LA-7596-PR

Progress Report

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Applied Nuclear Data Research and Development

July 1—September 30, 1978

University of California

LOS ALAMOS SCIENTIFIC LABORATORY

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Applied Nuclear Data Research and Development

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Compiled by

C. I. Baxman
P. G. Young

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APPLIED NUCLEAR DATA RESEARCH AND DEVELOPMENT
QUARTERLY PROGRESS REPORT
July 1 - September 30, 1978

Compiled by

C. I. Baxman and P. G. Young

ABSTRACT

This progress report describes the activities of the Los Alamos Nuclear Data Group for the period July 1 through September 30, 1978. The topical content is summarized in the contents.

I. THEORY AND EVALUATION OF NUCLEAR CROSS SECTIONS

A. Charge-Independent R-Matrix Analysis for the Four-Nucleon System (G. M. Hale and D. C. Dodder)

The analysis of reactions in the ^{4}He system having isospin-one parameters constrained to fit p + ^{3}He elastic scattering data has continued with the addition of new experimental data from Ohio State University and with some modification of the low-energy D(d,p)T analyzing-power measurements from Basel. Qualitative success of this charge-independent analysis in accounting for certain features of the 4-nucleon reactions, as described last quarter, were reported[1] at the recent Few Body Conference in Graz, Austria.

B. Charge-Symmetric R-Matrix Analysis of the Seven-Nucleon System [D. C. Dodder, G. M. Hale, S. D. Baker (Rice University), and E. K. Biegert Rice University)]

Two of the seven-nucleon reactions are important at low energies in applications; the $^{6}Li(n,t)^{4}He$ cross section is widely used as a neutron standard and that for the mirror $^{6}Li(p,^{3}He)^{4}He$ reaction is an important astrophysical cross section for understanding the abundance of the lithium isotopes. To determine both these important cross sections and the spectroscopy of the seven-nucleon systems ^{7}Li and ^{7}Be more reliably, we have been carrying out a charge-symmetric

R-matrix analysis that includes most of the known data for the seven-nucleon reactions.

The low-energy behavior of the $^6Li(n,t)^4He$ and $^6Li(p,^3He)^4He$ reactions is strongly influenced by a pair of $J^P = 5/2^-$ resonances, in addition to the usual long-range (external) Coulomb effects that prevail near threshold. Both the external Coulomb differences and the relatively small internal Coulomb effects on the resonance parameters produce remarkable qualitative differences in the cross sections for the two reactions, as is illustrated by the 3-dimensional plots of Fig. 1. In these calculations, the reduced width amplitudes of states in the ^7Li and ^7Be systems are the same, while the eigenenergies of the levels are shifted to account for internal Coulomb energy differences. The effect of both $5/2^-$ levels is apparent in broad structures in the $^6Li(p,^3He)^4He$ cross sections at $\sim$0.8 and 1.9 MeV, while only a single narrow anomoly, corresponding to the upper $5/2^-$ level, is visible at about 240 keV in the $^6Li(n,t)^4He$ cross section. The lower level is shifted below the n + ^6Li threshold in ^7Li by mass differences and other Coulomb effects.

A discussion of this application was included in a contribution[2] to the International Conference on Neutron Physics and Neutron Data for Reactors and Other Applied Purposes at Harwell. Reliable values of the $^6Li(p,^3He)^4He$ cross section resulting from this analysis are being reported[3] in the astrophysical literature.

C. $T(t,2n)^4He$ Reaction (G. M. Hale and P. G. Young)

The $T(t,2n)^4He$ reaction is of interest in d-T fusion systems as a possible mechanism for tritium removal and as a diagnostic for determining initial tritium ion temperatures in injected d-T designs. We have evaluated the integrated cross section and neutron spectra for this reaction at energies up to a few MeV and have calculated Maxwellian rates for temperatures up to kT = 100 keV.

The cross sections were obtained from a rudimentary R-matrix analysis of data for the t + t reactions at energies up to E_t = 2 MeV, using the EDA[4] code. An excellent fit to the few usable data sets available at these energies was obtained by allowing only a single transition (0^+) in the R-matrix with contributions from the ground state of ^6He plus a distant level. Included in the fit were the t + t elastic scattering differential cross-section measurements of Holm and Argo,[5] reduced in scale by $\sim$15% following the suggestion of Allen and Jarmie,[6] and the $T(t,2n)^4He$ integrated reaction cross-section measurements of Serov et al,[7] Govorov et al.,[8] and Jarmie and Allen.[9] Measurements detecting

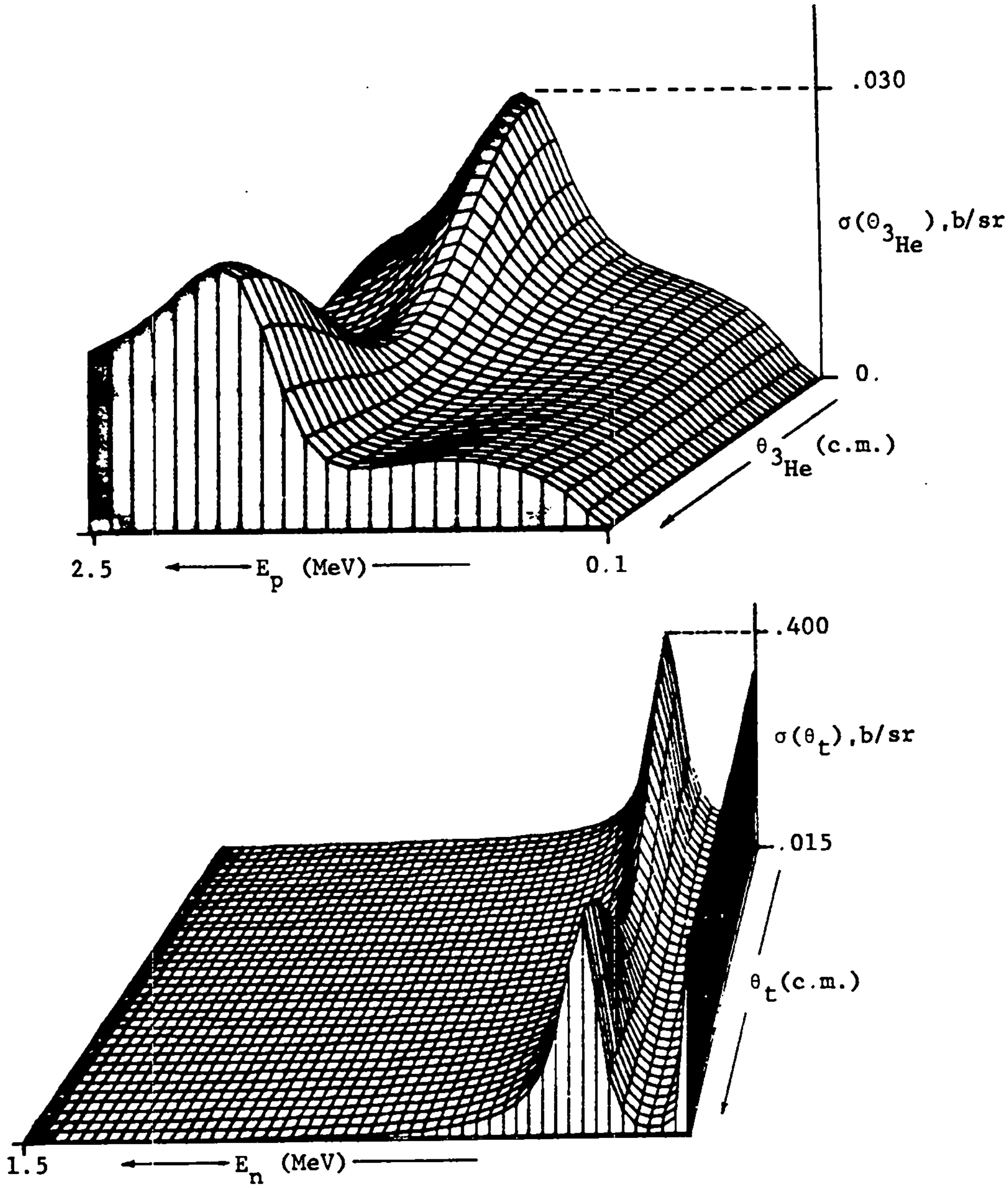

Fig. 1.
Calculated differential cross sections for the $^6Li(p,^3He)^4He$ (top) and $^6Li(n,t)^4He$ (bottom) reactions.

neutrons at 0° lab, like those of Agnew et al.[10] and Strel'nikov et al.,[11] could not be used directly in the analysis, but zero-degree lab cross sections calculated from our integrated cross sections using a simple model appear to lie between the measurements of Refs. 10 and 11 in the region where their data overlap, and fall below the results of Ref. 10 above 1 MeV. Figure 2 shows the calculated reaction cross section compared with the measurements of Ref. 7-9. The dashed curves give the estimated uncertainty band on the calculated cross sections. Figure 3 shows the Maxwellian-averaged reaction rate $\langle\sigma v\rangle$, as a function of kT, calculated from the R-matrix cross sections using the STEEP code.[12] Calculations of the reaction rate for kT up to 100 keV were found to be insensitive to extensions of the cross section above 2 MeV. Also shown in Fig. 3 (dashed curve) is the reaction rate obtained by Greene.[13] The differences between our curve and Greene's at the lower temperatures result mainly from our use of the new low-energy cross-section measurements of Serov,[7] which were not available at the time of Greene's report.

An evaluated energy spectrum of neutrons emitted from the T + T reaction was derived by optimizing a simple model to the measurements of Wong, Anderson, and McClure.[14] (The Wong et al. data were obtained by stopping 0.5-MeV tritons in a tritium-loaded titanium target and measuring the neutron emission spectra at 90° by the time-of-flight method.)

Following the analysis of Ref. 14, we assumed the neutron spectrum from T + T to be composed of the following reactions:

$$T + T \rightarrow n + n + {}^4He \qquad Q = 11.33 \text{ MeV}, \tag{1}$$

$$T + T \rightarrow n_0 + {}^5He^* \qquad Q = 10.44 \text{ MeV}, \tag{2}$$
$$\quad {}^5He^* \rightarrow n + {}^4He$$

$$T + T \rightarrow n_1 + {}^5He^* \qquad Q = 8.44 \text{ MeV} \quad , \tag{3}$$
$$\quad {}^5He^* \rightarrow n + {}^4He$$

where reaction (1) corresponds to pure 3-body breakup, and reactions (2) and (3) proceed through the ground and first excited states of ^{5}He. The neutron continua from reaction (1) and from decay of $^5He^*$ in reactions (2) and (3) were assumed to follow a pure phase space distribution. With these assumptions, it was not possible to reproduce a broad peak observed near $E_n = 3.5$ MeV in the Wong et al. experiment. To overcome this problem, a fourth reaction was arbitrarily introduced,

$$T + T \rightarrow n_2 + {}^5He^* \quad Q = 3.75 \text{ MeV}, \tag{4}$$

where this Q-value does not correspond to a known level in ^5He but was added merely to compensate for deficiency of the model.

An angle-averaged calculated spectrum for 85-keV incident tritons is compared in Fig. 4 to points obtained by drawing a smooth curve through the Wong et al.[14] measurement. A $\pm$ 10% error bar has been attached arbitrarily to the Wong data for comparison purposes. The average neutron energy in the calculated spectrum is 5.034 MeV. Center-of-mass widths of 0.85, 4.0, and 3.0 MeV were assumed for reactions (2)-(4), including an rms component of 0.6 MeV to account for kinematic broadening in averaging the spectra over all outgoing angles. Relative intensities of 0.60, 0.19, 0.14, and 0.14 were used in the calculation of reactions (1)-(4), respectively.

D. Comparison of Cross Sections Calculated with Various Statistical Model Codes Using Identical Parameter Sets (E. D. Arthur)

We have completed a comparison of cross sections calculated with GNASH to those obtained from COMNUC and STAPRE calculations performed by Don Gardner at Lawrence Livermore Laboratory (LLL). Cross sections were computed for n + ^{90}Zr reactions using identical parameter sets for neutron, proton, and alpha-particle transmission coefficients, level densities, gamma-ray normalizations, and discrete level information. For this comparision no attempt was made to include preequilibrium effects since such effects would tend to complicate the comparison at this stage.

GNASH results obtained for binary and tertiary reactions in the energy range from 11.5-16 MeV are compared to COMNUC results in Table I (STAPRE results are in agreement with those from COMNUC). Generally, the agreement obtained between calculated results is less than 5%. Below 11 MeV where only binary reactions occur, the agreement is generally within 1 or 2%.

This represents one of the most stringent comparison tests made between statistical codes, and the agreement is gratifying in light of the different techniques used for integration, treatment of cascade, etc. Efforts are now under

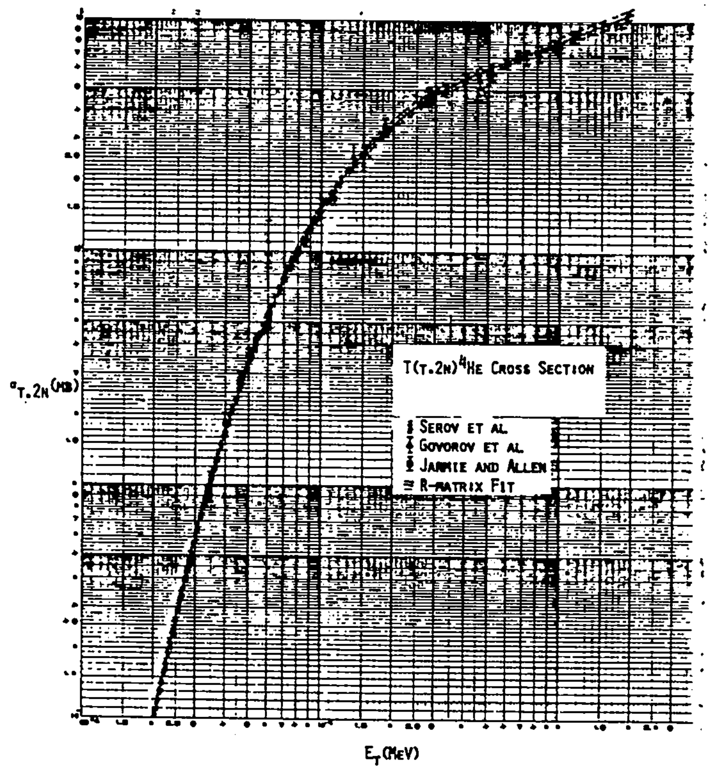

Fig. 2.
Calculated $T(t,2n)^4He$ cross sections compared with the measurements of Serov et al.,[7] Govorov et al.,[8] and Jarmie and Allen.[9] Also shown is the estimated uncertainty band on the calculated cross sections.

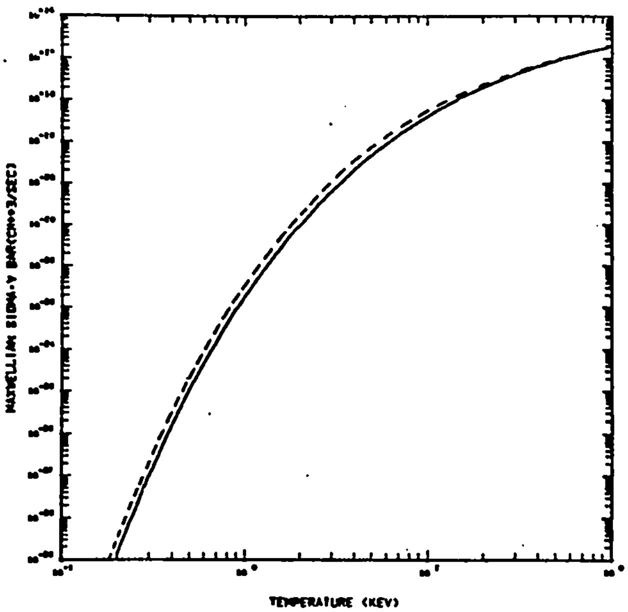

Fig. 3.
Maxwellian-averaged reaction rates for $T(t,2n)^4He$ compared to those of Greene[13] (dashed curve).

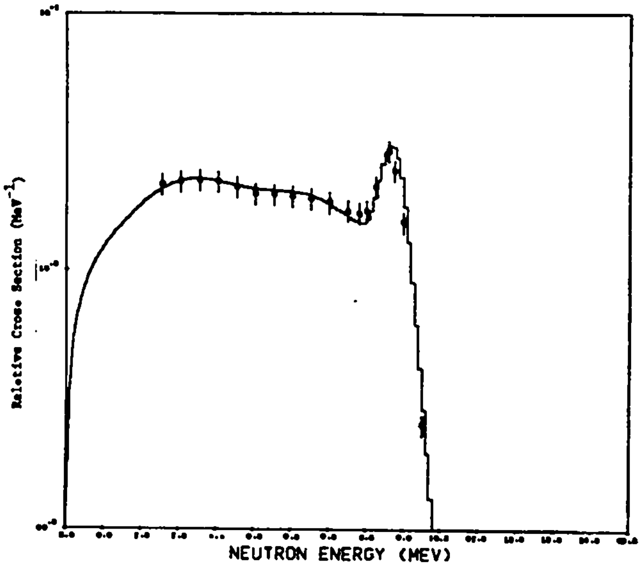

Fig. 4.
Angle-averaged neutron emission spectrum from the T+T interaction with 85-keV tritons. The points are from the experiment of Wong et al.[14] with 10% error bars arbitrarily assumed.

way to compare results from GNASH and STAPRE when preequilibrium contributions are included.

E. Calculations of ^{235}U and $^{238}U(n,xn)$ Cross Sections and Individual Neutron Emission Spectra (E. D. Arthur)

Using the GNASH preequilibrium-statistical model code, we have calculated (n,2n), (n,3n), and (n,4n) cross sections for ^{235}U and ^{238}U in the neutron energy range from 6 to 22 MeV. We have also calculated the individual spectra of the two (n,2n) and three (n,3n) neutrons. These spectra were then used to provide efficiency corrections to the data of Veeser.[15]

These calculations used neutron transmission coefficients determined from recent optical model parameter sets obtained by Madland[16] for use in the actinide region and fission barrier parameters based on the values of Back et al.[17] Preequilibrium effects are important in the energy range under consideration, and the Kalbach exciton model[18] was used to include such effects.

Figure 5 shows the individual neutron spectra calculated for 19-MeV neutrons on ^{235}U. Preequilibrium effects are most apparent in the first neutron spectra and lead to a general hardening of the spectra compared to what one would obtain from purely statistical calculations. Figure 6 shows the calculated $^{238}U(n,xn)$ cross sections compared with the experimental data of Veeser,[15] Frehaut,[19] and Mather.[20] The calculations are generally in good agreement with these data. Above 15 MeV the inclusion of preequilibrium effects contribute significantly to the agreement between calculated and experimental results. Without preequilibrium corrections, the calculated (n,2n) curve would generally be too low in this energy region.

TABLE I

CROSS SECTIONS (mb) CALCULATED WITH GNASH (G) AND COMNUC (C) FOR n + ^{90}Zr

E_n	(n,p)		(n,2n)		(n,np)		(n,pn)	
(MeV)	G	C	G	C	G	C	G	C
11.5	11.9	12.2	-	-	9.8	7.1	0.053	0.043
12.5	13.4	13.7	79.	69.	57.	55.5	0.51	0.53
13.	13.8	14.2	299.	294.	77.	76.7	1.22	1.27
14.	13.5	13.7	781.	769.	74.	81.1	4.25	4.4
15.	11.1	11.3	1079.	1092.	76.	79.5	9.5	9.74
16.	8.0	8.2	1232.	1273.	88.	84.8	15.7	16.

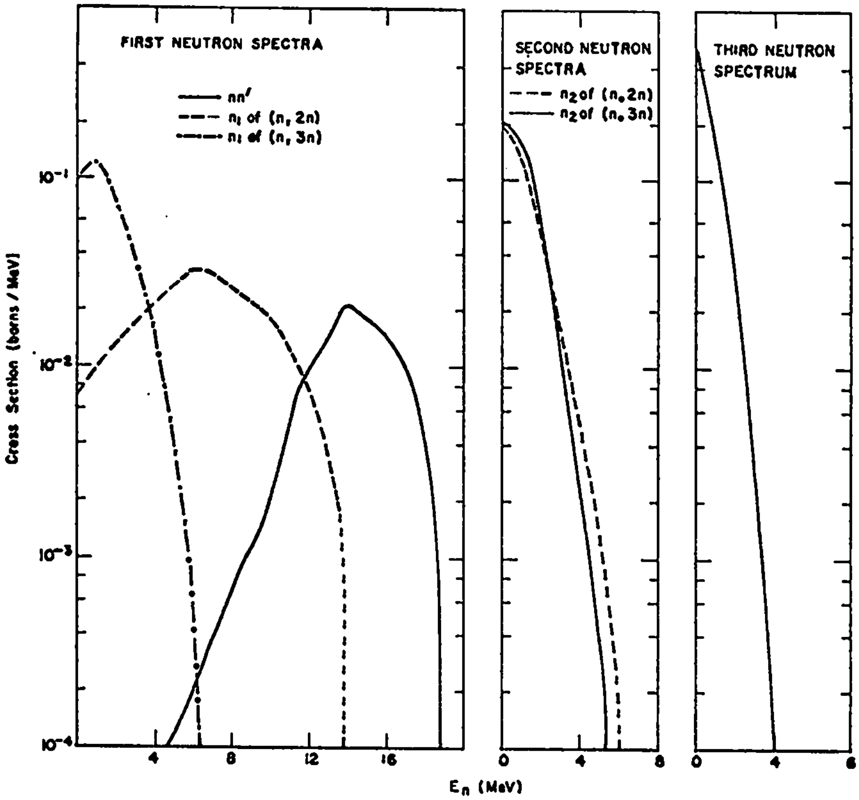

Fig. 5.
Calculated individual neutron spectra for 19-MeV neutrons on ^{235}U.

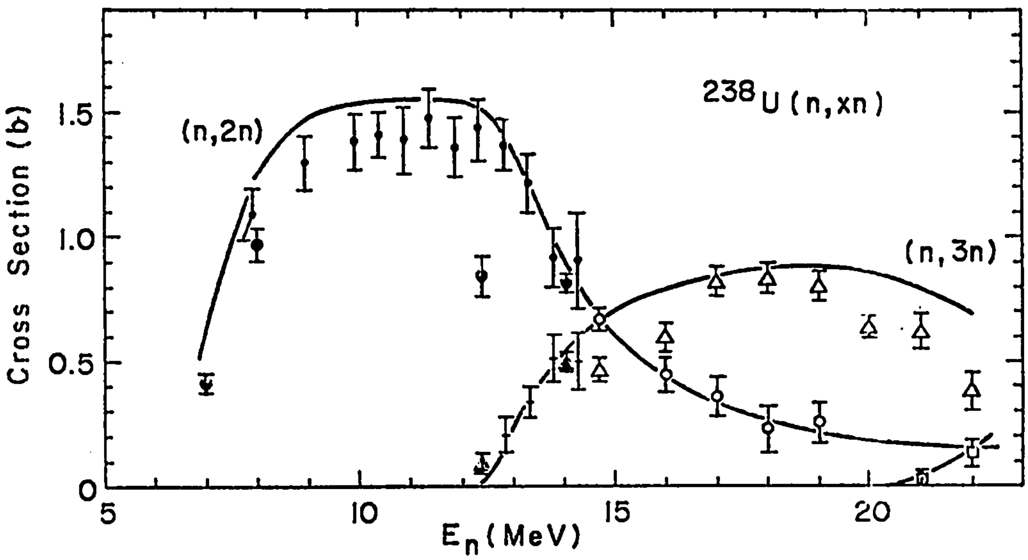

Fig. 6.
Comparison of the present calculations and experimental data for $^{238}U(n,xn)$ reactions. The open symbols are the Veeser results [circles, triangles, and squares are (n,2n), (n,3n), and (n,4n) results, respectively]. Small closed circles show (n,2n), and the dashed show (n,3n) measurements of Frehaut. The large closed circles show (n,2n), and the closed triangles show (n,3n) measurements by Mather.

F. Evaluated Photon and Neutron Spectra of Uranium Isotopes (D. G. Foster, Jr.)

An evaluation of the photon and neutron spectra emitted by isotopes of uranium and their immediate decay products has been completed. Since the primary interest was in radiation hazards for times less that 1000 yr after milling of uranium, the decay chains were followed only as far as the first descendant with a half-life greater than 10^4 yr.

Several improvements in evaluation techniques have been developed since performing a similar evaluation for the isotopes of plutonium three years ago.[21] Most of the data were taken from recent compilations[22] (which include partial evaluations) by the Nuclear Structure Group at Oak Ridge National Laboratory. These compilations are very detailed and usually include actual internal-conversion coefficients, properties of most of the nuclear levels, corrected energy scales, partial intensity balances at individual levels, and much additional information. Several sets of intensities required normalization. This information has been supplemented by copying portions of calculated tables[23] of internal-conversion coefficients into computer files and using them in conjunction with an interpolation routine to calculate the resulting feed to K, L, and lower energy x rays from each observed gamma transition. Similarly, tables of nuclear[22] and atomic[24] levels have been keypunched to use in calculating consistent gamma and x-ray energies. The relative intensities of individual x-ray lines were taken largely from direct measurements,[25] because extensive transitions between subshells make it very difficult to calculate these intensities even if the subshell internal-conversion coefficients are known.

Data for the spontaneous-fission yields of neutrons were taken mostly from the same sources.[22] Values of $\bar{\nu}$ were deduced from the systematics given by Bois and Frehaut,[26] using an empirical relation due to Smith[27] to calculate the nuclear temperature characterizing each spectrum. Table II summarizes the constants adopted for each nuclide.

For summing the results over decay chains and various mixtures of isotopes, two separate computer programs used in the previous work have been combined into a single program ACTDEC, which uses superposition of linear chains to calculate the decay rates and apply them to the evaluated spectra. Tabulated results using 30 neutron groups and both 30 and 100 photon groups have been stored in computer files to facilitate use of the data.

TABLE II

SPONTANEOUS-FISSION DATA

	Fissions per Disintegration	$\bar{\nu}$	Temperature (MeV)
^{231}Th	1.0×10^{-10}	1.0	1.03
^{234}Th	none		
^{231}Pa	none		
^{234}U	1.2×10^{-11}	1.39	1.11
^{235}U	none		
^{236}U	none		
^{238}U	5.4×10^{-5}	1.96	1.22

G. Neutron-Nucleus Optical Potential for the Actinide Region (D. G. Madland and P. G. Young)

Further progress has been made in the determination of a neutron-nucleus optical potential for the actinide region, namely, a first version of a deformed global potential for coupled-channel calculations has been obtained. (Earlier work, reported in Ref. 28, is now outdated.) The iterative procedure used to determine the potential and some results obtained using the potential are discussed in the following.

First, the regular optical model is assumed adequate, that is, the potential is spherical, local, energy and isospin dependent, and utilizes Saxon-Woods form factors. A modified global optical-model search code[29] was used to search on differential elastic and total cross-section data from ^{232}Th, ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu targets spanning an energy range of 1 keV to 14.1 MeV.[30-44] The following parameterization was adopted for the real and (surface) imaginary strengths and the imaginary diffuseness, respectively:

$$V_R = V_R^{(0)} - V_R^{(1)} E_L - V_R^{(2)} \eta \quad , \tag{5}$$

$$W_D = W_D^{(0)} - W_D^{(1)} E_L + W_D^{(2)} E_L^2 - W_D^{(3)} \eta \quad , \tag{6}$$

$$a_I = a_I^{(0)} + a_I^{(1)} E_L \quad , \tag{7}$$

where E_L is the laboratory neutron energy, and $\eta = (N-Z)/A$ is the isospin related symmetry parameter. The optimum spherical potential obtained using this parameterization is labeled "Iteration 0" in Table III and total cross sections calculated with it are compared with the experimental data[33,36,37,39,40,45-50] in Figs. 7 and 8. The main feature of the calculation is that it generally agrees well with all data sets except in the region ~1 to ~7 MeV, where it consistently underpredicts the data (by as much as ~8%). This region is where direct inelastic coupled-channel effects are strongest.

The second step is to use the Iteration 0 potential as the starting potential in coupled-channel calculations which simultaneously fit the inelastic differential cross sections as well as the elastic and total cross sections. The additional requirement of simultaneous good fits to the inelastic data should constrain the parameter values and correlations to more narrow ranges. Accordingly, coupled-channel search calculations for three coupled states were performed using the Karlsruhe search version of JUPITOR[50] modified to also search on the total cross section. The 2.5 and 3.4 MeV ^{235}U data of Refs. 30, 31, and 43 were studied. Search calculations on this data indicated that the real and imaginary radii, r_R and r_I, and the real diffuseness, a_R, are constrained to lie near the best fit values of 1.264, 1.256, and 0.612, respectively. The imaginary strength and diffuseness vary more widely at each energy but are correlated. The optimum values of β_2 and β_4 are 0.200 and 0.058, respectively, agreeing well with Refs. 30 and 31.

The third step is an iteration of the first, but with r_R, r_I, and a_R fixed at the values determined in the coupled-channel search calculations. The reoptimized spherical potential is labeled "Iteration 1" in Table III. Comparing to Iteration 0, the total χ^2 has improved by only ~10%. Thus, two statistically equivalent potentials have been determined, but it is believed that Iteration 1 is physically more realistic. Figures 7 and 8 show that the calculated total cross sections are much improved over Iteration 0 in the region ~1.5 to ~7 MeV for all cases. However, the results are somewhat worse in the ~500 keV to ~1 MeV region for ^{232}Th and ^{238}U.

The last step is to determine the deformed potential for coupled-channel calculations at all energies from the Iteration 1 spherical global potential. We assume that the values of r_R, r_I, and a_R are already well determined. The remaining unknowns (assuming the deformations are given) are V_R, W_D, and a_I. It was determined in step 2 that the product of W_D and a_I was better determined than

TABLE III

INITIAL RESULTS: SPHERICAL OPTICAL POTENTIALS FOR USE IN THE DETERMINATION OF A DEFORMED NUCLEUS INTERACTION POTENTIAL FOR COUPLED-CHANNEL CALCULATIONS IN THE ACTINIDE REGION[a]

($10\ \text{keV} \leqslant E_L \leqslant 10\ \text{MeV}$)

Parameter	Iteration 0	Iteration 1
$V_R^{(0)}$	53.016	50.378
$V_R^{(1)}$	0.360	0.354
$V_R^{(2)}$	24.620	27.073
r_R	1.203	(1.264)
a_R	0.629	(0.612)
$W_D^{(0)}$	8.983	9.265
$W_D^{(1)}$	0.220	0.232
$W_D^{(2)}$	$3.252/10^2$	$3.318/10^2$
$W_D^{(3)}$	13.642	12.666
r_I	1.297	(1.256)
$a_I^{(0)}$	0.555	0.553
$a_I^{(1)}$	$1.428/10^2$	$1.440/10^2$
$\chi^2_{\sigma(\theta)}$	8.64	10.30
$\chi^2_{\sigma T}$	5.86	2.75
$\chi^2_{(tot)}$	14.50	13.05

[a]Quantities in parentheses were held fixed during the searches. The spin-orbit term parameterization of Ref.29 was used throughout. Units are MeV and fermis.

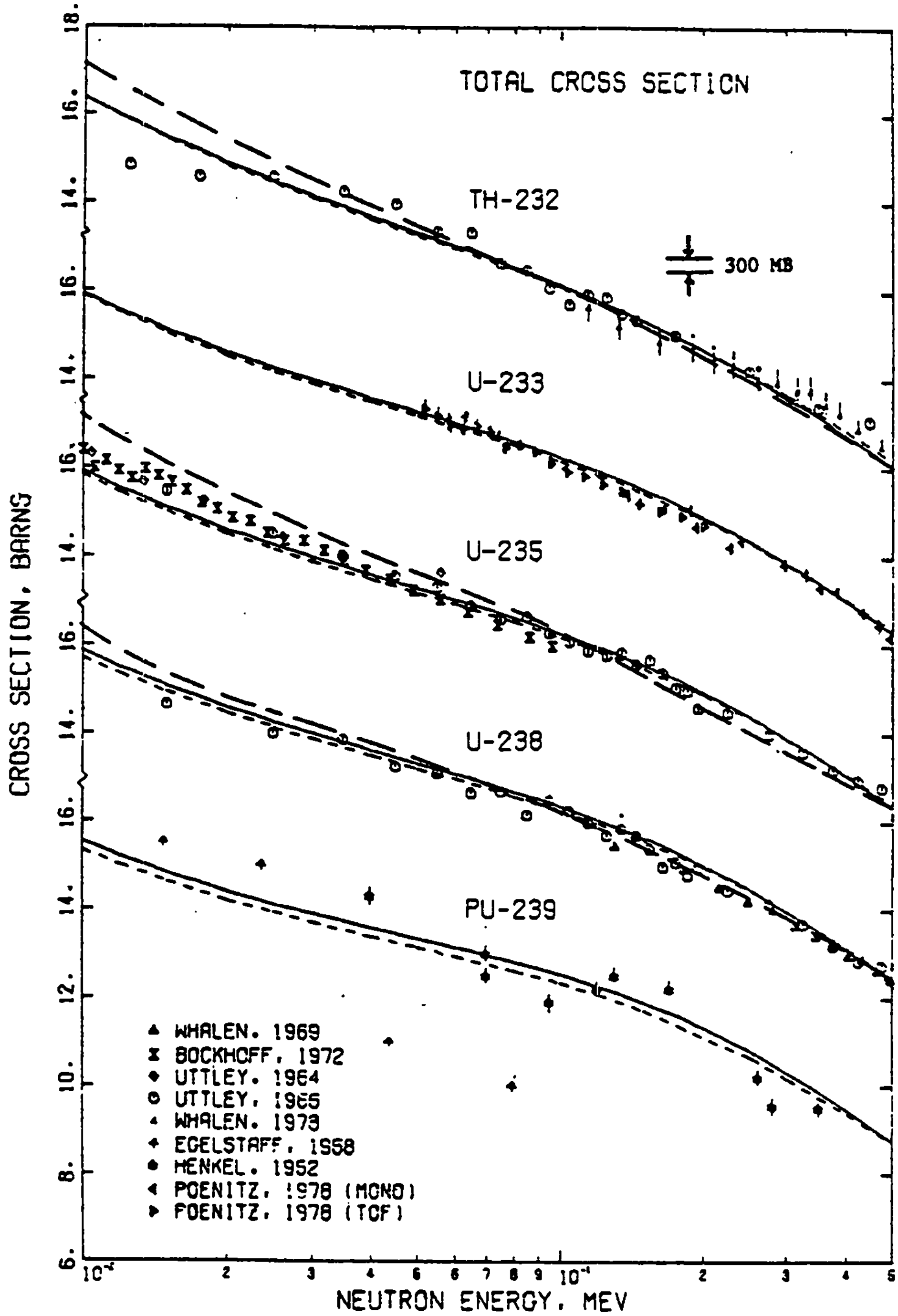

Fig. 7.

Comparisons of calculated and experimental total cross sections for the indicated isotopes in the energy range 10 to 500 keV for the cases of (a) Iteration 0 of the spherical global optical potential (---), (b) Iteration 1 of the spherical global optical potential (——), and (c) the deformed global coupled-channel potential (- -).

