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ATOMICS INTERNATIONAL
A Division of North American Rockwell Corporation

AI-AEC-MEMO COVER SHEET

REPORT TITLE **SOSUM, A PROGRAM TO COMPUTE MULTIGROUP BETA AND GAMMA
ENERGY SOURCES FROM RADIOISOTOPE ACTIVITIES.**

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FIGURE

1. Example SOSUM Library Record

TABLE

1. Data for Sample Problem

Objective

The objective of developing the SOSUM program was to provide a means of converting radioisotopic activity data into multigroup beta and gamma energy sources.

Introduction

Fission product inventory codes, e.g., ISOGEN⁽¹⁾, CURIE⁽²⁾, are generally used in safety studies where the output is radioisotope activity expressed in curies* or disintegrations/sec. In shielding related studies the source intensity and spectra are important since the attenuation and absorption properties of materials are dependent not only on the total decay energy but also on individual beta and photon energies. In a recent study for the FFTF fuel handling machine⁽³⁾ the fraction of the total decay heat that is self-absorbed in the fuel element was determined. An input to that study was the concentration of several hundred radioactive fission products for various operating and shutdown times. Since most of the radioisotopes emit several betas and photons, the need for a computer program to convert this data to multigroup beta and energy sources was obvious. The SOSUM program resulted from that need. A sample problem from the FFTF study is given in this report. Some of the programming format may appear peculiar, but SOSUM has been setup to directly accept punched-card output from the CURIE code.

Discussion

Main Program

The complete listing of the SOSUM code for IBM System/360 is given in Appendix I. The following is a brief description of the code. A sample problem is given later.

The SOSUM program takes input data on the activity of a given radioisotope and converts it to disintegrations/sec. Based on the isotopic name, mass number and a built-in library of Mev/disintegration SOSUM computes and stores the energy source, Mev/sec, in discrete energy groups. The energy groups have previously been specified as input. The code continues to process the data on individual isotopes and add the results to the energy groups until the data for a particular case is exhausted. The output gives the contribution of each isotope and the total energy source by energy group. Since the beta spectra was not important in the reference study⁽³⁾, the present library handles betas as a single group

Built-in Library

The complete library currently in SOSUM is given in Appendix I. It contains data on 181 isotopes ranging from Zn⁷² to Tb¹⁶¹. This data came

*1 curie = 3.7×10^{10} disintegrations/second.

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Reference 4. For each isotope the individual photons/disintegration, are given. The beta data has been reduced, however, to a single group since betas are seldom important in a shielded calculation and for a heating calculation they are all essentially absorbed at their origin. The data in Reference 4 gives the maximum energy in the beta spectrum and since the heating calculations are a function of the "average" beta energy, the average beta energy was determined by the following formula from Reference 5:

$$\bar{E} = 0.33 E \left(1 - \frac{Z^{\frac{1}{2}}}{50} \right) \left(1 + \frac{E^{\frac{1}{2}}}{4} \right)$$

where

$\bar{E}$ = average beta energy (Mev),

E = maximum beta energy (Mev) from Reference 4, and

Z = atomic number of emitting isotope.

An example record of the library data is shown and explained in Figure 1. As mentioned before, the program has been setup to handle either prepared input or punched card output directly from CURIE.

General Input Instructions

The general input instructions for SOSUM are as follows:

1. TITLE CARD(S)

Any 72 alphanumeric characters.

2. SETUP CARD(S)

Col. 1(I): Leave blank if activity data is CURIE code punched card output. Set equal to "1" if activity data is not CURIE output.

Col. 2(I): Leave blank if activity data is in "dis/sec", e.g., CURIE code punched card output. Set equal to "1" if activity data is in "curies". SOSUM will multiply by 3.7×10^{10} to get "dis/sec".

Col. 12(I): Number of gamma energy groups. Present limit is 7 for appearance in output.

Col. 13-24 (E12.8): Lower energy (Mev) for gamma group No. 1.

Col. 25-36 (E12.8): Upper energy (Mev) for gamma group No. 1

FIGURE 1 EXAMPLE SOSUM LIBRARY RECORD

ISOTOPE

$^{85}_{36}\text{Kr}^*$

DECAY SCHEME

REFERENCE

G.R. Crocker and M.A. Conners, "Gamma-Emission Data for the Calculation of Exposure Rates from Nuclear Debris, Vol. 1, Fission Products," USNRDL-TR-876 (June 1965)

SOSUM RECORD (APPENDIX II)

ISOTOPE NAME	MASS NO.	NO. OF GAMMAS	0.305 MEV γ 13.5% OF TIME	0.149 MEV γ 77.8% OF TIME
KR*	85	2	.305 .135	.149 .778
.23781				

TOTAL β
ENERGY/DISINTEGRATION

$$= \sum \bar{E}_\beta N_\beta$$

$$= (0.29359)(0.810)$$

$$\bar{E}_\beta = 0.33 E_\beta \left(1 - \frac{Z^2}{30}\right) \left(1 + \frac{E_\beta}{4}\right)$$

$$= 0.33(0.824) \left(1 - \frac{\sqrt{36}}{30}\right) \left(1 + \frac{0.824}{4}\right)$$

$$\bar{E}_\beta = 0.29359 \text{ MEV}$$

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Continue with the same format (E12.8) for all gamma groups alternating, in order, the lower energy and then the upper energy using as many cards as necessary. The energy groups do not have to be continuous or in order and may overlap. The only requirement is that the lower energy precede the upper energy for each group

3. ACTIVITY DATA CARD(S)

The activity of each isotope takes **one card**. As many cards as necessary are used; there is no limit. The punched card output from the CURIE code can be used directly. In fact, when using the CURIE output the entire deck must be submitted since CURIE does not explicitly identify metastable states. The following description is for a case not using CURIE output:

Col. 1-2 (A2): Symbol for isotope name. Must start in Column 1 even if it is a single letter.

Col. 3 (A1): Use an "*" if isotope is in metastable state. Blank otherwise.

Col. 6-8 (A3): Atomic mass number. Must end in Column 8. In sequencing activity data cards must be in order of ascending mass number. Isotopes of the same mass number can be in any order.

Col. 25-36 (E12.8): Activity in "dis/sec" or "curies" according to setup card.

4. END-OF-CASE CARD

Col. 1 (I): Put a "1" in first column. Multiple cases are run by submitting a new title card, setup card(s), activity cards, and end-of-case card.

5. END-OF-PROBLEM CARD

Col. 1-2(A2): Put a "/" in the first two columns according to the computing system.

Sample Problem

In order to illustrate the input and output formats of the SOSUM program an example problem from the FFTF study⁽³⁾ under which the code was developed is taken. Basically, the problem was to determine the beta and gamma energy due to halogen and inert gaseous fission products in the FFTF reactor for operation at 100 MW for 332 days and shutdown for 24 hours. Seven gamma energy groups were used. The inventory of fission products was received from PNL and are listed in Table 1 along with the gamma group structure. Pages (8) through (16) show the input sheets filled-out according to the instructions in the previous section. Pages (17) and (18) are the output and are self-explanatory.

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		MODEL NO.

TABLE I
DATA FOR SAMPLE PROBLEM

GAMMA GROUP NO.	ENERGY RANGE (MEV)
I	0.0 - 0.4
II	0.4 - 0.9
III	0.9 - 1.35
IV	1.35 - 1.8
V	1.8 - 2.2
VI	2.2 - 2.6
VII	2.6 - 10.0

HALOGENS		INERT GASES	
ISOTOPE	ACTIVITY (CURIES)	ISOTOPE	ACTIVITY (CURIES)
BR 80*	1.254×10^{-13}	KR 83*	2.023×10^3
BR 80	1.343×10^{-13}	KR 85*	9.989×10^3
BR 82	1.832×10^{-6}	KR 85	1.053×10^4
BR 83	5.092×10^2	KR 87	1.749×10^0
BR 84	2.215×10^{-8}	KR 88	3.158×10^3
I 128	4.189×10^{-13}	XE 131*	3.139×10^4
I 129	6.052×10^{-2}	XE 133*	5.556×10^5
I 130	6.473×10^4	XE 133	6.113×10^6
I 131	3.163×10^6	XE 135*	1.348×10^5
I 132	3.702×10^6	XE 135	2.412×10^6
I 133	2.045×10^6	XE 138	5.449×10^{-25}
I 134	2.027×10^{-1}		
I 135	4.794×10^5		

