0 1.627e-02 0 1.028e-02 0 6.493e-03
 0 4.102e-03 0 2.591e-03 0 1.637e-03 0 1.034e-03 0 6.531e-04 0 4.126e-04
 0 2.606e-04 0 1.646e-04 0 1.040e-04 0 6.568e-05 0 4.146e-05 0 2.615e-05
 0 1.636e-05 0 0.
 group =   8
99r0.         1r0.
 group =   9
99r0.         1r0.
 group =  10
99r0.         1r0.
 group =  11
99r0.         1r0.
 group =  12
 0 0.          0 3.233e+04 0 2.571e+04 0 2.023e+04 0 1.581e+04 0 1.228e+04
 0 9.489e+03 0 7.305e+03 0 5.606e+03 0 4.291e+03 0 3.277e+03 0 2.499e+03
 0 1.903e+03 0 1.448e+03 0 1.100e+03 0 8.358e+02 0 6.345e+02 0 4.814e+02
 0 3.651e+02 0 2.768e+02 0 2.090e+02 2r0.          0 1.092e+05 0 8.997e+04
 0 7.439e+04 0 6.161e+04 0 5.107e+04 0 4.234e+04 0 3.511e+04 0 2.908e+04
69r0.
 group =  13
23r0.         0 1.227e+01 0 1.009e+01 0 8.347e+00 0 6.917e+00 0 5.737e+00
 0 4.762e+00 0 3.952e+00 0 3.278e+0069r0.
 group =  14
 0 0.          0 7.054e+02 0 5.714e+02 0 4.569e+02 0 3.623e+02 0 2.853e+02
 0 2.234e+02 0 1.742e+02 0 1.353e+02 0 1.048e+02 0 8.097e+01 0 6.246e+01
 0 4.811e+01 0 3.701e+01 0 2.845e+01 0 2.184e+01 0 1.676e+01 0 1.285e+01
 0 9.843e+00 0 7.525e+00 0 5.709e+00 0 1.111e+06 0 1.054e+06 0 1.256e+06
 0 1.032e+06 0 8.529e+05 0 7.068e+05 0 5.865e+05 0 4.869e+05 0 4.043e+05
 0 3.355e+05 0 2.206e+05 0 2.099e+05 0 1.479e+05 0 1.230e+05 0 1.025e+05
 0 8.548e+04 0 7.132e+04 0 5.952e+04 0 4.969e+04 0 4.148e+04 0 3.464e+04
 0 2.892e+04 0 2.149e+04 0 1.361e+04 0 8.619e+03 0 5.459e+03 0 3.458e+03
 0 2.190e+03 0 1.387e+03 0 8.781e+02 0 5.560e+02 0 3.520e+02 0 2.228e+02
 0 1.410e+02 0 8.923e+01 0 5.646e+01 0 3.572e+01 0 2.260e+01 0 1.429e+01
 0 9.040e+00 0 5.717e+00 0 3.615e+00 0 2.286e+00 0 1.445e+00 0 9.136e-01
```

Table B-8. (continued)

```
 0 5.776e-01 0 3.651e-01 0 2.308e-01 0 1.459e-01 0 9.218e-02 0 5.826e-02
 0 3.681e-02 0 2.326e-02 0 1.470e-02 0 9.289e-03 0 5.869e-03 0 3.708e-03
 0 2.343e-03 0 1.480e-03 0 9.352e-04 0 5.908e-04 0 3.732e-04 0 2.358e-04
 0 1.490e-04 0 9.410e-05 0 5.944e-05 0 3.755e-05 0 2.372e-05 0 1.498e-05
 0 9.466e-06 0 5.979e-06 0 3.777e-06 0 2.386e-06 0 1.507e-06 0 9.519e-07
 0 6.009e-07 0 3.790e-07 0 2.371e-07 0 0.
 group =  15
 0 0.        0 5.067e+04 0 4.030e+04 0 3.171e+04 0 2.478e+04 0 1.925e+04
 0 1.488e+04 0 1.145e+04 0 8.790e+03 0 6.728e+03 0 5.140e+03 0 3.919e+03
 0 2.985e+03 0 2.271e+03 0 1.726e+03 0 1.311e+03 0 9.955e+02 0 7.554e+02
 0 5.730e+02 0 4.343e+02 0 3.280e+02 2r0.        0 2.035e+05 0 1.716e+05
 0 1.452e+05 0 1.227e+05 0 1.037e+05 0 8.754e+04 0 7.358e+04 0 6.124e+04
69r0.
 group =  16
 0 0.        0 2.476e+05 0 2.241e+05 0 2.021e+05 0 1.822e+05 0 1.642e+05
 0 1.480e+05 0 1.333e+05 0 1.198e+05 0 1.075e+05 0 9.601e+04 0 8.528e+04
 0 7.517e+04 0 6.559e+04 0 5.645e+04 0 4.772e+04 0 3.932e+04 0 3.128e+04
 0 2.346e+04 0 1.606e+04 0 8.527e+03 0 1.454e+08 0 3.616e+07 0 5.448e+07
 0 5.071e+07 0 4.675e+07 0 4.221e+07 0 3.754e+07 0 3.282e+07 0 2.800e+07
 0 2.281e+07 0 1.039e+07 0 1.078e+0767r0.
 group =  17
 0 0.        0 2.054e+05 0 2.028e+05 0 1.985e+05 0 1.927e+05 0 1.855e+05
 0 1.771e+05 0 1.676e+05 0 1.573e+05 0 1.463e+05 0 1.347e+05 0 1.228e+05
 0 1.105e+05 0 9.804e+04 0 8.551e+04 0 7.300e+04 0 6.054e+04 0 4.826e+04
 0 3.605e+04 0 2.429e+04 0 1.214e+04 0 4.167e+06 0 3.950e+06 0 4.716e+06
 0 3.889e+06 0 3.225e+06 0 2.681e+06 0 2.231e+06 0 1.856e+06 0 1.543e+06
 0 1.279e+06 0 8.361e+05 0 7.930e+0567r0.
 group =  18
 0 0.        0 2.004e+03 0 1.691e+03 0 1.407e+03 0 1.163e+03 0 9.553e+02
 0 7.822e+02 0 6.391e+02 0 5.216e+02 0 4.256e+02 0 3.472e+02 0 2.833e+02
 0 2.309e+02 0 1.880e+02 0 1.525e+02 0 1.230e+02 0 9.827e+01 0 7.739e+01
 0 5.948e+01 0 4.410e+01 0 3.014e+01 0 7.130e+06 0 6.758e+06 0 8.012e+06
 0 6.637e+06 0 5.530e+06 0 4.617e+06 0 3.856e+06 0 3.219e+06 0 2.683e+06
 0 2.224e+06 0 1.436e+06 0 1.360e+0667r0.
 group =  19
 0 0.        0 4.788e+02 0 4.397e+02 0 4.016e+02 0 3.659e+02 0 3.327e+02
 0 3.021e+02 0 2.738e+02 0 2.476e+02 0 2.230e+02 0 1.999e+02 0 1.781e+02
 0 1.574e+02 0 1.376e+02 0 1.186e+02 0 1.004e+02 0 8.276e+01 0 6.586e+01
 0 4.940e+01 0 3.378e+01 0 1.787e+01 2r0.        0 8.913e+03 0 7.416e+03
 0 6.209e+03 0 5.201e+03 0 4.355e+03 0 3.640e+03 0 3.030e+03 0 2.500e+03
69r0.
 group =  20
 0 0.        0 1.187e+01 0 9.886e+00 0 8.132e+00 0 6.642e+00 0 5.397e+00
 0 4.369e+00 0 3.530e+00 0 2.848e+00 0 2.296e+00 0 1.851e+00 0 1.492e+00
 0 1.203e+00 0 9.681e-01 0 7.776e-01 0 6.219e-01 0 4.939e-01 0 3.878e-01
```

Table B-8. (continued)