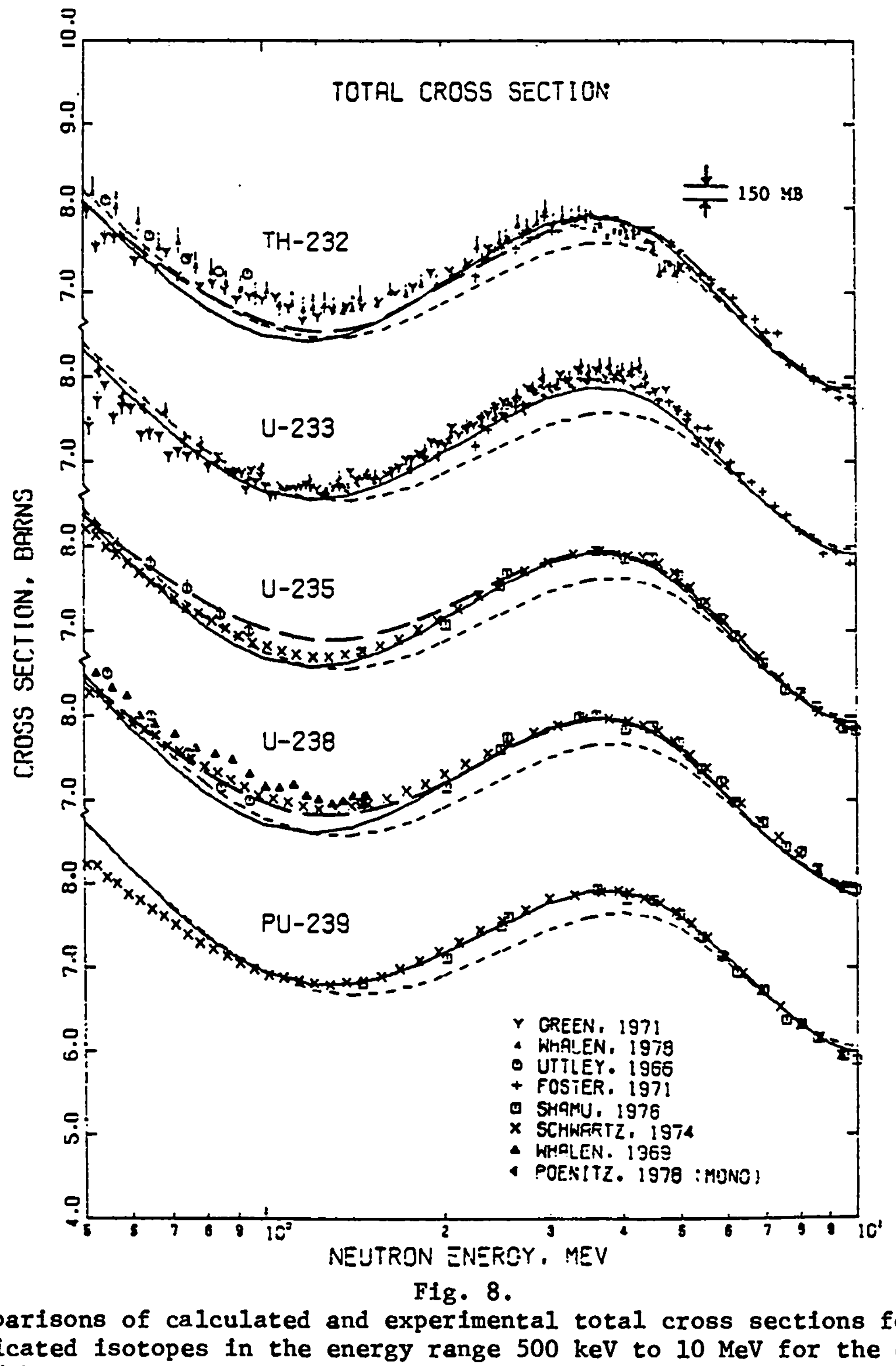

Fig. 8.

Comparisons of calculated and experimental total cross sections for the indicated isotopes in the energy range 500 keV to 10 MeV for the cases of (a) Iteration 0 of the spherical global optical potential (---), (b) Iteration 1 of the spherical global optical potential (——), and (c) the deformed coupled-channel potential (- -).

W_D or a_I individually. A comparison of equivalent fit W_Da_I products of step 2 to the W_Da_I product of step 3 indicates that $\langle W_Da_I(\text{coupled-channels})\rangle / W_Da_I(\text{spherical}) = \alpha \approx 0.7$. Similarly it was found that $\langle V_R(\text{coupled-channels})\rangle / V_R(\text{spherical}) = \beta \approx 1.02\text{-}1.03$. If one assumes that these simple relationships are valid at other energies, then their use with Eq. (5)-(7) may provide a means of transforming a suitably chosen spherical global potential to a deformed global potential. Sample calculations indicated the feasibility of this approach. Therefore, a complete set of coupled-channel calculations was performed for ^{232}Th, ^{235}U, and ^{238}U using values of $\alpha = 0.705 = 0.75 \times 0.94$ and $\beta = 1.025$.

The results are shown in Figs. 7-9. The agreement with the angular distributions is, of course, very good because these data were used in determining the simple scaling transformation. Comparison with the ^{238}U total cross section, however, is a test of the procedure over the entire energy range: the agreement

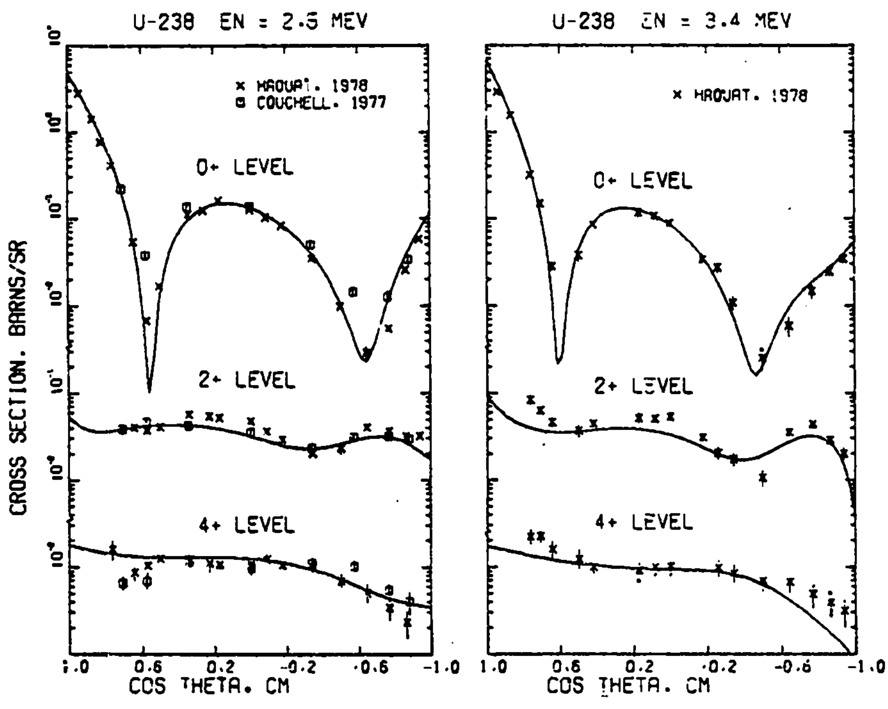

Fig. 9.
Comparisons of calculated and experimental angular distributions for the first three members of the ^{238}U ground-state band at 2.5 and 3.4 MeV. The calculations were performed with the deformed global coupled-channel potential described in the text.

is very good from ∿50 keV to 10 MeV and departs from the trend of the data below ∿50 keV by at most 3%. The calculation of the ^{232}Th and ^{235}U total cross sections (using the deformations of Refs. 30 and 3]) disagree with the data slightly more than in the ^{238}U case. We believe this is possibly due to the fact that the scaling transformation is based mostly upon ^{238}U data. However, the transformation could be more complicated, the isospin dependence could be incomplete, or the wrong form of the potential could have been chosen. Our results must therefore be considered preliminary until these possibilities have been studied.

In conclusion, a method has been proposed to transform a suitably chosen spherical global optical potential to a deformed global interaction potential for coupled-channel calculations. The transformation must be considered preliminary until more complete studies have been made. The deformed potential given here for the actinide region is limited to energies below 10 MeV because of the quadratic energy dependence of the absorptive potential.

This work has been reported at the International Conference on Neutron Physics and Neutron data for Reactors and Other Applied Purposes at Harwell, England, in September 1978.[16]

II. NUCLEAR CROSS-SECTION PROCESSING

A. NJOY Code Development (R. E. MacFarlane and R. M. Boicourt)

A new version of the NJOY cross-section processing system has been released to users at Oak Ridge National Laboratory (ORNL), Brookhaven National Laboratory (BNL), and Combustion Engineering, Inc. Besides correcting several errors, this version is completely compatible with ENDF/B-V, including the new covariance formats in ERRORR. All IBM-compatibility changes proposed by ORNL have been included or flagged with comment cards. This version has also been made compatible with the FTN compiler and the LTSS operating system at the Los Alamos Scientific Laboratory. A new short operator's manual and description of the code is being prepared for publication.

B. Energy Balance Tests for Preliminary ENDF/B-V (R. E. MacFarlane and L. Stewart)

Many of the evaluations for ENDF/B-V have been checked for neutron-photon energy balance using the HEATR module of NJOY. This testing method[51] is based on calculating the energy deposition by charged secondary particles and the recoil nucleus (i.e., heat production or KERMA factor) by energy balance using

$$\sigma_H = \sum_n (E + Q_n - \bar{E}_n)\sigma_n - \sum_\gamma \bar{E}_\gamma \sigma_\gamma \quad , \tag{8}$$

where σ_H is the heat production cross section (usually eV · barns), E is the incident neutron energy, Q_n is the mass-difference Q value for reaction n, $\bar{E}_n$ is the average energy of secondary neutrons, σ_γ is the photon production cross section for reaction γ, and $\bar{E}_\gamma$ is the average energy of emitted photons.

If the photon energy term in Eq. (8) is too large, σ_H can come out negative; clearly a nonphysical result. If the photon term is too small, σ_H can be too large. Equation (8) is seen to be a very sensitive test of the photon production files and the consistency between neutron and photon data in an evaluation.

The HEATR module of NJOY contains an option which compares σ_H from Eq. (8) with kinematic limits on the charged-particle energy available and flags any serious discrepancies. Such checks have been run on 28 of the nuclides from preliminary ENDF/B-V. The results show that only oxygen and lighter isotopes are truly consistent. The most common problem with the heavier isotopes is that photon production cross sections (MF=13) are not consistent with the corresponding neutron interaction data. There are also problems with both neutron and photon spectra. These difficulties have been reported to the evaluators and to the data testing subcommittee of CSEWG. Hopefully, deadlines and funding will still allow some of the more important discrepancies to be removed before the final version of ENDF/B-V is released.

C. Phase II Testing of Preliminary ENDF/B-V Data (R. B. Kidman)

The phase II testing of the preliminary ENDF/B-V[52] data was completed this quarter. Thirty-seven of the new isotopes were processed into a 185-group structure. These isotopes were then collapsed to 50 groups and combined with the unchanged LIB-IV[53] isotopes to form a PRE-V library that is in the same order and format as LIB-IV. The packaged benchmarks previously constructed for LIB-IV were then conveniently employed to complete Phase II testing of PRE-V on benchmarks JEZEBEL, GODIVA, ZPR-6-6A, and ZPR-6-7.

Table IV compares the corrected eigenvalues obtained by using[54] LIB-IV with those obtained by using PRE-V. These eigenvalue results (differences), especially for the uranium fueled assemblies GODIVA and ZPR-6-6A, plus other results for reaction rate ratios and reactivity worths, all of which are confirmed by

TABLE IV

CORRECTED EIGENVALUES

	LIB-IV	PRE-V
JEZEBEL	0.9945	1.0032
ZPR-6-7	0.9909	0.9942
GODIVA	1.0063	0.9893
ZPR-6-6A	0.9951	0.9857

other laboratories, have prompted another look at ^{235}U and ^{238}U before the final ENDF/B-V is released.

As the packaged benchmarks are being used in post LIB-IV calculations, they are being modified to give the transport theory eigenvalues as a function angular quadrature order, S_i. The results are shown in Table V. The small assembly eigenvalues vary much more with S_i than do the large assembly eigenvalues. Results such as these can be plotted, which should enable one to convert any S_i eigenvalue to a reasonable, extrapolated S_∞ eigenvalue.

For convenience in storage and future reference, the LIB-IV and PRE-V cross sections and their group-by-group percentage differences have been put on microfiche.

TABLE V

UNCORRECTED $P_{1/2}$ EIGENVALUES vs S_i

	JEZEBEL	ZPR-6-7	GODIVA	ZPR-6-6A
S_2	1.05458	0.98298	1.02888	0.98186
S_4	1.02070	0.97967	1.00242	0.97891
S_8	1.01120	0.97950	0.99586	0.97878
S_{16}	1.00850	0.97946	0.99399	0.97874
S_{32}	1.00775	0.97945	0.99348	0.97873
S_{48}	1.00761	0.97945	0.99338	0.97873

D. CSEWG Shielding Data Testing (R. J. Barrett)

Group-averaged photon production data were calculated from preliminary ENDF/B-V evaluations using NJOY for comparison with shielding benchmark experiments. Photon production from a thermal flux of neutrons was calculated for Fe, Na, N, and S, and production from a fast Fe, Na flux of neutrons was calculated for ^{16}O and S. The results were forwarded to R. C. Maerker at ORNL, who presented them along with his own calculations at the ORNL meeting of the Cross Section Evaluation Working Group's (CSEWG) Shielding Subcommittee.

E. MATURE (R. J. Barrett, R. M. Boicourt, and R. E. MacFarlane)

The MATXS format is currently being used at LASL and other installations as a comprehensive storage format for group-averaged neutron and photon cross sections. The TRANSX code has been developed and used extensively to produce transfer tables from MATXS files for use in S_n codes.

Currently under development is a generalized utility code called MATURE, which will alter MATXS files in a variety of user-specified ways. The operations comtemplated for this code include

- group collapsing,
- adding, eliminating, or replacing materials, and merging files;
- selective editing of files, adding reactions, summing partials to produce response functions,
- converting BCD to binary and binary to BCD;
- printing.

During this past quarter, a number of these options were implemented and tested on the LTSS system. Starting with the MATXS1 file, a multi-isotope library in 30 neutron and 12 photon groups, we were able to perform the following operations:

- Collapse the cross sections and matrices to 5-neutron and 2-photon groups, with a user-input weight function.
- Sum the partial transfer matrices to get a total matrix and a separate fission matrix.
- Eliminate all but a few user-specified materials.
- Convert binary to BCD and BCD to binary.
- Print a number of MATXS files and produce an index of each.

Work on the MATURE code is continuing, with highest priority being placed on expanding the selective editing capabilities.

F. ERRFILS -- A Preliminary Library of 30-Group Multigroup Covariance Data For Use in CTR Sensitivity Studies (R. J. LaBauve and D. W. Muir)

A library of 30-group multigroup covariance data designed for use in CTR sensitivity studes was prepared from preliminary ENDF/B-V data with the NJOY code. The selection of the contents of this library, called ERRFILS, is based upon a Los Alamos Scientific Laboratory report[55] by E. L. Simmons, S. A. W. Gerstl, and D. J. Dudziak, issued September 1977. In this report the authors examine the sensitivity of neutronic responses in the preliminary design of the Tokamak Experimental Power Reactor (EPR) by Argonne National Laboratory. Their investigations were limited to responses related to toroidial field coil (TFC) integrity and activation of the TFC's outermost dewar. In particular, these included (1) neutron and gamma-ray heating in the TFC; (2) the dose in the Mylar insulation of the TFC; (3) the radiation damage, i.e., the displacements per atom (dpa) in copper in the TFC; and (4) the copper transmutation in the TFC.

The investigations reported in LA-6942[55] revealed the scattering cross sections in the stainless steel (in particular, the iron in stainless steel) and copper and the absorption cross sections of the ^{10}B in boron carbide to be the most significant contributors to the integral sensitivities of the responses studied in this design. Of lesser importance were the scattering cross sections of hydrogen, carbon, and lead. Thus, in the 30-group multigroup covariance library we have constructed (ERRFILS), we have included data for Fe, Cr, Ni, ^{10}B, C, Cu, H, and Pb. Reactions include total cross sections, elastic and inelastic scattering cross sections, and the most important cross sections contributing to the absorption cross section for each nuclide.

The ERRFILS library was obtained by processing preliminary ENDF/B-V data into 30 groups with the NJOY code. Since the ENDF/B-V data are preliminary as of this date, the ERRFILS library must also be considered preliminary and can only be finalized when ENDF/B-V is finalized. This may require some reprocessing. We feel, however, that we have uncovered most of the errors in the preliminary ENDF/B-V covariance files. We also discovered several "bugs" in the ERRORR overlay of the NJOY code in the course of processing the ENDF/B-V covariance data.

The ENDF/B-V evaluation of one important material, namely Cu, did not contain covariance data. For this material, we assumed that the uncertainties for copper were the same as those for chromium, and we attached the covariance data for ENDF/B-V Cr to the ENDF/B-V Cu evaluation for processing. Another deficiency in the ENDF/B-V data is that the ^{10}B covariance evaluation is only given up to 1.02 MeV. This is not significant for this application, however, since the most important energy range for ^{10}B lies between 10^4 and 10^6 eV.

The group structure specified in the NJOY input was the LASL 30-group structure that was used in the EPR analysis, except the top energy boundary was set at 20 rather than 17 MeV. Table VI summarizes the ENDF/B-V covariance data (MF=33) processed with NJOY. This covariance data library was placed in a LASL photostore file named ERRFILS.

The excerpt from the ERRFILS library shown in Table VII provides an example for explaining the ENDF-like output format of the NJOY code. Note that on card No. 957, columns 67-70 contain the number 326, the MAT-No. for preliminary version V evaluation for Fe; columns 71 and 72 contain the number 33, the MF- or File-No. used to designate the covariance files; and columns 73-75 contain the number 4, which is the MT- or reaction-number, in this case the number used to designate total inelastic scattering. Also, on the same card, columns 42-44 contain the number 103, which is the MT-No. for the (n,p) reaction. Thus, the data to follow is the covariance of the iron inelastic scattering reaction with the iron (n,p) reaction. The number 30 in columns 65 and 66 indicates that the data are given in 30 energy groups. Note that the ENDF format requires that energies be specified in eV from low to high, so that the energy range for group 1, the lowest energy group, is from 1.39×10^{-4} eV to 1.52×10^{-1} eV, while the range of group 30 is from 1.5×10^7 to 2.0×10^7 eV.

To avoid duplicate group numbers for MT=4 and MT=103, skip to the second set of data beginning at card 961 and observe that columns 32 and 33 (as well as 54 and 55) contain the number 12, columns 43 and 44 contain the number 19, and columns 65 and 66 contain the number 20. The number 20 signifies that this set of data is for group 20 of MT=4, and the numbers 12 and 19 are used to identify the group numbers for MT=103; that is, the covariance data which follow on cards 962 and 963 are given for 12 groups for MT=103 beginning at group 19, specifically, for groups 19 through 30. This set of data then represents the relative covariances of energy group 20 for MT=4 with energy groups 19 through 30 for MT=103. In referring to the datum in the sixth field of card 962, for example, one would say that "the relative covariance of the iron inelastic cross sections (MT=4) in group 20 (1.353-1.738 MeV) with the iron (n,p) cross section (MT=103) in group 24 (3.68-6.07 MeV) is -2.76354×10^{-5}."

TABLE VI

PRELIMINARY ENDF/B-V COVARIANCE DATA (MF=33)
PROCESSED WITH NJOY

MAT	Nuclide	MT-Nos. Processed	Reaction Cross Sections
305	B-10	1,2,107,780,781	Total, elastic (n,α), (n,α_0), and (n,α_1)
306	C	1,2,4,51-68,91,102 104, 107	Total, elastic, total inelastic, inelastic levels 1-18, inelastic continuum, (n,γ), (n,d), (n,α)
324	Cr	1,2,3,4,16,17,22,28, 102,103,104,105,106 107	Total, elastic, nonelastic, total inelastic, (n,2n), (n,3n), (n,n'α), (n,n'p), (n,γ), (n,p), (n,t), (n,d), (n,^{3}He), (n,α)
326	Fe	1,2,3,4,16,22,28,102 103,104,105,106. 107	Total, elastic, nonelastic, total inelastic, (n,2n), (n,n'α), (n,n'p) (n,γ), (n,p), (n,d), (n,t), (n,^{3}He), (n,α)
328	Ni	1,2,4,16,22,28,51-76 91, 102,103,104,107, 111	Total, elastic, total inelastic, (n,2n), (n,n'α), (n,n'p), inelastic levels 1-26, inelastic continuum, (n,γ), (n,p), (n,d), (n,α), (n,2p)
329	Cu	1,2,3,4,16,17.22,28 102,103.104,106,107	Total, elastic, nonelastic, total inelastic, (n,2n), (n,3n), (n,n'α), (n,n'p), (n,γ), (n,p), (n,d), (n,^{3}He), (n,α)
382	Pb	1,2,3,4,16,17,51,52, 64,102	Total, elastic, nonelastic, total inelastic, (n,2n), (n,3n), inelastic levels 1,2, and 14, (n,γ)
1301	H1	1,2	Total, elastic

TABLE VII

EXCERPT FROM LISTING OF Fe COVARIANCE DATA

```
 0.00000+ 0 0.00000+ 0          10          21          10          26 32633  4  942
-1.68233- 5-4.09220- 5-4.60402- 5-5.46850- 5-6.07958- 5-9.28666- 5 32633  4  943
-6.19527- 5-5.86147- 5-5.31006- 5-4.79542- 5                       32633  4  944
 0.00000+ 0 0.00000+ 0          10          21          10          27 32633  4  945
-1.79797- 5-4.37020- 5-4.91180- 5-5.82458- 5-6.47342- 5-6.69235- 5 32633  4  946
-6.59564- 5-6.17893- 5-5.65893- 5-5.11434- 5                       32633  4  947
 0.00000+ 0 0.00000+ 0          10          21          10          28 32633  4  948
-2.33664- 5-5.66009- 5-6.33190- 5-7.46462- 5-8.26873- 5-8.54054- 5 32633  4  949
-8.42057- 5-7.90368- 5-7.25866- 5-6.58314- 5                       32633  4  950
 0.00000+ 0 0.00000+ 0          10          21          10          29 32633  4  951
-3.79314- 5-9.14425- 5-1.01624- 4-1.18819- 4-1.30975- 4-1.35094- 4 32633  4  952
-1.33276- 4-1.25443- 4-1.15669- 4-1.05431- 4                       32633  4  953
 0.00000+ 0 0.00000+ 0          10          21          10          30 32633  4  954
-7.67502- 5-1.83961- 4-2.02808- 4-2.34640- 4-2.57142- 4-2.64767- 4 32633  4  955
-2.61401- 4-2.46901- 4-2.28806- 4-2.09856- 4                       32633  4  956
 0.00000+ 0 0.00000+ 0           0         103           0          30 32633  4  957
 0.00000+ 0 0.00000+ 0          12          19          12          19 32633  4  958
-3.00625- 2-5.49590- 3-9.16211- 4-2.55882- 4-1.05817- 4-3.98212- 5 32633  4  959
-1.82843- 5-1.19599- 5-9.08446- 6-8.02472- 6-8.58906- 6-1.40747- 5 32633  4  960
 0.00000+ 0 0.00000+ 0          12          19          12          20 32633  4  961
-2.10670- 2-3.73993- 3-6.23950- 4-1.74668- 4-7.25652- 5-2.76354- 5 32633  4  962
-1.24404- 5-8.13740- 6-6.18098- 6-5.45994- 6-5.84391- 6-9.57630- 6 32633  4  963
 0.00000+ 0 0.00000+ 0          12          19          12          21 32633  4  964
-1.75379- 2-3.11578- 3-5.22155- 4-1.48190- 4-6.32026- 5-2.56708- 5 32633  4  965
-1.03550- 5-6.77328- 6-5.14482- 6-4.54466- 6-4.86426- 6-7.97097- 6 32633  4  966
 0.00000+ 0 0.00000+ 0          12          19          12          22 32633  4  967
-1.62260- 2-2.88949- 3-4.90917- 4-1.45075- 4-6.64791- 5-3.13859- 5 32633  4  968
-9.57625- 6-6.26391- 6-4.75791- 6-4.20288- 6-4.49845- 6-7.37153- 6 32633  4  969
 0.00000+ 0 0.00000+ 0          12          19          12          23 32633  4  970
-1.24270- 2-2.22318- 3-3.87761- 4-1.23118- 4-6.29763- 5-3.55438- 5 32633  4  971
-7.32785- 6-4.79321- 6-3.64081- 6-3.21609- 6-3.44227- 6-5.64078- 6 32633  4  972
 0.00000+ 0 0.00000+ 0          12          19          12          24 32633  4  973
-9.81031- 3-1.77611- 3-3.30389- 4-1.21935- 4-7.45627- 5-5.18605- 5 32633  4  974
-7.84091- 6-3.93980- 6-2.86779- 6-2.53325- 6-2.71190- 6-4.44312- 6 32633  4  975
 0.00000+ 0 0.00000+ 0          12          19          12          25 32633  4  976
-9.94913- 3-1.76595- 3-2.94357- 4-8.21732- 5-3.39546- 5-1.73183- 5 32633  4  977
-1.01459- 4-1.14334- 5-2.91911- 6-2.57858- 6-2.75993- 6-4.52264- 6 32633  4  978
 0.00000+ 0 0.00000+ 0          12          19          12          26 32633  4  979
-1.04560- 2-1.85593- 3-3.09359- 4-8.63599- 5-3.56845- 5-1.39812- 5 32633  4  980
-1.83700- 5-1.35159- 4-3.06784- 6-2.70996- 6-2.90054- 6-4.75307- 6 32633  4  981
 0.00000+ 0 0.00000+ 0          12          19          12          27 32633  4  982
-1.1-644- 2-1.96391- 3-3.27354- 4-9.13847- 5-3.77587- 5-1.41778- 5 32633  4  983
-6.53391- 4-4.27389- 6-2.17194- 4-2.86764- 6-3.06931- 6-5.02962- 6 32633  4  984
 0.00000+ 0 0.00000+ 0          12          19          12          28 32633  4  985
-1.37246- 2-2.43608- 3-4.06058- 4-1.13356- 4-4.68368- 5-1.75864- 5 32633  4  986
-8.1-482- 6-5.30143- 6-4.02684- 6-3.03990- 4-1.09600- 4-9.23886- 6 32633  4  987
 0.00000+ 0 0.00000+ 0          12          19          12          29 32633  4  988
-2.07988- 2-3.69175- 3-6.15359- 4-1.71784- 4-7.09785- 5-2.66513- 5 32633  4  989
-1.22824- 5-8.03402- 6-6.10245- 6-1.55180- 4-2.37058- 4-8.47901- 5 32633  4  990
 0.00000+ 0 0.00000+ 0          12          19          12          30 32633  4  991
-3.85016- 2-6.83396- 3-1.13912- 3-3.17998- 4-1.31391- 4-4.93354- 5 32633  4  992
-2.27365- 5-1.48721- 5-1.12965- 5-9.97873- 6-9.57846- 5-1.83795- 4 32633  4  993
 0.00000+ 0 0.00000+ 0           0         104           0          30 32633  4  994
 0.00000+ 0 0.00000+ 0           5          26           5          26 32633  4  995
-2.59263- 3-2.64153- 5-5.99977- 6-2.74906- 6-1.91200- 6             32633  4  996
 0.00000+ 0 0.00000+ 0           5          26           5          27 32633  4  997
-3.47481- 3-3.01192- 4-7.41987- 6-3.39974- 6-2.36456- 6             32633  4  998
 0.00000+ 0 0.00000+ 0           5          26           5          28 32633  4  999
-3.97400- 3-3.73606- 5-1.37411- 3-1.36912- 3-2.93395- 6             32633  4 1000
 0.00000+ 0 0.00000+ 0           5          26           5          29 32633  4 1001
-6.02237- 3-5.66179- 5-4.52828- 3-4.52072- 3-4.44488- 6             32633  4 1002
 0.00000+ 0 0.00000+ 0           5          26           5          30 32633  4 1003
-1.11483- 2-1.04808- 4-2.58194- 5-1.18303- 5-1.20244- 2             32633  4 1004
```

Cross sections for the various reactions (MT-Nos.) for each nuclide are also given in ERRFILS in an ENDF-like format in File No. 3 (MF=3), and the boundaries of the group structure from low to high in eV are given in MF=1, MT=451.

A small routine named COVARD was written to retrieve the covariance data from ERRFILS, fill out the gaps in the matrices with zeros, and invert the results so that the data would be rearranged from high to low energy. COVARD also contains an option for multiplying the relative covariance matrices obtained from ERRFILS by the product of the cross sections of the two reactions involved to obtain absolute covariance matrices. The output of COVARD, then, consists of (a) the 30-group cross sections of the reactions involved, (b) the 30 group x 30 group relative covariance matrix for the reactions, and (c) the 30 group x 30 group absolute covariance matrix for the reactions.

Each data set on ERRFILS can be specified by four numbers; namely, MAT1, the identifying number of the first material; MAT2, the identifying number of the second material; MT1, the identifying number of the reaction in MAT1; and MT2, the identifying number of the reaction in MAT2. Note, however, in the present version of ERRFILS, MAT2 is always equal to MAT1; that is, there are no covariances for reactions in different materials in this version. For simplicity in the calling sequence in COVARD, we have arranged to have a single ID number represent one combination of MAT1, MAT2, MT1, MT2. The definitions of the ID-numbers that we have assigned are given in Table VIII.

By comparing TABLE VIII with Table VI, one can see that we've eliminated many of the reactions for which covariance data exist on ERRFILS. We do not retrieve any of the data for the various inelastic levels and continua or for those reactions having negligibly small cross sections. Although COVARD will operate successfully on ERRFILS, we have prepared a stripped down version of ERRFILS name ERRFILT containing only those reactions given in Table VIII. The use of ERRFILT rather than ERRFILS somewhat decreases the running time for sequential problems for COVARD, as the data file is rewound every time a new ID is searched for.

TABLE VIII

DEFINITIONS OF ID-Nos. IN TERMS OF SPECIFICATION OF CROSS-SECTION COVARIANCES (NOTE: In this version, MAT1=MAT2)

ID-NO	MAT1	MAT2	MT1	MT2	CROSS SECTION COVARIANCE
1	305	305	1	1	B10 TOTAL WITH B10 TOTAL
2	305	305	1	2	B10 TOTAL WITH B10 ELASTIC
3	305	305	1	107	B10 TOTAL WITH B10 (N,ALPHA)
4	305	305	2	2	B10 ELASTIC WITH B10 ELASTIC
5	305	305	2	107	B10 ELASTIC WITH B10 (N,ALPHA)
6	305	305	107	107	B10 (N,ALPHA) WITH B10 (N,ALPHA)
7	306	306	1	1	C TOTAL WITH C TOTAL
8	306	306	1	2	C TOTAL WITH C ELASTIC
9	306	306	2	2	C ELASTIC WITH C ELASTIC
10	306	306	4	4	C INELASTIC WITH C INELASTIC
11	306	306	107	107	C (N,ALPHA) WITH C (N,ALPHA)
12	324	324	1	1	CR TOTAL WITH CR TOTAL
13	324	324	1	2	CR TOTAL WITH CR ELASTIC
14	324	324	2	2	CR ELASTIC WITH CR ELASTIC
15	324	324	2	4	CR ELASTIC WITH CR INELASTIC
16	324	324	4	4	CR INELASTIC WITH CR INELASTIC
17	324	324	4	102	CR INELASTIC WITH CR CAPTURE
18	324	324	102	102	CR CAPTURE WITH CR CAPTURE
19	326	326	1	1	FE TOTAL WITH FE TOTAL
20	326	326	1	2	FE TOTAL WITH FE ELASTIC
21	326	326	1	102	FE TOTAL WITH FE CAPTURE
22	326	326	2	2	FE ELASTIC WITH FE ELASTIC
23	326	326	2	4	FE ELASTIC WITH FE INELASTIC
24	326	326	2	102	FE ELASTIC WITH FE CAPTURE
25	326	326	4	4	FE INELASTIC WITH FE INELASTIC
26	326	326	4	102	FE INELASTIC WITH FE CAPTURE
27	326	326	4	103	FE INELASTIC WITH FE (N,P)
28	326	326	4	107	FE INELASTIC WITH FE (N,ALPHA)
29	326	326	102	102	FE CAPTURE WITH FE CAPTURE
30	326	326	103	103	FE (N,P) WITH FE (N,P)
31	326	326	107	107	FE (N,ALPHA) WITH FE (N,ALPHA)
32	328	328	1	1	NI TOTAL WITH NI TOTAL
33	328	328	2	2	NI ELASTIC WITH NI ELASTIC
34	328	328	4	4	NI INELASTIC WITH NI INELASTIC
35	328	328	102	102	NI CAPTURE WITH NI CAPTURE
36	328	328	103	103	NI (N,P) WITH NI (N,P)
37	329	329	1	1	CU TOTAL WITH CU TOTAL
38	329	329	1	2	CU TOTAL WITH CU ELASTIC
39	329	329	2	2	CU ELASTIC WITH CU ELASTIC
40	329	329	2	4	CU ELASTIC WITH CU INELASTIC
41	329	329	4	4	CU INELASTIC WITH CU INELASTIC
42	329	329	4	102	CU INELASTIC WITH CU CAPTURE
43	329	329	4	103	CU INELASTIC WITH CU (N,P)
44	329	329	4	107	CU INELASTIC WITH CU (N,ALPHA)
45	329	329	102	102	CU CAPTURE WITH CU CAPTURE
46	329	329	103	103	CU (N,P) WITH CU (N,P)
47	329	329	107	107	CU (N,ALPHA) WITH CU (N,ALPHA)
48	382	382	1	1	PB TOTAL WITH PB TOTAL
49	382	382	1	2	PB TOTAL WITH PB ELASTIC
50	382	382	1	102	PB TOTAL WITH PB CAPTURE
51	382	382	2	2	PB ELASTIC WITH PB ELASTIC
52	382	382	2	4	PB ELASTIC WITH PB INELASTIC
53	382	382	4	4	PB INELASTIC WITH PB INELASTIC
54	382	382	4	102	PB INELASTIC WITH PB CAPTURE
55	382	382	102	102	PB CAPTURE WITH PB CAPTURE
56	1301	1301	1	1	H TOTAL WITH H TOTAL
57	1301	1301	1	2	H TOTAL WITH H ELASTIC
58	1301	1301	2	2	H ELASTIC WITH H ELASTIC

MF1=3,MF2=33
MT1=MT-NO FOR SIGMA-1,MT2=MT NO FOR SIGMA-2.

III. FISSION PRODUCTS AND ACTINIDES: YIELDS, YIELD THEORY, DECAY DATA, DEPLETION, AND BUILDUP

A. Fission-Yield Theory [R. E. Pepping (University of Wisconsin), C. W. Maynard (University of Wisconsin), D. G. Madland, T. R. England, and P. G. Young]

Some empiricism has been introduced into the yield model through the spacing parameter δ. Delta is to be interpreted as the distance between the tips of the deformed, coaxial fragments at the scission point. In order to minimize the effect of prompt neutrons, experimental values for the charge yields, summed over all masses, were taken from ENDF/B-VC[56] for ^{235}U thermal fission, and the parameter δ was allowed to vary with Z, the light fragment charge number. The values of $\delta(Z)$ were determined by performing a GMAX calculation[57] with level density parameters as reported previously[58] on a discrete grid of the δ-values ranging from 1-7 fm. The δ parameters affect the energy release at scission, which enters the yield expression in an exponential. The resulting yields were then binned according to charge and the log of the unnormalized yield fit by a cubic spline in δ. The final set of δ-parameters were then determined using a standard least-squares package. The values of δ thus obtained varied in an even-odd fashion, the even Z's giving a value of about 6 fm and the odd Z's giving a value of about 4 fm. The agreement between computed and measured charge yields is good, but the total kinetic energy of the fragments is much too low, being only about 145 MeV. Also, for a given mass number, A, the even Z fragments are enhanced by almost 1500% as compared to the 22% value for fission products in ENDF/B-VC. It is unlikely that prompt neutron emission, which connects the fission products to the fission fragments, could reduce the computed enhancement to the measured enhancement.