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 1 of 9 JOB NO. 7900-50

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1 HALOGENS		Title Card
13 FTF - 100MW		
25 332-DAY OP		
37 ERATION, 24-		
49 HOUR SHUTDOWN		
61 N	1	
1 1 7		1 = not a CURIE case, 1 = activity data
13 0.0		group 1 starts @ 0.0 Mev in curies,
25 0.4		" 1 ends @ 0.4 Mev 7 = seven
37 0.4		" 2 starts @ 0.4 Mev gamma groups
49 0.9		" 2 ends @ 0.9 Mev
61 0.9	2	
1 1.35		
13 1.35		etc.
25 1.8		
37 1.8		
49 2.2		
61 2.2	3	" 6 starts @ 2.2 Mev
1 2.6		" 6 ends @ 2.6 Mev
13 2.6		" 7 starts @ 2.6 Mev
25 10.0		" 7 ends @ 10.0 Mev
37		
49		
61	4	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 2 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	BR* 80		Br 80*
13			
25	1.254 -13		1.254×10^{-13} curies
37			
49			
61		801	
1	BR 80		
13			
25	1.343 -13		
37			
49			
61		802	
1	BR 82		
13			
25	1.832 -6		
37			
49			
61		821	
1	BR 83		
13			
25	5.092 +2		
37			
49			
61		831	

etc.
↓

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 3 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	BR 84		
13			
25	2.215 -8		
37			
49		73 80	
61		841	
1	I 128		
13			
25	4.189 -13		
37			
49		73 80	
61		1281	
1	I 129		
13			
25	6.052 -2		
37			
49		73 80	
61		1291	
1	I 130		
13			
25	6.473 +4		
37			
49		73 80	
61		1301	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 4 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	I 131		
13			
25	3.163 +6		
37			
49		73 80	
61		1311	
1	I 132		
13			
25	3.702 +6		
37			
49		73 80	
61		1321	
1	I 133		
13			
25	2.045 +6		
37			
49		73 80	
61		1331	
1	I 134		
13			
25	2.027 -1		
37			
49		73 80	
61		1341	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 5 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	I 135		
13			
25	4.794 +5		
37			
49			
61		1351	
1	1		End-of-case Card
13			
25			
37			
49			
61		9999	
1	INERT GASES		New Case
13	FFTF - 10		
25	OMW, 332-DAY		
37	OPERATION,		
49	24-HOUR SHUT		
61	DOWN	1 1	
1	1 7		
13	0.0		
25	0.4		
37	0.4		
49	0.9		
61	0.9	1 2	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 6 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	1.35		
13	1.35		
25	1.8		
37	1.8		
49	2.2	73 80	
61	2.2	1 3	
1	2.6		
13	2.6		
25	10.0		
37			
49		73 80	
61		1 4	
1	KR* 83		
13			
25	2.023 +3		
37			
49		73 80	
61		1 831	
1	KR* 85		
13			
25	9.989 +3		
37			
49		73 80	
61		1 851	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 7 of 9 JOB NO. 7900-50

NUMBER		IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	KR 85		
13			
25	1.053 +4		
37			
49			
61		73 80 1 852	
1	KR 87		
13			
25	1.749		
37			
49			
61		73 80 1 87.1	
1	KR 88		
13			
25	3.158 +3		
37			
49			
61		73 80 1 88.1	
1	XE* 131		
13			
25	3.139 +4		
37			
49			
61		73 80 1 131.1	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 8 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	XE* 133		
13			
25	5.556 +5		
37			
49			
61		1 1331	
1	XE 133		
13			
25	6.113 +6		
37			
49			
61		1 1332	
1	XE* 135		
13			
25	1.348 +5		
37			
49			
61		1 1351	
1	XE 135		
13			
25	2.412 +6		
37			
49			
61		1 1352	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. DATA PROGRAMMER THOMSON DATE 2/26 PAGE 9 of 9 JOB NO. 7900-50

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	XE 138		
13			
25	5.449 -25		
37			
49			
61			
1		1 1381	
13	/*		End-of-problem Card
25			
37			
49			
61		99999999	
1			
13			
25			
37			
49			
61			
1			
13			
25			
37			
49			
61			

HALOGENS FF TF - 100MW, 332-DAY OPERATION, 24-HOUR SHUTDOWN

INITIAL ENERGY = 0.0 4.000E-01 9.000E-01 1.350E 00 1.800E 00 2.200E 00 2.600E 00
 FINAL ENERGY (INCLUSIVE) = , 4.000E-01 9.000E-01 1.350E 00 1.800E 00 2.200E 00 2.600E 00 1.000E 01

ISOTOPE	ACTIVITY (CURIES)	SOURCE (MEV/SEC) BETA	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
BR*	80 1.2540E-13	*** MASS NO UNAVAILABLE IN LIBRARY							
BR	80 1.3430E-13	*** MASS NO UNAVAILABLE IN LIBRARY							
BR	82 1.8320E-06	1.022E 04 0.0	1.241E 05	5.009E 04	1.820E 04	0.0	0.0	0.0	0.0
BR	83 5.0920E 02	6.477E 12 9.111E 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BR	84 2.2150E-08	1.008E 03 3.975E 00	3.847E 02	1.037E 02	6.187E 01	5.275E 02	1.579E 02	5.179E 02	0.0
I	128 4.1890E-13	1.123E-02 0.0	1.352E-03	4.503E-05	0.0	0.0	0.0	0.0	0.0
I	129 6.0520E-02	*** ISOTOPE UNAVAILABLE IN LIBRARY							
I	130 6.4730E 04	6.877E 14 0.0	2.916E 15	7.023E 14	0.0	0.0	0.0	0.0	0.0
I	131 3.1630E 06	2.252E 16 3.749E 16	9.167E 15	0.0	0.0	0.0	0.0	0.0	0.0
I	132 3.7020E 06	6.924E 16 2.790E 15	2.269E 17	3.723E 16	2.495E 16	7.662E 15	1.001E 15	0.0	0.0
I	133 2.0450E 06	3.514E 16 0.0	4.252E 15	0.0	2.088E 15	0.0	0.0	0.0	0.0
I	134 2.0270E-01	4.880E 09 3.055E 08	1.310E 10	3.070E 09	1.774E 09	0.0	0.0	0.0	0.0
I	135 4.7940E 05	2.615E 15 0.0	1.243E 16	2.689E 16	1.868E 16	0.0	0.0	0.0	0.0

TOTALS = 9.4546E 06 1.302E 17 4.028E 16 2.939E 17 5.438E 16 4.571E 16 7.662E 15 1.001E 15 5.179E 02

INERT GASES FFTF - 100MW, 332-DAY OPERATION, 24-HOUR SHUTDOWN

INITIAL ENERGY = 0.0 4.000E-01 9.000E-01 1.350E 00 1.800E 00 2.200E 00 2.600E 00
 FINAL ENERGY (INCLUSIVE) = 4.000E-01 9.000E-01 1.350E 00 1.800E 00 2.200E 00 2.600E 00 1.000E 01

ISOTOPE	ACTIVITY (CURIES)	SOURCE (MEV/SEC) BETA	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7		
KR*	83 2.0230E 03	0.0	3.069E 12	0.0	0.0	0.0	0.0	0.0	0.0		
KR*	85 9.9890E 03	8.789E 13	5.806E 13	0.0	0.0	0.0	0.0	0.0	0.0		
KR	85 1.0530E 04	9.083E 13	0.0	2.003E 12	0.0	0.0	0.0	0.0	0.0		
KR	87 1.7490E 00	8.557E 10	0.0	1.915E 10	0.0	0.0	4.113E 09	3.659E 10	0.0		
KR	88 3.1580E 03	4.421E 13	1.123E 13	2.241E 13	4.857E 12	2.536E 13	4.478E 13	9.815E 13	0.0		
XE*	131 3.1390E 04	0.0	6.286E 12	0.0	0.0	0.0	0.0	0.0	0.0		
XE*	133 5.5560E 05	0.0	8.813E 14	0.0	0.0	0.0	0.0	0.0	0.0		
XE	133 6.1130E 06	2.511E 16	7.691E 15	0.0	0.0	0.0	0.0	0.0	0.0		
XE*	135 1.3480E 05	0.0	0.0	2.186E 15	0.0	0.0	0.0	0.0	0.0		
XE	135 2.4120E 06	2.795E 16	2.167E 16	1.617E 15	0.0	0.0	0.0	0.0	0.0		
XE	138 5.4490E-25	1.890E-14	0.0	1.052E-14	0.0	7.177E-15	0.0	0.0	0.0		
TOTALS =			9.2725E 06	5.329E 16	3.032E 16	3.827E 15	4.867E 12	2.536E 13	4.479E 13	9.819E 13	0.0

