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高速臨界集合体の炉心核特性の感度係数
と予測誤差評価

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青山 卓史*・鈴木 隆之*・竹田 敏一*
長谷川 明・菊池 康之

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高速臨界集合体の炉心核特性の感度係数と予測誤差評価

日本原子力研究所東海研究所
シグマ研究委員会炉定数専門部会
青山 卓史*・鈴木 隆之*・竹田 敏一*
長谷川 明・菊池 康之

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JENDL-2データを用いて種々の高速臨界集合体における炉心核特性の感度係数を計算した。計算は一般化摂動論に基づく感度解析コード SAGEP を用いて実行した。各臨界集合体の16群の感度係数を示し、その相違について炉物理的に検討した。

また感度係数と断面積の共分散データを用いて断面積の不確かさによる核特性計算値の予測誤差を計算した。

本報告書は、シグマ研究委員会炉定数専門部会 JENDL 積分評価ワーキング・グループにより行なわれた成果である。

*大阪大学工学部

東海研究所： 319-11 茨城県那珂郡東海村白方白根2の4

Sensitivity Coefficients of Reactor Parameters in Fast
Critical Assemblies and Uncertainty Analysis

Takafumi AOYAMA,* Takayuki SUZUKI,* Toshikazu TAKEDA,*
Akira HASEGAWA and Yasuyuki KIKUCHI

Japanese Nuclear Data Committee,
Subcommittee on Reactor Constants,
Tokai Research Establishment

Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun, Ibaraki-ken

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Sensitivity coefficients of reactor parameters in several fast critical assemblies to various cross sections were calculated in 16 group by means of SAGEP code based on the generalized perturbation theory. The sensitivity coefficients were tabulated and the difference of sensitivity coefficients was discussed. Furthermore, the uncertainty of calculated reactor parameters due to cross section uncertainty were estimated using the sensitivity coefficients and cross section covariance data.

Keywords : Sensitivity Coefficients, Reactor Parameters, SAGEP,
Uncertainty, Cross Section Covariance Data

This report was prepared as an account of work by the working group on integral tests for JENDL of the subcommittee on reactor constant of JNDC.

* Faculty of Engineering, Osaka University

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1. はじめに

実機炉心の核特性を把握し、さらにその計算精度を向上させるために種々の臨界集合体を用いて積分実験が広く行われてきた。積分実験値とその計算値とを比較することは、解析手法並びに計算に使用した断面積ライブラリーの妥当性の評価に有効である。このうち核データの積分評価の立場からは、核特性の断面積に対する感度係数が非常に有用となる。感度解析により各核特性に対して各断面積変化が与える影響を調べることができ、異種の断面積ライブラリー間の相違による核特性の計算値の変化も感度係数を用いて予測することができる。また断面積の共分散データを用いて断面積の不確かさに起因する核特性計算値の予測誤差を計算することができ、さらには核特性測定値を用いて、積分データから断面積のアジャストメントを行うことも可能となる。

本報告では高速臨界集合体 FCA V-1, V-2, VI-1, VI-2, MZB, ZPPR-2, 9, 10 A, ZPR-6/7, 6/6A の炉心核特性の感度係数を16群で計算し、各集合体間の感度係数の相違について比較検討する。感度係数の計算は一般化摂動論に基づく感度解析コード SAGEP⁽¹⁾を用いて実行した。次に感度係数とオークリッジ研究所で作成され、日本原子力研究所で16群に縮約された断面積共分散データを用いて断面積の不確かさによる核特性計算値の予測誤差を計算し、各断面積の誤差による影響を調べる。

2. 高速臨界集合体の感度係数

2.1 計算体系並びに計算方法

感度係数を計算する対象となった高速臨界集合体は FCA V-1, V-2, VI-1, VI-2, MZB, ZPPR-2, 9, 10A, ZPR-6/7, 6/6A の 10 個の集合体である。Table 1 に各集合体の炉心半径, 高さ, 内側及び外側領域の炉心体積, 各領域の ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{235}U , ^{238}U の平均原子数密度の値を示す。各集合体の fertile material と fissile material との比は 2.3~7.8 まで分布しており (Table 1 参照), 種々のスペクトルを持つ炉心の感度係数が得られるためこれら 10 個の集合体を選んだ。FCA V-1, V-2 は常陽のモックアップ炉心であり, FCA VI-1, VI-2 はもんじゅのモックアップとなる内側炉心と濃縮ウランから成る外側炉心の 2 領域炉心である。MZB は日英共同研究によるもんじゅ用炉物理実験 (MOZART 計画) におけるもんじゅのクリーンな 2 領域モックアップ炉心である。ZPR-6/7, 6/6A 及び ZPPR-2 は原型炉クラスのベンチマーク炉心であり, ZPPR-9, 10A は日米共同研究による JUPITER 計画における実証炉のための 2 領域均質炉心のクリーンベンチマーク炉心及び工学的ベンチマーク炉心である。ZPR-6/6A は U 炉心, FCA V-1, V-2, VI-1, VI-2 は U+Pu 炉心 (FCA VI-1, VI-2 では内側炉心は Pu 炉心), MZB, ZPR-6/7, ZPPR-2, 9, 10A は Pu 炉心である。感度係数は 2 次元 RZ モデルで計算し, その際 MZB, ZPPR-10A 以外は日本原子力研究所で高速炉 2 次元ベンチマーク体系として提案されている形状寸法並びにメッシュ巾を参考にした⁽²⁾。

感度係数の計算のフローダイアグラムを Fig. 1 に示す。断面積セットとしては JENDL-2 データから得られた JFS-3-J2 70 群断面積セット⁽³⁾を用いた。格子を均質にして (体積平均), 各領域の 70 群実効断面積を SLAROM コード⁽⁴⁾ より求め, Table 2 に示したモデル (小型炉心は球, 大型炉心では R, Z, 1 次元モデル) で 70 群断面積を 16 群に縮約した。CITATION-FBR コード⁽⁵⁾ で 16 群拡散計算を行い, 中性子束並びに随伴中性子束を求めた。16 群定数並びに中性子束 (随伴中性子束) 分布を用いて SAGEP コードにより 16 群の感度係数を計算した。16 群のエネルギー群構造を Table 3 に示す。

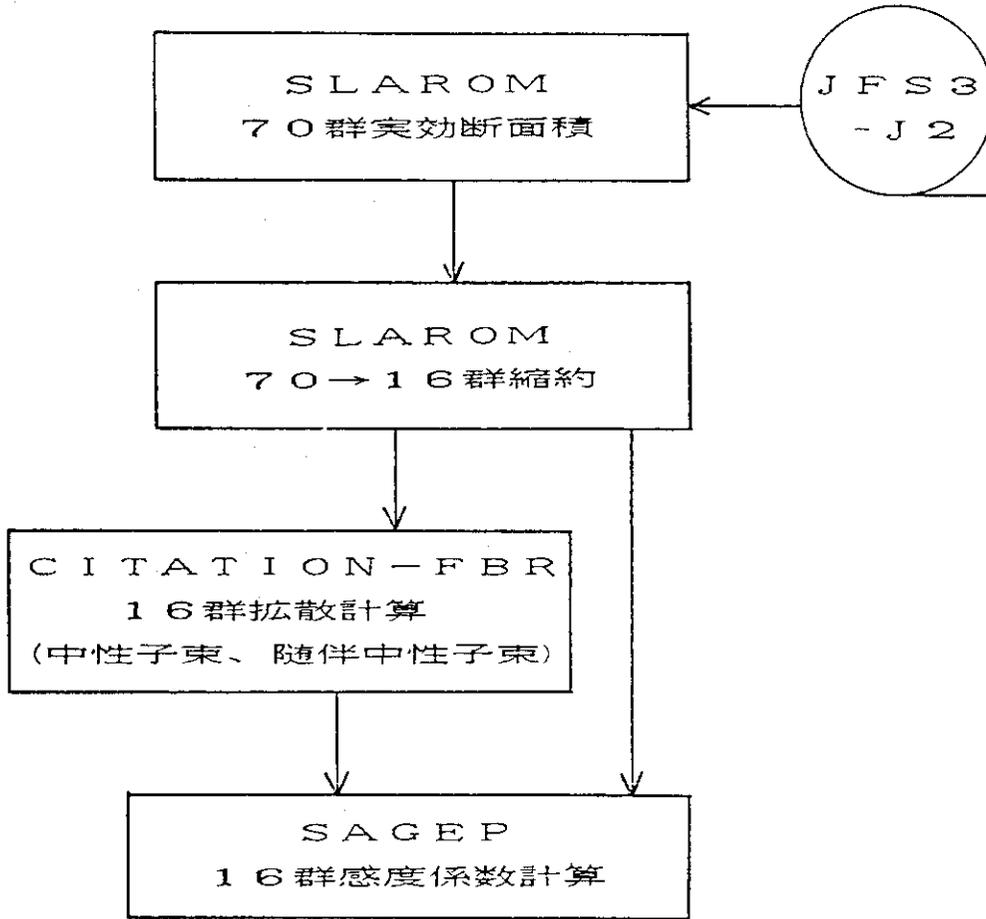


Fig. 1 感度係数計算のフローダイヤグラム

Table 1 Specifications of Critical Assemblies

	FCA V-1*	FCA V-2*	FCA VI-1**	FCA VI-2**	MZB
Fuel	U (+Pu)	U (+Pu)	Pu (+U)	Pu (+U)	Pu
Fissile to Fertile Ratio	2.6	2.3	3.6	3.2	5.2
Core Radius					
R 1 (cm)	28.23	36.45	28.03	29.38	62.21
R 2 (cm)	-----	-----	40.55	46.47	79.64
Core Height (cm)	60.96	60.96	91.44	91.44	89.20
Core Volume					
V 1 (l)	152.60	214.28	225.68	247.96	1084.4
V 2 (l)	-----	-----	246.70	378.54	693.2
Core 1					
Pu-239	0.10446	0.10458	0.15687	0.10458	0.08916
240	0.00943	0.00933	0.01400	0.00933	0.01791
241 (X10 ²² /cc)	0.00112	0.00107	0.00160	0.00092	0.00271
U-235	0.1960	0.1470	0.00152	0.00152	0.00429
238	0.77810	0.58359	0.69057	0.69057	0.59259
Core 2					
Pu-239	-----	-----	-----	-----	0.13457
240	-----	-----	-----	-----	0.03227
241 (X10 ²² /cc)	-----	-----	-----	-----	0.00519
U-235	-----	-----	0.21310	0.28483	0.00388
238	-----	-----	0.64152	0.68915	0.53511

* 1 region core

** Pu core + EU driver

Table 1 (Continued)

	ZPPR-2	ZPPR-9	ZPPR-10A*	ZPR-6/7	ZPR-6/6A
Fuel	Pu	Pu	Pu	Pu	U
Fissile to Fertile Ratio	5.1	7.8	6.9	6.5	5.0
Core Radius					
R 1 (cm)	64.67	88.87	97.72	24.34	24.34
R 2 (cm)	91.45	119.95	126.65	80.68	91.24
Core Height (cm)	91.62	101.76	101.76	152.56	152.56
Core Volume					
V 1 (l)	1203.8	2524.9	3052.7	283.9	283.9
V 2 (l)	1203.3	2074.8	2074.4	2835.8	3705.9
Core 1					
Pu-239	0.12750	0.08865	0.09498	0.08882	-----
240	0.01687	0.01174	0.01257	0.01177	-----
241 (X10 ²² /cc)	0.00232	0.00112	0.00119	0.00133	-----
U-235	0.00115	0.00181	0.00179	0.00126	0.11530
238	0.51915	0.82450	0.80973	0.57770	0.58012
Core 2					
Pu-239	0.12750	0.12672	0.13223	0.08882	-----
240	0.01687	0.01678	0.01748	0.01177	-----
241 (X10 ²² /cc)	0.00232	0.00168	0.00165	0.00133	-----
U-235	0.00115	0.00166	0.00165	0.00126	0.11491
238	0.51915	0.75645	0.74527	0.58020	0.57843

* I.C. contains CRPs

Table 2 Calculation Model for Collapsing Spectrum

Assembly	Collapsing Model
FCA V-1	1D Sphere
FCA V-2	1D Sphere
FCA VI-1	1D Sphere
FCA VI-2	1D Sphere
MZB	1D Cylinder (R-direction) + 1D Slab (Z-direction)
ZPPR-2	1D Cylinder (R-direction) + 1D Slab (Z-direction)
ZPPR-9	1D Cylinder (R-direction) + 1D Slab (Z-direction)
ZPPR-10A	1D Cylinder (R-direction) + 1D Slab (Z-direction)
ZPR-6/7	1D Sphere
ZPR-6/6A	1D Sphere

Table 3 Energy group structure of 16 group

Group	Corresponding group in 70 groups of JFS-3-J2	Energy range
1	1 ~ 2	10.0 ~ 6.07 MeV
2	3 ~ 4	6.07 ~ 3.68
3	5 ~ 6	3.68 ~ 2.23
4	7 ~ 8	2.23 ~ 1.35
5	9 ~ 10	1.35 ~ 0.82
6	11 ~ 13	0.82 ~ 0.39
7	14 ~ 16	0.39 ~ 0.18
8	17 ~ 19	0.18 ~ 0.09
9	20 ~ 22	86.5 ~ 40.9 keV
10	23 ~ 25	40.9 ~ 19.3
11	26 ~ 28	19.3 ~ 9.12
12	29 ~ 31	9.12 ~ 4.31
13	32 ~ 34	4.31 ~ 2.03
14	35 ~ 37	2.03 ~ 0.961
15	38 ~ 40	961 ~ 454 eV
16	41 ~ 70	454 ~ thermal

2.2 各炉心核特性の感度係数

感度係数計算の対象となった10集合体の核特性の種類を Table 4 に示す。実効増倍率はすべての集合体について取り扱った。中心反応率比は ZPPR-10A 以外の集合体で取り扱い、各集合体で種類が異なっている。(Table 4 参照) 反応率分布は $^{239}\text{Pu}(n, f)$ の径方向分布について MZB 及び ZPPR-9, 10A 集合体で取り扱った。内側炉心, 外側炉心の各点の反応率分布の炉心中心付近での規格化値に対する感度係数を計算した。ドップラー反応度は, FCA V-1, V-2, VI-1, VI-2, ZPPR-9 集合体で計算し, UO_2 サンプルについては全部の集合体で取り扱い, Fe サンプルについては FCA V-2, VI-1, VI-2 で取り扱い, ステンレス・スチール(SS) サンプルについては, FCA V-1, VI-1, VI-2 で取り扱った。それぞれのサンプルの温度変化は Table 4 に示すように異なっている。Na ボイド値については FCA VI-2, MZB, ZPPR-9 集合体で感度係数を計算した。Na ボイド値はセントラルタームともれの和として表わされ, それぞれの成分は, ボイドパターンに強く依存するので, 各集合体についてそれぞれ異なるボイドパターンを取り扱い, 感度係数の変化を考慮した。FCA VI-2 では炉中心の 3×3 ドロワーが軸方向に4パック, 5×5 ドロワーが軸方向に6パックだけボイドになった場合を取り扱った。MZB では炉中心の 3×3 ドロワーについて軸方向に ± 1.20 cm, ± 4.46 cm とボイド領域を増やした場合について取り扱った。ZPPR-9 の2種のボイドパターンは炉中心の9ドロワーが軸方向に ± 8 inch ボイドになった場合, 炉中心の97ドロワーが軸方向に ± 8 inch ボイドになった場合に相応している。

Table 5 には k_{eff} の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, f)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, $^{241}\text{Pu}(n, \gamma)$, Fe (n, γ) , Fe-散乱, Cr-散乱, Na (n, γ) , Na-散乱, O-散乱断面積に対する感度係数を示す。ZPR-6/6A は U 炉心であるので $^{235}\text{U}(n, f)$ 断面積に対する感度係数は大きい。U+Pu 炉心である FCA V-1, V-2, 及び外側炉心に濃縮ウランを用いている FCA VI-1, VI-2 でも感度は高いが, Pu 炉心では感度係数は小さくなっている。 $^{238}\text{U}(n, \gamma)$ 断面積に対する感度係数は FCA V-1, V-2 では他の集合体に比べて 20 keV 以下のエネルギー領域で感度係数が小さくなっている。これは FCA V-1, V-2 が小型炉心であり, Fig. 2 に示されるように中性子スペクトルが非常に硬くなっているためである。 ^{238}U -散乱断面積に対する感度係数は高エネルギー領域で負, 低エネルギー領域で正の値をとり, FCA V-1, V-2 では他の集合体に比べて感度が高く, FCA V-1, V-2 では他の集合体に比べて感度が高く, 1.4 MeV ~ 41 keV のエネルギー領域で特に大きくなっている。 $^{239}\text{Pu}(n, f)$ 断面積に対する感度係数は, Pu 炉心である MZB, ZPPR-2, 9, 10A, ZPR-6/7 で大きくほぼ同じ値になっている。 $^{239}\text{Pu}(n, \gamma)$ 断面積に対する感度係数は Pu 炉心の低エネルギー領域 (2.0 keV 以下) で大きい。Fe (n, γ) 断面積に対する感度係数は 100 keV 付近と Fe の共鳴のある 14 群で大きくなっている。Fe-散乱断面積に対する感度係数は, エネルギー範囲に依存して正負の値をとる。(高エネルギー領域で負)

Table 6 には中心反応率比 $28f/25f$ の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe (n, γ) , Fe-散乱, Cr-散乱, Ni-散乱, Na (n, γ) , Na-散乱, O-

散乱断面積に対する感度係数を示す。 $^{235}\text{U}(n, f)$ 断面積に対する感度係数は FCA VI-1, VI-2 で特に大きく, U 炉心である ZPR-6/6A ではスペクトルが硬くなるため感度係数は逆に小さくなっている。 $^{238}\text{U}(n, f)$ 断面積に対しては, 各集合体での感度係数は各エネルギー群でほぼ同じである。 $^{238}\text{U}(n, \gamma)$ 断面積に対する感度係数は高エネルギー領域で負, 低エネルギー領域で正の値をとり, スペクトルがソフトな大型炉心では, FCA V-1, V-2 に比べて, 特に 19 keV 以下のエネルギー領域で感度が高い。 ^{238}U -散乱断面積に対する感度係数は各集合体とも 3.7 ~ 1.4 MeV のエネルギー領域で大きな負の値をとる。 $^{239}\text{Pu}(n, f)$ 断面積に対しては, FCA VI-1, VI-2 で感度係数が大きくなっている。これは FCA VI-1, VI-2 は小型炉心であり, 内側炉心のみが Pu 炉心であるために $^{239}\text{Pu}(n, f)$ 断面積のスペクトル変化に対する効果が大きいのである。Fe-散乱, Cr-散乱, Ni-散乱断面積に対する感度係数は, ほとんどのエネルギー群で負の値をとり, 特に 2 MeV 付近のエネルギー領域で大きな値となっており, Na-散乱, O-散乱断面積に対してもほぼ同様な傾向がみられる。

Table 7 には中心反応率比 4.9 f / 2.5 f の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。当然のことながら $^{235}\text{U}(n, f)$, $^{239}\text{Pu}(n, f)$ 断面積に対する感度係数は大きい。 $^{238}\text{U}(n, \gamma)$ 断面積に対してはスペクトルの硬い FCA V-1, V-2 では他の集合体に比べて低エネルギー領域での感度係数が小さい。 ^{238}U -散乱断面積に対する感度係数は, ほとんどのエネルギー群で負の値をとる。Fe-散乱, Na-散乱, O-散乱断面積に対する感度係数もほぼ同様な傾向を示す。

Table 8 には中心反応率比 2.8 C / 4.9 f の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。 $^{238}\text{U}(n, \gamma)$, $^{239}\text{Pu}(n, f)$ 断面積に対する感度係数は大きく, 各集合体でほぼ同じ値になっている。 $^{235}\text{U}(n, f)$ 断面積に対する感度係数は FCA V-1, V-2, VI-1, VI-2 で大きく, V-1 及び V-2 と VI-1 及び VI-2 とでは正負逆になっている。 ^{238}U -散乱断面積に対しても感度が高い。Fe-散乱, Na-散乱断面積に対する感度係数は高エネルギー群で正, 低エネルギー群で負の値をとる。O-散乱断面積に対する感度係数についてもほぼ同様な傾向がみられるが, 各集合体とも 0.8 2 MeV ~ 8.7 keV のエネルギー領域で特に感度が高い。

Table 9 には $^{239}\text{Pu}(n, f)$ 径方向分布 (Table 4 参照) の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。炉中心付近で規格化した反応率分布を取り扱ったので外側炉心における感度係数の方が内側炉心での値より大きくなっている。特に $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, O-散乱断面積に対する感度係数が大きい。

Table 10 には UO_2 ドップラー反応度の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Cr-散乱, Ni-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。 $^{235}\text{U}(n, f)$ 断面積に対する感度係数は Pu 炉心である ZPP

R-9以外では大きく、0.82 MeV~19 keVのエネルギー領域で特に負の大きな値をとる。 $^{238}\text{U}(n, \gamma)$ 断面積に対する感度係数はFCA V-1, V-2で大きく、ZPPR-9では逆に負の値になっている。これはTable 11に示す感度係数の成分をみると小型炉心であるFCA V-1では直接効果が主となっているが、スペクトルがソフトなZPPR-9では中性子束、随伴中性子束成分が大きくなり、直接効果と間接効果の相殺が生じるためである。 ^{238}U -散乱、 $^{239}\text{Pu}(n, \gamma)$ 断面積に対する感度係数も大きい。 $^{239}\text{Pu}(n, f)$ 断面積に対する感度係数はFCA VI-2, ZPPR-9については、他の集合体と異なる傾向を示す。Table 12に示す感度係数の成分をみると、FCA VI-2ではFCA V-1に比べて随伴中性子束成分が大きいため全群の感度係数が正となり、ZPPR-9では直接効果が大きいいため大きな負の感度をもつことがわかる。この他Fe-散乱、Na-散乱、O-散乱断面積に対する感度係数も大きい。

Table 13, 14にはFe及びSSドップラー反応度の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Cr-散乱, Ni-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。FCA VI-1, VI-2でのFe及びSSドップラー反応度の感度係数はよく似ている。 $^{235}\text{U}(n, f)$ 断面積に対する感度係数はFCA VI-2で大きく、他の集合体の約2倍となっており、特に0.82 MeV~41 keVのエネルギー領域で大きな値をとる。 $^{238}\text{U}(n, \gamma)$ 及び $^{239}\text{Pu}(n, \gamma)$ 断面積に対しては2 keV付近で大きな負の感度があり、スペクトルがソフトなFCA VI-2で感度係数が大きくなっている。 $^{238}\text{U}(n, f)$ 断面積に対する感度係数は各集合体ではほぼ同じ値になっている。 $^{239}\text{Pu}(n, f)$ 断面積に対する感度係数は、FCA V-1, V-2で同じ傾向を示す以外は各集合体で相違がみられる。Table 15に示す感度係数の成分をみると、FCA V-1では直接効果が主となっておりスペクトルが硬いため中性子束成分、随伴中性子束成分が小さくなっているのに対し、FCA VI-2では2 keV以下の随伴中性子束成分が大きく、全群の感度係数は正となっている。Fe(n, γ) 断面積に対する感度係数は共鳴のある100 keV及び1 keV付近で大きな値になっている。またFe-散乱, Na-散乱, O-散乱断面積に対しても感度が高い。

Table 16にはNaボイド価値の $^{235}\text{U}(n, f)$, $^{235}\text{U}(n, \gamma)$, $^{238}\text{U}(n, f)$, $^{238}\text{U}(n, \gamma)$, ^{238}U -散乱, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$, $^{240}\text{Pu}(n, \gamma)$, $^{241}\text{Pu}(n, f)$, Fe(n, γ), Fe-散乱, Na(n, γ), Na-散乱, O-散乱断面積に対する感度係数を示す。一般にボイド領域が広がるにつれて感度係数が大きくなる傾向を示している。 $^{235}\text{U}(n, f)$ 断面積に対する感度係数はFCA VI-2で大きくPu炉心である。MZB, ZPPR-9では小さい。 $^{238}\text{U}(n, \gamma)$, $^{239}\text{Pu}(n, f)$, $^{239}\text{Pu}(n, \gamma)$ 断面積に対しては各集合体とも2 keV以下のエネルギー領域で特に感度が高い。⁽⁶⁾ Na-散乱断面積に対する感度係数は高エネルギー領域で正、低エネルギー領域で負の値をとる。

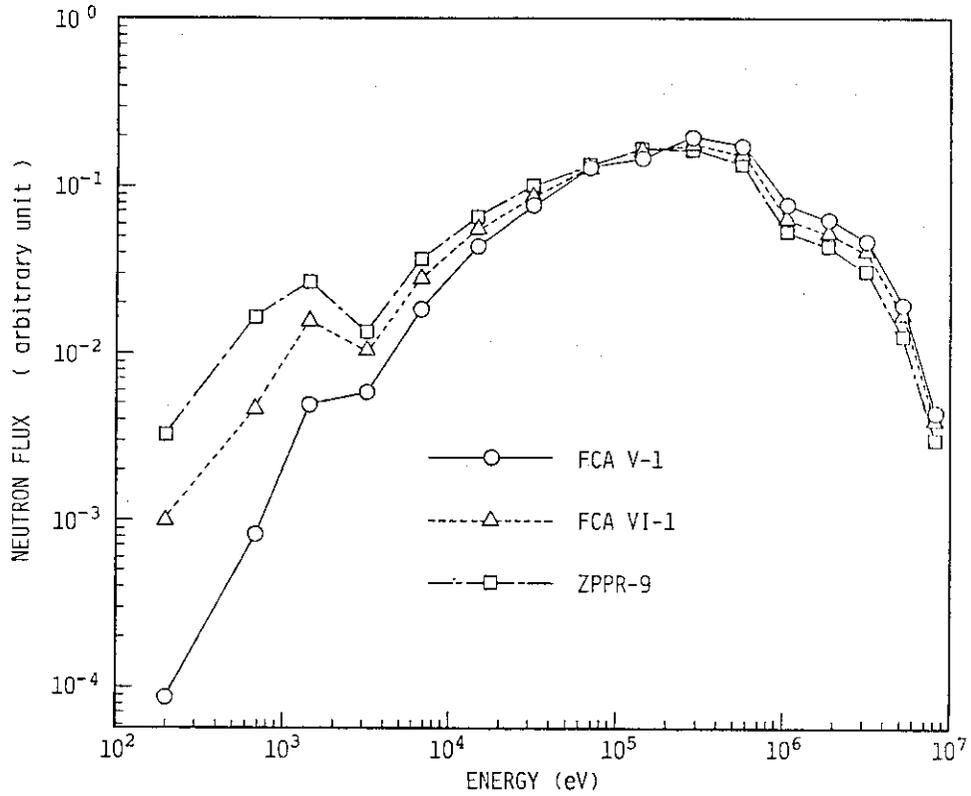


Fig. 2.1 Comparison of neutron fluxes calculated in FCA V-1, FCA VI-1 and ZPPR-9 assemblies.