Attempting to increase the total kinetic energy by increasing the Coulomb energy at scission gives another set of δ's. These also vary according to the evenness or oddness of the light fragment charge. The total kinetic energy obtained with these δ's is about 159 MeV, and the even Z enhancement along a given mass chain is reduced to a more modest 300%. Of course, there is some loss of agreement between the computed and measured charge yields. In Fig. 10, the computed and measured charge yields are plotted. The circles denote the measured values, and the solid line denotes the computed values. In Fig. 11, the computed fragment mass yield (solid line) is plotted. For reference, the measured product mass yield is also plotted (circles).

The smaller values of δ also introduce another problem. In seeking the minimum potential energy configuration at the scission point, the Coulomb energy corresponding to the smaller δ is so strong that the fragments seek a shape of greater deformation than that for which the mass may be computed. In order to stay within the current allowed space of fragment shapes, it appears that a low value of the total fragment kinetic energy will have to be accepted.

In order to compare this calculation to the results of a previous calculation,[59] the values of $\delta(Z)$ were fit to a polynomial expression that included an even-odd term. The expression which resulted was

$$\delta(Z) = (\delta_{Z,even} - \delta_{Z,odd})\left(\sum_{n=0}^{4} p_n Z^n\right) + p_5 Z + p_6 Z^5 \quad ,$$

where

$$\delta_{Z,even} = \begin{cases} 1, & Z = \text{even} \\ 0, & Z = \text{odd} \end{cases} \quad \text{and} \quad \delta_{z,odd} = \begin{cases} 1, & Z = \text{odd} \\ 0, & Z = \text{even} \end{cases} \quad .$$

Using the even-odd term from this expression, and A-dependent term $\delta(A,Z)$ may be extracted from the computed yields,

$$\delta(A,Z) = \delta(A) + (\delta_{Z,even} - \delta_{Z,odd}) \sum_{n=0}^{4} p_n Z^n \quad ,$$

where

$$\delta(A) = \sum_i y(A,Z_i) \; [R_c(A,Z_i) - R_{01}(A,Z_1) - R_{02}(A,Z_2)$$

$$- (\delta_{Z,even} - \delta_{Z,odd}) \sum_{n=0}^{4} p_n Z^4] \; ,$$

R_c = fragment center-to-center distance,
R_{01} = light fragment center-to-tip distance at the GMAX shape,
R_{02} = heavy fragment center-to-tip distance at the GMAX shape.

The $y(A,Z_i)$ are identified as the fractional independent yields. The resulting $\delta(A)$ parameters have a fairly constant value of 3 fm for light fragment mass less than 90 and decrease almost linearly to a value of 1.75 fm at mass 118.

Yields may then be computed assuming δ to be a function of both A and Z, using the equation for (A,Z) given above.

The computed charge yields are plotted in Fig. 12 (solid line) along with the measured values (circles). In Fig. 13 the computed fragment mass yields are computed, and the measured product mass yields (circles) are also computed for reference.

Currently, possible improvements in the level density expression are being examined. The parameters of the current level density expression were determined by fitting to experimentally observed neutron resonance spacings. The agreement at higher excitation energies with other formulations of the level density is unsatisfactory.[60] A newer model[61] appears to give good agreement at both low and high excitation energies and is currently under investigation. Another possibility being considered is a hybrid model that combines the older result at lower excitation and the desired high excitation behavior.

B. ENDF/B-V Yields (T. R. England, D. G. Madland, W. B. Wilson, N. L. Whittemore and J. Liaw (University of Oklahoma)]

ENDF/B-V contains independent and cumulative yields by A and Z but not mass chain yields. Mass chain yields and uncertainties are listed in Table IX for each of the 20 ENDF/B-V yield sets. This table is based on yield version VE, which has been sent to BNL and accepted for ENDF/B-V.

Extensive data tests have been completed on these yields and the results are now being reduced for inclusion in a summary report. Some of the more significant results of interest to the user will be included in the next progress report. No test has indicated any significant error in these yields, but their quality naturally varies because of a lack of experimental data for some fissionable nuclides and fission-neutron energies.

C. ANS 5.1 Decay-Heat Standard [T. R. England, R. E. Schenter (Hanford Engineering Development Laboratory), and F. Schmittroth (Hanford Engineering Development Laboratory)]

The ANS 5.1 Decay Heat Working Group met on September 8, 1978, to review comments by the Nuclear Power Plant Standards Committee, Nuclear Regulatory Commission, and ANS 5 members. Substantial clarifying changes were made in the text, but no change was made in the technical approach, decay-heat values, or uncertainties. Figure 14 compares the new ^{235}U standard with the previous standard for the case of infinite ^{235}U fission without fuel depletion or absorption in the

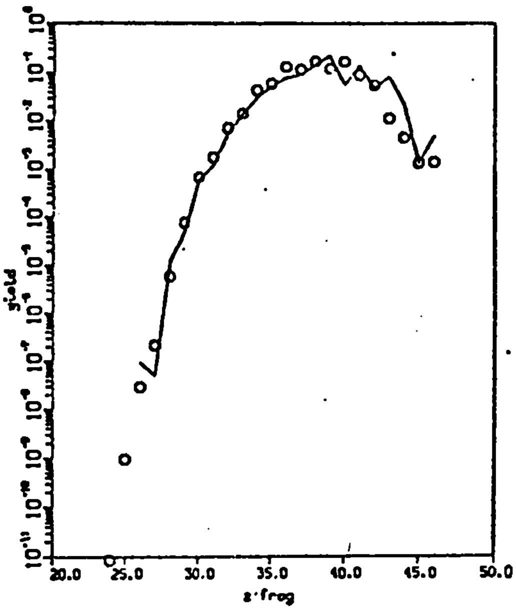

Fig. 10.
Independent yield vs light-fragment charge for $\delta=\delta(Z)$. Circles denote ENDF/B-VC data, solid line denotes computed value.

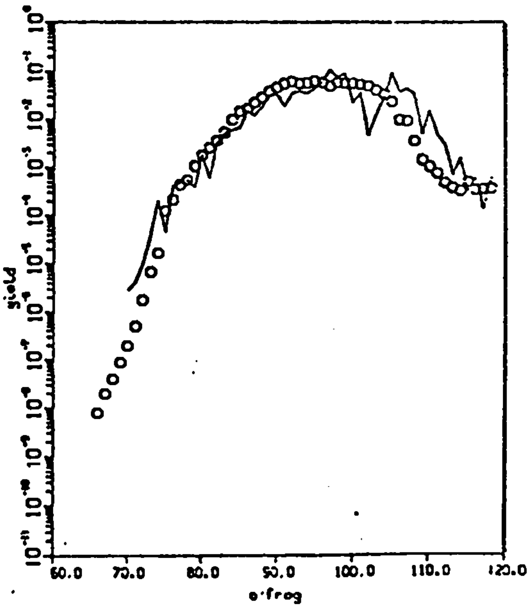

Fig. 11.
Independent yield vs light-fragment mass for $\delta=\delta(Z)$. Circles denote ENDF/B-VC for light-fission product, solid line gives computed light-fragment yield.

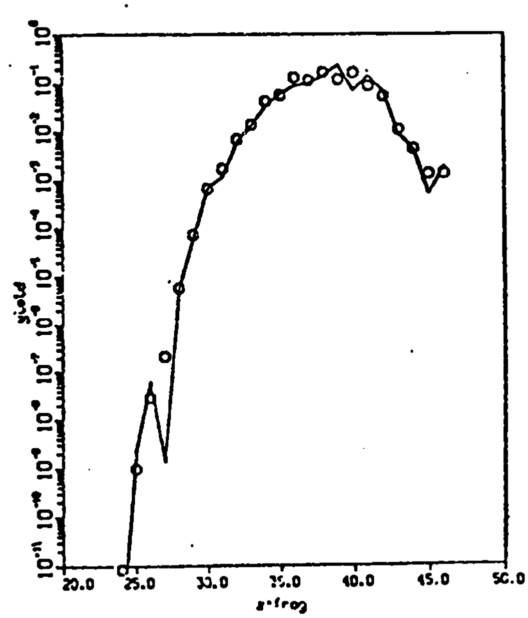

Fig. 12.
Independent yield vs fragment charge for $\delta(A,Z)= \delta(A)$ + pairing switch. Circles denot ENDF/B-VC data, solid line gives computed value.

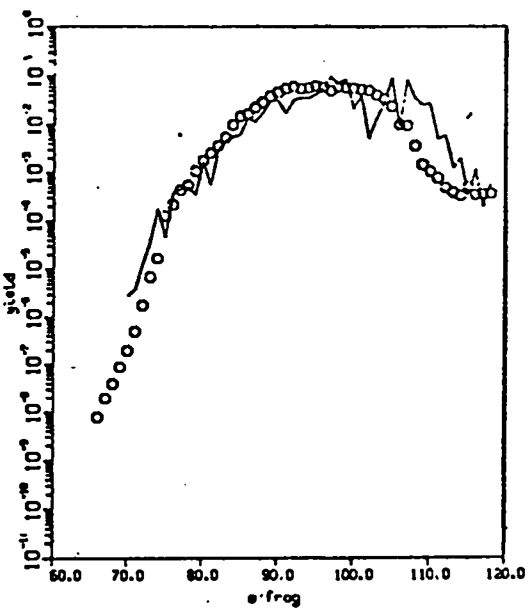

Fig. 13.
Independent yield vs light-fragment mass for $\delta(A,Z)=\delta(A)$ + pairing switch. Circles denote ENDF/B-VC light-product mass yield, solid line denotes light-fragment mass yield.

TABLE IX

ENDF/B-VE MASS CHAIN YIELDS/100 FISSIONS (UNCERTAINTIES IN %)

MASS	TH232(F)	UNCERTAINTY	TH232(HE)	UNCERTAINTY	U233(T)	UNCERTAINTY	U233(F)	UNCERTAINTY	U233(HE)	UNCERTAINTY
66	1.220E-06	+/- 32.00	1.290E-04	+/- 6.00	2.639E-07	+/- 23.00	4.500E-07	+/- 32.00	6.680E-04	+/- 11.00
67	4.191E-06	+/- 32.00	2.200E-04	+/- 8.00	1.200E-06	+/- 23.00	1.800E-06	+/- 32.00	1.520E-03	+/- 16.00
68	1.450E-05	+/- 32.00	7.330E-04	+/- 8.00	3.678E-06	+/- 23.00	5.500E-06	+/- 32.00	1.828E-03	+/- 32.00
69	3.351E-05	+/- 32.00	1.462E-03	+/- 8.00	1.010E-05	+/- 23.00	1.500E-05	+/- 32.00	2.940E-03	+/- 32.00
70	6.612E-05	+/- 23.00	2.685E-03	+/- 8.00	3.948E-05	+/- 23.00	6.000E-05	+/- 23.00	4.768E-03	+/- 32.00
71	1.680E-04	+/- 23.00	5.117E-03	+/- 8.00	1.749E-04	+/- 23.00	2.600E-04	+/- 32.00	7.549E-03	+/- 32.00
72	4.461E-04	+/- 16.00	7.637E-03	+/- 8.00	5.058E-04	+/- 23.00	7.700E-04	+/- 32.00	1.291E-02	+/- 8.00
73	6.632E-04	+/- 16.00	1.601E-02	+/- 6.00	1.135E-03	+/- 16.00	1.699E-03	+/- 23.00	1.919E-02	+/- 11.00
74	1.189E-03	+/- 16.00	2.915E-02	+/- 8.00	2.759E-03	+/- 23.00	4.198E-03	+/- 32.00	2.832E-02	+/- 16.00
75	2.969E-03	+/- 16.00	5.117E-02	+/- 8.00	8.278E-03	+/- 23.00	1.249E-02	+/- 32.00	4.387E-02	+/- 16.00
76	7.137E-03	+/- 16.00	8.745E-02	+/- 8.00	1.471E-02	+/- 22.99	2.220E-02	+/- 31.99	6.744E-02	+/- 15.99
77	1.229E-02	+/- 8.00	1.253E-01	+/- 8.00	2.615E-02	+/- 23.00	4.049E-02	+/- 23.00	1.028E-01	+/- 16.00
78	3.644E-02	+/- 16.00	2.406E-01	+/- 8.00	5.518E-02	+/- 23.00	6.997E-02	+/- 32.00	1.562E-01	+/- 16.00
79	8.465E-02	+/- 11.00	1.214E+00	+/- 6.00	1.512E-01	+/- 16.00	1.100E-01	+/- 23.00	2.328E-01	+/- 16.00
80	2.046E-01	+/- 16.00	1.293E+00	+/- 8.00	2.391E-01	+/- 23.00	1.999E-01	+/- 32.00	3.404E-01	+/- 16.00
81	4.290E-01	+/- 16.00	1.463E+00	+/- 8.00	2.910E-01	+/- 16.00	3.700E-01	+/- 6.00	5.466E-01	+/- 23.00
82	1.116E+00	+/- 16.00	1.675E+00	+/- 8.00	5.521E-01	+/- 22.97	5.827E-01	+/- 7.06	8.378E-01	+/- 22.84
83	2.223E+00	+/- 1.40	1.679E+00	+/- 4.00	1.018E+00	+/- .70	9.942E-01	+/- 2.00	1.307E+00	+/- 6.00
84	4.108E+00	+/- 2.00	2.282E+00	+/- 4.00	1.704E+00	+/- 1.00	1.640E+00	+/- 2.00	2.058E+00	+/- 4.00
85	4.242E+00	+/- 2.00	4.314E+00	+/- 4.00	2.196E+00	+/- .70	2.174E+00	+/- 6.00	2.042E+00	+/- 8.00
86	6.723E+00	+/- 2.00	5.191E+00	+/- 8.00	2.859E+00	+/- 1.40	2.783E+00	+/- 2.00	2.691E+00	+/- 15.98
87	7.154E+00	+/- 2.80	4.797E+00	+/- 4.00	4.019E+00	+/- 1.00	3.802E+00	+/- 2.00	3.327E+00	+/- 6.00
88	7.480E+00	+/- 2.00	5.123E+00	+/- 4.00	5.504E+00	+/- 1.00	5.117E+00	+/- 2.00	3.989E+00	+/- 6.00
89	7.600E+00	+/- 4.00	5.727E+00	+/- 2.80	6.314E+00	+/- 2.80	5.859E+00	+/- 6.00	4.607E+00	+/- 6.00
90	7.685E+00	+/- 6.00	5.894E+00	+/- 2.80	6.906E+00	+/- 2.80	6.450E+00	+/- 2.00	4.746E+00	+/- 8.00
91	7.378E+00	+/- 2.80	5.862E+00	+/- 2.80	6.537E+00	+/- 1.00	6.470E+00	+/- 2.00	5.156E+00	+/- 6.00
92	6.833E+00	+/- 4.00	5.598E+00	+/- 4.00	6.595E+00	+/- 1.00	6.494E+00	+/- 2.00	5.531E+00	+/- 4.00
93	6.731E+00	+/- 4.00	5.454E+00	+/- 2.80	7.014E+00	+/- 1.00	6.882E+00	+/- 2.00	5.394E+00	+/- 6.00
94	5.682E+00	+/- 6.00	7.061E+00	+/- 8.00	6.815E+00	+/- 1.00	6.740E+00	+/- 2.00	5.061E+00	+/- 16.00
95	5.374E+00	+/- 4.00	4.752E+00	+/- 6.00	6.190E+00	+/- 4.00	6.272E+00	+/- 2.00	5.024E+00	+/- 6.00
96	4.409E+00	+/- 6.00	3.640E+00	+/- 8.00	5.665E+00	+/- 1.00	5.705E+00	+/- 2.00	4.845E+00	+/- 15.94
97	4.454E+00	+/- 2.00	3.179E+00	+/- 4.00	5.458E+00	+/- 1.00	5.455E+00	+/- 2.00	4.712E+00	+/- 4.00
98	3.700E+00	+/- 6.00	2.612E+00	+/- 8.00	5.158E+00	+/- 1.40	5.140E+00	+/- 2.00	4.031E+00	+/- 11.00
99	2.876E+00	+/- 4.00	2.020E+00	+/- 2.80	4.874E+00	+/- 2.80	4.681E+00	+/- 4.00	3.611E+00	+/- 2.80
100	1.379E+00	+/- 6.00	1.551E+00	+/- 8.00	4.408E+00	+/- 1.40	4.380E+00	+/- 2.00	3.151E+00	+/- 11.00
101	7.305E-01	+/- 11.00	1.508E+00	+/- 8.00	3.231E+00	+/- 1.00	3.740E+00	+/- 6.00	2.803E+00	+/- 11.00
102	3.732E-01	+/- 11.00	1.058E+00	+/- 8.00	2.451E+00	+/- 1.40	2.830E+00	+/- 6.00	2.524E+00	+/- 16.00
103	1.528E-01	+/- 6.00	9.555E-01	+/- 6.00	1.669E+00	+/- 4.00	1.772E+00	+/- 6.00	2.345E+00	+/- 6.00
104	9.059E-02	+/- 11.00	9.872E-01	+/- 8.00	1.029E+00	+/- 1.40	1.240E+00	+/- 6.00	1.991E+00	+/- 16.00
105	4.617E-02	+/- 4.00	9.677E-01	+/- 4.00	4.829E-01	+/- 16.00	8.981E-01	+/- 6.00	1.816E+00	+/- 6.00
106	4.414E-02	+/- 8.00	1.089E+00	+/- 6.00	2.587E-01	+/- 1.00	2.920E-01	+/- 6.00	1.418E+00	+/- 11.00
107	5.194E-02	+/- 11.00	1.017E+00	+/- 8.00	1.174E-01	+/- 16.00	1.500E-01	+/- 8.00	1.467E+00	+/- 16.00
108	6.262E-02	+/- 16.00	1.029E+00	+/- 8.00	6.318E-02	+/- 16.00	1.100E-01	+/- 32.00	1.476E+00	+/- 16.00
109	6.091E-02	+/- 11.00	1.181E+00	+/- 6.00	4.419E-02	+/- 11.00	9.269E-02	+/- 16.00	1.670E+00	+/- 8.00
110	7.219E-02	+/- 16.00	1.096E+00	+/- 8.00	2.612E-02	+/- 16.00	8.997E-02	+/- 32.00	1.334E+00	+/- 22.99
111	7.132E-02	+/- 8.00	1.204E+00	+/- 4.00	1.921E-02	+/- 8.00	7.711E-02	+/- 8.00	1.399E+00	+/- 6.00
112	8.621E-02	+/- 8.00	1.277E+00	+/- 4.00	1.440E-02	+/- 11.00	6.890E-02	+/- 16.00	1.662E+00	+/- 6.00
113	8.630E-02	+/- 11.00	1.220E+00	+/- 4.00	1.366E-02	+/- 16.00	6.692E-02	+/- 16.00	1.722E+00	+/- 8.00
114	7.578E-02	+/- 16.00	1.150E+00	+/- 8.00	1.308E-02	+/- 16.00	6.297E-02	+/- 32.00	1.267E+00	+/- 16.00
115	6.924E-02	+/- 6.00	1.268E+00	+/- 6.00	1.183E-02	+/- 16.00	5.627E-02	+/- 11.00	1.370E+00	+/- 8.00

MASS	TH232(F)	UNCERTAINTY	TH232(HE)	UNCERTAINTY	U233(T)	UNCERTAINTY	U233(F)	UNCERTAINTY	U233(HE)	UNCERTAINTY
116	7.542E-02	+/- 16.00	1.550E+00	+/- 8.00	1.442E-02	+/- 16.00	6.318E-02	+/- 23.00	1.403E+00	+/- 15.99
117	6.812E-02	+/- 8.00	1.847E+00	+/- 6.00	1.141E-02	+/- 11.00	5.270E-02	+/- 16.00	1.332E+00	+/- 11.00
118	6.490E-02	+/- 16.00	1.480E+00	+/- 8.00	1.224E-02	+/- 11.00	5.186E-02	+/- 23.00	1.300E+00	+/- 16.00
119	5.893E-02	+/- 16.00	1.417E+00	+/- 8.00	1.258E-02	+/- 11.00	6.425E-02	+/- 16.00	1.238E+00	+/- 16.00
120	5.593E-02	+/- 16.00	1.370E+00	+/- 8.00	1.384E-02	+/- 11.00	7.165E-02	+/- 23.00	1.177E+00	+/- 16.00
121	5.041E-02	+/- 8.00	9.747E-01	+/- 6.00	1.496E-02	+/- 23.00	7.686E-02	+/- 16.00	1.653E+00	+/- 8.00
122	3.765E-02	+/- 16.00	1.261E+00	+/- 8.00	1.475E-02	+/- 11.00	7.164E-02	+/- 23.00	1.261E+00	+/- 22.99
123	3.056E-02	+/- 16.00	1.257E+00	+/- 8.00	1.990E-02	+/- 23.00	7.434E-02	+/- 23.00	1.371E+00	+/- 16.00
124	2.737E-02	+/- 16.00	1.499E+00	+/- 7.64	2.434E-02	+/- 10.99	1.039E-01	+/- 22.96	1.540E+00	+/- 15.78
125	3.861E-02	+/- 11.00	1.224E+00	+/- 8.00	1.122E-01	+/- 11.00	1.383E-01	+/- 8.00	1.814E+00	+/- 6.00
126	5.013E-02	+/- 16.00	1.309E+00	+/- 8.00	2.464E-01	+/- 23.00	2.735E-01	+/- 11.00	1.996E+00	+/- 16.00
127	9.077E-02	+/- 8.00	1.141E+00	+/- 4.00	5.617E-01	+/- 11.00	5.000E-01	+/- 6.00	2.232E+00	+/- 4.00
128	1.861E-01	+/- 16.00	1.522E+00	+/- 8.00	7.573E-01	+/- 6.00	1.111E+00	+/- 8.00	2.580E+00	+/- 16.00
129	3.730E-01	+/- 11.00	1.567E+00	+/- 6.00	1.613E+00	+/- 16.00	1.682E+00	+/- 6.00	2.856E+00	+/- 11.00
130	8.399E-01	+/- 11.00	2.258E+00	+/- 7.91	2.101E+00	+/- 15.98	2.519E+00	+/- 7.99	3.237E+00	+/- 15.73
131	1.621E+00	+/- 2.00	2.668E+00	+/- 4.00	3.606E+00	+/- .70	3.738E+00	+/- 2.00	3.457E+00	+/- 6.00
132	2.881E+00	+/- 1.40	3.200E+00	+/- 4.00	4.939E+00	+/- 1.00	4.953E+00	+/- 2.00	4.071E+00	+/- 4.00
133	3.964E+00	+/- 4.00	4.298E+00	+/- 6.00	6.022E+00	+/- .70	6.005E+00	+/- 2.00	4.564E+00	+/- 6.00
134	5.290E+00	+/- 2.00	6.812E+00	+/- 6.00	6.310E+00	+/- .70	6.218E+00	+/- 2.00	5.015E+00	+/- 5.98
135	5.382E+00	+/- 2.00	4.994E+00	+/- 4.00	6.215E+00	+/- 1.40	6.359E+00	+/- 2.00	5.070E+00	+/- 6.00
136	5.655E+00	+/- 2.00	5.853E+00	+/- 7.98	7.122E+00	+/- 3.94	6.985E+00	+/- 1.95	6.920E+00	+/- 13.80
137	6.640E+00	+/- 4.00	5.263E+00	+/- 2.80	6.812E+00	+/- .70	6.633E+00	+/- 2.00	4.958E+00	+/- 4.00
138	7.140E+00	+/- 11.00	5.301E+00	+/- 2.80	5.914E+00	+/- 1.40	6.479E+00	+/- 2.00	5.946E+00	+/- 11.00
139	7.156E+00	+/- 2.80	5.523E+00	+/- 2.80	6.334E+00	+/- 4.00	6.330E+00	+/- 2.00	5.871E+00	+/- 4.00
140	7.704E+00	+/- 2.80	5.767E+00	+/- 2.80	6.493E+00	+/- 1.00	6.214E+00	+/- 2.00	4.429E+00	+/- 4.00
141	7.303E+00	+/- 4.00	5.666E+00	+/- 2.80	6.531E+00	+/- 2.80	6.405E+00	+/- 2.60	4.630E+00	+/- 6.00
142	6.318E+00	+/- 4.00	5.019E+00	+/- 6.00	6.656E+00	+/- 1.00	6.468E+00	+/- 2.00	4.463E+00	+/- 16.00
143	6.519E+00	+/- 2.80	4.893E+00	+/- 2.80	5.892E+00	+/- 1.00	5.531E+00	+/- 2.00	3.275E+00	+/- 4.00
144	7.817E+00	+/- 4.00	3.928E+00	+/- 6.00	4.639E+00	+/- .70	4.485E+00	+/- 2.00	2.507E+00	+/- 8.00
145	5.283E+00	+/- 2.80	2.441E+00	+/- 4.00	3.392E+00	+/- .70	3.180E+00	+/- 2.00	2.040E+00	+/- 8.00
146	4.514E+00	+/- 4.00	2.252E+00	+/- 8.00	2.536E+00	+/- 1.00	2.375E+00	+/- 2.00	1.648E+00	+/- 16.00
147	3.011E+00	+/- 4.00	1.775E+00	+/- 4.00	1.750E+00	+/- 2.80	1.681E+00	+/- 2.00	1.195E+00	+/- 6.00
148	1.979E+00	+/- 2.80	9.799E-01	+/- 8.00	1.272E+00	+/- .70	1.192E+00	+/- 2.00	9.031E-01	+/- 23.00
149	8.832E-01	+/- 16.00	7.540E-01	+/- 6.00	7.771E-01	+/- 2.80	7.032E-01	+/- 2.00	6.234E-01	+/- 11.00
150	3.466E-01	+/- 16.00	3.763E-01	+/- 8.00	5.023E-01	+/- .99	4.638E-01	+/- 1.99	4.468E-01	+/- 22.82
151	3.142E-01	+/- 6.00	2.069E-01	+/- 4.00	3.153E-01	+/- 2.00	3.046E-01	+/- 2.00	3.299E-01	+/- 8.00
152	7.591E-02	+/- 16.00	1.187E-01	+/- 8.00	2.136E-01	+/- 2.80	1.908E-01	+/- 2.00	2.205E-01	+/- 16.00
153	3.325E-02	+/- 16.00	8.271E-02	+/- 6.00	1.048E-01	+/- 6.00	1.159E-01	+/- 6.00	1.441E-01	+/- 8.00
154	7.287E-03	+/- 42.57	5.064E-02	+/- 18.87	4.669E-02	+/- 29.84	6.184E-02	+/- 28.20	9.898E-02	+/- 22.49
155	3.828E-03	+/- 23.00	2.899E-02	+/- 8.00	2.179E-02	+/- 23.00	3.268E-02	+/- 16.00	6.651E-02	+/- 16.00
156	2.561E-03	+/- 11.00	1.679E-02	+/- 8.00	1.131E-02	+/- 6.00	1.777E-02	+/- 11.00	4.344E-02	+/- 6.00
157	9.562E-04	+/- 23.00	9.733E-03	+/- 8.00	6.327E-03	+/- 8.00	9.622E-03	+/- 23.00	2.784E-02	+/- 11.00
158	5.041E-04	+/- 32.00	5.736E-03	+/- 8.00	2.315E-03	+/- 32.00	3.150E-03	+/- 32.00	1.752E-02	+/- 15.88
159	1.060E-04	+/- 32.00	4.162E-03	+/- 8.00	8.746E-04	+/- 6.00	1.685E-03	+/- 16.00	1.073E-02	+/- 11.00
160	7.512E-05	+/- 32.00	1.582E-03	+/- 8.00	3.544E-04	+/- 44.93	3.974E-04	+/- 31.88	7.214E-03	+/- 15.93
161	1.650E-05	+/- 23.00	9.950E-04	+/- 6.00	1.209E-04	+/- 6.00	9.000E-05	+/- 32.00	4.709E-03	+/- 6.00
162	8.662E-06	+/- 32.00	4.680E-04	+/- 8.00	1.569E-05	+/- 32.00	2.160E-05	+/- 32.00	2.859E-03	+/- 32.00
163	5.041E-06	+/- 32.00	2.340E-04	+/- 8.00	7.317E-06	+/- 32.00	9.900E-06	+/- 32.00	1.775E-03	+/- 32.00
164	2.211E-06	+/- 32.00	1.210E-04	+/- 8.00	2.409E-06	+/- 32.00	3.330E-06	+/- 32.00	1.065E-03	+/- 31.99
165	3.741E-07	+/- 23.00	6.680E-05	+/- 8.00	7.577E-07	+/- 23.00	1.120E-06	+/- 23.00	6.420E-04	+/- 23.00
166	1.500E-07	+/- 32.00	2.780E-05	+/- 6.00	4.628E-07	+/- 32.00	6.390E-07	+/- 32.00	2.410E-04	+/- 11.00
167	1.060E-07	+/- 32.00	1.460E-05	+/- 8.00	6.477E-08	+/- 32.00	8.910E-08	+/- 32.00	2.270E-04	+/- 32.00
168	5.751E-08	+/- 32.00	7.360E-06	+/- 8.00	1.669E-08	+/- 32.00	2.340E-08	+/- 32.00	1.380E-04	+/- 32.00
169	2.921E-08	+/- 32.00	3.570E-06	+/- 8.00	5.648E-09	+/- 32.00	7.830E-09	+/- 32.00	8.310E-05	+/- 11.00
170	1.160E-08	+/- 32.00	1.600E-06	+/- 8.00	1.671E-09	+/- 31.97	2.342E-09	+/- 31.97	4.446E-05	+/- 31.96
171	5.041E-09	+/- 32.00	7.510E-07	+/- 8.00	5.558E-10	+/- 32.00	7.200E-10	+/- 32.00	2.470E-05	+/- 32.00
172	2.591E-09	+/- 32.00	3.500E-07	+/- 8.00	1.849E-10	+/- 32.00	2.700E-10	+/- 32.00	1.890E-05	+/- 11.00

MASS	U235(T)	UNCERTAINTY	U235(F)	UNCERTAINTY	U235(HE)	UNCERTAINTY	U236(F)	UNCERTAINTY	U238(F)	UNCERTAINTY
66	7.618E-08	+/- 32.00	8.816E-07	+/- 23.00	3.010E-04	+/- 8.00	7.470E-07	+/- 32.00	1.752E-08	+/- 32.00
67	3.919E-07	+/- 32.00	2.829E-06	+/- 23.00	6.740E-04	+/- 8.00	1.870E-06	+/- 32.00	6.057E-08	+/- 32.00
68	6.609E-07	+/- 32.00	4.918E-06	+/- 23.00	9.060E-04	+/- 32.00	3.740E-06	+/- 32.00	2.283E-07	+/- 23.00
69	1.430E-06	+/- 32.00	1.060E-05	+/- 23.00	1.410E-03	+/- 32.00	8.410E-06	+/- 32.00	6.187E-07	+/- 23.00
70	3.309E-06	+/- 32.00	2.299E-05	+/- 23.00	2.412E-03	+/- 23.00	1.870E-05	+/- 32.00	1.712E-06	+/- 23.00
71	7.708E-06	+/- 32.00	5.667E-05	+/- 23.00	4.027E-03	+/- 32.00	4.670E-05	+/- 32.00	4.946E-06	+/- 23.00
72	2.679E-05	+/- 11.00	2.019E-04	+/- 23.00	6.086E-03	+/- 8.00	1.680E-04	+/- 32.00	9.321E-06	+/- 32.00
73	1.180E-04	+/- 45.00	6.027E-04	+/- 16.00	1.161E-02	+/- 8.00	6.670E-04	+/- 23.00	4.776E-05	+/- 23.00
74	3.619E-04	+/- 23.00	1.450E-03	+/- 23.00	1.740E-02	+/- 11.00	1.588E-03	+/- 32.00	9.321E-05	+/- 32.00
75	1.179E-03	+/- 23.00	9.173E-03	+/- 16.00	2.761E-02	+/- 11.00	1.214E-02	+/- 32.00	2.423E-04	+/- 23.00
76	3.857E-03	+/- 32.00	1.615E-02	+/- 23.00	4.092E-02	+/- 11.00	2.055E-02	+/- 32.00	9.049E-04	+/- 23.00
77	8.432E-03	+/- 11.00	3.539E-02	+/- 11.00	6.802E-02	+/- 11.00	4.195E-02	+/- 23.00	3.334E-03	+/- 11.00
78	2.183E-02	+/- 8.00	6.470E-02	+/- 11.00	1.020E-01	+/- 11.00	5.231E-02	+/- 32.00	1.128E-02	+/- 23.00
79	4.531E-02	+/- 4.00	1.007E-01	+/- 8.00	1.734E-01	+/- 8.00	1.049E-01	+/- 23.00	3.342E-02	+/- 16.00
80	1.308E-01	+/- 4.00	1.762E-01	+/- 11.00	2.624E-01	+/- 11.00	1.682E-01	+/- 32.00	6.950E-02	+/- 23.00
81	1.953E-01	+/- 2.80	2.537E-01	+/- 11.00	2.977E-01	+/- 11.00	2.429E-01	+/- 32.00	1.431E-01	+/- 23.00
82	3.278E-01	+/- 2.80	3.817E-01	+/- 10.99	6.241E-01	+/- 10.92	3.458E-01	+/- 31.99	2.383E-01	+/- 23.00
83	5.360E-01	+/- .50	5.722E-01	+/- 1.00	1.115E+00	+/- 4.00	5.242E-01	+/- 23.00	3.935E-01	+/- 1.00
84	9.951E-01	+/- .70	1.026E+00	+/- 1.40	1.539E+00	+/- 16.00	9.576E-01	+/- 23.00	8.149E-01	+/- 1.40
85	1.310E+00	+/- .35	1.328E+00	+/- 1.00	1.685E+00	+/- 2.80	1.509E+00	+/- 8.00	7.308E-01	+/- 1.40
86	1.969E+00	+/- .50	1.934E+00	+/- 1.00	2.624E+00	+/- 11.00	1.672E+00	+/- 16.00	1.278E+00	+/- 1.40
87	2.557E+00	+/- .70	2.479E+00	+/- 2.00	2.473E+00	+/- 2.80	2.305E+00	+/- 6.00	1.587E+00	+/- 1.40
88	3.633E+00	+/- .70	3.485E+00	+/- 1.00	3.452E+00	+/- 4.00	2.958E+00	+/- 6.00	2.060E+00	+/- 2.00
89	4.877E+00	+/- 1.40	4.527E+00	+/- 2.00	4.213E+00	+/- 2.80	3.795E+00	+/- 6.00	2.846E+00	+/- 2.00
90	5.913E+00	+/- .70	5.453E+00	+/- 1.00	4.671E+00	+/- 2.80	4.526E+00	+/- 11.00	3.240E+00	+/- 2.00
91	5.933E+00	+/- .50	5.666E+00	+/- 1.00	4.897E+00	+/- 4.00	5.640E+00	+/- 6.00	4.069E+00	+/- 2.80
92	5.980E+00	+/- .70	5.742E+00	+/- 1.00	5.356E+00	+/- 8.00	6.217E+00	+/- 6.00	4.525E+00	+/- 4.00
93	6.383E+00	+/- .70	6.135E+00	+/- 1.00	5.295E+00	+/- 6.00	5.693E+00	+/- 4.00	4.975E+00	+/- 2.80
94	6.444E+00	+/- .70	6.197E+00	+/- 1.00	5.234E+00	+/- 8.00	5.586E+00	+/- 16.00	4.977E+00	+/- 6.00
95	6.495E+00	+/- .70	6.363E+00	+/- .70	5.050E+00	+/- 6.00	6.410E+00	+/- 6.00	5.105E+00	+/- 1.00
96	6.282E+00	+/- .70	6.099E+00	+/- 1.40	5.316E+00	+/- 7.99	5.750E+00	+/- 16.00	5.932E+00	+/- 6.00
97	5.941E+00	+/- .70	5.921E+00	+/- .70	5.610E+00	+/- 4.00	5.077E+00	+/- 4.00	5.525E+00	+/- 1.00
98	5.774E+00	+/- .70	5.869E+00	+/- 1.00	4.138E+00	+/- 8.00	5.804E+00	+/- 11.00	5.812E+00	+/- 1.40
99	6.119E+00	+/- 1.00	5.755E+00	+/- 1.40	5.085E+00	+/- 4.00	5.912E+00	+/- 6.00	6.248E+00	+/- 2.00
100	6.206E+00	+/- 1.40	6.284E+00	+/- 1.00	3.970E+00	+/- 8.00	5.567E+00	+/- 11.00	6.618E+00	+/- 1.40
101	5.074E+00	+/- 1.00	5.352E+00	+/- 1.40	3.470E+00	+/- 8.00	5.293E+00	+/- 11.00	6.084E+00	+/- 6.00
102	4.236E+00	+/- 1.00	4.535E+00	+/- 1.40	3.269E+00	+/- 8.00	4.934E+00	+/- 16.00	6.327E+00	+/- 6.00
103	3.042E+00	+/- 1.40	3.276E+00	+/- 1.40	3.218E+00	+/- 2.80	4.207E+00	+/- 4.00	6.229E+00	+/- 1.40
104	1.835E+00	+/- .70	2.275E+00	+/- 2.00	2.134E+00	+/- 8.00	3.363E+00	+/- 16.00	4.989E+00	+/- 6.00
105	9.674E-01	+/- 2.00	1.210E+00	+/- 2.00	1.891E+00	+/- 4.00	2.470E+00	+/- 6.00	3.975E+00	+/- 2.80
106	4.017E-01	+/- 1.00	5.577E-01	+/- 4.00	1.570E+00	+/- 4.00	1.014E+00	+/- 8.00	2.513E+00	+/- 4.00
107	1.405E-01	+/- 6.00	3.275E-01	+/- 11.00	1.284E+00	+/- 8.00	9.247E-01	+/- 23.00	1.303E+00	+/- 8.00
108	6.706E-02	+/- 6.00	1.717E-01	+/- 16.00	1.078E+00	+/- 11.00	3.457E-01	+/- 32.00	6.011E-01	+/- 16.00
109	3.443E-02	+/- 11.00	1.148E-01	+/- 11.00	1.423E+00	+/- 4.00	1.431E-01	+/- 23.00	2.671E-01	+/- 11.00
110	3.034E-02	+/- 11.00	9.026E-02	+/- 16.00	1.049E+00	+/- 11.00	1.027E-01	+/- 32.00	1.355E-01	+/- 16.00
111	2.005E-02	+/- 4.00	4.314E-02	+/- 2.80	1.205E+00	+/- 2.80	6.542E-02	+/- 8.00	8.065E-02	+/- 2.00
112	1.610E-02	+/- 4.00	3.819E-02	+/- 2.80	1.054E+00	+/- 8.00	4.763E-02	+/- 32.00	6.504E-02	+/- 6.00
113	1.634E-02	+/- 6.00	3.367E-02	+/- 2.80	1.084E+00	+/- 8.00	3.813E-02	+/- 23.00	5.267E-02	+/- 8.00
114	1.403E-02	+/- 6.00	3.290E-02	+/- 2.80	9.797E-01	+/- 11.00	3.269E-02	+/- 32.00	3.933E-02	+/- 16.00
115	1.079E-02	+/- 11.00	2.939E-02	+/- 8.00	9.624E-01	+/- 4.00	5.124E-02	+/- 23.00	3.385E-02	+/- 4.00