```
 0 2.988e-01 0 2.239e-01 0 1.577e-01 2r0.        0 4.316e+02 0 3.586e+02
 0 2.993e+02 0 2.501e+02 0 2.089e+02 0 1.743e+02 0 1.450e+02 0 1.198e+02
69r0.
 group =  21
23r0.        0 8.745e+00 0 7.258e+00 0 6.024e+00 0 5.000e+00 0 4.150e+00
 0 3.443e+00 0 2.856e+00 0 2.367e+0069r0.
```

APPENDIX C. SAMPLE PROBLEMS FOR DOSE

Sample Problem C.1

The dose rate for sample problem A.1 is computed at the aluminum chamber outer surface (mesh interval #18) using the adjoint option. The dose rate is computed for 12 after shutdown times.

Table C-1. Input for Sample Problem C.1

```
tdf 1m cavity:void-carbon liner-alum.-borated water:adjt:mesh 18
    10     2     3    21    12     5    67    18        0.00
   1
   5
   0.000e+00   0.500e+00 100.000e+00 101.000e+00 106.000e+00 300.000e+00
     1    10     1     5    50
 0 m 1 m10 m1 hr6 hr1 dy1 wk1 mo1 yr10 y100y1 ky
```

Table C-2. Output for Sample Problem C.1

```
tdf 1m cavity:void-carbon liner-alum.-borated water:adjt:mesh 18

identification number - "lid"                                    10
execution option - "lth" 1/2; forward/adjoint                     2
geometry option - "lge" 1/2/3/4; slab/cylinder/sphere/torus       3
number of energy groups - "ngrp" 21/25; gamma/neutron            21
number of after shutdown times - "nas"                           12
number of materials zones - "izn"                                 5
number of mesh intervals - "intval"                              67
interval number of tissue - "ipos" 0/nmbr; all/interval          18
radius of torus - "rtorus"                                    0.000

r-mesh(i)
   0.          500.0e-03   100.0e+00   101.0e+00   106.0e+00   300.0e+00

int(i)
     1    10     1     5    50

bas(i)
   0 m    1 m   10 m   1 hr   6 hr   1 dy   1 wk   1 mo   1 yr   10 y   100y   1 ky

gamma source file read for   1 after' shutdown time

gamma source file read for   2 after' shutdown time

gamma source file read for   3 after' shutdown time

gamma source file read for   4 after' shutdown time

gamma source file read for   5 after' shutdown time

gamma source file read for   6 after' shutdown time

gamma source file read for   7 after' shutdown time

gamma source file read for   8 after' shutdown time

gamma source file read for   9 after' shutdown time

gamma source file read for  10 after' shutdown time

gamma source file read for  11 after' shutdown time

gamma source file read for  12 after' shutdown time
```

Table C-2. (continued)

adjoint case dose rate calculation

interval no.	radius [cm]	volume [cm**3]	interval no.	radius [cm]	volume [cm**3]
1	0.2500	5.23599e-01	35	173.9000	1.47455e+06
2	5.4750	4.77958e+03	36	177.7800	1.54108e+06
3	15.4250	3.07813e+04	37	181.6600	1.60908e+06
4	25.3750	8.15407e+04	38	185.5400	1.67854e+06
5	35.3250	1.57058e+05	39	189.4200	1.74948e+06
6	45.2750	2.57332e+05	40	193.3000	1.82188e+06
7	55.2250	3.82365e+05	41	197.1800	1.89575e+06
8	65.1750	5.32154e+05	42	201.0600	1.97109e+06
9	75.1250	7.06702e+05	43	204.9400	2.04790e+06
10	85.0750	9.06007e+05	44	208.8200	2.12617e+06
11	95.0250	1.13007e+06	45	212.7000	2.20591e+06
12	100.5000	1.26925e+05	46	216.5800	2.28713e+06
13	101.5000	1.29463e+05	47	220.4600	2.36980e+06
14	102.5000	1.32026e+05	48	224.3400	2.45395e+06
15	103.5000	1.34615e+05	49	228.2200	2.53957e+06
16	104.5000	1.37229e+05	50	232.1000	2.62665e+06
17	105.5000	1.39868e+05	51	235.9800	2.71520e+06
18	107.9400	5.68137e+05	52	239.8600	2.80522e+06
19	111.8200	6.09711e+05	53	243.7400	2.89671e+06
20	115.7000	6.52753e+05	54	247.6200	2.98966e+06
21	119.5800	6.97263e+05	55	251.5000	3.08408e+06
22	123.4600	7.43241e+05	56	255.3800	3.17998e+06
23	127.3400	7.90688e+05	57	259.2600	3.27733e+06
24	131.2200	8.39602e+05	58	263.1400	3.37616e+06
25	135.1000	8.89984e+05	59	267.0200	3.47646e+06
26	138.9800	9.41834e+05	60	270.9000	3.57822e+06
27	142.8600	9.95152e+05	61	274.7800	3.68145e+06
28	146.7400	1.04994e+06	62	278.6600	3.78615e+06
29	150.6200	1.10619e+06	63	282.5400	3.89232e+06
30	154.5000	1.16392e+06	64	286.4200	3.99995e+06
31	158.3800	1.22311e+06	65	290.3000	4.10906e+06
32	162.2600	1.28376e+06	66	294.1800	4.21963e+06
33	166.1400	1.34589e+06	67	298.0600	4.33167e+06
34	170.0200	1.40949e+06			

Table C-2. (continued)

the dose rates at interval 18, radius 107.940 cm for 12 times after shutdown are:

the dose rate 0 m after shutdown is 2.49868e+08 mrem/hr

the dose rate 1 m after shutdown is 1.54888e+08 mrem/hr

the dose rate 10 m after shutdown is 6.98443e+07 mrem/hr

the dose rate 1 hr after shutdown is 2.50459e+07 mrem/hr

the dose rate 6 hr after shutdown is 1.90130e+07 mrem/hr

the dose rate 1 dy after shutdown is 8.25765e+06 mrem/hr

the dose rate 1 wk after shutdown is 1.04568e+04 mrem/hr

the dose rate 1 mo after shutdown is 7.07361e-01 mrem/hr

the dose rate 1 yr after shutdown is 7.07361e-01 mrem/hr

the dose rate 10 y after shutdown is 7.07354e-01 mrem/hr

the dose rate 100y after shutdown is 7.07321e-01 mrem/hr

the dose rate 1 ky after shutdown is 7.06689e-01 mrem/hr

Sample Problem C.2

The dose rate for sample problem A.2 is computed at the aluminum chamber outer surface (mesh interval #18) using the adjoint option. Since sample problem A.2 contains the impurities of the graphite liner and the impurities and remaining constituents of the aluminum chamber wall, a comparison of those results and the sample problem C.1 results can be made. The difference in the results is solely due to the activation of the impurities and remaining constituents.

Table C-3. Input for Sample Problem C.2

