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PRELIMINARY REPORT

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IRRADIATION PROCESSING DEPARTMENT

December 9, 1963

EMPIRICAL PLUTONIUM CONSTANTS 7090 PROGRAMINTRODUCTION

The current revision of the Process Optimization Program¹ contains two empirical plutonium-exposure expressions. One relates total Pu conversion to exposure² and the other, Pu-240 buildup to exposure. The former was incorporated to save computer time and the latter to provide product quality data. Both of these relationships, in addition to a third which relates Pu-241 buildup to exposure, are used in PULP-3,³ the data generator for LP-90.

EMCON-3, a 7090 computer program which determines arbitrary constants for all three empirical expressions, has been devised. It uses, as input, official conversion data⁴ and will facilitate rapid evaluation of the effect of periodic revisions in official conversion data, changes in reactor loadings, and/or changes in product specification.

This document contains a discussion of the empirical expressions, the program mechanics, and program input/output. A Fortran listing of the program logic (deck available upon request), a deck assembly diagram, and sample program output are included in the appendix to aid the reader in using and/or revising the program. Listings of empirical constants for most current reactor loadings are also included in the appendix.

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SUMMARY

A 7090 computer program has been written which will determine constants for the empirical plutonium expressions used in the Process Optimization and PULP-3 programs.

The program fits equations of the form

$$X = (a_x) \exp(-b_x M + c_x M^2) \quad (A)$$

$$Y = M / (a_y + b_y M) \quad (B)$$

$$Z = a_z M^{b_z} \quad (C)$$

where:

X = conversion ratio, grams total Pu/MWD

Y = concentration Pu-240, per cent

Z = concentration Pu-241, per cent

M = exposure, MWD/ton

$a_x, b_x, c_x, a_y, b_y, a_z, b_z$ = arbitrary constants

to official conversion data by solving simultaneous equations for (A) and using least squares for (B) and (C).

The maximum error introduced by these expressions (A) and (B) is of the order of 0.10 per cent (deviation from official values). The maximum error introduced by expression (C) is somewhat larger, approximately 4.0 per cent. In addition to determining constants for Pu-240, Pu-241, and total Pu, the program uses these constants to generate a table of conversions and per cents which can be compared with official data as a check on accuracy of fit. Conversions and per cents given for Pu-239 in the table are determined by differences.

Tubes per ton, another input parameter to the optimization program, is also calculated.

DISCUSSION

A. Empirical Relationships

Two empirical expressions relating plutonium conversion to exposure are currently incorporated into the Process Optimization Program,¹ and these two plus a third are used in PULP-3.² The expression

$$X = (a_x) \exp(-bM + cM^2) \quad (A)$$

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where:

X = conversion ratio, grams total Pu/MWD

M = exposure, MWD/ton uranium

a_x, b_x, c_x = arbitrary constants

was shown to have a maximum deviation from official values⁴ in the order of 0.10 per cent² and was the first to be used in the optimization program. It replaced a lengthy S.S. Accountability subroutine and resulted in a savings of computer time on routine calculations. It is also used in PULP-3, the data generator for LP-90.

The second empirical expression incorporated into the optimization program relates Pu-240 buildup to exposure. This expression is also used in PULP-3.

$$Y = M / (a_y + b_y M) \quad (B)$$

where:

Y = Pu-240 concentration, per cent

M = exposure, MWD/ton uranium

a_y, b_y = arbitrary constants

This expression was suggested by W. I. Neef, formerly in Process Analysis Unit, and is used to aid in optimization under the product specification. The accuracy of equation was investigated and found to deviate from official values by not more than 0.1 per cent in the exposure range of interest.

The third expression, which is used only in PULP-3, was also suggested by W. I. Neef. It relates Pu-241 buildup to exposure and has the form:

$$Z = a_z M^{b_z} \quad (C)$$

where:

Z = Pu-241 concentration, per cent

M = exposure, MWD/ton uranium

a_z, b_z = arbitrary constants

The maximum error introduced by this expression (approximately 4.0 per cent) is larger than for the total Pu and Pu-240 relationships; however, it is used in PULP-3 to calculate Pu-239 by difference and results in a very accurate Pu-239 determination (maximum error approximately 0.05 per cent). Sample curves showing per cent deviation as a function of exposure for equations (B) and (C) are shown on Figure 1.

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FIGURE 1 COMPARISON OF CALCULATED PU-240 AND PU-241 CONCENTRATIONS WITH OFFICIAL VALUES FOR A 40 PIRE KEE CHARGE.

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B. Program Mechanics

EMCON-3 can be used to calculate empirical constants for fuel charges containing water mixers at zero, one, or two locations. Pu-240 and Pu-241 concentrations, in per cent, and total Pu yield, in grams per ton of uranium, at three different exposures for the main portion of the charge and for the water mixer(s) are input data to the program. Factor weights (weight of uranium per piece) and number of pieces of each type metal must also be specified.

Empirical constants for average conversion for the charge are determined by arithmetically weighting the conversion of all segments. This feature is included to account for differences in conversion between the main part of the charge and water mixer(s), if any.

After the conversions have been weighted, the constants for total Pu are found by solving three simultaneous equations corresponding to three exposures and the respective conversions. Pu-240 and Pu-241 constants are calculated by the least square method using the three data points.

Constants found by the above methods are subsequently "plugged" into their respective conversion expressions and a table of conversions and per cents for exposures of 100-1500 MWD/ton is generated. These values can then be used as a check on the "goodness of fit" of the empirical expressions.

Tubes per ton, which is an input parameter to both the Process Optimization Program and PULP-3, is also calculated in EMCON-3 for each reactor loading.

A Fortran listing of the program logic is given in Appendix A, pages 9 to 11.

C. Program Input/Output

Input

Four input cards comprise a "case" and as many cases as are desired can be run at one time. The four data cards in each case are designated Card 1, and Cards 2a, 2b, and 2c. Formats for the cards and a graphic illustration of the deck assembly are shown on page 13 in Appendix B. Definitions of, and restrictions on the input data, are listed in Tables I and II, pages 14 to 16 in Appendix B.

Output

Illustrative samples of the program output are shown on Figures 2, 3, and 4, pages 18 to 20, Appendix C. Definition of terms on the output report are presented in Table III, pages 21 to 22, Appendix C. Figure 2 illustrates the program output when constants corresponding to a five-segment loading (two mixers) are desired. Program output for a three-segment loading (one mixer) is shown on Figure 3. Program output for a one-segment loading

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(no mixers) where constants for total Pu only are desired (no Pu-240 or Pu-241), is shown on Figure 4. These variations in program output are obtained by simply omitting input data on cards 1-2c as illustrated on the figures.

Listings of program output for several of the current reactor loadings, based on the most recent conversion values⁴ (March 1, 1963) are presented in Appendix D, pages 24 to 42.

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Process Technology Subsection
RESEARCH AND ENGINEERING SECTION