MASS	U235(T) UNCERTAINTY	U235(F) UNCERTAINTY	U235(HE)UNCERTAINTY	U236(F) UNCERTAINTY	U238(F) UNCERTAINTY
116	1.690E-02 +/- 6.00	3.467E-02 +/- 4.00	9.761E-01 +/- 11.00	3.363E-02 +/- 32.00	4.162E-02 +/- 11.00
117	1.085E-02 +/- 2.80	3.385E-02 +/- 11.00	1.079E+00 +/- 8.00	3.578E-02 +/- 16.00	3.678E-02 +/- 11.00
118	1.094E-02 +/- 11.00	3.311E-02 +/- 8.00	1.105E+00 +/- 8.00	3.594E-02 +/- 23.00	3.962E-02 +/- 11.00
119	1.216E-02 +/- 11.00	3.405E-02 +/- 8.00	1.116E+00 +/- 8.00	3.499E-02 +/- 23.00	3.576E-02 +/- 11.00
120	1.210E-02 +/- 11.00	3.435E-02 +/- 8.00	1.135E+00 +/- 8.00	3.783E-02 +/- 23.00	3.577E-02 +/- 16.00
121	1.299E-02 +/- 6.00	3.522E-02 +/- 11.00	1.042E+00 +/- 4.00	3.694E-02 +/- 32.00	4.352E-02 +/- 11.00
122	1.530E-02 +/- 11.00	4.041E-02 +/- 11.00	1.206E+00 +/- 11.00	4.987E-02 +/- 32.00	3.762E-02 +/- 16.00
123	1.585E-02 +/- 4.00	4.508E-02 +/- 11.00	1.240E+00 +/- 8.00	7.187E-02 +/- 23.00	4.046E-02 +/- 16.00
124	2.592E-02 +/- 10.99	6.596E-02 +/- 11.00	1.314E+00 +/- 10.95	9.232E-02 +/- 32.00	4.436E-02 +/- 16.00
125	2.939E-02 +/- 4.00	7.095E-02 +/- 6.00	1.423E+00 +/- 8.00	1.633E-01 +/- 23.00	5.271E-02 +/- 8.00
126	5.559E-02 +/- 8.00	1.395E-01 +/- 11.00	1.778E+00 +/- 4.00	2.459E-01 +/- 23.00	6.385E-02 +/- 11.00
127	1.256E-01 +/- 6.00	2.814E-01 +/- 16.00	2.183E+00 +/- 2.80	2.265E-01 +/- 16.00	1.300E-01 +/- 6.00
128	3.507E-01 +/- 2.80	6.808E-01 +/- 11.00	2.476E+00 +/- 8.00	6.052E-01 +/- 23.00	4.615E-01 +/- 11.00
129	7.435E-01 +/- 6.00	8.926E-01 +/- 6.00	3.557E+00 +/- 8.00	1.007E+00 +/- 8.00	9.975E-01 +/- 8.00
130	1.784E+00 +/- 2.00	1.935E+00 +/- 8.00	3.648E+00 +/- 7.95	1.991E+00 +/- 16.00	1.875E+00 +/- 8.00
131	2.883E+00 +/- .50	3.178E+00 +/- .70	3.995E+00 +/- 4.00	3.034E+00 +/- 6.00	3.233E+00 +/- 1.40
132	4.298E+00 +/- .50	4.601E+00 +/- .70	4.779E+00 +/- 6.00	4.305E+00 +/- 6.00	5.130E+00 +/- 1.40
133	6.702E+00 +/- .35	6.730E+00 +/- 1.00	5.527E+00 +/- 8.00	7.026E+00 +/- 6.00	6.620E+00 +/- 1.40
134	7.795E+00 +/- .70	7.536E+00 +/- .70	6.055E+00 +/- 5.99	8.017E+00 +/- 6.00	7.565E+00 +/- 2.80
135	6.541E+00 +/- 1.00	6.581E+00 +/- .70	5.912E+00 +/- 4.00	5.790E+00 +/- 6.00	6.863E+00 +/- 1.40
136	6.316E+00 +/- .50	6.162E+00 +/- .70	5.069E+00 +/- 10.53	6.412E+00 +/- 15.99	6.855E+00 +/- 4.00
137	6.221E+00 +/- .35	6.151E+00 +/- .70	4.917E+00 +/- 2.80	6.066E+00 +/- 4.00	6.000E+00 +/- 1.00
138	6.756E+00 +/- .70	6.550E+00 +/- 1.40	4.634E+00 +/- 4.00	6.219E+00 +/- 16.00	5.666E+00 +/- 2.00
139	6.377E+00 +/- 1.00	6.328E+00 +/- 1.00	4.738E+00 +/- 4.00	5.873E+00 +/- 16.00	5.967E+00 +/- 2.80
140	6.276E+00 +/- .50	6.105E+00 +/- .70	4.478E+00 +/- 2.80	5.796E+00 +/- 2.80	5.948E+00 +/- 1.00
141	5.796E+00 +/- 1.00	5.953E+00 +/- 2.00	4.375E+00 +/- 6.00	5.541E+00 +/- 6.00	5.456E+00 +/- 2.80
142	5.877E+00 +/- .50	5.667E+00 +/- 2.00	4.247E+00 +/- 6.00	5.817E+00 +/- 6.00	4.728E+00 +/- 1.40
143	5.937E+00 +/- .35	5.686E+00 +/- .50	3.806E+00 +/- 4.00	6.085E+00 +/- 6.00	4.558E+00 +/- 1.00
144	5.474E+00 +/- .50	5.260E+00 +/- 1.40	3.122E+00 +/- 4.00	5.209E+00 +/- 4.00	4.543E+00 +/- 1.00
145	3.917E+00 +/- .35	3.743E+00 +/- .50	2.681E+00 +/- 6.00	3.668E+00 +/- 11.00	3.755E+00 +/- 1.00
146	2.975E+00 +/- .35	2.902E+00 +/- .50	2.214E+00 +/- 8.00	2.943E+00 +/- 16.00	3.393E+00 +/- 1.00
147	2.253E+00 +/- 1.00	2.096E+00 +/- 1.40	1.627E+00 +/- 4.00	2.341E+00 +/- 4.00	2.531E+00 +/- 1.40
148	1.670E+00 +/- .35	1.672E+00 +/- .35	1.203E+00 +/- 11.00	1.741E+00 +/- 16.00	2.081E+00 +/- .70
149	1.067E+00 +/- 1.40	1.026E+00 +/- 1.00	6.442E-01 +/- 8.00	1.369E+00 +/- 8.00	1.610E+00 +/- 1.40
150	6.483E-01 +/- .50	6.842E-01 +/- .70	5.173E-01 +/- 10.97	7.295E-01 +/- 31.99	1.265E+00 +/- 1.40
151	4.184E-01 +/- 1.00	4.076E-01 +/- 1.00	3.536E-01 +/- 8.00	4.227E-01 +/- 11.00	8.011E-01 +/- 2.00
152	2.678E-01 +/- .70	2.797E-01 +/- 4.00	2.624E-01 +/- 11.00	3.877E-01 +/- 32.00	5.207E-01 +/- 1.40
153	1.613E-01 +/- 2.80	1.752E-01 +/- 4.00	2.018E-01 +/- 11.00	2.553E-01 +/- 23.00	4.109E-01 +/- 2.80
154	7.340E-02 +/- 16.66	7.430E-02 +/- 17.45	8.026E-02 +/- 32.17	1.292E-01 +/- 52.33	2.134E-01 +/- 3.82
155	3.205E-02 +/- 4.00	5.616E-02 +/- 16.00	6.399E-02 +/- 11.00	9.232E-02 +/- 32.00	1.328E-01 +/- 16.00
156	1.319E-02 +/- 4.00	1.929E-02 +/- 6.00	5.271E-02 +/- 2.80	3.365E-02 +/- 6.00	6.748E-02 +/- 2.80
157	6.154E-03 +/- 8.00	1.126E-02 +/- 23.00	3.785E-02 +/- 11.00	2.308E-02 +/- 32.00	3.872E-02 +/- 16.00
158	2.915E-03 +/- 23.00	6.772E-03 +/- 16.00	2.345E-02 +/- 11.00	1.108E-02 +/- 32.00	1.730E-02 +/- 16.00
159	1.004E-03 +/- 6.00	3.053E-03 +/- 11.00	1.193E-02 +/- 8.00	4.339E-03 +/- 32.00	8.091E-03 +/- 16.00
160	3.160E-04 +/- 32.00	1.181E-03 +/- 16.00	7.175E-03 +/- 10.97	1.939E-03 +/- 32.00	3.229E-03 +/- 23.00
161	8.528E-05 +/- 4.00	3.598E-04 +/- 11.00	5.201E-03 +/- 8.00	4.920E-04 +/- 6.00	1.279E-03 +/- 8.00
162	1.920E-05 +/- 32.00	6.137E-05 +/- 23.00	2.799E-03 +/- 11.00	4.990E-04 +/- 32.00	4.916E-04 +/- 23.00
163	7.668E-06 +/- 32.00	1.020E-05 +/- 23.00	1.592E-03 +/- 11.00	1.110E-04 +/- 32.00	1.211E-04 +/- 23.00
164	2.399E-06 +/- 32.00	6.137E-06 +/- 23.00	9.841E-04 +/- 11.00	4.430E-05 +/- 32.00	3.925E-05 +/- 23.00
165	1.170E-06 +/- 23.00	2.459E-06 +/- 23.00	5.410E-04 +/- 11.00	1.700E-05 +/- 23.00	1.502E-05 +/- 23.00
166	5.519E-07 +/- 23.00	1.020E-06 +/- 23.00	2.710E-04 +/- 8.00	1.020E-05 +/- 32.00	5.386E-06 +/- 23.00
167	3.009E-07 +/- 23.00	4.098E-07 +/- 23.00	1.860E-04 +/- 11.00	4.800E-06 +/- 32.00	1.592E-06 +/- 23.00
168	6.888E-08 +/- 23.00	1.020E-07 +/- 23.00	1.070E-04 +/- 11.00	1.200E-06 +/- 32.00	6.826E-07 +/- 23.00
169	2.819E-08 +/- 23.00	6.137E-08 +/- 23.00	7.700E-05 +/- 8.00	2.950E-07 +/- 32.00	2.243E-07 +/- 23.00
170	5.919E-09 +/- 23.00	2.049E-08 +/- 23.00	3.261E-05 +/- 11.00	8.960E-08 +/- 32.00	6.828E-08 +/- 23.00
171	2.819E-09 +/- 23.00	7.167E-09 +/- 23.00	1.770E-05 +/- 11.00	2.950E-08 +/- 32.00	1.912E-08 +/- 23.00
172	9.708E-10 +/- 23.00	2.049E-09 +/- 23.00	1.610E-05 +/- 8.00	7.940E-09 +/- 32.00	9.972E-09 +/- 23.00

MASS	U236(HE) UNCERTAINTY	NP237(F) UNCERTAINTY	PU239(T) UNCERTAINTY	PU239(F) UNCERTAINTY	PU239(HE)UNCERTAINTY
66	8.501E-05 +/- 11.00	1.910E-07 +/- 8.00	1.841E-07 +/- 23.00	8.813E-07 +/- 16.00	6.330E-05 +/- 8.00
67	1.400E-04 +/- 16.00	3.810E-07 +/- 8.00	3.681E-07 +/- 23.00	2.911E-06 +/- 16.00	9.991E-05 +/- 8.00
68	3.011E-04 +/- 16.00	1.920E-06 +/- 8.00	1.290E-06 +/- 23.00	8.553E-06 +/- 16.00	2.210E-04 +/- 8.00
69	5.051E-04 +/- 16.00	1.010E-05 +/- 8.00	4.611E-06 +/- 23.00	3.171E-05 +/- 16.00	3.770E-04 +/- 8.00
70	9.082E-04 +/- 16.00	2.490E-05 +/- 8.00	1.571E-05 +/- 23.00	8.823E-05 +/- 16.00	6.811E-04 +/- 8.00
71	1.605E-03 +/- 16.00	6.320E-05 +/- 8.00	2.851E-05 +/- 23.00	2.071E-04 +/- 32.00	1.216E-03 +/- 8.00
72	3.020E-03 +/- 11.00	1.540E-04 +/- 8.00	9.613E-05 +/- 45.00	5.312E-04 +/- 32.00	2.222E-03 +/- 8.00
73	5.242E-03 +/- 11.00	3.740E-04 +/- 6.00	2.301E-04 +/- 23.00	7.502E-04 +/- 16.00	3.804E-03 +/- 6.00
74	8.072E-03 +/- 16.00	6.770E-04 +/- 8.00	5.332E-04 +/- 32.00	1.763E-03 +/- 16.00	5.982E-03 +/- 8.00
75	1.398E-02 +/- 16.00	1.346E-03 +/- 8.00	1.243E-03 +/- 32.00	2.734E-03 +/- 23.00	1.041E-02 +/- 8.00
76	2.217E-02 +/- 16.00	6.139E-03 +/- 8.00	2.756E-03 +/- 31.99	5.864E-03 +/- 16.00	1.666E-02 +/- 7.99
77	3.138E-02 +/- 8.00	1.089E-02 +/- 8.00	7.336E-03 +/- 11.00	1.399E-02 +/- 8.00	2.403E-02 +/- 8.00
78	4.104E-02 +/- 11.00	2.516E-02 +/- 8.00	2.853E-02 +/- 11.00	3.744E-02 +/- 16.00	3.097E-02 +/- 8.00
79	1.683E-01 +/- 11.00	5.796E-02 +/- 6.00	4.704E-02 +/- 16.00	6.103E-02 +/- 11.00	8.733E-02 +/- 6.00
80	2.146E-01 +/- 16.00	1.149E-01 +/- 8.00	1.133E-01 +/- 16.00	1.050E-01 +/- 16.00	1.601E-01 +/- 8.00
81	3.341E-01 +/- 11.00	2.360E-01 +/- 8.00	1.716E-01 +/- 16.00	1.423E-01 +/- 11.00	2.767E-01 +/- 8.00
82	4.566E-01 +/- 16.00	3.363E-01 +/- 10.98	2.057E-01 +/- 22.63	2.142E-01 +/- 7.98	3.551E-01 +/- 7.92
83	6.332E-01 +/- 1.40	4.815E-01 +/- 1.40	2.951E-01 +/- .50	3.088E-01 +/- 2.00	4.788E-01 +/- 6.00
84	1.083E+00 +/- 2.80	7.634E-01 +/- 2.00	4.745E-01 +/- 1.00	4.888E-01 +/- 2.00	8.104E-01 +/- 8.00
85	9.764E-01 +/- 1.40	9.648E-01 +/- 2.00	5.732E-01 +/- .50	6.004E-01 +/- 1.00	9.924E-01 +/- 4.00
86	1.513E+00 +/- 2.80	1.307E+00 +/- 2.00	7.591E-01 +/- 1.00	7.762E-01 +/- 1.40	1.148E+00 +/- 7.99
87	1.666E+00 +/- 2.80	1.731E+00 +/- 2.00	9.925E-01 +/- .70	1.006E+00 +/- 2.00	1.336E+00 +/- 6.00
88	2.182E+00 +/- 2.00	2.196E+00 +/- 2.00	1.364E+00 +/- 1.40	1.312E+00 +/- 1.40	2.007E+00 +/- 8.00
89	2.895E+00 +/- 2.00	2.515E+00 +/- 4.00	1.708E+00 +/- 2.80	1.751E+00 +/- 2.00	2.084E+00 +/- 4.00
90	3.190E+00 +/- 2.80	3.334E+00 +/- 2.00	2.109E+00 +/- 2.00	2.038E+00 +/- 1.40	2.429E+00 +/- 8.00
91	3.750E+00 +/- 2.00	3.914E+00 +/- 2.00	2.503E+00 +/- 1.40	2.436E+00 +/- 1.00	2.114E+00 +/- 8.00
92	3.924E+00 +/- 2.80	4.478E+00 +/- 2.00	3.009E+00 +/- 2.00	2.981E+00 +/- 1.00	2.953E+00 +/- 8.00
93	4.481E+00 +/- 2.80	5.138E+00 +/- 2.00	3.896E+00 +/- 1.40	3.730E+00 +/- 1.00	3.253E+00 +/- 6.00
94	4.902E+00 +/- 8.00	5.126E+00 +/- 2.00	4.429E+00 +/- 2.00	4.206E+00 +/- 1.00	3.535E+00 +/- 8.00
95	4.947E+00 +/- 2.80	5.699E+00 +/- 2.00	4.894E+00 +/- 2.00	4.685E+00 +/- 1.00	3.837E+00 +/- 8.00
96	5.613E+00 +/- 11.00	5.541E+00 +/- 2.00	5.080E+00 +/- 2.00	4.803E+00 +/- 1.40	4.408E+00 +/- 7.99
97	5.290E+00 +/- 2.00	6.131E+00 +/- 2.00	5.396E+00 +/- 2.80	5.271E+00 +/- .70	4.475E+00 +/- 4.00
98	5.490E+00 +/- 11.00	6.124E+00 +/- 2.00	5.832E+00 +/- 2.00	5.631E+00 +/- 1.40	4.930E+00 +/- 8.00
99	5.670E+00 +/- 1.40	6.192E+00 +/- 2.80	6.156E+00 +/- 2.00	6.005E+00 +/- 2.00	4.127E+00 +/- 6.00
100	5.035E+00 +/- 8.00	6.559E+00 +/- 2.00	6.810E+00 +/- 4.00	6.551E+00 +/- 1.00	5.185E+00 +/- 8.00
101	5.655E+00 +/- 2.80	6.179E+00 +/- 2.00	5.899E+00 +/- 1.40	6.541E+00 +/- 1.40	5.066E+00 +/- 8.00
102	4.614E+00 +/- 8.00	5.884E+00 +/- 2.00	5.969E+00 +/- 2.00	6.650E+00 +/- 1.40	5.552E+00 +/- 8.00
103	4.635E+00 +/- 2.00	5.584E+00 +/- 2.80	6.950E+00 +/- 2.00	6.835E+00 +/- 1.40	5.235E+00 +/- 6.00
104	3.598E+00 +/- 6.00	4.209E+00 +/- 2.00	5.914E+00 +/- 2.00	6.524E+00 +/- 1.40	5.517E+00 +/- 8.00
105	3.234E+00 +/- 2.00	3.179E+00 +/- 4.00	5.362E+00 +/- 6.00	5.405E+00 +/- 4.00	4.238E+00 +/- 6.00
106	2.439E+00 +/- 4.00	2.240E+00 +/- 11.00	4.282E+00 +/- 2.80	4.354E+00 +/- 1.40	3.582E+00 +/- 6.00
107	1.729E+00 +/- 6.00	1.694E+00 +/- 11.00	3.362E+00 +/- 11.00	3.054E+00 +/- 8.00	2.901E+00 +/- 8.00
108	1.235E+00 +/- 11.00	9.537E-01 +/- 16.00	2.173E+00 +/- 16.00	1.911E+00 +/- 11.00	2.431E+00 +/- 8.00
109	1.227E+00 +/- 6.00	4.462E-01 +/- 11.00	1.676E+00 +/- 8.00	1.915E+00 +/- 6.00	2.481E+00 +/- 4.00
110	1.037E+00 +/- 11.00	2.306E-01 +/- 16.00	5.989E-01 +/- 23.00	6.199E-01 +/- 11.00	1.768E+00 +/- 8.00
111	1.114E+00 +/- 2.80	9.607E-02 +/- 4.00	3.037E-01 +/- 2.80	3.556E-01 +/- 2.00	1.510E+00 +/- 6.00
112	1.014E+00 +/- 4.00	7.265E-02 +/- 6.00	1.333E-01 +/- 2.80	1.924E-01 +/- 2.80	1.414E+00 +/- 6.00
113	9.466E-01 +/- 6.00	5.173E-02 +/- 6.00	6.517E-02 +/- 4.00	1.263E-01 +/- 2.00	1.313E+00 +/- 8.00
114	7.257E-01 +/- 11.00	5.128E-02 +/- 8.00	6.061E-02 +/- 4.00	9.313E-02 +/- 2.00	1.274E+00 +/- 8.00
115	8.391E-01 +/- 4.00	4.891E-02 +/- 8.00	3.573E-02 +/- 4.00	7.170E-02 +/- 6.00	9.749E-01 +/- 6.00

MASS	U238(HE)	UNCERTAINTY	NP237(F)	UNCERTAINTY	PU239(T)	UNCERTAINTY	PU239(F)	UNCERTAINTY	PU239(HE)	UNCERTAINTY
116	6.619E-01	+/- 11.00	4.818E-02	+/- 8.00	4.950E-02	+/- 8.00	5.972E-02	+/- 6.00	1.173E+00	+/- 7.99
117	7.352E-01	+/- 8.00	4.343E-02	+/- 8.00	5.633E-02	+/- 8.00	7.877E-02	+/- 11.00	1.167E+00	+/- 8.00
118	8.324E-01	+/- 11.00	5.532E-02	+/- 8.00	3.642E-02	+/- 11.00	6.274E-02	+/- 11.00	1.287E+00	+/- 8.00
119	7.349E-01	+/- 11.00	5.569E-02	+/- 8.00	3.908E-02	+/- 16.00	6.321E-02	+/- 11.00	1.261E+00	+/- 8.00
120	8.610E-01	+/- 11.00	5.541E-02	+/- 8.00	3.657E-02	+/- 16.00	6.164E-02	+/- 11.00	1.257E+00	+/- 8.00
121	8.310E-01	+/- 4.00	5.469E-02	+/- 6.00	3.831E-02	+/- 8.00	6.849E-02	+/- 11.00	1.474E+00	+/- 6.00
122	8.633E-01	+/- 11.00	6.089E-02	+/- 8.00	5.017E-02	+/- 16.00	7.587E-02	+/- 11.00	1.470E+00	+/- 7.99
123	9.360E-01	+/- 11.00	6.720E-02	+/- 8.00	4.372E-02	+/- 23.00	8.581E-02	+/- 16.00	1.742E+00	+/- 8.00
124	1.051E+00	+/- 11.00	7.504E-02	+/- 8.00	8.781E-02	+/- 15.98	1.329E-01	+/- 15.98	2.026E+00	+/- 7.84
125	1.229E+00	+/- 6.00	1.318E-01	+/- 4.00	1.110E-01	+/- 8.00	1.484E-01	+/- 8.00	2.019E+00	+/- 6.00
126	1.645E+00	+/- 16.00	1.655E-01	+/- 16.00	2.708E-01	+/- 11.00	3.125E-01	+/- 8.00	2.083E+00	+/- 8.00
127	1.502E+00	+/- 6.00	3.586E-01	+/- 8.00	4.893E-01	+/- 11.00	5.533E-01	+/- 8.00	2.287E+00	+/- 8.00
128	1.678E+00	+/- 8.00	6.786E-01	+/- 16.00	7.478E-01	+/- 6.00	9.436E-01	+/- 6.00	2.737E+00	+/- 8.00
129	2.009E+00	+/- 8.00	1.466E+00	+/- 6.00	1.486E+00	+/- 11.00	1.626E+00	+/- 8.00	3.411E+00	+/- 8.00
130	3.197E+00	+/- 11.00	2.297E+00	+/- 11.00	2.329E+00	+/- 10.97	2.567E+00	+/- 7.99	4.473E+00	+/- 7.81
131	4.042E+00	+/- 2.00	3.697E+00	+/- 2.00	3.846E+00	+/- .70	3.869E+00	+/- 1.00	4.763E+00	+/- 6.00
132	4.853E+00	+/- 1.40	5.008E+00	+/- 1.40	5.393E+00	+/- .70	5.309E+00	+/- 1.00	5.314E+00	+/- 8.00
133	6.145E+00	+/- 2.00	6.639E+00	+/- 1.40	6.975E+00	+/- .70	6.890E+00	+/- 1.00	5.433E+00	+/- 8.00
134	6.506E+00	+/- 2.00	7.369E+00	+/- 1.40	7.621E+00	+/- .70	7.373E+00	+/- 1.00	5.679E+00	+/- 7.96
135	5.832E+00	+/- 1.40	7.549E+00	+/- 2.00	7.618E+00	+/- 1.40	7.449E+00	+/- 1.00	5.858E+00	+/- 8.00
136	5.706E+00	+/- 1.99	6.870E+00	+/- 1.99	6.710E+00	+/- 2.77	7.032E+00	+/- 1.37	6.579E+00	+/- 7.12
137	4.930E+00	+/- 2.00	6.267E+00	+/- 2.00	6.698E+00	+/- .50	6.479E+00	+/- .50	4.531E+00	+/- 6.00
138	4.688E+00	+/- 2.00	6.203E+00	+/- 2.00	6.057E+00	+/- 1.40	6.093E+00	+/- 1.00	4.177E+00	+/- 8.00
139	5.086E+00	+/- 2.00	5.651E+00	+/- 2.80	5.624E+00	+/- 4.00	5.596E+00	+/- 2.00	4.050E+00	+/- 8.00
140	4.621E+00	+/- 1.40	5.489E+00	+/- 1.40	5.552E+00	+/- 1.00	5.326E+00	+/- 1.00	3.831E+00	+/- 4.00
141	4.389E+00	+/- 2.80	5.439E+00	+/- 4.00	5.257E+00	+/- 2.80	5.238E+00	+/- 2.80	3.386E+00	+/- 8.00
142	4.139E+00	+/- 4.00	4.900E+00	+/- 2.00	4.984E+00	+/- 1.00	4.774E+00	+/- 1.00	3.033E+00	+/- 8.00
143	3.917E+00	+/- 2.80	4.703E+00	+/- 2.00	4.428E+00	+/- .70	4.295E+00	+/- .70	2.601E+00	+/- 6.00
144	3.645E+00	+/- 4.00	4.198E+00	+/- 2.00	3.738E+00	+/- .50	3.622E+00	+/- 2.80	2.703E+00	+/- 4.00
145	3.005E+00	+/- 4.00	3.482E+00	+/- 2.00	2.992E+00	+/- .50	2.965E+00	+/- .70	2.127E+00	+/- 8.00
146	2.167E+00	+/- 8.00	2.798E+00	+/- 2.00	2.462E+00	+/- .50	2.436E+00	+/- .70	1.757E+00	+/- 8.00
147	2.097E+00	+/- 2.00	2.211E+00	+/- 2.00	2.043E+00	+/- 1.40	1.978E+00	+/- 1.00	1.776E+00	+/- 4.00
148	1.746E+00	+/- 11.00	1.729E+00	+/- 2.00	1.635E+00	+/- .70	1.637E+00	+/- .50	1.305E+00	+/- 8.00
149	1.425E+00	+/- 6.00	1.275E+00	+/- 2.00	1.239E+00	+/- 1.40	1.239E+00	+/- 1.00	1.063E+00	+/- 8.00
150	1.099E+00	+/- 16.00	9.850E-01	+/- 2.00	9.663E-01	+/- .50	9.843E-01	+/- .70	9.740E-01	+/- 7.90
151	8.017E-01	+/- 6.00	7.138E-01	+/- 2.00	7.721E-01	+/- 1.40	7.770E-01	+/- 1.40	7.345E-01	+/- 8.00
152	5.888E-01	+/- 16.00	4.563E-01	+/- 2.00	5.852E-01	+/- 1.40	6.061E-01	+/- 4.00	5.536E-01	+/- 8.00
153	3.918E-01	+/- 6.00	3.594E-01	+/- 4.00	3.637E-01	+/- 6.00	4.344E-01	+/- 4.00	4.549E-01	+/- 8.00
154	2.565E-01	+/- 20.26	1.853E-01	+/- 35.26	2.717E-01	+/- 31.60	2.755E-01	+/- 32.06	3.299E-01	+/- 19.01
155	1.579E-01	+/- 16.00	1.192E-01	+/- 8.00	1.655E-01	+/- 11.00	2.260E-01	+/- 11.00	2.318E-01	+/- 8.00
156	1.080E-01	+/- 4.00	9.992E-02	+/- 6.00	1.184E-01	+/- 2.80	1.475E-01	+/- 4.00	2.105E-01	+/- 6.00
157	8.379E-02	+/- 16.00	3.330E-02	+/- 8.00	7.410E-02	+/- 6.00	1.128E-01	+/- 8.00	1.115E-01	+/- 8.00
158	4.333E-02	+/- 16.00	1.320E-02	+/- 8.00	4.074E-02	+/- 23.00	7.304E-02	+/- 16.00	7.488E-02	+/- 8.00
159	2.634E-02	+/- 11.00	6.709E-03	+/- 8.00	2.059E-02	+/- 6.00	4.176E-02	+/- 11.00	5.188E-02	+/- 8.00
160	1.595E-02	+/- 15.98	2.592E-03	+/- 8.00	9.723E-03	+/- 31.96	2.605E-02	+/- 15.98	3.802E-02	+/- 7.97
161	8.489E-03	+/- 4.00	8.050E-04	+/- 8.00	4.846E-03	+/- 6.00	8.924E-03	+/- 4.00	1.823E-02	+/- 6.00
162	6.039E-03	+/- 16.00	3.130E-04	+/- 8.00	2.396E-03	+/- 32.00	7.104E-03	+/- 23.00	9.276E-03	+/- 8.00
163	3.452E-03	+/- 16.00	1.340E-04	+/- 8.00	9.703E-04	+/- 32.00	3.777E-03	+/- 45.00	3.275E-03	+/- 8.00
164	2.026E-03	+/- 16.00	5.810E-05	+/- 8.00	3.661E-04	+/- 32.00	2.379E-03	+/- 45.00	1.875E-03	+/- 8.00
165	1.116E-03	+/- 16.00	1.960E-05	+/- 8.00	1.390E-04	+/- 23.00	1.100E-03	+/- 32.00	7.560E-04	+/- 8.00
166	6.341E-04	+/- 8.00	1.160E-05	+/- 8.00	6.822E-05	+/- 16.00	7.642E-04	+/- 32.00	5.180E-04	+/- 6.00
167	3.751E-04	+/- 16.00	1.610E-06	+/- 8.00	1.981E-05	+/- 32.00	3.371E-04	+/- 32.00	2.810E-04	+/- 8.00
168	2.030E-04	+/- 16.00	4.120E-07	+/- 8.00	5.542E-06	+/- 32.00	9.663E-05	+/- 32.00	1.410E-04	+/- 8.00
169	1.300E-04	+/- 8.00	1.340E-07	+/- 8.00	1.881E-06	+/- 32.00	3.261E-05	+/- 32.00	6.580E-05	+/- 8.00
170	6.051E-05	+/- 16.00	4.221E-07	+/- 8.00	3.934E-07	+/- 44.97	9.748E-06	+/- 31.98	4.761E-05	+/- 7.98
171	3.361E-05	+/- 16.00	1.250E-07	+/- 8.00	1.891E-07	+/- 32.00	3.251E-06	+/- 32.00	3.760E-05	+/- 8.00
172	2.160E-05	+/- 16.00	4.840E-07	+/- 8.00	5.562E-08	+/- 32.00	9.663E-07	+/- 32.00	1.880E-05	+/- 8.00

