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公開資料

ORGLIB ;

An Interactive Program for Displaying Nuclide Decay and Generation Data Based on ORIGEN Data Library

User's Manual

June. 1982

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ORGLIB

An Interactive Program for Displaying
Nuclide Decay and Generation Data Based on ORIGEN Data Library

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青木
出口

Tape contents of ORGLIB code package

Density ; 1600bpi

9-track/NON-LABEL

File	Description	LRECL	BLKSIZE	BLOCKS
1	ORGLIB Source(FORTRAN)	80	3200	68
2	ORGLIB Library Routine(FORTRAN)	80	3200	15
3	ORGLIB Library Routine(ASM)	80	3200	26
4	ORIGEN-73 Light Element	80	3200	32
5	ORIGEN-73 Actinide	80	3200	13
6	ORIGEN-73 F.P.	80	3200	58
7	ORIGEN-76 Light Element	80	3200	85
8	ORIGEN-76 Actinide	80	3200	13
9	ORIGEN-76 F.P.	80	3200	58
10	ORIGEN-79 Light Element	80	3200	85
11	ORIGEN-79 Actinide	80	3200	13
12	ORIGEN-79 F.P.	80	3200	103

1. Name and Title of Code

ORGLIB: Interactive program for displaying nuclide decay and generation data based on ORIGEN data library (DLC-38/ORYX-E).

2. Nature of Program

ORGLIB program displays ORIGEN library data interactively on graphic display terminal TEKTRONIX T-4014. Data and figure displayed on terminal are as follows;

(1) Table of nuclides and their half-lives for each element.

(2) Table of half-life, data for decay scheme, energy released by decay, natural abundancy and neutron cross sections for each nuclide.

(3) Figure of production and decay routes in reactor for each nuclide.

3. Commands of ORGLIB Program

ORGLIB program is executed interactively using commands. Commands of ORGLIB program are as follows ;

(1) Commands for defining library

STRUCTURE n

function : define and use light element (sturcture and cladding material) library.

ACTINIDE n

function : define and use actinides and their daughters library.

FISSION n

function : define and use fission products library

n : library specification number.
n=73, 76 or 79. default value is 79.

(2) Commands for displaying data

LIST z

function : display the table of nuclides and their half-lives for element (z).

z : atomic number or symbol of element (ex. Zr)

NUCLIDE z a (r)

function : display the table of half-life, data for decay scheme, energy released by decay, natural abundancy and neutron cross sections for nuclide.

z : atomic number or symbol of element.

a : mass number. in case of meta-stable nuclide, mass number + m (ex. 242m)

r : reactor type or its number

1 – HTGR

2 – LWR

3 – LMFBR

4 – MSBR

CHAIN z a (r)

function : display the figure of production and decay routes in reactor for nuclide.

z,a,r : same as above command NUCLIDE.

(3) Command for terminating program

END

function : terminate the program.

(4) Miscellanea

HELP

function : display the function of command.

All of commands may be typed in when arrow mark (→) is displayed on CRT.

4. Job Flow of ORGLIB Program

(1) Execute ORGLIB program. The method of executing ORGLIB program depends on system of machine installed.

Example 1 :

CALL "DS name of ORGLIB load module"

Example 2 :

Type in registered PROCEDURE NAME.

Procedure containes the above CALL statement.

(2) Type in command for defining libravy. Until next command is typed in, defined library is used in next stage of data display.

(3) Type in command for displaying data. Desired commands may be typed in to display data and figures required.

(4) Type in "END" command for termination of ORGLIB program.

Fig.1 shows job flow of ORGLIB program.

5. Libraries Used in ORGLIB Program

9 libraries are used in ORGLIB program. These libraries are derived from CCC-217/ORIGEN and DLC-38/ORYX-E. Definition of libraries used in ORGLIB program is described in Table 1.

6. Computer Hardware and Software Requirements

(1) Hardware Requirements

ORGLIB program is operable on FACOM M-series machine with TEKTRONIX T-4014 graphic terminal. FACOM M-series machine is compatible with IBM machine.

(2) Software Requirements

ORGLIB program is operable on FACOM level H-extended FORTRAN-Ⅳ compiler with OPTIMIZE(2) parameter. This compiler is the same as IBM compiler.

The other software needed for graphics is Terminal Control System (TCS)-PLOT10(TEKTRONIX).