RD Jensen:mf

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APPENDIX A

EMCON-3 PROGRAM

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EMPIRICAL CONSTANTS-3

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10 MPMA=1000*(F3(3),G3(3),V3(3),U3(3),D3(3),T3(3),VMA(3),TMA(3),D3(3),V3(3),
11 T3(3),V3(3),V3(3),V3(3),Y3(3),Y3(3),Y3(3),Y3(3),G3(3),G3(3),X3(3),Y3(3),
12 A3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),
13 A3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),G3(3),
14 G3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
15 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
16 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
17 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
18 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
19 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
20 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
21 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
22 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
23 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
24 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
25 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
26 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
27 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
28 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
29 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
30 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
31 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
32 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
33 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
34 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
35 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
36 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
37 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
38 FOR AT(1)=V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),V3(3),
39 YUN(1)=(F3(3)+G3(3)+V3(3)+U3(3)+D3(3)+T3(3)+VMA(3)+TMA(3)+D3(3)+V3(3)+

```


9 CONTINUE
28 WRITE OUTPUT TAPE 3,24
29 WRITE OUTPUT TAPE 3,1,R
30 WRITE OUTPUT TAPE 3,2,FUEL
31 WRITE OUTPUT TAPE 3,3,LEG1,LEG2,LEG3,LEG4,LEG5
64 WRITE OUTPUT TAPE 3,10,A41
65 WRITE OUTPUT TAPE 3,11,B41
66 WRITE OUTPUT TAPE 3,12,A41
68 WRITE OUTPUT TAPE 3,14,B41
69 WRITE OUTPUT TAPE 3,15,AFU
70 WRITE OUTPUT TAPE 3,16,BFU
71 WRITE OUTPUT TAPE 3,17,CPL
67 WRITE OUTPUT TAPE 3,13,TPT
35 WRITE OUTPUT TAPE 3,4
36 WRITE OUTPUT TAPE 3,5,EN,EN14,F1MF,VN,WFA,WMB
33 WRITE OUTPUT TAPE 3,7
34 WRITE OUTPUT TAPE 3,6,(EN(I),UN(I),VN(I),TN(I),UMA(I),VMA(I),TMA(I),
1),UM(I),VM(I),TM(I),I=1,3)
51 WRITE OUTPUT TAPE 3,8
51 WRITE OUTPUT TAPE 3,9,(EN(I),YUN(I),YVN(I),YTN(I),CE40(I),CE41(I),
1)TN(I),I=1,3)
92 WRITE OUTPUT TAPE 3,18
93 WRITE OUTPUT TAPE 3,19,(EX(K),GPT39(K),GPT40(K),GPT41(K),GPTFU(K),
1)GPM39(K),GPMFU(K),CE39(K),CE40(K),CE41(K),K=1,15)
94 GO TO 26
95 CALL EXIT
END(1,1,1,0,0,0,0,1,0,0,1,0)

APPENDIX B

INPUT FORMAT, DEFINITIONS, AND RESTRICTIONS

Input Format - Page 13

Format Definitions and Restrictions - Page 14

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BLANK CARD

CARD 2c

CARD 2b

CARD 2a

CARDI

A DATA

BINARY DECK

* XEQ

* IDENT

CASE

CASE

HW-79858

TABLE I - LEGEND FOR CARD 1

<u>Term</u>	<u>Definition</u>	<u>Restrictions</u>
KASE	Case number	Any positive number between one and 99--cases need not be consecutively numbered--used for internal program control only.
R	Reactor type	Any six Hollerith characters--normally single characters O, C, or K--can be omitted.
FUEL	Fuel type	Any six Hollerith characters (e.g., O3N, K4E).
I1-L5	Number of fuel pieces in each of five segments	Segments should be numbered rear to front, i.e., I1 corresponds to furthest downstream segment--can be omitted.
EN	Number of fuel elements in main part of charge.	None
ENMA	Number of mixers at the furthest downstream mixer location.	None--however, the value of this term is usually 1 or 0.
ENMB	Number of mixers at the furthest upstream mixer location.	None--however, the value of this term is usually 1 or 0.
WN	Factor weights for fuel elements in main charge, lb.	None
WMA	Factor weight of mixers corresponding to ENMA.	Need not be specified if ENMA = 0.
WMB	Factor weight of mixers corresponding to ENMB	Need not be specified if ENMB = 0.

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TABLE II - LEGEND FOR CARDS 2a, 2b, AND 2c

NOTE: The lowest exposure value must appear on Card 2a; the middle exposure on Card 2b; and the highest, on Card 2c. Further, the middle exposure must be at the exact midpoint of the interval bounded by the lowest and highest exposure values (e.g., 100, 500, 900; or 450, 550, 650; etc.)

<u>Term</u>	<u>Definition</u>	<u>Restrictions</u>
EM	Exposure, MWD/ton uranium	None
UN	Pu-241 concen- tration at exposure EM for the main part of the charge, per cent	May be omitted if constants for the Pu-241 expression are not wanted.
VN	Pu-240 concen- tration at exposure EM for the main part of the charge, grams/ ton uranium.	May be omitted if constants for the Pu-240 expression are not wanted.
TN	Total Pu con- version at exposure EM for the main part of the charge, grams/ton uranium.	May <u>not</u> be omitted.
UMA	Pu-241 concen- tration at exposure EM for the down- stream mixer(s), per cent.	May be omitted if constants for the Pu-241 expression are not wanted or if there is (are) no downstream mixer(s).
VMA	Pu-240 concen- tration at exposure EM for the downstream mixer(s), per cent	May be omitted if constants for the Pu-240 expression are not wanted or if there is (are) no downstream mixer(s).
TMA	Total Pu conver- sion at exposure EM for the down- stream mixer(s), grams Pu/ton uranium.	This value may be omitted only if there is (are) no downstream mixer(s).

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TABLE II (Continued)

<u>Term</u>	<u>Definition</u>	<u>Restrictions</u>
UMB	Same as UMA, for upstream mixer(s)	Same as for UMA, for upstream mixer(s)
VMB	Same as VMA, for upstream mixer(s)	Same as for VMA, for upstream mixer(s)
TMB	Same as TMA, for upstream mixer(s)	Same as for TMA, for upstream mixer(s)

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APPENDIX C

OUTPUT FORMAT AND FORMAT DEFINITIONS

Output Format - Pages 18-20

Format Definitions - Pages 21-22

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EMPIRICAL CONSTANTS

REACTION= TEST } INPUT
 FUEL= CASE
 LOAD= 7 1 3 1 23

A40= 12A.469 } PU-240 CONSTANTS

B40= 0.02205

A41= 0.30240E-05 } PU-241 CONSTANTS

B41= 1.76747

APU= 0.79402 } TOTAL PU CONSTANTS

BPU= 0.141131E-03

CPU= 0.12608E-07

TPU= 10.80439

TUBES PER TON

EN ENNA ENMB YN WMA WMR } INPUT
 33. 1. 1. 5.29 5.27 5.27

EM	UN	VN	YN	UMA	VMA	TMA	UMB	VMR	TMR	INPUT
700.	0.321	4.504	503.61	0.329	5.684	557.24	0.320	5.880	557.00	}
1000.	0.608	6.567	694.42	0.619	7.771	761.96	0.610	7.770	761.5	
1300.	0.957	8.182	873.26	0.969	9.687	951.29	0.966	9.680	951.2	

EM	YUN	VVN	YTN	CE40	CE41	GTN	WEIGHTED CONVERSIONS