MASS	PU240(F) UNCERTAINTY	PU241(T) UNCERTAINTY	PU241(F) UNCERTAINTY	PU242(F) UNCERTAINTY	CF252(S) UNCERTAINTY
66	5.411E-06 +/- 23.00	1.350E-07 +/- 23.00	1.840E-07 +/- 32.00	1.890E-07 +/- 32.00	2.318E-09 +/- 32.00
67	8.111E-06 +/- 23.00	2.511E-07 +/- 23.00	1.290E-06 +/- 32.00	3.780E-07 +/- 32.00	1.159E-08 +/- 32.00
68	1.890E-05 +/- 23.00	5.802E-07 +/- 23.00	2.770E-06 +/- 32.00	6.620E-07 +/- 32.00	3.487E-08 +/- 32.00
69	2.970E-05 +/- 23.00	1.260E-06 +/- 23.00	1.010E-05 +/- 32.00	1.420E-06 +/- 32.00	1.159E-07 +/- 32.00
70	1.330E-05 +/- 32.00	4.541E-06 +/- 23.00	3.230E-05 +/- 32.00	2.840E-06 +/- 32.00	4.456E-07 +/- 23.00
71	3.790E-05 +/- 32.00	6.762E-06 +/- 23.00	8.300E-05 +/- 32.00	4.730E-06 +/- 32.00	1.389E-06 +/- 32.00
72	1.120E-04 +/- 8.00	2.511E-05 +/- 23.00	1.480E-04 +/- 32.00	1.040E-05 +/- 32.00	4.646E-06 +/- 32.00
73	3.340E-04 +/- 23.00	5.852E-05 +/- 16.00	4.720E-04 +/- 23.00	1.730E-05 +/- 23.00	1.109E-05 +/- 23.00
74	8.721E-04 +/- 32.00	9.663E-05 +/- 23.00	1.106E-03 +/- 32.00	4.730E-05 +/- 32.00	3.487E-05 +/- 32.00
75	5.391E-04 +/- 16.00	2.901E-04 +/- 23.00	4.610E-04 +/- 16.00	9.460E-05 +/- 32.00	1.159E-04 +/- 32.00
76	1.468E-03 +/- 16.00	9.663E-04 +/- 23.00	8.070E-04 +/- 16.00	2.840E-04 +/- 32.00	2.898E-04 +/- 32.00
77	1.310E-02 +/- 16.00	1.933E-03 +/- 23.00	9.611E-03 +/- 16.00	9.620E-03 +/- 23.00	8.902E-04 +/- 23.00
78	2.709E-02 +/- 16.00	9.470E-03 +/- 6.00	1.826E-02 +/- 16.00	1.798E-02 +/- 32.00	2.081E-03 +/- 11.00
79	5.075E-02 +/- 11.00	1.525E-02 +/- 11.00	3.597E-02 +/- 11.00	3.560E-02 +/- 23.00	6.678E-03 +/- 23.00
80	8.485E-02 +/- 16.00	2.964E-02 +/- 16.00	6.439E-02 +/- 16.00	6.340E-02 +/- 32.00	1.566E-02 +/- 16.00
81	1.412E-01 +/- 16.00	6.299E-02 +/- 16.00	9.541E-02 +/- 11.00	1.041E-01 +/- 32.00	3.046E-02 +/- 16.00
82	2.007E-01 +/- 15.98	1.319E-01 +/- 15.99	1.438E-01 +/- 8.00	1.609E-01 +/- 31.99	4.977E-02 +/- 15.97
83	3.031E-01 +/- 11.00	2.127E-01 +/- 2.80	1.980E-01 +/- 1.00	2.406E-01 +/- 23.00	5.989E-02 +/- 8.00
84	4.273E-01 +/- 11.00	3.715E-01 +/- 2.80	3.480E-01 +/- 1.00	3.515E-01 +/- 32.00	1.031E-01 +/- 16.00
85	5.721E-01 +/- 11.00	3.986E-01 +/- 2.00	3.968E-01 +/- 1.00	4.140E-01 +/- 23.00	1.668E-01 +/- 16.00
86	7.560E-01 +/- 11.00	6.396E-01 +/- 4.00	5.845E-01 +/- 1.00	6.531E-01 +/- 23.00	1.830E-01 +/- 11.00
87	9.911E-01 +/- 16.00	7.864E-01 +/- 2.80	7.516E-01 +/- 1.00	8.547E-01 +/- 16.00	2.720E-01 +/- 11.00
88	1.235E+00 +/- 11.00	1.021E+00 +/- 2.80	9.639E-01 +/- 1.00	1.093E+00 +/- 23.00	3.661E-01 +/- 16.00
89	1.474E+00 +/- 8.00	1.226E+00 +/- 4.00	1.250E+00 +/- 6.00	1.345E+00 +/- 16.00	3.891E-01 +/- 6.00
90	1.883E+00 +/- 6.00	1.576E+00 +/- 2.80	1.531E+00 +/- 1.00	1.728E+00 +/- 11.00	6.707E-01 +/- 16.00
91	2.269E+00 +/- 6.00	1.892E+00 +/- 2.80	1.897E+00 +/- 1.40	2.064E+00 +/- 16.00	6.742E-01 +/- 4.00
92	2.880E+00 +/- 11.00	2.373E+00 +/- 4.00	2.337E+00 +/- 2.00	2.504E+00 +/- 16.00	7.158E-01 +/- 6.00
93	3.778E+00 +/- 4.00	3.090E+00 +/- 4.00	2.971E+00 +/- 1.40	3.130E+00 +/- 11.00	9.426E-01 +/- 8.00
94	4.118E+00 +/- 11.00	3.544E+00 +/- 4.00	3.411E+00 +/- 1.40	3.653E+00 +/- 16.00	1.140E+00 +/- 11.00
95	4.396E+00 +/- 6.00	4.074E+00 +/- 2.80	3.919E+00 +/- 1.00	4.022E+00 +/- 16.00	1.320E+00 +/- 2.80
96	4.929E+00 +/- 11.00	4.621E+00 +/- 3.99	4.380E+00 +/- 2.00	4.490E+00 +/- 16.00	1.604E+00 +/- 15.99
97	5.147E+00 +/- 6.00	4.856E+00 +/- 2.80	4.653E+00 +/- .70	4.836E+00 +/- 11.00	1.715E+00 +/- 2.80
98	5.475E+00 +/- 11.00	5.141E+00 +/- 8.00	4.962E+00 +/- 1.00	5.181E+00 +/- 11.00	2.240E+00 +/- 11.00
99	5.996E+00 +/- 2.80	6.270E+00 +/- 2.80	5.536E+00 +/- 4.00	5.386E+00 +/- 8.00	2.657E+00 +/- 2.80
100	6.045E+00 +/- 11.00	6.128E+00 +/- 8.00	6.265E+00 +/- 1.00	5.621E+00 +/- 11.00	3.312E+00 +/- 11.00
101	6.053E+00 +/- 11.00	6.006E+00 +/- 8.00	6.330E+00 +/- 1.00	5.886E+00 +/- 11.00	3.990E+00 +/- 6.00
102	6.086E+00 +/- 11.00	6.391E+00 +/- 8.00	6.697E+00 +/- 1.00	5.832E+00 +/- 16.00	4.089E+00 +/- 4.00
103	6.713E+00 +/- 4.00	6.151E+00 +/- 4.00	6.426E+00 +/- 4.00	5.882E+00 +/- 11.00	5.638E+00 +/- 2.80
104	5.903E+00 +/- 11.00	6.876E+00 +/- 8.00	7.129E+00 +/- 1.00	5.814E+00 +/- 16.00	6.246E+00 +/- 11.00
105	5.549E+00 +/- 6.00	6.146E+00 +/- 6.00	6.418E+00 +/- 6.00	5.673E+00 +/- 11.00	6.320E+00 +/- 2.80
106	4.969E+00 +/- 6.00	6.226E+00 +/- 6.00	6.085E+00 +/- 1.40	5.313E+00 +/- 16.00	6.942E+00 +/- 11.00
107	4.153E+00 +/- 11.00	5.211E+00 +/- 11.00	4.871E+00 +/- 8.00	5.023E+00 +/- 11.00	6.516E+00 +/- 8.00
108	3.036E+00 +/- 11.00	3.938E+00 +/- 11.00	3.492E+00 +/- 11.00	4.231E+00 +/- 16.00	6.101E+00 +/- 8.00
109	1.792E+00 +/- 6.00	2.254E+00 +/- 6.00	2.524E+00 +/- 8.00	3.248E+00 +/- 8.00	5.952E+00 +/- 6.00
110	1.177E+00 +/- 11.00	1.172E+00 +/- 16.00	1.417E+00 +/- 8.00	2.199E+00 +/- 16.00	5.918E+00 +/- 11.00
111	5.034E-01 +/- 6.00	5.710E-01 +/- 4.00	7.478E-01 +/- 16.00	1.285E+00 +/- 16.00	5.194E+00 +/- 2.80
112	2.392E-01 +/- 6.00	2.311E-01 +/- 4.00	3.607E-01 +/- 11.00	6.445E-01 +/- 23.00	4.162E+00 +/- 2.80
113	1.597E-01 +/- 8.00	1.459E-01 +/- 6.00	2.114E-01 +/- 16.00	3.078E-01 +/- 23.00	3.479E+00 +/- 4.00
114	9.865E-02 +/- 16.00	7.249E-02 +/- 23.00	1.167E-01 +/- 11.00	1.514E-01 +/- 32.00	3.451E+00 +/- 11.00
115	6.638E-02 +/- 6.00	4.224E-02 +/- 23.00	1.023E-01 +/- 23.00	1.024E-01 +/- 32.00	2.504E+00 +/- 6.00

MASS	PU240(F) UNCERTAINTY	PU241(T) UNCERTAINTY	PU241(F) UNCERTAINTY	PU242(F) UNCERTAINTY	CF252(S) UNCERTAINTY
116	7.930E-02 +/- 16.00	2.859E-02 +/- 32.00	9.612E-02 +/- 16.00	9.463E-02 +/- 32.00	1.956E+00 +/- 11.00
117	7.862E-02 +/- 11.00	2.539E-02 +/- 16.00	8.753E-02 +/- 11.00	9.731E-02 +/- 16.00	1.109E+00 +/- 8.00
118	7.391E-02 +/- 16.00	2.383E-02 +/- 32.00	8.265E-02 +/- 16.00	8.658E-02 +/- 23.00	8.957E-01 +/- 16.00
119	7.401E-02 +/- 11.00	2.383E-02 +/- 32.00	8.170E-02 +/- 16.00	8.658E-02 +/- 23.00	3.305E-01 +/- 16.00
120	7.820E-02 +/- 16.00	2.394E-02 +/- 23.00	8.287E-02 +/- 16.00	8.177E-02 +/- 23.00	2.910E-01 +/- 16.00
121	7.852E-02 +/- 16.00	2.353E-02 +/- 32.00	8.774E-02 +/- 16.00	9.198E-02 +/- 32.00	1.116E-01 +/- 6.00
122	8.773E-02 +/- 16.00	2.352E-02 +/- 32.00	9.067E-02 +/- 16.00	9.401E-02 +/- 32.00	6.966E-02 +/- 32.00
123	1.012E-01 +/- 16.00	2.490E-02 +/- 23.00	9.749E-02 +/- 16.00	9.849E-02 +/- 23.00	4.219E-02 +/- 11.00
124	1.154E-01 +/- 16.00	2.916E-02 +/- 32.00	1.072E-01 +/- 16.00	1.124E-01 +/- 32.00	2.322E-02 +/- 31.99
125	1.054E-01 +/- 11.00	4.242E-02 +/- 11.00	9.185E-02 +/- 8.00	6.672E-02 +/- 8.00	2.198E-02 +/- 8.00
126	2.812E-01 +/- 16.00	7.665E-02 +/- 23.00	1.898E-01 +/- 16.00	1.777E-01 +/- 23.00	2.573E-02 +/- 32.00
127	4.188E-01 +/- 6.00	2.294E-01 +/- 4.00	3.137E-01 +/- 11.00	3.044E-01 +/- 23.00	9.883E-02 +/- 8.00
128	6.683E-01 +/- 16.00	3.544E-01 +/- 23.00	5.927E-01 +/- 8.00	5.077E-01 +/- 23.00	2.022E-01 +/- 16.00
129	1.102E+00 +/- 11.00	7.572E-01 +/- 16.00	9.929E-01 +/- 8.00	8.487E-01 +/- 16.00	3.743E-01 +/- 11.00
130	1.993E+00 +/- 11.00	1.651E+00 +/- 16.00	1.695E+00 +/- 8.00	1.486E+00 +/- 16.00	7.028E-01 +/- 16.00
131	3.544E+00 +/- 4.00	2.843E+00 +/- 2.00	3.218E+00 +/- 4.00	3.185E+00 +/- 4.00	1.501E+00 +/- 6.00
132	4.807E+00 +/- 4.00	4.218E+00 +/- 2.00	4.641E+00 +/- 2.00	4.566E+00 +/- 6.00	1.976E+00 +/- 4.00
133	7.005E+00 +/- 4.00	6.770E+00 +/- 1.40	6.693E+00 +/- .70	6.593E+00 +/- 2.00	3.323E+00 +/- 8.00
134	7.027E+00 +/- 6.00	7.418E+00 +/- 2.00	7.717E+00 +/- 1.00	7.375E+00 +/- 2.00	3.078E+00 +/- 16.00
135	7.450E+00 +/- 4.00	7.302E+00 +/- 1.40	7.323E+00 +/- .70	7.165E+00 +/- 4.00	4.009E+00 +/- 2.80
136	6.809E+00 +/- 5.95	6.682E+00 +/- 2.79	6.825E+00 +/- 1.40	6.888E+00 +/- 4.00	3.999E+00 +/- 10.94
137	6.465E+00 +/- 4.00	6.865E+00 +/- 1.40	6.571E+00 +/- .70	6.387E+00 +/- 4.00	4.860E+00 +/- 2.80
138	6.541E+00 +/- 6.00	6.771E+00 +/- 2.80	6.426E+00 +/- 1.00	6.329E+00 +/- 6.00	5.222E+00 +/- 8.00
139	5.877E+00 +/- 11.00	5.947E+00 +/- 6.00	6.173E+00 +/- 2.80	6.026E+00 +/- 6.00	5.943E+00 +/- 4.00
140	5.108E+00 +/- 4.00	6.170E+00 +/- 2.00	5.363E+00 +/- 1.40	4.995E+00 +/- 6.00	6.086E+00 +/- 2.00
141	4.765E+00 +/- 6.00	4.964E+00 +/- 2.00	4.986E+00 +/- 6.00	5.106E+00 +/- 11.00	6.173E+00 +/- 2.80
142	4.964E+00 +/- 6.00	5.032E+00 +/- 2.00	4.661E+00 +/- 1.40	4.599E+00 +/- 6.00	6.030E+00 +/- 6.00
143	4.720E+00 +/- 4.00	4.704E+00 +/- 1.40	4.561E+00 +/- .70	4.678E+00 +/- 2.00	6.430E+00 +/- 2.00
144	4.067E+00 +/- 4.00	4.334E+00 +/- 1.40	4.188E+00 +/- 1.00	4.259E+00 +/- 4.00	6.038E+00 +/- 4.00
145	3.277E+00 +/- 4.00	3.344E+00 +/- 1.40	3.245E+00 +/- .70	3.467E+00 +/- 2.00	5.429E+00 +/- 6.00
146	2.736E+00 +/- 4.00	2.862E+00 +/- 1.40	2.737E+00 +/- .70	3.002E+00 +/- 2.00	4.793E+00 +/- 11.00
147	2.233E+00 +/- 4.00	2.368E+00 +/- 2.00	2.235E+00 +/- 1.00	2.419E+00 +/- 6.00	4.453E+00 +/- 2.80
148	1.915E+00 +/- 4.00	1.990E+00 +/- 1.40	1.906E+00 +/- .50	2.063E+00 +/- 2.00	4.189E+00 +/- 11.00
149	1.369E+00 +/- 6.00	1.524E+00 +/- 2.00	1.451E+00 +/- .70	1.615E+00 +/- 2.00	2.950E+00 +/- 4.00
150	1.140E+00 +/- 4.00	1.248E+00 +/- 2.00	1.193E+00 +/- .70	1.360E+00 +/- 2.80	2.408E+00 +/- 15.90
151	8.432E-01 +/- 6.00	9.369E-01 +/- 2.00	9.121E-01 +/- 1.00	1.025E+00 +/- 4.00	1.861E+00 +/- 4.00
152	6.576E-01 +/- 6.00	7.466E-01 +/- 2.00	7.083E-01 +/- 1.00	8.348E-01 +/- 2.80	1.491E+00 +/- 16.00
153	5.797E-01 +/- 6.00	5.482E-01 +/- 4.00	5.382E-01 +/- 4.00	6.554E-01 +/- 6.00	1.294E+00 +/- 4.00
154	3.171E-01 +/- 16.04	3.961E-01 +/- 12.96	3.708E-01 +/- 12.40	4.600E-01 +/- 6.97	1.046E+00 +/- 7.66
155	2.476E-01 +/- 6.00	2.417E-01 +/- 8.00	3.217E-01 +/- 16.00	3.678E-01 +/- 32.00	8.749E-01 +/- 16.00
156	1.754E-01 +/- 6.00	1.761E-01 +/- 2.80	2.340E-01 +/- 16.00	2.657E-01 +/- 32.00	6.747E-01 +/- 4.00
157	1.304E-01 +/- 8.00	1.372E-01 +/- 4.00	1.560E-01 +/- 16.00	1.839E-01 +/- 32.00	5.309E-01 +/- 6.00
158	8.503E-02 +/- 16.00	8.625E-02 +/- 23.00	1.072E-01 +/- 16.00	1.226E-01 +/- 32.00	4.629E-01 +/- 16.00
159	3.651E-02 +/- 6.00	4.867E-02 +/- 4.00	6.239E-02 +/- 16.00	7.357E-02 +/- 32.00	3.523E-01 +/- 6.00
160	3.046E-02 +/- 16.00	1.917E-02 +/- 23.00	3.802E-02 +/- 16.00	4.598E-02 +/- 32.00	2.691E-01 +/- 15.99
161	1.190E-02 +/- 8.00	8.572E-03 +/- 4.00	2.242E-02 +/- 16.00	2.657E-02 +/- 32.00	1.995E-01 +/- 4.00
162	6.745E-03 +/- 23.00	2.492E-03 +/- 23.00	1.045E-02 +/- 32.00	1.431E-02 +/- 32.00	1.734E-01 +/- 16.00
163	2.283E-03 +/- 32.00	8.993E-04 +/- 23.00	5.890E-03 +/- 32.00	6.130E-03 +/- 32.00	1.446E-01 +/- 16.00
164	1.141E-03 +/- 32.00	2.881E-04 +/- 23.00	3.040E-03 +/- 32.00	3.065E-03 +/- 32.00	9.455E-02 +/- 16.00
165	5.651E-04 +/- 23.00	9.003E-05 +/- 23.00	1.447E-03 +/- 23.00	2.031E-03 +/- 23.00	6.575E-02 +/- 16.00
166	5.181E-04 +/- 23.00	6.032E-05 +/- 23.00	5.700E-04 +/- 32.00	1.022E-03 +/- 32.00	4.339E-02 +/- 16.00
167	2.860E-04 +/- 23.00	2.731E-05 +/- 23.00	2.850E-04 +/- 32.00	3.980E-04 +/- 32.00	2.392E-02 +/- 16.00
168	1.280E-04 +/- 23.00	1.250E-05 +/- 23.00	1.140E-04 +/- 32.00	1.740E-04 +/- 32.00	1.196E-02 +/- 16.00
169	9.231E-05 +/- 16.00	5.271E-06 +/- 23.00	5.420E-05 +/- 32.00	9.710E-05 +/- 32.00	3.254E-03 +/- 32.00
170	3.211E-05 +/- 23.00	1.530E-06 +/- 23.00	1.520E-05 +/- 32.00	4.600E-05 +/- 32.00	1.282E-03 +/- 31.99
171	1.780E-05 +/- 23.00	2.871E-07 +/- 23.00	5.320E-06 +/- 32.00	2.550E-05 +/- 32.00	5.995E-04 +/- 32.00
172	1.040E-05 +/- 23.00	9.583E-08 +/- 23.00	1.520E-06 +/- 32.00	1.530E-05 +/- 32.00	3.767E-04 +/- 32.00

fission products. The standard contains a method for approximate absorption corrections and heating values for ^{238}U and ^{239}Pu and methods for obtaining the heating rates for finite, variable fission rates.

The technical basis for the new standard is summarized in Ref. 62. The standard has been accepted as an ANS Standard and is expected to be formally accepted as an ANSI Standard in November 1978. It is expected that the new standard will form the basis for changes by the Nuclear Regulatory Commission following formal rule change hearings in the Code of Federal Regulations, Title 10 - Energy, Part 50 - Licensing of Products and Utilization Facilities, Appendix K - ECCS Evaluation Models. The process requires extensive evaluation of procedure and sensitivity studies by the NRC. The ANS 5.1 Committee was informed that the NRC staff currently estimates that this process will require approximately two years. Current rules require that ECCS design use a 20% addition to the mean heating values (in contrast to the $\sim$2% 1σ uncertainty); however, the new mean values can apparently be used without formal rule-making hearings, and even this represents a significant savings to the reactor industry.

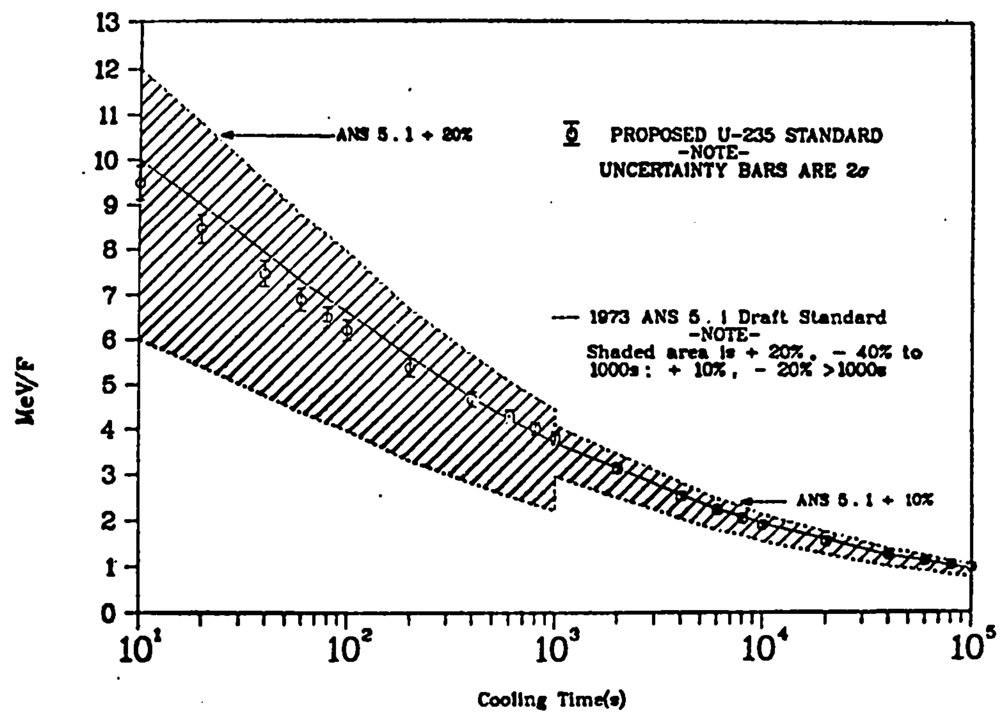

Fig. 14.
Comparison of proposed nominal (2σ uncertainty bars) with ANS 5.1 (infinite irradiation, no depletion or absorption effects).

D. ^{233}U, ^{235}U, and ^{239}Pu Gamma Spectra (T. R. England and N. L. Whittemore)

Measurements of the fission product gamma spectra by P. Bendt and E. Jurney of LASL's P-Division have been completed. For ^{233}U, ^{235}U, and ^{239}Pu fission in a constant flux for 2×10^4 s, the spectra have been measured at 12 mean cooling times from 29 to 1.465×10^5 s for each fuel. The results have been compared to calculations using ENDF/B-IV fission product data. Figures 15-17 are typical spectral comparisons. Table X compares the integrated energies and Fig. 18 compares the per cent deviation of the calculated integrated gamma energies from the measurements. Calculated values are for the rates at the midpoint of the counting interval. Except for the first interval, this rate is within 1% of the time average over each counting period. However, the value tabulated for 29 s applies to a counting period of 4-54 s; here the time average value is $\sim$4.5% larger than the rate at 29 s. That is, the calculation is $\sim$4.5% closer to the measurement than is indicated in Table X or Fig. 18 at 29 s.

A complete report on the measurements and comparisons with calculations is in preparation.

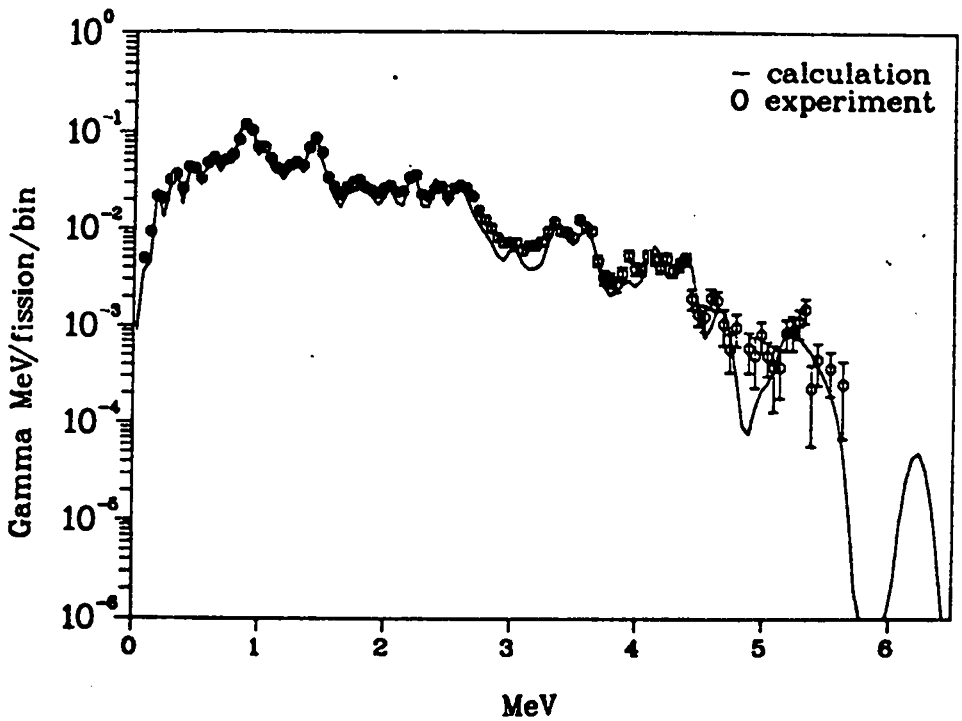

Fig. 15.
^{233}U comparison of calculation with LASL experiment 5.56-h 128-s decay.

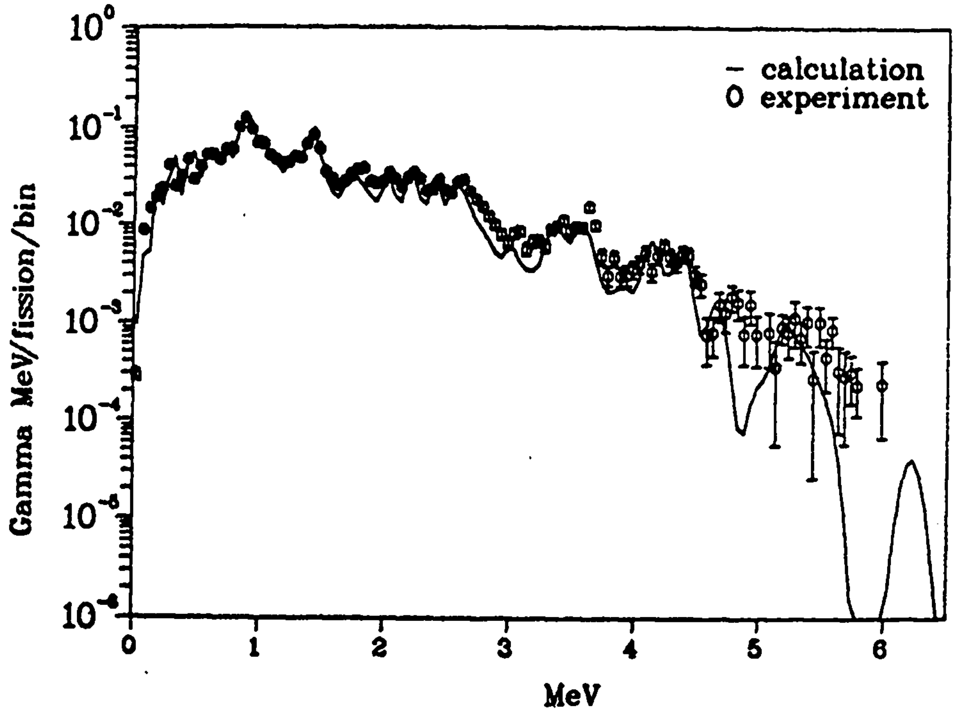

Fig. 16.
^{235}U comparison of calculation with LASL experiment 5.56-h irradiation 128-s decay.

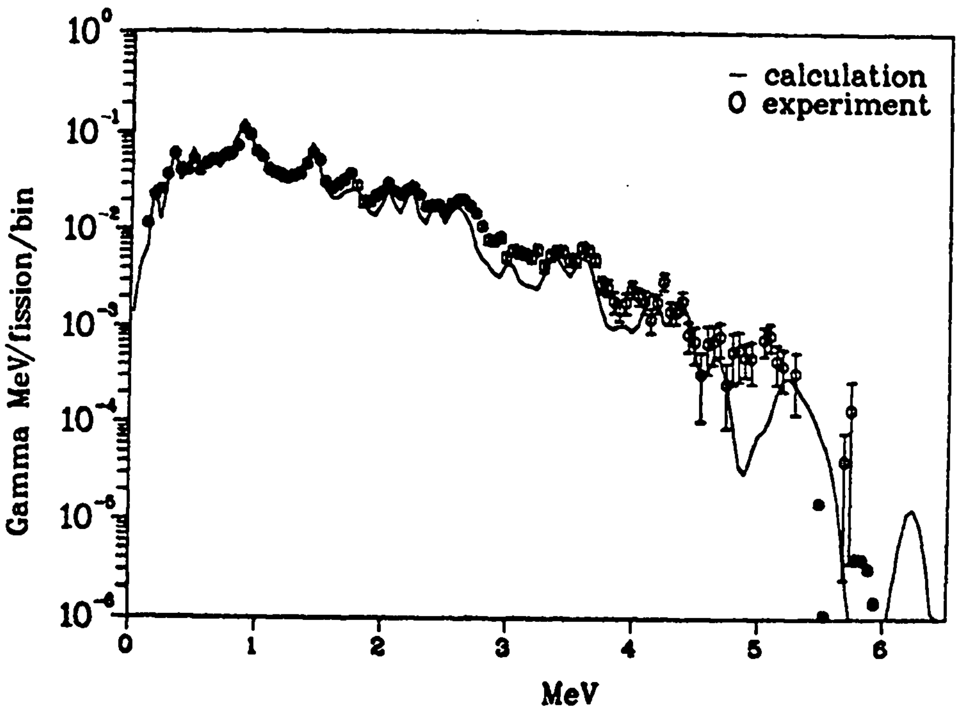

Fig. 17.
^{239}Pu comparison of calculation with LASL experiment 5.56-h irradiation 128-3 decay.

TABLE X

INTEGRATED γ-SPECTRUM: COMPARISON OF LAST MEASUREMENTS AND CINDER-10 PLUS ENDF/B-IV (8/14/78)

	^{235}U			^{233}U			^{239}Pu		
MEAN COOLING TIME(s)	MeV/FISS EXP	RATIO EXP/CAL	% ENERGY FROM 180 NUCLIDES	MeV/FISS EXP	RATIO EXP/CAL	% ENERGY FROM 180 NUCLIDES	MeV/FISS EXP	RATIO EXP/CAL	% ENERGY FROM 180 NUCLIDES
29	3.762 ± 0.198	1.137 (1.140)[a]	80.4	3.333 ± 0.155	1.129 (1.131)[a]	85.2	3.100 ± 0.168	1.133 (1.136)[a]	74.8
128	2.502 ± 0.108	1.077 (1.080)	91.5	2.430 ± 0.094	1.108 (1.111)	92.9	2.136 ± 0.086	1.081 (1.084)	87.1
284	1.975 ± 0.089	1.054 (1.057)	94.7	1.982 ± 0.083	1.100 (1.103)	95.1	1.747 ± 0.074	1.081 (1.085)	92.2
538	1.658 ± 0.071	1.053 (1.057)	96.2	1.647 ± 0.068	1.084 (1.087)	96.3	1.502 ± 0.061	1.098 (1.102)	94.7
1218	1.195 ± 0.027	0.991 (0.995)	97.6	1.242 ± 0.025	1.071 (1.075)	97.3	1.104 ± 0.024	1.063 (1.068)	96.8
2530	0.823 ± 0.029	0.974 (0.979)	98.9	0.787 ± 0.028	0.955 (0.959)	98.8	0.725 ± 0.025	1.024 (1.029)	98.6
3930	0.626 ± 0.029	0.970 (0.975)	99.5	0.656 ± 0.028	1.040 (1.045)	99.4	0.533 ± 0.024	1.001 (1.007)	99.2
5010	0.531 ± 0.034	0.975 (0.981)	99.7	0.550 ± 0.035	1.032 (1.037)	99.6	0.444 ± 0.028	1.006 (1.012)	99.4
23760	0.108 ± 0.004	0.924 (0.937)	99.8	0.121 ± 0.004	0.970 (0.983)	99.7	0.099 ± 0.003	0.980 (0.998)	99.5
59320	0.042 ± 0.002	0.956 (0.982)	99.9	0.044 ± 0.002	0.999 (1.024)	99.8	0.041 ± 0.002	0.976 (1.004)	99.4
96840	0.024 ± 0.002	0.956 (0.989)	99.8	0.024 ± 0.002	0.958 (0.990)	99.8	0.024 ± 0.002	0.961 (0.995)	99.3
146500	0.014 ± 0.002	0.922 (0.961)	99.8	0.015 ± 0.002	0.974 (1.013)	99.8	0.015 ± 0.002	0.963 (1.004)	99.2

[a]Values in parentheses are ratios after removing the conversion electron energy (CE) of the 38 nuclides having CE data in ENDF/B-IV.

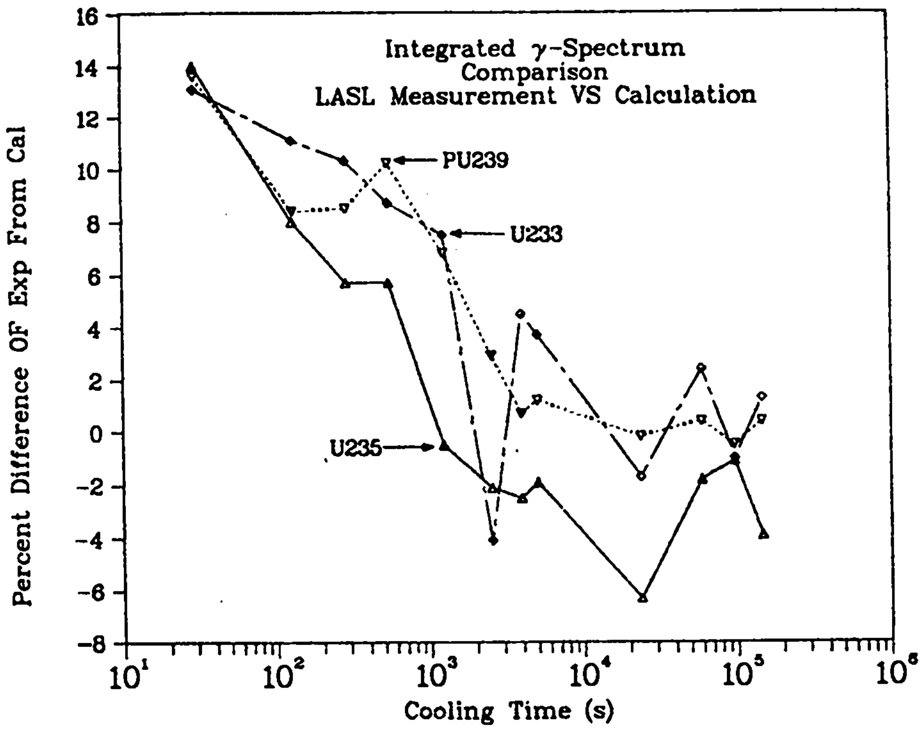

Fig. 18.
Integrated γ-spectrum comparison with LASL measurement vs calculation.