7. Dynamic Allocation of Data Set

ORGLIB program allocates library data set dynamically using Superviser Macro (SVC-99). Library data set is dynamically allocated on FT10F001 when command for defining library is typed in. Subroutine ALLOC, ALLOCM and FREE are programed for dynamic allocation of library data set. The details of these subroutines are as follows ;

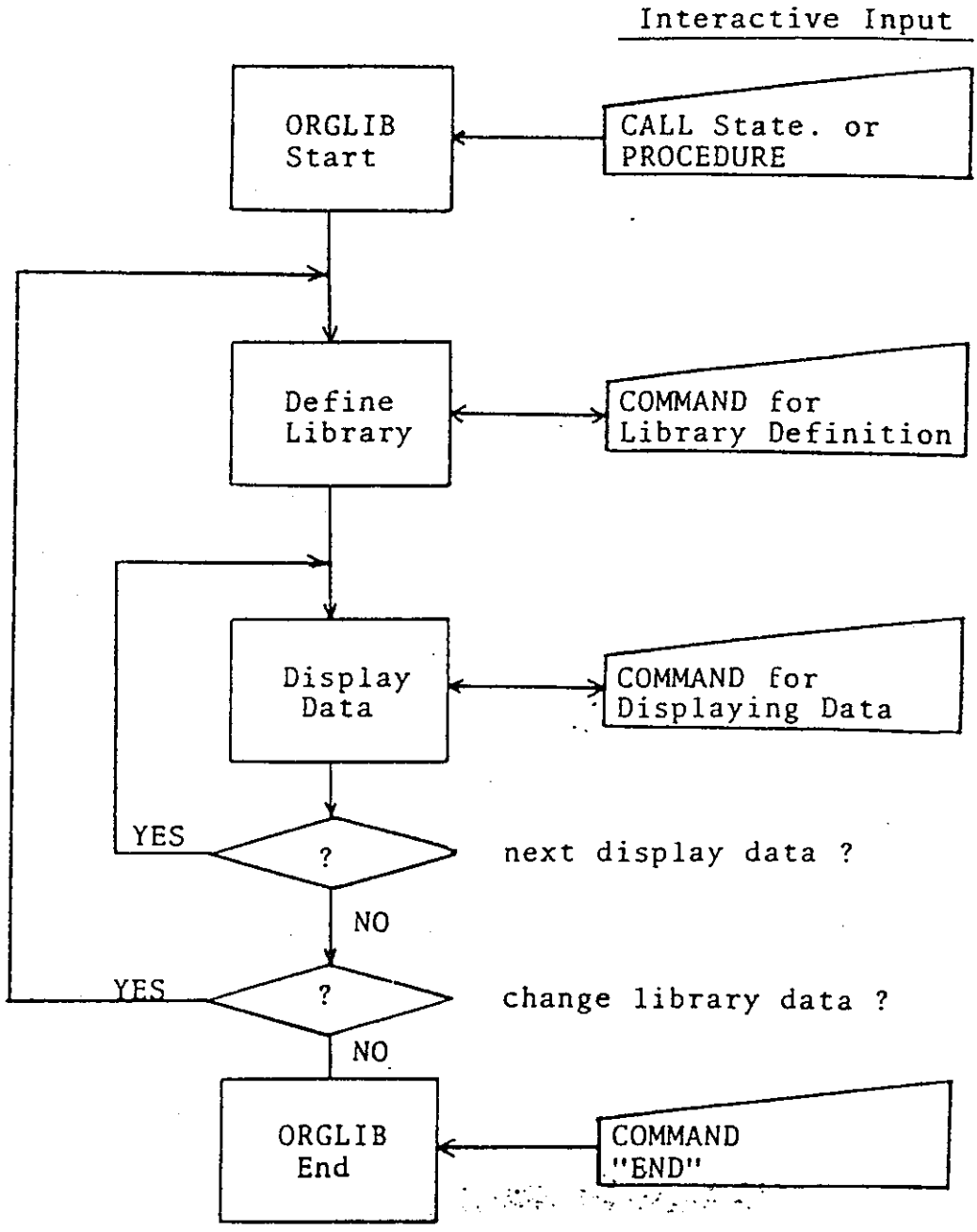


Fig. 1 Job fow of ORGLIB program

Table 1 Definition of library used in ORGLIB program

Name of Library	File Name in Source Material	Source
ORIGEN-73 Light Element	NUCLIDE Library - Structure Material and Light Element(7/73)	CCC-217/ORIGEN
ORIGEN-73 Actinide	NUCLIDE Library - Actinides and Decay Products(7/73)	CCC-217/ORIGEN
ORIGEN-73 F.P.	FISSION PRODUCTS(NUCLIDE)(7/73)	CCC-217/ORIGEN
ORIGEN-76 Light Element	Light Element Library(5/75)	DLC-38/ORYX-E
ORIGEN-76 Actinide	NUCLIDE Library - Actinides and Decay Products(1/76)	DLC-38/ORYX-E
ORIGEN-76 F.P.	FISSION PRODUCTS(NUCLIDE,packaged 7/73, updated 1/76)	DLC-38/ORYX-E
ORIGEN-79 Light Element	Light Element Library(Kee;5/78)	DLC-38/ORYX-E
ORIGEN-79 Actinide	NUCLIDE Library - Actinides and Decay Products(1/76)	DLC-38/ORYX-E
ORIGEN-79 F.P.	ORFIP-Y(yield & decay scheme,1/76)	DLC-38/ORYX-E

(1) Subroutine ALLOC

ALLOC is subroutine for allocating data set dynamically in execution of program. Data set must be already defined. DCB may not be specified.

CALL ALLOC (dd, ddname, member, status, code)

dd : Unit number of FORTRAN or DDname.
For unit number, dd is integer value of 1 to 99.
For DD name, dd is alphanumerical string less than or equal to 8 byte-length justified left.

dsname : Data set name less than or equal to 44 byte-length justified left with one or more blanks.

member : Member name less than or equal to 8 byte-length justified left.

status : Status of data set to be allocated.
Integer number (1:OLD, 2:MOD, 4:NEW, 8: SHR)

code : Return code (Integer *4)

Member name is specified in the case when data set is partitioned sequential data set. Otherwise, one or more blanks must be specified.

When status of data set is OLD, status at release is DELETE.

The subroutine is terminated abnormaly, when return code is not zero. Return code may be converted into message when subroutine ALLOCM is called.

(2) Subroutine ALLOCM

ALLOCM converts return code from subroutine ALLOC into message.