700.	1.63	24.65	506.65	4.865	0.321	0.72378	}
1000.	4.29	46.38	696.25	6.642	0.615	0.69825	
1300.	8.46	72.63	877.78	8.275	0.957	0.67515	

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPMPU	CN39	CN40	CN41	Values generated with constants listed above
100.	77.69	0.60	0.01	78.30	0.77691	.79299	99.224	.765	0.010	}
200.	152.18	2.32	0.05	154.46	0.76041	.77231	98.460	1.505	0.035	
300.	223.35	5.08	0.17	228.59	0.74449	.76196	97.707	2.221	0.072	
400.	291.65	8.70	0.36	300.76	0.72914	.75195	96.966	2.914	0.120	
500.	357.16	13.30	0.66	371.13	0.71432	.74225	96.237	3.584	0.178	
600.	420.42	18.62	1.08	439.72	0.70003	.73287	95.520	4.234	0.246	
700.	480.37	24.65	1.64	506.65	0.68624	.72378	94.813	4.864	0.323	
800.	538.33	31.32	2.34	571.99	0.67292	.71499	94.116	5.475	0.409	
900.	594.15	38.58	3.20	635.63	0.66005	.70648	93.426	6.168	0.504	
1000.	647.63	46.39	4.24	698.25	0.64763	.69825	92.749	6.644	0.617	
1100.	699.18	54.69	5.45	759.32	0.63562	.69029	92.079	7.203	0.718	
1200.	748.81	63.45	6.86	819.11	0.62401	.68260	91.417	7.746	0.837	
1300.	796.62	72.62	8.47	877.78	0.61278	.67515	90.762	8.273	0.965	
1400.	842.70	82.17	10.28	935.15	0.60193	.66796	90.114	8.787	1.110	
1500.	887.13	92.07	12.32	991.52	0.59142	.66101	89.472	9.286	1.242	

FIGURE 2 PROGRAM OUTPUT FOR TWO-MIXER CASE

EMPIRICAL CONSTANTS

REACTOR TEST

FUEL CASE

LOAD= 7 1 27 0 0 0

A40= 129.589
 B40= 0.02185
 A41= 0.30548E-05
 B41= 1.76549
 APU= 0.79192
 HPU= 0.139671E-03
 CPU= 0.12278E-07
 TPT=10.80731

FN ENMA ENMR MA WMA WMB

34. 1. - . 5.29 5.20-5.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
700.	0.321	4.414	503.6	0.329	5.684	557.24	-0.	-0.	-0.
1000.	0.608	0.967	694.42	0.619	7.771	761.96	-0.	-0.	-0.
1300.	0.957	0.182	873.26	0.969	9.687	951.24	-0.	-0.	-0.

EN	YUN	VUN	YTN	CE40	CE41	GTN
700.	1.62	24.40	505.11	4.831	0.321	0.72158
1000.	4.24	45.98	696.32	6.604	0.608	0.69632
1300.	6.38	72.03	875.45	8.228	0.957	0.67343

EX	GPT39	GPT40	GPT41	GPTU	GPM39	GPMPU	CN39	CN40	CN41
100.	77.40	0.59	0.01	78.00	0.77405	.78005	99.231	.759	0.910
200.	151.55	2.30	0.05	153.90	0.75775	.76951	98.472	1.493	0.035
300.	222.61	5.02	0.16	227.79	0.74202	.75931	97.724	2.204	0.072
400.	291.74	8.67	0.36	299.77	0.72685	.74942	96.988	2.892	0.121
500.	356.10	13.16	0.66	369.92	0.71220	.73984	96.264	3.556	0.176
600.	418.83	18.43	1.08	438.34	0.69805	.73056	95.551	4.205	0.245
700.	479.88	24.40	1.63	505.11	0.68439	.72156	94.846	4.832	0.322
800.	536.96	31.02	2.33	570.31	0.67120	.71269	94.153	5.449	0.415
900.	592.61	38.23	3.18	634.02	0.65845	.70447	93.468	6.3	0.512
1000.	646.13	45.98	4.21	696.32	0.64613	.69632	92.792	6.603	0.615
1100.	697.63	54.22	5.42	757.28	0.63421	.68843	92.124	7.160	0.715
1200.	747.23	62.92	6.81	816.96	0.62269	.68081	91.464	7.702	0.834
1300.	795.1	72.03	8.41	875.45	0.61154	.67343	90.811	8.228	0.961
1400.	841.05	81.53	10.21	932.81	0.60076	.66629	90.165	8.741	1.095
1500.	885.47	91.38	12.23	989.19	0.59032	.65939	89.524	9.239	1.237

FIGURE 3 PROGRAM OUTPUT FOR ONE-MIXER CASE

EMPIRICAL CONSTANTS

REACTOR TEST

FUEL CASE

LOAD= 35 -0 -0 -0 -0 -0

A40= -0.

B40= 0.

A41= 0.1000E 01

B41= 0.

APU= 0.78797

BPU= 0.138451E-03

CPU= 0.1269E-07

TPT=10.80205

EN ENMA ENMR WN WMA WMB

35. -0. -0. 5.29-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
700.	-0.	-0.	503.60	-0.	-0.	-0.	-0.	-0.	-0.
1000.	-0.	-0.	694.42	-0.	-0.	-0.	-0.	-0.	-0.
1300.	-0.	-0.	873.26	-0.	-0.	-0.	-0.	-0.	-0.

EM YUN YVN YTN CE40 CE41 GTN

700.	-0.	-0.	503.60	-0.	-0.	0.71943
1000.	-0.	-0.	694.42	-0.	-0.	0.69442
1300.	-0.	-0.	873.26	-0.	-0.	0.67174

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GMPU	CN39	CN40	CN41
100.	76.95	0.	0.78	77.72	0.76946	.77723	99.000	.	1.000
200.	151.83	0.	1.53	153.36	0.75915	.76682	99.000	.	1.000
300.	224.75	0.	2.27	227.02	0.74917	.75673	99.000	.	1.000
400.	295.80	0.	2.99	298.78	0.73949	.74696	99.000	.	1.000
500.	365.0	0.	3.69	368.74	0.73011	.73749	99.000	.	1.000
600.	432.62	0.	4.37	436.99	0.72103	.72831	99.000	.	1.000
700.	498.56	0.	5.04	503.60	0.71223	.71943	99.000	.	1.000
800.	562.97	0.	5.69	568.66	0.70371	.71082	99.000	.	1.000
900.	625.92	0.	6.32	632.24	0.69546	.70249	99.000	.	1.000
1000.	687.48	0.	6.94	694.42	0.68748	.69442	99.000	.	1.000
1100.	747.72	0.	7.55	755.27	0.67974	.68661	99.000	.	1.000
1200.	806.71	0.	8.15	814.56	0.67226	.67915	99.000	.	1.000
1300.	864.53	0.	8.73	873.26	0.66502	.67174	99.000	.	1.000
1400.	921.23	0.	9.31	930.53	0.65802	.66466	99.000	.	1.000
1500.	976.87	0.	9.87	986.74	0.65125	.65742	99.000	.	1.000

FIGURE 4 PROGRAM OUTPUT FOR NO-MIXER CASE --TOTAL PU CONSTANTS ONLY

TABLE III - DEFINITION OF TERMS ON THE OUTPUT REPORT OF EMCON-3

<u>Term</u>	<u>Source</u>	<u>Units</u>	<u>Definition</u>
REACTOR	Input	None	Case identification
FUEL	Input	None	Case identification
LOAD	Input	None	Number of fuel pieces in each charge segment (rear to front).
A40,B4C	Calc.	None	Pu-240 constants a_y, b_y
A41,B41	Calc.	None	Pu-241 constants a_z, b_z
APU,BPU,CPU	Calc.	None	Total Pu constants a_x, b_x, c_x
TPT	Calc.	Tubes/ ton uranium	Tubes per ton
EN	Input	None	Number of fuel elements in main charge.
ENMA	Input	None	Number of mixers at furthest downstream mixer location.
ENMB	Input	None	Number of mixers at furthest upstream mixer location.
WN	Input	Lb.	Weight of uranium per canned fuel element in main charge.
WMA	Input	Lb.	Weight per piece of mixers at furthest downstream location.
WMB	Input	Lb.	Weight per piece of mixers at furthest upstream location.
EM	Input	MWD/ton	Fuel exposure
UN	Input	Per cent	Pu-241 concentration, main charge
VN	Input	Per cent	Pu-240 concentration, main charge
TN	Input	Gram per ton uranium	Total Pu yield, main charge
UMA	Input	Per cent	Pu-241 concentration, downstream mixer
VMA	Input	Per cent	Pu-240 concentration, downstream mixer

DECLASSIFIED

TABLE III (Continued)

<u>Term</u>	<u>Source</u>	<u>Units</u>	<u>Definition</u>
TMA	Input	Grams per ton uranium	Total Pu yield, downstream mixer
UMB	Input	Per cent	Pu-240 concentration, upstream mixer.
TMB	Input	Grams/ton uranium	Total Pu yield, upstream mixer
YUN	Calc.	Grams/ton uranium	Weighted yield of Pu-241
YVN	Calc.	Grams/ton uranium	Weighted yield of Pu-240
YTN	Calc.	Grams/ton uranium	Weighted total Pu yield
CE40	Calc.	Per cent	Weighted Pu-240 concentration
CE41	Calc.	Per cent	Weighted Pu-241 concentration
GTN	Calc.	Grams/ MWD	Weighted total Pu conversion ratio
EX	Calc.	MWD/ton	Exposure
GPT39	Calc.	Grams/ton uranium	Predicted Pu-239 yield
GPT40	Calc.	Grams/ton uranium	Predicted Pu-240 yield
GPT41	Calc.	Grams/ton uranium	Predicted Pu-241 yield
GPTPU	Calc.	Grams/ton uranium	Predicted total Pu yield
GPM39	Calc.	Grams/MWD	Predicted conversion ratio for Pu-239
GPMPU	Calc.	Grams/MWD	Predicted conversion ratio for total Pu
CN39	Calc.	Per cent	Predicted Pu-239 concentration
CN40	Calc.	Per cent	Predicted Pu-240 concentration
CN41	Calc.	Per cent	Predicted Pu-241 concentration

DECLASSIFIED

APPENDIX D

SAMPLE OUTPUT DATA

DECLASSIFIED

EMPIRICAL CONSTANTS

REACTION= 0119

FUEL= 03N

LOAD= 9 1 22 - - -