E. Delayed Neutron Calculations [T. R. England, N. L. Whittemore, and J. Liaw (University of Oklahoma)]

Using ENDF/B-V yields and delayed-neutron emission probabilities from 102 precursors, the equilibrium delayed neutrons per 100 fissions have been calculated for each fuel and yield set, each precursor, decay group, and totals over all groups. Table XI lists the results including uncertainties. The uncertainties are calculated from both yield and emission probability uncertainties but are too small to be credible. These calculations treat the ENDF/B-V yield uncertainties as being statistically independent and only indicate the relative quality of calculated delayed neutrons. In fact, there are a number of correlations that could increase the uncertainties. This is now being examined in a joint effort with F. Schmittroth and R. E. Schenter of Hanford Engineering Development Laboratory. The ^{238}U value is much smaller than current evaluations, and this is believed to be a result of the large yield pairing effect that results from a pairing model that is singular at the large ^{238}U fission threshold. Table XII lists a comparison of total values with ENDF/B-IV calculations, evaluations, and ranges of measured values.

TABLE XI

DELAYED NEUTRONS/100 FISSIONS (UNCERTAINTY 105)

GROUP	NUCLITE	PU240(F) UNCERTAINTY	PU241(T) UNCERTAINTY	PU241(F) UNCERTAINTY	PU242(F) UNCERTAINTY	CF252(S) UNCERTAINTY
1	35BR 870	1.875E-02 +/- 32.89	1.548E-02 +/- 8.58	1.552E-02 +/- 13.37	1.775E-02 +/- 24.22	5.114E-03 +/- 24.22
1	43TC1090	5.519E-03 +/-118.72	1.327E-02 +/-109.66	1.475E-02 +/-109.66	1.720E-02 +/-102.61	2.593E-02 +/-102.61
		2.427E-02 +/- 37.07	2.875E-02 +/- 50.81	3.027E-02 +/- 53.88	3.495E-02 +/- 51.98	3.105E-02 +/- 85.80
2	35BR 880	4.266E-02 +/- 45.38	4.093E-02 +/- 12.47	4.042E-02 +/- 45.38	4.711E-02 +/- 45.38	1.422E-02 +/- 64.27
2	41NB1030	5.262E-03 +/-102.61	6.177E-03 +/-102.61	6.432E-03 +/-102.61	5.905E-03 +/-101.27	4.842E-03 +/-102.61
2	51SB1341	1.622E-04 +/- 65.50	4.307E-04 +/- 47.11	4.134E-04 +/- 65.50	2.948E-04 +/- 65.50	1.296E-04 +/- 65.50
2	52TE1360	1.050E-02 +/- 50.04	1.980E-02 +/- 50.04	1.654E-02 +/- 50.04	2.501E-02 +/- 50.04	6.417E-03 +/- 54.77
2	53 I1370	1.857E-01 +/- 24.97	2.973E-01 +/- 11.42	2.817E-01 +/- 24.97	2.667E-01 +/- 24.97	1.795E-01 +/- 24.97
2	55CS1410	1.744E-03 +/- 24.21	2.176E-03 +/- 17.69	2.212E-03 +/- 24.21	2.260E-03 +/- 17.69	2.385E-03 +/- 8.54
		2.461E-01 +/- 20.65	3.668E-01 +/- 9.90	3.477E-01 +/- 21.13	3.473E-01 +/- 20.53	2.075E-01 +/- 22.24
3	33AS 840	1.542E-04 +/- 78.91	2.022E-04 +/- 78.91	1.971E-04 +/- 78.91	1.632E-04 +/- 78.91	4.323E-05 +/- 78.91
3	34SE 870	6.196E-04 +/- 65.58	4.943E-04 +/- 27.08	6.271E-04 +/- 65.58	9.110E-04 +/- 65.57	1.295E-04 +/- 65.57
3	35BR 890	5.130E-02 +/- 68.03	5.412E-02 +/- 24.42	6.881E-02 +/- 50.57	6.762E-02 +/- 50.57	1.491E-02 +/- 68.03
3	37RB 920	2.680E-04 +/- 24.46	2.184E-04 +/- 18.07	2.462E-04 +/- 18.04	2.628E-04 +/- 24.46	6.810E-05 +/- 24.46
3	37RB 930	2.826E-02 +/- 25.02	2.680E-02 +/- 25.02	2.857E-02 +/- 25.02	2.873E-02 +/- 25.02	7.322E-03 +/- 46.07
3	39 Y 970	1.354E-02 +/-101.27	1.426E-02 +/-101.27	1.275E-02 +/-101.27	1.430E-02 +/-101.27	4.513E-03 +/-102.61
3	40ZR1040	1.962E-04 +/-118.73	6.158E-04 +/-109.66	5.598E-04 +/-109.66	7.243E-04 +/-109.66	1.765E-04 +/-118.73
3	49IN1271	7.563E-04 +/-118.73	5.964E-04 +/-118.73	7.706E-04 +/-118.73	7.153E-04 +/-118.73	2.245E-04 +/-118.73
3	53 I1380	2.485E-02 +/- 46.46	6.012E-02 +/- 13.01	4.879E-02 +/- 25.73	3.760E-02 +/- 25.73	3.229E-02 +/- 19.73
		1.199E-01 +/- 33.25	1.574E-01 +/- 14.07	1.613E-01 +/- 24.70	1.510E-01 +/- 25.87	5.967E-02 +/- 22.25
4	30ZN 790	1.444E-05 +/-118.73	9.358E-06 +/-118.71	1.980E-05 +/-118.73	2.915E-05 +/-118.72	1.355E-06 +/-118.64
4	31GA 790	2.520E-05 +/-118.73	1.085E-05 +/-118.72	2.619E-05 +/-118.73	2.416E-05 +/-118.73	3.607E-06 +/-118.71
4	31GA 800	9.264E-05 +/-118.73	5.551E-05 +/-118.72	1.299E-04 +/-118.72	9.837E-05 +/-118.73	2.080E-05 +/-118.73
4	31GA 810	2.752E-04 +/-118.73	2.416E-04 +/-118.73	3.737E-04 +/-118.73	3.803E-04 +/-118.73	5.943E-05 +/-118.74
4	32GE 830	5.993E-05 +/-118.73	7.168E-05 +/-118.73	6.037E-05 +/-118.73	1.049E-04 +/-118.73	8.486E-06 +/-118.73
4	32GE 840	1.066E-03 +/-118.73	2.038E-03 +/-118.73	1.655E-03 +/-118.73	2.608E-03 +/-118.73	1.681E-04 +/-118.73
4	33AS 850	1.659E-02 +/- 65.32	1.997E-02 +/- 65.32	2.053E-02 +/- 65.32	1.903E-02 +/- 65.32	5.224E-03 +/- 65.31
4	34SE 880	1.758E-04 +/- 87.73	2.155E-04 +/- 87.73	1.585E-04 +/- 87.73	3.849E-04 +/- 87.73	3.494E-05 +/- 87.72
4	35BR 900	3.428E-02 +/- 64.70	5.788E-02 +/- 14.55	5.461E-02 +/- 64.70	4.656E-02 +/- 64.70	1.470E-02 +/- 64.70
4	36KR 920	2.833E-04 +/- 45.91	2.105E-04 +/- 10.91	2.925E-04 +/- 45.91	4.408E-04 +/- 24.73	4.708E-05 +/- 64.64
4	36KR 930	6.043E-03 +/- 64.78	3.868E-03 +/- 12.81	7.764E-03 +/- 64.78	1.173E-02 +/- 46.10	1.032E-03 +/- 64.76
4	37RB 940	9.980E-02 +/- 45.65	1.362E-01 +/- 24.25	1.397E-01 +/- 24.25	1.200E-01 +/- 24.25	4.266E-02 +/- 45.65
4	38SR1000	8.387E-04 +/-118.73	2.312E-03 +/-118.73	2.085E-03 +/-118.73	2.936E-03 +/-118.73	2.502E-04 +/-118.73
4	39 Y 971	2.186E-02 +/- 29.71	1.957E-02 +/- 29.74	1.838E-02 +/- 29.73	1.611E-02 +/- 29.79	8.374E-03 +/- 48.80
4	39 Y 980	1.460E-02 +/-101.27	1.818E-02 +/-101.27	1.819E-02 +/-101.27	1.765E-02 +/-101.27	6.551E-03 +/-102.61
4	39 Y 990	1.954E-02 +/- 70.52	3.058E-02 +/- 70.52	2.801E-02 +/- 70.52	2.509E-02 +/- 70.51	9.081E-03 +/- 80.42
4	41NB1050	2.154E-02 +/-109.66	4.637E-02 +/-102.61	5.035E-02 +/-102.61	3.997E-02 +/-102.61	3.170E-02 +/-102.61
4	42MO1090	6.494E-05 +/-118.73	3.062E-04 +/-118.73	2.818E-04 +/-118.73	5.411E-04 +/-118.73	2.639E-04 +/-118.73
4	42MO1100	1.799E-05 +/-118.74	7.964E-05 +/-118.72	7.618E-05 +/-118.73	1.874E-04 +/-118.73	1.168E-04 +/-118.73
4	47AG1220	1.242E-04 +/-118.73	6.890E-05 +/-118.73	2.544E-04 +/-118.73	2.022E-04 +/-118.73	1.532E-04 +/-118.73
4	49IN1270	7.563E-04 +/-118.72	5.965E-04 +/-118.72	7.708E-04 +/-118.72	7.155E-04 +/-118.72	2.245E-04 +/-118.72
4	49IN1290	3.504E-03 +/-118.73	5.407E-03 +/-118.73	6.309E-03 +/-118.73	4.839E-03 +/-118.73	1.862E-03 +/-118.73
4	50SN1330	1.499E-05 +/-118.73	5.488E-05 +/-118.73	3.781E-05 +/-118.73	5.570E-05 +/-118.73	9.335E-06 +/-118.73
4	50SN1340	1.043E-03 +/- 76.11	5.950E-03 +/- 76.10	3.918E-03 +/- 76.10	5.993E-03 +/- 76.10	6.699E-04 +/- 76.10
4	51SB1350	1.302E-02 +/- 65.57	4.060E-02 +/- 65.57	3.311E-02 +/- 65.58	3.284E-02 +/- 65.58	1.105E-02 +/- 65.57
4	52TE1370	5.537E-03 +/- 67.92	1.518E-02 +/- 50.41	1.227E-02 +/- 50.41	1.804E-02 +/- 50.41	4.528E-03 +/- 67.92
4	52TE1380	2.263E-03 +/- 70.09	1.008E-02 +/- 70.09	6.297E-03 +/- 70.09	9.714E-03 +/- 70.09	1.884E-03 +/- 70.09
4	53 I1390	3.301E-02 +/- 64.61	8.736E-02 +/- 11.91	7.778E-02 +/- 45.86	6.902E-02 +/- 45.86	4.179E-02 +/- 64.61
4	54XE1410	3.462E-04 +/- 45.54	6.420E-04 +/- 7.52	5.774E-04 +/- 24.03	8.168E-04 +/- 24.03	4.233E-04 +/- 10.61
4	54XE1420	9.064E-04 +/- 64.42	2.364E-03 +/- 10.84	1.808E-03 +/- 64.42	2.841E-03 +/- 45.59	7.692E-04 +/- 64.42
4	55CS1420	3.439E-03 +/- 57.44	5.491E-03 +/- 57.44	5.131E-03 +/- 57.44	4.511E-03 +/- 57.44	5.234E-03 +/- 55.01
4	55CS1430	1.284E-02 +/- 46.70	2.329E-02 +/- 26.18	2.416E-02 +/- 26.18	2.241E-02 +/- 26.18	1.965E-02 +/- 26.18
4	55CS1440	5.638E-03 +/- 68.71	1.401E-02 +/- 51.48	1.413E-02 +/- 51.48	1.081E-02 +/- 68.71	1.511E-02 +/- 29.68

GROUP	NUCLIDE	PU240(F)	UNCERTAINTY	PU241(T)	UNCERTAINTY	PU241(F)	UNCERTAINTY	PU242(F)	UNCERTAINTY	CF252(S)	UNCERTAINTY
4	56BA1500	6.649E-08	+/-118.73	4.010E-07	+/-118.72	2.976E-07	+/-118.72	6.433E-07	+/-118.72	6.762E-08	+/-118.72
4	57LA1490	4.628E-04	+/-118.73	1.187E-03	+/-118.73	1.109E-03	+/-118.73	1.138E-03	+/-118.73	8.399E-04	+/-118.73
		3.201E-01	+/- 20.56	5.505E-01	+/- 13.52	5.303E-01	+/- 16.88	4.878E-01	+/- 15.94	2.245E-01	+/- 22.31
5	31GA 820	2.180E-04	+/-118.71	3.504E-04	+/-118.72	3.909E-04	+/-118.73	3.920E-04	+/-118.73	5.317E-05	+/-118.77
5	33AS 860	2.251E-03	+/- 67.34	3.907E-03	+/- 67.34	3.780E-03	+/- 67.34	3.293E-03	+/- 67.34	5.875E-04	+/- 67.34
5	33AS 870	2.335E-03	+/- 64.00	4.030E-03	+/- 64.00	4.519E-03	+/- 64.01	5.354E-03	+/- 64.00	5.833E-04	+/- 64.01
5	34SE 890	1.168E-03	+/- 70.68	1.844E-03	+/- 70.68	2.091E-03	+/- 70.68	3.344E-03	+/- 70.68	2.199E-04	+/- 70.69
5	34SE 900	4.392E-04	+/-118.73	1.117E-03	+/-118.73	8.828E-04	+/-118.73	1.562E-03	+/-118.73	1.023E-04	+/-118.73
5	35BR 910	6.433E-03	+/- 66.53	9.872E-03	+/- 66.53	1.141E-02	+/- 66.53	1.185E-02	+/- 66.53	1.768E-03	+/- 66.53
5	36KR 950	7.377E-04	+/-118.73	1.945E-03	+/-118.73	1.658E-03	+/-118.73	2.607E-03	+/-118.73	1.333E-04	+/-118.73
5	38SR 970	1.368E-03	+/-102.61	1.871E-03	+/-102.61	1.561E-03	+/-102.61	2.313E-03	+/-102.61	3.203E-04	+/-118.73
5	38SR 980	2.624E-03	+/-118.73	4.478E-03	+/-109.66	3.913E-03	+/-109.66	6.434E-03	+/-102.61	6.671E-04	+/-118.73
5	38SR 990	3.355E-03	+/- 95.28	8.006E-03	+/- 95.28	6.560E-03	+/- 95.28	9.537E-03	+/- 95.28	9.592E-04	+/- 95.28
5	39 Y 981	4.414E-02	+/- 55.07	5.031E-02	+/- 55.10	5.250E-02	+/- 55.08	4.094E-02	+/- 55.13	2.173E-02	+/- 67.32
5	39 Y1000	3.290E-02	+/-109.66	5.910E-02	+/-102.61	6.503E-02	+/-102.61	4.453E-02	+/-109.66	1.905E-02	+/-118.73
5	40ZR1050	2.831E-04	+/-118.73	1.157E-03	+/-118.73	1.089E-03	+/-118.73	1.445E-03	+/-118.73	3.229E-04	+/-118.73
5	41NB1040	1.287E-02	+/-102.61	2.445E-02	+/-102.61	2.644E-02	+/-102.61	1.865E-02	+/-102.61	1.749E-02	+/-102.61
5	41NB1060	9.055E-03	+/-118.73	2.826E-02	+/-109.66	2.950E-02	+/-109.66	1.999E-02	+/-118.73	1.811E-02	+/-118.73
5	43TC1100	2.326E-03	+/-118.73	5.327E-03	+/-118.73	6.580E-03	+/-118.73	7.789E-03	+/-118.73	1.983E-02	+/-118.73
5	48CD1280	7.943E-06	+/-118.73	1.443E-05	+/-118.73	1.635E-05	+/-118.73	2.202E-05	+/-118.73	3.039E-06	+/-118.73
5	49IN1280	2.174E-03	+/-118.73	2.178E-03	+/-118.73	3.452E-03	+/-118.73	2.365E-03	+/-118.73	1.062E-03	+/-118.73
5	49IN1291	1.762E-03	+/-118.73	2.668E-03	+/-118.73	3.144E-03	+/-118.73	2.365E-03	+/-118.73	9.377E-04	+/-118.73
5	49IN1300	2.086E-03	+/-118.73	5.064E-03	+/-118.73	4.533E-03	+/-118.73	3.192E-03	+/-118.73	1.315E-03	+/-118.73
5	51SB1360	2.015E-03	+/- 72.85	9.197E-03	+/- 72.84	7.736E-03	+/- 72.84	7.740E-03	+/- 72.84	2.388E-03	+/- 72.84
5	52TE1390	2.392E-04	+/-118.73	1.121E-03	+/-105.00	9.044E-04	+/-118.73	1.374E-03	+/-118.73	2.211E-04	+/-118.72
5	53 I1400	1.202E-02	+/- 69.57	9.079E-02	+/- 42.05	3.661E-02	+/- 69.57	2.881E-02	+/- 69.57	2.151E-02	+/- 69.57
5	53 I1410	3.045E-03	+/- 72.16	1.234E-02	+/- 72.16	1.100E-02	+/- 72.16	1.268E-02	+/- 72.16	4.571E-03	+/- 72.16
5	54XE1440	2.222E-05	+/-118.73	1.018E-04	+/-118.73	8.152E-05	+/-118.73	1.306E-04	+/-118.73	3.127E-05	+/-118.73
5	55CS1450	6.216E-03	+/- 65.58	1.679E-02	+/- 65.58	1.617E-02	+/- 65.58	1.709E-02	+/- 65.57	8.347E-03	+/- 65.57
5	56BA1490	1.596E-07	+/-118.73	7.658E-07	+/-118.73	5.997E-07	+/-118.73	1.058E-06	+/-118.73	1.628E-07	+/-118.73
5	57LA1500	7.625E-05	+/-118.73	2.476E-04	+/-118.73	2.341E-04	+/-118.73	2.348E-04	+/-118.73	1.638E-04	+/-118.73
		1.522E-01	+/- 31.84	3.465E-01	+/- 25.79	3.018E-01	+/- 29.99	2.560E-01	+/- 27.11	1.425E-01	+/- 33.96
6	31GA 830	1.362E-04	+/-118.70	3.001E-04	+/-118.75	2.685E-04	+/-118.76	3.816E-04	+/-118.71	2.301E-05	+/-118.71
6	32GE 850	3.633E-04	+/-118.72	6.942E-04	+/-118.73	6.173E-04	+/-118.72	9.678E-04	+/-118.73	7.279E-05	+/-118.70
6	32GE 860	4.379E-05	+/-118.72	1.202E-04	+/-118.72	9.462E-05	+/-118.72	1.756E-04	+/-118.72	6.156E-06	+/-118.72
6	34SE 910	7.855E-05	+/- 74.48	1.975E-04	+/- 74.48	1.961E-04	+/- 74.48	3.528E-04	+/- 74.48	1.320E-05	+/- 74.48
6	35BR 920	2.486E-03	+/- 69.57	3.541E-03	+/- 69.57	5.365E-03	+/- 69.57	5.357E-03	+/- 69.57	5.618E-04	+/- 69.56
6	35BR 930	6.220E-04	+/-118.73	6.212E-03	+/-118.73	1.570E-03	+/-118.73	1.939E-03	+/-118.73	1.229E-04	+/-118.73
6	36KR 940	1.467E-03	+/- 90.25	2.954E-03	+/- 90.25	2.514E-03	+/- 90.25	4.194E-03	+/- 90.25	2.792E-04	+/- 90.25
6	37RB 950	3.554E-02	+/- 64.37	5.862E-02	+/- 45.53	5.784E-02	+/- 45.53	5.347E-02	+/- 45.53	1.071E-02	+/- 64.37
6	37RB 960	1.471E-02	+/- 64.40	3.023E-02	+/- 64.40	3.031E-02	+/- 64.40	2.509E-02	+/- 64.40	4.908E-03	+/- 64.40
6	37RB 970	6.402E-03	+/- 65.37	1.575E-02	+/- 65.37	1.435E-02	+/- 65.37	1.732E-02	+/- 65.37	1.693E-03	+/- 65.37
6	37RB 980	3.142E-04	+/- 65.98	1.024E-03	+/- 65.97	1.035E-03	+/- 65.96	1.127E-03	+/- 65.97	1.052E-04	+/- 65.95
6	37RB 990	1.131E-05	+/-118.73	5.749E-05	+/-118.72	5.124E-05	+/-118.72	6.367E-05	+/-118.72	3.438E-06	+/-118.73
6	47AG1230	1.633E-04	+/-118.72	1.029E-04	+/-118.73	3.527E-04	+/-118.72	3.322E-04	+/-118.73	1.020E-04	+/-118.73
6	49IN1310	1.351E-03	+/-118.73	4.710E-03	+/-118.73	3.902E-03	+/-118.73	4.151E-03	+/-118.73	9.774E-04	+/-118.73
6	49IN1320	3.389E-04	+/-118.73	2.029E-03	+/-118.73	1.510E-03	+/-118.73	1.590E-03	+/-118.73	3.016E-04	+/-118.74
6	50SN1350	3.010E-05	+/-118.73	2.010E-04	+/-118.73	1.219E-04	+/-118.73	2.099E-04	+/-118.73	2.354E-05	+/-118.73
6	51SB1370	1.453E-04	+/-118.72	9.353E-04	+/-118.73	7.364E-04	+/-118.73	8.872E-04	+/-118.73	1.893E-04	+/-118.72
6	53 I1420	8.869E-05	+/-118.71	4.710E-03	+/-118.73	4.420E-04	+/-118.73	4.605E-04	+/-118.73	1.049E-04	+/-118.72
6	53 I1430	8.310E-07	+/-118.73	7.048E-06	+/-118.72	6.193E-06	+/-118.73	8.122E-06	+/-118.72	8.192E-07	+/-118.73
6	54XE1430	3.633E-04	+/-118.73	1.197E-03	+/-118.73	1.053E-03	+/-118.73	1.614E-03	+/-118.73	3.471E-04	+/-118.73
6	55CS1460	5.458E-04	+/- 64.22	2.173E-03	+/- 64.21	1.978E-03	+/- 64.21	2.138E-03	+/- 64.21	1.186E-03	+/- 64.21
6	55CS1470	7.947E-05	+/- 65.10	5.967E-05	+/- 65.10	4.828E-05	+/- 65.11	6.647E-05	+/- 65.10	1.111E-05	+/- 65.11
		6.528E-02	+/- 38.73	1.358E-01	+/- 26.95	1.244E-01	+/- 28.03	1.219E-01	+/- 26.62	2.174E-02	+/- 36.01
		9.278E-01	+/- 11.59	1.566E+00	+/- 8.19	1.496E+00	+/- 10.50	1.399E+00	+/- 9.82	6.869E-01	+/- 12.96

GROUP	NUCLIDE	U238(HF)	UNCERTAINTY	NP237(F)	UNCERTAINTY	PU239(T)	UNCERTAINTY	PU239(F)	UNCERTAINTY	PU239(HE)	UNCERTAINT
4	56BA1500	1.873E-06	+/-118.71	2.976E-08	+/-118.72	7.155E-09	+/-118.73	9.795E-09	+/-118.72	1.195E-09	+/-118.73
4	57LA1490	2.809E-03	+/-118.73	5.112E-04	+/-118.73	1.656E-04	+/-118.73	2.245E-04	+/-118.73	7.534E-05	+/-118.73
		1.034E+00	+/- 12.53	4.818E-01	+/- 17.35	2.699E-01	+/- 12.69	2.519E-01	+/- 21.56	1.409E-01	+/- 23.37
5	31GA 820	2.988E-03	+/-118.73	4.106E-04	+/-118.74	8.608E-05	+/-118.74	1.270E-04	+/-118.72	6.372E-05	+/-118.79
5	33AS 860	2.063E-02	+/- 67.34	4.842E-03	+/- 67.34	1.131E-03	+/- 67.34	1.533E-03	+/- 67.34	8.915E-04	+/- 67.34
5	33AS 870	2.364E-02	+/- 64.00	4.088E-03	+/- 64.00	6.072E-04	+/- 64.00	1.155E-03	+/- 64.00	4.336E-04	+/- 64.04
5	34SE 890	9.191E-03	+/- 70.68	1.374E-03	+/- 70.68	5.413E-04	+/- 70.68	6.061E-04	+/- 70.68	2.205E-04	+/- 70.69
5	34SE 900	4.503E-03	+/-118.73	5.400E-04	+/-118.73	1.470E-04	+/-118.73	1.798E-04	+/-118.73	4.895E-05	+/-118.73
5	35BR 910	4.354E-02	+/- 66.53	1.226E-02	+/- 66.53	1.885E-03	+/- 36.80	4.222E-03	+/- 66.53	1.426E-03	+/- 66.53
5	36KR 950	6.718E-03	+/-118.73	7.015E-04	+/-118.73	8.752E-05	+/-118.73	3.093E-04	+/-118.73	7.078E-05	+/-118.73
5	38SR 970	2.510E-03	+/-102.61	1.199E-03	+/-102.61	7.606E-04	+/-109.66	8.725E-04	+/-109.66	3.849E-04	+/-118.73
5	38SR 980	6.583E-03	+/-102.61	1.962E-03	+/-118.73	1.226E-03	+/-118.73	1.392E-03	+/-118.73	5.118E-04	+/-118.73
5	38SR 990	1.393E-02	+/- 95.28	2.575E-03	+/- 95.28	1.272E-03	+/- 95.28	1.600E-03	+/- 95.28	4.016E-04	+/- 95.28
5	39 Y 981	6.710E-02	+/- 55.12	6.525E-02	+/- 55.05	4.374E-02	+/- 55.05	4.586E-02	+/- 55.05	3.572E-02	+/- 67.28
5	39 Y1000	1.035E-01	+/-102.61	4.895E-02	+/-109.66	2.301E-02	+/-118.73	2.917E-02	+/-109.66	1.469E-02	+/-118.73
5	40ZR1050	1.146E-03	+/-118.73	1.596E-04	+/-118.73	1.256E-04	+/-118.73	1.673E-04	+/-118.73	3.090E-05	+/-118.73
5	41NB1040	1.805E-02	+/-102.61	1.330E-02	+/-102.61	1.075E-02	+/-109.66	1.541E-02	+/-102.61	8.723E-03	+/-102.61
5	41NB1060	2.274E-02	+/-118.73	6.400E-03	+/-118.73	4.702E-03	+/-118.73	7.115E-03	+/-118.73	2.266E-03	+/-118.73
5	43TC1100	8.992E-03	+/-118.73	7.151E-04	+/-118.73	8.167E-04	+/-118.73	1.020E-03	+/-118.73	9.539E-04	+/-118.73
5	48CD1280	3.942E-05	+/-118.73	6.308E-06	+/-118.73	2.224E-06	+/-118.74	3.687E-06	+/-118.73	1.771E-07	+/-118.72
5	49IN1280	1.124E-02	+/-109.66	3.162E-03	+/-118.73	1.222E-03	+/-105.00	2.311E-03	+/-118.73	8.831E-04	+/-118.73
5	49IN1291	6.747E-03	+/-118.73	2.996E-03	+/-118.73	1.380E-03	+/-118.73	1.504E-03	+/-118.73	2.146E-04	+/-118.73
5	49IN1300	8.920E-03	+/-118.73	3.175E-03	+/-118.73	1.237E-03	+/-118.73	1.368E-03	+/-118.73	8.020E-05	+/-118.71
5	51SB1360	9.874E-03	+/- 72.84	2.483E-03	+/- 72.84	6.266E-04	+/- 72.85	7.120E-04	+/- 72.85	2.190E-05	+/- 72.84
5	52TE1390	1.491E-03	+/-118.73	1.714E-04	+/-118.74	5.143E-05	+/-104.99	6.335E-05	+/-118.76	2.791E-06	+/-118.80
5	53 I1400	7.793E-02	+/- 69.57	1.562E-02	+/- 69.57	1.305E-02	+/- 42.04	5.911E-03	+/- 69.57	7.440E-04	+/- 69.57
5	53 I1410	2.727E-02	+/- 72.16	3.454E-03	+/- 72.16	2.700E-03	+/- 72.16	1.096E-03	+/- 72.16	1.006E-04	+/- 72.16
5	54XE1440	2.877E-04	+/-118.73	1.570E-05	+/-118.73	4.571E-06	+/-118.73	5.477E-06	+/-118.73	5.979E-07	+/-118.73
5	55CS1450	4.721E-02	+/- 65.57	6.585E-03	+/- 65.58	2.998E-03	+/- 65.58	2.377E-03	+/- 65.57	5.101E-04	+/- 65.58
5	56BA1490	3.034E-06	+/-118.73	1.050E-07	+/-118.73	2.488E-08	+/-118.73	3.541E-08	+/-118.73	5.160E-09	+/-118.73
5	57LA1500	8.006E-04	+/-118.73	7.062E-05	+/-118.73	2.047E-05	+/-118.73	2.771E-05	+/-118.73	8.587E-06	+/-118.71
		5.476E-01	+/- 25.92	2.025E-01	+/- 33.87	1.144E-01	+/- 34.39	1.261E-01	+/- 35.75	6.942E-02	+/- 44.96
6	31GA 830	2.573E-03	+/-118.73	1.804E-04	+/-118.71	3.654E-05	+/-118.71	5.884E-05	+/-118.71	2.044E-05	+/-118.72
6	32GE 850	3.458E-03	+/-118.73	4.544E-04	+/-118.73	5.784E-05	+/-118.71	1.515E-04	+/-118.76	5.622E-05	+/-118.72
6	32GE 860	6.432E-04	+/-118.73	4.731E-05	+/-118.72	1.008E-05	+/-118.72	1.424E-05	+/-118.72	3.212E-06	+/-118.72
6	34SE 910	1.091E-03	+/- 74.48	9.156E-05	+/- 74.48	1.120E-05	+/- 74.48	2.710E-05	+/- 74.48	4.095E-06	+/- 74.48
6	35BR 920	2.451E-02	+/- 69.57	4.120E-03	+/- 69.57	6.204E-04	+/- 69.57	1.324E-03	+/- 69.57	1.382E-05	+/- 69.56
6	35BR 930	2.277E-03	+/-118.73	8.401E-04	+/-118.73	2.943E-03	+/-118.73	2.342E-04	+/-118.73	5.617E-05	+/-118.73
6	36KR 940	7.468E-03	+/- 90.25	1.299E-03	+/- 90.25	4.798E-04	+/- 71.23	6.294E-04	+/- 90.25	1.817E-04	+/- 90.25
6	37RB 950	1.450E-01	+/- 24.01	5.484E-02	+/- 45.53	3.250E-02	+/- 24.01	2.778E-02	+/- 64.37	1.282E-02	+/- 64.37
6	37RB 960	9.789E-02	+/- 45.56	2.098E-02	+/- 64.40	6.872E-03	+/- 32.79	9.967E-03	+/- 64.40	4.415E-03	+/- 64.40
6	37RB 970	4.990E-02	+/- 65.37	7.610E-03	+/- 65.37	2.059E-03	+/- 65.37	3.357E-03	+/- 65.37	1.054E-03	+/- 65.37
6	37RB 980	4.323E-03	+/- 65.97	3.889E-04	+/- 65.97	9.126E-05	+/- 35.82	1.496E-04	+/- 65.95	4.186E-05	+/- 65.96
6	37RB 990	2.945E-04	+/-118.72	1.149E-05	+/-118.73	2.175E-06	+/-118.73	3.674E-06	+/-118.73	5.487E-07	+/-118.73
6	47AG1230	3.840E-03	+/-118.73	1.452E-04	+/-118.73	3.845E-05	+/-118.70	7.942E-05	+/-118.71	1.079E-04	+/-118.73
6	49IN1310	4.673E-03	+/-118.73	1.529E-03	+/-118.73	5.956E-04	+/-118.73	5.321E-04	+/-118.72	1.010E-05	+/-118.72
6	49IN1320	1.445E-03	+/-118.73	4.528E-04	+/-118.72	3.031E-04	+/-118.74	1.117E-04	+/-118.72	8.953E-07	+/-118.73
6	50SN1350	1.068E-04	+/-118.73	2.150E-05	+/-118.73	8.388E-06	+/-118.73	5.944E-06	+/-118.73	2.916E-08	+/-118.73
6	51SB1370	1.298E-03	+/-118.73	1.496E-04	+/-118.72	4.562E-05	+/-118.72	3.622E-05	+/-118.72	7.081E-07	+/-118.73
6	53 I1420	1.998E-03	+/-105.00	9.042E-05	+/-118.72	3.762E-05	+/-118.72	2.465E-05	+/-118.72	1.920E-06	+/-118.73
6	53 I1430	5.108E-05	+/-118.72	7.888E-07	+/-118.73	9.305E-08	+/-118.73	1.384E-07	+/-118.73	5.065E-09	+/-118.73
6	54XE1430	2.597E-03	+/-118.73	2.894E-04	+/-118.73	1.110E-04	+/-118.73	1.199E-04	+/-118.73	1.344E-05	+/-118.73
6	55CS1460	6.879E-03	+/- 64.21	5.726E-04	+/- 64.21	1.933E-04	+/- 64.18	1.670E-04	+/- 64.23	2.922E-05	+/- 64.20
6	55CS1470	4.108E-04	+/- 65.09	7.974E-06	+/- 65.11	1.152E-06	+/- 65.11	1.710E-06	+/- 65.11	2.112E-07	+/- 65.11
		3.628E-01	+/- 18.97	9.412E-02	+/- 30.89	4.701E-02	+/- 19.14	4.478E-02	+/- 42.82	1.863E-02	+/- 46.51
		2.668E+00	+/- 8.05	1.310E+00	+/- 10.39	7.916E-01	+/- 7.57	7.481E-01	+/- 12.15	4.062E-01	+/- 15.50