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APPENDIX I

SOSUM PROGRAM LISTING

COMPILER OPTIONS - NAME= MAIN,CPT=02,LINECNT=42,SOURCE,ERCDIC,NOLIST,DECK,LOAD,MAP,NJEDIT,ID

```

C      ***** SDSUM, A PROGRAM TO COMPUTE MULTIGROUP BETA AND GAMMA      00000100
C      ENERGY SOURCES FROM RADIOISOTOPE ACTIVITIES                      00000150
C                                                                           00000160
C      BY R.J. THOMSON AND B.J. DRAY,   DECEMBER 12, 1967              00000200
C                                                                           00000220
C      TDR NO.   AI-AEC-12693                                           00000250
C                                                                           00000280
C                                                                           00000300
ISN 0002      INTEGER*2      SYMB(300), SYMBS(300), SI, SIS, STAR, EOC, EC, 00000310
1              BLNK, CS11(16), CS12(16), LC, LCCI(16), CS1(16),          00000320
2              SIPREV, SIPRE2                                           00000330
C                                                                           00000360
ISN 0003      DIMENSION MNICI(16), UNITS(06), JA(06)                    00000400
C                                                                           00000490
ISN 0004      COMMON  TITLE(018), MASSNC(300), ENERGY(5000),  PHOT(5000), 00000500
1              BETA(300),   BEG(007),SOURCE(100,7),   EEG(0007),        00000510
2              SS(007), BSOURC(300),   ISJB(300)                        00000520
C                                                                           00000700
ISN 0005      DATA  UNITS / '(DIS/SEC/CI)  (CURIES) '/              00000710
2,            UA /'*** MASS NO *** ISOTOPE '/                        00000717
4,            STAR, EOC, BLNK, J, IERR, K                             00000740
5            /' * ', '1 ', ' ', ' ', 0, 0, 1/                        00000750
C                                                                           00000790
ISN 0006      DATA  MNICI / 77, 79, 81, 83, 85, 91, 97, 99, 105, 107, 00000800
A              111, 117, 126, 127, 129, 135/                          00000810
1,            CSI  /'GE','SE','SE','SE','KR','Y ','NB','TC','RH','R+', 00000820
2              'AG','CD','SB','TE','TE','XE'/                        00000830
3,            CS11 /'AS','AS','SE','KR','BR','SR','ZR','MO','RU','RU', 00000840
4              'PU','IN','SN','SB','SB','I '/                        00000850
5,            CS12 /'GE','AS','AS','BR','SE','RB','Y ','NB','TC','TC', 00000860
6              'AG','CD','SB','SN','SB','TE'/                        00000870
7,            LCCI / 3, 3, 2, 4, 4, 5, 5, 5, 5, 5,                    00000880
8              3, 3, 3, 4, 4, 5/                                      00000890
C                                                                           00000900
C                                                                           00001000
ISN 0007      ISOB(1)=1                                              00001300
C                                                                           00001700
C      *** READ IN LIBRARY                                             00001740
C      *** J = INDEX OF ISOTOPE IN LIBRARY                            00001750
ISN 0008      1C J = J+1                                           00001800
ISN 0009      KTEMP = K+4                                           00001900

```

ISN 0010	READ (5,500) SYMB(J),SYMB5(J),MASSNO(J),NOEN, (ENERGY(KK),	00002000
	1 PHUT(KK),KK=K,KTEMP)	00002100
ISN 0011	KPNOEN = K+NOEN-1	00002200
ISN 0012	ISOB(J+1) = KPNOEN+1	00002300
ISN 0013	KTEMP = KTEMP+1	00002400
ISN 0014	IF (NOEN .GT. 5) READ (5,510) (ENERGY(KK),PHOT(KK),KK=KTEMP,KPNOEN	00002500
	1)	00002600
ISN 0016	READ (5,515) BETA(J)	00002650
ISN 0017	IF (MASSNO (J) .GT. 260) GO TO 100	00002700
ISN 0019	K = ISOB(J+1)	00002800
ISN 0020	GO TO 10	00002900
	C	00003000
ISN 0021	100 NEGEX = 0	00003010
	C *** READ TITLE AND SETUP ENERGY GROUPS	00003050
ISN 0022	READ (5,520,END=999) TITLE	00003100
ISN 0023	READ (5,530) NCI,ICI,NEG, (BEG(L),EEG(L),L=1,NEG)	00003200
ISN 0024	IF (NEG .LE. 7) GO TO 106	00003205
ISN 0026	NEG = 7	00003206
ISN 0027	NEGEX = 1	00003207
ISN 0028	106 I3=1	00003210
ISN 0029	IF (ICI .EQ. 1) I3=I3+3	00003220
ISN 0031	I4=I3+2	00003230
ISN 0032	104 DO 105 LL=1,NEG	00003300
ISN 0033	IF (EEG(LL) .EQ. 0.0) EEG(LL)=BEG(LL+1)	00003400
ISN 0035	105 CONTINUE	00003500
	C	00003600
ISN 0036	LCOUNT=32	00003610
ISN 0037	M2=0	00003620
ISN 0038	JPREV = 1	00003640
ISN 0039	NACT=0	00003650
ISN 0040	SI = BLNK	00003660
ISN 0041	SIPREV = BLNK	00003670
	C	00003700
ISN 0042	DO 101 IK=1,NEG	00003702
ISN 0043	101 SS(IK)=0.0	00003704
ISN 0044	DO 102 IK=1,100	00003710
ISN 0045	B SOURC(IK)=0.0	00003720
ISN 0046	DO 103 IJ=1,NEG	00003730
ISN 0047	103 SOURCE(IK,IJ)=0.0	00003740
ISN 0048	102 CONTINUE	00003750
ISN 0049	TACT=0.0	00003760
ISN 0050	BS=0.0	00003770

	C		00003790
	C	*** CONVERT ACTIVITIES TO DIS/SEC FOR SOURCE CALCULATION	00003795
ISN 0051	110	DPSECI = 1.0	00003800
ISN 0052		IF (ICI .EQ. 1) DPSECI=3.7E+10	00003900
	C		00004000
ISN 0054	120	NACT = NACT+1	00004100
ISN 0055	125	LCJUNT=LCOUNT+1	00004150
ISN 0056		SIPRE2 = SIPREV	00004160
ISN 0057		SIPREV = SI	00004175
ISN 0058	130	PEAD (5,540,END=900) EC, SI, SIS, MNI, LC, ACT	00004200
	C	*** EC = 1 INDICATES END OF CASE	00004220
ISN 0059		IF (EC .EQ. EDC) GC TO 900	00004250
	C		00004300
ISN 0061		IF (NCI .EQ. 1) GO TO 170	00004304
	C		00004305
	C	*** ALTERATIONS TO INPUT FROM CURIE CODE	00004306
ISN 0063	DO 140	N=1,16	00004308
ISN 0064		IF (MNI .EQ. MNICI(N) .AND. SI .EQ. CSI(N) .AND. CSI1(N) .EQ.	00004310
	1	SIPREV .AND. LC .EQ. LCCI(N) .AND. CSI2(N) .EQ. SIPRE2)	00004312
	2	SIS = STAR	00004314
ISN 0066	140	CONTINUE	00004316
	C		00004326
	C	*** SEARCH FOR MASS NUMBER AND ISOTOPE IN LIBRARY	00004350
ISN 0067	170	ISYMB = 0	00004500
ISN 0068	DO 180	I=JPREV,J	00004600
ISN 0069		IF (MNI .GT. MASSNO(I)) GC TO 180	00004700
ISN 0071		IF (MNI .NE. MASSNO(I)) GC TO 190	00004800
ISN 0073		IF (SI .EQ. SYMB(I) .AND. SIS .EQ. SYMRS(I)) GC TO 200	00005000
ISN 0075		ISYMB = 1	00005100
ISN 0076	180	CONTINUE	00005200
	C		00005300
ISN 0077	190	N = 1	00005400
ISN 0078		IF (ISYMB .EQ. 1) N=4	00005420
	C		00005430
ISN 0080	192	NE = N+2	00005440
ISN 0081		TACT = TACT + ACT	00005450
ISN 0082		IERR = 1	00005460
ISN 0083		IF (NACT .EQ. 1) GC TO 410	00005470
ISN 0085		GO TO 405	00005490
	C		00005500
	C	*** SET INDEX FOR LIBRARY	00005550
ISN 0086	200 DO 210	IL=1,181	00005600