A40= 94.044

A46= 0.0230

A41= 0.48879E-05

A42= 1.75721

A43= 0.95334

BPUE= 0.213169E-3

CPUE= 0.30137E-07

TPUE= 0.48572

EN ENMA ENM4 EN M4 MP

31. 1. -0. 7.43 5.36-0.

EN	UN	VM	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	0.183	3.083	352.35	0.116	3.492	331.51	-0.	-.	-.
700.	1.499	6.366	584.13	0.324	5.835	552.45	-0.	-.	-.
1000.	0.912	0.527	794.43	0.413	7.98	754.65	-0.	-.	-.

EN	YUM	YVM	YTN	CE40	CF41	GTN
400.	0.54	13.63	361.80	3.875	0.182	0.87969
700.	2.89	37.07	583.41	6.355	0.495	0.83344
1000.	7.19	47.84	703.95	8.545	0.906	0.79392

EX	GPT39	GPT40	GPT41	GPTU	GP439	GP44	GP45	GP46	GP47
100.	92.37	0.97	0.01	93.36	0.92372	0.93355	0.946	1.38	0.010
200.	179.13	3.71	0.10	182.94	0.89562	0.91449	0.918	2.27	0.054
300.	26.73	8.00	0.30	269.2	0.80911	0.89675	0.916	2.972	0.115
400.	337.60	13.00	0.64	351.68	0.84400	0.87549	0.943	3.874	0.183
500.	41.12	20.45	1.17	431.74	0.82024	0.80348	0.992	4.737	0.273
600.	478.64	28.31	1.89	508.64	0.75773	0.84807	0.964	5.564	0.372
700.	543.40	37.08	2.85	583.41	0.77641	0.83344	0.956	6.355	0.488
800.	604.95	46.65	4.05	655.65	0.75619	0.81946	0.966	7.115	0.617
900.	663.32	56.93	5.31	725.70	0.73702	0.8064	0.9397	7.844	0.759
1000.	718.84	67.63	7.25	793.92	0.71824	0.79302	0.9542	8.544	0.914
1100.	771.70	79.00	9.29	868.32	0.71157	0.78211	0.9733	9.217	1.08
1200.	822.22	91.26	11.64	925.13	0.60516	0.7704	0.976	9.845	1.259
1300.	87.51	103.68	14.32	982.31	0.60942	0.7639	0.982	1.409	1.449
1400.	916.70	116.51	17.34	1050.61	0.60443	0.7503	0.980	11.00	1.05
1500.	961.10	129.72	20.71	1111.50	0.60407	0.7415	0.9808	11.67	1.003

EMPIRICAL CONSTANTS

REACTOR= OSPL
FUEL=03N
LOAD= 80 10210 - 000

A40= 96.331
B40= 0.02264
A41= 0.44863F-05
B41= 1.76297
APU= 0.95352
BPU= 0.208962E-03
CPU= 0.29144F-07
TPY= 9.05674

EN ENMA ENMB WN WMA WMP
29. 1. -0. 7.43 5.36-0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMP	TMB
400.	0.174	3.403	352.98	0.116	3.492	331.51	-0.	-0.	-0.
700.	0.475	6.246	585.71	0.326	5.835	552.45	-0.	-0.	-0.
1000.	0.872	8.416	797.55	0.613	7.988	754.85	-0.	-0.	-0.

EM	YUN	VVN	YTN	CE40	CF41	GTN
400.	0.61	13.38	352.46	3.796	0.173	0.88115
700.	2.76	36.49	584.90	6.239	0.472	0.83558
1000.	6.90	66.95	796.51	8.406	0.866	0.79651

EX	GPT39	GPT40	GPT41	GPTU	APM39	GPMPU	CN39	CN40	CN41
100.	92.45	0.95	0.01	93.41	0.92446	.93418	98.971	1.114	0.615
200.	179.39	3.63	0.09	183.11	0.89693	.91556	97.966	1.983	0.651
300.	261.26	7.84	0.28	269.38	0.87087	.69793	96.986	2.909	0.105
400.	338.47	13.38	0.61	352.46	0.84617	.68115	96.031	3.795	0.174
500.	411.39	20.09	1.11	432.59	0.82277	.86518	95.098	4.645	0.257
600.	484.35	27.84	1.81	510.00	0.80059	.85000	94.187	5.459	0.355
700.	545.68	36.50	2.72	584.90	0.77955	.83558	93.295	6.241	0.465
800.	607.66	45.90	3.87	657.50	0.75958	.82187	92.421	6.990	0.589
900.	666.56	56.14	5.28	727.97	0.74062	.80826	91.564	7.711	0.725
1000.	722.61	66.95	6.95	796.51	0.72261	.79651	90.722	8.405	0.673
1100.	776.15	78.33	8.92	863.30	0.70550	.78481	89.894	9.733	1.033
1200.	827.19	90.21	11.18	928.48	0.68924	.77374	89.081	9.716	1.214
1300.	875.92	102.56	13.76	992.24	0.67378	.76326	88.277	1.336	1.386
1400.	922.71	115.33	16.66	1054.70	0.65908	.75336	87.485	1.935	1.580
1500.	967.64	128.48	19.91	1116.03	0.64509	.74412	86.704	11.512	1.784

EX	GPT39	GPT40	GPT41	GPTPU	GPMPU	CN39	CN40	CN41
100.	76.78	0.68	0.01	77.38	0.76776	99.213	.776	0.011
200.	150.20	2.33	0.05	152.64	0.75129	98.437	1.527	0.036
300.	220.62	5.39	0.17	225.68	0.73540	97.073	2.253	0.073
400.	288.3	9.79	0.36	297.16	0.72008	96.922	2.957	0.121
500.	352.65	13.34	0.66	366.65	0.70530	96.182	3.638	0.180
600.	414.63	18.57	1.08	434.38	0.69103	95.453	4.299	0.248
700.	474.10	24.72	1.63	500.45	0.67729	94.736	4.939	0.325
800.	531.21	31.41	2.32	564.94	0.66401	94.026	5.561	0.411
900.	586.6	38.7	3.17	627.94	0.65118	93.331	6.164	0.505
1000.	638.80	46.54	4.20	689.55	0.63880	92.642	6.749	0.608
1100.	689.51	54.87	5.39	749.76	0.62683	91.962	7.318	0.719
1200.	738.32	63.60	6.78	808.75	0.61526	91.291	7.871	0.836
1300.	785.31	72.88	8.36	866.53	0.60403	90.626	8.408	0.965
1400.	830.54	82.45	10.15	923.16	0.59327	89.969	8.931	1.100
1500.	874.22	92.39	12.15	978.76	0.58281	89.319	9.441	1.242

EMPIRICAL CONSTANTS

REACTOR= H415

FUEL=HEX

LOAD= 7 1 32

A40= 123.085

H40= 0.82221

A41= 0.37293E-05

H41= 1.74657

APU= 0.78416

BPUE= 0.145549E-03

CPUE= 0.13409E-07

YPT= 9.32836

EN ENMA ENMR WN WMA ENR

39. 1. 5.36 5.36-0.

EM	UIN	VN	TN	UMA	VMA	TMA	UMB	VMR	TMR
700.	0.347	5.827	497.64	0.326	5.835	552.45	-0.	-0.	-0.
1000.	0.653	6.852	685.36	0.613	7.951	754.85	-0.	-0.	-0.
1300.	1.022	8.516	860.99	0.960	9.952	941.85	-0.	-0.	-0.

EM	YUN	YVN	YTV	CE40	CE41	GTN
700.	1.73	25.20	499.01	5.049	0.346	0.71287
1000.	4.48	47.29	667.10	6.883	0.652	0.68710
1300.	8.81	73.83	863.11	8.555	1.020	0.66385

EX	GPI39	GPT40	GPT41	GPIPU	GPM39	GPMPU	CN39	CN40	CN41
100.	76.67	0.62	0.01	77.29	0.76668	77293	99.191	798	0.012
200.	149.96	2.34	0.06	152.41	0.74982	76207	98.393	1.568	0.039
300.	220.08	5.21	0.18	225.47	0.73359	75156	97.609	2.312	0.079
400.	287.14	8.99	0.39	296.56	0.71796	74141	96.838	3.31	0.131
500.	351.45	13.63	0.71	365.79	0.70290	73157	96.081	3.726	0.193
600.	413.13	19.06	1.15	433.24	0.68839	72266	95.336	4.399	0.265
700.	472.8	25.20	1.73	499.01	0.67440	71287	94.603	5.49	0.347
800.	528.73	31.99	2.47	563.19	0.66091	70399	93.882	5.681	0.439
900.	583.11	39.37	3.37	625.86	0.64791	69541	93.171	6.291	0.539
1000.	635.36	47.29	4.45	687.10	0.63536	68711	92.470	6.863	0.648
1100.	685.57	55.70	5.71	746.99	0.62324	67918	91.776	7.457	0.765
1200.	733.80	64.56	7.17	805.60	0.61155	67133	91.095	8.14	0.891
1300.	780.34	73.83	8.84	863.11	0.60026	66385	90.421	8.555	1.024
1400.	825.10	83.48	10.72	919.29	0.58935	65664	89.754	9.01	1.166
1500.	868.22	93.47	12.81	974.50	0.57882	64967	89.094	9.591	1.315

RECEIVED

EMPIRICAL CO-STARS

WFACTION= 0.415
FUEL=0.35
LOAD= 42 1 - - -

A40= 123.173
P40= 0.12221
A41= 0.37290E-05
R41= 1.74657
APU= 0.7840
BPU= 0.145523E-07
CPU= 0.13441E-07
TPT= 0.67754

EN ENMA ENMA WFA WFA WFA
42. 1. - - - 5.36-0.

EM	UN	VN	TN	UMA	VPA	TMA	UM3	VMA	TMA
700.	0.347	5.125	497.65	0.326	5.035	552.45	-0.	-0.	-0.
1000.	0.653	6.550	665.38	0.613	7.981	754.65	-0.	-0.	-0.
1300.	1.122	8.513	861.03	0.960	9.952	941.65	-0.	-0.	-0.

EM	VUN	VVN	VTN	CE40	CE41	GIN
700.	1.73	25.11	498.92	5.046	0.346	0.71275
1000.	4.46	47.26	687.10	6.879	1.652	0.66700
1300.	8.01	73.77	862.91	8.550	1.020	0.66378

EX	GPT39	GPT40	GPT41	GPTPU	GPR39	GPRPU	CN39	CN40	CN41
100.	76.65	0.62	0.01	77.28	0.76653	0.77278	99.191	0.797	0.012
200.	149.94	2.39	0.06	152.38	0.74968	0.76192	96.394	1.567	0.039
300.	220.14	5.21	0.18	225.43	0.73346	0.75142	97.611	2.311	0.079
400.	287.14	8.98	0.39	296.50	0.71784	0.74126	96.840	3.29	0.131
500.	351.39	13.62	0.71	365.72	0.70279	0.73143	95.083	3.724	0.193
600.	412.97	19.14	1.15	433.16	0.68829	0.72193	95.339	4.390	0.265
700.	472.11	25.18	1.73	498.92	0.67431	0.71275	94.606	5.046	0.347
800.	528.66	31.90	2.47	563.10	0.66083	0.70387	93.885	5.676	0.439
900.	583.35	39.34	3.37	625.76	0.64783	0.69529	93.175	6.287	0.539