```
tdf 1m cavity:void-carbon liner-alum.-borated water:adjt:mesh 18
    10     2     3    21    12     5    67    18        0.00
   1
   5
   0.000e+00   0.500e+00 100.000e+00 101.000e+00 106.000e+00 300.000e+00
     1    10     1     5    50
 0 m 1 m10 m1 hr6 hr1 dy1 wk1 mo1 yr10 y100y1 ky
```

Table C-4. Output for Sample Problem C.2

```
tdf 1m cavity:void-carbon liner-alum.-borated water:adjt:mesh 18

identification number - "iid"                                        10
execution option - "ith" 1/2; forward/adjoint                         2
geometry option - "ige" 1/2/3/4; slab/cylinder/sphere/torus           3
number of energy groups - "ngrp" 21/25; gamma/neutron                21
number of after shutdown times - "nas"                               12
number of materials zones - "izn"                                     5
number of mesh intervals - "intval"                                  67
interval number of tissue - "ipos" 0/nmbr; all/interval              18
radius of torus - "rtorus"                                        0.000

r-mesh(i)
   0.          500.0e-03   100.0e+00   101.0e+00   106.0e+00   300.0e+00

int(i)
     1    10     1     5    50

bas(i)
   0 m    1 m   10 m   1 hr   6 hr   1 dy   1 wk   1 mo   1 yr   10 y   100y   1 ky

gamma source file read for   1 after' shutdown time

gamma source file read for   2 after' shutdown time

gamma source file read for   3 after' shutdown time

gamma source file read for   4 after' shutdown time

gamma source file read for   5 after' shutdown time

gamma source file read for   6 after' shutdown time

gamma source file read for   7 after' shutdown time

gamma source file read for   8 after' shutdown time

gamma source file read for   9 after' shutdown time

gamma source file read for  10 after' shutdown time

gamma source file read for  11 after' shutdown time

gamma source file read for  12 after' shutdown time
```

Table C-4. (continued)

adjoint case dose rate calculation

interval no.	radius [cm]	volume [cm**3]	interval no.	radius [cm]	volume [cm**3]
1	0.2500	5.23599e-01	35	173.9000	1.47455e+06
2	5.4750	4.77958e+03	36	177.7800	1.54108e+06
3	15.4250	3.07813e+04	37	181.6600	1.60908e+06
4	25.3750	8.15407e+04	38	185.5400	1.67854e+06
5	35.3250	1.57058e+05	39	189.4200	1.74948e+06
6	45.2750	2.57332e+05	40	193.3000	1.82188e+06
7	55.2250	3.82365e+05	41	197.1800	1.89575e+06
8	65.1750	5.32154e+05	42	201.0600	1.97109e+06
9	75.1250	7.06702e+05	43	204.9400	2.04790e+06
10	85.0750	9.06007e+05	44	208.8200	2.12617e+06
11	95.0250	1.13007e+06	45	212.7000	2.20591e+06
12	100.5000	1.26925e+05	46	216.5800	2.28713e+06
13	101.5000	1.29463e+05	47	220.4600	2.36980e+06
14	102.5000	1.32026e+05	48	224.3400	2.45395e+06
15	103.5000	1.34615e+05	49	228.2200	2.53957e+06
16	104.5000	1.37229e+05	50	232.1000	2.62665e+06
17	105.5000	1.39868e+05	51	235.9800	2.71520e+06
18	107.9400	5.68137e+05	52	239.8600	2.80522e+06
19	111.8200	6.09711e+05	53	243.7400	2.89671e+06
20	115.7000	6.52753e+05	54	247.6200	2.98966e+06
21	119.5800	6.97263e+05	55	251.5000	3.08408e+06
22	123.4600	7.43241e+05	56	255.3800	3.17998e+06
23	127.3400	7.90688e+05	57	259.2600	3.27733e+06
24	131.2200	8.39602e+05	58	263.1400	3.37616e+06
25	135.1000	8.89984e+05	59	267.0200	3.47646e+06
26	138.9800	9.41834e+05	60	270.9000	3.57822e+06
27	142.8600	9.95152e+05	61	274.7800	3.68145e+06
28	146.7400	1.04994e+06	62	278.6600	3.78615e+06
29	150.6200	1.10619e+06	63	282.5400	3.89232e+06
30	154.5000	1.16392e+06	64	286.4200	3.99995e+06
31	158.3800	1.22311e+06	65	290.3000	4.10906e+06
32	162.2600	1.28376e+06	66	294.1800	4.21963e+06
33	166.1400	1.34589e+06	67	298.0600	4.33167e+06
34	170.0200	1.40949e+06			

Table C-4. (continued)

the dose rates at interval 18, radius 107.940 cm for 12 times after shutdown are:

the dose rate 0 m after shutdown is 3.09440e+08 mrem/hr

the dose rate 1 m after shutdown is 1.63937e+08 mrem/hr

the dose rate 10 m after shutdown is 7.15680e+07 mrem/hr

the dose rate 1 hr after shutdown is 2.57409e+07 mrem/hr

the dose rate 6 hr after shutdown is 1.93896e+07 mrem/hr

the dose rate 1 dy after shutdown is 8.39346e+06 mrem/hr

the dose rate 1 wk after shutdown is 1.67564e+04 mrem/hr

the dose rate 1 mo after shutdown is 4.03980e+03 mrem/hr

the dose rate 1 yr after shutdown is 1.40199e+03 mrem/hr

the dose rate 10 y after shutdown is 6.98991e+00 mrem/hr

the dose rate 100y after shutdown is 7.07363e-01 mrem/hr

the dose rate 1 ky after shutdown is 7.06692e-01 mrem/hr

Sample Problem C.3

The dose rate for sample problem A.3 is computed at the diode's casing outer surface (mesh interval #1079) using the adjoint option. The dose rate is computed for 12 after shutdown times.

Table C-5. Input for Sample Problem C.3

```
tdf ss diode with 10 cm opening:aluminum+boral+ss304     : adjt:mesh 1079
    10      2      2     21     12    448   1472   1079          0.00
  2
 16
  0.000e+00   1.000e+00   8.000e+00   9.000e+00  10.000e+00  12.000e+00
 14.000e+00  22.000e+00  24.000e+00  28.000e+00  29.000e+00  30.000e+00
 33.000e+00  35.000e+00  45.000e+00  46.000e+00  70.000e+00
    1      3      1      1      1      1      3      1      2      1      1      1
    1      3      1     10
 28
100.000e+00 101.000e+00 106.000e+00 107.000e+00 111.000e+00 112.000e+00
117.000e+00 118.000e+00 156.000e+00 163.000e+00 164.000e+00 168.000e+00
169.000e+00 171.000e+00 172.000e+00 175.000e+00 176.000e+00 180.000e+00
181.000e+00 182.000e+00 191.000e+00 195.000e+00 196.000e+00 199.000e+00
202.000e+00 204.000e+00 211.000e+00 212.000e+00 230.000e+00
    1      2      1      1      1      1      1     10      2      1      2      1
    1      1      1      1      2      1      1      1      1      1      1      1
    1      2      1      5
0 m 1 m10 m1 hr6 hr1 dy1 wk1 mo1 yr10 y100y1 ky
```

Table C-6. Output for Sample Problem C.3