CALL ALLOCM (code, status, msg)

code : return code from subroutine ALLOC

status : status when subroutine ALLOC is called.

msg : message area (72 bytes)

Message is returned with message number which is error return code from system.

(3) Subroutine FREE

FREE releases data set allocated by subroutine ALLOC.

CALL FREE (dd, dsname, member, disp, res, code)

dd : Unit number of FORTRAN or DD name.

dsname : data set name

member : member name

disp : replace disposition at release, integer number (1:UNCATLG, 2:CATLG, 4:DELETE, 8:KEEP)

res : not used

code : return code (Integer *4)

dsname, member may be omitted. If omitted, one or more blanks must be specified. If disp is specified, status at release is altered. When status at release need not to be altered, disp must be specified zero.

8. Function of Subroutine in ORGLIB Source Program

(1) MAIN

This is main module. This module executes initialization of program, contral of command, allocation of library data set and termination of program.

(2) COMMAND

Subroutine COMMAND analyzes the command from terminal.

(3) NVALUE

Subroutine NVALUE converts alphanumerical data from terminal into numerical data by calling NUM subroutine.

(4) NUCLID

Subroutine NUCLID processes NUCLIDE command and displays data to terminal.

(5) CHAIN

Subroutine CHAIN processes CHAIN command and displays data to terminal.

(6) NGRID

Subroutine NGRID is called by subroutine CHAIN, and draws the rectangle to enclose the symbol of element.

(7) ARROW

Subroutine ARROW is called by subroutine CHAIN, and draws the arrow which indicates production and decay route.

(8) LIST

Subroutine LIST processes LIST command and displays data to terminal.

(9) HELP

Subroutine HELP processes HELP command and displays information to terminal.

9. Installation of ORGLIB Program

(1) Change of ORGLIB Source Program

Data statements DSN and MEM defined in MAIN subroutine of ORGLIB source program have to be changed.

(i) DSN (5,M)

Data set names defined to ORIGEN data libraries are specified in DSN (5, M) data statement, respectively.

M = 1 : ORIGEN-73 library

M = 2 : ORIGEN-76 library

M = 3 : ORIGEN-79 library

(ii) MEM (N, M)

Each of ORIGEN data library has 3 types of data, i.e. light element, activide and fission product. Member names of 3 types of data for each of ORIGEN data library are specified in MEN(N,M) data statement.