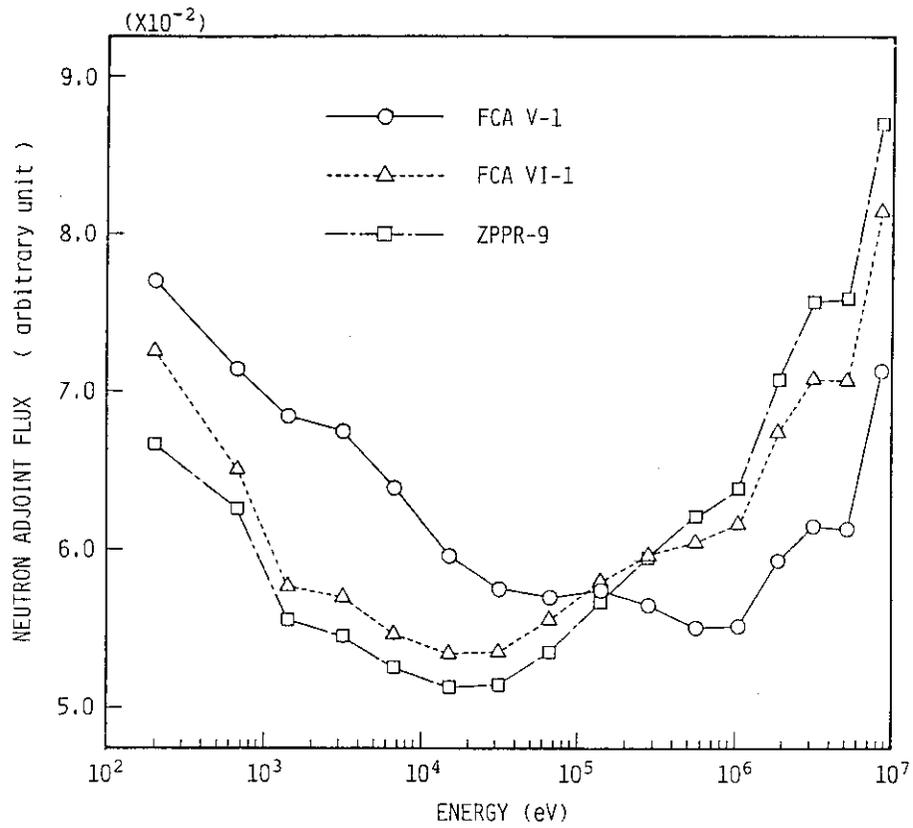


Fig. 2.2 Comparison of neutron adjoint fluxes calculated in FCA V-1, FCA VI-1 and ZPPR-9 assemblies.

Table 4 Neutronic properties whose sensitivity coefficients are calculated

Neutronic properties	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB
k_{eff}	○	○	○	○	○
Central reaction rate ratio					
28f/25f	○	○	○	○	○
49f/25f	○	○	○	○	○
28c/49f	○		○		○
$^{239}\text{Pu}(n,f)$ distribution					○
No.1					mid. I.C.
No.2					mid. O.C.
Doppler worth	○	○	○	○	
UO_2	(300K-1073K)	(300K-1073K)	(300K- 823K)	(300K- 823K)	
IRON	(300K-1073K)	(300K-1073K)	(300K-1073K)	(300K- 823K)	
SS	(300K-1073K)		(300K-1073K)	(300K- 823K)	
Na-void worth				○	○
No.1				(9.34x20.32)*	(9.4 x24.00)
No.2				(15.57x30.48)	(9.4 x89.20)

f=fission : c=capture : 25= ^{235}U : 28= ^{238}U : 49= ^{239}Pu
 * Na-void region : radius(cm) X hight(cm)

Table 4 (Continued)

Neutronic properties	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
k_{eff}	○	○	○	○	○
Central reaction rate ratio					
28f/25f	○	○	○	○	○
49f/25f	○	○	○	○	○
28c/49f		○	○	○	○
$^{239}\text{Pu}(n,f)$ distribution		○	○		
No.1		mid.I.C.	mid.I.C.		
No.2		mid.O.C.	mid.O.C.		
Doppler worth		○			
UO_2		(298K-935.4K)			
IRON					
SS					
Na-void worth		○			
No.1		(9.25 X 40.64)*			
No.2		(30.67 X 40.64)			

f=fission : c=capture : 25= ^{235}U : 28= ^{238}U : 49= ^{239}Pu : 40= ^{240}Pu : 41= ^{241}Pu
 * Na-void region : radius(cm) X hight(cm)

TABLE 5.1 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO U-235 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	0.181	0.154	0.082	0.180	0.007	0.002	0.003	0.003	0.002	0.151
2	6.07 E+6	0.518	0.432	0.221	0.489	0.020	0.006	0.007	0.007	0.006	0.443
3	3.68 E+6	1.182	1.005	0.500	1.095	0.045	0.014	0.016	0.016	0.015	1.124
4	2.23 E+6	1.551	1.372	0.660	1.460	0.063	0.019	0.023	0.022	0.020	1.569
5	1.35 E+6	1.830	1.628	0.783	1.753	0.075	0.023	0.026	0.026	0.025	1.876
6	8.21 E+5	4.071	3.368	1.878	3.738	0.179	0.052	0.065	0.065	0.061	4.279
7	3.88 E+5	5.106	4.398	2.551	4.972	0.248	0.075	0.093	0.092	0.091	5.953
8	1.83 E+5	4.621	3.863	2.583	4.532	0.301	0.091	0.113	0.117	0.109	6.971
9	8.65 E+4	4.838	4.081	2.834	4.871	0.300	0.091	0.113	0.118	0.110	6.677
10	4.09 E+4	3.486	3.329	2.256	4.064	0.280	0.094	0.116	0.113	0.113	6.507
11	1.93 E+4	2.319	2.168	1.602	2.624	0.235	0.075	0.091	0.097	0.084	4.790
12	9.12 E+3	1.192	1.243	0.912	1.494	0.183	0.058	0.070	0.072	0.062	3.446
13	4.31 E+3	0.510	0.602	0.417	0.706	0.101	0.033	0.039	0.037	0.034	1.830
14	2.03 E+3	0.596	0.908	0.702	1.110	0.285	0.092	0.099	0.110	0.088	4.419
15	9.61 E+2	0.123	0.259	0.237	0.396	0.186	0.063	0.060	0.069	0.054	2.364
16	4.54 E+2	0.018	0.050	0.060	0.127	0.200	0.065	0.044	0.053	0.032	1.253
TOTAL		32.141	28.860	18.276	33.611	2.708	0.852	0.982	1.015	0.905	53.652

TABLE 5.2 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO U-235 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
2	6.07 E+6	-0.003	-0.002	-0.001	-0.003	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
3	3.68 E+6	-0.038	-0.032	-0.016	-0.036	-0.000	-0.000	-0.001	-0.001	-0.001	-0.039
4	2.23 E+6	-0.106	-0.094	-0.044	-0.101	-0.004	-0.001	-0.002	-0.001	-0.001	-0.112
5	1.35 E+6	-0.127	-0.114	-0.051	-0.120	-0.005	-0.002	-0.002	-0.002	-0.002	-0.135
6	8.21 E+5	-0.316	-0.266	-0.139	-0.288	-0.013	-0.004	-0.005	-0.005	-0.004	-0.341
7	3.88 E+5	-0.604	-0.522	-0.277	-0.579	-0.025	-0.007	-0.010	-0.009	-0.009	-0.711
8	1.83 E+5	-0.717	-0.602	-0.356	-0.697	-0.035	-0.011	-0.014	-0.013	-0.012	-1.089
9	8.65 E+4	-0.875	-0.746	-0.448	-0.884	-0.039	-0.012	-0.015	-0.014	-0.013	-1.233
10	4.09 E+4	-0.712	-0.693	-0.398	-0.852	-0.039	-0.012	-0.015	-0.014	-0.013	-1.376
11	1.93 E+4	-0.532	-0.510	-0.319	-0.637	-0.033	-0.010	-0.013	-0.013	-0.011	-1.143
12	9.12 E+3	-0.313	-0.323	-0.210	-0.425	-0.026	-0.008	-0.011	-0.010	-0.009	-0.895
13	4.31 E+3	-0.165	-0.186	-0.119	-0.247	-0.016	-0.005	-0.007	-0.006	-0.006	-0.546
14	2.03 E+3	-0.205	-0.300	-0.219	-0.420	-0.051	-0.016	-0.020	-0.019	-0.017	-1.454
15	9.61 E+2	-0.049	-0.099	-0.084	-0.167	-0.033	-0.011	-0.012	-0.011	-0.011	-0.828
16	4.54 E+2	-0.009	-0.024	-0.029	-0.069	-0.036	-0.012	-0.015	-0.011	-0.010	-0.547
TOTAL		-4.769	-4.512	-2.709	-5.523	-0.359	-0.112	-0.144	-0.129	-0.119	-10.452

TABLE 5.3 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO U-238 FISSION CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/5A
1	10.0 E+6	0.658	0.592	0.693	0.697	0.589	0.583	0.698	0.682	0.618	0.483
2	6.07 E+6	1.630	1.453	1.616	1.635	1.356	1.344	1.673	1.580	1.438	1.228
3	3.68 E+6	3.155	2.842	3.141	3.188	2.751	2.811	3.402	3.185	2.988	2.705
4	2.23 E+6	3.178	2.969	3.135	3.242	2.911	2.909	3.478	3.290	3.081	2.889
5	1.35 E+6	0.344	0.328	0.325	0.345	0.283	0.283	0.348	0.324	0.308	0.291
6	8.21 E+5	0.033	0.030	0.030	0.031	0.024	0.023	0.030	0.029	0.027	0.025
7	3.88 E+5	0.005	0.005	0.004	0.005	0.003	0.003	0.004	0.004	0.004	0.004
8	1.83 E+5	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
9	8.65 E+4	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001
10	4.09 E+4	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001
11	1.93 E+4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
12	9.12 E+3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	4.31 E+3	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001
14	2.03 E+3	0.000	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.001
15	9.61 E+2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	4.54 E+2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		9.010	8.226	8.952	9.151	7.931	7.967	9.645	9.105	8.474	7.633

TABLE 5.4 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO U-238 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.002	-0.002	-0.002	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
2	6.07 E+6	-0.014	-0.012	-0.014	-0.015	-0.012	-0.012	-0.016	-0.014	-0.013	-0.011
3	3.68 E+6	-0.066	-0.059	-0.068	-0.070	-0.062	-0.063	-0.080	-0.073	-0.068	-0.062
4	2.23 E+6	-0.195	-0.182	-0.198	-0.207	-0.190	-0.188	-0.230	-0.215	-0.199	-0.193
5	1.35 E+6	-0.565	-0.541	-0.547	-0.550	-0.495	-0.494	-0.601	-0.550	-0.528	-0.531
6	8.21 E+5	-1.757	-1.613	-1.623	-1.681	-1.266	-1.207	-1.504	-1.467	-1.386	-1.421
7	3.88 E+5	-2.289	-2.177	-2.102	-2.274	-1.572	-1.548	-1.943	-1.840	-1.809	-1.946
8	1.83 E+5	-2.383	-2.180	-2.427	-2.490	-2.117	-2.071	-2.571	-2.536	-2.346	-2.646
9	8.65 E+4	-3.238	-2.953	-3.307	-3.509	-2.858	-2.777	-3.430	-3.432	-3.127	-3.668
10	4.09 E+4	-2.813	-2.894	-3.143	-3.671	-3.110	-3.319	-4.069	-3.774	-3.709	-4.451
11	1.93 E+4	-1.812	-1.758	-2.280	-2.519	-2.601	-2.617	-3.195	-3.185	-2.871	-3.473
12	9.12 E+3	-0.873	-0.950	-1.317	-1.521	-1.862	-1.886	-2.280	-2.184	-2.049	-2.430
13	4.31 E+3	-0.347	-0.462	-0.602	-0.768	-0.952	-1.031	-1.232	-1.060	-1.121	-1.277
14	2.03 E+3	-0.282	-0.443	-0.825	-1.024	-1.992	-2.044	-2.263	-2.257	-2.197	-2.223
15	9.61 E+2	-0.070	-0.146	-0.362	-0.539	-1.328	-1.445	-1.509	-1.511	-1.550	-1.309
16	4.54 E+2	-0.008	-0.024	-0.081	-0.197	-0.768	-0.835	-0.797	-0.714	-0.772	-0.535
TOTAL		-16.714	-16.395	-18.900	-21.078	-21.187	-21.537	-25.723	-24.814	-23.743	-26.179

TABLE 5.5 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO U-238 SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.287	-0.254	-0.289	-0.320	-0.191	-0.182	-0.247	-0.289	-0.255	-0.166
2	6.07 E+6	-0.164	-0.146	-0.264	-0.333	-0.297	-0.281	-0.604	-0.505	-0.407	-0.246
3	3.68 E+6	-0.406	-0.350	-0.747	-0.865	-1.041	-1.011	-1.823	-1.556	-1.272	-0.801
4	2.23 E+6	-0.073	-0.050	-0.586	-0.613	-1.129	-1.104	-1.911	-1.673	-1.319	-0.585
5	1.35 E+6	1.329	1.295	0.718	0.809	-0.047	-0.099	-0.388	-0.317	-0.068	0.294
6	8.21 E+5	2.800	2.523	1.905	1.804	0.575	0.580	0.281	0.277	0.566	0.754
7	3.88 E+5	2.499	2.340	1.774	1.664	0.646	0.577	0.235	0.237	0.512	0.754
8	1.83 E+5	1.333	1.217	1.119	0.884	0.481	0.455	0.100	0.110	0.375	0.663
9	8.65 E+4	1.388	1.306	1.103	1.017	0.388	0.372	0.180	0.172	0.396	0.643
10	4.09 E+4	0.835	0.910	0.775	0.753	0.302	0.339	0.257	0.230	0.446	0.511
11	1.93 E+4	0.541	0.561	0.521	0.482	0.161	0.181	0.154	0.147	0.299	0.328
12	9.12 E+3	0.180	0.201	0.191	0.175	0.051	0.059	0.056	0.052	0.125	0.124
13	4.31 E+3	0.058	0.066	0.064	0.063	0.011	0.017	0.020	0.012	0.045	0.041
14	2.03 E+3	0.081	0.142	0.121	0.147	0.074	0.084	0.083	0.074	0.180	0.140
15	9.61 E+2	0.012	0.028	0.039	0.033	0.006	0.012	0.014	0.008	0.074	0.049
16	4.54 E+2	0.001	0.003	0.007	0.007	-0.029	-0.026	-0.017	-0.018	0.022	0.013
TOTAL		10.126	9.793	6.475	5.681	-0.037	-0.028	-3.610	-3.037	-0.281	2.516

TABLE 5.6 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-239 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	0.154	0.173	0.236	0.102	0.251	0.266	0.233	0.242	0.236	0.
2	6.07 E+6	0.538	0.597	0.779	0.336	0.829	0.878	0.800	0.803	0.781	0.
3	3.68 E+6	1.249	1.413	1.805	0.808	1.950	2.107	1.875	1.869	1.904	0.
4	2.23 E+6	1.655	1.949	2.352	1.070	2.676	2.868	2.509	2.532	2.578	0.
5	1.35 E+6	1.819	2.153	2.546	1.193	2.938	3.155	2.854	2.802	2.836	0.
6	8.21 E+5	3.796	4.161	5.556	2.563	6.506	6.669	6.326	6.531	6.152	0.
7	3.88 E+5	4.029	4.595	6.067	3.000	7.443	7.790	7.662	7.643	7.440	0.
8	1.83 E+5	3.105	3.431	5.581	2.771	7.549	7.781	7.797	8.078	7.657	0.
9	8.65 E+4	2.891	3.227	4.757	2.559	6.435	6.611	6.742	7.070	6.690	0.
10	4.09 E+4	1.783	2.254	3.356	2.077	5.051	5.738	5.938	5.744	5.938	0.
11	1.93 E+4	1.057	1.330	2.252	1.393	3.561	3.849	4.019	4.184	4.082	0.
12	9.12 E+3	0.479	0.681	1.296	0.894	2.306	2.536	2.634	2.638	2.727	0.
13	4.31 E+3	0.215	0.312	0.681	0.522	1.235	1.380	1.436	1.372	1.505	0.
14	2.03 E+3	0.207	0.472	1.183	0.985	3.092	3.399	3.338	3.517	3.718	0.
15	9.61 E+2	0.059	0.153	0.569	0.649	2.122	2.515	2.423	2.522	2.852	0.
16	4.54 E+2	0.009	0.033	0.168	0.355	1.204	1.636	1.546	1.426	1.883	0.
TOTAL		23.043	26.933	39.183	21.278	55.146	59.179	58.130	58.974	58.981	0.

TABLE 5.7 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-239 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.000	0.
3	3.68 E+6	-0.005	-0.005	-0.007	-0.003	-0.008	-0.009	-0.008	-0.008	-0.008	0.
4	2.23 E+6	-0.015	-0.018	-0.023	-0.010	-0.025	-0.027	-0.024	-0.024	-0.024	0.
5	1.35 E+6	-0.027	-0.032	-0.039	-0.018	-0.043	-0.047	-0.041	-0.040	-0.042	0.
6	8.21 E+5	-0.105	-0.117	-0.153	-0.071	-0.171	-0.175	-0.161	-0.167	-0.159	0.
7	3.88 E+5	-0.224	-0.257	-0.321	-0.159	-0.359	-0.376	-0.352	-0.353	-0.354	0.
8	1.83 E+5	-0.247	-0.275	-0.404	-0.199	-0.486	-0.501	-0.465	-0.486	-0.481	0.
9	8.65 E+4	-0.299	-0.339	-0.435	-0.232	-0.515	-0.527	-0.488	-0.518	-0.517	0.
10	4.09 E+4	-0.284	-0.367	-0.448	-0.275	-0.580	-0.657	-0.608	-0.595	-0.658	0.
11	1.93 E+4	-0.260	-0.327	-0.453	-0.275	-0.614	-0.656	-0.610	-0.644	-0.673	0.
12	9.12 E+3	-0.194	-0.271	-0.401	-0.265	-0.605	-0.657	-0.608	-0.619	-0.682	0.
13	4.31 E+3	-0.113	-0.162	-0.265	-0.207	-0.406	-0.483	-0.451	-0.407	-0.511	0.
14	2.03 E+3	-0.122	-0.250	-0.473	-0.381	-1.026	-1.128	-1.017	-1.064	-1.205	0.
15	9.61 E+2	-0.039	-0.087	-0.279	-0.304	-0.876	-1.040	-0.928	-0.962	-1.158	0.
16	4.54 E+2	-0.006	-0.022	-0.090	-0.175	-0.516	-0.697	-0.617	-0.566	-0.794	0.
TOTAL		-1.939	-2.530	-3.791	-2.573	-6.231	-6.981	-6.377	-6.454	-7.267	0.

TABLE 5.8 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-240 FISSION CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	0.013	0.014	0.019	0.008	0.049	0.033	0.028	0.030	0.029	0.
2	6.07 E+6	0.041	0.045	0.059	0.026	0.151	0.099	0.090	0.091	0.088	0.
3	3.68 E+6	0.096	0.108	0.137	0.061	0.354	0.238	0.212	0.211	0.215	0.
4	2.23 E+6	0.120	0.140	0.169	0.077	0.458	0.305	0.267	0.270	0.275	0.
5	1.35 E+6	0.132	0.154	0.183	0.086	0.502	0.336	0.305	0.298	0.303	0.
6	8.21 E+5	0.133	0.143	0.194	0.090	0.531	0.344	0.325	0.333	0.318	0.
7	3.88 E+5	0.028	0.032	0.042	0.021	0.122	0.080	0.079	0.078	0.076	0.
8	1.83 E+5	0.012	0.013	0.022	0.011	0.070	0.045	0.045	0.047	0.044	0.
9	8.65 E+4	0.012	0.013	0.019	0.010	0.061	0.040	0.040	0.042	0.040	0.
10	4.09 E+4	0.008	0.010	0.015	0.009	0.054	0.038	0.039	0.038	0.039	0.
11	1.93 E+4	0.004	0.005	0.009	0.005	0.033	0.022	0.023	0.024	0.024	0.
12	9.12 E+3	0.001	0.001	0.002	0.002	0.010	0.007	0.007	0.007	0.008	0.
13	4.31 E+3	0.001	0.001	0.003	0.002	0.011	0.008	0.008	0.008	0.009	0.
14	2.03 E+3	0.002	0.003	0.009	0.007	0.050	0.035	0.034	0.036	0.038	0.
15	9.61 E+2	0.000	0.001	0.004	0.004	0.028	0.021	0.020	0.022	0.023	0.
16	4.54 E+2	0.000	0.000	0.000	0.001	0.005	0.004	0.004	0.003	0.004	0.
TOTAL		0.604	0.685	0.886	0.419	2.489	1.655	1.528	1.538	1.534	0.

TABLE 5.9 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-240 CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
3	3.68 E+6	-0.001	-0.001	-0.002	-0.001	-0.004	-0.003	-0.003	-0.002	-0.003	0.
4	2.23 E+6	-0.003	-0.003	-0.004	-0.002	-0.010	-0.007	-0.006	-0.006	-0.006	0.
5	1.35 E+6	-0.004	-0.004	-0.005	-0.003	-0.014	-0.010	-0.009	-0.008	-0.009	0.
6	8.21 E+5	-0.014	-0.016	-0.021	-0.010	-0.055	-0.035	-0.032	-0.034	-0.032	0.
7	3.88 E+5	-0.022	-0.025	-0.031	-0.016	-0.083	-0.055	-0.051	-0.051	-0.052	0.
8	1.83 E+5	-0.027	-0.030	-0.044	-0.022	-0.126	-0.082	-0.076	-0.079	-0.079	0.
9	8.65 E+4	-0.037	-0.041	-0.053	-0.028	-0.150	-0.096	-0.089	-0.094	-0.095	0.
10	4.09 E+4	-0.033	-0.042	-0.052	-0.032	-0.160	-0.113	-0.105	-0.103	-0.113	0.
11	1.93 E+4	-0.027	-0.033	-0.046	-0.028	-0.147	-0.098	-0.091	-0.096	-0.101	0.
12	9.12 E+3	-0.015	-0.022	-0.032	-0.021	-0.113	-0.077	-0.071	-0.072	-0.080	0.
13	4.31 E+3	-0.008	-0.011	-0.014	-0.014	-0.065	-0.047	-0.044	-0.041	-0.050	0.
14	2.03 E+3	-0.010	-0.020	-0.040	-0.032	-0.198	-0.139	-0.125	-0.131	-0.148	0.
15	9.61 E+2	-0.003	-0.008	-0.021	-0.022	-0.142	-0.108	-0.096	-0.100	-0.119	0.
16	4.54 E+2	-0.001	-0.002	-0.009	-0.018	-0.116	-0.103	-0.092	-0.082	-0.117	0.
TOTAL		-0.205	-0.260	-0.379	-0.246	-1.385	-0.972	-0.891	-0.901	-1.002	0.

TABLE 5.10 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-241 FISSION CROSS SECTION
(X 10⁻³)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	0.001	0.002	0.002	0.001	0.007	0.004	0.003	0.003	0.003	0.
2	6.07 E+6	0.005	0.005	0.006	0.002	0.022	0.011	0.009	0.008	0.009	0.
3	3.68 E+6	0.011	0.012	0.015	0.006	0.053	0.027	0.021	0.019	0.024	0.
4	2.23 E+6	0.016	0.018	0.021	0.008	0.078	0.040	0.030	0.028	0.034	0.
5	1.35 E+6	0.018	0.020	0.024	0.010	0.089	0.046	0.035	0.032	0.039	0.
6	8.21 E+5	0.039	0.041	0.054	0.022	0.203	0.099	0.081	0.078	0.088	0.
7	3.88 E+5	0.051	0.055	0.072	0.031	0.283	0.142	0.120	0.112	0.130	0.
8	1.83 E+5	0.046	0.048	0.078	0.034	0.338	0.167	0.144	0.139	0.158	0.
9	8.65 E+4	0.046	0.049	0.072	0.033	0.311	0.152	0.134	0.131	0.149	0.
10	4.09 E+4	0.033	0.040	0.058	0.031	0.280	0.151	0.136	0.122	0.151	0.
11	1.93 E+4	0.022	0.026	0.044	0.023	0.220	0.113	0.102	0.099	0.116	0.
12	9.12 E+3	0.011	0.015	0.029	0.017	0.166	0.086	0.078	0.073	0.090	0.
13	4.31 E+3	0.005	0.007	0.014	0.010	0.082	0.044	0.040	0.035	0.047	0.
14	2.03 E+3	0.005	0.011	0.029	0.020	0.234	0.121	0.105	0.103	0.129	0.
15	9.61 E+2	0.001	0.003	0.010	0.010	0.118	0.066	0.055	0.054	0.072	0.
16	4.54 E+2	0.000	0.001	0.004	0.007	0.081	0.050	0.042	0.037	0.056	0.
TOTAL		0.310	0.352	0.534	0.265	2.566	1.318	1.135	1.074	1.295	0.