1000.	635.29	47.25	4.45	687.00	0.63529	0.68700	92.474	6.878	0.646
1100.	685.51	55.66	5.71	746.46	0.62319	0.67898	91.763	7.452	0.765
1200.	733.81	64.51	7.17	805.50	0.61151	0.67125	91.101	8.089	0.891
1300.	780.29	73.78	8.84	862.91	0.60023	0.66378	90.426	8.551	1.024
1400.	825.16	83.42	10.72	919.19	0.58933	0.65657	89.759	9.075	1.166
1500.	868.20	93.40	12.81	974.41	0.57680	0.64961	89.100	9.585	1.315

EMPIRICAL CONSTANTS

REACTOR= K016

FUFL=28 K5E

LOAD= 4A -0 -0 -0 -0 -0

A40= 123.915

H40= 0.03133

A41= 0.70654E-05

R41= 1.70693

APU= 0.54995

RPUS= 0.143717E-03

GPU= 6.12291E-07

TPT= 7.40666

EN EMMA ENMR WT WMA TMR
46. -0. -0. 5.87-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
700.	0.506	4.799	541.27	-0.	-0.	-0.	-0.	-0.	-0.
1000.	0.940	0.443	745.27	-0.	-0.	-0.	-0.	-0.	-0.
1300.	1.454	7.395	935.87	-0.	-0.	-0.	-0.	-0.	-0.

EM	YUN	VUN	YTN	CE40	CF41	GTN
700.	2.74	25.94	541.27	4.799	0.506	0.77324
1000.	7.01	45.02	745.27	6.443	0.940	0.74527
1300.	13.61	73.69	935.87	7.895	1.454	0.71990

FX	GP139	GP140	GP141	GP142	GP143	GP144	GP145	GP146	GP147	GP148	GP149	GP150	GP151	GP152	GP153	GP154	GP155	GP156	GP157	GP158	GP159	GP160	GP161	GP162	GP163	GP164	GP165	GP166	GP167	GP168	GP169	GP170	GP171	GP172	GP173	GP174	GP175	GP176	GP177	GP178	GP179	GP180	GP181	GP182	GP183	GP184	GP185	GP186	GP187	GP188	GP189	GP190	GP191	GP192	GP193	GP194	GP195	GP196	GP197	GP198	GP199	GP200	GP201	GP202	GP203	GP204	GP205	GP206	GP207	GP208	GP209	GP210	GP211	GP212	GP213	GP214	GP215	GP216	GP217	GP218	GP219	GP220	GP221	GP222	GP223	GP224	GP225	GP226	GP227	GP228	GP229	GP230	GP231	GP232	GP233	GP234	GP235	GP236	GP237	GP238	GP239	GP240	GP241	GP242	GP243	GP244	GP245	GP246	GP247	GP248	GP249	GP250	GP251	GP252	GP253	GP254	GP255	GP256	GP257	GP258	GP259	GP260	GP261	GP262	GP263	GP264	GP265	GP266	GP267	GP268	GP269	GP270	GP271	GP272	GP273	GP274	GP275	GP276	GP277	GP278	GP279	GP280	GP281	GP282	GP283	GP284	GP285	GP286	GP287	GP288	GP289	GP290	GP291	GP292	GP293	GP294	GP295	GP296	GP297	GP298	GP299	GP300	GP301	GP302	GP303	GP304	GP305	GP306	GP307	GP308	GP309	GP310	GP311	GP312	GP313	GP314	GP315	GP316	GP317	GP318	GP319	GP320	GP321	GP322	GP323	GP324	GP325	GP326	GP327	GP328	GP329	GP330	GP331	GP332	GP333	GP334	GP335	GP336	GP337	GP338	GP339	GP340	GP341	GP342	GP343	GP344	GP345	GP346	GP347	GP348	GP349	GP350	GP351	GP352	GP353	GP354	GP355	GP356	GP357	GP358	GP359	GP360	GP361	GP362	GP363	GP364	GP365	GP366	GP367	GP368	GP369	GP370	GP371	GP372	GP373	GP374	GP375	GP376	GP377	GP378	GP379	GP380	GP381	GP382	GP383	GP384	GP385	GP386	GP387	GP388	GP389	GP390	GP391	GP392	GP393	GP394	GP395	GP396	GP397	GP398	GP399	GP400	GP401	GP402	GP403	GP404	GP405	GP406	GP407	GP408	GP409	GP410	GP411	GP412	GP413	GP414	GP415	GP416	GP417	GP418	GP419	GP420	GP421	GP422	GP423	GP424	GP425	GP426	GP427	GP428	GP429	GP430	GP431	GP432	GP433	GP434	GP435	GP436	GP437	GP438	GP439	GP440	GP441	GP442	GP443	GP444	GP445	GP446	GP447	GP448	GP449	GP450	GP451	GP452	GP453	GP454	GP455	GP456	GP457	GP458	GP459	GP460	GP461	GP462	GP463	GP464	GP465	GP466	GP467	GP468	GP469	GP470	GP471	GP472	GP473	GP474	GP475	GP476	GP477	GP478	GP479	GP480	GP481	GP482	GP483	GP484	GP485	GP486	GP487	GP488	GP489	GP490	GP491	GP492	GP493	GP494	GP495	GP496	GP497	GP498	GP499	GP500	GP501	GP502	GP503	GP504	GP505	GP506	GP507	GP508	GP509	GP510	GP511	GP512	GP513	GP514	GP515	GP516	GP517	GP518	GP519	GP520	GP521	GP522	GP523	GP524	GP525	GP526	GP527	GP528	GP529	GP530	GP531	GP532	GP533	GP534	GP535	GP536	GP537	GP538	GP539	GP540	GP541	GP542	GP543	GP544	GP545	GP546	GP547	GP548	GP549	GP550	GP551	GP552	GP553	GP554	GP555	GP556	GP557	GP558	GP559	GP560	GP561	GP562	GP563	GP564	GP565	GP566	GP567	GP568	GP569	GP570	GP571	GP572	GP573	GP574	GP575	GP576	GP577	GP578	GP579	GP580	GP581	GP582	GP583	GP584	GP585	GP586	GP587	GP588	GP589	GP590	GP591	GP592	GP593	GP594	GP595	GP596	GP597	GP598	GP599	GP600	GP601	GP602	GP603	GP604	GP605	GP606	GP607	GP608	GP609	GP610	GP611	GP612	GP613	GP614	GP615	GP616	GP617	GP618	GP619	GP620	GP621	GP622	GP623	GP624	GP625	GP626	GP627	GP628	GP629	GP630	GP631	GP632	GP633	GP634	GP635	GP636	GP637	GP638	GP639	GP640	GP641	GP642	GP643	GP644	GP645	GP646	GP647	GP648	GP649	GP650	GP651	GP652	GP653	GP654	GP655	GP656	GP657	GP658	GP659	GP660	GP661	GP662	GP663	GP664	GP665	GP666	GP667	GP668	GP669	GP670	GP671	GP672	GP673	GP674	GP675	GP676	GP677	GP678	GP679	GP680	GP681	GP682	GP683	GP684	GP685	GP686	GP687	GP688	GP689	GP690	GP691	GP692	GP693	GP694	GP695	GP696	GP697	GP698	GP699	GP700	GP701	GP702	GP703	GP704	GP705	GP706	GP707	GP708	GP709	GP710	GP711	GP712	GP713	GP714	GP715	GP716	GP717	GP718	GP719	GP720	GP721	GP722	GP723	GP724	GP725	GP726	GP727	GP728	GP729	GP730	GP731	GP732	GP733	GP734	GP735	GP736	GP737	GP738	GP739	GP740	GP741	GP742	GP743	GP744	GP745	GP746	GP747	GP748	GP749	GP750	GP751	GP752	GP753	GP754	GP755	GP756	GP757	GP758	GP759	GP760	GP761	GP762	GP763	GP764	GP765	GP766	GP767	GP768	GP769	GP770	GP771	GP772	GP773	GP774	GP775	GP776	GP777	GP778	GP779	GP780	GP781	GP782	GP783	GP784	GP785	GP786	GP787	GP788	GP789	GP790	GP791	GP792	GP793	GP794	GP795	GP796	GP797	GP798	GP799	GP800	GP801	GP802	GP803	GP804	GP805	GP806	GP807	GP808	GP809	GP810	GP811	GP812	GP813	GP814	GP815	GP816	GP817	GP818	GP819	GP820	GP821	GP822	GP823	GP824	GP825	GP826	GP827	GP828	GP829	GP830	GP831	GP832	GP833	GP834	GP835	GP836	GP837	GP838	GP839	GP840	GP841	GP842	GP843	GP844	GP845	GP846	GP847	GP848	GP849	GP850	GP851	GP852	GP853	GP854	GP855	GP856	GP857	GP858	GP859	GP860	GP861	GP862	GP863	GP864	GP865	GP866	GP867	GP868	GP869	GP870	GP871	GP872	GP873	GP874	GP875	GP876	GP877	GP878	GP879	GP880	GP881	GP882	GP883	GP884	GP885	GP886	GP887	GP888	GP889	GP890	GP891	GP892	GP893	GP894	GP895	GP896	GP897	GP898	GP899	GP900	GP901	GP902	GP903	GP904	GP905	GP906	GP907	GP908	GP909	GP910	GP911	GP912	GP913	GP914	GP915	GP916	GP917	GP918	GP919	GP920	GP921	GP922	GP923	GP924	GP925	GP926	GP927	GP928	GP929	GP930	GP931	GP932	GP933	GP934	GP935	GP936	GP937	GP938	GP939	GP940	GP941	GP942	GP943	GP944	GP945	GP946	GP947	GP948	GP949	GP950	GP951	GP952	GP953	GP954	GP955	GP956	GP957	GP958	GP959	GP960	GP961	GP962	GP963	GP964	GP965	GP966	GP967	GP968	GP969	GP970	GP971	GP972	GP973	GP974	GP975	GP976	GP977	GP978	GP979	GP980	GP981	GP982	GP983	GP984	GP985	GP986	GP987	GP988	GP989	GP990	GP991	GP992	GP993	GP994	GP995	GP996	GP997	GP998	GP999	GP1000
100.	83.12	1.60	0.02	63.79	0.83117	0.018																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
200.	162.62	2.94	0.10	165.25	0.81308	0.061																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
300.	238.73	5.30	0.29	244.49	0.79567	0.120																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
400.	311.56	9.43	0.63	321.02	0.77890	0.195																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
500.	381.38	14.21	1.13	396.72	0.76276	0.286																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
600.	448.32	19.76	1.83	469.91	0.74720	0.390																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
700.	512.54	25.95	2.75	541.27	0.73221	0.508																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