ISN 0087	IF ((I-IL) .GT. 1) GO TO 205	00005610
ISN 0089	JPREV = 2	00005620
ISN 0090	GO TO 222	00005630
ISN 0091	205 IF (MASSNO(I-IL) .LT. MNI) GO TO 220	00005640
ISN 0093	210 CONTINUE	00005650
	C	00005660
ISN 0094	220 JPREV = I-IL	00005690
ISN 0095	222 IY = ISOB(I)	00005700
ISN 0096	IYE = ISOB(I+1)-1	00005800
	C	00005900
	C *** FIND APPLICABLE ENERGY GROUP AND CALCULATE SOURCES	00005950
ISN 0097	DO 310 INY=IY,IYE	00006000
ISN 0098	DO 300 IG=1,NEG	00006100
ISN 0099	IF ((ENERGY(INY) .GT. BEG(IG)) .AND. (ENERGY(INY) .LE. EEG(IG)))	00006200
	1 GO TO 320	00006300
ISN 0101	GO TO 300	00006305
ISN 0102	320 SOURCE(M2+1,IG) = ENERGY(INY)*PHOT(INY)*DPS ECI*ACT+SOURCE(M2+1,IG)	00006310
ISN 0103	300 CONTINUE	00006400
	C	00006600
ISN 0104	310 CONTINUE	00007000
ISN 0105	BSOURC(M2+1)=BETA(I) *ACT*DPSECI	00007010
ISN 0106	BS = BS + BSOURC(M2+1)	00007020
ISN 0107	TACT = TACT + ACT	00007030
	C	00007100
ISN 0108	400 M2=M2+1	00007110
ISN 0109	405 IF (LCOUNT .LT. 32) GO TO 420	00007122
ISN 0111	410 LCOUNT=0	00007124
ISN 0112	415 WRITE (6,600) TITLE, (BEG(L),L=1,NEG)	00007125
ISN 0113	WRITE (6,605) (EEG(L),L=1,NEG)	00007126
ISN 0114	WRITE (6,615) (UNITS(IU),IU=13,14)	00007128
ISN 0115	IF (NEGEX .EQ. 0) GO TO 420	00007130
ISN 0117	NEGEX = 0	00007135
ISN 0118	WRITE (6,610)	00007140
ISN 0119	LCOUNT = LCOUNT + 2	00007145
ISN 0120	420 IF (IERR .EQ. 1) GO TO 700	00007150
ISN 0122	WRITE (6,625) SI,SIS,MNI,ACT, BSOURC(M2), (SOURCE(M2,M),M=1,NEG)	00007155
	C	00007160
	C *** SUMMATION OF STORED SOURCES	00007200
ISN 0123	DO 490 M=1,NEG	00007400
ISN 0124	480 SS(M) = SS(M) + SOURCE(M2,M)	00007800
ISN 0125	490 CONTINUE	00008000
ISN 0126	GO TO 120	00008100

ISN 0127	C	700 IERR = 0	00008110
ISN 0128		WRITE (6,650) SI, SIS, MNI, ACT, (JA(NN),NN=N,NE)	00008120
ISN 0129		GO TO 120	00008130
	C		00008140
	C		00008150
ISN 0130		900 WRITE (6,640) TACT, BS,(SS(M),M=1,NEG)	00008200
ISN 0131		GO TO 100	00008250
ISN 0132		999 CALL EXIT	00008260
ISN 0133		STOP	00008300
	C		00008400
ISN 0134		500 FORMAT (2A2, 1I4,1X,1I3, 10F6.0)	00010000
ISN 0135		510 FORMAT (12F6.0)	00010100
ISN 0136		515 FORMAT (1E12.8)	00010200
ISN 0137		520 FORMAT (18A4)	00010250
ISN 0138		530 FORMAT (2I1, 1I10, 5E12.8 / (6E12.8))	00010300
ISN 0139		540 FORMAT (1A2, T1, 2A2, I4, I1, 15X, 1E12.8)	00010400
	C		00010450
ISN 0140		600 FORMAT ('1'//10X,18A4//2X,'INITIAL ENERGY',11X,'=',4X, 1P7E11.3)	00010500
ISN 0141		605 FORMAT (' ' FINAL ENERGY (INCLUSIVE) =', 1P1E15.3, 6E11.3)	00010600
ISN 0142		610 FORMAT ('+ *** WARNING - NUMBER OF ENERGY GROUPS IS LIMITED TO 7, 1GROUPS EXCEEDING 7 ARE IGNORED.'//)	00010700
ISN 0143		615 FORMAT ('0 ISOTOPE ACTIVITY SOURCE (MEV/SEC)' / 1 10X, 3A4, 1X, ' BETA GROUP 1 GROUP 2 GROUP 3 GROUP 2 4 GROUP 5 GROUP 6 GROUP 7',//)	00010800
			00010850
ISN 0144		625 FORMAT (' ', 2A2, 1I4, 1P1E11.4, 8E11.3)	00010900
ISN 0145		630 FORMAT (' ', 10X, I4, 7X, 1P1E15.4, 2X, 1E15.4, 2X, 1E15.4)	00010910
ISN 0146		640 FORMAT ('0' / 2X, 'TOTALS =', 1P1E11.4, 8E11.3)	00010920
ISN 0147		650 FORMAT (' ',2A2,1I4, 1P1E11.4,8X,3A4,'UNAVAILABLE IN LIBRARY')	00011000
ISN 0148		END	00011200
			00011300
			00011400
			00014000

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I		I*4	00CC50	J		I*4	00JJ54	K		I*4	000058	L		I*4	00005C
M		I*4	00CC60	N		I*4	00JJ64	RS		R*4	000068	EC		I*2	00003C
IG		I*4	00CC6C	IJ		I*4	00JJ70	IK		I*4	000074	IL		I*4	000078
IU		I*4	00CC7C	IY		I*4	000080	I3		I*4	000084	I4		I*4	000088
KK		I*4	00CC8C	LC		I*2	00008E	LL		I*4	000090	M2		I*4	000094
NE		I*4	00CC98	NN		I*4	00JJ9C	SI		I*2	000040	SS	C	R*4	00B110
UA		R*4	00C618	ACT		R*4	00JJAO	BEG	C	R*4	00A5E8	CSI		I*2	0000E8
EEG	C	R*4	00B CF4	EOC		I*2	000042	ICI		I*4	0000A4	INY		I*4	0000A8
IYE		I*4	00CCAC	MNI		I*4	00JJBO	NCI		I*4	0000B4	NEG		I*4	0000B8
SIS		I*2	00CC44	BETA	C	R*4	00A138	BLNK		I*2	000046	CSII		I*2	000108
CSIZ		I*2	00C128	EXIT	XF	R*4	000000	IERR		I*4	0000BC	ISOB	C	I*4	00B5DC
LCCI		I*2	00C148	NACT		I*4	00JJCO	NOEN		I*4	0000C4	PHOT	C	R*4	005318
STAR		I*2	00CC48	SYMB		I*2	000168	TACT		R*4	0000C8	UNITS		R*4	000630
TITLE	C	R*4	00CC00	SYMB5		I*2	0003C0	NEGEX		I*4	0000CC	MNICI		I*4	000648
KTEMP		I*4	00CCD0	JPREV		I*4	0000D4	ISYMB		I*4	0000D8	IBCOM#	XF	I*4	000000
SOURCE	C	R*4	00A604	SIPREV		I*2	00004A	SIPRE2		I*2	00004C	MASSNO	C	I*4	000048
LCOUNT		I*4	00CCDC	KPNDEN		I*4	0000E0	ENERGY	C	R*4	0004F8	DPSECI		R*4	0000E4
BSOURC	C	R*4	00B12C												

LABEL	ADDR
100000	0009DC
100003	000ABF
100007	000B3C
100010	000BE4
100013	000C4C
101	000C9E
102	000CF0
100021	000DA8
88002	000E06
140	000E2C
100028	000EAC
190	000EDA
200	000F1E
210	000F6C
100037	00103C
310	001068
100041	001108
100045	00118C
100048	0011DC
490	001202
100053	00135C
100053	00135C