TABLE 5.11 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO PU-241 CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	(X 10 ⁻²)										
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/7A	
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
3	3.68 E+6	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.000	-0.000	-0.001	0.
4	2.23 E+6	-0.001	-0.001	-0.001	-0.000	-0.003	-0.002	-0.001	-0.001	-0.001	-0.001	0.
5	1.35 E+6	-0.001	-0.001	-0.001	-0.001	-0.004	-0.002	-0.002	-0.002	-0.002	-0.002	0.
6	8.21 E+5	-0.003	-0.003	-0.004	-0.001	-0.013	-0.006	-0.005	-0.005	-0.005	-0.006	0.
7	3.88 E+5	-0.003	-0.004	-0.005	-0.002	-0.017	-0.008	-0.007	-0.007	-0.008	-0.008	0.
8	1.83 E+5	-0.003	-0.003	-0.005	-0.002	-0.019	-0.009	-0.008	-0.007	-0.009	-0.009	0.
9	8.65 E+4	-0.004	-0.004	-0.005	-0.002	-0.020	-0.010	-0.008	-0.008	-0.009	-0.009	0.
10	4.09 E+4	-0.003	-0.003	-0.005	-0.002	-0.017	-0.009	-0.008	-0.007	-0.010	-0.010	0.
11	1.93 E+4	-0.002	-0.003	-0.004	-0.002	-0.017	-0.007	-0.007	-0.007	-0.007	-0.008	0.
12	9.12 E+3	-0.001	-0.002	-0.003	-0.002	-0.014	-0.007	-0.006	-0.006	-0.007	-0.007	0.
13	4.31 E+3	-0.001	-0.001	-0.002	-0.001	-0.008	-0.004	-0.003	-0.003	-0.004	-0.004	0.
14	2.03 E+3	-0.001	-0.002	-0.002	-0.003	-0.026	-0.014	-0.011	-0.010	-0.014	-0.014	0.
15	9.61 E+2	-0.000	-0.001	-0.002	-0.001	-0.016	-0.009	-0.007	-0.007	-0.009	-0.009	0.
16	4.54 E+2	-0.000	-0.000	-0.001	-0.001	-0.013	-0.008	-0.006	-0.005	-0.008	-0.008	0.
TOTAL		-0.024	-0.028	-0.040	-0.021	-0.190	-0.099	-0.078	-0.074	-0.097	-0.097	0.

TABLE 5.12 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO IRON CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	(X 10 ⁻²)										
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/7A	
1	10.0 E+6	-0.035	-0.041	-0.055	-0.051	-0.065	-0.070	-0.057	-0.066	-0.071	-0.059	-0.059
2	6.07 E+6	-0.038	-0.045	-0.058	-0.054	-0.072	-0.077	-0.069	-0.072	-0.078	-0.070	-0.070
3	3.68 E+6	-0.024	-0.029	-0.036	-0.034	-0.046	-0.050	-0.043	-0.044	-0.051	-0.049	-0.049
4	2.23 E+6	-0.013	-0.016	-0.019	-0.018	-0.025	-0.027	-0.022	-0.024	-0.027	-0.028	-0.028
5	1.35 E+6	-0.016	-0.021	-0.023	-0.022	-0.031	-0.033	-0.027	-0.029	-0.033	-0.035	-0.035
6	8.21 E+5	-0.067	-0.080	-0.098	-0.091	-0.129	-0.133	-0.112	-0.124	-0.132	-0.145	-0.145
7	3.88 E+5	-0.084	-0.102	-0.121	-0.119	-0.156	-0.164	-0.142	-0.151	-0.167	-0.192	-0.192
8	1.83 E+5	-0.097	-0.112	-0.153	-0.142	-0.215	-0.218	-0.190	-0.215	-0.225	-0.268	-0.268
9	8.65 E+4	-0.084	-0.097	-0.121	-0.118	-0.157	-0.155	-0.136	-0.158	-0.162	-0.201	-0.201
10	4.09 E+4	-0.089	-0.120	-0.146	-0.162	-0.215	-0.242	-0.209	-0.220	-0.257	-0.325	-0.325
11	1.93 E+4	-0.033	-0.045	-0.064	-0.065	-0.106	-0.105	-0.090	-0.109	-0.114	-0.143	-0.143
12	9.12 E+3	-0.025	-0.035	-0.051	-0.059	-0.091	-0.101	-0.086	-0.092	-0.111	-0.138	-0.138
13	4.31 E+3	-0.002	-0.004	-0.006	-0.007	-0.012	-0.011	-0.011	-0.011	-0.014	-0.016	-0.016
14	2.03 E+3	-0.032	-0.066	-0.144	-0.172	-0.450	-0.447	-0.390	-0.474	-0.492	-0.491	-0.491
15	9.61 E+2	-0.001	-0.002	-0.006	-0.009	-0.024	-0.026	-0.023	-0.026	-0.031	-0.028	-0.028
16	4.54 E+2	-0.000	-0.001	-0.002	-0.006	-0.029	-0.029	-0.023	-0.024	-0.028	-0.028	-0.020
TOTAL		-0.640	-0.816	-1.105	-1.129	-1.821	-1.893	-1.629	-1.838	-1.995	-1.995	-2.206

TABLE 5.13 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO IRON SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO IRON SCATTERING CROSS SECTION									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.082	-0.083	-0.123	-0.136	-0.127	-0.138	-0.111	-0.170	-0.172	-0.132
2	6.07 E+6	-0.020	-0.013	-0.098	-0.152	-0.185	-0.206	-0.343	-0.307	-0.301	-0.186
3	3.68 E+6	0.101	0.114	-0.052	-0.162	-0.282	-0.317	-0.523	-0.476	-0.504	-0.319
4	2.23 E+6	0.037	0.059	-0.141	-0.232	-0.371	-0.429	-0.602	-0.568	-0.589	-0.418
5	1.35 E+6	0.291	0.352	0.166	0.152	-0.023	-0.101	-0.210	-0.175	-0.175	0.148
6	8.21 E+5	0.534	0.576	0.507	0.359	0.472	0.393	0.154	0.221	0.197	0.394
7	3.88 E+5	0.418	0.488	0.356	0.242	0.336	0.164	-0.090	0.040	-0.033	0.335
8	1.83 E+5	0.201	0.238	0.215	0.107	0.186	0.070	-0.134	-0.041	-0.057	0.281
9	8.65 E+4	0.263	0.313	0.236	0.194	0.181	0.108	-0.023	0.034	0.044	0.333
10	4.09 E+4	0.371	0.480	0.427	0.400	0.420	0.422	0.259	0.280	0.393	0.596
11	1.93 E+4	0.153	0.187	0.199	0.203	0.160	0.180	0.148	0.146	0.222	0.358
12	9.12 E+3	0.086	0.109	0.121	0.107	0.096	0.110	0.095	0.090	0.147	0.148
13	4.31 E+3	0.015	0.018	0.023	0.031	0.023	0.041	0.043	0.023	0.054	0.043
14	2.03 E+3	0.027	0.058	0.092	0.087	0.169	0.230	0.193	0.184	0.306	0.184
15	9.61 E+2	0.006	0.015	0.031	0.031	0.026	0.049	0.047	0.034	0.111	0.039
16	4.54 E+2	0.000	0.002	0.004	0.004	-0.037	-0.031	-0.015	-0.019	0.019	0.011
TOTAL		2.400	2.914	1.963	1.234	1.046	0.543	-1.114	-0.704	-0.339	1.815

TABLE 5.14 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION									
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.012	-0.012	-0.017	-0.021	-0.016	-0.022	-0.009	-0.020	-0.018	-0.016
2	6.07 E+6	0.015	0.018	0.008	-0.009	-0.002	-0.026	-0.028	-0.021	-0.017	-0.010
3	3.68 E+6	0.001	0.002	-0.053	-0.083	-0.134	-0.077	-0.172	-0.159	-0.145	-0.104
4	2.23 E+6	0.042	0.052	-0.007	-0.030	-0.084	-0.076	-0.122	-0.114	-0.100	-0.049
5	1.35 E+6	0.091	0.110	0.080	0.063	0.070	0.012	0.024	0.031	0.029	0.040
6	8.21 E+5	0.159	0.171	0.156	0.108	0.146	0.098	0.063	0.080	0.062	0.088
7	3.88 E+5	0.124	0.144	0.106	0.075	0.085	0.050	-0.002	0.017	0.009	0.077
8	1.83 E+5	0.144	0.161	0.185	0.117	0.219	0.115	0.102	0.132	0.115	0.149
9	8.65 E+4	0.072	0.083	0.075	0.062	0.076	0.038	0.038	0.048	0.046	0.063
10	4.09 E+4	0.033	0.044	0.037	0.038	0.028	0.033	0.014	0.017	0.023	0.058
11	1.93 E+4	0.046	0.055	0.060	0.064	0.045	0.036	0.040	0.040	0.050	0.090
12	9.12 E+3	0.073	0.089	0.107	0.102	0.094	0.054	0.097	0.090	0.114	0.114
13	4.31 E+3	0.010	0.012	0.014	0.014	0.008	0.011	0.013	0.008	0.016	0.013
14	2.03 E+3	0.005	0.012	0.017	0.015	0.028	0.042	0.028	0.027	0.039	0.025
15	9.61 E+2	0.001	0.002	0.004	0.004	0.003	0.008	0.005	0.004	0.010	0.004
16	4.54 E+2	0.000	0.000	0.000	0.000	-0.004	-0.004	-0.001	-0.002	0.001	0.001
TOTAL		0.803	0.943	0.772	0.520	0.561	0.292	0.090	0.178	0.234	0.543

TABLE 5.15 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO SODIUM CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-5/6A
1	10.0 E+6	-0.009	-0.014	-0.017	-0.016	-0.024	-0.024	-0.021	-0.027	-0.025	-0.020
2	6.07 E+6	-0.003	-0.004	-0.005	-0.004	-0.007	-0.007	-0.007	-0.008	-0.007	-0.006
3	3.68 E+6	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
4	2.23 E+6	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
5	1.35 E+6	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
6	8.21 E+5	-0.002	-0.003	-0.003	-0.003	-0.005	-0.005	-0.004	-0.005	-0.005	-0.005
7	3.38 E+5	-0.004	-0.007	-0.008	-0.008	-0.012	-0.013	-0.011	-0.014	-0.013	-0.014
8	1.83 E+5	-0.007	-0.010	-0.012	-0.012	-0.020	-0.021	-0.018	-0.022	-0.021	-0.025
9	8.65 E+4	-0.005	-0.007	-0.009	-0.011	-0.014	-0.016	-0.015	-0.016	-0.017	-0.020
10	4.09 E+4	-0.003	-0.005	-0.007	-0.007	-0.013	-0.014	-0.012	-0.015	-0.014	-0.018
11	1.93 E+4	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
12	9.12 E+3	-0.001	-0.002	-0.003	-0.004	-0.007	-0.008	-0.007	-0.008	-0.008	-0.010
13	4.31 E+3	-0.012	-0.022	-0.031	-0.042	-0.069	-0.080	-0.072	-0.074	-0.088	-0.102
14	2.03 E+3	-0.003	-0.007	-0.012	-0.014	-0.036	-0.039	-0.033	-0.046	-0.042	-0.044
15	9.61 E+2	-0.000	-0.001	-0.002	-0.003	-0.009	-0.011	-0.009	-0.012	-0.012	-0.010
16	4.54 E+2	-0.000	-0.000	-0.000	-0.001	-0.005	-0.006	-0.004	-0.006	-0.006	-0.004
TOTAL		-0.050	-0.083	-0.111	-0.128	-0.226	-0.246	-0.216	-0.258	-0.262	-0.281

TABLE 5.16 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO SODIUM SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-5/6A
1	10.0 E+6	-0.035	-0.042	-0.061	-0.069	-0.083	-0.084	-0.075	-0.114	-0.101	-0.073
2	6.07 E+6	-0.015	-0.011	-0.052	-0.077	-0.117	-0.115	-0.196	-0.191	-0.165	-0.096
3	3.68 E+6	0.014	0.025	-0.046	-0.103	-0.186	-0.180	-0.311	-0.304	-0.290	-0.184
4	2.23 E+6	0.007	0.024	-0.051	-0.115	-0.168	-0.157	-0.292	-0.292	-0.271	-0.209
5	1.35 E+6	0.155	0.247	0.140	0.106	0.072	0.040	-0.071	-0.026	-0.043	0.111
6	8.21 E+5	0.369	0.510	0.362	0.255	0.175	0.186	-0.152	-0.084	-0.074	0.422
7	3.38 E+5	0.226	0.350	0.191	0.130	0.091	0.017	-0.244	-0.148	-0.164	0.256
8	1.83 E+5	0.085	0.138	0.075	0.026	-0.051	-0.097	-0.282	-0.242	-0.196	0.174
9	8.65 E+4	0.128	0.202	0.109	0.104	0.004	-0.019	-0.137	-0.110	-0.071	0.266
10	4.09 E+4	0.102	0.182	0.134	0.157	0.089	0.088	0.036	0.072	0.100	0.404
11	1.93 E+4	0.101	0.153	0.157	0.166	0.141	0.154	0.140	0.172	0.195	0.334
12	9.12 E+3	0.077	0.111	0.152	0.169	0.205	0.246	0.275	0.272	0.308	0.290
13	4.31 E+3	0.051	0.083	0.102	0.123	0.138	0.206	0.222	0.179	0.254	0.196
14	2.03 E+3	0.011	0.030	0.050	0.047	0.118	0.152	0.133	0.166	0.195	0.111
15	9.61 E+2	0.001	0.004	0.008	0.010	0.013	0.021	0.022	0.020	0.040	0.008
16	4.54 E+2	0.000	0.000	0.001	0.001	-0.007	-0.007	-0.003	-0.004	0.003	0.002
TOTAL		1.275	2.004	1.272	0.932	0.435	0.451	-0.933	-0.635	-0.279	2.013

TABLE 5.17 SENSITIVITY COEFFICIENT OF K-EFF WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.022	-0.016	-0.029	-0.040	-0.029	-0.021	-0.021	-0.038	-0.042	-0.033
2	6.07 E+6	0.097	0.082	0.106	0.054	0.062	0.132	0.071	0.075	0.072	0.059
3	3.68 E+6	0.175	0.149	0.166	0.068	0.054	0.182	0.068	0.074	0.060	0.049
4	2.23 E+6	0.041	0.056	-0.060	-0.201	-0.250	-0.120	-0.361	-0.308	-0.346	-0.275
5	1.35 E+6	0.557	0.530	0.408	0.278	0.030	0.270	0.014	0.026	0.031	0.260
6	8.21 E+5	1.063	0.870	0.632	0.438	-0.281	0.005	-0.616	-0.546	-0.472	0.682
7	3.88 E+5	0.741	0.682	0.389	0.207	-0.179	-0.109	-0.681	-0.566	-0.514	0.455
8	1.83 E+5	0.216	0.216	0.054	-0.053	-0.332	-0.383	-0.770	-0.709	-0.582	0.244
9	8.65 E+4	0.260	0.256	0.082	0.075	-0.201	-0.263	-0.441	-0.425	-0.327	0.367
10	4.09 E+4	0.286	0.303	0.266	0.302	0.077	0.084	0.025	0.008	0.130	0.699
11	1.93 E+4	0.245	0.218	0.283	0.277	0.162	0.188	0.200	0.175	0.270	0.475
12	9.12 E+3	0.085	0.074	0.125	0.125	0.104	0.140	0.169	0.147	0.185	0.173
13	4.31 E+3	0.016	0.017	0.027	0.055	0.024	0.080	0.096	0.048	0.095	0.069
14	2.03 E+3	0.022	0.038	0.105	0.121	0.203	0.305	0.302	0.271	0.402	0.207
15	9.61 E+2	0.004	0.008	0.026	0.034	0.040	0.048	0.058	0.040	0.099	0.013
16	4.54 E+2	0.000	0.001	0.002	0.001	-0.006	-0.014	-0.007	-0.008	0.006	0.004
TOTAL		3.786	3.483	2.580	1.742	-0.521	0.525	-1.895	-1.736	-0.933	3.449

TABLE 6.1 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO U-235 FISSION CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
1	10.0 E+6	-0.533	-0.478	-0.415	-0.400	-0.235	-0.212	-0.212	-0.307	-0.307	-0.307
2	6.07 E+6	-1.577	-1.417	-1.230	-1.132	-0.718	-0.654	-0.654	-0.879	-0.879	-0.879
3	3.68 E+6	-4.191	-3.865	-3.215	-2.906	-1.965	-1.829	-1.829	-2.573	-2.573	-2.573
4	2.23 E+6	-5.245	-5.092	-4.283	-3.779	-2.757	-2.574	-2.574	-3.010	-3.010	-3.010
5	1.35 E+6	-4.681	-4.735	-4.862	-4.325	-3.169	-2.992	-2.992	-2.194	-2.194	-2.194
6	8.21 E+5	-9.890	-9.324	-11.359	-9.812	-7.745	-6.934	-6.934	-4.845	-4.845	-4.845
7	3.88 E+5	-12.088	-11.851	-14.689	-13.616	-10.603	-9.771	-9.771	-6.798	-6.798	-6.798
8	1.83 E+5	-10.625	-10.118	-15.785	-14.580	-12.664	-11.566	-11.566	-7.988	-7.988	-7.988
9	8.65 E+4	-10.893	-10.500	-14.892	-15.288	-11.995	-11.096	-11.096	-7.636	-7.636	-7.636
10	4.09 E+4	-7.612	-8.348	-11.978	-14.206	-10.673	-11.115	-11.115	-7.423	-7.423	-7.423
11	1.93 E+4	-5.129	-5.542	-9.273	-10.914	-8.549	-8.549	-8.549	-5.441	-5.441	-5.441
12	9.12 E+3	-2.715	-3.287	-6.274	-8.079	-6.379	-6.721	-6.721	-3.915	-3.915	-3.915
13	4.31 E+3	-1.192	-1.631	-3.265	-4.758	-3.337	-3.774	-3.774	-2.076	-2.076	-2.076
14	2.03 E+3	-1.461	-2.600	-6.970	-10.598	-9.790	-10.667	-10.667	-5.041	-5.041	-5.041
15	9.61 E+2	-0.324	-0.787	-2.886	-5.986	-5.558	-6.868	-6.868	-2.692	-2.692	-2.692
16	4.54 E+2	-0.048	-0.162	-0.909	-3.370	-2.734	-4.159	-4.159	-1.409	-1.409	-1.409
TOTAL		-78.202	-79.736	-112.285	-123.750	-98.871	-99.587	-99.587	-64.227	-64.227	-64.227

TABLE 6.2 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO U-235 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000
2	6.07 E+6	-0.003	-0.002	0.001	0.001	-0.000	-0.000	-0.003
3	3.68 E+6	-0.038	-0.032	0.010	0.023	-0.001	-0.000	-0.039
4	2.23 E+6	-0.041	-0.036	0.033	0.081	-0.001	-0.000	-0.032
5	1.35 E+6	0.129	0.113	0.048	0.116	0.005	0.002	0.137
6	8.21 E+5	0.371	0.305	0.132	0.284	0.015	0.004	0.388
7	3.88 E+5	0.748	0.635	0.266	0.569	0.032	0.010	0.816
8	1.83 E+5	0.929	0.772	0.338	0.670	0.051	0.015	1.253
9	8.65 E+4	1.174	0.995	0.414	0.827	0.060	0.018	1.418
10	4.09 E+4	0.993	0.964	0.350	0.762	0.063	0.021	1.582
11	1.93 E+4	0.772	0.742	0.262	0.541	0.056	0.018	1.311
12	9.12 E+3	0.469	0.488	0.161	0.346	0.045	0.015	1.025
13	4.31 E+3	0.248	0.285	0.090	0.199	0.027	0.009	0.623
14	2.03 E+3	0.319	0.470	0.167	0.341	0.087	0.029	1.668
15	9.61 E+2	0.071	0.150	0.062	0.134	0.048	0.017	0.945
16	4.54 E+2	0.013	0.035	0.021	0.058	0.041	0.016	0.619
TOTAL		6.154	5.884	2.355	4.953	0.530	0.172	11.711

TABLE 6.3 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO U-238 FISSION CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	5.126	4.977	5.458	5.136	5.283	5.179	4.455
2	6.07 E+6	14.490	14.005	14.718	14.001	14.336	14.090	13.233
3	3.68 E+6	34.370	33.890	34.581	34.619	34.305	34.438	34.290
4	2.23 E+6	37.984	39.033	37.363	38.038	38.796	39.030	40.294
5	1.35 E+6	3.839	3.961	3.769	3.911	4.001	3.990	4.196
6	8.21 E+5	0.304	0.283	0.322	0.337	0.352	0.337	0.357
7	3.88 E+5	0.036	0.035	0.039	0.045	0.047	0.046	0.049
8	1.83 E+5	0.015	0.015	0.020	0.024	0.027	0.027	0.027
9	8.65 E+4	0.012	0.012	0.015	0.020	0.020	0.020	0.020
10	4.09 E+4	0.007	0.008	0.010	0.016	0.015	0.016	0.016
11	1.93 E+4	0.006	0.007	0.009	0.015	0.014	0.016	0.015
12	9.12 E+3	0.002	0.003	0.004	0.008	0.006	0.008	0.007
13	4.31 E+3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	2.03 E+3	0.001	0.002	0.005	0.013	0.013	0.015	0.011
15	9.61 E+2	0.001	0.002	0.007	0.021	0.020	0.026	0.018
16	4.54 E+2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		96.194	96.232	96.322	96.203	97.236	97.238	96.989

TABLE 6.4 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO U-238 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.001	-0.001	-0.002	-0.003	-0.002	-0.002	-0.002
2	6.07 E+6	-0.006	-0.004	-0.008	-0.011	-0.011	-0.011	-0.010
3	3.68 E+6	-0.031	-0.021	-0.042	-0.059	-0.054	-0.055	-0.055
4	2.23 E+6	-0.014	0.002	-0.017	-0.036	-0.037	-0.038	-0.042
5	1.35 E+6	0.514	0.497	0.535	0.598	0.502	0.506	0.522
6	8.21 E+5	1.688	1.573	1.749	1.891	1.494	1.428	1.526
7	3.88 E+5	2.223	2.160	2.413	2.707	2.048	2.007	2.097
8	1.83 E+5	2.366	2.219	3.046	3.271	3.004	2.919	2.890
9	8.65 E+4	3.365	3.139	4.414	4.976	4.349	4.220	4.028
10	4.09 E+4	3.026	3.193	4.564	5.769	5.407	5.407	4.921
11	1.93 E+4	2.086	2.077	3.707	4.588	4.413	4.527	3.881
12	9.12 E+3	1.076	1.206	2.404	3.231	3.220	3.378	2.735
13	4.31 E+3	0.439	0.601	1.156	1.789	1.613	1.847	1.439
14	2.03 E+3	0.388	0.630	1.757	2.736	3.422	3.676	2.520
15	9.61 E+2	0.091	0.204	0.719	1.460	1.974	2.315	1.478
16	4.54 E+2	0.010	0.032	0.167	0.597	0.922	1.167	0.598
TOTAL		17.220	17.507	26.561	33.506	31.899	33.292	28.527

TABLE 6.5 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO U-238 SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-1.116	-0.878	-1.425	-1.670	-1.545	-1.520	-1.251
2	6.07 E+6	-3.308	-2.609	-3.948	-4.765	-4.187	-4.202	-3.770
3	3.68 E+6	-9.769	-8.066	-11.670	-14.183	-12.360	-12.696	-12.202
4	2.23 E+6	-10.236	-8.785	-11.400	-13.061	-11.619	-11.597	-11.347
5	1.35 E+6	-2.391	-2.247	-2.299	-2.357	-1.496	-1.358	-1.106
6	8.21 E+5	-3.026	-2.734	-2.664	-2.315	-1.241	-1.093	-0.842
7	3.88 E+5	-2.801	-2.644	-2.662	-2.248	-1.385	-1.179	-0.850
8	1.83 E+5	-1.618	-1.467	-2.182	-1.672	-1.329	-1.155	-0.775
9	8.65 E+4	-1.747	-1.609	-2.002	-1.808	-1.113	-0.971	-0.722
10	4.09 E+4	-0.923	-0.997	-1.137	-1.174	-0.617	-0.622	-0.530
11	1.93 E+4	-0.580	-0.588	-0.730	-0.781	-0.344	-0.344	-0.318
12	9.12 E+3	-0.171	-0.188	-0.244	-0.278	-0.098	-0.103	-0.110
13	4.31 E+3	-0.049	-0.059	-0.078	-0.098	-0.023	-0.029	-0.035
14	2.03 E+3	-0.077	-0.131	-0.215	-0.290	-0.111	-0.117	-0.128
15	9.61 E+2	-0.012	-0.027	-0.062	-0.110	-0.029	-0.038	-0.044
16	4.54 E+2	-0.001	-0.003	-0.012	-0.039	0.016	0.009	-0.011
TOTAL		-37.826	-33.033	-42.729	-46.850	-37.470	-37.017	-34.042

TABLE 6.6 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO PU-239 FISSION CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.076	-0.082	-0.084	-0.013	-0.146	-0.156	0.
2	6.07 E+6	-0.173	-0.178	-0.089	0.103	-0.326	-0.359	0.
3	3.68 E+6	-0.403	-0.438	-0.245	0.242	-0.782	-0.887	0.
4	2.23 E+6	-0.083	-0.060	0.625	1.103	-0.291	-0.370	0.
5	1.35 E+6	0.996	1.207	2.643	2.761	1.168	1.100	0.
6	8.21 E+5	2.278	2.533	6.326	6.443	3.261	2.906	0.
7	3.88 E+5	2.547	2.919	7.314	7.912	4.102	3.781	0.
8	1.83 E+5	2.027	2.261	7.148	7.759	4.426	4.050	0.
9	8.65 E+4	1.891	2.156	6.097	7.279	3.800	3.592	0.
10	4.09 E+4	1.188	1.553	4.478	6.164	3.002	3.263	0.
11	1.93 E+4	0.782	1.032	3.272	4.453	2.168	2.367	0.
12	9.12 E+3	0.418	0.618	2.102	3.104	1.462	1.692	0.
13	4.31 E+3	0.211	0.314	1.188	1.922	0.802	0.984	0.
14	2.03 E+3	0.224	0.519	2.236	3.967	2.143	2.638	0.
15	9.61 E+2	0.066	0.184	1.156	2.879	1.477	2.180	0.
16	4.54 E+2	0.011	0.043	0.400	1.792	0.652	1.430	0.
TOTAL		11.904	14.580	44.566	57.868	26.918	28.211	0.