800.	574.19	32.8	3.89	610.89	0.71774	0.638																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
900.	633.41	40.17	5.29	676.87	0.70379	0.779																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1000.	691.31	48.61	6.95	745.27	0.69031	0.933																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1100.	745.12	56.27	8.90	815.19	0.67729	1.098																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1200.	797.66	64.91	11.13	873.70	0.66471	1.274																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1300.	848.31	73.9	13.67	935.87	0.65255	1.460																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1400.	897.9	83.10	16.52	996.78	0.64078	1.657																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1500.	944.8	92.73	19.70	1056.58	0.62939	1.864																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

2025 RELEASE UNDER E.O. 14176

EMPIRICAL CONSTANTS

HEACTO1= KJ12

FUEL=ZK K5M

LOAD= 34 -U - - -

A40= 83.816

B40= 0.0428

A41= 0.24246E-04

B41= 1.64967

APU= 1.04068

SPU= 0.23012E-03

CPU= 0.3212E-07

TPT= 6.70466

EN ENMA ENMR MN WMA MYR
3R. 0.0. 0.0. 7.85-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMH
400.	0.472	3.961	381.54	-0.	-0.	-0.	-0.	-0.	-0.
700.	1.22	0.128	629.68	-0.	-0.	-0.	-0.	-0.	-0.
1000.	2.131	7.895	853.23	-0.	-0.	-0.	-0.	-0.	-0.

EN	YUN	YVN	YTN	CE40	CE41	GTN
400.	1.88	15.11	381.54	3.961	0.472	0.95385
700.	7.68	38.78	629.68	6.158	1.22	0.89954
1000.	18.18	87.36	853.23	7.895	2.131	0.85323

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPMPU	CN39	CN40	CN41
100.	100.52	1.15	0.05	101.73	1.00524	1.01728	98.817	1.135	0.048
200.	194.40	4.31	0.30	199.01	0.97199	0.99904	97.683	2.165	0.152
300.	282.24	9.07	0.86	292.18	0.94081	0.97392	96.600	3.104	0.296
400.	364.61	15.12	1.81	381.54	0.91151	0.95385	95.562	3.963	0.476
500.	441.97	22.21	3.21	467.40	0.88395	0.93479	94.561	4.752	0.687
600.	514.78	30.14	5.11	550.02	0.85796	0.91671	93.592	5.480	0.928
700.	583.40	38.74	7.54	629.68	0.83343	0.89954	92.650	6.153	1.197
800.	648.19	47.88	10.54	706.61	0.81023	0.86327	91.731	6.777	1.492
900.	709.44	57.46	14.15	781.06	0.78827	0.86784	90.831	7.357	1.812
1000.	767.45	67.39	18.39	853.23	0.76745	0.85323	89.946	7.898	2.156
1100.	822.45	77.60	23.30	923.34	0.74768	0.83940	89.073	8.404	2.523
1200.	874.68	88.03	28.88	991.59	0.72890	0.82633	88.210	8.878	2.912
1300.	924.36	98.65	35.17	1058.17	0.71104	0.81398	87.354	9.322	3.324
1400.	971.60	109.41	42.19	1123.26	0.69404	0.80233	86.504	9.740	3.756
1500.	1016.77	120.30	49.96	1187.02	0.67785	0.79135	85.657	1.134	4.208

EMPIRICAL CONSTANTS

REACTOR= 203
FUEL= G2N
LOAD= 13 1 18 - -0

A40= 95.947
B40= 0.02326
A41= 0.48659F-05
B41= 1.75691
APU= 0.96154
BPU= 0.20976 E-03
CPU= 0.29136E-07
TPI= 8.55652

EN ENMA ENMB WN WMA WMR
31. 1. -0. 7.37 5.27 -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMA	TMR
400.	0.182	3.810	355.8	0.113	3.366	334.33	-0.	-0.	-0.
700.	0.495	6.256	590.25	0.320	5.633	557.90	-0.	-0.	-0.
1000.	0.907	8.404	803.56	0.603	7.706	763.09	-0.	-0.	-0.

EM	YUN	VVN	YTN	CE40	CE41	GTN
400.	0.64	13.50	355.32	3.801	0.181	0.88829
700.	2.97	36.77	589.52	6.237	0.491	0.84217
1000.	7.23	67.33	802.65	8.389	0.908	0.80265

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPMPII	CN39	CN40	CN41
100.	93.21	0.96	0.01	94.19	0.93213	.94186	98.967	1.118	0.016
200.	187.85	3.67	0.10	164.62	0.90427	.92312	97.958	1.968	0.054
300.	263.37	7.92	0.30	271.58	0.87789	.9527	96.976	2.915	0.109
400.	341.17	13.54	0.64	355.32	0.85292	.88829	96.016	3.800	0.181
500.	414.63	20.27	1.17	436.07	0.82926	.87213	95.084	4.648	0.269
600.	484.16	28.06	1.90	514.06	0.80683	.85677	94.171	5.459	0.370
700.	549.89	36.77	2.86	589.52	0.78556	.84217	93.278	6.237	0.485
800.	612.33	46.28	4.06	662.64	0.76538	.82830	92.493	6.984	0.613
900.	671.61	56.49	5.53	733.62	0.74622	.81514	91.546	7.700	0.754
1000.	728.13	67.33	7.28	802.65	0.72803	.80265	90.704	8.389	0.908
1100.	781.82	78.73	9.33	869.89	0.71075	.79181	89.876	9.51	1.073
1200.	833.19	91.64	11.70	935.52	0.69432	.7796	89.061	9.668	1.250
1300.	882.32	102.99	14.39	999.70	0.67871	.76900	88.259	1.302	1.439
1400.	929.48	115.76	17.42	1062.58	0.66386	.75898	87.467	1.894	1.839
1500.	974.63	128.91	20.80	1124.30	0.64974	.74954	86.685	11.465	1.850

RECEIVED

EMPIRICAL CONSTANTS

REACTOR= 206
FUEL= C2N
LOAD= 8 1 5 1 17

A40= 95.882
B40= 0.02326
A41= 0.47936E-05
B41= 1.75914
APU= 0.95998
BPU= 0.209911E-03
CPU= 0.29258E-07
YPT= 6.63409

EN ENMA ENMP WN WMA WMR
30. 2. - 7.37 5.27 -

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	0.183	3.821	355.71	0.117	3.402	334.07	-0.	-0.	-0.
700.	0.499	6.265	590.03	0.329	5.684	557.24	-0.	-0.	-0.
1000.	0.913	8.422	803.2	0.619	7.771	761.96	-0.	-0.	-0.

EM	YUN	YVR	YTN	CF40	CF41	GTN
400.	0.64	13.49	354.73	3.803	0.10	0.88681
700.	2.89	36.72	582.54	6.240	0.492	0.84077
1000.	7.21	57.26	611.32	8.394	0.91	0.80132

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPM39	CM39	CN39	CN40	CN41
100.	93.36	0.96	0.01	94.33	0.93060	0.93060	94.32	98.966	1.18	0.016
200.	100.55	3.67	0.10	184.32	0.90277	0.90277	92.159	97.957	1.989	0.054
300.	202.93	7.91	0.30	271.13	0.87643	0.87643	93.377	96.974	2.917	0.109
400.	34.59	13.49	0.64	354.73	0.85149	0.85149	80681	96.816	3.803	0.181
500.	413.93	20.25	1.17	435.34	0.82752	0.82752	57048	95.081	4.651	0.268
600.	483.24	28.93	1.90	513.21	0.80546	0.80546	05534	94.168	5.463	0.370
700.	548.95	36.73	2.85	588.54	0.78422	0.78422	04077	93.274	6.241	0.485
800.	611.26	46.22	4.06	601.54	0.76407	0.76407	02093	92.199	6.967	0.613
900.	670.42	56.46	5.53	732.41	0.74493	0.74493	01379	91.541	7.704	0.754
1000.	726.79	67.26	7.28	801.32	0.72679	0.72679	0132	91.699	8.393	0.906
1100.	76.49	78.62	9.33	868.47	0.70954	0.70954	78941	89.671	9.056	1.174
1200.	831.75	90.54	11.69	934.0	0.69315	0.69315	77833	89.055	9.693	1.251
1300.	841.83	12.00	14.39	996.9	0.67756	0.67756	76776	88.252	1.318	1.441
1400.	927.84	115.03	17.41	1060.59	0.66272	0.66272	75778	87.459	1.899	1.641
1500.	972.90	124.76	20.40	1122.54	0.64865	0.64865	74836	86.277	11.47	1.653

RECEIVED

EMPIRICAL CONSTANTS

REACTOR= 212

FUEL= C5N

LOAD= 52 -0 -1 -0

A40= 103.288
B40= 0.01984
A41= 0.28824E-05
B41= 1.78010
APU= 0.96667
BPU= 0.199017E-03
CPU= 0.27443E-07
TPT= 0.03342

EN ENMA EMBB WN WMA LMR
32. 0. 0. 7.78-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	0.123	3.597	358.65	-0.	-0.	-0.	-0.	-0.	-0.
700.	0.338	5.972	596.64	-0.	-0.	-0.	-0.	-0.	-0.
1000.	0.627	8.123	814.26	-0.	-0.	-0.	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CE41	GTN
400.	0.44	12.90	358.65	3.597	0.123	0.89662
700.	2.02	35.63	596.64	5.972	0.338	0.65234
1000.	5.11	66.14	814.26	8.123	0.627	0.61426

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	CPMPH	CN39	CN40	CN41
100.	93.84	0.9	0.01	94.79	0.93878	.94788	99.040	.95	0.010
200.	182.46	3.47	0.07	185.99	0.91229	.92997	98.099	1.805	0.036
300.	266.14	7.52	0.20	273.87	0.88715	.91289	97.180	2.746	0.074
400.	345.31	12.90	0.44	358.65	0.86327	.89662	96.280	3.596	0.124