LABEL	ADDR
10	000A04
100004	000AEE
100	000B48
106	000BF4
100014	000C4A
100016	000CA6
100019	000D04
100022	000DB4
88003	000E12
170	000E42
88005	000EAC
100031	000EEA
100033	000F3A
220	000F7A
100038	001054
100040	001072
100042	001114
100046	001198
100049	001266
100051	001208
900	001358

LABEL	ADDR
100001	000A7C
100005	000B04
100008	000B44
100011	000C04
105	000C52
100017	000CDE
100020	000D24
100023	000DF2
88004	000E1E
100026	000E84
100029	000EC4
192	000EF2
100034	000F48
222	000F86
320	001058
405	0010B2
100043	001140
100047	0011A6
100050	001274
700	0012DC
100054	00139C

LABEL	ADDR
100002	000A90
100006	000B08
100009	000B04
100012	000C10
100015	000C56
103	000CF4
120	000D2C
88001	000DFE
100024	000E2A
100027	000E8E
180	000EC6
100032	000F1A
205	000F54
100036	001010
300	001062
410	0010BE
100044	00114C
420	0011D0
480	0012C4
100052	001334
100055	0013A8

***** END OF COMPILATION *****

ATOMICS INTERNATIONAL

A Division of North American Rockwell Corporation

NO. AI AEC TDR-12693

DATE June 3, 1968

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APPENDIX II

SOSUM LIBRARY

REC	1-	***** PHOTON AND BETA ENERGIES AND ABUNDANCES *****												00000010-
REC	2-													00000020-
REC	3-	REFERENCE (USNRDL-TR-876) DATED 13 JJNE 1965												00000030-
REC	4-													00000040-
REC	5-													00000050-
REC	6-ZN	72	4	0.051	0.018	.100	.009	.143	.913	.192	.073			00000100-
REC	7-	.096908												00000101-
REC	8-GA	72	29	.950	.001	2.508	.170	2.690	.001	3.340	0.0	0.440	.015	000000200-
REC	9-	0.812	.023	1.268	.015	1.598	.055	1.850	.058	2.490	.099	0.620	0.0	00000300-
REC	10-	1.320	.001	2.201	.300	0.115	0.0	0.735	.032	1.580	.016	1.820	.001	000000400-
REC	11-	0.601	.069	1.231	.012	1.340	0.0	0.630	.188	0.730	0.0	1.465	.039	000000500-
REC	12-	0.835	.857	1.710	.002	0.894	.009	0.690	.002	2.150	.001	2.849	.004	000000600-
REC	13-	.43288												00000601-
REC	14-GA	73	3	.745	.060	.295	.970	1.040	.010					00000700-
REC	15-	.425												00000701-
REC	16-GE*	73	2	.054	.090	.013	0.0							00000800-
REC	17-	0.0												00000801-
REC	18-ZN	74	1	.700	1.000									00000900-
REC	19-	.70634												00000901-
REC	20-GA	74	18	.495	0.098	.600	1.401	.855	.119	1.020	.098	1.100	.077	000001000-
REC	21-	1.200	.105	1.310	.028	1.450	.094	1.720	.077	1.840	.036	1.960	.094	000001100-
REC	22-	2.350	.701	2.550	.035	2.720	.049	2.950	.042	3.170	.022	3.330	.024	000001200-
REC	23-	3.610	0.015											00001300-
REC	24-	1.0017												00001301-
REC	25-GE*	75	1	0.139	0.333									00001400-
REC	26-	0.0												00001401-
REC	27-GE	75	6	0.066	.003	.199	.014	.254	.110	.427	.003	.477	.003	000001500-
REC	28-	.628	.001											00001600-
REC	29-	.42801												00001601-
REC	30-AS	76	19	2.112	.003	1.454	.002	2.555	0.0	2.097	.006	1.438	.005	000001700-
REC	31-	0.869	.001	2.420	0.	1.860	0.	1.2	.009	1.789	.003	1.229	.010	000001800-
REC	32-	.56	.054	1.216	.043	.657	.063	.559	.392	.760	.004	1.400	.001	000001900-
REC	33-	1.530	.001	1.63	0.0									00002000-
REC	34-	1.0687												00002001-
REC	35-GE*	77	2	0.159	.190	.215	.180							00002100-
REC	36-	.75729												00002101-
REC	37-GE	77	19	2.32	.007	1.96	.024	1.74	.004	.92	.058	2.02	.024	000002200-
REC	38-	1.5	.011	1.37	.037	.8	.108	1.08	.072	1.19	.037	.709	.108	000002300-
REC	39-	.563	.18	.632	.108	.416	.252	.358	.158	.153	0.	.210	.355	000002400-
REC	40-	.265	.262	.215	.504									00002500-

REC	41-	.63051															00002501-
REC	42-AS	77	4	.086	.003	.159	.002	.245	.023	.525	.007						00002600-
REC	43-	.23321															00002601-
REC	44-GE	78	1	.450	.990												00002700-
REC	45-	.32587															00002701-
REC	46-AS*	78	1	.500	1.000												00002800-
REC	47-	0.0															00002801-
REC	48-AS	78	14	.615	.420	.695	.155	.830	.079	.990	.025	1.100	.029	0.000	0.290		00002900-
REC	49-	1.21		.042	1.31	.108	1.49	.021	1.7	.017	1.32	.014	1.94	.015	0.000	0.300	00003000-
REC	50-	2.05		.010	2.24	.010	2.65	.014									00003100-
REC	51-	1.4633															00003101-
REC	52-SE*	79	1	.096	.090												00003200-
REC	53-	0.0															00003201-
REC	54-SE*	81	1	.103	.104												00003300-
REC	55-	0.0															00003301-
REC	56-BR	82	8	.554	.727	.619	.454	.698	.309	.777	.909	.827	.273	0.000	0.340		00003400-
REC	57-	1.044		.318	1.317	.309	1.475	.182									00003500-
REC	58-	.1507															00003501-
REC	59-SE*	83	4	2.020	.028	1.01	.071	.65	.014	.35	.009						00003600-
REC	60-	1.3604															00003601-
REC	61-SE	83	9	.225	.607	.358	.953	.524	.823	.712	.347	.833	.563	0.000	0.370		00003700-
REC	62-	1.058		.217	1.309	.347	1.88	.217	2.294	.130							00003800-
REC	63-	.34865															00003801-
REC	64-BR	83	3	.046	.160	.032	1.	.009	1.								00003900-
REC	65-	.34377															00003901-
REC	66-KR*	83	2	.032	1.	.009	1.										00004000-
REC	67-	0.0															00004001-
REC	68-BR	84	22	3.28	.024	3.93	.104	3.03	.03	2.05	.158	.27	.005	0.000	0.410		00004100-
REC	69-	1.57		.01	1.21	.032	2.82	.019	2.47	.073	2.17	.016	.61	.024	0.000	0.420	00004200-
REC	70-	1.9		.150	.43	.022	1.01	.087	.74	.016	.52	.024	.879	.417	0.000	0.430	00004300-
REC	71-	.81		.062	.35	.010	1.74	.020	1.47	.017	.47	.009					00004400-
REC	72-	1.2295															00004401-
REC	73-KR*	85	2	.305	.135	.149	.778										00004500-
REC	74-	.23781															00004501-
REC	75-KR	85	1	.514	.010												00004600-
REC	76-	.23313															00004601-
REC	77-RB*	86	1	.56	1.												00004700-
REC	78-	0.0															00004701-
REC	79-RB	86	1	1.084	.09												00004800-
REC	80-	.64686															00004801-