```
tdf ss diode with 10 cm opening:aluminum+boral+ss304     : adjt:mesh 1079

identification number - "lid"                                        10
execution option - "lth" 1/2; forward/adjoint                         2
geometry option - "lge" 1/2/3/4; slab/cylinder/sphere/torus           2
number of energy groups - "ngrp" 21/25; gamma/neutron                21
number of after shutdown times - "nas"                               12
number of materials zones - "izn"                                   448
number of mesh intervals - "intval"                                1472
interval number of tissue - "ipos" 0/nmbr; all/interval            1079
radius of torus - "rtorus"                                        0.000

r-mesh(i)
   0.          100.0e-02   800.0e-02   900.0e-02   100.0e-01   120.0e-01   140.0e-01   220.0e-01   240.0e-01   280.0e-01
   290.0e-01   300.0e-01   330.0e-01   350.0e-01   450.0e-01   460.0e-01   700.0e-01

int(i)
     1     3     1     1     1     1     3     1     2     1     1     1     1     3     1    10

z-mesh(i)
   100.0e+00   101.0e+00   106.0e+00   107.0e+00   111.0e+00   112.0e+00   117.0e+00   118.0e+00   156.0e+00   163.0e+00
   164.0e+00   168.0e+00   169.0e+00   171.0e+00   172.0e+00   175.0e+00   176.0e+00   180.0e+00   181.0e+00   182.0e+00

   191.0e+00   195.0e+00   196.0e+00   199.0e+00   202.0e+00   204.0e+00   211.0e+00   212.0e+00   230.0e+00

int(i)
     1     2     1     1     1     1     1    10     2     1     2     1     1     1     1     1     2     1     1     1
     1     1     1     1     1     2     1     5

bas(i)
   0 m    1 m   10 m   1 hr   6 hr   1 dy   1 wk   1 mo   1 yr   10 y   100y   1 ky

gamma source file read for   1 after' shutdown time

gamma source file read for   2 after' shutdown time

gamma source file read for   3 after' shutdown time

gamma source file read for   4 after' shutdown time

gamma source file read for   5 after' shutdown time

gamma source file read for   6 after' shutdown time

gamma source file read for   7 after' shutdown time
```

Table C-6. (continued)

```
gamma source file read for   8 after' shutdown time
gamma source file read for   9 after' shutdown time
gamma source file read for  10 after' shutdown time
gamma source file read for  11 after' shutdown time
gamma source file read for  12 after' shutdown time
```

Table C-6. (continued)

adjoint case dose rate calculation

interval no.	volume [cm**3]	interval no.	volume [cm**3]
1	3.14159e+00	737	3.14159e+00
2	3.17650e+01	738	3.17650e+01
3	6.59734e+01	739	6.59734e+01
4	1.00182e+02	740	1.00182e+02
5	5.34071e+01	741	5.34071e+01
6	5.96903e+01	742	5.96903e+01
7	1.38230e+02	743	1.38230e+02
8	1.63363e+02	744	1.63363e+02
9	2.56912e+02	745	2.56912e+02
10	3.01593e+02	746	3.01593e+02
11	3.46273e+02	747	3.46273e+02
12	2.89027e+02	748	2.89027e+02
13	3.14159e+02	749	3.14159e+02
14	3.39292e+02	750	3.39292e+02
15	1.79071e+02	751	1.79071e+02
16	1.85354e+02	752	1.85354e+02
17	5.93761e+02	753	5.93761e+02
18	4.27257e+02	754	4.27257e+02
19	7.67945e+02	755	7.67945e+02
20	8.37758e+02	756	8.37758e+02
21	9.07571e+02	757	9.07571e+02
22	2.85885e+02	758	2.85885e+02
23	7.11759e+02	759	7.11759e+02
24	7.47950e+02	760	7.47950e+02
25	7.84142e+02	761	7.84142e+02
26	8.20333e+02	762	8.20333e+02
27	8.56524e+02	763	8.56524e+02
28	8.92715e+02	764	8.92715e+02
29	9.28906e+02	765	9.28906e+02
30	9.65097e+02	766	9.65097e+02
31	1.00129e+03	767	1.00129e+03
32	1.03748e+03	768	1.03748e+03
33	7.85398e+00	769	6.28319e+00
34	7.94125e+01	770	6.35300e+01
35	1.64934e+02	771	1.31947e+02
36	2.50455e+02	772	2.00364e+02
37	1.33518e+02	773	1.06814e+02
38	1.49226e+02	774	1.19381e+02
39	3.45575e+02	775	2.76460e+02
40	4.08407e+02	776	3.26726e+02
41	6.42281e+02	777	5.13825e+02
42	7.53982e+02	778	6.03186e+02

Table C-6. (continued)

43	8.65683e+02	779	6.92547e+02
44	7.22566e+02	780	5.78053e+02
45	7.85398e+02	781	6.28319e+02
46	8.48230e+02	782	6.78584e+02
47	4.47677e+02	783	3.58142e+02
48	4.63385e+02	784	3.70708e+02
49	1.48440e+03	785	1.18752e+03
50	1.06814e+03	786	8.54513e+02
51	1.91986e+03	787	1.53589e+03
52	2.09440e+03	788	1.67552e+03
53	2.26893e+03	789	1.81514e+03
54	7.14712e+02	790	5.71770e+02
55	1.77940e+03	791	1.42352e+03
56	1.86988e+03	792	1.49590e+03
57	1.96035e+03	793	1.56828e+03
58	2.05083e+03	794	1.64067e+03
59	2.14131e+03	795	1.71305e+03
60	2.23179e+03	796	1.78543e+03
61	2.32227e+03	797	1.85781e+03
62	2.41274e+03	798	1.93019e+03
63	2.50322e+03	799	2.00258e+03
64	2.59370e+03	800	2.07496e+03
65	7.85398e+00	801	3.14159e+00
66	7.94125e+01	802	3.17650e+01
67	1.64934e+02	803	6.59734e+01
68	2.50455e+02	804	1.00182e+02
69	1.33518e+02	805	5.34071e+01
70	1.49226e+02	806	5.96903e+01
71	3.45575e+02	807	1.38230e+02
72	4.08407e+02	808	1.63363e+02
73	6.42281e+02	809	2.56912e+02
74	7.53982e+02	810	3.01593e+02
75	8.65683e+02	811	3.46273e+02
76	7.22566e+02	812	2.89027e+02
77	7.85398e+02	813	3.14159e+02
78	8.48230e+02	814	3.39292e+02
79	4.47677e+02	815	1.79071e+02
80	4.63385e+02	816	1.85354e+02
81	1.48440e+03	817	5.93761e+02
82	1.06814e+03	818	4.27257e+02
83	1.91986e+03	819	7.67945e+02
84	2.09440e+03	820	8.37758e+02
85	2.26893e+03	821	9.07571e+02
86	7.14712e+02	822	2.85885e+02
87	1.77940e+03	823	7.11759e+02

Table C-6. (continued)

```
the dose rates at interval 1079 for   12 times after shutdown are:
the dose rate  0 m after shutdown is  1.49768e+06 mrem/hr
the dose rate  1 m after shutdown is  3.54802e+05 mrem/hr
the dose rate 10 m after shutdown is  3.65684e+04 mrem/hr
the dose rate 1 hr after shutdown is  1.12091e+04 mrem/hr
the dose rate 6 hr after shutdown is  5.58043e+03 mrem/hr
the dose rate 1 dy after shutdown is  1.79778e+03 mrem/hr
the dose rate 1 wk after shutdown is  8.99514e+01 mrem/hr
the dose rate 1 mo after shutdown is  7.10227e+01 mrem/hr
the dose rate 1 yr after shutdown is  1.95129e+01 mrem/hr
the dose rate 10 y after shutdown is  4.36765e+00 mrem/hr
the dose rate 100y after shutdown is  5.55971e-05 mrem/hr
the dose rate 1 ky after shutdown is  2.40995e-05 mrem/hr
```

APPENDIX D. CONVERT PROGRAM LISTING