TABLE 6.7 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO PU-239 CAPTURE CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
2	6.07 E+6	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	0.
3	3.68 E+6	-0.005	-0.006	-0.012	-0.011	-0.006	-0.007	0.
4	2.23 E+6	-0.006	-0.007	-0.017	-0.019	-0.005	-0.004	0.
5	1.35 E+6	0.028	0.032	0.041	0.021	0.044	0.046	0.
6	8.21 E+5	0.124	0.135	0.197	0.107	0.202	0.202	0.
7	3.88 E+5	0.281	0.316	0.476	0.284	0.470	0.479	0.
8	1.83 E+5	0.325	0.358	0.685	0.417	0.696	0.695	0.
9	8.65 E+4	0.406	0.457	0.826	0.551	0.796	0.793	0.
10	4.09 E+4	0.401	0.517	0.749	0.749	0.959	1.063	0.
11	1.93 E+4	0.382	0.481	1.081	0.853	1.069	1.131	0.
12	9.12 E+3	0.293	0.414	0.911	0.736	1.168	1.168	0.
13	4.31 E+3	0.171	0.251	0.705	0.716	0.861	0.861	0.
14	2.03 E+3	0.191	0.395	1.326	1.421	1.834	2.039	0.
15	9.61 E+2	0.056	0.133	0.698	1.050	1.384	1.711	0.
16	4.54 E+2	0.009	0.032	0.230	0.629	0.731	1.085	0.
TOTAL		2.655	3.509	8.236	7.697	9.967	11.263	0.

TABLE 6.8 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO PU-240 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.
3	3.68 E+6	-0.001	-0.001	-0.003	-0.002	-0.003	-0.001	0.
4	2.23 E+6	-0.001	-0.001	-0.003	-0.003	-0.001	-0.001	0.
5	1.35 E+6	0.004	0.004	0.006	0.003	0.064	0.010	0.
6	8.21 E+5	0.017	0.018	0.027	0.015	0.064	0.041	0.
7	3.88 E+5	0.028	0.031	0.045	0.028	0.107	0.070	0.
8	1.83 E+5	0.036	0.039	0.075	0.046	0.177	0.113	0.
9	8.65 E+4	0.050	0.056	0.101	0.068	0.226	0.145	0.
10	4.09 E+4	0.047	0.060	0.111	0.087	0.257	0.183	0.
11	1.93 E+4	0.039	0.048	0.109	0.086	0.248	0.169	0.
12	9.12 E+3	0.023	0.034	0.083	0.072	0.195	0.137	0.
13	4.31 E+3	0.012	0.018	0.048	0.049	0.111	0.084	0.
14	2.03 E+3	0.016	0.031	0.048	0.119	0.345	0.250	0.
15	9.61 E+2	0.004	0.012	0.052	0.075	0.219	0.177	0.
16	4.54 E+2	0.001	0.003	0.023	0.065	0.159	0.159	0.
TOTAL		0.275	0.352	0.789	0.705	2.117	1.533	0.

TABLE 6.9 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO PU-241 FISSION CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.001	-0.001	-0.001	-0.000	-0.004	-0.002	0.
2	6.07 E+6	-0.002	-0.001	-0.001	0.001	-0.009	-0.005	0.
3	3.68 E+6	-0.004	-0.004	-0.002	0.002	-0.023	-0.013	0.
4	2.23 E+6	-0.001	-0.001	0.006	0.009	-0.012	-0.008	0.
5	1.35 E+6	0.010	0.011	0.024	0.022	0.027	0.009	0.
6	8.21 E+5	0.023	0.024	0.060	0.053	0.081	0.028	0.
7	3.88 E+5	0.031	0.034	0.085	0.080	0.126	0.046	0.
8	1.83 E+5	0.029	0.031	0.099	0.093	0.162	0.060	0.
9	8.65 E+4	0.029	0.032	0.090	0.094	0.150	0.058	0.
10	4.09 E+4	0.021	0.027	0.076	0.091	0.136	0.062	0.
11	1.93 E+4	0.016	0.020	0.062	0.073	0.110	0.051	0.
12	9.12 E+3	0.010	0.013	0.047	0.059	0.086	0.043	0.
13	4.31 E+3	0.004	0.007	0.024	0.035	0.043	0.024	0.
14	2.03 E+3	0.006	0.012	0.054	0.081	0.134	0.071	0.
15	9.61 E+2	0.001	0.003	0.021	0.043	0.067	0.044	0.
16	4.54 E+2	0.000	0.001	0.009	0.033	0.034	0.034	0.
TOTAL		0.174	0.208	0.655	0.768	1.108	0.502	0.

TABLE 6.10 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO IRON CAPTURE CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.043	-0.052	-0.077	-0.095	-0.090	-0.095	-0.084
2	6.07 E+6	-0.037	-0.044	-0.061	-0.078	-0.068	-0.073	-0.070
3	3.68 E+6	-0.022	-0.027	-0.036	-0.048	-0.040	-0.044	-0.046
4	2.23 E+6	-0.004	-0.006	-0.006	-0.010	-0.005	-0.005	-0.007
5	1.35 E+6	0.016	0.020	0.024	0.024	0.035	0.034	0.035
6	8.21 E+5	0.076	0.090	0.116	0.114	0.152	0.158	0.163
7	3.88 E+5	0.100	0.122	0.159	0.164	0.204	0.216	0.217
8	1.83 E+5	0.120	0.140	0.223	0.220	0.308	0.313	0.305
9	8.65 E+4	0.108	0.126	0.187	0.196	0.241	0.241	0.228
10	4.09 E+4	0.119	0.162	0.249	0.301	0.353	0.404	0.368
11	1.93 E+4	0.047	0.064	0.122	0.139	0.182	0.187	0.162
12	9.12 E+3	0.036	0.053	0.105	0.139	0.159	0.185	0.156
13	4.31 E+3	0.004	0.006	0.013	0.018	0.020	0.022	0.018
14	2.03 E+3	0.048	0.102	0.327	0.495	0.774	0.821	0.556
15	9.61 E+2	0.001	0.003	0.012	0.024	0.037	0.047	0.031
16	4.54 E+2	0.000	0.001	0.005	0.019	0.033	0.042	0.022
TOTAL		0.569	0.761	1.353	1.622	2.291	2.452	2.055

TABLE 6.11 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO IRON SCATTERING CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.419	-0.502	-0.770	-1.011	-1.021	-1.103	-0.954
2	6.07 E+6	-1.771	-2.063	-2.922	-3.633	-3.620	-3.924	-3.634
3	3.68 E+6	-2.596	-3.191	-4.639	-6.197	-6.101	-6.918	-6.832
4	2.23 E+6	-4.602	-5.759	-6.815	-7.886	-8.375	-9.017	-9.324
5	1.35 E+6	-0.956	-1.187	-1.315	-1.231	-1.187	-1.146	-0.888
6	8.21 E+5	-0.922	-0.991	-1.123	-0.807	-0.989	-0.916	-0.590
7	3.88 E+5	-0.903	-1.056	-1.286	-0.991	-1.089	-0.992	-0.514
8	1.83 E+5	-0.486	-0.566	-1.062	-0.790	-0.894	-0.824	-0.420
9	8.65 E+4	-0.599	-0.704	-0.892	-0.781	-0.781	-0.745	-0.445
10	4.09 E+4	-0.714	-0.921	-1.172	-0.995	-0.995	-1.066	-0.745
11	1.93 E+4	-0.284	-0.353	-0.589	-0.723	-0.463	-0.548	-0.408
12	9.12 E+3	-0.140	-0.176	-0.272	-0.322	-0.189	-0.214	-0.164
13	4.31 E+3	-0.023	-0.027	-0.062	-0.090	-0.043	-0.066	-0.046
14	2.03 E+3	-0.036	-0.082	-0.142	-0.196	-0.121	-0.134	-0.202
15	9.61 E+2	-0.009	-0.023	-0.079	-0.156	-0.046	-0.062	-0.044
16	4.54 E+2	-0.001	-0.003	-0.014	-0.049	0.020	0.006	-0.012
TOTAL		-14.462	-17.604	-23.243	-26.191	-25.895	-27.668	-25.222

TABLE 6.12 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.027	-0.033	-0.063	-0.112	-0.112	-0.240	-0.082
2	6.07 E+6	-0.199	-0.222	-0.344	-0.503	-0.491	-0.853	-0.377
3	3.68 E+6	-1.088	-1.309	-1.808	-2.294	-2.326	-1.480	-1.979
4	2.23 E+6	-0.980	-1.204	-1.457	-1.705	-1.808	-1.913	-1.504
5	1.35 E+6	-0.171	-0.202	-0.189	-0.160	-0.189	-0.267	-0.111
6	8.21 E+5	-0.260	-0.274	-0.300	-0.198	-0.263	-0.200	-0.127
7	3.88 E+5	-0.263	-0.306	-0.372	-0.264	-0.308	-0.193	-0.118
8	1.83 E+5	-0.269	-0.297	-0.469	-0.292	-0.432	-0.256	-0.208
9	8.65 E+4	-0.141	-0.160	-0.200	-0.158	-0.171	-0.166	-0.086
10	4.09 E+4	-0.069	-0.094	-0.138	-0.157	-0.118	-0.142	-0.072
11	1.93 E+4	-0.086	-0.107	-0.190	-0.238	-0.153	-0.114	-0.104
12	9.12 E+3	-0.115	-0.143	-0.245	-0.299	-0.182	-0.065	-0.127
13	4.31 E+3	-0.017	-0.017	-0.033	-0.041	-0.018	-0.016	-0.014
14	2.03 E+3	-0.008	-0.017	-0.030	-0.040	-0.023	-0.024	-0.027
15	9.61 E+2	-0.001	-0.003	-0.010	-0.020	-0.006	-0.012	-0.004
16	4.54 E+2	-0.000	-0.000	-0.001	-0.005	0.002	-0.001	-0.001
TOTAL		-3.691	-4.388	-5.847	-6.486	-6.598	-5.940	-4.942

TABLE 6.13 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO NICKEL SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.011	-0.014	-0.026	-0.045	-0.051	-0.037	-0.032
2	6.07 E+6	-0.168	-0.193	-0.272	-0.347	-0.399	-0.290	-0.263
3	3.68 E+6	-0.510	-0.615	-0.831	-1.037	-1.204	-0.903	-0.879
4	2.23 E+6	-0.394	-0.485	-0.581	-0.685	-0.832	-0.598	-0.597
5	1.35 E+6	-0.082	-0.097	-0.087	-0.070	-0.100	-0.062	-0.051
6	8.21 E+5	-0.140	-0.147	-0.156	-0.101	-0.156	-0.102	-0.068
7	3.88 E+5	-0.188	-0.215	-0.238	-0.155	-0.237	-0.149	-0.091
8	1.83 E+5	-0.107	-0.122	-0.210	-0.140	-0.204	-0.128	-0.073
9	8.65 E+4	-0.150	-0.173	-0.219	-0.180	-0.201	-0.129	-0.080
10	4.09 E+4	-0.169	-0.234	-0.342	-0.398	-0.329	-0.258	-0.178
11	1.93 E+4	-0.251	-0.299	-0.390	-0.402	-0.309	-0.240	-0.167
12	9.12 E+3	-0.036	-0.046	-0.082	-0.103	-0.073	-0.058	-0.045
13	4.31 E+3	-0.008	-0.010	-0.020	-0.028	-0.015	-0.015	-0.010
14	2.03 E+3	-0.010	-0.021	-0.036	-0.050	-0.033	-0.025	-0.035
15	9.61 E+2	-0.002	-0.005	-0.016	-0.032	-0.011	-0.010	-0.007
16	4.54 E+2	-0.000	-0.001	-0.003	-0.009	0.004	0.001	-0.002
TOTAL		-2.228	-2.675	-3.510	-3.782	-4.148	-3.004	-2.578

TABLE 6.14 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO SODIUM CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.013	-0.019	-0.024	-0.030	-0.035	-0.035	-0.030
2	6.07 E+6	-0.003	-0.004	-0.005	-0.006	-0.007	-0.007	-0.006
3	3.68 E+6	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001
4	2.23 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
5	1.35 E+6	0.001	0.001	0.001	0.001	0.001	0.001	0.001
6	8.21 E+5	0.002	0.003	0.004	0.004	0.006	0.006	0.006
7	3.88 E+5	0.006	0.008	0.010	0.011	0.016	0.017	0.016
8	1.83 E+5	0.009	0.012	0.018	0.019	0.029	0.030	0.029
9	8.65 E+4	0.007	0.010	0.015	0.018	0.023	0.025	0.023
10	4.09 E+4	0.004	0.007	0.012	0.013	0.022	0.023	0.021
11	1.93 E+4	0.000	0.000	0.001	0.001	0.001	0.001	0.001
12	9.12 E+3	0.002	0.004	0.006	0.009	0.012	0.014	0.011
13	4.31 E+3	0.018	0.033	0.066	0.105	0.120	0.148	0.116
14	2.03 E+3	0.004	0.011	0.026	0.040	0.065	0.072	0.050
15	9.61 E+2	0.000	0.001	0.004	0.008	0.014	0.018	0.012
16	4.54 E+2	0.000	0.000	0.001	0.004	0.006	0.009	0.004
TOTAL		0.036	0.067	0.133	0.196	0.273	0.321	0.252

TABLE 6.15 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO SODIUM SCATTERING CROSS SECTION (X 10⁻³)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.232	-0.324	-0.442	-0.574	-0.687	-0.716	-0.608
2	6.07 E+6	-0.749	-1.008	-1.325	-1.693	-1.994	-2.081	-1.871
3	3.68 E+6	-1.122	-1.712	-2.166	-3.022	-3.499	-3.865	-3.747
4	2.23 E+6	-1.921	-3.003	-3.092	-3.743	-4.777	-4.940	-5.053
5	1.35 E+6	-0.696	-1.066	-0.980	-0.983	-1.275	-1.211	-1.075
6	8.21 E+5	-0.937	-1.279	-1.501	-1.164	-1.455	-1.367	-0.732
7	3.88 E+5	-0.651	-0.972	-1.133	-0.874	-1.086	-0.954	-0.436
8	1.83 E+5	-0.297	-0.447	-0.828	-0.639	-0.781	-0.691	-0.298
9	8.65 E+4	-0.396	-0.592	-0.812	-0.770	-0.743	-0.683	-0.376
10	4.09 E+4	-0.255	-0.454	-0.642	-0.774	-0.667	-0.723	-0.497
11	1.93 E+4	-0.206	-0.320	-0.503	-0.618	-0.492	-0.532	-0.394
12	9.12 E+3	-0.126	-0.199	-0.359	-0.482	-0.363	-0.416	-0.325
13	4.31 E+3	-0.104	-0.139	-0.331	-0.396	-0.285	-0.334	-0.218
14	2.03 E+3	-0.017	-0.047	-0.070	-0.097	-0.070	-0.077	-0.126
15	9.61 E+2	-0.002	-0.005	-0.021	-0.042	-0.012	-0.015	-0.009
16	4.54 E+2	-0.000	-0.001	-0.002	-0.008	0.004	0.002	-0.002
TOTAL		-7.712	-11.568	-14.207	-15.879	-18.183	-18.603	-15.768

TABLE 6.16 SENSITIVITY COEFFICIENT OF 28F/25F WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
1	10.0 E+6	-0.091	-0.083	-0.166	-0.313	-0.224	-0.260	-0.223
2	6.07 E+6	0.287	0.272	0.265	-0.054	0.065	0.002	0.037
3	3.68 E+6	0.149	0.126	-0.134	-0.885	-0.528	-0.796	-0.768
4	2.23 E+6	-4.512	-4.155	-5.424	-7.323	-5.708	-6.499	-6.699
5	1.35 E+6	-2.191	-1.972	-2.254	-2.343	-1.847	-2.091	-1.840
6	8.21 E+5	-3.040	-2.539	-3.757	-3.252	-2.370	-2.461	-1.221
7	3.88 E+5	-2.262	-2.023	-3.031	-2.600	-1.791	-1.832	-0.749
8	1.83 E+5	-0.903	-0.819	-2.036	-1.784	-1.233	-1.168	-0.404
9	8.65 E+4	-0.977	-0.896	-1.592	-1.851	-1.016	-0.969	-0.474
10	4.09 E+4	-0.725	-0.773	-1.431	-1.905	-1.012	-1.152	-0.801
11	1.93 E+4	-0.495	-0.456	-0.936	-1.212	-0.626	-0.698	-0.530
12	9.12 E+3	-0.141	-0.133	-0.297	-0.401	-0.196	-0.235	-0.188
13	4.31 E+3	-0.034	-0.027	-0.096	-0.168	-0.057	-0.116	-0.075
14	2.03 E+3	-0.019	-0.048	-0.056	-0.083	-0.040	-0.071	-0.227
15	9.61 E+2	-0.007	-0.011	-0.062	-0.131	-0.027	-0.024	-0.016
16	4.54 E+2	-0.000	-0.001	-0.006	-0.023	0.001	0.004	-0.004
TOTAL		-14.961	-13.537	-21.114	-24.329	-16.609	-18.366	-14.181

TABLE 7.1 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO FISSION CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	U-235	FISSION	ZPPR-2
1	10.0 E+6	-0.418	-0.383	-0.353	-0.249	-0.249	-0.211	-0.211
2	6.07 E+6	-1.354	-1.239	-1.077	-0.755	-0.755	-0.651	-0.651
3	3.68 E+6	-3.653	-3.414	-2.873	-2.078	-2.078	-1.822	-1.822
4	2.23 E+6	-5.082	-4.969	-3.885	-2.823	-2.823	-2.572	-2.572
5	1.35 E+6	-5.876	-5.803	-4.451	-3.308	-3.308	-3.004	-3.004
6	8.21 E+5	-12.702	-11.631	-10.383	-7.651	-7.651	-6.965	-6.965
7	3.88 E+5	-15.445	-14.690	-13.315	-10.655	-10.655	-9.813	-9.813
8	1.83 E+5	-13.422	-12.419	-14.341	-11.805	-11.805	-11.612	-11.612
9	8.65 E+4	-13.579	-12.759	-13.239	-12.218	-12.218	-11.137	-11.137
10	4.09 E+4	-9.345	-10.023	-10.619	-11.589	-11.589	-11.152	-11.152
11	1.93 E+4	-6.313	-6.702	-8.285	-9.206	-9.206	-8.682	-8.682
12	9.12 E+3	-3.394	-4.033	-5.704	-7.111	-7.111	-6.743	-6.743
13	4.31 E+3	-1.516	-2.027	-3.005	-4.309	-4.309	-3.786	-3.786
14	2.03 E+3	-1.875	-3.290	-6.540	-9.927	-9.927	-10.704	-10.704
15	9.61 E+2	-0.437	-1.026	-2.742	-5.767	-5.767	-6.890	-6.890
16	4.54 E+2	-0.056	-0.217	-0.873	-3.315	-3.315	-4.155	-4.155
TOTAL		-94.475	-94.626	-101.686	-102.765	-102.765	-99.900	-99.900

TABLE 7.2 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO U-235 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-2
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	U-235	
1	10.0 E+6	-0.000	-0.000	0.000	0.000	0.000	-0.000
2	6.07 E+6	-0.000	-0.000	0.000	0.000	0.000	-0.000
3	3.68 E+6	-0.002	-0.001	0.002	0.003	0.003	-0.000
4	2.23 E+6	-0.004	-0.004	0.005	0.010	0.010	-0.000
5	1.35 E+6	-0.004	-0.004	0.007	0.014	0.014	-0.000
6	8.21 E+5	0.005	0.004	0.021	0.039	0.039	0.000
7	3.88 E+5	0.087	0.072	0.053	0.095	0.095	0.001
8	1.83 E+5	0.195	0.160	0.078	0.126	0.126	0.002
9	8.65 E+4	0.326	0.275	0.103	0.162	0.162	0.004
10	4.09 E+4	0.353	0.340	0.088	0.147	0.147	0.006
11	1.93 E+4	0.323	0.304	0.063	0.097	0.097	0.006
12	9.12 E+3	0.220	0.223	0.035	0.056	0.056	0.005
13	4.31 E+3	0.119	0.134	0.019	0.031	0.031	0.003
14	2.03 E+3	0.164	0.134	0.035	0.055	0.055	0.009
15	9.61 E+2	0.026	0.062	0.012	0.020	0.020	0.004
16	4.54 E+2	0.005	0.013	0.004	0.009	0.009	0.003
TOTAL		1.816	1.800	0.525	0.866	0.866	0.043

(X10⁻²)

TABLE 7.3 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO U-238 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-2
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	U-238	
1	10.0 E+6	-0.029	-0.032	-0.026	-0.023	-0.023	-0.008
2	6.07 E+6	-0.077	-0.085	-0.066	-0.057	-0.057	-0.023
3	3.68 E+6	-0.137	-0.154	-0.116	-0.086	-0.086	-0.050
4	2.23 E+6	-0.127	-0.157	-0.104	-0.071	-0.071	-0.033
5	1.35 E+6	-0.016	-0.021	-0.012	-0.008	-0.008	-0.001
6	8.21 E+5	-0.002	-0.002	-0.001	-0.001	-0.001	0.000
7	3.88 E+5	-0.000	-0.000	-0.000	0.000	0.000	0.000
8	1.83 E+5	-0.000	-0.000	0.000	0.000	0.000	0.000
9	8.65 E+4	0.000	-0.000	0.000	0.000	0.000	0.000
10	4.09 E+4	0.000	0.000	0.000	0.000	0.000	0.000
11	1.93 E+4	0.000	0.000	0.000	0.000	0.000	0.000
12	9.12 E+3	0.000	0.000	0.000	0.000	0.000	0.000
13	4.31 E+3	0.000	0.000	0.000	0.000	0.000	0.000
14	2.03 E+3	0.000	0.000	0.000	0.000	0.000	0.000
15	9.61 E+2	0.000	0.000	0.000	0.000	0.000	0.000
16	4.54 E+2	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		-0.386	-0.452	-0.324	-0.245	-0.245	-0.114

(X10⁻²)

TABLE 7.4 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO U-238 CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	0.000	0.000	0.000	-0.000	-0.000
2	6.07 E+6	0.000	0.000	0.000	-0.000	-0.000
3	3.68 E+6	0.001	0.002	-0.000	-0.002	-0.002
4	2.23 E+6	0.003	0.005	0.001	-0.003	-0.004
5	1.35 E+6	0.017	0.024	0.012	0.006	-0.002
6	8.21 E+5	0.131	0.147	0.108	0.090	0.030
7	3.88 E+5	0.344	0.354	0.329	0.300	0.185
8	1.83 E+5	0.523	0.500	0.606	0.543	0.472
9	8.65 E+4	0.912	0.851	1.138	1.087	0.934
10	4.09 E+4	1.005	1.043	1.438	1.468	1.569
11	1.93 E+4	0.811	0.781	1.365	1.497	1.415
12	9.12 E+3	0.471	0.511	0.985	1.185	1.123
13	4.31 E+3	0.199	0.266	0.489	0.677	0.608
14	2.03 E+3	0.192	0.285	0.783	1.072	1.198
15	9.61 E+2	0.033	0.081	0.265	0.442	0.552
16	4.54 E+2	0.003	0.011	0.061	0.165	0.219
TOTAL		4.645	4.863	7.581	8.629	8.199

TABLE 7.5 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO U-238 SCATTERING CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	-0.027	-0.007	-0.036	-0.049	-0.046
2	6.07 E+6	-0.117	-0.062	-0.135	-0.182	-0.150
3	3.68 E+6	-0.456	-0.313	-0.513	-0.638	-0.531
4	2.23 E+6	-1.191	-0.994	-1.310	-1.338	-1.121
5	1.35 E+6	-0.845	-0.766	-0.864	-0.913	-0.672
6	8.21 E+5	-0.738	-0.670	-0.711	-0.728	-0.463
7	3.88 E+5	-0.867	-0.807	-0.868	-0.815	-0.573
8	1.83 E+5	-0.639	-0.570	-0.902	-0.755	-0.672
9	8.65 E+4	-0.798	-0.703	-0.916	-0.792	-0.553
10	4.09 E+4	-0.352	-0.364	-0.414	-0.384	-0.232
11	1.93 E+4	-0.237	-0.226	-0.276	-0.267	-0.129
12	9.12 E+3	-0.068	-0.069	-0.088	-0.092	-0.032
13	4.31 E+3	-0.020	-0.019	-0.029	-0.032	-0.008
14	2.03 E+3	-0.027	-0.045	-0.072	-0.087	0.000
15	9.61 E+2	-0.004	-0.009	-0.022	-0.034	-0.005
16	4.54 E+2	-0.000	-0.001	-0.004	-0.012	0.001
TOTAL		-6.386	-5.623	-7.159	-7.119	-5.186

TABLE 7.6 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO PU-239 FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	PU-239	FISSION	CROSS SECTION
1	10.0 E+6	0.516	0.487	0.471	0.347	0.305	0.305	
2	6.07 E+6	1.961	1.843	1.689	1.245	1.108	1.108	
3	3.68 E+6	5.163	4.952	4.404	3.386	3.031	3.031	
4	2.23 E+6	7.275	7.290	6.031	4.674	4.341	4.341	
5	1.35 E+6	8.069	8.167	6.627	5.262	4.875	4.875	
6	8.21 E+5	16.807	15.739	14.875	11.816	10.912	10.912	
7	3.88 E+5	17.992	17.496	16.647	14.375	13.357	13.357	
8	1.83 E+5	13.897	13.135	15.824	14.023	13.785	13.785	
9	8.65 E+4	12.885	12.375	13.300	13.109	11.963	11.963	
10	4.09 E+4	7.940	8.701	9.516	10.998	10.586	10.586	
11	1.93 E+4	4.919	5.404	6.670	7.793	7.317	7.317	
12	9.12 E+3	2.400	2.975	4.084	5.313	4.979	4.979	
13	4.31 E+3	1.140	1.435	2.240	3.237	2.785	2.785	
14	2.03 E+3	1.168	2.290	4.135	6.643	7.145	7.145	
15	9.61 E+2	0.342	0.780	2.093	4.752	5.577	5.577	
16	4.54 E+2	0.053	0.175	0.685	2.880	3.633	3.633	
TOTAL		102.527	103.245	109.292	109.853	105.698		