REC	81-KR	87	4	.403	.524	.847	.1	2.05	.031	2.57	.220		00004900-
REC	82-	1.3223											00004901-
REC	83-KR	88	9	.028	0.	.166	.070	.191	.35	.360	.049	.845	.22700005000-
REC	84-	1.19	.035	1.55	.140	2.19	.175	2.40	.350				00005100-
REC	85-	.37833											00005101-
REC	86-RB	88	10	.908	.145	1.39	.014	1.85	.23	2.11	.01	2.68	.02500005200-
REC	87-	3.010	.003	3.24	.003	3.52	.002	3.68	.001	4.87	.003		00005300-
REC	88-	1.9977											00005301-
REC	89-KR	89	28	.215	.31	.375	.13	.430	.13	.510	.19	.595	.39 00005400-
REC	90-	.730	.15	.880	.23	1.12	.19	1.32	.13	1.52	.27	1.67	.12 00005500-
REC	91-	1.9	.061	2.05	.1	2.23	.054	2.35	.099	2.62	.031	2.7	.02200005600-
REC	92-	2.85	.071	3.0	.035	3.18	.043	3.38	.060	3.56	.043	3.72	.04300005700-
REC	93-	3.90	.037	4.05	.014	4.16	.010	4.31	.010	4.58	.005		00005800-
REC	94-	0.0											00005801-
REC	95-RB	89	8	.663	.150	1.05	.750	1.25	.530	1.55	.040	2.2	.14000005900-
REC	96-	2.59	.130	2.75	.03	3.53	.02						00006000-
REC	97-	.59495											00006001-
REC	98-KR	90	6	.125	.67	.240	.07	.540	.67	1.1	.67	1.54	.28 00006100-
REC	99-	1.78	.12										00006200-
REC	100-	0.0											00006201-
REC	101-SR	91	5	.645	.150	.748	.270	.930	.03	1.025	.3	1.413	.15 00006300-
REC	102-	.61899											00006301-
REC	103-Y *	91	1	.551	.956								00006400-
REC	104-	0.0											00006401-
REC	105-Y	91	1	1.208	.003								00006500-
REC	106-	.58128											00006501-
REC	107-SR	92	3	.23	.035	.44	.041	1.37	.900				00006600-
REC	108-	.22478											00006601-
REC	109-Y	92	10	.448	.023	.490	.004	.550	.026	.840	.011	.904	.00800006700-
REC	110-	.932	.137	1.12	.002	1.395	.047	1.83	.004	2.06	0.		00006800-
REC	111-	.10545											00006801-
REC	112-SR	93	1	.2	1.								00006900-
REC	113-	.20444											00006901-
REC	114-Y	93	13	2.43	0.	2.18	.001	2.18	.003	1.9	.018	1.42	.00700007000-
REC	115-	1.15	.002	.49	0.0	.935	.023	.655	.007	.267	.064	.380	0.0 00007100-
REC	116-	1.2	.001	1.62	.001								00007200-
REC	117-	1.1442											00007201-
REC	118-NB*	93	1	.029	1.								00007300-
REC	119-	0.0											00007301-
REC	120-Y	94	10	.56	.06	.92	.43	1.13	.05	1.65	.024	1.9	.01600007400-

REC	121-	2.13	.024	2.57	.015	2.84	.007	3.06	.013	3.53	.011				00007500-
REC	122-	0.0													00007501-
REC	123-ZR	95	3	.726	.55	.76	.43	.235	.02						00007600-
REC	124-	.13193													00007601-
REC	125-NB*	95	1	.235	1.0										00007700-
REC	126-	0.0													00007701-
REC	127-VB	95	1	.768	.990										00007800-
REC	128-	.053457													00007801-
REC	129-VB	96	10	.216	.033	.238	.034	.451	.31	.560	.37	.725	.05		00007900-
REC	130-	.770 1.		.804	.17	.840	.26	1.073	.32	1.187	.34				00008000-
REC	131-	.23388													00008001-
REC	132-ZR	97	4	1.02	.01	1.15	.02	1.72	.005	1.77	.005				00008100-
REC	133-	.97476													00008101-
REC	134-VB*	97	1	.75	.986										00008200-
REC	135-	0.0													00008201-
REC	136-VB	97	2	1.020	.010	.665	.990								00008300-
REC	137-	.46580													00008301-
REC	138-MO	99	6	.95	0.0	.74	.100	.73	.04	.372	.01	.181	.037		00008400-
REC	139-	.140 .068													00008500-
REC	140-	.40777													00008501-
REC	141-TC*	99	3	.142	.004	.002	.986	.140	.9						00008600-
REC	142-	0.0													00008601-
REC	143-TC	100	2	.538	1.000	.6	1.000								00008700-
REC	144-	1.4097													00008701-
REC	145-MO	101	20	.080	.030	.191	.19	.193	.02	.3	.07	.4	.02		00008800-
REC	146-	.510 .16		.590	.21	.704	.12	.840	.01	.890	.15	.950	.02		00008900-
REC	147-	1.024 .25		1.18	.11	1.14	.01	1.29	.03	1.38	.09	1.46	.01		00009000-
REC	148-	1.56 .11		1.66	.03	2.08	.16								00009100-
REC	149-	.42259													00009101-
REC	150-TC	101	9	.939	.002	.385	.016	.845	.003	.720	.011	.635	.009		00009200-
REC	151-	.545 .076		.235	.007	.410	.004	.307	.910						00009300-
REC	152-	.46935													00009301-
REC	153-TC*	102	1	1.1	1.0										00009400-
REC	154-	1.571													00009401-
REC	155-RU	103	5	.610	.065	.555	.005	.493	.880	.440	.005	.053	.007		00009500-
REC	156-	.069763													00009501-
REC	157-RH*	103	1	.04	.024										00009600-
REC	158-	0.0													00009601-
REC	159-RH*	104	3	.051	.370	.077	.020	.095	.020						00009700-
REC	160-	.00045293													00009701-

REC	161-RH	104	2	.556	.990	1.240	.010										00009800-
REC	162-	.96324															00009801-
REC	163-RU	105	10	.13	.011	.21	.05	.25	.065	.317	.13	.4	.07				00009900-
REC	164-	.475	.21	.670	.175	.725	.5	.870	.04	.97	.025						00010000-
REC	165-	.41076															00010001-
REC	166-RH*	105	1	.129	.476												00010100-
REC	167-	0.0															00010101-
REC	168-RH	105	1	.322	.097												00010200-
REC	169-	.17898															00010201-
REC	170-RH*	106	16	.220	.121	.407	.121	.450	.212	.512	.606	.620	.200				00010300-
REC	171-	.735	.285	.820	.242	.950	.021	1.055	.175	1.140	.085	1.225	.115				00010400-
REC	172-	1.560	.127	1.740	.012	1.860	.012	2.120	.006	2.280	.003						00010500-
REC	173-	.34681															00010501-
REC	174-RH	106	5	.513	.315	.624	.139	.860	.005	1.060	.019	1.140	.006				00010600-
REC	175-	1.3356															00010601-
REC	176-RU	107	7	.195	.143	.370	.06	.480	0.	.860	.07	.930	.04				00010700-
REC	177-	1.030	.04	1.290	.04												00010800-
REC	178-	1.258															00010801-
REC	179-RH	107	8	.115	.005	.285	.025	.307	.73	.365	.015	.390	.107				00010900-
REC	180-	.470	.010	.570	.018	.675	.027										00011000-
REC	181-	.46470															00011001-
REC	182-RU	108	1	.165	.280												00011100-
REC	183-	.46703															00011101-
REC	184-RH	108	4	.43	.43	.51	.1	.62	.22	1.52	.051						00011200-
REC	185-	1.7022															00011201-
REC	186-RH*	109	1	.110	1.0												00011300-
REC	187-	0.0															00011301-
REC	188-PD*	109	1	.180	.625												00011400-
REC	189-	0.0															00011401-
REC	190-PD	109	1	.088	.100												00011500-
REC	191-	.36637															00011501-
REC	192-AG*	109	1	.088	.046												00011600-
REC	193-	0.0															00011601-
REC	194-PD*	111	1	.170	.300												00011700-
REC	195-	0.0															00011701-
REC	196-PD	111	25	.067	.036	.108	.007	.120	.011	.148	.019	.293	.009				00011800-
REC	197-	.367	.011	.395	.046	.435	.019	.470	.010	.523	.015	.584	.027				00011900-
REC	198-	.650	.033	.727	.017	.828	.011	.865	.004	.963	.002	1.030	.004				00012000-
REC	199-	1.140	.009	1.220	.003	1.315	.003	1.400	.004	1.500	.001	1.690	.008				00012100-
REC	200-	1.780	.004	1.990	.003												00012200-