GROUP	NUCLIDE	U238(HE)	UNCERTAINTY	NP237(F)	UNCERTAINTY	PU239(T)	UNCERTAINTY	PU239(F)	UNCERTAINTY	PU239(HE)	UNCERTAINTY
1	35BR 870	3.001E-02	+/- 8.58	3.392E-02	+/- 17.71	1.644E-02	+/- 8.58	1.784E-02	+/- 32.89	2.055E-02	+/- 45.64
1	43TC1090	1.049E-02	+/-109.65	1.899E-03	+/-118.73	4.475E-03	+/-118.73	5.250E-03	+/-118.73	3.100E-03	+/-118.73
		4.650E-02	+/- 25.61	3.582E-02	+/- 17.91	2.091E-02	+/- 26.29	2.309E-02	+/- 37.07	2.365E-02	+/- 42.60
2	35BR 880	1.039E-01	+/- 9.93	8.120E-02	+/- 23.74	3.645E-02	+/- 8.40	4.104E-02	+/- 45.38	4.711E-02	+/- 45.38
2	41NB1030	5.345E-03	+/-101.27	5.066E-03	+/-102.61	4.701E-03	+/-102.61	5.110E-03	+/-102.61	3.192E-03	+/-102.61
2	51SB1341	4.260E-04	+/- 65.50	2.428E-04	+/- 65.50	1.033E-04	+/- 65.50	1.047E-04	+/- 65.50	6.126E-06	+/- 65.50
2	52TE1360	1.336E-02	+/- 50.04	7.389E-03	+/- 63.25	4.862E-03	+/- 63.25	4.882E-03	+/- 63.25	5.054E-04	+/- 77.92
2	53 I1370	2.400E-01	+/- 11.42	2.089E-01	+/- 24.97	1.755E-01	+/- 11.42	1.370E-01	+/- 24.97	3.352E-02	+/- 64.73
2	55CS1410	2.107E-03	+/- 17.69	2.132E-03	+/- 24.21	1.742E-03	+/- 13.34	1.635E-03	+/- 24.21	7.387E-04	+/- 24.21
		3.651E-01	+/- 8.36	3.049E-01	+/- 18.38	2.233E-01	+/- 9.44	1.898E-01	+/- 20.78	8.507E-02	+/- 36.02
3	33AS 840	8.562E-04	+/- 64.46	3.647E-04	+/- 78.91	8.731E-05	+/- 56.16	1.564E-04	+/- 78.91	1.766E-04	+/- 78.91
3	34SE 870	1.678E-03	+/- 47.21	7.991E-04	+/- 65.58	3.117E-04	+/- 65.57	3.829E-04	+/- 65.58	2.330E-04	+/- 65.58
3	35BR 890	1.915E-01	+/- 28.08	9.597E-02	+/- 50.57	4.609E-02	+/- 23.42	4.790E-02	+/- 68.03	3.813E-02	+/- 68.03
3	37RB 920	4.433E-04	+/- 18.04	4.323E-04	+/- 18.04	2.348E-04	+/- 13.80	2.580E-04	+/- 24.46	1.051E-04	+/- 45.77
3	37RB 930	4.776E-02	+/- 25.02	4.294E-02	+/- 25.02	2.580E-02	+/- 18.79	2.289E-02	+/- 25.02	1.636E-02	+/- 25.02
3	39 Y 970	1.663E-02	+/-100.18	1.667E-02	+/-101.27	1.237E-02	+/-100.60	1.290E-02	+/-101.27	9.692E-03	+/-101.27
3	40ZR1040	4.546E-04	+/-118.73	1.254E-04	+/-118.73	9.633E-05	+/-118.73	1.420E-04	+/-118.73	3.475E-05	+/-118.73
3	49IN1271	4.012E-03	+/-118.73	7.453E-04	+/-118.73	6.885E-04	+/-118.73	7.658E-04	+/-118.73	6.970E-04	+/-118.73
3	53 I1380	4.857E-02	+/- 14.04	3.336E-02	+/- 25.73	3.029E-02	+/- 14.04	2.704E-02	+/- 15.94	2.915E-03	+/- 34.02
		3.119E-01	+/- 18.65	1.914E-01	+/- 27.80	1.160E-01	+/- 15.28	1.124E-01	+/- 31.88	6.834E-02	+/- 41.07
4	30ZN 790	1.592E-04	+/-118.73	1.226E-05	+/-118.72	2.898E-06	+/-118.68	8.157E-06	+/-118.71	3.414E-06	+/-118.80
4	31GA 790	1.646E-04	+/-118.73	3.370E-05	+/-118.73	9.577E-06	+/-105.00	2.523E-05	+/-118.73	2.347E-05	+/-118.73
4	31GA 800	7.476E-04	+/-118.73	1.726E-04	+/-118.73	7.942E-05	+/-118.73	9.322E-05	+/-118.73	7.840E-05	+/-118.72
4	31GA 810	2.537E-03	+/-118.73	5.136E-04	+/-118.73	1.639E-04	+/-118.74	1.756E-04	+/-118.73	1.333E-04	+/-118.72
4	32GE 830	2.869E-04	+/-118.73	5.846E-05	+/-118.73	2.563E-05	+/-118.73	3.285E-05	+/-118.73	1.880E-05	+/-118.73
4	32GE 840	8.452E-03	+/-118.73	1.325E-03	+/-118.73	3.000E-04	+/-118.73	5.538E-04	+/-118.73	2.585E-04	+/-118.73
4	33AS 850	8.599E-02	+/- 65.32	3.358E-02	+/- 65.32	5.272E-03	+/- 34.56	1.284E-02	+/- 65.32	1.105E-02	+/- 65.32
4	34SE 880	6.735E-04	+/- 87.73	1.869E-04	+/- 87.73	7.853E-05	+/- 87.73	9.297E-05	+/- 87.73	4.682E-05	+/- 87.73
4	35BR 900	2.223E-01	+/- 24.89	8.315E-02	+/- 64.70	4.869E-02	+/- 12.44	2.887E-02	+/- 64.71	1.881E-02	+/- 64.71
4	36KR 920	5.892E-04	+/- 9.51	2.843E-04	+/- 45.91	1.034E-04	+/- 9.51	1.706E-04	+/- 45.91	1.055E-05	+/- 64.64
4	36KR 930	1.525E-02	+/- 12.81	6.015E-03	+/- 64.78	1.324E-03	+/- 12.81	2.891E-03	+/- 64.78	1.053E-03	+/- 64.78
4	37RB 940	3.187E-01	+/- 24.25	1.697E-01	+/- 24.25	8.416E-02	+/- 17.75	8.463E-02	+/- 45.65	5.342E-02	+/- 45.65
4	38SR1000	4.599E-03	+/-118.73	6.348E-04	+/-118.73	2.763E-04	+/-118.73	3.738E-04	+/-118.73	8.628E-05	+/-118.72
4	39 Y 971	2.038E-02	+/- 29.77	3.082E-02	+/- 29.69	2.384E-02	+/- 29.69	2.428E-02	+/- 29.69	2.041E-02	+/- 29.68
4	39 Y 980	2.490E-02	+/-101.27	1.963E-02	+/-101.27	1.307E-02	+/-101.27	1.380E-02	+/-101.27	1.017E-02	+/-102.61
4	39 Y 990	4.202E-02	+/- 70.51	2.384E-02	+/- 70.52	1.425E-02	+/- 70.52	1.629E-02	+/- 70.52	7.981E-03	+/- 80.43
4	41NB1050	4.007E-02	+/-102.61	1.706E-02	+/-109.66	1.559E-02	+/-118.73	1.932E-02	+/-109.66	8.193E-03	+/-118.73
4	42MO1090	2.557E-04	+/-118.73	1.639E-05	+/-118.72	3.254E-05	+/-118.73	3.878E-05	+/-118.72	8.229E-06	+/-118.73
4	42MO1100	1.274E-04	+/-118.73	3.226E-06	+/-118.71	3.395E-06	+/-118.72	4.162E-06	+/-118.72	1.172E-06	+/-118.76
4	47AG1220	3.075E-03	+/-118.73	1.321E-04	+/-118.73	4.732E-05	+/-118.73	7.795E-05	+/-118.73	2.170E-04	+/-118.73
4	49IN1270	4.012E-03	+/-118.72	7.453E-04	+/-118.72	6.885E-04	+/-109.66	7.658E-04	+/-118.73	6.970E-04	+/-118.73
4	49IN1290	1.345E-02	+/-118.73	5.921E-03	+/-118.73	2.720E-03	+/-102.61	2.962E-03	+/-118.73	4.196E-04	+/-118.73
4	50SN1330	2.943E-05	+/-118.73	1.167E-05	+/-118.73	6.301E-06	+/-118.73	4.970E-06	+/-118.73	8.500E-08	+/-118.73
4	50SN1340	3.007E-03	+/- 76.10	8.284E-04	+/- 76.11	3.145E-04	+/- 76.09	2.781E-04	+/- 76.09	2.210E-06	+/- 76.10
4	51SB1350	3.232E-02	+/- 65.57	1.439E-02	+/- 65.58	7.515E-03	+/- 35.04	5.697E-03	+/- 65.57	1.776E-04	+/- 65.56
4	52TE1370	1.257E-02	+/- 50.41	4.087E-03	+/- 67.92	2.890E-03	+/- 67.92	2.048E-03	+/- 67.92	1.264E-04	+/- 67.92
4	52TE1380	8.162E-03	+/- 70.09	1.600E-03	+/- 70.09	6.404E-04	+/- 42.90	1.108E-03	+/- 70.09	3.299E-05	+/- 70.08
4	53 I1390	9.200E-02	+/- 14.10	3.742E-02	+/- 64.61	3.168E-02	+/- 45.86	1.903E-02	+/- 64.61	2.833E-03	+/- 64.60
4	54XE1410	6.004E-04	+/- 8.04	2.892E-04	+/- 45.54	2.001E-04	+/- 8.04	1.812E-04	+/- 64.38	3.366E-05	+/- 64.38
4	54XE1420	2.081E-03	+/- 8.34	5.587E-04	+/- 64.42	5.567E-04	+/- 9.46	3.379E-04	+/- 64.42	4.694E-05	+/- 64.42
4	55CS1420	5.881E-03	+/- 57.44	3.946E-03	+/- 57.44	2.820E-03	+/- 55.01	2.772E-03	+/- 57.44	1.054E-03	+/- 69.25
4	55CS1430	3.575E-02	+/- 26.18	1.643E-02	+/- 26.18	8.682E-03	+/- 26.18	8.663E-03	+/- 46.70	2.502E-03	+/- 65.21
4	55CS1440	3.019E-02	+/- 33.97	7.898E-03	+/- 68.71	3.736E-03	+/- 51.48	3.239E-03	+/- 68.71	9.630E-04	+/- 68.71

GROUP	NUCLIDE	U235(T)	UNCERTAINTY	U235(F)	UNCERTAINTY	U235(HE)	UNCERTAINTY	U236(F)	UNCERTAINTY	U238(F)	UNCERTAINTY
4	56LA1500	5.735E-08	+/-118.72	1.320E-07	+/-118.79	8.521E-09	+/-118.72	3.096E-07	+/-118.72	6.944E-06	+/-118.73
4	57LA1490	4.704E-04	+/-118.73	6.824E-04	+/-118.73	1.718E-04	+/-118.73	1.261E-03	+/-118.73	3.354E-03	+/-118.73
		6.433E-01	+/- 6.41	7.251E-01	+/- 16.22	3.624E-01	+/- 19.58	8.405E-01	+/- 15.23	1.316E+00	+/- 12.10
5	31GA 820	1.105E-03	+/-118.73	5.706E-04	+/-118.72	3.678E-04	+/-118.73	1.042E-03	+/-118.73	1.640E-03	+/-118.73
5	33AS 860	9.441E-03	+/- 31.11	1.074E-02	+/- 67.34	5.415E-03	+/- 67.34	1.128E-02	+/- 67.34	1.545E-02	+/- 67.34
5	33AS 870	3.045E-02	+/- 32.00	1.173E-02	+/- 64.00	2.795E-03	+/- 64.00	1.500E-02	+/- 64.00	2.337E-02	+/- 64.00
5	34SE 890	6.023E-03	+/- 34.00	6.797E-03	+/- 70.68	1.448E-03	+/- 70.68	7.391E-03	+/- 70.68	1.931E-02	+/- 70.68
5	34SE 900	2.613E-03	+/-118.73	2.725E-03	+/-118.73	3.911E-04	+/-118.73	3.150E-03	+/-118.73	1.141E-02	+/-118.73
5	35BR 910	2.704E-02	+/- 19.15	2.064E-02	+/- 66.53	9.156E-03	+/- 66.53	3.696E-02	+/- 66.53	5.180E-02	+/- 66.53
5	36KR 950	6.622E-04	+/-118.73	2.334E-03	+/-118.73	3.878E-04	+/-118.73	3.276E-03	+/-118.73	1.371E-02	+/-118.73
5	38SR 970	2.026E-03	+/-100.08	2.002E-03	+/-102.61	8.719E-04	+/-109.66	1.950E-03	+/-102.61	3.397E-03	+/-102.61
5	38SR 980	3.632E-03	+/-100.60	4.170E-03	+/-109.66	1.051E-03	+/-118.73	5.054E-03	+/-109.66	1.312E-02	+/-102.61
5	38SR 990	1.200E-02	+/- 72.38	5.834E-03	+/- 95.28	1.548E-03	+/- 95.28	7.834E-03	+/- 95.28	2.913E-02	+/- 95.28
5	39 Y 981	4.391E-02	+/- 67.60	6.032E-02	+/- 55.07	4.045E-02	+/- 55.05	6.013E-02	+/- 55.09	4.632E-02	+/- 55.28
5	39 Y1000	2.950E-02	+/-100.60	5.979E-02	+/-102.61	2.362E-02	+/-118.73	5.996E-02	+/-102.61	1.070E-01	+/-102.61
5	40ZR1050	1.243E-03	+/-118.73	1.554E-04	+/-118.73	3.923E-05	+/-118.73	4.971E-04	+/-118.73	3.320E-03	+/-118.73
5	41NB1040	5.293E-03	+/-100.32	6.736E-03	+/-109.66	5.388E-03	+/-109.66	1.271E-02	+/-102.61	2.445E-02	+/-102.61
5	41NB1060	8.098E-04	+/-118.73	2.350E-03	+/-118.73	2.616E-03	+/-118.73	5.040E-03	+/-118.73	2.150E-02	+/-118.73
5	43TC1100	8.267E-05	+/-118.72	3.823E-04	+/-118.73	1.681E-03	+/-118.73	5.363E-04	+/-118.73	1.151E-03	+/-118.73
5	48CD1280	6.999E-06	+/-118.73	1.745E-05	+/-118.73	1.343E-06	+/-118.71	3.001E-05	+/-118.73	1.117E-04	+/-118.73
5	49IN1280	1.507E-03	+/-118.73	3.771E-03	+/-118.73	2.690E-03	+/-118.73	4.324E-03	+/-118.73	5.045E-03	+/-118.73
5	49IN1291	1.745E-03	+/-118.73	5.424E-05	+/-118.73	9.925E-04	+/-118.73	4.132E-03	+/-118.73	7.098E-03	+/-118.73
5	49IN1300	4.649E-03	+/-105.00	4.471E-03	+/-118.73	4.044E-04	+/-118.73	7.340E-03	+/-118.73	1.519E-02	+/-118.73
5	51SB1360	3.626E-03	+/- 72.84	5.687E-03	+/- 72.84	1.541E-04	+/- 72.83	1.106E-02	+/- 72.84	4.755E-02	+/- 72.84
5	52TE1390	4.297E-04	+/-105.00	7.045E-04	+/-118.73	3.069E-05	+/-118.72	1.373E-03	+/-118.73	1.065E-02	+/-118.73
5	53 I1400	4.794E-02	+/- 69.57	3.216E-02	+/- 69.57	5.111E-03	+/- 42.05	5.176E-02	+/- 69.57	1.291E-01	+/- 52.62
5	53 I1410	5.676E-03	+/- 72.16	6.662E-03	+/- 72.16	9.587E-04	+/- 72.16	1.797E-02	+/- 72.16	7.014E-02	+/- 72.16
5	54XE1440	4.567E-05	+/-118.73	8.194E-05	+/-118.73	5.862E-06	+/-118.73	1.498E-04	+/-118.73	9.274E-04	+/-101.27
5	55CS1450	8.094E-03	+/- 21.45	1.596E-02	+/- 65.58	3.152E-03	+/- 65.58	2.330E-02	+/- 65.58	6.930E-02	+/- 27.08
5	56BA1490	1.869E-07	+/-118.73	3.361E-07	+/-118.73	2.874E-08	+/-118.73	8.706E-07	+/-118.73	8.772E-06	+/-118.73
5	57LA1500	5.783E-05	+/-118.73	1.132E-04	+/-118.73	2.462E-05	+/-118.73	1.841E-04	+/-118.73	8.746E-04	+/-118.73
		2.496E-01	+/- 22.67	2.673E-01	+/- 29.04	1.108E-01	+/- 33.93	3.534E-01	+/- 25.12	7.420E-01	+/- 21.91
6	31GA 830	2.090E-04	+/-118.79	6.220E-04	+/-118.72	2.034E-04	+/-118.72	8.349E-04	+/-118.73	1.880E-03	+/-118.73
6	32GE 850	8.826E-04	+/-118.73	1.705E-03	+/-118.73	3.534E-04	+/-118.71	2.808E-03	+/-118.73	6.250E-03	+/-118.73
6	32GE 860	1.861E-04	+/-118.72	2.466E-04	+/-118.75	3.653E-05	+/-118.72	3.294E-04	+/-118.74	1.615E-03	+/-118.73
6	34SE 910	3.389E-04	+/- 74.48	3.321E-04	+/- 74.48	5.082E-05	+/- 74.48	7.268E-04	+/- 74.48	3.182E-03	+/- 74.48
6	35BR 920	7.950E-03	+/- 42.04	5.748E-03	+/- 69.57	2.924E-03	+/- 69.57	1.603E-02	+/- 69.57	2.425E-02	+/- 69.57
6	35BR 930	1.286E-03	+/-118.73	1.048E-03	+/-118.73	4.818E-04	+/-118.73	3.506E-03	+/-118.73	1.094E-02	+/-118.73
6	36KR 940	4.879E-03	+/- 65.62	3.965E-03	+/- 90.25	8.713E-04	+/- 90.25	4.800E-03	+/- 90.25	1.682E-02	+/- 77.94
6	37RB 950	7.119E-02	+/- 7.44	8.669E-02	+/- 24.01	3.703E-02	+/- 64.37	1.005E-01	+/- 24.01	1.443E-01	+/- 24.01
6	37RB 960	2.891E-02	+/- 17.52	3.766E-02	+/- 64.40	1.419E-02	+/- 64.40	4.265E-02	+/- 64.40	8.135E-02	+/- 45.56
6	37RB 970	2.342E-02	+/- 65.37	1.634E-02	+/- 65.37	4.467E-03	+/- 65.37	1.831E-02	+/- 65.37	2.566E-02	+/- 26.59
6	37RB 980	3.668E-04	+/- 65.98	9.648E-04	+/- 65.97	1.648E-04	+/- 65.95	1.340E-03	+/- 65.96	5.382E-03	+/- 65.97
6	37RB 990	1.621E-05	+/-118.73	3.905E-05	+/-118.72	5.212E-06	+/-118.73	6.375E-05	+/-118.72	5.513E-04	+/-118.71
6	47AG1230	3.149E-05	+/-118.74	1.622E-04	+/-118.72	3.965E-04	+/-118.73	3.670E-04	+/-118.73	4.239E-04	+/-118.73
6	49IN1310	2.913E-03	+/-105.00	3.064E-03	+/-118.73	7.692E-05	+/-118.72	5.641E-03	+/-118.73	2.180E-02	+/-118.73
6	49IN1320	1.619E-03	+/-104.99	1.168E-03	+/-118.73	1.011E-05	+/-118.72	2.501E-03	+/-118.73	1.655E-02	+/-118.73
6	50SN1350	5.451E-05	+/-118.73	8.579E-05	+/-118.73	4.825E-07	+/-118.73	1.961E-04	+/-118.73	2.599E-03	+/-118.73
6	51SB1370	1.048E-02	+/-118.73	4.942E-04	+/-118.72	1.002E-05	+/-118.72	1.142E-03	+/-118.73	9.064E-03	+/-118.73
6	53 I1420	9.743E-04	+/-118.73	4.039E-04	+/-118.72	3.441E-05	+/-118.72	8.388E-04	+/-118.72	4.496E-03	+/-118.73
6	53 I1430	2.234E-06	+/-118.73	5.219E-06	+/-118.73	1.850E-07	+/-118.73	1.439E-05	+/-118.72	1.649E-04	+/-118.71
6	54XE1430	6.368E-04	+/-118.73	7.607E-04	+/-118.73	1.182E-04	+/-118.73	1.961E-03	+/-118.73	4.895E-03	+/-100.32
6	55CS1460	2.256E-03	+/- 23.59	1.635E-03	+/- 64.21	2.639E-04	+/- 64.21	2.945E-03	+/- 64.21	1.498E-02	+/- 23.59
6	55CS1470	1.386E-05	+/- 65.11	3.517E-05	+/- 65.11	3.019E-06	+/- 65.11	8.285E-05	+/- 65.10	1.107E-03	+/- 65.05
		1.586E-01	+/- 13.85	1.632E-01	+/- 21.13	6.170E-02	+/- 41.83	2.076E-01	+/- 19.98	3.983E-01	+/- 16.98
		1.774E+00	+/- 5.12	1.975E+00	+/- 9.17	9.936E-01	+/- 10.11	2.252E+00	+/- 8.67	3.424E+00	+/- 7.70

GROUP	NUCLIDE	U235(T)	UNCERTAINTY	U235(F)	UNCERTAINTY	U235(HE)	UNCERTAINTY	U236(F)	UNCERTAINTY	U238(F)	UNCERTAINTY
1	35BR 670	4.756E-02	+/- 8.09	5.022E-02	+/- 17.71	3.778E-02	+/- 13.37	4.790E-02	+/- 17.71	3.471E-02	+/- 9.66
1	43TC1090	1.357E-04	+/-118.72	6.285E-04	+/-118.72	3.826E-03	+/-118.73	9.003E-04	+/-118.72	2.469E-03	+/-118.71
		4.769E-02	+/- 8.08	5.085E-02	+/- 17.55	4.161E-02	+/- 16.33	4.880E-02	+/- 17.52	3.718E-02	+/- 11.99
2	35BR 880	1.390E-01	+/- 8.40	1.560E-01	+/- 23.74	1.263E-01	+/- 12.47	1.411E-01	+/- 23.74	1.135E-01	+/- 32.54
2	41NB1030	2.915E-03	+/-100.08	3.254E-03	+/-102.61	2.581E-03	+/-102.61	4.341E-03	+/-102.61	7.347E-03	+/-100.60
2	51SB1341	2.268E-04	+/- 14.23	3.280E-04	+/- 65.50	3.032E-05	+/- 65.50	5.336E-04	+/- 47.11	8.644E-04	+/- 26.90
2	52TE1360	1.380E-02	+/- 47.24	1.386E-02	+/- 50.04	1.457E-03	+/- 77.92	1.951E-02	+/- 50.04	4.208E-02	+/- 47.24
2	53 I1370	2.321E-01	+/- 11.42	2.433E-01	+/- 24.97	8.309E-02	+/- 24.97	2.892E-01	+/- 24.97	3.828E-01	+/- 18.72
2	55CS1410	2.344E-03	+/- 7.81	2.238E-03	+/- 17.69	1.403E-03	+/- 24.21	2.553E-03	+/- 17.69	2.720E-03	+/- 9.64
		3.904E-01	+/- 7.64	4.189E-01	+/- 17.08	2.149E-01	+/- 12.20	4.572E-01	+/- 17.57	5.493E-01	+/- 15.18
3	33AS 840	3.218E-04	+/- 46.54	5.366E-04	+/- 78.91	5.506E-04	+/- 78.91	5.369E-04	+/- 78.91	6.139E-04	+/- 78.91
3	34SE 870	1.577E-03	+/- 14.84	1.834E-03	+/- 47.21	8.005E-04	+/- 65.58	1.984E-03	+/- 47.21	1.959E-03	+/- 27.08
3	35BR 890	1.720E-01	+/- 23.42	2.366E-01	+/- 32.58	1.359E-01	+/- 32.58	2.162E-01	+/- 32.58	2.231E-01	+/- 32.58
3	37RB 920	5.855E-04	+/- 8.57	4.994E-04	+/- 18.04	4.943E-04	+/- 24.46	6.634E-04	+/- 16.04	4.475E-04	+/- 11.55
3	37RB 930	5.118E-02	+/- 9.96	4.669E-02	+/- 25.02	3.759E-02	+/- 25.02	5.479E-02	+/- 25.02	5.672E-02	+/- 14.77
3	39 Y 970	1.719E-02	+/-100.02	1.718E-02	+/-101.27	1.365E-02	+/-101.27	1.505E-02	+/-101.27	1.744E-02	+/-100.18
3	40ZR1040	1.245E-04	+/-105.00	1.365E-04	+/-118.73	3.874E-05	+/-118.73	3.053E-04	+/-118.73	1.452E-03	+/-102.61
3	49IN1271	2.559E-04	+/-118.73	6.788E-04	+/-118.73	1.632E-03	+/-118.73	6.306E-04	+/-118.73	4.541E-04	+/-118.73
3	53 I1380	4.143E-02	+/- 13.01	4.529E-02	+/- 25.73	1.166E-02	+/- 19.73	5.422E-02	+/- 25.73	7.933E-02	+/- 25.73
		2.846E-01	+/- 15.61	3.494E-01	+/- 23.10	2.023E-01	+/- 23.44	3.444E-01	+/- 21.69	3.815E-01	+/- 20.44
4	30ZN 790	1.845E-05	+/-109.66	4.806E-05	+/-118.73	1.973E-05	+/-118.74	6.665E-05	+/-118.73	6.836E-05	+/-118.73
4	31GA 790	2.613E-05	+/-100.60	6.872E-05	+/-118.73	7.632E-05	+/-118.73	7.872E-05	+/-118.73	3.358E-05	+/-118.73
4	31GA 800	1.007E-04	+/-101.27	3.209E-04	+/-118.73	2.597E-04	+/-118.73	3.517E-04	+/-118.73	2.102E-04	+/-118.73
4	31GA 810	3.547E-04	+/-105.00	8.710E-04	+/-118.73	3.671E-04	+/-118.73	1.028E-03	+/-118.73	1.162E-03	+/-118.73
4	32GE 830	8.497E-05	+/-100.60	1.583E-04	+/-118.73	1.007E-04	+/-118.73	1.783E-04	+/-118.73	2.250E-04	+/-118.73
4	32GE 840	3.146E-03	+/-105.00	4.199E-03	+/-118.73	1.435E-03	+/-118.73	5.140E-03	+/-118.73	1.570E-02	+/-118.73
4	33AS 850	3.583E-02	+/- 15.30	6.194E-02	+/- 65.32	3.775E-02	+/- 65.32	8.218E-02	+/- 65.32	6.402E-02	+/- 65.32
4	34SE 880	5.491E-04	+/- 62.10	7.246E-04	+/- 75.00	2.159E-04	+/- 87.73	7.615E-04	+/- 75.00	1.292E-03	+/- 64.26
4	35BR 900	1.435E-01	+/- 14.55	1.778E-01	+/- 46.00	8.145E-02	+/- 64.70	1.679E-01	+/- 46.00	1.845E-01	+/- 46.00
4	36KR 920	5.685E-04	+/- 9.51	3.463E-04	+/- 12.11	2.632E-04	+/- 12.11	8.502E-04	+/- 24.73	8.630E-04	+/- 10.89
4	36KR 930	1.053E-02	+/- 10.77	5.713E-03	+/- 25.08	4.169E-03	+/- 14.67	1.645E-02	+/- 46.10	2.860E-02	+/- 12.81
4	37RB 940	1.861E-01	+/- 8.19	2.310E-01	+/- 24.25	1.393E-01	+/- 24.25	2.327E-01	+/- 24.25	2.986E-01	+/- 17.75
4	38SR1000	7.597E-04	+/-118.73	1.818E-03	+/-118.73	2.615E-04	+/-118.73	2.227E-03	+/-118.73	1.280E-02	+/-118.73
4	39 Y 971	2.545E-02	+/- 19.17	2.560E-02	+/- 29.72	2.611E-02	+/- 29.69	2.084E-02	+/- 29.74	1.412E-02	+/- 49.37
4	39 Y 980	1.948E-02	+/-101.27	2.056E-02	+/-101.27	1.200E-02	+/-101.27	2.142E-02	+/-101.27	2.603E-02	+/-101.27
4	39 Y 990	2.832E-02	+/- 66.94	2.698E-02	+/- 70.52	1.681E-02	+/- 70.52	3.048E-02	+/- 70.52	4.509E-02	+/- 70.50
4	41NB1050	7.472E-03	+/-105.00	7.830E-03	+/-118.73	5.704E-03	+/-118.73	2.029E-02	+/-109.66	4.942E-02	+/-102.61
4	42MO1090	2.022E-06	+/-118.68	1.133E-05	+/-118.73	2.068E-05	+/-118.72	2.041E-05	+/-118.72	1.491E-04	+/-118.73
4	42MO1100	8.087E-07	+/-118.71	4.200E-06	+/-118.70	4.565E-06	+/-118.81	7.820E-06	+/-118.75	5.922E-05	+/-118.73
4	47AG1220	3.052E-05	+/-118.74	1.119E-04	+/-118.73	6.462E-04	+/-118.73	1.766E-04	+/-118.73	2.110E-04	+/-118.73
4	49IN1270	2.560E-04	+/-109.65	6.789E-04	+/-118.72	1.632E-03	+/-118.73	6.308E-04	+/-118.71	4.551E-04	+/-118.66
4	49IN1290	3.489E-03	+/-118.73	1.061E-04	+/-118.73	1.943E-03	+/-118.73	8.395E-03	+/-118.73	1.609E-02	+/-109.66
4	50SN1330	2.918E-05	+/-118.73	3.116E-05	+/-118.73	7.924E-07	+/-118.73	6.172E-05	+/-118.73	2.651E-04	+/-105.00
4	50SN1340	1.911E-03	+/- 76.10	2.857E-03	+/- 76.10	2.703E-05	+/- 76.10	7.187E-03	+/- 76.10	5.469E-02	+/- 76.10
4	51SB1350	2.049E-02	+/- 14.84	2.566E-02	+/- 65.57	1.173E-03	+/- 65.58	3.799E-02	+/- 65.58	1.220E-01	+/- 47.21
4	52TE1370	9.364E-03	+/- 39.25	9.625E-03	+/- 67.92	7.219E-04	+/- 67.92	1.563E-02	+/- 50.41	5.202E-02	+/- 32.33
4	52TE1380	3.776E-03	+/- 42.90	5.417E-03	+/- 70.09	2.686E-04	+/- 70.08	9.383E-03	+/- 70.09	4.782E-02	+/- 53.30
4	53 I1390	1.401E-01	+/- 9.26	6.641E-02	+/- 45.86	1.272E-02	+/- 64.60	9.017E-02	+/- 45.86	1.887E-01	+/- 24.63
4	54XE1410	5.663E-04	+/- 7.52	3.952E-04	+/- 10.61	1.058E-04	+/- 13.03	7.836E-04	+/- 24.03	1.401E-03	+/- 9.20
4	54XE1420	1.826E-03	+/- 9.46	1.891E-03	+/- 64.42	3.413E-04	+/- 24.14	2.963E-03	+/- 45.59	7.941E-03	+/- 24.13
4	55CS1420	5.087E-03	+/- 52.78	5.720E-03	+/- 57.44	3.033E-03	+/- 57.44	6.846E-03	+/- 57.44	7.425E-03	+/- 53.77
4	55CS1430	2.369E-02	+/- 13.12	2.411E-02	+/- 26.18	9.351E-03	+/- 46.70	3.604E-02	+/- 26.18	3.793E-02	+/- 20.30
4	55CS1440	9.964E-03	+/- 26.25	1.542E-02	+/- 51.48	3.897E-03	+/- 68.71	2.000E-02	+/- 51.48	3.224E-02	+/- 33.97

GROUP	NUCLIDE	TH232(F)	UNCERTAINTY	TH232(HE)	UNCERTAINTY	U233(T)	UNCERTAINTY	U233(F)	UNCERTAINTY	U233(HE)	UNCERTAINTY
4	56LA1500	1.318E-06	+/-118.72	2.665E-07	+/-118.72	2.236E-09	+/-118.73	2.074E-09	+/-118.73	1.166E-09	+/-118.73
4	57LA1490	1.571E-03	+/-118.73	1.189E-03	+/-118.73	8.070E-05	+/-118.73	8.873E-05	+/-118.73	6.560E-05	+/-118.73
		1.725E+00	+/- 10.65	1.272E+00	+/- 13.97	3.077E-01	+/- 17.43	2.948E-01	+/- 19.38	2.493E-01	+/- 24.94
5	31GA 820	6.243E-03	+/-118.73	6.083E-03	+/-118.73	1.661E-04	+/-118.71	2.006E-04	+/-118.71	2.461E-04	+/-118.72
5	33AS 860	6.896E-02	+/- 49.64	4.483E-02	+/- 67.34	3.192E-03	+/- 67.34	3.528E-03	+/- 67.34	3.134E-03	+/- 67.34
5	33AS 870	1.055E-01	+/- 64.00	3.270E-02	+/- 64.00	3.047E-03	+/- 64.00	2.554E-03	+/- 64.00	1.503E-03	+/- 64.00
5	34SE 890	4.279E-02	+/- 54.08	1.085E-02	+/- 70.68	1.066E-03	+/- 70.68	1.306E-03	+/- 70.68	7.661E-04	+/- 70.68
5	34SE 900	2.040E-02	+/-118.73	4.087E-03	+/-118.73	5.988E-04	+/-118.73	3.169E-04	+/-118.73	1.752E-04	+/-118.73
5	35BR 910	8.449E-02	+/- 48.53	4.714E-02	+/- 66.53	5.968E-03	+/- 66.53	7.431E-03	+/- 66.53	5.783E-03	+/- 66.53
5	36KR 950	1.008E-02	+/-118.73	2.668E-03	+/-118.73	3.001E-05	+/-118.73	2.376E-04	+/-118.73	1.723E-04	+/-118.73
5	38SR 970	2.744E-03	+/-102.61	1.183E-03	+/-102.61	7.092E-04	+/-109.66	6.918E-04	+/-109.66	5.453E-04	+/-109.66
5	38SR 980	7.337E-03	+/-102.61	2.152E-03	+/-118.72	8.499E-04	+/-118.73	8.717E-04	+/-118.73	6.232E-04	+/-118.73
5	38SR 990	1.077E-02	+/- 95.28	2.955E-03	+/- 95.28	7.633E-04	+/- 95.28	7.710E-04	+/- 95.28	5.814E-04	+/- 95.28
5	39 Y 981	3.080E-02	+/- 67.69	3.206E-02	+/- 67.36	3.094E-02	+/- 81.27	3.548E-02	+/- 67.29	3.369E-02	+/- 67.29
5	39 Y1000	1.945E-02	+/-118.73	2.365E-02	+/-118.73	1.169E-02	+/-118.73	1.388E-02	+/-118.73	1.202E-02	+/-118.73
5	40ZR1050	3.228E-05	+/-118.73	2.147E-04	+/-118.73	8.411E-06	+/-118.73	1.609E-05	+/-118.73	2.031E-05	+/-118.73
5	41NB1040	4.131E-04	+/-118.73	4.392E-03	+/-109.66	1.560E-03	+/-118.73	2.146E-03	+/-118.73	3.896E-03	+/-109.66
5	41NB1060	3.549E-04	+/-118.73	8.408E-03	+/-118.73	2.358E-04	+/-118.73	3.248E-04	+/-118.73	1.240E-03	+/-118.73
5	43TC1100	6.087E-04	+/-118.73	7.621E-03	+/-118.73	2.576E-05	+/-118.71	1.021E-04	+/-118.73	1.075E-03	+/-118.73
5	48CD1280	3.848E-05	+/-118.73	1.760E-05	+/-118.73	2.124E-06	+/-118.73	2.429E-06	+/-118.72	2.850E-07	+/-118.72
5	49IN1280	1.916E-03	+/-118.73	7.569E-03	+/-118.73	1.299E-03	+/-118.73	1.953E-03	+/-118.73	1.140E-03	+/-118.73
5	49IN1291	2.423E-03	+/-118.73	3.449E-03	+/-118.73	T.117E-03	+/-118.73	1.073E-03	+/-118.73	2.659E-04	+/-118.73
5	49IN1300	5.839E-03	+/-118.73	3.582E-03	+/-118.73	7.383E-04	+/-118.73	7.964E-04	+/-118.73	9.329E-05	+/-118.71
5	51SB1360	3.088E-02	+/- 72.84	4.820E-03	+/- 72.84	3.657E-04	+/- 72.85	3.668E-04	+/- 72.85	3.864E-05	+/- 72.84
5	52TE1390	9.386E-03	+/-118.73	1.006E-03	+/-118.73	3.584E-05	+/-104.99	3.358E-05	+/-118.72	7.750E-06	+/-118.72
5	53 I1400	1.443E-01	+/- 52.62	6.616E-02	+/- 69.57	3.803E-03	+/- 69.57	4.073E-03	+/- 69.57	1.436E-03	+/- 69.57
5	53 I1410	8.303E-02	+/- 72.16	2.071E-02	+/- 72.16	6.779E-04	+/- 72.16	7.227E-04	+/- 72.16	2.496E-04	+/- 72.16
5	54XE1440	1.362E-03	+/-118.73	1.508E-04	+/-118.73	4.539E-06	+/-118.73	3.402E-06	+/-118.73	1.029E-06	+/-118.73
5	55CS1450	7.961E-02	+/- 47.21	2.433E-02	+/- 65.57	1.498E-03	+/- 65.57	1.557E-03	+/- 65.57	7.761E-04	+/- 65.57
5	56BA1490	3.465E-06	+/-118.73	8.592E-07	+/-118.73	1.071E-08	+/-118.73	1.086E-08	+/-118.73	5.790E-09	+/-118.73
5	57LA1500	1.996E-04	+/-118.73	1.696E-04	+/-118.73	7.037E-06	+/-118.73	7.481E-06	+/-118.73	6.491E-06	+/-118.70
		7.700E-01	+/- 18.97	3.630E-01	+/- 22.52	7.041E-02	+/- 41.86	8.045E-02	+/- 37.33	6.949E-02	+/- 39.80
6	31GA 830	1.045E-02	+/-118.73	2.970E-03	+/-118.73	9.855E-05	+/-118.72	9.803E-05	+/-118.72	1.014E-04	+/-118.72
6	32GE 850	2.742E-02	+/-118.73	7.502E-03	+/-118.73	3.044E-04	+/-118.74	3.087E-04	+/-118.74	2.039E-04	+/-118.75
6	32GE 860	6.019E-03	+/-118.73	9.205E-04	+/-118.73	2.683E-05	+/-118.72	2.574E-05	+/-118.72	1.450E-05	+/-118.72
6	34SE 910	4.321E-03	+/- 74.48	7.766E-04	+/- 74.48	3.212E-05	+/- 74.48	3.822E-05	+/- 74.48	2.205E-05	+/- 74.48
6	35BR 920	3.584E-02	+/- 69.57	1.929E-02	+/- 69.57	1.236E-03	+/- 69.57	1.722E-03	+/- 69.57	1.408E-03	+/- 69.57
6	35BR 930	1.342E-02	+/-118.73	1.264E-01	+/-118.73	3.053E-03	+/-118.73	2.472E-04	+/-118.73	1.861E-04	+/-118.73
6	36KR 940	1.505E-02	+/- 77.94	8.410E-03	+/- 90.25	6.435E-04	+/- 90.25	6.784E-04	+/- 90.25	4.364E-04	+/- 90.25
6	37RB 950	1.255E-01	+/- 24.01	9.241E-02	+/- 24.01	1.060E-02	+/- 64.37	2.656E-02	+/- 64.37	2.372E-02	+/- 64.37
6	37RB 960	5.060E-02	+/- 64.40	4.006E-02	+/- 64.40	6.253E-03	+/- 64.40	7.521E-03	+/- 64.40	7.266E-03	+/- 64.40
6	37RB 970	3.749E-02	+/- 65.37	1.607E-02	+/- 65.37	1.704E-03	+/- 65.37	1.967E-03	+/- 65.37	1.954E-03	+/- 65.37
6	37RB 980	2.530E-03	+/- 65.97	9.399E-04	+/- 65.97	5.234E-05	+/- 65.95	6.737E-05	+/- 65.95	6.736E-05	+/- 65.96
6	37RB 990	1.611E-04	+/-118.72	3.670E-05	+/-118.72	9.176E-07	+/-118.73	1.230E-06	+/-118.73	1.185E-06	+/-118.73
6	47AG1230	3.106E-04	+/-118.72	3.855E-03	+/-118.73	1.468E-05	+/-118.69	5.100E-05	+/-118.73	1.541E-04	+/-118.73
6	49IN1310	8.443E-03	+/-118.73	1.359E-03	+/-118.73	3.504E-04	+/-118.73	2.598E-04	+/-118.73	1.300E-05	+/-118.72
6	49IN1320	7.297E-03	+/-118.73	3.702E-04	+/-118.73	5.591E-05	+/-118.72	4.537E-05	+/-118.72	1.387E-06	+/-118.73
6	50SN1350	1.591E-03	+/-118.73	3.388E-05	+/-118.73	2.691E-06	+/-118.73	2.064E-06	+/-118.73	5.186E-08	+/-118.73
6	51SB1370	7.027E-03	+/-118.73	4.726E-04	+/-118.73	1.959E-05	+/-118.72	1.742E-05	+/-118.72	1.600E-06	+/-118.73
6	53 I1420	4.602E-03	+/-118.73	4.683E-03	+/-105.00	1.377E-05	+/-104.99	1.485E-05	+/-118.76	5.648E-06	+/-118.72
6	53 I1430	1.646E-04	+/-118.72	1.945E-05	+/-118.72	5.608E-08	+/-118.73	6.926E-08	+/-118.73	1.657E-08	+/-118.73
6	54XE1430	8.847E-03	+/-118.73	1.732E-03	+/-118.73	5.233E-05	+/-118.73	8.597E-05	+/-118.73	2.825E-05	+/-118.73
6	55CS1460	1.408E-02	+/- 64.21	4.044E-03	+/- 64.21	7.639E-05	+/- 64.18	8.446E-05	+/- 64.18	4.892E-05	+/- 64.20
6	55CS1470	8.496E-04	+/- 65.05	1.316E-04	+/- 65.10	5.412E-07	+/- 65.11	6.127E-07	+/- 65.11	3.120E-07	+/- 65.11
		3.820E-01	+/- 19.12	3.325E-01	+/- 46.76	2.459E-02	+/- 36.04	3.979E-02	+/- 44.92	3.563E-02	+/- 45.07
		4.619E+00	+/- 7.12	2.990E+00	+/- 9.14	8.587E-01	+/- 8.37	9.292E-01	+/- 10.00	7.226E-01	+/- 13.31