TABLE 7.7 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO PU-239 CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	PU-239	CAPTURE	CROSS SECTION
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
3	3.68 E+6	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	
4	2.23 E+6	-0.001	-0.001	-0.002	-0.002	-0.000	-0.000	
5	1.35 E+6	-0.001	-0.001	-0.003	-0.004	0.000	0.000	
6	8.21 E+5	0.001	0.001	-0.007	-0.010	0.005	0.005	
7	3.88 E+5	0.032	0.035	0.037	0.011	0.044	0.044	
8	1.83 E+5	0.068	0.074	0.125	0.065	0.112	0.112	
9	8.65 E+4	0.113	0.126	0.222	0.135	0.175	0.175	
10	4.09 E+4	0.143	0.183	0.334	0.242	0.289	0.289	
11	1.93 E+4	0.160	0.198	0.444	0.327	0.354	0.354	
12	9.12 E+3	0.138	0.190	0.471	0.380	0.389	0.389	
13	4.31 E+3	0.083	0.118	0.326	0.309	0.284	0.284	
14	2.03 E+3	0.099	0.187	0.632	0.599	0.669	0.669	
15	9.61 E+2	0.021	0.055	0.273	0.333	0.413	0.413	
16	4.54 E+2	0.003	0.012	0.088	0.179	0.209	0.209	
TOTAL		0.859	1.177	2.939	2.563	2.944		

TABLE 7.8 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO PU-240 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-2
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	PU-240	
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
3	3.68 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
4	2.23 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
5	1.35 E+6	-0.000	-0.000	-0.000	-0.001	0.000	0.000
6	8.21 E+5	0.000	0.000	-0.001	-0.001	0.001	0.001
7	3.88 E+5	0.003	0.003	0.004	0.001	0.006	0.006
8	1.83 E+5	0.008	0.008	0.014	0.007	0.018	0.018
9	8.65 E+4	0.014	0.015	0.027	0.017	0.032	0.032
10	4.09 E+4	0.017	0.021	0.039	0.028	0.050	0.050
11	1.93 E+4	0.016	0.020	0.045	0.033	0.053	0.053
12	9.12 E+3	0.011	0.016	0.037	0.030	0.046	0.046
13	4.31 E+3	0.006	0.008	0.022	0.021	0.028	0.028
14	2.03 E+3	0.008	0.015	0.053	0.050	0.082	0.082
15	9.61 E+2	0.002	0.005	0.020	0.024	0.043	0.043
16	4.54 E+2	0.000	0.001	0.009	0.019	0.031	0.031
TOTAL		0.084	0.112	0.269	0.226	0.389	0.389

(X10⁻²)

TABLE 7.9 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO PU-241 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-2
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	PU-241	
1	10.0 E+6	0.000	0.000	0.000	0.000	0.000	-0.000
2	6.07 E+6	0.000	0.000	0.000	0.000	0.000	-0.000
3	3.68 E+6	0.000	0.000	0.001	0.001	0.001	-0.001
4	2.23 E+6	0.000	0.000	0.001	0.001	0.001	-0.001
5	1.35 E+6	0.000	0.000	0.001	0.002	0.001	-0.001
6	8.21 E+5	0.001	0.001	0.004	0.004	0.004	-0.001
7	3.88 E+5	0.004	0.004	0.010	0.009	0.003	0.003
8	1.83 E+5	0.006	0.006	0.017	0.013	0.010	0.010
9	8.65 E+4	0.008	0.009	0.022	0.016	0.013	0.013
10	4.09 E+4	0.008	0.009	0.022	0.019	0.018	0.018
11	1.93 E+4	0.006	0.008	0.020	0.017	0.017	0.017
12	9.12 E+3	0.004	0.006	0.017	0.015	0.015	0.015
13	4.31 E+3	0.002	0.003	0.009	0.009	0.008	0.008
14	2.03 E+3	0.003	0.005	0.020	0.020	0.020	0.020
15	9.61 E+2	0.000	0.001	0.006	0.009	0.010	0.010
16	4.54 E+2	0.000	0.000	0.003	0.006	0.007	0.007
TOTAL		0.043	0.054	0.154	0.142	0.119	0.119

(X10⁻²)

TABLE 7.10 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO IRON CAPTURE CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	-0.000	-0.000	-0.001	-0.003	-0.002
2	6.07 E+6	-0.001	-0.001	-0.003	-0.004	-0.002
3	3.68 E+6	-0.001	-0.001	-0.002	-0.003	-0.001
4	2.23 E+6	-0.000	-0.001	-0.001	-0.001	-0.001
5	1.35 E+6	-0.000	-0.001	-0.001	-0.001	-0.000
6	8.21 E+5	0.002	0.002	0.001	-0.001	0.003
7	3.88 E+5	0.012	0.014	0.017	0.014	0.020
8	1.83 E+5	0.025	0.029	0.043	0.036	0.051
9	8.65 E+4	0.030	0.035	0.050	0.045	0.054
10	4.09 E+4	0.042	0.057	0.083	0.088	0.110
11	1.93 E+4	0.019	0.026	0.047	0.048	0.059
12	9.12 E+3	0.017	0.024	0.044	0.053	0.062
13	4.31 E+3	0.002	0.003	0.006	0.007	0.007
14	2.03 E+3	0.025	0.048	0.149	0.198	0.269
15	9.61 E+2	0.000	0.001	0.004	0.007	0.011
16	4.54 E+2	0.000	0.000	0.002	0.005	0.008
TOTAL		0.171	0.236	0.439	0.490	0.647

TABLE 7.11 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO IRON SCATTERING CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	0.009	0.015	0.007	-0.009	-0.010
2	6.07 E+6	-0.042	-0.033	-0.075	-0.119	-0.119
3	3.68 E+6	-0.091	-0.082	-0.164	-0.246	-0.252
4	2.23 E+6	-0.049	-0.048	-0.084	-0.197	-0.216
5	1.35 E+6	-0.366	-0.452	-0.519	-0.550	-0.563
6	8.21 E+5	-0.202	-0.222	-0.263	-0.356	-0.388
7	3.88 E+5	-0.437	-0.506	-0.641	-0.718	-0.774
8	1.83 E+5	-0.263	-0.310	-0.595	-0.572	-0.716
9	8.65 E+4	-0.339	-0.407	-0.587	-0.592	-0.586
10	4.09 E+4	-0.353	-0.452	-0.567	-0.576	-0.504
11	1.93 E+4	-0.183	-0.227	-0.352	-0.403	-0.307
12	9.12 E+3	-0.072	-0.089	-0.128	-0.136	-0.065
13	4.31 E+3	-0.018	-0.011	-0.038	-0.036	-0.014
14	2.03 E+3	-0.005	-0.025	-0.006	0.061	0.196
15	9.61 E+2	-0.003	-0.008	-0.030	-0.035	0.041
16	4.54 E+2	-0.000	-0.001	-0.006	-0.016	0.000
TOTAL		-2.413	-2.861	-4.047	-4.500	-4.277

TABLE 7.12 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO SODIUM CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO SODIUM CAPTURE CROSS SECTION				
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	-0.000	-0.000	-0.000	-0.001	-0.001
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000
3	3.68 E+6	-0.000	-0.000	-0.000	-0.000	-0.000
4	2.23 E+6	-0.000	-0.000	-0.000	-0.000	-0.000
5	1.35 E+6	-0.000	-0.000	-0.000	-0.000	-0.000
6	8.21 E+5	0.000	0.000	0.000	-0.000	0.000
7	3.88 E+5	0.001	0.001	0.001	0.001	0.000
8	1.83 E+5	0.002	0.003	0.003	0.003	0.005
9	8.65 E+4	0.002	0.003	0.004	0.004	0.006
10	4.09 E+4	0.001	0.003	0.004	0.004	0.006
11	1.93 E+4	0.000	0.000	0.000	0.000	0.000
12	9.12 E+3	0.001	0.002	0.003	0.003	0.005
13	4.31 E+3	0.009	0.016	0.028	0.041	0.049
14	2.03 E+3	0.002	0.005	0.012	0.016	0.024
15	9.61 E+2	0.000	0.001	0.001	0.002	0.004
16	4.54 E+2	0.000	0.000	0.000	0.001	0.002
TOTAL		0.017	0.032	0.057	0.075	0.101

TABLE 7.13 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO SODIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO SODIUM SCATTERING CROSS SECTION				
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	0.002	0.005	-0.000	-0.008	-0.009
2	6.07 E+6	-0.024	-0.017	-0.045	-0.064	-0.074
3	3.68 E+6	-0.036	-0.040	-0.072	-0.115	-0.136
4	2.23 E+6	0.009	0.013	-0.000	-0.054	-0.075
5	1.35 E+6	-0.094	-0.136	-0.134	-0.197	-0.223
6	8.21 E+5	-0.455	-0.646	-0.731	-0.800	-0.954
7	3.88 E+5	-0.416	-0.621	-0.723	-0.734	-0.909
8	1.83 E+5	-0.221	-0.334	-0.594	-0.553	-0.790
9	8.65 E+4	-0.299	-0.456	-0.606	-0.604	-0.684
10	4.09 E+4	-0.221	-0.367	-0.475	-0.545	-0.593
11	1.93 E+4	-0.150	-0.232	-0.325	-0.362	-0.323
12	9.12 E+3	-0.076	-0.125	-0.190	-0.197	-0.101
13	4.31 E+3	-0.094	-0.062	-0.217	-0.163	-0.070
14	2.03 E+3	-0.001	-0.014	0.005	0.047	0.143
15	9.61 E+2	-0.001	-0.001	-0.008	-0.005	0.025
16	4.54 E+2	-0.000	-0.000	-0.001	-0.003	0.000
TOTAL		-2.078	-3.033	-4.115	-4.358	-4.812

TABLE 7.14 SENSITIVITY COEFFICIENT OF 49F/25F WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
1	10.0 E+6	0.007	0.008	0.007	-0.001	-0.001
2	6.07 E+6	0.027	0.028	0.026	0.000	-0.002
3	3.68 E+6	0.051	0.054	0.045	-0.004	-0.011
4	2.23 E+6	0.051	0.056	0.033	-0.074	-0.082
5	1.35 E+6	-0.219	-0.178	-0.231	-0.399	-0.322
6	8.21 E+5	-1.926	-1.666	-2.230	-2.468	-2.115
7	3.88 E+5	-1.638	-1.450	-2.130	-2.349	-1.957
8	1.83 E+5	-0.814	-0.732	-1.667	-1.708	-1.615
9	8.65 E+4	-0.955	-0.872	-1.503	-1.686	-1.266
10	4.09 E+4	-0.689	-0.678	-1.125	-1.421	-1.020
11	1.93 E+4	-0.379	-0.348	-0.626	-0.744	-0.440
12	9.12 E+3	-0.085	-0.083	-0.157	-0.169	-0.058
13	4.31 E+3	-0.039	-0.011	-0.069	-0.065	-0.021
14	2.03 E+3	0.026	0.002	0.102	0.277	0.355
15	9.61 E+2	-0.002	-0.001	-0.022	-0.009	0.068
16	4.54 E+2	-0.000	-0.000	-0.002	-0.008	0.000
TOTAL		-6.584	-5.871	-9.549	-10.828	-8.485

TABLE 8.1 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO U-235 FISSION CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPPR-6/7
1	10.0 E+6	0.003	0.001	0.022	0.040	0.000	0.000	0.000
2	6.07 E+6	0.011	0.005	0.057	0.103	0.001	0.000	0.000
3	3.68 E+6	0.029	0.016	0.127	0.228	0.002	0.001	0.001
4	2.23 E+6	-0.012	-0.013	0.159	0.284	0.001	0.001	0.000
5	1.35 E+6	-0.079	-0.070	0.176	0.313	-0.000	-0.000	0.000
6	8.21 E+5	-0.254	-0.186	0.395	0.617	-0.004	-0.002	-0.001
7	3.88 E+5	-0.941	-0.754	0.437	0.686	-0.025	-0.010	-0.005
8	1.83 E+5	-1.759	-1.393	0.376	0.568	-0.060	-0.022	-0.014
9	8.65 E+4	-2.777	-2.265	0.423	0.649	-0.086	-0.031	-0.020
10	4.09 E+4	-2.572	-2.392	0.394	0.623	-0.090	-0.035	-0.024
11	1.93 E+4	-1.891	-1.740	0.332	0.461	-0.069	-0.026	-0.019
12	9.12 E+3	-0.985	-1.052	0.214	0.283	-0.042	-0.016	-0.012
13	4.31 E+3	-0.358	-0.453	0.102	0.136	-0.014	-0.006	-0.005
14	2.03 E+3	-0.382	-0.566	0.169	0.208	-0.032	-0.009	-0.010
15	9.61 E+2	-0.065	-0.156	0.060	0.075	0.003	0.003	-0.001
16	4.54 E+2	-0.001	-0.008	0.016	0.026	0.033	0.008	0.004
TOTAL		-12.033	-11.028	3.459	5.299	-0.383	-0.145	-0.105

TABLE 8.2 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO U-235 CAPTURE CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.000	0.000	-0.000	-0.000	0.000	0.000	0.000
2	6.07 E+6	0.000	0.000	-0.000	-0.000	0.000	0.000	0.000
3	3.68 E+6	0.005	0.004	-0.003	-0.006	0.000	0.000	0.000
4	2.23 E+6	0.009	0.008	-0.010	-0.018	0.000	0.000	0.000
5	1.35 E+6	0.001	0.001	-0.013	-0.025	-0.000	-0.000	-0.000
6	8.21 E+5	-0.022	-0.016	-0.041	-0.068	-0.001	-0.000	-0.000
7	3.88 E+5	-0.180	-0.147	-0.102	-0.163	-0.006	-0.002	-0.002
8	1.83 E+5	-0.459	-0.368	-0.148	-0.209	-0.017	-0.006	-0.005
9	8.65 E+4	-0.865	-0.710	-0.188	-0.255	-0.028	-0.010	-0.008
10	4.09 E+4	-0.921	-0.861	-0.149	-0.214	-0.034	-0.012	-0.010
11	1.93 E+4	-0.709	-0.653	-0.096	-0.132	-0.028	-0.010	-0.008
12	9.12 E+3	-0.366	-0.383	-0.051	-0.077	-0.018	-0.006	-0.005
13	4.31 E+3	-0.144	-0.177	-0.027	-0.043	-0.008	-0.002	-0.002
14	2.03 E+3	-0.149	-0.213	-0.049	-0.071	-0.020	-0.004	-0.005
15	9.61 E+2	-0.026	-0.059	-0.017	-0.026	-0.005	0.001	-0.001
16	4.54 E+2	-0.000	-0.002	-0.005	-0.008	0.000	0.003	0.002
TOTAL		-3.827	-3.575	-0.900	-1.315	-0.165	-0.048	-0.044

TABLE 8.3 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO U-238 FISSION CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.087	0.089	0.064	0.051	0.025	0.026	0.030
2	6.07 E+6	0.207	0.208	0.141	0.111	0.055	0.063	0.064
3	3.68 E+6	0.381	0.384	0.260	0.182	0.115	0.131	0.140
4	2.23 E+6	0.315	0.354	0.193	0.122	0.067	0.057	0.079
5	1.35 E+6	0.033	0.042	0.016	0.009	-0.001	-0.003	-0.000
6	8.21 E+5	0.004	0.005	0.002	0.001	-0.001	-0.001	-0.000
7	3.88 E+5	0.000	0.001	0.000	-0.000	-0.000	-0.000	-0.000
8	1.83 E+5	0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000
9	8.65 E+4	-0.000	0.000	-0.000	-0.000	-0.000	-0.001	-0.000
10	4.09 E+4	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
11	1.93 E+4	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
12	9.12 E+3	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
13	4.31 E+3	0.000	-0.000	0.000	0.000	0.000	0.000	0.000
14	2.03 E+3	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
15	9.61 E+2	-0.000	-0.000	-0.000	-0.000	0.000	0.000	-0.000
16	4.54 E+2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		1.027	1.082	0.673	0.473	0.258	0.271	0.310

TABLE 8.4 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO U-238 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.012	0.010	0.009	0.006	0.006	0.005	0.006
2	6.07 E+6	0.091	0.080	0.067	0.043	0.044	0.040	0.041
3	3.68 E+6	0.471	0.427	0.349	0.235	0.233	0.205	0.221
4	2.23 E+6	1.493	1.418	1.068	0.719	0.745	0.635	0.696
5	1.35 E+6	4.193	4.020	2.960	2.041	2.102	1.844	1.963
6	8.21 E+5	9.625	8.521	7.325	4.998	5.490	4.712	4.800
7	3.88 E+5	10.981	10.070	8.598	6.388	6.895	6.202	6.174
8	1.83 E+5	11.187	9.984	10.644	8.261	9.365	8.382	8.350
9	8.65 E+4	16.565	15.100	13.760	12.131	12.493	11.478	11.356
10	4.09 E+4	14.545	15.288	13.439	14.146	13.554	14.100	13.919
11	1.93 E+4	10.363	10.554	10.743	11.646	11.153	11.479	11.255
12	9.12 E+3	5.312	6.261	6.916	8.511	7.837	8.413	8.267
13	4.31 E+3	2.147	3.123	3.352	4.917	3.886	4.593	4.559
14	2.03 E+3	1.995	3.532	5.354	8.172	8.350	8.507	9.142
15	9.61 E+2	0.492	1.133	2.394	4.981	4.838	5.428	6.039
16	4.54 E+2	0.052	0.176	0.554	2.161	1.830	2.667	2.976
TOTAL		89.524	89.698	87.533	89.356	88.820	88.691	89.764

TABLE 8.5 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO U-238 SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.102	0.058	0.133	0.128	0.120	0.129	0.113
2	6.07 E+6	0.349	0.213	0.400	0.415	0.343	0.412	0.336
3	3.68 E+6	1.291	0.917	1.381	1.404	1.155	1.320	1.173
4	2.23 E+6	2.756	2.268	2.702	2.395	2.114	2.146	2.008
5	1.35 E+6	1.777	1.586	1.607	1.519	1.198	1.257	1.113
6	8.21 E+5	1.659	1.478	1.348	1.220	0.884	0.888	0.753
7	3.88 E+5	2.139	1.924	1.832	1.521	1.276	1.255	1.082
8	1.83 E+5	1.829	1.546	2.168	1.546	1.668	1.479	1.372
9	8.65 E+4	1.840	1.568	1.561	1.026	0.875	0.539	0.669
10	4.09 E+4	0.773	0.772	0.674	0.473	0.295	0.121	0.255
11	1.93 E+4	0.421	0.404	0.328	0.219	0.070	-0.026	0.067
12	9.12 E+3	0.090	0.093	0.070	0.033	-0.010	-0.048	-0.008
13	4.31 E+3	0.017	0.013	0.011	-0.021	-0.013	-0.044	-0.025
14	2.03 E+3	0.032	0.054	0.049	-0.022	-0.029	-0.081	-0.035
15	9.61 E+2	0.003	0.009	0.006	-0.033	-0.016	-0.032	-0.017
16	4.54 E+2	0.000	0.001	-0.000	-0.019	-0.006	-0.005	-0.001
TOTAL		15.078	12.903	14.268	11.805	9.925	9.310	8.854

TABLE 8.6 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO PU-239 FISSION CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	-0.515	-0.486	-0.477	-0.355	-0.319	-0.277	-0.307
2	6.07 E+6	-1.957	-1.842	-1.714	-1.275	-1.166	-1.070	-1.121
3	3.68 E+6	-5.153	-4.944	-4.457	-3.458	-3.126	-2.829	-3.066
4	2.23 E+6	-7.297	-7.317	-6.153	-4.796	-4.520	-3.965	-4.401
5	1.35 E+6	-8.143	-8.253	-6.835	-5.444	-5.119	-4.581	-4.965
6	8.21 E+5	-16.978	-15.912	-15.374	-12.248	-12.113	-10.691	-11.081
7	3.88 E+5	-18.341	-17.873	-17.458	-15.049	-14.598	-13.560	-13.627
8	1.83 E+5	-14.475	-13.744	-17.149	-14.963	-15.562	-14.325	-14.269
9	8.65 E+4	-13.747	-13.307	-15.000	-14.266	-13.631	-12.770	-12.596
10	4.09 E+4	-8.619	-9.533	-10.920	-12.022	-10.764	-11.440	-11.172
11	1.93 E+4	-5.306	-5.880	-7.507	-8.354	-7.475	-7.822	-7.600
12	9.12 E+3	-2.530	-3.175	-4.393	-5.506	-4.731	-5.130	-5.017
13	4.31 E+3	-1.163	-1.485	-2.284	-3.232	-2.461	-2.778	-2.704
14	2.03 E+3	-1.164	-2.296	-4.067	-6.456	-6.199	-6.488	-6.774
15	9.61 E+2	-0.343	-0.782	-2.026	-4.504	-4.153	-4.868	-5.186
16	4.54 E+2	-0.050	-0.165	-0.586	-2.529	-1.962	-3.061	-3.229
TOTAL		-105.781	-106.993	-116.402	-114.459	-107.898	-105.655	-107.115

TABLE 8.7 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO PU-239 CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	6.07 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	3.68 E+6	0.001	0.001	0.002	0.002	0.000	0.000	0.001
4	2.23 E+6	0.001	0.002	0.004	0.004	0.001	0.000	0.001
5	1.35 E+6	0.000	0.001	0.004	0.005	-0.001	-0.001	-0.001
6	8.21 E+5	-0.007	-0.006	0.006	0.014	-0.010	-0.009	-0.010
7	3.88 E+5	-0.066	-0.071	-0.073	-0.024	-0.079	-0.068	-0.076
8	1.83 E+5	-0.160	-0.170	-0.269	-0.133	-0.223	-0.183	-0.206
9	8.65 E+4	-0.300	-0.327	-0.522	-0.285	-0.378	-0.299	-0.340
10	4.09 E+4	-0.373	-0.464	-0.727	-0.454	-0.526	-0.453	-0.520
11	1.93 E+4	-0.352	-0.425	-0.781	-0.469	-0.546	-0.435	-0.515
12	9.12 E+3	-0.229	-0.325	-0.621	-0.382	-0.444	-0.336	-0.428
13	4.31 E+3	-0.100	-0.156	-0.312	-0.194	-0.214	-0.151	-0.224
14	2.03 E+3	-0.089	-0.179	-0.471	-0.219	-0.434	-0.191	-0.376
15	9.61 E+2	-0.021	-0.052	-0.154	0.060	-0.137	0.088	-0.068
16	4.54 E+2	-0.000	-0.002	0.014	0.218	0.058	0.238	0.163
TOTAL		-1.693	-2.173	-3.899	-1.859	-2.933	-1.797	-2.599

TABLE 8.8 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO PU-240 CAPTURE CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	6.07 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	3.68 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2.23 E+6	0.000	0.000	0.001	0.001	0.000	0.000	0.000
5	1.35 E+6	0.000	0.000	0.001	0.001	-0.000	-0.000	-0.000
6	8.21 E+5	-0.001	-0.001	0.001	0.002	-0.003	-0.002	-0.002
7	3.88 E+5	-0.007	-0.007	-0.007	-0.002	-0.018	-0.010	-0.011
8	1.83 E+5	-0.018	-0.019	-0.029	-0.015	-0.056	-0.030	-0.034
9	8.65 E+4	-0.037	-0.040	-0.064	-0.035	-0.106	-0.055	-0.062
10	4.09 E+4	-0.044	-0.054	-0.084	-0.053	-0.139	-0.078	-0.090
11	1.93 E+4	-0.036	-0.043	-0.079	-0.047	-0.125	-0.065	-0.077
12	9.12 E+3	-0.027	-0.027	-0.049	-0.030	-0.079	-0.039	-0.050
13	4.31 E+3	-0.007	-0.011	-0.021	-0.013	-0.033	-0.015	-0.022
14	2.03 E+3	-0.007	-0.014	-0.040	-0.018	-0.081	-0.023	-0.046
15	9.61 E+2	-0.002	-0.005	-0.011	-0.004	-0.022	0.009	-0.007
16	4.54 E+2	-0.000	-0.000	0.001	0.023	0.011	0.035	0.024
TOTAL		-0.175	-0.219	-0.382	-0.183	-0.650	-0.272	-0.377

TABLE 8.9 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO PU-241 FISSION CROSS SECTION (X10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.000	-0.000	-0.000	-0.000	0.000	0.000	0.000
2	6.07 E+6	0.000	-0.000	-0.001	-0.001	0.001	0.000	0.000
3	3.68 E+6	0.000	-0.000	-0.001	-0.001	0.002	0.001	0.001
4	2.23 E+6	-0.000	-0.000	-0.002	-0.002	0.002	0.000	0.000
5	1.35 E+6	-0.001	-0.001	-0.003	-0.003	0.001	-0.000	-0.001
6	8.21 E+5	-0.002	-0.003	-0.009	-0.008	-0.003	-0.002	-0.003
7	3.88 E+5	-0.008	-0.008	-0.020	-0.016	-0.021	-0.009	-0.011
8	1.83 E+5	-0.014	-0.015	-0.036	-0.025	-0.053	-0.019	-0.025
9	8.65 E+4	-0.021	-0.022	-0.046	-0.031	-0.073	-0.026	-0.033
10	4.09 E+4	-0.020	-0.024	-0.046	-0.034	-0.077	-0.026	-0.038
11	1.93 E+4	-0.014	-0.017	-0.036	-0.026	-0.058	-0.022	-0.028
12	9.12 E+3	-0.007	-0.010	-0.023	-0.018	-0.037	-0.013	-0.018
13	4.31 E+3	-0.003	-0.004	-0.010	-0.009	-0.013	-0.005	-0.007
14	2.03 E+3	-0.003	-0.005	-0.019	-0.017	-0.032	-0.007	-0.015
15	9.61 E+2	-0.000	-0.001	-0.005	-0.005	-0.006	0.002	-0.002
16	4.54 E+2	-0.000	-0.000	-0.001	-0.000	0.008	0.007	0.006
TOTAL		-0.094	-0.112	-0.258	-0.196	-0.359	-0.122	-0.171