N = 1 : light element

N = 2 : actinide

N = 3 : fission product

(2) Requirement to IBM User

ORGLIB program uses ENCODE statement. For IBM user, subroutine call statement which has the same function as ENCODE must be substituted for ENCODE statement.

(3) Requirement to CDC User

Subroutine ALLOC, ALLOCM and FREE, which are used to allocate data set dynamically, are not available for CDC user. These subroutines must be substituted with;

(i) Subroutine call statements which have the same function.

(ii) Subroutines which shall be newly programmed.

(iii) Change of ORGLIB program so as not to allocate data set dynamically..

10. Sample of Display Output

Samples of display output are shown below.

(1) LIST Command Output

Table 2 ; Nuclides and their half-lives for Pu

Table 3 ; Nuclides and their half-lives for Cs

Table 4 ; Nuclides and their half-lives for Zr

(2) NUCLIDE Command Output

Table 5 ; Decay and production data for Pu-239(Actinide)

Table 6 ; Decay and production data for Cs-137(Fission Product)

Table 7 ; Decay and production data for Zr-90(Light Elemet)

(3) CHAIN Command Output

Fig. 2 ; Decay and production routes for Pu-239(Actinide)

Fig. 3 ; Decay and production routes for Cs-137(Fission Product)

Fig. 4 ; Decay and production routes for Zr-90(Light Element

Table 2 Nuclides and their half-lives for Pu

<<	94	Plutonium	(Actinide)		(ORIGEN-79) >>
94	Pu	236	Half-life	(years)	0.28500E+01
94	Pu	238	Half-life	(years)	0.89000E+02
94	Pu	239	Half-life	(thousand years)	0.24400E+02
94	Pu	240	Half-life	(years)	0.67600E+04
94	Pu	241	Half-life	(years)	0.14600E+02
94	Pu	242	Half-life	(million years)	0.37900E+00
94	Pu	243	Half-life	(hours)	0.49800E+01
94	Pu	244	Half-life	(million years)	0.82800E+02
94	Pu	245	Half-life	(hours)	0.10600E+02

Table 3 Nuclides and their half-lives for Cs

<<	55	Cesium	(Fission Product)		(ORIGEN-79) >>
55	Cs	133	Half-life	(stable)	
55	Cs	134	Half-life	(seconds)	0.65010E+08
55	Cs	134m	Half-life	(seconds)	0.10440E+05
55	Cs	135	Half-life	(seconds)	0.72530E+14
55	Cs	135m	Half-life	(seconds)	0.31800E+04
55	Cs	136	Half-life	(seconds)	0.11230E+07
55	Cs	137	Half-life	(seconds)	0.94990E+09
55	Cs	138	Half-life	(seconds)	0.19320E+04
55	Cs	138m	Half-life	(seconds)	0.17400E+03
55	Cs	139	Half-life	(seconds)	0.55800E+03
55	Cs	140	Half-life	(seconds)	0.63800E+02
55	Cs	141	Half-life	(seconds)	0.25000E+02
55	Cs	142	Half-life	(seconds)	0.17000E+01
55	Cs	143	Half-life	(seconds)	0.17000E+01
55	Cs	144	Half-life	(seconds)	0.10200E+01
55	Cs	145	Half-life	(seconds)	0.58000E+00
55	Cs	146	Half-life	(seconds)	0.19000E+00
55	Cs	147	Half-life	(seconds)	0.55780E+00
55	Cs	148	Half-life	(seconds)	0.20150E+00
55	Cs	149	Half-life	(seconds)	0.27820E+00
55	Cs	150	Half-life	(seconds)	0.12440E+00

Table 4 Nuclides and their half-lives for Zr

<<	40	Zirconium	(Light Element)		(ORIGEN-79) >>
40	Zr	89	Half-life	(hours)	0.78400E+02
40	Zr	90	Half-life	(stable)	
40	Zr	91	Half-life	(stable)	
40	Zr	92	Half-life	(stable)	
40	Zr	93	Half-life	(million years)	0.15000E+01
40	Zr	94	Half-life	(stable)	
40	Zr	95	Half-life	(days)	0.65000E+02
40	Zr	96	Half-life	(stable)	
40	Zr	97	Half-life	(hours)	0.17000E+02

Table 5 Decay and production data for Pu-239(Actinide)