REC	201-	0.0															00012201-
REC	202-AG*	111	1	.065	1.00												00012300-
REC	203-	0.0															00012301-
REC	204-AG	111	3	.247	.011	.342	.060	.095	.001								00012400-
REC	205-	.3659															00012401-
REC	206-PD	112	1	.018	.200												00012500-
REC	207-	.090431															00012501-
REC	208-AG	112	22	2.950	.001	3.280	0.	3.100	0.	1.810	.008	2.830	.006				00012600-
REC	209-	2.240	.008	1.490	.012	2.710	.004	2.110	.032	2.540	.010	1.930	.008				00012700-
REC	210-	1.810	.008	1.090	.012	1.620	.032	.93	.012	1.400	.053	1.210	.006				00012800-
REC	211-	.855	.016	.785	.009	1.310	.014	.690	.045	.615	.400						00012900-
REC	212-	6.8465															00012901-
REC	213-CD*	115	3	.485	.003	1.3	.010	.935	.023								00013000-
REC	214-	.59709															00013001-
REC	215-CD	115	6	.523	.240	.263	.002	.033	.002	.490	.122	.230	.006				00013100-
REC	216-	.260	.017														00013200-
REC	217-	.32607															00013201-
REC	218-IN*	115	1	.335	.516												00013300-
REC	219-	.016116															00013301-
REC	220-AG	116	2	.7	1.	.517	1.										00013400-
REC	221-	2.2197															00013401-
REC	222-CD*	117	5	.281	.570	.430	.120	.840	.140	1.270	.700	1.550	.150				00013500-
REC	223-	0.0															00013501-
REC	224-IN*	117	4	.310	.087	.822	.020	.622	.020	.161	.221						00013600-
REC	225-	.50759															00013601-
REC	226-IN	117	2	.565	1.000	.161	.885										00013700-
REC	227-	.25518															00013701-
REC	228-SN*	117	2	.161	.885	.159	.310										00013800-
REC	229-	0.0															00013801-
REC	230-IN	118	1	1.220	.200												00013900-
REC	231-	1.8359															00013901-
REC	232-IN*	119	2	.300	.023	.907	.050										00014000-
REC	233-	1.007															00014001-
REC	234-IN	119	3	.796	.950	.731	.050	.024	.050								00014100-
REC	235-	.59767															00014101-
REC	236-SN*	119	1	.024	.120												00014200-
REC	237-	0.0															00014201-
REC	238-CD	120	1	.500	1.000												00014300-
REC	239-	.72625															00014301-
REC	240-IN	121	1	.940	1.000												00014400-

REC	241-	1.1734															00014401-
REC	242-SB*	122	2	.075	.244	.061	.532										00014500-
REC	243-	0.0															00014501-
REC	244-SB	122	3	.564	.664	.686	.003	1.259	.001								00014600-
REC	245-	.55878															00014601-
REC	246-IN	123	1	1.100	1.000												00014700-
REC	247-	1.3619															00014701-
REC	248-SN*	123	1	1.080	.020												00014800-
REC	249-	.51395															00014801-
REC	250-SN	123	1	.160	.885												00014900-
REC	251-	.45718															00014901-
REC	252-SB	124	16	.603	.976	.645	.072	.714	.037	.722	.105	.970	.020	00015000-			
REC	253-	1.050	.020	1.298	.012	1.320	.020	1.355	.030	1.450	.020	1.500	.010	00015100-			
REC	254-	1.540	.006	1.690	.480	1.900	.004	2.090	.063	2.260	.006			00015200-			
REC	255-	.37483												00015201-			
REC	256-SN*	125	4	.326	.997	.640	.003	1.070	.003	1.380	.019			00015300-			
REC	257-	.77199												00015301-			
REC	258-SN	125	7	.342	.004	.468	.005	.811	.010	.904	.009	1.068	.036	00015400-			
REC	259-	1.410	.001	1.970	.012									00015500-			
REC	260-	.87784												00015501-			
REC	261-SB	125	17	.035	.064	.109	.040	.171	.003	.176	.068	.203	.002	00015600-			
REC	262-	.206	.003	.255	.015	.290	.015	.319	.008	.379	.012	.427	.310	00015700-			
REC	263-	.462	.100	.598	.190	.604	.052	.633	.110	.652	.007	.668	.016	00015800-			
REC	264-	.089752												00015801-			
REC	265-TE*	125	2	.035	.081	.110	.006							00015900-			
REC	266-	0.0												00015901-			
REC	267-SB	126	3	.415	1.000	.695	1.000	.665	1.000					00016000-			
REC	268-	.72265												00016001-			
REC	269-SN	127	1	.500	1.000									00016100-			
REC	270-	1.218												00016101-			
REC	271-SB	127	5	.060	.040	.248	.140	.310	.060	.463	.540	.772	.240	00016200-			
REC	272-	.37656												00016201-			
REC	273-TE*	127	2	.089	.985	.059	.015							00016300-			
REC	274-	0.0												00016301-			
REC	275-TE	127	6	.418	.008	.360	.001	.215	0.0	.059	.001	.203	0.0	00016400-			
REC	276-	.145	0.0											00016500-			
REC	277-	.23567												00016501-			
REC	278-SN	128	4	.044	.070	.072	.181	.497	.598	.570	.216			00016600-			
REC	279-	0.0												00016601-			
REC	280-SB*	128	3	.320	.810	.754	1.960	1.074	.040					00016700-			

REC	281-	.95614															00016701-
REC	282-I	128	4	.445	.172	.750	.002	.540	.017	.990	.003						00016800-
REC	283-	.72427															00016801-
REC	284-SB	129	4	.165	.580	.308	.550	.534	1.000	.788	.250						00016900-
REC	285-	.57354															00016901-
REC	286-TE*	129	1	.106	.050												00017000-
REC	287-	0.0															00017001-
REC	288-TE	129	5	1.120	.104	.720	.037	.210	0.	.475	.154	.027	.963				00017100-
REC	289-	.43888															00017101-
REC	290-XE*	129	2	.196	.083	.040	.118										00017200-
REC	291-	0.0															00017201-
REC	292-I	130	5	1.150	.255	.410	.205	.740	.536	.660	.606	.530	.636				00017300-
REC	293-	.28714															00017301-
REC	294-SB	131	1	.600	1.000												00017400-
REC	295-	1.2161															00017401-
REC	296-TE*	131	16	2.240	.006	.240	.030	2.000	.040	1.220	.170	1.080	.050				00017500-
REC	297-	0.080	.040	1.920	.020	0.100	.080	.200	.080	1.140	.285	.335	.160				00017600-
REC	298-	1.620	.030	.840	.400	.920	.050	.780	.800	.182	0.						00017700-
REC	299-	.15772															00017701-
REC	300-TE	131	6	1.130	.100	.985	0.	.920	.05	.600	.05	.454	.200				00017800-
REC	301-	.145	.800														00017900-
REC	302-	.71825															00017901-
REC	303-I	131	9	.724	.028	.638	.091	.177	0.	.364	.810	.284	.055				00018000-
REC	304-	.156	.010	.210	.010	.164	.007	.080	.063								00018100-
REC	305-	.19246															00018101-
REC	306-XE*	131	1	.164	.033												00018200-
REC	307-	0.0															00018201-
REC	308-TE	132	2	.233	.935	.052	.160										00018300-
REC	309-	.069415															00018301-
REC	310-I	132	27	.240	.013	.375	.046	.460	.022	.523	.190	.624	.052				00018400-
REC	311-	.647	.090	.650	.170	.670	.990	.720	.065	.775	.820	.950	.190				00018500-
REC	312-	1.142	.045	1.300	.031	1.400	.083	1.450	.014	1.500	.018	1.660	.007				00018600-
REC	313-	1.750	.004	1.910	.009	1.990	.010	2.070	.007	2.180	.002	2.350	.001				00018700-
REC	314-	2.420	.001	2.540	.001	2.630	0.	2.800	0.								00018800-
REC	315-	.50552															00018801-
REC	316-TE*	133	11	.334	.041	.309	.207	.387	.057	.432	.500	.468	.220				00018900-
REC	317-	.557	.350	.632	.180	.698	.240	.754	.850	.910	.570	.973	.100				00019000-
REC	318-	.49009															00019001-
REC	319-TE	133	2	.800	1.000	1.100	.700										00019100-
REC	320-	.61233															00019101-