TABLE 8.10 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO IRON CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.003	0.003	0.006	0.007	0.005	0.004	0.005
2	6.07 E+6	0.004	0.004	0.007	0.008	0.005	0.004	0.005
3	3.68 E+6	0.003	0.003	0.004	0.005	0.003	0.002	0.003
4	2.23 E+6	0.001	0.001	0.001	0.002	0.001	0.001	0.001
5	1.35 E+6	-0.000	-0.000	0.000	0.001	-0.001	-0.001	-0.001
6	8.21 E+5	-0.006	-0.006	-0.006	-0.002	-0.008	-0.007	-0.009
7	3.88 E+5	-0.026	-0.030	-0.033	-0.025	-0.035	-0.029	-0.036
8	1.83 E+5	-0.060	-0.067	-0.090	-0.069	-0.079	-0.079	-0.095
9	8.65 E+4	-0.079	-0.089	-0.111	-0.090	-0.114	-0.088	-0.104
10	4.09 E+4	-0.109	-0.144	-0.174	-0.160	-0.193	-0.163	-0.198
11	1.93 E+4	-0.043	-0.056	-0.082	-0.069	-0.067	-0.067	-0.085
12	9.12 E+3	-0.028	-0.041	-0.059	-0.055	-0.065	-0.050	-0.068
13	4.31 E+3	-0.002	-0.004	-0.005	-0.006	-0.004	-0.004	-0.006
14	2.03 E+3	-0.023	-0.046	-0.114	-0.079	-0.182	-0.077	-0.151
15	9.61 E+2	-0.000	-0.001	-0.003	0.001	-0.004	0.002	-0.002
16	4.54 E+2	-0.000	-0.000	0.000	0.006	0.000	0.007	0.005
TOTAL		-0.365	-0.473	-0.660	-0.522	-0.785	-0.544	-0.734

TABLE 8.11 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO IRON SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.006	0.001	0.027	0.045	0.043	0.036	0.045
2	6.07 E+6	0.154	0.142	0.248	0.284	0.269	0.233	0.280
3	3.68 E+6	0.312	0.320	0.499	0.564	0.537	0.447	0.580
4	2.23 E+6	0.262	0.293	0.391	0.515	0.485	0.370	0.551
5	1.35 E+6	0.728	0.885	0.940	0.898	0.886	0.672	0.901
6	8.21 E+5	0.368	0.405	0.463	0.576	0.574	0.493	0.583
7	3.88 E+5	1.099	1.252	1.431	1.405	1.376	1.174	1.472
8	1.83 E+5	0.810	0.938	1.517	1.219	1.473	1.094	1.479
9	8.65 E+4	0.873	1.022	1.132	0.855	0.865	0.498	0.790
10	4.09 E+4	0.673	0.838	0.764	0.491	0.403	0.054	0.317
11	1.93 E+4	0.089	0.147	0.008	-0.224	-0.240	-0.447	-0.377
12	9.12 E+3	0.042	0.055	-0.007	-0.116	-0.121	-0.202	-0.172
13	4.31 E+3	-0.015	-0.051	-0.048	-0.153	-0.075	-0.148	-0.153
14	2.03 E+3	0.007	0.022	-0.046	-0.286	-0.220	-0.355	-0.371
15	9.61 E+2	-0.002	-0.005	-0.038	-0.198	-0.124	-0.187	-0.222
16	4.54 E+2	-0.000	-0.000	-0.002	-0.027	-0.008	-0.006	-0.003
TOTAL		5.407	6.265	7.279	5.849	6.123	3.725	5.701

TABLE 8.12 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO SODIUM CAPTURE CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.001	0.001	0.002	0.002	0.002	0.001	0.002
2	6.07 E+6	0.000	0.000	0.001	0.001	0.001	0.000	0.001
3	3.68 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2.23 E+6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	1.35 E+6	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000
6	8.21 E+5	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
7	3.88 E+5	-0.001	-0.002	-0.002	-0.002	-0.003	-0.002	-0.003
8	1.83 E+5	-0.004	-0.006	-0.007	-0.006	-0.009	-0.008	-0.009
9	8.65 E+4	-0.005	-0.007	-0.009	-0.008	-0.011	-0.010	-0.011
10	4.09 E+4	-0.004	-0.006	-0.008	-0.007	-0.012	-0.010	-0.011
11	1.93 E+4	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
12	9.12 E+3	-0.001	-0.003	-0.004	-0.004	-0.005	-0.004	-0.005
13	4.31 E+3	-0.010	-0.021	-0.028	-0.027	-0.036	-0.026	-0.039
14	2.03 E+3	-0.002	-0.005	-0.009	-0.006	-0.015	-0.007	-0.013
15	9.61 E+2	-0.000	-0.000	-0.001	0.000	-0.001	0.001	-0.001
16	4.54 E+2	-0.000	-0.000	0.000	0.001	0.000	0.002	0.001
TOTAL		-0.027	-0.049	-0.066	-0.056	-0.091	-0.062	-0.089

TABLE 8.13 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO SODIUM SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	0.010	0.009	0.021	0.029	0.032	0.026	0.033
2	6.07 E+6	0.081	0.070	0.134	0.148	0.168	0.143	0.168
3	3.68 E+6	0.131	0.166	0.228	0.270	0.301	0.254	0.318
4	2.23 E+6	0.065	0.105	0.125	0.189	0.215	0.163	0.237
5	1.35 E+6	0.151	0.201	0.222	0.314	0.338	0.264	0.342
6	8.21 E+5	0.866	1.230	1.317	1.319	1.685	1.319	1.569
7	3.88 E+5	1.067	1.561	1.626	1.441	1.919	1.429	1.764
8	1.83 E+5	0.716	1.052	1.535	1.183	1.870	1.279	1.684
9	8.65 E+4	0.765	1.130	1.121	0.839	1.086	0.599	0.917
10	4.09 E+4	0.228	0.372	0.307	0.116	0.096	-0.180	-0.002
11	1.93 E+4	0.025	0.086	-0.074	-0.272	-0.370	-0.543	-0.467
12	9.12 E+3	-0.159	-0.229	-0.440	-0.790	-0.832	-1.080	-1.044
13	4.31 E+3	-0.096	-0.397	-0.318	-0.659	-0.586	-0.766	-0.766
14	2.03 E+3	0.002	0.011	-0.036	-0.179	-0.179	-0.259	-0.270
15	9.61 E+2	-0.002	-0.006	-0.022	-0.084	-0.074	-0.099	-0.118
16	4.54 E+2	-0.000	-0.000	-0.000	-0.005	-0.002	-0.001	-0.001
TOTAL		3.849	5.360	5.745	3.859	5.668	2.549	4.366

TABLE 8.14 SENSITIVITY COEFFICIENT OF 28C/49F WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-9	ZPR-6/7
1	10.0 E+6	-0.009	-0.008	-0.002	0.011	0.007	0.008	0.009
2	6.07 E+6	-0.079	-0.074	-0.055	-0.001	-0.012	0.007	-0.008
3	3.68 E+6	-0.112	-0.109	-0.060	0.035	0.007	0.039	0.028
4	2.23 E+6	0.086	0.064	0.156	0.315	0.202	0.208	0.281
5	1.35 E+6	0.337	0.245	0.388	0.637	0.407	0.416	0.501
6	8.21 E+5	3.374	2.931	3.741	3.909	3.303	3.058	3.293
7	3.88 E+5	4.222	3.661	4.792	4.638	3.801	3.419	3.873
8	1.83 E+5	2.682	2.339	4.325	3.677	3.623	2.941	3.483
9	8.65 E+4	2.423	2.134	2.701	2.290	1.826	1.224	1.626
10	4.09 E+4	0.630	0.608	0.631	0.230	0.096	-0.393	-0.111
11	1.93 E+4	-0.002	0.079	-0.219	-0.629	-0.547	-0.866	-0.708
12	9.12 E+3	-0.167	-0.143	-0.353	-0.647	-0.464	-0.652	-0.573
13	4.31 E+3	-0.064	-0.130	-0.136	-0.425	-0.159	-0.346	-0.325
14	2.03 E+3	-0.017	-0.005	-0.177	-0.633	-0.423	-0.650	-0.630
15	9.61 E+2	-0.009	-0.019	-0.084	-0.322	-0.188	-0.279	-0.305
16	4.54 E+2	-0.000	-0.000	-0.001	-0.013	-0.002	-0.002	-0.001
TOTAL		13.297	11.571	15.648	13.072	11.477	8.131	10.434

TABLE 9.1 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-235 FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2
1	10.0 E+6	-0.000	0.002	-0.000	0.000	-0.000	-0.000
2	6.07 E+6	-0.000	0.005	-0.000	0.000	-0.000	-0.001
3	3.68 E+6	-0.001	0.009	-0.000	0.002	-0.000	-0.002
4	2.23 E+6	-0.000	0.027	-0.000	0.002	-0.000	-0.005
5	1.35 E+6	-0.000	0.049	-0.000	0.005	-0.000	-0.007
6	8.21 E+5	-0.003	0.138	-0.001	0.024	-0.001	-0.020
7	3.88 E+5	-0.006	0.211	-0.002	0.042	-0.002	-0.036
8	1.83 E+5	-0.010	0.259	-0.004	0.057	-0.004	-0.057
9	8.65 E+4	-0.009	0.317	-0.005	0.064	-0.004	-0.062
10	4.09 E+4	-0.007	0.338	-0.006	0.063	-0.005	-0.067
11	1.93 E+4	-0.003	0.318	-0.006	0.045	-0.005	-0.060
12	9.12 E+3	0.001	0.273	-0.005	0.030	-0.004	-0.041
13	4.31 E+3	0.003	0.167	-0.003	0.020	-0.002	-0.010
14	2.03 E+3	-0.001	0.272	-0.008	0.003	-0.007	-0.105
15	9.61 E+2	0.007	0.061	-0.006	-0.011	-0.004	-0.057
16	4.54 E+2	0.034	-0.464	-0.003	0.034	-0.001	0.046
TOTAL		0.006	1.981	-0.049	0.379	-0.039	-0.483

TABLE 9.2 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-235 CAPTURE CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
2	6.07 E+6	0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
3	3.68 E+6	0.000	-0.001	0.000	-0.000	0.000	0.000	0.000
4	2.23 E+6	0.000	-0.003	0.000	-0.000	0.000	0.001	0.001
5	1.35 E+6	0.000	-0.003	0.000	-0.000	0.000	0.002	0.002
6	8.21 E+5	0.000	-0.009	0.000	-0.003	0.000	0.004	0.004
7	3.88 E+5	0.001	-0.019	0.000	-0.006	0.000	0.008	0.008
8	1.83 E+5	0.001	-0.033	0.000	-0.009	0.001	0.010	0.010
9	8.65 E+4	0.002	-0.054	0.000	-0.012	0.001	0.013	0.013
10	4.09 E+4	0.002	-0.077	0.001	-0.014	0.001	0.014	0.014
11	1.93 E+4	0.001	-0.103	0.001	-0.015	0.000	0.012	0.012
12	9.12 E+3	0.001	-0.119	0.000	-0.016	0.000	0.007	0.007
13	4.31 E+3	0.000	-0.114	0.000	-0.037	0.002	0.035	0.035
14	2.03 E+3	0.002	-0.317	0.001	-0.045	0.002	0.029	0.029
15	9.61 E+2	0.001	-0.384	0.001	-0.212	0.003	0.017	0.017
16	4.54 E+2	-0.002	-1.600	0.001	-0.212	0.003	0.017	0.017
TOTAL		0.009	-2.836	0.006	-0.372	0.011	0.151	0.151

TABLE 9.3 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-238 FISSION CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	-0.004	0.137	-0.007	0.033	-0.001	-0.053	-0.053
2	6.07 E+6	-0.009	0.339	-0.017	0.141	-0.005	-0.143	-0.143
3	3.68 E+6	-0.035	0.557	-0.037	0.391	-0.017	-0.394	-0.394
4	2.23 E+6	-0.018	1.263	-0.043	0.301	-0.033	-0.754	-0.754
5	1.35 E+6	-0.002	0.181	-0.005	0.062	-0.004	-0.084	-0.084
6	8.21 E+5	-0.001	0.015	-0.000	0.012	-0.000	-0.008	-0.008
7	3.88 E+5	-0.000	0.003	-0.000	0.002	-0.000	-0.002	-0.002
8	1.83 E+5	-0.000	0.002	-0.000	0.001	-0.000	-0.001	-0.001
9	8.65 E+4	-0.000	0.002	-0.000	0.001	-0.000	-0.001	-0.001
10	4.09 E+4	-0.000	0.001	-0.000	0.001	-0.000	-0.001	-0.001
11	1.93 E+4	-0.000	0.002	-0.000	0.001	-0.000	-0.001	-0.001
12	9.12 E+3	0.000	0.001	-0.000	0.000	-0.000	-0.000	-0.000
13	4.31 E+3	0.000	0.001	0.000	0.000	0.000	0.000	0.000
14	2.03 E+3	-0.000	0.001	-0.000	-0.000	-0.000	-0.001	-0.001
15	9.61 E+2	0.000	0.000	-0.000	-0.001	-0.000	-0.002	-0.002
16	4.54 E+2	0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.000
TOTAL		-0.068	2.503	-0.109	0.944	-0.061	-1.443	-1.443

TABLE 9.4 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-238 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-238 CAPTURE CROSS SECTION					
		MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2
1	10.0 E+6	0.000	-0.001	0.000	-0.001	0.000	0.001
2	6.07 E+6	0.000	-0.008	0.000	-0.004	0.000	0.005
3	3.68 E+6	0.001	-0.033	0.002	-0.023	0.002	0.029
4	2.23 E+6	0.002	-0.113	0.004	-0.038	0.004	0.087
5	1.35 E+6	0.006	-0.309	0.009	-0.080	0.007	0.183
6	8.21 E+5	0.029	-0.842	0.026	-0.455	0.025	0.555
7	3.88 E+5	0.048	-1.238	0.036	-0.770	0.043	0.808
8	1.83 E+5	0.087	-1.952	0.057	-1.339	0.081	1.472
9	8.65 E+4	0.117	-3.970	0.092	-2.405	0.142	2.454
10	4.09 E+4	0.127	-6.127	0.136	-3.285	0.201	3.484
11	1.93 E+4	0.092	-7.817	0.128	-3.353	0.184	3.554
12	9.12 E+3	0.054	-7.945	0.101	-3.082	0.104	2.763
13	4.31 E+3	0.019	-5.990	0.057	-2.338	0.035	1.309
14	2.03 E+3	0.083	-10.521	0.127	-3.076	0.236	4.225
15	9.61 E+2	0.048	-12.668	0.103	-3.613	0.269	3.529
16	4.54 E+2	-0.023	-27.510	0.061	-9.067	0.207	1.500
TOTAL		0.688	-87.044	0.937	-32.930	1.541	25.959

TABLE 9.5 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-238 SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO U-238 SCATTERING CROSS SECTION					
		MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2
1	10.0 E+6	0.005	-0.400	0.011	-0.255	0.022	0.258
2	6.07 E+6	0.018	-1.267	0.040	-0.786	0.077	0.976
3	3.68 E+6	0.041	-2.860	0.105	-1.938	0.173	2.519
4	2.23 E+6	0.074	-3.106	0.114	-1.777	0.144	2.790
5	1.35 E+6	0.072	-1.450	0.069	-0.695	0.091	1.772
6	8.21 E+5	0.090	-2.629	0.111	-1.162	0.177	3.455
7	3.88 E+5	0.104	-2.946	0.123	-1.356	0.189	3.083
8	1.83 E+5	0.082	-3.293	0.119	-1.475	0.122	2.516
9	8.65 E+4	0.043	-1.934	0.079	-0.676	0.075	1.293
10	4.09 E+4	0.014	-1.276	0.047	-0.617	0.021	0.626
11	1.93 E+4	0.005	-0.941	0.025	-0.303	0.001	0.224
12	9.12 E+3	0.001	-0.309	0.007	-0.024	0.001	0.039
13	4.31 E+3	-0.000	-0.034	0.001	-0.022	0.000	-0.011
14	2.03 E+3	-0.002	-0.245	0.010	-0.050	-0.137	-0.217
15	9.61 E+2	-0.004	-0.156	0.005	0.061	-0.124	-0.260
16	4.54 E+2	-0.007	-0.265	0.001	-0.058	-0.043	-0.220
TOTAL		0.536	-23.110	0.870	-11.090	0.788	18.843

TABLE 9.6 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	PU-239	FISSION	CROSS SECTION
1	10.0 E+6	0.012	-0.277	0.010	-0.060	0.033	0.375			
2	6.07 E+6	0.040	-2.726	0.034	-0.275	0.115	1.261			
3	3.68 E+6	0.086	-3.495	0.077	-0.817	0.261	2.798			
4	2.23 E+6	0.124	-3.507	0.101	-1.270	0.278	3.534			
5	1.35 E+6	0.125	-7.860	0.108	-1.304	0.306	3.700			
6	8.21 E+5	0.153	-8.377	0.195	-2.088	0.561	6.034			
7	3.88 E+5	0.071	-7.938	0.173	-2.030	0.589	4.574			
8	1.83 E+5	-0.074	-4.856	0.101	-1.419	0.340	1.712			
9	8.65 E+4	-0.137	-2.150	0.016	-0.492	0.191	-0.546			
10	4.09 E+4	-0.148	0.305	-0.053	-0.266	0.035	-2.081			
11	1.93 E+4	-0.106	0.305	-0.086	0.012	-0.052	-2.528			
12	9.12 E+3	-0.063	1.660	-0.082	0.293	-0.052	-2.114			
13	4.31 E+3	-0.027	2.153	-0.053	0.719	-0.016	-1.183			
14	2.03 E+3	-0.154	3.600	-0.173	-0.213	-0.679	-5.673			
15	9.61 E+2	-0.126	7.523	-0.200	1.266	-0.876	-6.256			
16	4.54 E+2	-0.033	22.749	-0.188	9.000	-0.728	-4.598			
TOTAL		-0.257	-4.178	-0.022	1.056	0.307	-0.990			

TABLE 9.7 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	PU-239	CAPTURE	CROSS SECTION
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000			
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000			
3	3.68 E+6	-0.000	-0.001	-0.000	-0.005	-0.000	-0.007			
4	2.23 E+6	-0.001	-0.003	-0.001	-0.015	-0.001	-0.023			
5	1.35 E+6	-0.002	0.001	-0.002	-0.023	-0.002	-0.041			
6	8.21 E+5	-0.002	0.136	-0.005	-0.051	-0.006	-0.126			
7	3.88 E+5	-0.002	0.136	-0.010	-0.066	-0.009	-0.217			
8	1.83 E+5	0.002	0.276	-0.010	0.012	-0.007	-0.204			
9	8.65 E+4	0.004	0.350	-0.006	0.122	-0.002	-0.133			
10	4.09 E+4	0.006	0.448	-0.002	0.288	0.006	-0.026			
11	1.93 E+4	0.006	0.519	0.003	0.455	0.010	0.096			
12	9.12 E+3	0.004	0.550	0.007	0.608	0.004	0.161			
13	4.31 E+3	0.002	0.369	0.007	0.527	-0.002	0.124			
14	2.03 E+3	0.027	1.115	0.028	1.401	0.072	1.068			
15	9.61 E+2	0.032	1.043	0.044	1.800	0.146	1.731			
16	4.54 E+2	0.010	0.409	0.043	1.526	0.172	1.432			
TOTAL		0.085	5.248	0.095	6.569	0.381	3.833			

TABLE 9.8 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO PU-240 CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CAPTURE	CROSS SECTION
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
2	6.07 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
3	3.68 E+6	-0.000	-0.002	-0.000	-0.002	-0.000	-0.002	-0.000	-0.002
4	2.23 E+6	-0.001	-0.004	-0.000	-0.004	-0.000	-0.004	-0.000	-0.006
5	1.35 E+6	-0.001	-0.004	-0.000	-0.005	-0.000	-0.008	-0.000	-0.008
6	8.21 E+5	-0.003	-0.005	-0.001	-0.012	-0.001	-0.025	-0.001	-0.025
7	3.88 E+5	-0.003	0.006	-0.001	-0.010	-0.001	-0.031	-0.001	-0.031
8	1.83 E+5	-0.004	0.032	-0.002	0.002	-0.001	-0.033	-0.001	-0.033
9	8.65 E+4	-0.004	0.054	-0.001	0.023	-0.000	-0.023	-0.000	-0.023
10	4.09 E+4	-0.003	0.072	-0.000	0.050	0.001	-0.004	0.001	-0.004
11	1.93 E+4	-0.003	0.075	0.000	0.068	0.001	0.014	0.001	0.014
12	9.12 E+3	-0.002	0.065	0.001	0.071	0.000	0.019	0.000	0.019
13	4.31 E+3	-0.002	0.037	0.001	0.051	-0.000	0.011	0.000	0.011
14	2.03 E+3	-0.000	0.153	0.003	0.169	0.009	0.128	0.009	0.128
15	9.61 E+2	0.002	0.126	0.004	0.179	0.015	0.171	0.015	0.171
16	4.54 E+2	-0.001	0.045	0.006	0.221	0.025	0.196	0.025	0.196
TOTAL		-0.026	0.650	0.009	0.801	0.046	0.406	0.046	0.406

TABLE 9.9 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO PU-241 FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	FISSION	CROSS SECTION
1	10.0 E+6	0.001	0.003	0.000	0.001	0.000	0.003	0.000	0.003
2	6.07 E+6	0.002	0.008	0.000	0.004	0.000	0.009	0.000	0.009
3	3.68 E+6	0.005	0.018	0.001	0.010	0.001	0.020	0.001	0.020
4	2.23 E+6	0.007	0.031	0.001	0.015	0.001	0.027	0.001	0.027
5	1.35 E+6	0.007	0.035	0.001	0.017	0.001	0.029	0.001	0.029
6	8.21 E+5	0.012	0.053	0.002	0.028	0.002	0.048	0.002	0.048
7	3.88 E+5	0.013	0.061	0.002	0.026	0.002	0.041	0.002	0.041
8	1.83 E+5	0.010	0.057	0.001	0.011	0.001	0.012	0.001	0.012
9	8.65 E+4	0.008	0.061	-0.000	-0.008	-0.000	-0.017	-0.000	-0.017
10	4.09 E+4	0.007	0.066	-0.002	0.026	-0.001	-0.041	-0.001	-0.041
11	1.93 E+4	0.006	0.073	-0.003	-0.034	-0.002	-0.050	-0.002	-0.050
12	9.12 E+3	0.006	0.073	-0.003	-0.033	-0.002	-0.048	-0.002	-0.048
13	4.31 E+3	0.003	0.044	-0.002	-0.019	-0.001	-0.024	-0.001	-0.024
14	2.03 E+3	0.004	0.089	-0.005	-0.064	-0.004	-0.114	-0.004	-0.114
15	9.61 E+2	0.002	0.061	-0.004	-0.050	-0.002	-0.086	-0.002	-0.086
16	4.54 E+2	0.004	0.082	-0.005	-0.050	-0.001	-0.076	-0.001	-0.076
TOTAL		0.097	0.816	-0.014	-0.172	-0.004	-0.266	-0.004	-0.266

TABLE 9.10 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO IRON CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	0.001	-0.031	0.000	-0.015	0.001	0.017	0.017
2	6.07 E+6	0.001	-0.031	0.000	-0.015	0.001	0.018	0.018
3	3.68 E+6	0.001	-0.012	0.000	-0.008	0.001	0.012	0.012
4	2.23 E+6	0.000	-0.008	-0.000	-0.003	0.001	0.007	0.007
5	1.35 E+6	0.000	-0.011	-0.000	-0.003	0.001	0.007	0.007
6	8.21 E+5	0.003	-0.047	0.000	-0.018	0.004	0.049	0.049
7	3.88 E+5	0.005	-0.062	0.001	-0.014	0.007	0.081	0.081
8	1.83 E+5	0.009	-0.099	0.002	-0.021	0.014	0.157	0.157
9	8.65 E+4	0.007	-0.119	0.002	-0.024	0.014	0.141	0.141
10	4.09 E+4	0.010	-0.277	0.005	-0.066	0.026	0.245	0.245
11	1.93 E+4	0.004	-0.267	0.003	-0.043	0.017	0.147	0.147
12	9.12 E+3	0.003	-0.340	0.003	-0.049	0.016	0.136	0.136
13	4.31 E+3	0.000	-0.095	0.000	-0.029	0.002	0.015	0.015
14	2.03 E+3	0.019	-2.595	0.021	-0.504	0.140	1.057	1.057
15	9.61 E+2	0.001	-0.317	0.001	-0.070	0.011	0.071	0.071
16	4.54 E+2	-0.001	-2.315	0.001	-0.807	0.014	0.052	0.052
TOTAL		0.065	-6.625	0.040	-1.689	0.271	2.212	2.212

TABLE 9.11 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO IRON SCATTERING CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	0.004	-0.335	0.005	-0.149	0.011	0.163	0.163
2	6.07 E+6	0.014	-1.215	0.023	-0.515	0.043	0.556	0.556
3	3.68 E+6	0.023	-2.090	0.047	-0.902	0.081	1.365	1.365
4	2.23 E+6	0.037	-2.074	0.041	-0.793	0.056	1.296	1.296
5	1.35 E+6	0.047	-0.816	0.031	-0.258	0.017	0.761	0.761
6	8.21 E+5	0.049	-0.870	0.063	0.102	0.061	1.277	1.277
7	3.88 E+5	0.070	0.474	0.073	0.503	0.032	1.003	1.003
8	1.83 E+5	0.052	0.183	0.061	0.529	-0.031	0.566	0.566
9	8.65 E+4	0.030	1.724	0.045	1.141	-0.060	0.139	0.139
10	4.09 E+4	0.014	4.812	0.055	1.375	-0.093	-0.251	-0.251
11	1.93 E+4	0.001	1.975	0.015	0.362	-0.090	-0.354	-0.354
12	9.12 E+3	-0.002	1.352	0.007	0.144	-0.020	-0.192	-0.192
13	4.31 E+3	-0.001	1.018	-0.001	0.161	-0.002	-0.064	-0.064
14	2.03 E+3	-0.010	2.386	0.002	0.531	-0.234	-0.715	-0.715
15	9.61 E+2	-0.006	1.241	0.005	-0.020	-0.181	-0.453	-0.453
16	4.54 E+2	-0.009	0.554	0.002	-0.038	-0.049	-0.198	-0.198
TOTAL		0.313	8.320	0.474	2.173	-0.461	4.999	4.999