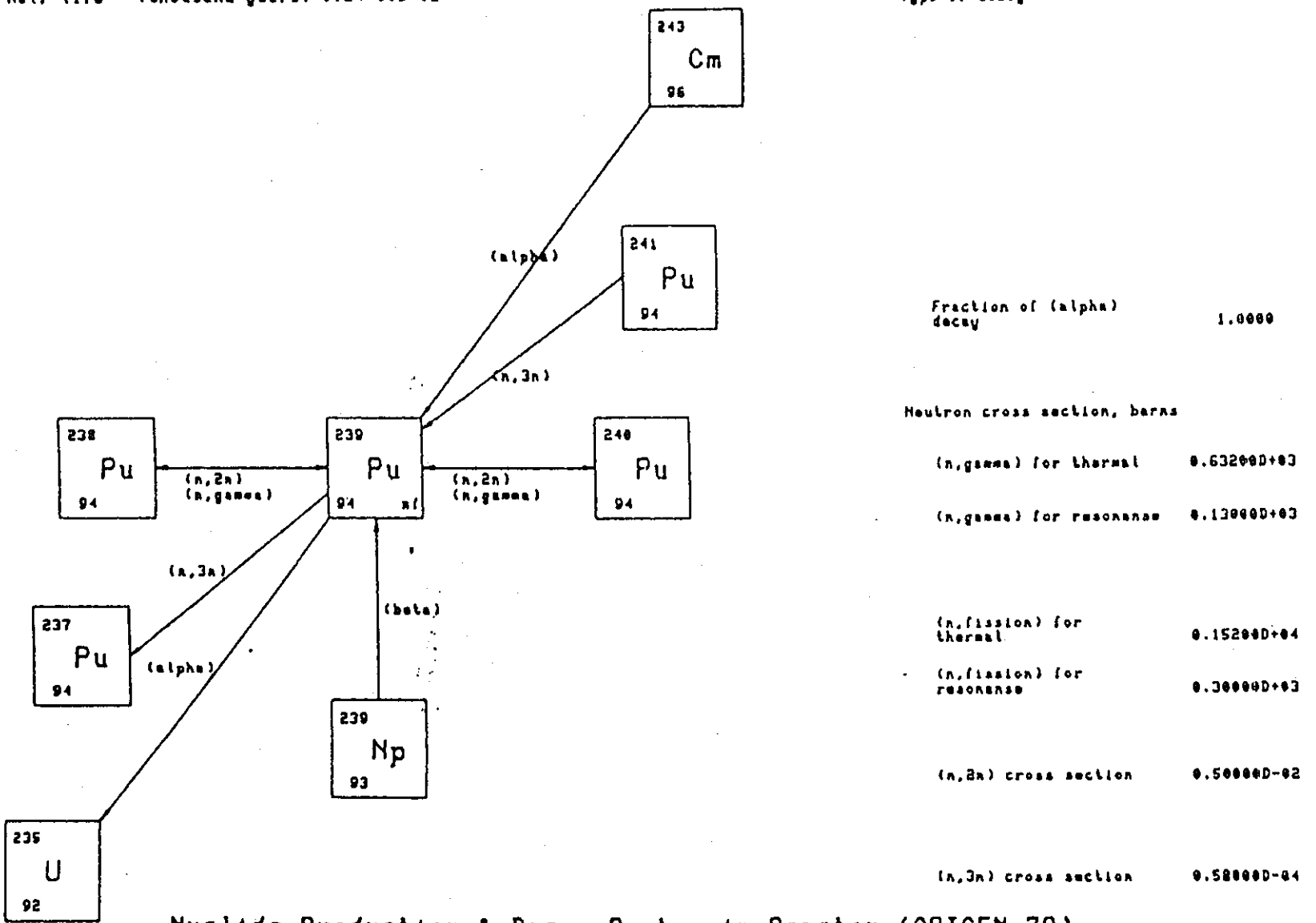
94 Pu 239 Plutonium (Actinide) LWR (ORIGEN-79)	
Half-life (thousand years)	0.24400E+02
Fraction of beta decay transitions that result in a product nuclide in an excited nuclear state.	0.0
Fraction of transitions that take place by positron emission.	0.0
Fraction of positron emission that result in a product nuclide in an excited nuclear state.	0.0
Fraction of disintegrations from an excited nuclear state to the ground state.	0.0
Fraction of transitions that take place by alpha particle emission.	0.10000E+01
Fraction of disintegrations that take place by spontaneous fission.	0.0
Total amount of energy released by radioactive decay as recoverable heat, in MeV per disintegration.	0.52430E+01
Fraction of the total energy that is associated with gamma radiation.	0.0
Percent abundance of naturally occurring isotopes.	0.0
Thermal neutron (n,gamma) cross section, barns.	0.63200E+03
Resonance integral for (n,gamma) reactions, barns.	0.13000E+03
Fraction of (n,gamma) absorptions that result in an excited nuclear state of the product nuclide.	0.0
Thermal neutron (n,fission) cross section, barns.	0.15200E+04
Resonance integral for (n,fission) reactions, barns.	0.30000E+03
Fission-spectrum-averaged (n,fission) cross section for isotope having a high-energy threshold for reaction, barns.	0.0
Fission-spectrum-averaged (n,2n) cross section, barns.	0.50000E-02
Fraction of (n,2n) reactions that result in the formation of a product nuclide in an excited nuclear state.	0.0
Fission-spectrum-averaged (n,3n) cross section, barns.	0.58000E-04