500.	420.30	19.46	0.81	440.57	0.84059	.88113	95.400	4.417	0.184
600.	491.43	27.06	1.32	519.83	0.81905	.86638	94.537	5.209	0.254
700.	559.00	35.64	2.00	596.64	0.79857	.85234	93.692	5.974	0.334
800.	623.29	45.06	2.85	671.20	0.77911	.83899	92.862	6.714	0.424
900.	684.54	55.25	3.89	743.68	0.76060	.82631	92.048	7.429	0.523
1000.	742.99	65.13	5.14	814.26	0.74299	.81426	91.247	8.122	0.631
1100.	798.86	77.65	6.60	883.11	0.72624	.8293	90.460	8.792	0.748
1200.	852.36	89.73	8.30	950.39	0.71030	.79199	89.685	9.442	0.873
1300.	903.67	102.35	10.23	1016.25	0.69513	.76173	88.922	1.71	1.007
1400.	952.97	115.45	12.42	1080.84	0.68069	.77203	88.169	1.682	1.149
1500.	1000.42	129.01	14.86	1144.29	0.66695	.76286	87.427	11.274	1.299

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EMPIRICAL CONSTA TS

REACTOR= 215
FUEL= CAN.
LOAD= 32 -0 - -0 -0

A40= 60.448
P40= 0.06223
A41= 0.32877F-03
B41= 1.38786
APU= 1.11-25
BPU= 0.28243E-13
CPU= 0.42636F-07
TPT= 4.20309

EN ENMA ENMH VN WMA UMP
32. -0. -0.14.87-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	1.328	4.279	399.38	-0.	-0.	-0.	-0.	-0.	-0.
700.	3.008	5.946	651.24	-0.	-0.	-0.	-0.	-0.	-0.
1000.	4.706	7.002	873.56	-0.	-0.	-0.	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CE41	GTN
400.	5.30	17.09	399.38	4.279	1.328	0.99845
700.	19.59	38.72	651.24	5.946	3.008	0.93034
1000.	41.11	61.17	873.56	7.002	4.706	0.87356

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	CPMPU	CN39	CN40	CN41
100.	106.20	1.57	0.21	107.98	1.06196	1.1798	98.348	1.456	0.196
200.	203.67	5.47	1.08	210.21	1.01834	1.05107	96.886	2.601	0.513
300.	293.60	10.83	2.77	307.20	0.97867	1.02399	95.574	3.525	0.901
400.	376.90	17.12	5.36	399.38	0.94225	0.99845	94.371	4.285	1.343
500.	454.28	23.98	8.92	487.19	0.90857	0.97438	93.246	4.923	1.831
600.	526.35	31.21	13.47	571.02	0.87725	0.95170	92.177	5.465	2.358
700.	593.59	38.63	19.02	651.24	0.84798	0.93034	91.147	5.932	2.921
800.	656.44	46.15	25.60	728.19	0.82055	0.91024	90.147	6.338	3.515
900.	715.29	53.70	33.21	802.20	0.79477	0.89133	89.167	6.694	4.140
1000.	770.48	61.23	41.86	873.56	0.77048	0.87356	88.200	7.009	4.791
1100.	822.30	68.71	51.55	942.56	0.74755	0.85687	87.241	7.290	5.469
1200.	871.04	76.13	62.29	1009.47	0.72587	0.84122	86.288	7.541	6.171
1300.	916.96	83.47	74.10	1074.53	0.70535	0.82656	85.335	7.768	6.896
1400.	960.27	90.75	86.98	1137.99	0.68590	0.81285	84.363	7.974	7.043
1500.	1001.19	97.94	100.94	1200.07	0.66746	0.80005	83.427	8.162	8.411

RECEIVED

EMPIRICAL CONSTANTS

REACTOR= 218

FUEL= CAN

LOAD= 19 -0 -0 -0 -0

A40= 60.350

B40= 0.08207

A41= 0.31975E-03

B41= 1.39223

APU= 1.11035

BPU= 0.282791E-03

CPU= 0.42769E-07

TPT= 7.07889

EN ENMA EVMB WN WMA VMB

19. 60. -0.14.87-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	1.326	4.286	399.36	-0.	-0.	-0.	-0.	-0.	-0.
700.	3.310	5.957	651.16	-0.	-0.	-0.	-0.	-0.	-0.
1000.	4.718	7.014	873.41	-0.	-0.	-0.	-0.	-0.	-0.

EM YUN YVN YTN CE40 CE41 GTN

400.	5.30	17.12	399.36	4.286	1.326	0.99840
700.	19.63	38.79	651.16	5.957	3.010	0.93023
1000.	41.21	61.26	873.41	7.014	4.718	0.87341

EX	GPT39	GPT40	GPT41	GPTU	GPM39	GPMU	CN39	CN40	CN41
100.	106.20	1.58	0.21	107.98	1.06200	1.07985	98.347	1.459	0.195
200.	203.67	5.48	1.07	210.22	1.01833	1.05109	96.884	2.605	0.511
300.	293.58	10.85	2.76	307.19	0.97861	1.02397	95.571	3.531	0.899
400.	376.86	17.14	5.36	399.36	0.94215	0.99840	94.366	4.293	1.341
500.	454.21	24.02	8.91	487.15	0.90843	0.97430	93.239	4.932	1.830
600.	526.24	31.26	13.47	570.96	0.87706	0.95160	92.167	5.475	2.359
700.	593.43	38.69	19.03	651.16	0.84776	0.93023	91.135	5.942	2.923
800.	656.23	46.22	25.63	728.09	0.82029	0.91111	90.131	6.349	3.520
900.	719.12	53.76	33.27	802.07	0.79447	0.89119	89.147	6.706	4.148
1000.	779.14	61.32	41.95	873.41	0.77014	0.87341	88.176	7.121	4.803
1100.	821.88	68.82	51.69	942.39	0.74717	0.85672	87.213	7.303	5.485
1200.	870.54	76.25	62.48	1009.27	0.72545	0.84106	86.254	7.555	6.191
1300.	916.36	83.61	74.35	1074.32	0.70489	0.82641	85.297	7.782	6.921
1400.	959.57	90.89	87.30	1137.76	0.68541	0.81269	84.339	7.948	7.673
1500.	1000.39	98.10	101.34	1199.83	0.66693	0.79989	83.377	8.176	8.447

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EMPIRICAL CONSTANTS

REACTOR= 3.3
FUEL= K4N
LOAD= 38 -0 -1 -1 -0

A40= 95.342
B40= 0.02612
A41= 0.6200E-05
B41= 1.74101
APU= 1.02836
BPU= 0.21151E-03
CPU= 0.29234E-07
TPT= 7.2197

EN ENMA ENMH WN WMA WMR
38. 0. 0. 7.29-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
400.	0.209	3.781	376.79	-0.	-0.	-0.	-0.	-0.	-0.
700.	0.565	6.161	624.84	-0.	-0.	-0.	-0.	-0.	-0.
1000.	1.027	8.233	850.33	-0.	-0.	-0.	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CF41	GTN
400.	0.79	14.25	376.79	3.781	0.209	0.94197
700.	3.53	38.50	624.84	6.161	0.565	0.89263
1000.	8.73	70.11	850.33	8.233	1.027	0.85033

EX	GPT39	GPT40	GPT41	CE40	CF41	GTPU	GPM39	GPM40	GPM41
100.	98.89	1.02	0.02	0.02	99.93	99.93	98.96	1.21	0.019
200.	191.83	3.84	0.12	0.12	195.65	195.65	97.94	1.909	0.063
300.	279.30	8.36	0.37	0.37	288.74	288.74	96.14	2.908	0.127
400.	361.75	14.25	0.79	0.79	376.79	376.79	94.197	3.781	0.210
500.	439.59	21.33	1.43	1.43	462.34	462.34	92.469	4.613	0.310
600.	513.18	29.45	2.32	2.32	544.95	544.95	90.825	5.405	0.426
700.	582.87	38.49	3.48	3.48	624.84	624.84	89.263	6.161	0.557
800.	648.95	48.33	4.93	4.93	702.23	702.23	87.779	6.803	0.713
900.	711.76	58.56	6.70	6.70	777.33	777.33	86.370	7.573	0.862
1000.	771.51	70.01	8.91	8.91	850.33	850.33	85.033	8.233	1.036
1100.	828.46	81.69	11.27	11.27	921.43	921.43	83.766	8.866	1.223
1200.	882.84	93.55	14.10	14.10	990.79	990.79	82.506	9.472	1.423
1300.	934.85	106.44	17.32	17.32	1058.60	1058.60	81.431	10.55	1.634
1400.	984.67	119.40	20.94	20.94	1125.20	1125.20	80.358	11.614	1.861
1500.	1032.50	132.72	24.98	24.98	1190.20	1190.20	79.346	11.151	2.099

EMPIRICAL CONSTA IS

REACTION= 3.6
FUEL= K46
LOAD= 11 1 26 - -

A40= 95.143
B40= 0.02617
A41= 0.60863E-05
B41= 1.74402
APU= 1.01944
BPU= 0.211094E-03
CPU= 0.29429E-07
TPT= 7.27431

EN ENMA ENMH W N WMA MR
37. 1. 7.29 5.21-0.

EM	UN	VN	TN	UMA	VMA	TMA	UM3	VMA	TMA	CN39	CN40	CN41
400.	0.21	3.792	376.7	0.147	3.466	301.12	-0.	0.	0.	-0.	-0.	-0.
700.	0.569	6.175	624.61	0.408	5.738	601.44	-0.	0.	0.	-0.	-0.	-0.
1000.	1.34	8.249	849.95	0.760	7.780	821.36	-0.	0.	0.	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CE41	GTN
400.	0.79	14.25	376.40	3.786	0.209	0.94101
700.	3.53	38.49	624.17	6.167	0.506	0.69167
1000.	8.74	69.99	849.41	8.240	1.029	0.64941

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPM40	GPM41
100.	98.80	1.02	0.02	99.64	0.98796	0.9836	0.9836
200.	191.64	3.90	0.12	195.66	0.95819	0.97829	0.97829
300.	279.1	8.38	0.37	287.76	0.93004	0.95919	0.95919
400.	361.36	14.25	0.79	376.40	0.90341	0.94101	0.94101
500.	439.13	21.33	1.43	461.66	0.87820	0.92373	0.92373
600.	512.60	29.46	2.32	544.37	0.85433	0.91729	0.91729
700.	582.20	38.49	3.48	624.17	0.83171	0.89167	0.89167
800.	648.21	48.33	4.94	701.47	0.81026	0.87684	0.87684
900.	710.92	58.86	6.71	776.48	0.78991	0.86276	0.86276