```
c
c
c
c
c ------------------- program dkrconvert ------------------------------
c  this program takes the binary gamma-ray source files created by the
c  dkr code and converts it to a fido formatted file used as an input
c  gamma-ray source file either for an anisn gamma-ray transport cal-
c  culation or for a dose rate calculation using the dose code.  the
c  program is set to read up to five binary gamma-ray source files and
c  combine them into one fido formatted gamma-ray source file.  the
c  file units are specified by the user.  additional gamma-ray values
c  per after shutdown time can be added to the source file. the limit
c  on the array sizes are; 1500 final mesh intervals, 21 gamma-ray
c  energy groups, and 12 after shutdown times (see dkr input section)
c
      dimension gs(12,21,1500), nt(5), intr(5), value(21), zero(21)
      integer const(1500), count
      character rr*1, blnk*1, repeat(1500)*1, fnam(5)*4, flnam*4
c
      data rr, blnk / 'r' , ' ' /
      data zero / 21 * 0.0 /
      data fnam / 'gam1','gam2','gam3','gam4','gam5' /
c
c  assigning the standard input and output units and the new file unit
c
      call link (" unit5=(incnvrt,open,text) //")
      call create ( 6,'outcnvrt',2,900000)
      call create (12,'gamcnvrt',2,900000)
c
      n5 = 5
      n6 = 6
      nt12 = 12
c
c  read input data
c
      call rdinpt(n5, n6, nt, fnam, intr, isrt, iswtch, nf)
c
c  open gamma ray binary files
c
      do 3 i=1,nf
         nun = nt(i)
         flnam = fnam(i)
         open (unit=nun,file=flnam)
    3 continue
c
c  read binary gamma-ray source files
c
      call rdbnry(n6, nt, intr, iswtch, nf, gs, nas, ngrp, int)
c
c  close gamma ray binary files
c
      do 4 i=1,nf
         nun = nt(i)
         close (unit=nun,status='keep')
    4 continue
c
c  now to insert the additional values
c
   25 if( isrt .gt. 0 ) then
         it = 0
         read(n5,100) las, ipos
         write(n6,200) las, ipos
         do 5 jt=1,nas
```

```
65                it = it + 1
66                if( las .eq. it ) then
67                   read(n5,105) (value(j),j=1,ngrp)
68                   write(n6,205)
69                   write(n6,210) (value(j),j=1,ngrp)
70                else
71                   do 10 j=1,ngrp
72                      value(j) = zero(j)
73       10          continue
74                endif
75                do 15 jg=1,ngrp
76                   do 20 i=int,ipos,-1
77                      gs(jt,jg,i+1) = gs(jt,jg,i)
78       20          continue
79                   gs(jt,jg,ipos) = value(jg)
80       15       continue
81        5    continue
82             isrt = isrt - 1
83             int = int + 1
84             go to 25
85          endif
86          write(n6,110)
87    c
88      100 format(2i6)
89      105 format(6e12.3)
90      110 format('0',10x,'the gamma source file for after shutdown time ',
91        1               'no. 1 is given below',/)
92    c
93    c  now to create the fido formatted file
94    c
95          do 50 jt=1,nas
96          do 55 jg=1,ngrp
97             intrl = 0
98             count = 0
99             do 60 jk=2,int
100               if( gs(jt,jg,jk) .eq. gs(jt,jg,jk-1) ) then
101                  count = count + 1
102                  if( jk .ne. int ) go to 60
103               endif
104               intrl = intrl + 1
105               if( count .gt. 0 ) then
106                  count = count + 1
107                  const(intrl) = count
108                  repeat(intrl) = rr
109                  gs(jt,jg,intrl) = gs(jt,jg,jk-1)
110      65          if( count .gt. 99 ) then
111                     const(intrl) = 99
112                     count = count - 99
113                     intrl = intrl + 1
114                     const(intrl) = count
115                     repeat(intrl) = rr
116                     gs(jt,jg,intrl) = gs(jt,jg,jk-1)
117                     go to 65
118                  endif
119                  if(jk.eq.int .and. gs(jt,jg,jk).ne.gs(jt,jg,jk-1)) then
120                     intrl = intrl + 1
121                     const(intrl) = 0
122                     repeat(intrl) = blnk
123                     gs(jt,jg,intrl) = gs(jt,jg,jk)
124                  endif
125               else
126                  const(intrl) = count
127                  repeat(intrl) = blnk
128                  gs(jt,jg,intrl) = gs(jt,jg,jk-1)
129                  if( jk .eq. int ) then
```

```
                  intrl = intrl + 1
                  const(intrl) = count
                  repeat(intrl) = blnk
                  gs(jt,jg,intrl) = gs(jt,jg,jk)
               endif
            endif
            count = 0
   60    continue
         write(nt12,220) (const(j),repeat(j),gs(jt,jg,j),j=1,intrl)
         if( jt .eq. 1 ) then
            write(n6,215) jg
            write(n6,220) (const(j),repeat(j),gs(jt,jg,j),j=1,intrl)
         endif
   55 continue
   50 continue
c
  200 format('0',10x,'insert values for after shutdown no.',i3,' and',
     1              ' position',i3,/)
  205 format('0',10x,'value(g),g=1-->21')
  210 format(' ',(10x,7(3x,e9.3)),7(/,11x,7(3x,e9.3)))
  215 format(' ','group = ',i3)
  220 format(6(i2,a1,e9.3))
      stop
      end
c
c  ---------------------- subroutine rdinpt ----------------------------
c
c  this subroutine reads and prints the input data for the dkrconvert
c  code
c
      subroutine rdinpt(
     1 n5, n6,
     2
     3 nt, fnam, intr, isrt, iswtch, nf)
c
      dimension nt(5), intr(5)
      character fnam(5)*4
c
c  read number of binary files and number of inserts
c
      read(n5,100) nf, isrt
c
c  read switch for overlay binary reads or sequential binary reads
c  iswtch =   0/1   overlay binary read/sequential binary read
c
      read(n5,100) iswtch
c
c  read binary file number and last interval
c
      read(n5,100) (nt(i),intr(i),i=1,nf)
c
  100 format(2i6)
c
c  in this section some of the input parameters are printed
c
c  print number of files to be read and number of inserts
c
      write(n6,200)
      write(n6,205) nf
      write(n6,210) isrt
      write(n6,215) iswtch
c
c  print binary file numbers and last interval to be read
c
      write(n6,220)
```