Table 6 Decay and production data for Cs-137(Fission Product)

55 Cs 137	Cesium	(Fission Product)	LWR	(ORIGEN-79)
Half-life (seconds)				0.94900E+09
Fraction of beta decay transitions that result in a product nuclide in an excited nuclear state.				0.94600E+00
Fraction of transitions that take place by positron emission.				0.0
Fraction of positron emission that result in a product nuclide in an excited nuclear state.				0.0
Fraction of disintegrations from an excited nuclear state to the ground state.				0.0
Fraction of transitions that take place by alpha particle emission.				0.0
Fraction of disintegrations that take place by spontaneous fission.				0.0
Total amount of energy released by radioactive decay as recoverable heat, in MeV per disintegration.				0.17400E+00
Fraction of the total energy that is associated with gamma radiation.				0.0
Percent abundance of naturally occurring isotopes.				0.0
Thermal neutron (n,gamma) cross section, barns.				0.11000E+00
Resonance integral for (n,gamma) reactions, barns.				0.30000E+00
Fraction of (n,gamma) absorptions that result in an excited nuclear state of the product nuclide.				0.0
Direct fission yield data for thermal-neutron-induced fission from U-233.				0.15000E+00
Direct fission yield data for thermal-neutron-induced fission from U-235.				0.10800E+00
Direct fission yield data for fission-spectrum-energy neutrons from U-238.				0.16000E-01
Direct fission yield data for thermal-neutron-induced fission from Pu-239.				0.78200E+00

Table 7 Decay and production data for Zr-90(Light Element)

40 Zr 90 Zirconium (Light Element) LWR (ORIGEN-79)	
Half-life (stable)	
Fraction of beta decay transitions that result in a product nuclide in an excited nuclear state.	0.0
Fraction of transitions that take place by positron emission.	0.0
Fraction of positron emission that result in a product nuclide in an excited nuclear state.	0.0
Fraction of disintegrations from an excited nuclear state to th. ground state.	0.0
Fraction of transitions that take place by alpha particle emission.	0.0
Fraction of disintegrations that take place by spontaneous fission.	0.0
Total amount of energy released by radioactive decay as recoverable heat, in MeV per disintegration.	0.0
Fraction of the total energy that is associated with gamma radiation.	0.0
Percent abundance of naturally occurring isotopes.	0.51460E+02
Total 2200m/sec neutron absorption cross section, barns.	0.10000E+00
Fraction of thermal neutron captures that produce a product nuclide in an excited nuclear state.	0.0
Fraction of thermal neutron absorptions that are (n,alpha) reactions.	0.0
Fraction of thermal neutron absorptions that are (n,p) reactions.	0.0
Resonance integral (above 0.5 eV) for all epithermal neutron absorption, barn.	0.28000E+00
Fraction of resonance absorptions that are (n,alpha) reactions.	0.0
Fraction of resonance absorptions that are (n,p) reactions.	0.0
Fission-spectrum-averaged cross section for all reactions with a threshold above 1 MeV, barns.	0.99400E-03
Fraction of (n,2n) reactions that result in an excited isomeric state of the product nuclide.	0.0
Fraction of high-energy reactions that are of (n,alpha) type.	0.40000E-02
Fraction of high-energy reactions that are of (n,p) type.	0.99600E+00