GROUP	NUCLIDE	TH232(F)	UNCERTAINTY	TH232(HE)	UNCERTAINTY	U233(T)	UNCERTAINTY	U233(F)	UNCERTAINTY	U233(HE)	UNCERTAINTY
1	35BR 870	1.572E-01	+/- 9.68	9.922E-02	+/- 9.68	5.085E-02	+/- 9.68	6.346E-02	+/- 24.22	4.289E-02	+/- 24.22
1	43TC1090	5.723E-04	+/-118.69	8.991E-03	+/-109.66	7.999E-05	+/-118.73	1.861E-04	+/-118.73	2.660E-03	+/-118.73
		1.577E-01	+/- 9.65	1.082E-01	+/- 12.72	5.093E-02	+/- 9.67	6.364E-02	+/- 24.15	4.555E-02	+/- 23.84
2	35BR 880	4.014E-01	+/- 23.74	2.109E-01	+/- 12.47	1.035E-01	+/- 8.40	1.338E-01	+/- 23.74	1.112E-01	+/- 23.74
2	41NB1030	1.758E-04	+/-102.61	1.030E-03	+/-105.00	1.016E-03	+/-109.66	1.165E-03	+/-109.66	1.612E-03	+/-102.61
2	51SB1341	3.920E-04	+/- 65.50	2.919E-04	+/- 65.50	6.092E-05	+/- 65.50	5.926E-05	+/- 65.50	7.470E-06	+/- 65.50
2	52TE1360	3.243E-02	+/- 50.04	9.766E-03	+/- 50.04	3.882E-03	+/- 77.92	3.487E-03	+/- 77.92	7.127E-04	+/- 77.92
2	53 I1370	3.880E-01	+/- 14.68	2.128E-01	+/- 14.68	1.189E-01	+/- 10.51	1.132E-01	+/- 24.97	4.908E-02	+/- 46.04
2	55CS1410	3.697E-03	+/- 13.34	2.655E-03	+/- 17.69	1.698E-03	+/- 24.21	1.786E-03	+/- 24.21	1.139E-03	+/- 24.21
		8.261E-01	+/- 13.58	4.375E-01	+/- 9.41	2.291E-01	+/- 6.80	2.535E-01	+/- 16.82	1.637E-01	+/- 21.25
3	33AS 840	2.870E-03	+/- 51.57	1.476E-03	+/- 51.57	3.693E-04	+/- 78.91	4.078E-04	+/- 78.91	5.348E-04	+/- 78.91
3	34SE 870	9.557E-03	+/- 27.08	3.414E-03	+/- 27.08	1.571E-03	+/- 21.45	1.146E-03	+/- 47.21	6.164E-04	+/- 65.56
3	35BR 890	5.667E-01	+/- 32.58	3.555E-01	+/- 28.08	1.143E-01	+/- 25.56	1.303E-01	+/- 32.58	1.047E-01	+/- 50.57
3	37RB 920	7.725E-04	+/- 13.80	6.149E-04	+/- 18.04	4.766E-04	+/- 24.46	5.143E-04	+/- 24.46	4.563E-04	+/- 24.46
3	37RB 930	7.441E-02	+/- 18.79	5.460E-02	+/- 25.02	3.157E-02	+/- 25.02	3.861E-02	+/- 25.02	3.218E-02	+/- 25.02
3	39 Y 970	1.394E-02	+/-100.32	9.714E-03	+/-100.60	1.191E-02	+/-101.27	1.216E-02	+/-101.27	1.114E-02	+/-101.27
3	40ZR1040	2.201E-05	+/-118.73	8.321E-05	+/-118.73	1.335E-05	+/-118.73	1.610E-05	+/-118.73	2.002E-05	+/-118.73
3	49IN1271	3.172E-04	+/-118.73	2.399E-03	+/-118.73	6.291E-04	+/-118.73	5.433E-04	+/-118.73	8.677E-04	+/-118.73
3	53 I1380	8.979E-02	+/- 25.73	4.919E-02	+/- 25.73	1.520E-02	+/- 19.73	1.331E-02	+/- 46.46	8.440E-03	+/- 65.03
		7.584E-01	+/- 24.68	4.770E-01	+/- 21.40	1.761E-01	+/- 18.59	1.970E-01	+/- 23.18	1.590E-01	+/- 34.62
4	30ZN 790	1.420E-04	+/-118.73	5.641E-04	+/-118.73	1.248E-05	+/-118.75	9.285E-06	+/-118.72	1.416E-05	+/-118.73
4	31GA 790	7.918E-05	+/-118.73	8.230E-04	+/-109.66	4.487E-05	+/-118.73	3.606E-05	+/-118.73	7.719E-05	+/-118.73
4	31GA 800	5.493E-04	+/-118.73	3.391E-03	+/-118.73	1.324E-04	+/-118.73	1.282E-04	+/-118.73	2.238E-04	+/-118.73
4	31GA 810	2.968E-03	+/-118.73	6.386E-03	+/-118.73	2.140E-04	+/-118.73	3.009E-04	+/-118.73	3.897E-04	+/-118.73
4	32GE 830	1.487E-03	+/-109.66	4.984E-04	+/-118.73	8.613E-05	+/-118.73	7.437E-05	+/-118.73	7.260E-05	+/-118.73
4	32GE 840	6.496E-02	+/-109.66	1.026E-02	+/-118.73	1.209E-03	+/-118.72	1.168E-03	+/-118.73	9.880E-04	+/-118.73
4	33AS 850	3.305E-01	+/- 26.44	2.762E-01	+/- 26.44	3.042E-02	+/- 65.32	3.340E-02	+/- 65.32	3.136E-02	+/- 65.32
4	34SE 880	4.213E-03	+/- 64.26	1.029E-03	+/- 75.00	2.712E-04	+/- 87.73	2.503E-04	+/- 87.73	1.409E-04	+/- 87.73
4	35BR 900	3.879E-01	+/- 24.89	2.997E-01	+/- 24.89	9.340E-02	+/- 18.62	6.403E-02	+/- 64.70	5.264E-02	+/- 64.70
4	36KR 920	1.504E-03	+/- 24.73	7.037E-04	+/- 10.89	2.651E-04	+/- 9.51	2.968E-04	+/- 45.91	1.610E-04	+/- 24.73
4	36KR 930	4.173E-02	+/- 25.08	1.468E-02	+/- 33.53	3.056E-03	+/- 10.77	4.053E-03	+/- 64.78	2.642E-03	+/- 64.78
4	37RB 940	2.979E-01	+/- 24.25	4.047E-01	+/- 32.91	9.393E-02	+/- 45.65	1.102E-01	+/- 24.25	9.872E-02	+/- 45.65
4	38SR1000	1.989E-03	+/-118.73	7.130E-04	+/-118.72	1.326E-04	+/-118.73	1.415E-04	+/-118.73	9.004E-05	+/-118.73
4	39 Y 971	1.213E-02	+/- 49.15	1.404E-02	+/- 48.85	2.320E-02	+/- 29.68	2.395E-02	+/- 29.68	2.264E-02	+/- 29.68
4	39 Y 980	1.584E-02	+/-102.61	1.086E-02	+/-102.61	9.218E-03	+/-109.66	1.047E-02	+/-102.61	9.733E-03	+/-102.61
4	39 Y 990	1.905E-02	+/- 70.51	1.264E-02	+/- 70.52	9.308E-03	+/- 80.43	9.897E-03	+/- 80.43	8.908E-03	+/- 80.43
4	41NB1050	5.349E-04	+/-118.73	9.893E-03	+/-118.73	1.142E-03	+/-118.73	2.364E-03	+/-118.73	4.354E-03	+/-118.73
4	42MO1090	3.554E-05	+/-118.73	1.809E-04	+/-118.73	4.903E-07	+/-118.71	1.055E-06	+/-118.71	8.734E-06	+/-118.73
4	42MO1100	3.084E-05	+/-118.73	8.309E-05	+/-118.73	9.540E-08	+/-118.72	3.303E-07	+/-118.72	1.742E-06	+/-118.72
4	47AG1220	2.066E-04	+/-118.73	3.576E-03	+/-118.73	1.206E-05	+/-118.73	5.953E-05	+/-118.73	3.129E-04	+/-118.73
4	49IN1270	3.176E-04	+/-118.69	2.399E-03	+/-118.72	6.291E-04	+/-118.73	5.433E-04	+/-118.73	8.678E-04	+/-118.73
4	49IN1290	5.369E-03	+/-118.73	6.828E-03	+/-118.73	2.199E-03	+/-118.73	2.109E-03	+/-118.73	5.200E-04	+/-118.73
4	50SN1330	1.293E-04	+/-118.73	1.077E-05	+/-118.73	3.559E-06	+/-118.73	2.431E-06	+/-118.73	1.206E-07	+/-118.73
4	50SN1340	2.073E-02	+/- 76.10	1.354E-03	+/- 76.10	1.649E-04	+/- 76.10	1.243E-04	+/- 76.09	3.383E-06	+/- 76.10
4	51SB1350	8.948E-02	+/- 47.21	1.577E-02	+/- 65.57	2.822E-03	+/- 65.57	2.649E-03	+/- 65.58	2.514E-04	+/- 65.59
4	52TE1370	4.798E-02	+/- 32.33	7.174E-03	+/- 67.92	1.651E-03	+/- 67.92	1.352E-03	+/- 67.92	2.281E-04	+/- 67.92
4	52TE1380	4.756E-02	+/- 53.30	4.965E-03	+/- 70.09	5.773E-04	+/- 70.09	4.280E-04	+/- 70.09	1.059E-04	+/- 70.07
4	53 I1390	1.964E-01	+/- 24.63	9.309E-02	+/- 45.86	2.128E-02	+/- 45.86	1.299E-02	+/- 64.61	6.271E-03	+/- 64.61
4	54XE1410	1.951E-03	+/- 24.03	6.611E-04	+/- 13.03	1.487E-04	+/- 8.04	1.628E-04	+/- 64.38	4.124E-05	+/- 24.03
4	54XE1420	9.678E-03	+/- 24.13	2.566E-03	+/- 13.21	3.580E-04	+/- 9.46	2.837E-04	+/- 64.42	1.070E-04	+/- 64.41
4	55CS1420	9.505E-03	+/- 57.44	6.803E-03	+/- 57.44	2.687E-03	+/- 57.44	2.862E-03	+/- 57.44	1.906E-03	+/- 57.44
4	55CS1430	5.935E-02	+/- 26.18	3.502E-02	+/- 26.18	6.443E-03	+/- 65.21	7.904E-03	+/- 65.21	4.126E-03	+/- 65.21
4	55CS1440	5.122E-02	+/- 33.97	2.351E-02	+/- 51.48	2.572E-03	+/- 68.71	2.548E-03	+/- 68.71	1.290E-03	+/- 68.71

TABLE XII

DELAYED NEUTRONS PER 100 FISSIONS[a]

Fissionable Nuclide	Calculated From ENDF/B-V Data	Calculated From ENDF/B-IV Data	Evaluation ENDF/B-IV[b]	Range of Experimental Data[c]	
^{232}Th(F)	4.62 ± 0.33 (4.32)	3.93	5.27 ± 0.40	3.9 ± 0.9	5.9 ± 1.5
^{232}Th(H)	2.99 ± 0.27 (2.68)	----	3.00 ± 0.40	1.30 ± 0.51	8.72 ± 0.67
^{233}U(T)	0.859± 0.07 (0.807)	0.821	0.740± 0.04	0.63 ± 0.18	0.671± 0.41
^{233}U(F)	0.929± 0.09 (0.874)	----	0.740± 0.04	0.67 ± 0.08	0.75 ± 0.064
^{233}U(H)	0.723± 0.10 (0.666)	----	0.44 ± 0.05	1.42 ± 0.42	0.439± 0.04
^{235}U(T)	1.77 ± 0.09 (1.64)	1.60	1.67 ± 0.07	1.58 ± 0.10	2.05 ± 0.61
^{235}U(F)	1.98 ± 0.18 (1.82)	1.48	1.67 ± 0.07	1.63 ± 0.13	1.83 ± 0.18
^{235}U(H)	0.994± 0.10 (0.905)	1.09	0.90 ± 0.10	0.88 ± 0.07	0.91 ± 0.04
^{236}U(F)	2.25 ± 0.20 (2.04)	----	----	----	----
^{238}U(F)	3.42 ± 0.26 (2.94)	2.93	4.60 ± 0.25[d]	3.88 ± 0.49	4.84 ± 0.36
^{238}U(H)	2.67 ± 0.22 (2.29)	1.96	2.60 ± 0.20	1.70 ± 0.67	7.85 ± 0.50
^{237}Np(F)	1.31 ± 0.14 (1.15)	----	----	----	----
^{239}Pu(T)	0.792± 0.06 (0.686)	0.520	0.645± 0.04	0.59 ± 0.23	0.95 ± 0.15
^{239}Pu(F)	0.748± 0.09 (0.623)	0.508	0.645± 0.04	0.62 ± 0.05	0.721± 0.008
^{239}Pu(H)	0.406± 0.06 (0.340)	----	0.43 ± 0.03	0.41 ± 0.02	1.35 ± 0.16
^{240}Pu(F)	0.928± 0.11 (0.786)	----	0.90 ± 0.09	0.94 ± 0.11	----
^{241}Pu(T)	1.59 ± 0.14 (1.31)	1.05	1.57 ± 0.15	0.160± 0.16	----
^{241}Pu(F)	1.50 ± 0.16 (1.22)	----	1.57 ± 0.15	----	----
^{242}Pu(F)	1.40 ± 0.14 (1.16)	----	----	1.50 ± 0.5	----
^{252}Cf(S)	0.687± 0.09 (0.527)	----	----	0.86 ± 0.10	----

[a] ENDF/B-V calculated values (in parentheses) include only measured Pn values (48 nuclides); otherwise the calculations include model estimates for an additional 54 precursors. The yields are ENDF/B-VE. The calculated values for ENDF/B-IV use Version IV yields and Pn values for 57 precursors, 24 being estimated values.
(NOTE: T = Thermal, F = Fast, H = High Energy, and S = Spontaneous Fission.)

[b] Evaluations and uncertainties from S. A. Cox, "Delayed Neutron Data - Review and Evaluation," Argonne National Laboratory report ANL/NDM-5 (1974).

[c] Summary report by R. J. Tuttle, "Delayed Neutron Data for Reactor-Physics Analysis," Nucl. Sci. Eng. 56, 37 (1975).

[d] Preliminary ENDF/B-V evaluation alters this to 4.40 ± 0.12.

F. Calculation of H. B. Robinson II Spent Fuel Actinide and Fission-Product Inventory [W. B. Wilson, G. Grisham (CNC-11), T. R. England, and N. L. Whittemore]

The density of actinide and fission-product nuclides in spent fuel assembly B05 of the H. B. Robinson II reactor were calculated with the EPRI-CINDER code and fission-product absorption-decay library.[63] A library of actinide data being developed for EPRI describing the fission, transmutation, and decay of $234 \leq A \leq 246$ nuclides was used with a power history constructed from data given in Ref. 64. Calculations were performed preliminary to analyses planned by LASL's Group CNC-11 of a single fuel rod from the assembly, which was removed from the reactor in 1974 following the second fuel cycle at an exposure of $\sim$28 GW days/MT.

These calculations are to be repeated following CNC-11 measurements, using selected nuclide concentrations to indicate true sample exposure. Additional calculations will be performed for EPRI using resonance self-shielded actinide cross sections.

REFERENCES

1. G. M. Hale and D. C. Dodder, "Charge-Independent R-Matrix Analysis of the Four-Nucleon System," Proc. of the 8th Internl. Conf. on Few Body Systems and Nuclear Forces, Graz, Austria, (Sept. 1978) Vol. 2 (to be published).

2. D. C. Dodder and G. M. Hale, "Applications of Approximate Isospin Conservation in R-Matrix Analyses," Proc. Internl. Conf. on Neutron Physics and Neutron Data for Reactors and Other Applied Purposes, Harwell, England (Sept. 1978) (to be published).

3. E. K. Biegert, S. D. Baker, D. C. Dodder, and G. M. Hale, "Low Energy ^{6}Li(p, ^{3}He) ^{4}He Cross Section," to be submitted to Astrophysical Journal.

4. D. C. Dodder, G. M. Hale, and K. Witte, Los Alamos Scientific Laboratory, private communication.

5. D. M. Holm and H. V. Argo, "t-t Elastic Scattering from 1.6 to 2.0 MeV," Phys. Rev. 101, 1772 (1956).

6. R. C. Allen and N. Jarmie, "Triton Reaction Cross Sections," Phys. Rev. 111, 1129 (1958).

7. V. I. Serov, S. N. Abramovich, and L. A. Morkin, "Total Cross Section Measurement for the Reaction T(t,2n)^{4}He," At. Eng. 42, 59 (1977) [English Translation Sov. At. En. 42, 66 (1977)].

8. A. M. Govorov, L. Ka-Yeng, G. M. Osetinskii, V. I. Satatskii, and I. V. Sizov, "Total Cross Section of the T+T Reaction in the 60-1140 keV Energy Range," J. Exptl. Theor. Phys. (USSR) 42, 383 (1962) [English Trans. Sov.: Sov. Phys. JETP 15, 266 (1962)].

9. N. Jarmie and R. C. Allen, "T(t,α)n,n Reaction," Phys. Rev. 111, 1121 (1958).

10. H. M. Agnew, W. T. Leland, H. V. Argo, R. W. Crews, A. H. Hemmendinger, W. E. Scott, and R. F. Taschek, "Measurement of the Cross Section for the Reaction T+T He^4 + 2n + 11.4 MeV," Phys. Rev. 84, 862 (1951).

11. Y. V. Strel'nikov, S. N. Abramovich, L. A. Markin, and N. D. Yur'eva, "Excitation Function for the Reaction ^{3}He(t,2n)^{4}He at 0° Angle and Energies of 40-200 keV," Bull. Acad. Sci. USSR, Phys. Ser. 35, 149 (1971).

12. D. R. Harris, D. E. Dei, A. A. Husseiny, Z. A. Sabri, and G. M. Hale, "The STEEP4 Code for Computation of Specific Thermonuclear Reaction Rates from Pointwise Cross Sections," Los Alamos Scientific Laboratory report LA-6344-MS (1976).

13. S. L. Greene, Jr., "Maxwell Averaged Cross Sections for Some Thermonuclear Reactions on Light Isotopes," Lawrence Livermore Laboratory report UCRL-70522 (1967).

14. C. Wong, J. D. Anderson, and J. W. McClure, "Neutron Spectrum for the T+T Reaction," Nucl. Phys. 71, 106 (1965).

15. L. R. Veeser and E. D. Arthur, "Measurements of (n,3n) Cross Sections for ^{235}U and ^{238}U,"Proc. of the Internl. Conf. on Neutron Physics and Neutron Data for Reactors and Other Applied Purposes, Sept. 1978, Harwell, England (to be published).

16. D. G. Madland and P. G. Young, "Neutron-Nucleus Optical Potential for the Actinide Region," Proc. of the Internl. Conf. on Neutron Physics and Neutron Data for Reactors and Other Applied Purposes, Sept. 1978, Harwell, England (to be published).

17. B. B. Back, H. C. Britt, O. Hansen, B. Leroux, and J. D. Garrett, "Fission of Odd-A and Doubly Odd Actinide Nuclei Induced by Direct Reactions," Phys. Rev. C10, 1948 (1974).

18. C. Kalbach, "The Griffin Model, Complex Particles, and Direct Nuclear Reactions," Z. Phys. A283, 401 (1977).

19. J. Frehaut and G. Mosinski, "Measurement of (n,2n) and (n,3n) Cross Sections between 6 and 15 MeV," Nuclear Cross Sections and Technology (NBS Special Publication 425, 1975) p. 855.

20 D. S. Mather and L. F. Pain, "Measurement of (n,2n) Cross Sections for Induced Energies between 6 and 14 MeV," Atomic Weapons Research Establishment report AWRE O 72/72 (1972).

21. D. G. Foster, Jr., "Photon Radiation from Dirty Plutonium," in "Applied Nuclear Data Research and Development October 1-December 31, 1975," compiled by C. I. Baxman and P. G. Young, Los Alamos Scientific Laboratory report LA-6266-PR, p. 4 (1976).

22. Y. A. Ellis, "Nuclear Data Sheets for A = 230," Nuclear Data Sheets 20, 139 (1977).

M. R. Schmorak, "Nuclear Data Sheets for A = 232, 236, 240," Nuclear Data Sheets 20, 165 (1977).

M. R. Schmorak, "Nuclear Data Sheets for A = 231, 234, 239," Nuclear Data Sheets 21, 91 (1977).

Y. A. Ellis, "Nuclear Data Sheets for A = 234," Nuclear Data Sheets 21, 493 (1977).

Y. A. Ellis, "Nuclear Data Sheets for A = 238," Nuclear Data Sheets 21, 549 (1977).

23. R. S. Hager and E. C. Seltzer, "Internal Conversion Tables, Part I: K-, L-, M-Shell Conversion Coefficients for Z = 30 to Z = 103," Nuclear Data A4, 1 (1968).

24. C. M. Lederer, J. M. Hollander, and I. Perlman, Table of Isotopes (John Wiley and Sons, New York, 1967) Appendix 3.

25. E. Vano, R. Gaeta, L. Gonzales, and C. F. Liang, "Etude des Niveaux Excites du ^{231}Th par la Desintegration α du ^{235}U," Nucl. Phys. A251, 225 (1975).

I. Ahmad, "Nuclear Spectroscopy Studies of Some Very Heavy Odd-Mass Nuclides," Lawrence Livermore Radiation Laboratory report UCRL-16888, pp. 20-22 (1966).

26. R. Bois and J. Frehaut, "Evaluation Semi-Empirique du $\bar{\nu}_p$ pour la Fission Induite par Neutrons Rapides," Commissariat a l'Energie Atomique report CEA-R-4791 (1976).

27. A. B. Smith, "Fission Neutron Spectra: Perspective and Suggestions," Proc. of a Consultants' Meeting on the Status of Prompt Fission Neutron Spectra, Vienna, Austria, p. 3 (August 1971).

28. D. G. Madland, "Neutron Optical Potential for Uranium Isotopes," in "Applied Nuclear Data Research and Development July 1-September 30, 1977," compiled by C. I. Baxman and P. G. Young, Los Alamos Scientific Laboratory report LA-7066-PR, p. 12 (1977).

29. F. D. Becchetti, Jr., and G. W. Greenlees, "Nucleon-Nucleus Optical-Model Parameters, A > 40 E < 50 MeV," Phys. Rev. 182, 1190 (1969).

30. G. Haouat, J. Sigaud, J. Lachkar, Ch. Lagrange, B. Duchemin, and Y. Patin, "Differential Cross Section Measurements of Fast Neutron Scattering for ^{208}Pb, ^{232}Th, and ^{238}U," INDC report INDC(FR) 13/L, NEANDC(E) 180 "L" (1977).

31. G. Haouat, J. Lachkar, Ch. Lagrange, Y. Patin, J. Sigaud, and R. Shamu, "Differential Cross Section Measurements for 3.4 MeV Neutron Scattering by ^{208}Pb, ^{232}Th, ^{235}U, ^{238}U, and ^{239}Pu," INDC report INDC(FR) 29/L, NEANDC(E) 196 "L" (1978).

32. D. G. Foster, Jr., and Dale W. Glasgow, "Neutron Total Cross Sections 2.5-15 MeV, I. Experimental," Phys. Rev. C3, 576 (1971).

33. N. J. Pattenden and J. A. Harvey, "Measurement of the Neutron Total Cross Section of ^{233}U from 0.07 to 10,000 eV," Nucl. Sci. Eng. 17, 404 (1963).

34. M. L. Yeater, R. W. Hockenbury, and R. R. Fullwood, "Eta of ^{233}U from 1 to 800 eV," Nucl. Sci. Eng. 9, 105 (1961).

35. W. P. Poenitz, J. F. Whalen, and P. Guenther, "Measurements of the Total Neutron Cross Section of ^{233}U Between 40 keV and 4.5 MeV," submitted for publication in Nucl. Sci. Eng. (1978).

36. C. A. Uttley, C. M. Newstead, and K. M. Diment, "Neutron Strength Function Measurements in the Medium and Heavy Nuclei," IAEA Conf. on Nuclear Data, paper CN-23/26, Paris (1966), and personal communication to the Brookhaven National Laboratory Nuclear Data Center (1964).

37. H. Derrien, personal communication to the Brookhaven National Laboratory Nuclear Data Center (1969).

38. K. H. Bockhoff, A. Dufrasne, G. Rohr, and H. Weigmann, "Neutron Total Cross-Section Fluctuations of ^{235}U in the keV Range," J. Nucl. Energy 26, 91 (1972).

39. R. B. Schwartz, R. A. Schrack, and H. T. Heaton, III, "Total Neutron Cross Sections of ^{235}U, ^{238}U, and ^{239}Pu from 0.5 to 15 MeV," Nucl. Sci. Eng. 54, 322 (1974).

40. R. C. Allen, "The Interaction of 0.15 to 1.0 MeV Neutrons with ^{238}U, ^{235}U, and ^{239}Pu," Nucl. Sci. Eng. 2, 787 (1957).

41. L. Cranberg, "Neutron Scattering by ^{235}U, ^{238}U, and ^{239}Pu," Los Alamos Scientific Laboratory report LA-2177 (1959).

42. H.-H. Knitter, M. M. Islam, and M. Cappola, "Investigation of Fast Neutron Interaction with ^{235}U," Z. Physik 257, 108 (1972).

43. G. P. Couchell, J. J. Egan, G. H. R. Kregel, and T. V. Marcella, "Inelastic Neutron Scattering Cross Sections for ^{238}U from 0.9 to 3.1 MeV," Trans. Am. Nucl. Soc. 27, 871 (1977).

44. J. Voignier, "Experimental Study of the Interaction of 14-MeV Neutrons with ^{238}U," Commissariat a l'Energie Atomique report CEA-R-3503 (1968).

45. J. F. Whalen and A. B. Smith, "Note on the Fast-Neutron Total Cross Section of Thorium," Nucl. Sci. Eng. 67, 129 (1978), and personal communication to the Brookhaven National Laboratory National Nuclear Data Center (1969).

46. R. E. Shamu, Western Michigan University, personal communication (1978).

47. P. A. Egelstaff, D. B. Gayther, and K. P. Nicholson, "The Slow-Neutron Resonance Behavior of Plutonium Isotopes," J. Nucl. Energy 6, 303 (1958).

48. R. L. Henkel, "Total Neutron Cross Sections for ^{235}U, Normal Uranium, ^{239}Pu," Los Alamos Scientific Laboratory report LA-1493 (1952).

49. L. Green, "Total Cross-Section Measurements with a CF-252 Time-of-Flight Spectrometer," Proc. of 3rd Conference on Neutron Cross Section Technology, Knoxville, Tenn., CONF-710301, Vol. 1, p. 325 (1971)

50. H. Rebel and G. W. Schweimer, "Improved Version of Tamura's Code for Coupled-Channel Calculations: JUPITOR Karlsruhe Version," Gesellschaft fur Kernforschung M.B.H., Karlsruhe report KFK-1333 (1971).

51. R. E. MacFarlane, P. G. Young, and D. W. Muir, "Nuclear Heating and ENDF/B Consistency," in "Applied Nuclear Data Research and Development April 1-June 30, 1977," compiled by C. I. Baxman and P. G. Young, Los Alamos Scientific Laboratory report LA-6971-PR (1977).

52. D. Garber, Ed., "Data Formats and Procedures for ENDF Neutron Cross Section Library," Brookhaven National Laboratory report BNL-50274 (1976).

53. R. B. Kidman and R. E. MacFarlane, "LIB-IV, A Library of Group Constants for Nuclear Reactor Calculations," Los Alamos Scientific Laboratory report LA-6260-MS (1976).

54. R. B. Kidman, "ENDF/B-IV, LIB-IV, and the CSEWG Benchmarks," Los Alamos Scientific Laboratory report LA-7355-MS (1978).

55. E. L. Simmons, S. A. W. Gerstl, and D. J. Dudziak, "Cross-Section Sensitivity Analysis for a Tokamak Experimental Power Reactor," Los Alamos Scientific Laboratory report LA-6942-MS (1977).

56. T. R. England, Los Alamos Scientific Laboratory, private communication.

57. R. E. Pepping, D. E. Madland, C. W. Maynard, T. R. England, and P. G. Young, "Fission Yield Theory," in "Applied Nuclear Data Research and Development October 1-December 31, 1977," compiled by C. R. Baxman and P. G. Young, Los Alamos Scientific Laboratory report LA-7200-PR (1978).

58. R. E. Pepping, D. G. Madland, C. W. Maynard, T. R. England, and P. G. Young, "Fission Yield Theory," in "Applied Nuclear Data Research and Development July 1-September 30, 1977," compiled by C. I. Baxman and P. G. Young, Los Alamos Scientific Laboratory report LA-7066-PR (1977).

59. T. Yamamoto and K. Sugiyama, "Statistical Estimation of Distributions of Physical Quantities in Nuclear Fission," J. Nucl. Sci. Tech. 11, 461 (1974).

60. L. G. Moretto, "Statistical Description of Deformation in Excited Nuclei and the Disappearance of Shell Effects with Increasing Excitation," Nucl. Phys. A182, 641 (1972).

61. S. Kataria, V. Ramamurthy, and S. Kapoor, "Semi-Emperical Nuclear Level Density Formula with Shell Effects," Phys. Rev. C18, 549 (1977).

62. T. R. England, R. E. Schenter, and F. Schmittroth, "Integral Decay-Heat Measurements and Comparison to ENDF/B-IV and V," Los Alamos Scientific Laboratory report LA-7422-MS [NUREG/CR-0305] (1978).

63. T. R. England, W. B. Wilson, and M. G. Stamatelatos, "Fission Product Data for Thermal Reactors, Part 1: A Data Set for ERPI-CINDER Using ENDF/B-IV," Los Alamos Scientific Laboratory report LA-6745-MS (1976) and "Fission Product Data for Thermal Reactors, Part 2: Users Manual for EPRI-CINDER Code and Data," Los Alamos Scientific Laboratory report LA-6746-MS (1976). [Also published as Electric Power Research Institute report EPRI NP-356, Part 1 and Part 2 (1976.)]

64. S. J. Dagbjartsson, B. A. Murdock, D. E. Owen, and P. E. MacDonald, "Axial Gas Flow in Irradiated Power Fuel Rods," Idaho National Engineering Laboratory report TREE-NUREG-1158 (with addendum) (1977).