TABLE 9.12 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO SODIUM CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	0.001	-0.003	0.000	-0.000	0.001	0.022	0.022
2	6.07 E+6	0.000	-0.000	0.000	0.000	0.000	0.007	0.007
3	3.68 E+6	0.000	0.000	0.000	0.000	0.000	0.001	0.001
4	2.23 E+6	0.000	0.000	0.000	0.000	0.000	0.001	0.001
5	1.95 E+6	0.000	0.000	0.000	0.000	0.000	0.001	0.001
6	8.21 E+5	0.000	0.001	0.000	0.001	0.000	0.006	0.006
7	3.88 E+5	0.001	0.003	0.000	0.004	0.001	0.017	0.017
8	1.83 E+5	0.001	0.007	0.000	0.007	0.003	0.030	0.030
9	8.65 E+4	0.001	0.000	0.000	0.007	0.002	0.023	0.023
10	4.09 E+4	0.001	0.000	0.000	0.008	0.003	0.027	0.027
11	1.93 E+4	0.000	0.000	0.000	0.000	0.000	0.001	0.001
12	9.12 E+3	0.000	-0.007	0.000	0.000	0.003	0.018	0.018
13	4.31 E+3	0.003	-0.174	0.003	0.005	0.003	0.155	0.155
14	2.03 E+3	0.002	-0.059	0.002	0.026	0.025	0.137	0.137
15	9.61 E+2	0.001	-0.038	0.001	0.005	0.009	0.044	0.044
16	4.54 E+2	0.000	-0.099	0.000	-0.019	0.006	0.022	0.022
TOTAL		0.011	-0.370	0.008	0.073	0.075	0.513	0.513

TABLE 9.13 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO SODIUM SCATTERING CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (EV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2	CROSS SECTION
1	10.0 E+6	0.001	-0.161	0.003	-0.073	0.004	0.135	0.135
2	6.07 E+6	0.004	-0.579	0.013	-0.252	0.010	0.376	0.376
3	3.68 E+6	0.003	-1.058	0.027	-0.492	0.023	0.769	0.769
4	2.23 E+6	0.006	-1.154	0.024	-0.477	0.016	0.803	0.803
5	1.95 E+6	0.017	-1.090	0.026	-0.385	0.005	0.441	0.441
6	8.21 E+5	0.025	-2.857	0.088	-1.062	-0.043	1.155	1.155
7	3.88 E+5	0.048	-2.247	0.073	-0.793	-0.106	0.419	0.419
8	1.83 E+5	0.046	-1.777	0.058	-0.598	-0.191	0.123	0.123
9	8.65 E+4	0.029	-1.277	0.043	-0.482	-0.256	-0.363	-0.363
10	4.09 E+4	0.010	-0.362	0.025	-0.322	-0.336	-0.786	-0.786
11	1.93 E+4	-0.001	-0.176	0.012	-0.278	-0.322	-0.839	-0.839
12	9.12 E+3	-0.010	0.851	-0.004	-0.005	-0.149	-0.811	-0.811
13	4.31 E+3	-0.012	1.218	-0.007	0.022	-0.047	-0.613	-0.613
14	2.03 E+3	-0.010	0.203	-0.000	-0.176	-0.280	-0.812	-0.812
15	9.61 E+2	-0.002	0.232	0.001	-0.076	-0.076	-0.186	-0.186
16	4.54 E+2	-0.001	-0.040	0.000	-0.009	-0.010	-0.038	-0.038
TOTAL		0.152	-10.275	0.381	-5.394	-1.756	-0.224	-0.224

TABLE 9.14 SENSITIVITY COEFFICIENT OF PU-239 FISSION WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (eV)	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-10A NO.1	ZPPR-10A NO.2
1	10.0 E+6	-0.002	-0.077	0.003	-0.077	0.008	0.118
2	6.07 E+6	-0.013	-0.360	0.012	-0.241	0.032	0.466
3	3.68 E+6	-0.024	-0.637	0.026	-0.472	0.061	0.968
4	2.23 E+6	-0.025	-0.968	0.046	-1.037	0.092	1.730
5	1.35 E+6	-0.031	-1.602	0.065	-0.907	0.118	2.121
6	8.21 E+5	0.016	-4.158	0.193	-1.379	0.227	4.402
7	3.88 E+5	0.060	-3.954	0.170	-1.355	0.188	3.083
8	1.83 E+5	0.093	-2.718	0.121	-0.993	0.075	1.656
9	8.65 E+4	0.065	-1.847	0.072	-0.021	0.029	0.576
10	4.09 E+4	0.025	-1.612	0.040	1.133	0.039	-0.141
11	1.93 E+4	0.002	-1.073	0.014	1.225	0.063	-0.382
12	9.12 E+3	-0.007	-0.381	-0.002	1.101	0.017	-0.265
13	4.31 E+3	-0.004	-0.062	-0.005	0.597	0.000	-0.034
14	2.03 E+3	-0.019	-0.699	-0.009	1.390	-0.112	-0.813
15	9.61 E+2	-0.003	-0.164	-0.000	0.584	-0.091	-0.363
16	4.54 E+2	-0.001	-0.011	0.001	-0.026	-0.020	-0.100
TOTAL		0.132	-20.324	0.748	-0.481	0.727	13.018

TABLE 10.1 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO U-235 FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	-0.347	-0.304	-0.306	-0.752	-0.006
2	6.07 E+6	-1.051	-0.903	-0.866	-2.128	-0.017
3	3.68 E+6	-2.496	-2.173	-1.966	-4.762	-0.039
4	2.23 E+6	-3.507	-3.115	-2.625	-6.392	-0.052
5	1.35 E+6	-4.235	-3.795	-3.150	-7.738	-0.061
6	8.21 E+5	-10.154	-8.664	-7.403	-16.175	-0.133
7	3.88 E+5	-14.412	-12.553	-9.955	-20.967	-0.187
8	1.83 E+5	-15.162	-12.839	-9.900	-18.359	-0.227
9	8.65 E+4	-18.567	-15.513	-10.614	-18.812	-0.232
10	4.09 E+4	-14.453	-12.302	-8.144	-14.807	-0.223
11	1.93 E+4	-9.954	-7.124	-5.408	-8.823	-0.160
12	9.12 E+3	-5.844	-3.077	-2.798	-4.563	-0.099
13	4.31 E+3	-2.108	-0.883	-1.215	-2.036	-0.031
14	2.03 E+3	3.699	3.821	-1.352	-2.144	0.244
15	9.61 E+2	2.638	2.942	-0.020	0.082	0.421
16	4.54 E+2	0.691	0.896	0.164	0.659	0.360
TOTAL		-95.259	-75.585	-65.558	-127.716	-0.442

TABLE 10.2 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO U-235 CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.000	0.000	0.000	0.000	0.000
2	6.07 E+6	0.003	0.003	0.003	0.008	0.000
3	3.68 E+6	0.041	0.034	0.044	0.111	0.000
4	2.23 E+6	0.086	0.079	0.113	0.294	0.001
5	1.35 E+6	0.093	0.084	0.120	0.324	0.001
6	8.21 E+5	0.244	0.220	0.296	0.729	0.002
7	3.88 E+5	0.281	0.284	0.523	1.381	0.001
8	1.83 E+5	-0.112	0.023	0.583	1.561	-0.005
9	8.65 E+4	-0.951	-0.600	0.657	1.879	-0.016
10	4.09 E+4	-2.827	-2.460	0.554	1.768	-0.037
11	1.93 E+4	-4.506	-3.436	0.455	1.314	-0.054
12	9.12 E+3	-4.759	-3.356	0.331	0.893	-0.068
13	4.31 E+3	-3.858	-2.415	0.176	0.492	-0.070
14	2.03 E+3	-7.880	-5.888	0.081	0.416	-0.273
15	9.61 E+2	-3.127	-2.900	-0.117	-0.188	-0.268
16	4.54 E+2	-0.668	-0.760	-0.114	-0.427	-0.269
TOTAL		-27.939	-21.087	3.704	10.555	-1.056

TABLE 10.3 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO U-238 FISSION CROSS SECTION

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	-1.784	-1.691	-1.827	-1.919	-1.516
2	6.07 E+6	-4.706	-4.408	-4.546	-4.814	-3.581
3	3.68 E+6	-9.092	-8.534	-8.853	-9.067	-7.511
4	2.23 E+6	-9.518	-9.095	-9.226	-9.610	-7.737
5	1.35 E+6	-1.095	-1.065	-1.021	-1.128	-0.766
6	8.21 E+5	-0.114	-0.107	-0.104	-0.113	-0.066
7	3.88 E+5	-0.018	-0.018	-0.017	-0.019	-0.009
8	1.83 E+5	-0.009	-0.008	-0.009	-0.009	-0.005
9	8.65 E+4	-0.007	-0.007	-0.007	-0.007	-0.004
10	4.09 E+4	-0.005	-0.005	-0.005	-0.005	-0.003
11	1.93 E+4	-0.004	-0.003	-0.004	-0.004	-0.003
12	9.12 E+3	-0.001	-0.001	-0.002	-0.002	-0.001
13	4.31 E+3	0.	-0.000	0.	0.	0.
14	2.03 E+3	-0.003	-0.006	-0.009	-0.010	-0.011
15	9.61 E+2	-0.001	-0.003	-0.003	-0.004	-0.003
16	4.54 E+2	0.000	-0.000	0.000	0.000	0.000
TOTAL		-26.356	-24.949	-25.632	-26.710	-21.217

TABLE 10.4 SENSITIVITY COEFFICIENT OF DOPPLER UO2 WITH RESPECT TO U-238 CAPTURE CROSS SECTION

TABLE 10.5 SENSITIVITY COEFFICIENT OF DOPPLER UO2 WITH RESPECT TO U-238 SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.005	0.004	0.005	0.005	0.002
2	6.07 E+6	0.028	0.026	0.027	0.028	0.010
3	3.68 E+6	0.117	0.110	0.112	0.111	0.049
4	2.23 E+6	0.297	0.294	0.286	0.291	0.118
5	1.35 E+6	0.820	0.817	0.751	0.811	0.260
6	8.21 E+5	2.814	2.796	2.527	2.789	0.481
7	3.88 E+5	3.112	3.230	2.928	3.570	-0.005
8	1.83 E+5	2.131	2.500	2.109	2.479	-1.300
9	8.65 E+4	0.475	1.417	0.768	1.359	-4.157
10	4.09 E+4	8.649	13.131	3.922	2.233	-5.079
11	1.93 E+4	9.514	14.509	3.105	0.158	-5.855
12	9.12 E+3	10.298	10.924	4.132	0.780	-3.633
13	4.31 E+3	8.798	6.882	4.866	2.680	-0.058
14	2.03 E+3	11.880	8.822	10.952	7.444	2.816
15	9.61 E+2	3.594	3.265	5.452	4.538	1.595
16	4.54 E+2	0.367	0.502	0.569	-0.886	-3.067
TOTAL		62.900	69.229	42.513	28.390	-17.824

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	1.240	1.082	1.243	1.312	0.480
2	6.07 E+6	2.345	1.998	2.389	2.366	0.710
3	3.68 E+6	5.565	4.718	5.796	5.388	2.378
4	2.23 E+6	10.334	8.432	9.199	6.876	4.333
5	1.35 E+6	1.556	0.962	1.697	-0.180	0.890
6	8.21 E+5	-0.968	-1.559	-0.522	-2.730	-1.768
7	3.88 E+5	1.018	0.295	0.804	-1.391	-1.026
8	1.83 E+5	3.431	2.298	3.991	2.192	0.933
9	8.65 E+4	8.331	5.545	5.854	3.309	2.960
10	4.09 E+4	3.286	2.294	1.905	1.072	0.750
11	1.93 E+4	3.595	2.304	1.801	1.231	0.971
12	9.12 E+3	1.712	1.038	0.812	0.651	0.572
13	4.31 E+3	0.594	0.123	0.260	0.210	0.162
14	2.03 E+3	1.478	0.762	1.459	1.374	0.363
15	9.61 E+2	0.475	0.374	0.781	0.753	0.052
16	4.54 E+2	0.062	0.075	0.239	0.362	0.205
TOTAL		44.054	30.743	37.707	22.794	12.966

TABLE 10.6 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO PU-239 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-9
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	FCA VI-2	
1	10.0 E+6	-0.282	-0.327	-0.270	0.113	-0.847	
2	6.07 E+6	-1.039	-1.182	-0.946	0.365	-2.829	
3	3.68 E+6	-2.478	-2.858	-2.368	0.758	-6.603	
4	2.23 E+6	-3.468	-4.097	-3.411	0.785	-8.882	
5	1.35 E+6	-3.889	-4.622	-3.840	0.710	-9.929	
6	8.21 E+5	-8.670	-9.761	-9.367	0.627	-20.571	
7	3.88 E+5	-10.294	-11.852	-12.266	-0.831	-23.337	
8	1.83 E+5	-9.114	-10.225	-13.553	-2.138	-22.201	
9	8.65 E+4	-9.847	-10.933	-14.438	-3.721	-18.173	
10	4.09 E+4	-6.177	-6.913	-10.865	-3.671	-14.502	
11	1.93 E+4	-3.350	-3.126	-7.055	-2.608	-8.496	
12	9.12 E+3	-1.397	-0.769	-3.519	-1.417	-4.577	
13	4.31 E+3	-0.222	0.040	-0.923	-0.245	-1.838	
14	2.03 E+3	2.104	2.873	8.908	7.397	4.477	
15	9.61 E+2	1.631	2.139	12.469	13.968	15.372	
16	4.54 E+2	0.402	0.669	6.951	15.598	20.373	
TOTAL		-56.090	-60.944	-54.494	25.690	-102.564	

TABLE 10.7 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO PU-239 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO					ZPPR-9
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	FCA VI-2	
1	10.0 E+6	0.000	0.000	0.000	-0.000	0.000	
2	6.07 E+6	0.000	0.000	0.000	-0.000	0.001	
3	3.68 E+6	0.005	0.006	0.003	-0.006	0.017	
4	2.23 E+6	0.012	0.015	0.003	-0.021	0.049	
5	1.35 E+6	0.019	0.023	0.002	-0.039	0.081	
6	8.21 E+5	-0.076	0.090	0.018	-0.138	0.267	
7	3.88 E+5	0.092	0.123	-0.064	-0.360	0.449	
8	1.83 E+5	-0.054	-0.010	-0.368	-0.620	0.345	
9	8.65 E+4	-0.345	-0.298	-0.906	-0.989	0.011	
10	4.09 E+4	-1.160	-1.344	-2.147	-1.851	-0.647	
11	1.93 E+4	-2.245	-2.246	-3.970	-2.878	-1.597	
12	9.12 E+3	-2.981	-2.841	-5.590	-4.023	-2.562	
13	4.31 E+3	-2.669	-2.096	-5.053	-4.073	-2.538	
14	2.03 E+3	-4.705	-4.917	-14.255	-11.240	-8.903	
15	9.61 E+2	-2.489	-2.549	-13.528	-14.291	-13.268	
16	4.54 E+2	-0.460	-0.700	-5.786	-11.711	-11.918	
TOTAL		-16.914	-16.745	-51.642	-52.240	-40.213	

TABLE 10.8 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO PU-240 CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	WITH RESPECT TO				ZPPR-9
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	0.000	0.000	0.000	-0.000	0.000
2	6.07 E+6	0.000	0.000	0.000	-0.000	0.000
3	3.68 E+6	0.001	0.001	0.001	-0.001	0.005
4	2.23 E+6	0.002	0.003	0.001	-0.004	0.013
5	1.35 E+6	0.003	0.003	0.000	-0.005	0.017
6	8.21 E+5	0.010	0.012	0.002	-0.019	0.054
7	3.88 E+5	0.009	0.012	-0.006	-0.035	0.065
8	1.83 E+5	-0.006	-0.001	-0.040	-0.068	0.056
9	8.65 E+4	-0.043	-0.036	-0.111	-0.122	0.002
10	4.09 E+4	-0.135	-0.155	-0.249	-0.214	-0.111
11	1.93 E+4	-0.229	-0.226	-0.401	-0.290	-0.238
12	9.12 E+3	-0.239	-0.234	-0.443	-0.318	-0.299
13	4.31 E+3	-0.184	-0.148	-0.344	-0.271	-0.247
14	2.03 E+3	-0.390	-0.386	-1.206	-0.937	-1.089
15	9.61 E+2	-0.188	-0.222	-1.008	-1.015	-1.355
16	4.54 E+2	-0.047	-0.070	-0.591	-1.217	-1.757
TOTAL		-1.435	-1.448	-4.396	-4.515	-4.885

TABLE 10.9 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO PU-241 FISSION CROSS SECTION

GROUP	UP. ENERGY (EV)	WITH RESPECT TO				ZPPR-9
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	-0.003	-0.003	-0.002	0.001	-0.010
2	6.07 E+6	-0.009	-0.010	-0.008	0.003	-0.030
3	3.68 E+6	-0.022	-0.024	-0.020	0.006	-0.071
4	2.23 E+6	-0.033	-0.037	-0.031	0.006	-0.103
5	1.35 E+6	-0.038	-0.043	-0.036	0.006	-0.119
6	8.21 E+5	-0.089	-0.095	-0.090	0.006	-0.255
7	3.88 E+5	-0.128	-0.140	-0.145	-0.008	-0.352
8	1.83 E+5	-0.134	-0.143	-0.188	-0.025	-0.396
9	8.65 E+4	-0.155	-0.164	-0.215	-0.047	-0.348
10	4.09 E+4	-0.111	-0.120	-0.185	-0.053	-0.317
11	1.93 E+4	-0.066	-0.060	-0.133	-0.042	-0.205
12	9.12 E+3	-0.031	-0.015	-0.076	-0.025	-0.127
13	4.31 E+3	-0.004	0.002	-0.017	-0.003	-0.047
14	2.03 E+3	0.057	0.067	0.224	0.156	0.147
15	9.61 E+2	0.032	0.041	0.231	0.213	0.352
16	4.54 E+2	0.010	0.016	0.167	0.292	0.546
TOTAL		-0.724	-0.728	-0.525	0.484	-1.335

TABLE 10.10 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO IRON CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.051	0.057	0.072	0.051	0.077
2	6.07 E+6	0.052	0.059	0.070	0.043	0.076
3	3.68 E+6	0.028	0.032	0.038	0.020	0.046
4	2.23 E+6	0.011	0.015	0.016	0.008	0.022
5	1.35 E+6	0.013	0.017	0.017	0.007	0.024
6	8.21 E+5	0.061	0.074	0.076	0.030	0.078
7	3.88 E+5	0.053	0.068	0.064	0.019	0.044
8	1.83 E+5	0.004	0.021	-0.008	-0.069	-0.045
9	8.65 E+4	-0.072	-0.062	-0.095	-0.120	-0.130
10	4.09 E+4	-0.316	-0.389	-0.387	-0.405	-0.422
11	1.93 E+4	-0.264	-0.287	-0.356	-0.327	-0.323
12	9.12 E+3	-0.354	-0.353	-0.469	-0.474	-0.448
13	4.31 E+3	-0.055	-0.048	-0.079	-0.080	-0.068
14	2.03 E+3	-1.166	-1.246	-3.183	-3.532	-3.832
15	9.61 E+2	-0.047	-0.061	-0.210	-0.310	-0.331
16	4.54 E+2	-0.012	-0.020	-0.125	-0.348	-0.354
TOTAL		-2.012	-2.123	-4.557	-5.486	-5.585

TABLE 10.11 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO IRON SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.350	0.366	0.521	0.465	0.263
2	6.07 E+6	1.011	1.073	1.505	1.213	0.474
3	3.68 E+6	1.862	1.921	2.724	2.000	0.551
4	2.23 E+6	1.017	1.310	1.808	1.491	0.388
5	1.35 E+6	1.720	1.908	2.217	1.344	0.694
6	8.21 E+5	0.890	1.029	1.537	1.057	-0.854
7	3.88 E+5	2.509	2.780	3.434	2.716	0.625
8	1.83 E+5	2.327	2.509	4.219	3.298	1.672
9	8.65 E+4	4.042	4.207	5.052	4.060	2.270
10	4.09 E+4	5.393	5.266	5.337	4.558	2.126
11	1.93 E+4	4.867	3.164	4.832	4.489	3.363
12	9.12 E+3	2.455	1.674	2.167	2.017	1.193
13	4.31 E+3	0.580	0.198	0.633	0.731	0.551
14	2.03 E+3	1.373	1.033	2.651	2.919	1.539
15	9.61 E+2	0.412	0.489	1.129	1.147	-0.160
16	4.54 E+2	0.057	0.106	0.333	0.513	0.190
TOTAL		30.864	29.035	40.100	34.018	14.883

TABLE 10.12 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	(X 10 ⁻²)				
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.054	0.056	0.082	0.074	0.014
2	6.07 E+6	0.158	0.165	0.242	0.201	-0.014
3	3.68 E+6	0.502	0.535	0.766	0.597	0.160
4	2.23 E+6	0.438	0.522	0.666	0.484	0.097
5	1.35 E+6	0.071	0.095	0.145	0.058	-0.160
6	8.21 E+5	0.214	0.236	0.378	0.237	-0.317
7	3.88 E+5	0.686	0.768	0.965	0.675	0.042
8	1.83 E+5	0.499	0.550	0.954	0.678	-0.233
9	8.65 E+4	0.464	0.490	0.581	0.413	0.022
10	4.09 E+4	0.863	0.770	0.921	0.815	0.508
11	1.93 E+4	1.716	1.025	1.731	1.595	1.119
12	9.12 E+3	2.515	1.380	2.438	2.319	1.476
13	4.31 E+3	0.316	0.125	0.281	0.276	0.148
14	2.03 E+3	0.273	0.202	0.483	0.515	0.216
15	9.61 E+2	0.055	0.065	0.146	0.147	-0.015
16	4.54 E+2	0.006	0.011	0.034	0.052	0.017
TOTAL		8.830	6.994	10.815	9.136	3.082

TABLE 10.13 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO NICKEL SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	(X 10 ⁻²)				
		FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.022	0.023	0.032	0.029	0.006
2	6.07 E+6	0.101	0.105	0.147	0.118	0.024
3	3.68 E+6	0.251	0.268	0.368	0.278	0.089
4	2.23 E+6	0.183	0.217	0.274	0.195	0.018
5	1.35 E+6	0.019	0.030	0.053	0.016	-0.092
6	8.21 E+5	0.090	0.106	0.175	0.114	-0.185
7	3.88 E+5	0.314	0.358	0.459	0.307	-0.132
8	1.83 E+5	0.373	0.405	0.676	0.498	0.116
9	8.65 E+4	0.721	0.748	0.870	0.684	0.232
10	4.09 E+4	2.268	2.005	2.390	2.151	1.334
11	1.93 E+4	2.344	2.163	1.863	1.533	0.464
12	9.12 E+3	0.927	0.446	0.935	0.901	0.598
13	4.31 E+3	0.199	0.072	0.196	0.212	0.125
14	2.03 E+3	0.346	0.257	0.620	0.668	0.278
15	9.61 E+2	0.091	0.107	0.239	0.240	-0.022
16	4.54 E+2	0.011	0.021	0.064	0.097	0.030
TOTAL		8.259	7.331	9.361	8.039	2.883

TABLE 10.14 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO SODIUM CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.012	0.017	0.021	0.015	0.021
2	6.07 E+6	0.003	0.005	0.005	0.003	0.005
3	3.68 E+6	0.000	0.000	0.001	0.000	0.001
4	2.23 E+6	0.000	0.001	0.001	0.000	0.001
5	1.35 E+6	0.000	0.001	0.001	0.000	0.001
6	8.21 E+5	0.001	0.002	0.002	0.001	0.002
7	3.88 E+5	0.002	0.003	0.003	-0.000	-0.000
8	1.83 E+5	-0.001	-0.000	-0.002	-0.007	-0.009
9	8.65 E+4	-0.006	-0.007	-0.009	-0.013	-0.019
10	4.09 E+4	-0.012	-0.019	-0.020	-0.020	-0.029
11	1.93 E+4	-0.001	-0.001	-0.002	-0.002	-0.002
12	9.12 E+3	-0.020	-0.024	-0.029	-0.031	-0.037
13	4.31 E+3	-0.274	-0.279	-0.404	-0.481	-0.506
14	2.03 E+3	-0.103	-0.135	-0.252	-0.281	-0.333
15	9.61 E+2	-0.015	-0.024	-0.070	-0.104	-0.134
16	4.54 E+2	-0.002	-0.004	-0.023	-0.064	-0.081
TOTAL		-0.416	-0.466	-0.775	-0.985	-1.121

TABLE 10.15 SENSITIVITY COEFFICIENT OF DOPPLER U02 WITH RESPECT TO SODIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.142	0.179	0.246	0.223	0.151
2	6.07 E+6	0.422	0.495	0.694	0.570	0.273
3	3.68 E+6	0.781	1.007	1.251	0.992	0.319
4	2.23 E+6	0.463	0.772	0.883	0.765	0.019
5	1.35 E+6	0.371	0.586	0.617	0.445	-0.122
6	8.21 E+5	2.097	2.825	3.342	2.475	0.541
7	3.88 E+5	2.423	3.385	3.736	2.811	1.424
8	1.83 E+5	2.072	2.809	4.213	3.102	2.439
9	8.65 E+4	4.030	5.213	5.520	4.216	3.298
10	4.09 E+4	4.437	4.756	5.245	4.638	4.461
11	1.93 E+4	4.264	3.207	4.675	4.169	3.981
12	9.12 E+3	4.221	2.080	4.890	4.914	5.024
13	4.31 E+3	3.037	1.231	3.716	3.331	2.915
14	2.03 E+3	0.746	0.684	1.543	1.696	1.174
15	9.61 E+2	0.078	0.110	0.257	-0.116	-0.116
16	4.54 E+2	0.009	0.021	0.056	0.089	0.036
TOTAL		29.593	29.358	40.885	34.708	25.817