REC	321-I	133	3	.530	.980	.850	.050	1.380	.020							00019200-
REC	322-	.46441														00019201-
REC	323-XE*	133	1	.233	.184											00019300-
REC	324-	0.0														00019301-
REC	325-XE	133	5	.380	0.	.302	0.	.160	.001	.079	.008	.081	.410	00019400-		
REC	326-	.11103												00019401-		
REC	327-TE	134	1	1.500	1.000									00019500-		
REC	328-	.096323												00019501-		
REC	329-I	134	29	.140	.030	.180	0.	.210	.044	.270	0.	.320	0.	00019600-		
REC	330-	.390	.070	.410	.005	.43	.030	.51	.010	.54	.080	.610	.180	00019700-		
REC	331-	.69	.070	.75	.010	.77	.060	.848	.950	.860	.045	.890	.055	00019800-		
REC	332-	.890	.650	.960	.020	1.0	.045	1.070	.030	1.070	.150	1.150	.095	00019900-		
REC	333-	1.280	.016	1.340	.017	1.460	.035	1.490	.010	1.620	.050	1.790	.050	00020000-		
REC	334-	.65066												00020001-		
REC	335-CS*	134	3	.127	.682	.137	.008	.010	0.					00020100-		
REC	336-	.0018324												00020101-		
REC	337-CS	134	11	1.365	.050	.802	.105	.569	.115	1.038	.050	.475	.040	00020200-		
REC	338-	1.570	.001	.960	.005	.797	.725	1.153	.025	.563	.140	.605	.974	00020300-		
REC	339-	.16088												00020301-		
REC	340-I	135	11	.420	.144	.533	.277	.620	.416	.700	.194	.851	.116	00020400-		
REC	341-	1.040	.198	1.140	.532	1.270	.554	1.470	.198	1.690	.256	1.800	.183	00020500-		
REC	342-	.14740												00020501-		
REC	343-XE*	135	1	.528	.830									00020600-		
REC	344-	0.0												00020601-		
REC	345-XE	135	3	.604	.030	.360	.001	.250	.970					00020700-		
REC	346-	.31324												00020701-		
REC	347-I	136	13	1.000	.060	2.400	.120	.710	.030	2.250	.070	3.200	.050	00020800-		
REC	348-	1.910	.050	.390	.190	1.720	.020	2.840	.080	1.550	.040	.200	.120	00020900-		
REC	349-	2.630	.110	1.320	.950									00021000-		
REC	350-	1.1778												00021001-		
REC	351-CS	136	8	.337	.590	.152	.190	.270	.220	1.255	.210	1.065	.840	00022000-		
REC	352-	.830	1.000	.170	.230	.200	.030							00022100-		
REC	353-	.11814												00022101-		
REC	354-BA*	137	1	.662	.910									00022200-		
REC	355-	0.0												00022201-		
REC	356-XE	138	3	.420	1.000	.510	.200	1.780	.200					00022300-		
REC	357-	.93726												00022301-		
REC	358-CS	138	12	3.340	.005	2.630	.090	0.193	.008	1.010	.250	.550	.080	00022400-		
REC	359-	.229	.016	.139	.020	.870	.040	.411	.030	2.210	.180	.463	.230	00022500-		
REC	360-	1.426	.730											00022600-		

REC	401-CE	146	8	.050	.010	.110	.090	.142	.200	.210	.160	.220	.070	00024900-
REC	402-	.250	.020	.270	.050	.320	.470							00025000-
REC	403-	.25089												00025001-
REC	404-PR	146	3	1.490	.330	.750	.460	.460	1.000					00025100-
REC	405-	1.2468												00025101-
REC	406-ND	147	10	.532	.168	.441	.019	.120	.006	.588	.010	.600	.003	00025200-
REC	407-	.277	.014	.197	.003	.400	.016	.321	.032	.091	.280			00025300-
REC	408-	.23869												00025301-
REC	409-PM	148	3	.551	.359	.910	.284	1.450	.436					00025400-
REC	410-	.52994												00025401-
REC	411-ND	149	11	.029	0.	.096	0.	.112	.024	.114	.144	.124	.017	00025500-
REC	412-	.188	.021	.198	.019	.210	.327	.225	.014	.240	.267	.266	.089	00025600-
REC	413-	.38860												00025601-
REC	414-PM	149	1	.286	.017									00025700-
REC	415-	.37246												00025701-
REC	416-PM	150	12	2.750	.090	1.950	.020	1.680	.070	.820	.190	1.330	.200	00025800-
REC	417-	.510	.100	1.170	.200	.820	.190	.400	.200	.340	.800	.570	.020	00025900-
REC	418-	.700	.050											00026000-
REC	419-	.84246												00026001-
REC	420-ND	151	7	.085	.090	.109	.120	.110	.120	.117	.120	.421	.250	00026100-
REC	421-	.720	.500	1.140	.500									00026200-
REC	422-	.72517												00026201-
REC	423-PM	151	22	.0257	0.	.0351	0.	.0658	0.0	.0597	0.0	.10	0.0	00026300-
REC	424-	.1048	0.0	.1432	.008	.1522	.004	.1630	.110	.1768	.052	.2090	.018	00026400-
REC	425-	.2324	.014	.2401	.030	.2752	.063	.3401	.210	.3449	.015	.4394	.009	00026500-
REC	426-	.4445	.033	.6700	.012	.7170	.035	.7520	.001	.7720	.001			00026600-
REC	427-	.31002												00026601-
REC	428-PM	152	2	.120	1.000	.500	1.000							00026700-
REC	429-	1.2895												00026701-
REC	430-EU*	152	8	1.390	.010	.963	.090	.841	.110	.563	.240	.122	.132	00026800-
REC	431-	1.320	.010	.975	.005	.344	.026							00026900-
REC	432-	.52973												00026901-
REC	433-EU	152	15	.344	.252	.411	.020	.773	.120	.692	.002	1.100	.025	00027000-
REC	434-	1.240	.020	.122	.387	.245	.075	1.095	.120	.964	.150	.866	.040	00027100-
REC	435-	1.112	.130	.443	.050	1.411	.250	1.210	.020					00027200-
REC	436-	.079509												00027201-
REC	437-PM	153	2	.125	.750	.180	.250							00027300-
REC	438-	.60699												00027301-
REC	439-SM	153	9	.590	0.0	.540	.001	.191	0.	.107	0.	.173	.003	00027400-
REC	440-	.070	.029	.084	.006	.097	.014	.103	.143					00027500-

REC	441-	.23514													00027501-
REC	442-EU	154	11	.693	.050	1.600	.021	.725	.206	.591	.062	1.280	.345	00027600-	
REC	443-	1.006	.145	.758	.086	.998	.114	.875	.172	.248	.062	.123	.189	00027700-	
REC	444-	.24149												00027701-	
REC	445-SM	155	3	.246	.060	.141	.010	.105	.940					00027800-	
REC	446-	.60178												00027801-	
REC	447-EU	155	3	.060	.013	.087	.268	.105	.170					00027900-	
REC	448-	.054711												00027901-	
REC	449-EU	156	20	.089	.084	.199	.007	.600	.015	.646	.065	.720	.056	00028000-	
REC	450-	.812	.092	.867	.001	.961	.003	1.055	.061	1.153	.057	1.154	.056	00028100-	
REC	451-	1.231	.092	1.242	.061	1.366	.001	1.877	.002	1.937	.002	1.966	.005	00028200-	
REC	452-	2.026	.003	2.098	.004	2.184	.006							00028300-	
REC	453-	.42542												00028301-	
REC	454-EU	157	2	.200	.830	.600	.750							00028400-	
REC	455-	.40642												00028401-	
REC	456-SM	158	1	.500	1.000									00028500-	
REC	457-	.34754												00028501-	
REC	458-EU	158	2	.400	1.000	.800	1.000							00028600-	
REC	459-	1.0128												00028601-	
REC	460-GD	159	6	.362	.192	.305	.001	.225	.005	.137	0.	.079	0.	00028700-	
REC	461-	.058 0.												00028800-	
REC	462-	.29908												00028801-	
REC	463-TB	160	18	.087	.072	.197	.012	.215	.013	.298	.084	.393	.005	00028900-	
REC	464-	.682	.003	.764	.007	.879	.114	.962	.036	.966	.084	.985	.003	00029000-	
REC	465-	1.070	.004	1.080	.006	1.112	.006	1.179	.054	1.200	.008	1.272	.029	00029100-	
REC	466-	1.314	.008											00029200-	
REC	467-	.19888												00029201-	
REC	468-GD	161	13	.531	.015	.273	.011	.105	.010	.482	.019	.165	.041	00029300-	
REC	469-	.361	.590	.284	.072	.102	.183	.315	.215	.259	.016	.181	.021	00029400-	
REC	470-	.134 0.		.078	.011									00029500-	
REC	471-	.57996												00029501-	
REC	472-TB	161	4	.057	.040	.074	.072	.049	.290	.026	.240			00029600-	
REC	473-	.16708												00029601-	
REC	474-	999												00029700-	
REC	475-													00029800-

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