1000.	770.59	69.99	8.82	849.41	0.77059	0.84941	0.84941
1100.	827.47	81.67	11.29	920.43	0.75225	0.83675	0.83675
1200.	881.78	93.82	14.13	989.73	0.73482	0.82477	0.82477
1300.	933.73	106.40	17.35	1057.48	0.71825	0.81344	0.81344
1400.	983.50	119.35	20.99	1123.84	0.70250	0.80274	0.80274
1500.	1031.27	132.66	25.04	1188.97	0.68751	0.79265	0.79265

EMPIRICAL CONSTANTS

REACTOR= 604

FUEL= K4E

LOAD= 46 -0 -0 -0 -0

A40= 130.437

B40= 0.02501

A41= 0.39219E-05

B41= 1.74645

APU= 0.43418

BPU= 0.138705E-03

CPU= 0.11925E-07

TPT= 8.34516

EN ENMA ENMH MN MMA LMR
46. -0. -0. 5.21-0. -0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMB	TMB
700.	0.364	4.731	533.00	-0.	-0.	-0.	-0.	-0.	-0.
1000.	0.685	6.434	734.85	-0.	-0.	-0.	-0.	-0.	-0.
1300.	1.172	7.977	923.94	-0.	-0.	-0.	-0.	-0.	-0.

EM	YUN	VVN	VTN	CE40	CE41	GTN
700.	1.94	25.22	533.00	4.731	0.364	0.76143
1000.	5.03	47.28	734.85	6.434	0.685	0.73485
1300.	9.91	73.70	923.94	7.977	1.072	0.71072

EX	GP139	GP140	GP141	GP1PU	GPM39	GPMPU	CN39	CN40	CN41
100.	81.65	0.62	0.01	82.28	0.81650	0.82279	99.236	0.752	0.012
200.	159.88	2.48	0.07	162.35	0.79942	0.81174	98.482	1.477	0.041
300.	234.89	5.23	0.20	240.31	0.76295	0.80104	97.742	2.175	0.083
400.	300.82	9.01	0.43	316.27	0.70706	0.79066	97.015	2.848	0.137
500.	375.86	13.65	0.79	390.30	0.75172	0.78061	96.299	3.498	0.203
600.	442.15	19.06	1.29	462.52	0.73692	0.77067	95.596	4.125	0.279
700.	505.84	25.22	1.95	533.00	0.72262	0.76143	94.904	4.731	0.365
800.	567.5	32.00	2.77	601.83	0.70881	0.75228	94.222	5.317	0.461
900.	625.93	39.37	3.79	669.8	0.69547	0.74343	93.550	5.884	0.566
1000.	682.58	47.27	5.00	734.85	0.68258	0.73485	92.887	6.433	0.681
1100.	737.12	55.66	6.42	799.21	0.67011	0.72654	92.232	6.964	0.804
1200.	789.66	64.48	8.07	862.21	0.65805	0.71857	91.586	7.479	0.936
1300.	840.29	73.71	9.94	923.94	0.64633	0.71072	90.946	7.978	1.076
1400.	889.11	83.30	12.06	984.47	0.63508	0.70319	90.314	8.461	1.225
1500.	936.22	93.23	14.42	1043.86	0.62414	0.69501	89.686	8.931	1.382

EMPIRICAL CONSTANTS

REACTOR= 608
FUEL=K4F
LOAD= 15 1 3 0 0 0

A40= 129.198
B40= 0.02505
A41= 0.40179E-05
B41= 1.74447
APU= 0.83717
BPU= 0.14569E-03
CPU= 0.12344E-07
TPT= 8.34516

EN ENMA ENMH VN WMA VMR
45. 1. 0. 5.21 5.21-0.

EM	UN	VN	TN	JMA	VMA	TMA	UMB	VMB	TMB
700.	0.367	4.746	532.83	0.408	5.738	601.44	-0.	-0.	-0.
1000.	0.691	6.452	734.53	0.760	7.780	821.36	-0.	-0.	-0.
1300.	1.080	7.997	923.47	1.178	9.623	1024.26	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CE41	GIN
700.	1.97	25.49	534.32	4.770	0.368	0.76332
1000.	5.10	47.75	736.42	6.484	0.693	0.73642
1300.	10.02	74.39	925.66	8.036	1.062	0.71205

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPMPII	CN39	CN40	CN41
100.	81.92	0.63	0.01	82.56	0.81921	.82558	99.228	.759	0.612
200.	160.38	2.43	0.07	162.87	0.80189	.81436	98.468	1.49	0.642
300.	235.55	5.29	0.20	241.05	0.78513	.81349	97.721	2.194	0.684
400.	307.63	9.11	0.44	317.18	0.76907	.79296	96.988	2.873	0.139
500.	376.77	13.81	0.80	391.38	0.75354	.76276	96.267	3.528	0.205
600.	443.13	19.29	1.31	463.73	0.73855	.77288	95.558	4.160	0.282
700.	506.86	25.49	1.97	534.32	0.72408	.76332	94.860	4.771	0.369
800.	568.11	32.34	2.81	603.25	0.71012	.75496	94.173	5.361	0.466
900.	626.97	39.77	3.84	670.58	0.69664	.74509	93.497	5.931	0.572
1000.	683.61	47.74	5.06	736.42	0.68361	.73642	92.829	6.483	0.688
1100.	738.12	56.20	6.50	800.83	0.67102	.72802	92.170	7.118	0.812
1200.	791.62	65.09	8.17	863.88	0.65885	.71990	91.520	7.535	0.945
1300.	841.21	74.39	10.06	925.66	0.64708	.71205	90.876	8.37	1.087
1400.	889.94	84.66	12.20	986.23	0.63570	.70445	90.240	8.523	1.237
1500.	937.2	94.65	14.59	1045.66	0.62468	.69711	89.611	8.995	1.395

EMPIRICAL CONSTANTS

REACTOR= 012
FUEL=R4E
LOAD= 5 1 2 1 37

A40= 129.313
R40= 0.02478
A41= 0.38557E-05
B41= 1.74879
APU= 0.63997
BPU= 0.140598E-03
CPU= 0.12239E-07
TPT= 6.34516

EN ENMA ENMH VN WMA WMR
44. 2. - 5.21 5.21-0.

EM	UN	VN	TN	UMA	VMA	TMA	UM3	VMR	TMR
700.	0.361	4.723	533.1	0.408	5.736	681.44	-0.	-0.	-0.
1000.	0.681	6.425	735.03	0.760	7.780	821.36	-0.	-0.	-0.
1300.	1.66	7.968	924.21	1.178	9.623	1024.26	-0.	-0.	-0.

EM	YUN	YVN	YTN	CE40	CE41	GIN
700.	1.95	25.58	530.7	4.773	0.363	0.76582
1000.	5.06	47.95	730.78	6.490	0.605	0.73873
1300.	9.95	74.72	928.56	8.047	1.071	0.71428

EX	GPT30	GPT40	GPT41	GPTU	GPM39	GPMU	CN39	CN40	CN41
100.	82.28	1.63	0.01	82.83	0.82196	0.82534	99.229	0.759	0.012
200.	161.91	2.43	0.07	163.42	0.80457	0.81708	98.478	1.490	0.041
300.	236.34	5.31	0.20	241.85	0.76781	0.8616	97.723	2.194	0.083
400.	308.66	9.14	0.44	318.24	0.77164	0.79559	96.990	2.873	0.137
500.	378.02	13.86	0.79	392.67	0.75605	0.78535	96.269	3.528	0.282
600.	444.60	19.30	1.29	465.25	0.74100	0.77542	95.560	4.161	0.278
700.	508.53	25.59	1.95	536.97	0.72647	0.76582	94.863	4.773	0.364
800.	569.96	32.46	2.79	605.21	0.71245	0.75651	94.176	5.364	0.460
900.	629.1	39.93	3.80	672.75	0.69890	0.74751	93.498	5.936	0.565
1000.	685.82	47.94	5.02	738.76	0.68582	0.73878	92.831	6.489	0.680
1100.	740.48	56.44	6.45	803.38	0.67317	0.7334	92.171	7.25	0.803
1200.	793.12	65.30	8.11	866.01	0.66094	0.72218	91.523	7.545	0.935
1300.	843.84	74.73	9.99	928.26	0.64911	0.71428	90.876	8.48	1.076
1400.	892.73	84.45	12.12	989.29	0.63766	0.7644	90.239	8.536	1.225
1500.	939.84	94.3	14.49	1048.67	0.62659	0.69925	89.609	9.1	1.382

EMPIRICAL CONSTANTS

REACTOR= 504
FUEL=C3E
LOAD= 7 1 3 1 23

A40= 126.836
B40= 0.02174
A41= 0.30701F-05
H41= 1.76485
APU= 0.79395
BPU= 0.140914E-03
CPU= 0.12491F-07
YPT=10.80439

EN ENMA ENMB WN WMA WMR
33. 2. - . 5.29 5.27-0.

EM	UN	VN	TN	UMA	VMA	TMA	UMB	VMR	TMR
700.	0.321	4.814	503.61	0.329	5.684	557.24	-0.	-0.	-0.
1000.	0.608	6.567	694.42	0.619	7.771	761.96	-0.	-0.	-0.
1300.	0.957	8.182	873.26	0.969	9.687	951.29	-0.	-0.	-0.

EM	YUN	VVN	YTN	CE40	CE41	GTN
700.	1.63	24.62	506.65	4.859	0.322	0.72379
1000.	4.25	46.38	696.27	6.642	0.609	0.69827
1300.	8.41	72.63	877.70	8.275	0.958	0.67516

EX	GPT39	GPT40	GPT41	GPTPU	GPM39	GPMPU	CN39	CN40	CN41
100.	77.69	0.60	0.01	78.29	0.77688	0.78294	99.226	0.763	0.010
200.	152.18	2.32	0.05	154.45	0.76040	0.77227	98.463	1.502	0.035
300.	223.35	5.07	0.17	228.58	0.74451	0.76194	97.711	2.216	0.072
400.	291.67	8.75	0.36	300.78	0.72917	0.75194	96.972	2.908	0.120
500.	357.18	13.28	0.66	371.13	0.71437	0.74225	96.243	3.579	0.178
600.	420.15	18.60	1.08	439.72	0.70008	0.73287	95.525	4.229	0.246
700.	480.40	24.62	1.63	506.65	0.68629	0.72379	94.818	4.859	0.322
800.	538.37	31.29	2.33	572.00	0.67297	0.71500	94.121	5.471	0.408
900.	594.19	38.56	3.19	635.85	0.66010	0.70650	93.433	6.065	0.502
1000.	647.67	46.37	4.22	698.27	0.64767	0.69827	92.754	6.641	0.605
1100.	699.22	54.68	5.43	759.33	0.63565	0.69030	92.083	7.201	0.716
1200.	748.84	63.45	6.84	819.12	0.62403	0.68260	91.420	7.746	0.835
1300.	796.63	72.63	8.44	877.70	0.61280	0.67516	90.764	8.275	0.961
1400.	842.70	82.20	10.24	935.14	0.60193	0.66796	90.114	8.790	1.095
1500.	887.11	92.12	12.27	991.50	0.59141	0.66100	89.471	9.291	1.237

DATE

FILMED

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END