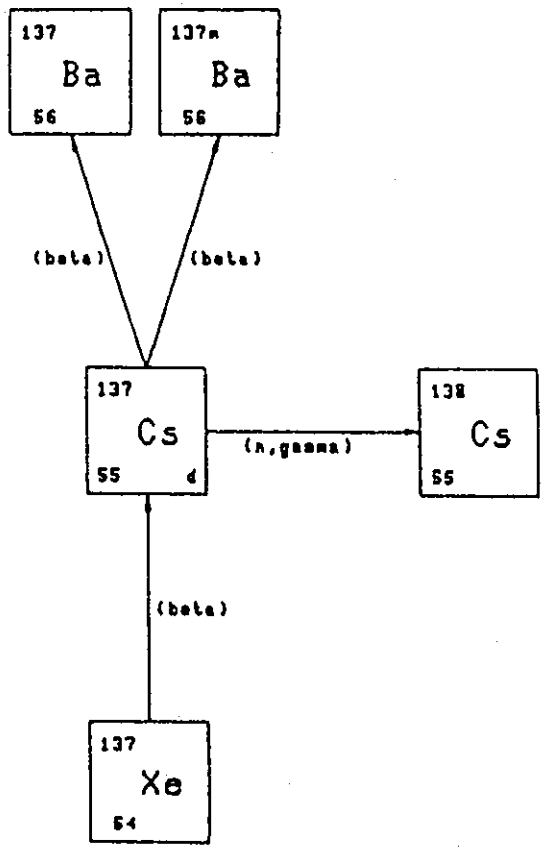


Nuclide Production & Decay Routes in Reactor (ORIGEN-79)

Fig. 2 Decay and production routes for Pu-239(Actinide)

55 Cs 137 Cesium (Fission Product) LWR

Half-life (seconds) 0.94999D+09



Type of decay

Fraction of beta decay	0.0540
Fraction of beta decay to excited state	0.9460

Neutron cross section (barns)

(n,gamma) for thermal	0.11000D+00
(n,gamma) for resonance	0.30000D+00

Direct fission yield data (%)

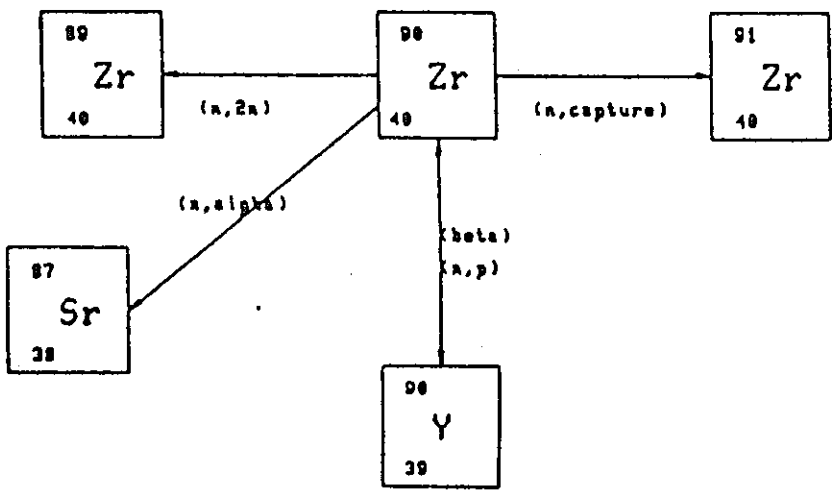
Thermal-neutron-induced fission from U-233.	0.16000D+00
Thermal-neutron-induced fission from U-235.	0.10800D+00
Fission-spectrum-energy neutrons from U-238.	0.16000D-01
Thermal-neutron-induced fission from Pu-239.	0.78200D+00

Nuclide Production & Decay Routes in Reactor (ORIGEN-79)

Fig. 3 Decay and production routes for Cs-137(Fission Product)

40 Zr 90 Zirconium (Light Elemet) LWR

Half-life (stable)



Cross section for thermal	0.10000D+00
Fraction of (n,capture) for thermal	1.0000
Cross section for resonance	0.20000D+00
Fraction of (n,capture) for resonance	1.0000
Cross section for high-energy	0.90400D-03
Fraction of (n,2n)	0.13878D-16
Fraction of (n,alpha) for high-energy	0.0040
Fraction of (n,p) for high-energy	0.9960

Nuclide Production & Decay Routes in Reactor (ORIGEN-79)

Fig. 4 Decay and production routes for Zr-90(Light Element)

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