```
      write(n6,225) (nt(i),i=1,nf)
      write(n6,230)
      write(n6,235) (fnam(i),i=1,nf)
      write(n6,240)
      write(n6,225) (intr(i),i=1,nf)
c
  200 format('1',10x,'----- input values -----')
  205 format('0',10x,'number of binary files to be read - "nf"',8x,i6)
  210 format(' ',10x,'number of values to be inserted - "isrt"',8x,i6)
  215 format(' ',10x,'0/1 - overlay/sequential read - "iswtch"',8x,i6)
  220 format('0',10x,'file number units - "nt(i)"')
  225 format(' ',10x,5(2x,i6))
  230 format('0',10x,'file names - "fnam(i)"')
  235 format(' ',10x,5(4x,a4))
  240 format('0',10x,'last interval to be read on files - "intr(i)"')
c
      return
      end
c
c  ------------------- subroutine rdbnry ------------------------------
c
c  this subroutine reads the binary gamma-ray source files
c
      subroutine rdbnry(
     1 n6, nt, intr, iswtch, nf,
     2
     3 gs, nas, mggnew, int)
c
      dimension gsns(12,21), gs(12,21,1500), nt(5), intr(5)
c
c     krgn: mesh interval number
c     nas: number of times after shutdown
c     mggnew: number of energy groups
c     jop: number of operation times
c
      int = 0
      do 5 i=1,nf
         if(iswtch .eq. 1) then
    1       read(nt(i),end=88) krgn, nas, mggnew, jop
            read(nt(i)) ((gsns(js,jg),jg=1,mggnew),js=1,nas)
            int = int + 1
            do 10 js=1,nas
            do 10 jg=1,mggnew
                  gs(js,jg,int) = gsns(js,jg)
   10       continue
            if( krgn .lt. intr(i) ) go to 1
         else if(iswtch .eq. 0) then
    2       read(nt(i),end=88) krgn, nas, mggnew, jop
            read(nt(i)) ((gsns(js,jg),jg=1,mggnew),js=1,nas)
            do 15 js=1,nas
            do 15 jg=1,mggnew
               if( i .eq. 1 ) then
                  gs(js,jg,krgn) = gsns(js,jg)
               else
                  gs(js,jg,krgn) = gs(js,jg,krgn) + gsns(js,jg)
               endif
   15       continue
            if( krgn .lt. intr(i) ) go to 2
         else
            write(n6,100) iswtch
         endif
         if( int .lt. intr(i) ) int = intr(i)
   88    continue
         write(n6,105) nt(i), krgn, int
c
```

```
260            if( iswtch .eq. 0  .and.  krgn .gt. int ) int = krgn
261         5 continue
262   c
263       100 format('0',10x,'error in binary read input.  iswtch read as',i3)
264       105 format('0',10x,'reading of binary file',i3,' completed.',
265          1            5x,i6,' intervals have been read',
266          1            2x,'total no. of intervals is ',i6)
267   c
268           return
269           end
```

APPENDIX E. DOSE PROGRAM LISTING

```
c  ---------------------- program dkrdose ----------------------------------
c
c  this program is designed to calculate the dose rate of a certain
c  reactor due to neutrons or gammas by using the combination of either
c  an adjoint field and a neutron or gamma source distribution or the
c  anisn forward scalar flux and neutron or gamma flux-to-dose conver-
c  sion factors.  this program is setup for 25 neutron groups or 21
c  gamma groups.  the limit on array sizes are 2475 mesh intervals, 30
c  material zones, and 12 after shutdown times.
c
      dimension vol(2475),avrad(2475),rate(2475),ajrate(12)
      character title*72, bas(12)*8
c
c  assigning the standard input and output units and data units
c
      call dropfile(0)
c
      open(unit=5,file='indose',status='old')
      call create( 6,'outdose',2,900000)
c
      n5 = 5
      n6 = 6
      n8 = 18
      n9 = 19
c
c  read input data
c
      call rdinpt( n5, n6, lth, ngrp, nas, intval, ipos,
     1             bas, title, avrad, vol, idim)
c
c  now to compute the dose rates for the forward or adjoint cases
c
      if( lth .eq. 1 ) then
c
c  forward case
c
         call forwd( n6, n9, intval, ngrp, ipos, rate )
c
c  print heading, interval volumes and dose rates
c
         write(n6,200) bas(nas)
         write(n6,205)
         if( ipos .eq. 0 ) then
            do 10 i=1,intval
               write(n6,210) i,avrad(i),vol(i),rate(i)
10          continue
         else
            write(n6,210) ipos,avrad(ipos),vol(ipos),rate(ipos)
         endif
      else if( lth .eq. 2 ) then
c
c  adjoint case
c
         call adjnt( n6, n8, n9, intval, ngrp, ipos, nas,
     1               vol, ajrate )
c
c  print heading and interval volumes
c
         write(n6,215)
         if(idim .eq. 1) then
```

```
65            write(n6,220)
66            int = intval / 2
67            int1 = int + 1
68            if( 2 * int  .ne.  intval ) then
69               do 20 i=1,int
70                  ii = int1 + i
71                  write(n6,225) i,avrad(i),vol(i),ii,avrad(ii),vol(ii)
72      20       continue
73               write(n6,225) int1,avrad(int1),vol(int1)
74            else
75               do 30 i=1,int
76                  ii = int + i
77                  write(n6,225) i,avrad(i),vol(i),ii,avrad(ii),vol(ii)
78      30       continue
79            endif
80            write(n6,230) ipos,avrad(ipos),nas
81            else if(idim .eq. 2) then
82               write(n6,235)
83               int = intval / 2
84               int1 = int + 1
85               if( 2 * int  .ne.  intval ) then
86                  do 40 i=1,int
87                     ii = int1 + i
88                     write(n6,240) i,vol(i),ii,vol(ii)
89      40          continue
90                     write(n6,240) int1,vol(int1)
91               else
92                  do 50 i=1,int
93                     ii = int + i
94                     write(n6,240) i,vol(i),ii,vol(ii)
95      50          continue
96               endif
97    c
98    c  print total adjoint dose rate
99    c
100              write(n6,245) ipos,nas
101           endif
102           write(n6,250) (bas(i),ajrate(i),i=1,nas)
103        else
104           write(n6,255) lth
105           stop
106        endif
107   c
108     200 format('1',5x,'forward case dose rate calculation at ',a4,
109        1              ' after shutdown')
110     205 format('0',5x,'interval no.',5x,'radius [cm]',5x,'volume [cm**3]',
111        1           5x,'dose rate [mrem/hr]')
112     210 format(' ',9x,i4,9x,f11.4,6x,1pe12.5,10x,1pe12.5)
113     215 format('1',5x,'adjoint case dose rate calculation')
114   c
115     220 format('0',5x,'interval no.',5x,'radius [cm]',5x,'volume [cm**3]'
116        1         ,15x,'interval no.',5x,'radius [cm]',5x,'volume [cm**3]')
117     225 format(' ',9x,i4,8x,f11.4,7x,1p1e12.5,
118        1          20x,i4,8x,0pf11.4,7x,1p1e12.5)
119     230 format('1',5x,'the dose rates at interval ',i4,', radius ',f10.3,
120        1              ' cm for ',i4,' times after shutdown are:')
121     235 format('0',5x,'interval no.',5x,'volume [cm**3]',
122        1          15x,'interval no.',5x,'volume [cm**3]')
123     240 format(' ',9x,i4,10x,1p1e12.5,
124        1          20x,i4,10x,1p1e12.5)
125     245 format('1',5x,'the dose rates at interval ',i4,' for ',
126        1             i4,' times after shutdown are:')
127     250 format('0',5x,'the dose rate ',a4,' after shutdown is ',1pe12.5,
128        1              ' mrem/hr')
129     255 format('0','error ----> in "lth" input.  read as ',i4)
```

```
      stop
      end
c  ---------- subroutine rdinpt ----------
c
c this subroutine reads and prints the input data for the dkrdose code
c
      subroutine rdinpt(
     1 n5,n6,
     3  lth, ngrp, nas, intval, ipos,
     3  bas, title, avrad, vol, idim )
c
      dimension nint(30), rad(31), zzz(31), izzz(30)
      dimension avrad(2475), vol(2475)
      character title*72, bas(12)*8
c
c  read title
c
      read(n5,100) title
c
c  read id number "lid", execution option "lth", geometry option "lge",
c       number of energy groups "ngrp", number of after shutdown times
c       "nas", number of material zones "izn", number of mesh intervals
c       "intval", interval number of tissue "ipos", radius of torus
c       "rtorus".
c
      read(n5,105) lid, lth, lge, ngrp, nas, izn, intval, ipos, rtorus
      read(n5,107) idim
      read(n5,107) irmsh
c
c  read the zone radii positions (radii positions = irmsh + 1)
c  and the number of mesh intervals per zone for the radial pos.
c
      read(n5,110) (rad(i),i=1,irmsh+1)
      read(n5,115) (nint(i),i=1,irmsh)
c
c  compute average radius and volume of each mesh interval for 1d
c  compute volume for each mesh interval for 2d
c
      if(idim .eq. 1) then
         call clcv1d(n6, lge, irmsh, nint, rad, rtorus, vol, avrad)
      else if(idim .eq. 2) then
         read(n5,107)  izmsh
         read(n5,110) (zzz(i),i=1,izmsh + 1)
         read(n5,115) (izzz(i),i=1,izmsh)
         call clcv2d(n6, lge, rad, nint, zzz, izzz, irmsh, izmsh, vol)
      else
         stop 111
      endif
c
c  read the after shutdown times
c
      read(n5,120) (bas(i),i=1,nas)
c
  100 format(a72)
  105 format(8i6,f12.3)
  107 format(i4)
  110 format(6e12.3)
  115 format(12i6)
  120 format(12a4)
c
c  in this section all of the input parameters are printed
c
c  print title
c
      write(n6,200) title
```

```
c
c  print input parameters
c
      write(n6,205) lid
      write(n6,210) lth
      write(n6,215) lge
      write(n6,220) ngrp
      write(n6,225) nas
      write(n6,230) izn
      write(n6,235) intval
      write(n6,240) ipos
      write(n6,242) rtorus
c
  200 format('1',10x,a72)
  205 format('0',10x,'identification number - "lid"',34x,i6)
  210 format(' ',10x,'execution option - "lth" 1/2; forward/adjoint',
     1               18x,i6)
  215 format(' ',10x,'geometry option - "lge" 1/2/3/4; slab/cylinder/',
     1               'sphere/torus',4x,i6)
  220 format(' ',10x,'number of energy groups - "ngrp" 21/25; gamma/',
     1               'neutron',10x,i6)
  225 format(' ',10x,'number of after shutdown times - "nas"',25x,i6)
  230 format(' ',10x,'number of materials zones - "izn"',30x,i6)
  235 format(' ',10x,'number of mesh intervals - "intval"',28x,i6)
  240 format(' ',10x,'interval number of tissue - "ipos" 0/nmbr; all/',
     1               'interval',8x,i6)
  242 format(' ',10x,'radius of torus - "rtorus"',34x,f9.3)
c
c  print the zone radii and the number of mesh intervals
c
      write(n6,245)
      write(n6,250) (rad(i),i=1,irmsh +1)
      write(n6,255)
      write(n6,260) (nint(i),i=1,irmsh)
      if(idim .eq. 2) then
         write(n6,265)
         write(n6,250) (zzz(i),i=1,izmsh+1)
         write(n6,255)
         write(n6,260) (izzz(i),i=1,izmsh)
      endif
c
  245 format('0',10x,'r-mesh(i)')
  250 format(' ',(10x,3p10e12.3),(/,11x,3p10e12.3))
  255 format('0',10x,'int(i)')
  260 format(' ',10x,20i6)
  265 format('0',10x,'z-mesh(i)')
c
c  print the alphanumeric for the after-shutdown times
c
      write(n6,270)
      write(n6,275) (bas(i),i=1,nas)
c
  270 format('0',10x,'bas(i)')
  275 format(' ',12x,12(a4,3x))
      return
      end
c
c  ------------------------ subroutine vfido ------------------------------
c
c  this subroutine deciphers the anisn fido formatted adjoint field or
c  forward flux which is printed on file 19
c
      subroutine vfido(
     1 j9, j6, intval,
     3 x1 )
```

```
c
      dimension in(6), k(6), v(6), x1(intval)
      integer count
c
      data lr, lt / 'r' , 't' /
c
c  begin the decoding process
c
      count = 0
   10 continue
c
c  reading one line at a time
c
      read(j9,100) (in(i),k(i),v(i),i=1,6),m
      do 20 i=1,6
         if( count .eq. intval ) then
            return
         else if( k(i) .eq. lr ) then
c
c  if a "r" is encountered repeat v(i) value "c" times where "c" is the
c  constant preceeding "r"
c
            l = in(i)
            do 30 j=1,l
               count = count + 1
               x1(count) = v(i)
   30       continue
         else if( k(i) .eq. lt ) then
c
c  if a "t" is encountered terminate reading
c
            write(j6,200) count
            stop
         else
            count = count + 1
            x1(count) = v(i)
         endif
   20 continue
      if( count .eq. intval ) then
         return
      else
         go to 10
      endif
c
  100 format(6(i2,a1,f9.0),i8)
  200 format('0','error ---> only ',i7,' entries read')
      end
c
c  ------------------------- subroutine clcv1d-------------------------
c
c  this subroutine computes the average radius and volume for each mesh
c  interval for the three major geometries; slab, cylinder, and sphere
c
      subroutine clcv1d(
     1 n6, lge, irmsh, nint, rad, rtorus,
     3 vol, avrad )
c
      dimension vol(2475), avrad(2475), rad(31), nint(30)
      integer count
c
c  defining pi and 4*pi/3
c
      pi = 4.0 * atan( 1.0 )
      piq = pi * pi
      piv = 4.0 * pi / 3.0
```

```
c
c now to compute the interval volumes
c
      count = 0
      xi = rad(1)
      do 10 i=1,irmsh
         nnt = nint(i)
         dx = rad(i+1) - rad(i)
         do 20 j=1,nnt
            count = count + 1
            xo = (float(nnt) * rad(i) + j * dx) / float(nnt)
            dif = xo - xi
            if( lge .eq. 1 ) then
               vol(count) = dif
            else if( lge .eq. 2 ) then
               vol(count) = pi * dif * (xo + xi)
            else if( lge .eq. 3 ) then
               vol(count) = piv * dif * (xo*xo + xo*xi + xi*xi)
            else if( lge .eq. 4 ) then
               vol(count) = 2.0 * piq * dif * (xo + xi) * rtorus
            else
               write(n6,200) lge
            endif
c
c  now to compute the average radius of each interval
c
            avrad(count) = .5 * (xo + xi)
            xi = xo
   20    continue
   10 continue
c
  200 format('0','error ---> in "lge" input.  read as ',i4)
      return
      end
c
c  ------------------------- subroutine clcv2d-------------------------
c
c  this subroutine computes the average radius and volume for each mesh
c  interval for the two major geometries; slab, and cylinder
c
      subroutine clcv2d(
     1 n6, lge, rad, nint, zzz, izzz, irmsh, izmsh,
     3 vol )
c
      dimension vol(2475), rad(31), nint(30)
      dimension zzz(31), izzz(30)
      integer count
c
c  defining pi and 4*pi/3
c
      pi = 4.0 * atan( 1.0 )
c
c now to compute the interval volumes
c
      count = 0
      do 5 k=1,izmsh
         zi = zzz(k)
         zo = zzz(k+1)
         ntz = izzz(k)
         dz = (zo - zi) / float(ntz)
         do 10 ii=1,ntz
            xi = rad(1)
         do 10 i=1,irmsh
            nnt = nint(i)
            dx = rad(i+1) - rad(i)
```

```
390               do 20 j=1,nnt
391                  count = count + 1
392                  xo = (float(nnt) * rad(i) + j * dx) / float(nnt)
393                  dif = xo - xi
394                  if( lge .eq. 1 ) then
395                     vol(count) = dif * dz
396                  else if( lge .eq. 2 ) then
397                     vol(count) = pi * dif * (xo + xi) * dz
398                  else
399                     write(n6,200) lge
400                  endif
401                  xi = xo
402      20       continue
403      10    continue
404       5 continue
405    c
406      200 format('0','error ----> in "lge" input.  read as ',i4)
407          return
408          end
409    c
410    c  ---------- subroutine forwd ----------
411    c
412    c  this subroutine computes the dose rate received by tissue at a given
413    c  position or positions due to neutrons or gammas using the forward
414    c  case anisn scalar flux values
415    c
416          subroutine forwd(
417         1 n6, n9, intval, ngrp, ipos,
418         3 rate )
419    c
420          dimension flux(2475,25), dd(2475), fkerma(25), gkerma(21),
421         1          rate(2475)
422          real nkerma(25)
423          character title*72, smark*8
424    c
425    c  the data values given below are gamma and neutron flux-to-dose
426    c  conversion factors in units of "mrem/hr"
427    c
428          data gkerma/ 1.180e-02, 1.030e-02, 8.776e-03, 7.845e-03,
429         1             7.477e-03, 7.110e-03, 6.740e-03, 6.371e-03,
430         1             6.003e-03, 5.604e-03, 5.226e-03, 4.828e-03,
431         1             4.407e-03, 3.960e-03, 3.467e-03, 2.925e-03,
432         1             2.310e-03, 1.508e-03, 7.533e-04, 3.833e-04,
433         1             5.741e-04 /
434    c
435          data nkerma/ 2.081e-01, 1.908e-01, 1.720e-01, 1.551e-01,
436         1             1.471e-01, 1.471e-01, 1.471e-01, 1.473e-01,
437         1             1.495e-01, 1.522e-01, 1.543e-01, 1.464e-01,
438         1             1.372e-01, 1.287e-01, 1.270e-01, 1.271e-01,
439         1             9.815e-02, 5.596e-02, 2.167e-02, 5.695e-03,
440         1             3.692e-03, 4.081e-03, 4.472e-03, 4.524e-03,
441         1             3.973e-03 /
442    c
443    c  determining if computation is a neutron or gamma dose calculation
444    c
445          if( ngrp .eq. 25 ) then
446             do 10 i=1,ngrp
447                fkerma(i) = nkerma(i)
448      10     continue
449          else if( ngrp .eq. 21 ) then
450             do 20 i=1,ngrp
451                fkerma(i) = gkerma(i)
452      20     continue
453          else
454             write(n6,200) ngrp
```

```
455            stop
456         endif
457   c
458   c  read scalar flux file
459   c
460         open (unit=n9, file='sclrflux')
461   c
462   c     read(n9,100) title
463         read(n9,105) smark
464         do 30 n=1,ngrp
465            call vfido( n9, n6, intval, dd )
466            do 40 i=1,intval
467               flux(i,n) = dd(i)
468      40    continue
469      30 continue
470   c     write(n6,205) title
471   c
472   c  compute dose rate.  if "ipos" = 0 compute dose rate for all positions
473   c
474         if( ipos .eq. 0 ) then
475            do 50 i=1,intval
476               rate(i) = 0.0
477               do 60 n=1,ngrp
478                  rate(i) = rate(i) + fkerma(n) * flux(i,n)
479      60       continue
480      50    continue
481         else
482            drate = 0.0
483            do 70 n=1,ngrp
484               drate = drate + fkerma(n) * flux(ipos,n)
485      70    continue
486            rate(ipos) = drate
487         endif
488   c
489     100 format(a72)
490     105 format(a4)
491     200 format('0','error ----> ',i4,' scalar flux energy groups read')
492     205 format('0',10x,'anisn forward case scalar flux file read: ',a72)
493   c
494         close (unit=n9, status='keep')
495   c
496         return
497         end
498   c
499   c  ------------------ subroutine adjnt ----------------------------------
500   c
501   c  this subroutine computes the dose rate at a position, "ipos" for
502   c  several times after shutdown using the adjoint flux field computed
503   c  by anisn
504   c
505         subroutine adjnt(
506        1 n6, n8, n9, intval, ngrp, ipos, nas, vol,
507        3 total )
508   c
509         dimension dd(2475), flux(2475,25),
510        1          rfun(25,2475), total(12), vol(2475)
511          integer count
512          character title*72, smark*8
513   c
514   c  read adjoint flux field file and also inverting the flux in energy
515   c
516         open (unit=n9,file='adjtflux')
517   c
518   c     read(n9,100) title
519   c     read(n9,105) smark
```

```
      do 10 n=1,ngrp
c        call vfido( n9, n6, intval, dd )
         read(n9,110) (dd(i),i=1,intval)
         if( ngrp .eq. 25 ) then
            ninv = 26 - n
         else if( ngrp .eq. 21 ) then
            ninv = 22 - n
         else
            write(n6,200) ngrp
            stop
         endif
         do 20 i=1,intval
            flux(i,ninv) = dd(i)
   20    continue
   10 continue
c     write(n6,205) title
c
      close (unit=n9, status='keep')
c
c  read file containing gamma or neutron sources
c
      open (unit=n8, file='gamcnvrt')
c
      do 30 ks=1,nas
         do 40 n=1,ngrp
            call vfido( n8, n6, intval, dd )
            do 50 i=1,intval
               rfun(n,i) = dd(i)
   50       continue
   40    continue
c
         if( ngrp .eq. 21 ) then
            write(n6,210) ks
         else if( ngrp .eq. 25 ) then
            write(n6,215) ks
         endif
c
c  compute dose rate for "nas" after shutdown times
c
         total(ks) = 0.0
         do 60 i=1,intval
            rate = 0.0
            do 70 n=1,ngrp
               rate = rate + rfun(n,i) * flux(i,n)
   70       continue
            rate = rate * vol(i)
            total(ks) = total(ks) + rate
   60    continue
         total(ks) = total(ks) / vol(ipos)
   30 continue
c
      close (unit=n8, status='keep')
c
  100 format(a72)
  105 format(a4)
  110 format(6e12.4)
  200 format('0','error ----> ',i4,' adjoint field energy groups read')
  205 format('0',10x,'anisn adjoint flux file read: ',a72)
  210 format('0',10x,'gamma source file read for ',i3,' after'
     1               ' shutdown time')
  215 format('0',10x,'neutron source file read for ',i3,' after'
     1               ' shutdown time')
      return
      end
```

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