TABLE 10.16 SENSITIVITY COEFFICIENT OF DOPPLER UO2 WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION

GROUP	UP. ENERGY (eV)	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
1	10.0 E+6	0.133	0.103	0.175	0.153	-0.016
2	6.07 E+6	0.246	0.192	0.309	0.320	-0.451
3	3.68 E+6	0.519	0.398	0.653	0.608	-0.801
4	2.23 E+6	0.981	0.901	1.464	1.255	-0.624
5	1.35 E+6	1.091	1.018	1.371	1.112	-1.315
6	8.21 E+5	6.919	5.664	8.139	6.526	1.276
7	3.88 E+5	9.406	7.768	10.711	8.877	3.273
8	1.83 E+5	7.860	6.411	11.823	9.400	5.916
9	8.65 E+4	14.596	12.299	14.529	12.150	7.746
10	4.09 E+4	15.283	11.081	13.269	12.863	9.417
11	1.93 E+4	12.623	7.365	10.243	9.764	7.354
12	9.12 E+3	5.842	3.701	4.993	5.230	4.600
13	4.31 E+3	1.356	-0.057	1.332	1.866	1.349
14	2.03 E+3	2.100	1.506	4.243	5.495	4.405
15	9.61 E+2	0.275	0.240	0.761	0.954	0.038
16	4.54 E+2	0.033	0.044	0.142	0.233	0.090
TOTAL		79.263	58.635	84.156	76.804	42.258

Table 11.1 Component-wise sensitivity of Doppler UO₂ in FCA V-1 assembly with respect to ²³⁸U(n,γ) cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	0.0	1.69E-5	3.85E-5	5.54E-5
2	6.07E+6	0.0	7.31E-5	2.13E-4	2.86E-4
3	3.68E+6	0.0	2.67E-4	9.17E-4	1.18E-3
4	2.23E+6	-1.37E-5	3.86E-4	2.61E-3	2.99E-3
5	1.35E+6	0.0	3.15E-4	7.98E-3	8.30E-3
6	8.21E+5	0.0	9.98E-4	2.76E-2	2.86E-2
7	3.88E+5	0.0	-3.83E-3	3.55E-2	3.17E-2
8	1.83E+5	0.0	-1.36E-2	3.54E-2	2.18E-2
9	8.65E+4	1.00E-9	-3.94E-2	4.47E-2	5.28E-3
10	4.09E+4	1.38E-1	-7.12E-2	1.99E-2	8.69E-2
11	1.93E+4	1.94E-1	-8.46E-2	-1.38E-2	9.53E-2
12	9.12E+3	2.04E-1	-7.14E-2	-3.01E-2	1.03E-1
13	4.31E+3	1.57E-1	-4.09E-2	-2.81E-2	8.80E-2
14	2.03E+3	2.20E-1	-4.25E-2	-5.89E-2	1.19E-1
15	9.61E+2	7.92E-2	-1.43E-2	-2.89E-2	3.59E-2
16	4.54E+2	9.27E-3	-1.22E-3	-4.38E-3	3.67E-3
Total		1.00E+0	-3.81E-1	1.06E-2	6.32E-1

Table 11.2 Component-wise sensitivity of Doppler UO₂ in FCA VI-2 assembly with respect to ²³⁸U(n,γ) cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	0.0	1.67E-5	3.58E-5	5.25E-5
2	6.07E+6	0.0	7.46E-5	2.10E-4	2.84E-4
3	3.68E+6	0.0	2.46E-4	8.61E-4	1.11E-3
4	2.23E+6	-7.30E-7	4.01E-4	2.51E-3	2.91E-3
5	1.35E+6	3.09E-7	2.40E-4	7.87E-3	8.11E-3
6	8.21E+5	-6.21E-7	1.72E-3	2.62E-2	2.79E-2
7	3.88E+5	0.0	3.51E-5	3.57E-2	3.57E-2
8	1.83E+5	7.00E-7	-9.57E-3	3.44E-2	2.48E-2
9	8.65E+4	1.84E-6	-3.10E-2	4.46E-2	1.36E-2
10	4.09E+4	5.40E-2	-6.55E-2	3.39E-2	2.23E-2
11	1.93E+4	8.20E-2	-8.61E-2	5.74E-3	1.58E-3
12	9.12E+3	1.11E-1	-8.87E-2	-1.44E-2	7.80E-3
13	4.31E+3	1.11E-1	-6.32E-2	-2.14E-2	2.68E-2
14	2.03E+3	2.82E-1	-1.12E-1	-9.56E-2	7.44E-2
15	9.61E+2	2.50E-1	-7.95E-2	-1.26E-1	4.54E-2
16	4.54E+2	1.09E-1	-2.95E-2	-8.87E-2	-8.86E-3
Total		1.00E+0	-5.62E-1	-1.54E-1	2.84E-1

Table 11.3 Component-wise sensitivity of Doppler UO_2 in ZPPR-9 assembly with respect to $^{238}U(n,\gamma)$ cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	0.0	1.58E-6	1.72E-5	1.88E-5
2	6.07E+6	0.0	-7.18E-6	1.09E-4	1.02E-4
3	3.68E+6	0.0	-7.76E-5	5.64E-4	4.87E-4
4	2.23E+6	0.0	-5.26E-4	1.70E-3	1.18E-3
5	1.35E+6	0.0	-2.14E-3	4.74E-3	2.60E-3
6	8.21E+5	0.0	-6.83E-3	1.16E-2	4.81E-3
7	3.88E+5	-2.00E-8	-1.45E-2	1.44E-2	-5.45E-5
8	1.83E+5	0.0	-3.07E-2	1.77E-2	-1.30E-2
9	8.65E+4	1.00E-9	-6.29E-2	2.13E-2	-4.16E-2
10	4.09E+4	4.57E-2	-1.10E-1	1.34E-2	-5.08E-2
11	1.93E+4	7.09E-2	-1.24E-1	-5.32E-3	-5.85E-2
12	9.12E+3	9.97E-2	-1.17E-1	-1.94E-2	-3.63E-2
13	4.31E+3	9.76E-2	-7.54E-2	-2.28E-2	-5.77E-4
14	2.03E+3	2.83E-1	-1.49E-1	-1.06E-1	2.82E-2
15	9.61E+2	2.77E-1	-1.09E-1	-1.52E-1	1.59E-2
16	4.54E+2	1.27E-1	-4.25E-2	-1.15E-1	-3.07E-2
Total		1.00E+0	-8.44E-1	-3.34E-1	-1.78E-1

Table 12.1 Component-wise sensitivity of Doppler UO_2 in FCA V-1 assembly with respect to $^{239}Pu(n,f)$ cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-2.21E-3	4.47E-4	-1.09E-3	-2.85E-3
2	6.07E+6	-7.51E-3	1.10E-3	-3.90E-3	-1.03E-2
3	3.68E+6	-1.80E-2	2.31E-3	-8.88E-3	-2.46E-2
4	2.23E+6	-2.39E-2	1.37E-3	-1.19E-2	-3.44E-2
5	1.35E+6	-2.57E-2	9.14E-4	-1.38E-2	-3.86E-2
6	8.21E+5	-5.45E-2	1.16E-4	-3.20E-2	-8.63E-2
7	3.88E+5	-5.87E-2	-7.28E-3	-3.67E-2	-1.03E-1
8	1.83E+5	-4.56E-2	-1.57E-2	-2.98E-2	-9.10E-2
9	8.65E+4	-4.22E-2	-2.74E-2	-2.88E-2	-9.84E-2
10	4.09E+4	-2.60E-2	-3.34E-2	-2.42E-3	-6.18E-2
11	1.93E+4	-1.57E-2	-3.46E-2	1.67E-2	-3.35E-2
12	9.12E+3	-7.38E-3	-2.74E-2	2.08E-2	-1.40E-2
13	4.31E+3	-3.44E-3	-1.81E-2	1.93E-2	-2.22E-3
14	2.03E+3	-3.36E-3	-2.05E-2	4.49E-2	2.10E-2
15	9.61E+2	-9.96E-4	-8.14E-3	2.55E-2	1.63E-2
16	4.54E+2	-1.56E-4	-1.02E-3	5.20E-3	4.02E-3
Total		-3.35E-1	-1.87E-1	-3.70E-2	-5.59E-1

Table 12.2 Component-wise sensitivity of Doppler UO₂ in FCA VI-2 assembly with respect to ²³⁹Pu(n,f) cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-1.48E-3	1.28E-3	1.33E-3	1.13E-3
2	6.07E+6	-4.78E-3	3.90E-3	4.53E-3	3.65E-3
3	3.68E+6	-1.19E-2	9.24E-3	1.02E-2	7.58E-3
4	2.23E+6	-1.57E-2	1.08E-2	1.27E-2	7.85E-3
5	1.35E+6	-1.71E-2	1.13E-2	1.29E-2	7.10E-3
6	8.21E+5	-3.68E-2	2.29E-2	2.02E-2	6.27E-3
7	3.88E+5	-4.31E-2	1.92E-2	1.55E-2	-8.31E-3
8	1.83E+5	-3.93E-2	7.39E-3	1.06E-2	-2.14E-2
9	8.65E+4	-3.58E-2	-6.12E-3	4.68E-3	-3.72E-2
10	4.09E+4	-2.87E-2	-2.03E-2	1.23E-2	-3.67E-2
11	1.93E+4	-1.93E-2	-2.86E-2	2.18E-2	-2.61E-2
12	9.12E+3	-1.25E-2	-3.03E-2	2.86E-2	-1.42E-2
13	4.31E+3	-7.39E-3	-2.40E-2	2.89E-2	-2.45E-3
14	2.03E+3	-1.41E-2	-5.36E-2	1.42E-1	7.40E-2
15	9.61E+2	-9.76E-3	-4.80E-2	1.97E-1	1.40E-1
16	4.54E+2	-5.57E-3	-2.53E-2	1.87E-1	1.56E-1
Total		-3.03E-1	-1.50E-1	7.10E-1	2.57E-1

Table 12.3 Component-wise sensitivity of Doppler UO₂ in ZPPR-9 assembly with respect to ²³⁹Pu(n,f) cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-3.54E-3	-1.03E-3	-3.90E-3	-8.47E-3
2	6.07E+6	-1.15E-2	-3.88E-3	-1.29E-2	-2.83E-2
3	3.68E+6	-2.77E-2	-8.71E-3	-2.96E-2	-6.60E-2
4	2.23E+6	-3.65E-2	-1.30E-2	-3.93E-2	-8.88E-2
5	1.35E+6	-4.01E-2	-1.56E-2	-4.36E-2	-9.93E-2
6	8.21E+5	-8.86E-2	-2.89E-2	-8.82E-2	-2.06E-1
7	3.88E+5	-1.06E-1	-3.17E-2	-9.61E-2	-2.33E-1
8	1.83E+5	-1.05E-1	-3.05E-2	-8.64E-2	-2.22E-1
9	8.65E+4	-8.88E-2	-2.74E-2	-6.55E-2	-1.82E-1
10	4.09E+4	-7.71E-2	-2.80E-2	-4.00E-2	-1.45E-1
11	1.93E+4	-5.21E-2	-2.49E-2	-7.96E-3	-8.50E-2
12	9.12E+3	-3.44E-2	-2.20E-2	1.06E-2	-4.58E-2
13	4.31E+3	-1.91E-2	-1.52E-2	1.59E-2	-1.84E-2
14	2.03E+3	-4.49E-2	-3.70E-2	1.27E-1	4.48E-2
15	9.61E+2	-3.42E-2	-2.86E-2	2.17E-1	1.54E-1
16	4.54E+2	-2.25E-2	-6.25E-3	2.32E-1	2.04E-1
Total		-7.92E-1	-3.23E-1	8.87E-2	-1.03E+0

TABLE 13.1 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO U-235 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	-0.298	-0.306	-0.738
2	6.07 E+6	-0.891	-0.861	-2.082
3	3.68 E+6	-2.137	-1.959	-4.666
4	2.23 E+6	-3.023	-2.611	-6.260
5	1.35 E+6	-3.767	-3.143	-7.580
6	8.21 E+5	-8.806	-7.438	-15.881
7	3.88 E+5	-12.427	-9.887	-20.460
8	1.83 E+5	-10.275	-9.510	-17.649
9	8.65 E+4	-8.851	-9.734	-17.668
10	4.09 E+4	-5.494	-7.158	-13.515
11	1.93 E+4	-3.120	-4.660	-7.868
12	9.12 E+3	-2.945	-2.435	-4.020
13	4.31 E+3	-2.757	-1.078	-1.816
14	2.03 E+3	0.617	-1.224	-1.696
15	9.61 E+2	3.145	-0.052	0.219
16	4.54 E+2	0.495	0.065	0.449
TOTAL		-60.533	-61.993	-121.230

TABLE 13.2 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO U-235 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.000	0.000	0.000
2	6.07 E+6	0.003	0.003	0.008
3	3.68 E+6	0.035	0.044	0.107
4	2.23 E+6	0.084	0.112	0.284
5	1.35 E+6	0.073	0.119	0.313
6	8.21 E+5	0.185	0.299	0.711
7	3.88 E+5	0.089	0.559	1.390
8	1.83 E+5	-0.502	0.669	1.625
9	8.65 E+4	-0.987	0.786	1.963
10	4.09 E+4	-1.695	0.659	1.801
11	1.93 E+4	-1.508	0.513	1.298
12	9.12 E+3	-1.317	0.358	0.864
13	4.31 E+3	-1.177	0.207	0.492
14	2.03 E+3	-4.980	0.182	0.417
15	9.61 E+2	-1.299	0.014	-0.072
16	4.54 E+2	-0.252	-0.033	-0.233
TOTAL		-13.247	4.490	10.969

TABLE 13.3 SENSITIVITY COEFFICIENT OF DOPPLER, IRON WITH RESPECT TO U-238 FISSION CROSS SECTION

GROUP	UP. ENERGY (eV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	-1.708	-1.849	-1.926
2	6.07 E+6	-4.435	-4.576	-4.798
3	3.68 E+6	-8.573	-8.891	-9.008
4	2.23 E+6	-9.065	-9.189	-9.570
5	1.35 E+6	-1.079	-1.029	-1.119
6	8.21 E+5	-0.110	-0.106	-0.111
7	3.88 E+5	-0.018	-0.017	-0.018
8	1.83 E+5	-0.008	-0.008	-0.008
9	8.65 E+4	-0.006	-0.006	-0.006
10	4.09 E+4	-0.004	-0.004	-0.004
11	1.93 E+4	-0.002	-0.002	-0.003
12	9.12 E+3	-0.001	-0.001	-0.001
13	4.31 E+3	-0.000	0.	0.
14	2.03 E+3	-0.000	0.001	0.002
15	9.61 E+2	0.001	0.004	0.009
16	4.54 E+2	0.000	0.000	0.000
TOTAL		-25.007	-25.674	-26.562

TABLE 13.4 SENSITIVITY COEFFICIENT OF DOPPLER, IRON WITH RESPECT TO U-238 CAPTURE CROSS SECTION

GROUP	UP. ENERGY (eV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.005	0.005	0.005
2	6.07 E+6	0.027	0.027	0.028
3	3.68 E+6	0.113	0.115	0.110
4	2.23 E+6	0.311	0.297	0.295
5	1.35 E+6	0.811	0.745	0.784
6	8.21 E+5	2.770	2.487	2.625
7	3.88 E+5	3.116	2.710	3.284
8	1.83 E+5	2.022	1.340	1.929
9	8.65 E+4	1.209	0.049	0.470
10	4.09 E+4	-1.327	-2.022	-2.308
11	1.93 E+4	-2.015	-3.668	-4.513
12	9.12 E+3	-2.249	-4.479	-6.307
13	4.31 E+3	-1.977	-3.474	-4.653
14	2.03 E+3	-6.049	-14.121	-19.293
15	9.61 E+2	-1.599	-4.913	-9.126
16	4.54 E+2	-0.204	-1.178	-3.856
TOTAL		-5.036	-26.081	-40.525

TABLE 13.5 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO U-238 SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)			
		FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	1.132	1.248	1.279	
2	6.07 E+6	2.179	2.456	2.336	
3	3.68 E+6	5.289	6.110	5.434	
4	2.23 E+6	6.911	7.790	5.979	
5	1.35 E+6	0.766	1.432	-0.446	
6	8.21 E+5	-1.996	-0.915	-3.006	
7	3.88 E+5	-0.183	0.367	-1.961	
8	1.83 E+5	0.640	1.862	0.331	
9	8.65 E+4	1.969	2.125	0.709	
10	4.09 E+4	1.199	0.820	0.285	
11	1.93 E+4	0.853	0.787	0.589	
12	9.12 E+3	0.435	0.464	0.478	
13	4.31 E+3	0.237	0.278	0.334	
14	2.03 E+3	0.613	0.360	0.036	
15	9.61 E+2	0.132	0.271	0.263	
16	4.54 E+2	0.015	0.058	0.095	
TOTAL		20.191	25.513	12.737	

TABLE 13.6 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO PU-239 FISSION CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)			
		FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	-0.320	-0.271	0.098	
2	6.07 E+6	-1.165	-0.959	0.312	
3	3.68 E+6	-2.812	-2.376	0.672	
4	2.23 E+6	-3.983	-3.348	0.642	
5	1.35 E+6	-4.564	-3.877	0.580	
6	8.21 E+5	-9.858	-9.560	0.630	
7	3.88 E+5	-11.545	-11.731	-0.551	
8	1.83 E+5	-7.735	-9.290	-0.302	
9	8.65 E+4	-5.690	-5.599	1.234	
10	4.09 E+4	-2.641	-2.755	1.282	
11	1.93 E+4	-1.243	-2.626	-0.172	
12	9.12 E+3	-1.141	-2.848	-0.417	
13	4.31 E+3	-1.073	-2.644	-1.679	
14	2.03 E+3	1.225	8.173	11.039	
15	9.61 E+2	1.939	11.419	16.384	
16	4.54 E+2	0.339	3.404	8.769	
TOTAL		-50.265	-34.891	38.522	

TABLE 13.7 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO PU-239 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)			
		FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	0.000	0.000	-0.000	
2	6.07 E+6	0.000	0.000	-0.000	
3	3.68 E+6	0.006	0.003	-0.006	
4	2.23 E+6	0.016	0.005	-0.019	
5	1.35 E+6	0.019	0.000	-0.039	
6	8.21 E+5	0.074	-0.000	-0.150	
7	3.88 E+5	0.021	-0.204	-0.425	
8	1.83 E+5	-0.262	-0.758	-0.770	
9	8.65 E+4	-0.482	-1.254	-1.186	
10	4.09 E+4	-0.941	-1.758	-1.737	
11	1.93 E+4	-1.000	-2.308	-2.092	
12	9.12 E+3	-1.131	-2.989	-2.879	
13	4.31 E+3	-1.046	-2.858	-2.673	
14	2.03 E+3	-4.206	-12.350	-11.583	
15	9.61 E+2	-1.155	-5.436	-7.181	
16	4.54 E+2	-0.235	-1.785	-4.197	
TOTAL		-10.323	-31.692	-34.937	

TABLE 13.8 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO PU-240 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)			
		FCA V-2	FCA VI-1	FCA VI-2	
1	10.0 E+6	0.000	0.000	-0.000	
2	6.07 E+6	0.000	0.000	-0.000	
3	3.68 E+6	0.001	0.001	-0.001	
4	2.23 E+6	0.003	0.001	-0.003	
5	1.35 E+6	0.003	0.000	-0.005	
6	8.21 E+5	0.010	-0.000	-0.020	
7	3.88 E+5	0.002	-0.020	-0.042	
8	1.83 E+5	-0.029	-0.083	-0.085	
9	8.65 E+4	-0.059	-0.154	-0.146	
10	4.09 E+4	-0.109	-0.204	-0.201	
11	1.93 E+4	-0.101	-0.233	-0.211	
12	9.12 E+3	-0.093	-0.237	-0.227	
13	4.31 E+3	-0.074	-0.195	-0.178	
14	2.03 E+3	-0.330	-1.044	-0.966	
15	9.61 E+2	-0.101	-0.405	-0.510	
16	4.54 E+2	-0.024	-0.182	-0.436	
TOTAL		-0.899	-2.756	-3.031	

TABLE 13.9 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO PU-241 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	-0.003	-0.002	0.001
2	6.07 E+6	-0.010	-0.008	0.002
3	3.68 E+6	-0.024	-0.020	0.005
4	2.23 E+6	-0.036	-0.030	0.005
5	1.35 E+6	-0.043	-0.036	0.005
6	8.21 E+5	-0.096	-0.092	0.006
7	3.88 E+5	-0.136	-0.138	-0.005
8	1.83 E+5	-0.108	-0.128	-0.003
9	8.65 E+4	-0.085	-0.082	0.017
10	4.09 E+4	-0.045	-0.046	0.020
11	1.93 E+4	-0.024	-0.049	-0.002
12	9.12 E+3	-0.024	-0.062	-0.007
13	4.31 E+3	-0.024	-0.053	-0.030
14	2.03 E+3	0.030	0.205	0.231
15	9.61 E+2	0.037	0.209	0.247
16	4.54 E+2	0.008	0.081	0.163
TOTAL		-0.583	-0.252	0.657

TABLE 13.10 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO IRON CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.058	0.071	0.051
2	6.07 E+6	0.059	0.070	0.040
3	3.68 E+6	0.034	0.037	0.013
4	2.23 E+6	0.015	0.016	0.008
5	1.35 E+6	0.008	0.014	0.005
6	8.21 E+5	-0.056	-0.013	0.023
7	3.88 E+5	6.840	5.799	4.123
8	1.83 E+5	23.619	17.893	12.916
9	8.65 E+4	15.679	16.521	11.727
10	4.09 E+4	18.225	10.008	8.789
11	1.93 E+4	5.797	2.964	2.455
12	9.12 E+3	0.342	-0.014	-0.239
13	4.31 E+3	-0.022	-0.043	-0.045
14	2.03 E+3	26.783	41.414	52.770
15	9.61 E+2	-0.049	-0.100	-0.177
16	4.54 E+2	-0.008	-0.039	-0.087
TOTAL		97.324	94.598	92.372

TABLE 13.11 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO IRON SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.389	0.519	0.453
2	6.07 E+6	1.184	1.527	1.196
3	3.68 E+6	1.999	2.609	1.872
4	2.23 E+6	2.025	2.306	1.759
5	1.35 E+6	2.325	2.227	1.280
6	8.21 E+5	1.764	1.881	1.277
7	3.88 E+5	3.835	3.485	2.524
8	1.83 E+5	1.386	2.570	1.653
9	8.65 E+4	2.937	2.351	2.011
10	4.09 E+4	3.490	3.345	3.039
11	1.93 E+4	2.159	3.517	3.795
12	9.12 E+3	2.391	2.395	2.667
13	4.31 E+3	3.346	2.469	3.810
14	2.03 E+3	-1.756	-2.769	-6.316
15	9.61 E+2	0.255	0.580	0.842
16	4.54 E+2	0.025	0.090	0.138
TOTAL		27.757	29.104	22.001

TABLE 13.12 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.060	0.081	0.072
2	6.07 E+6	0.170	0.236	0.190
3	3.68 E+6	0.581	0.779	0.593
4	2.23 E+6	0.640	0.730	0.499
5	1.35 E+6	0.139	0.163	0.095
6	8.21 E+5	0.302	0.412	0.233
7	3.88 E+5	0.796	0.905	0.535
8	1.83 E+5	0.732	0.977	0.557
9	8.65 E+4	0.451	0.458	0.295
10	4.09 E+4	0.294	0.445	0.444
11	1.93 E+4	0.720	1.177	1.245
12	9.12 E+3	1.728	2.499	2.651
13	4.31 E+3	0.272	0.394	0.428
14	2.03 E+3	0.020	-0.243	-0.577
15	9.61 E+2	0.030	0.068	0.091
16	4.54 E+2	0.003	0.009	0.014
TOTAL		6.936	9.090	7.323

TABLE 13.13 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO NICKEL SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.024	0.032	0.028
2	6.07 E+6	0.112	0.147	0.114
3	3.68 E+6	0.283	0.367	0.273
4	2.23 E+6	0.285	0.300	0.201
5	1.35 E+6	0.055	0.065	0.017
6	8.21 E+5	0.152	0.205	0.118
7	3.88 E+5	0.422	0.471	0.260
8	1.83 E+5	0.300	0.470	0.283
9	8.65 E+4	0.526	0.515	0.360
10	4.09 E+4	0.725	1.128	1.154
11	1.93 E+4	1.118	1.166	1.105
12	9.12 E+3	0.693	1.017	1.072
13	4.31 E+3	0.209	0.312	0.344
14	2.03 E+3	0.006	-0.345	-0.789
15	9.61 E+2	0.050	0.111	0.145
16	4.54 E+2	0.005	0.017	0.025
TOTAL		4.945	5.976	4.711

TABLE 13.14 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO SODIUM CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.018	0.022	0.015
2	6.07 E+6	0.005	0.005	0.003
3	3.68 E+6	0.001	0.001	0.000
4	2.23 E+6	0.001	0.001	0.000
5	1.35 E+6	0.000	0.001	0.000
6	8.21 E+5	0.002	0.002	0.000
7	3.88 E+5	0.001	0.001	-0.002
8	1.83 E+5	-0.009	-0.009	-0.012
9	8.65 E+4	-0.011	-0.013	-0.018
10	4.09 E+4	-0.013	-0.015	-0.019
11	1.93 E+4	-0.001	-0.001	-0.001
12	9.12 E+3	-0.010	-0.015	-0.022
13	4.31 E+3	-0.139	-0.221	-0.306
14	2.03 E+3	-0.116	-0.218	-0.290
15	9.61 E+2	-0.011	-0.028	-0.052
16	4.54 E+2	-0.001	-0.007	-0.023
TOTAL		-0.285	-0.494	-0.725

TABLE 13.15 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO SODIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.189	0.247	0.220
2	6.07 E+6	0.535	0.690	0.551
3	3.68 E+6	0.978	1.183	0.931
4	2.23 E+6	1.024	1.051	0.843
5	1.35 E+6	0.953	0.827	0.535
6	8.21 E+5	3.395	3.600	2.411
7	3.88 E+5	3.346	3.339	2.180
8	1.83 E+5	1.035	2.031	1.345
9	8.65 E+4	2.248	2.033	1.699
10	4.09 E+4	1.355	2.300	2.386
11	1.93 E+4	2.262	3.190	3.259
12	9.12 E+3	4.280	5.668	6.101
13	4.31 E+3	4.869	6.609	5.430
14	2.03 E+3	-0.221	-1.316	-2.465
15	9.61 E+2	0.063	0.152	0.252
16	4.54 E+2	0.005	0.015	0.024
TOTAL		26.317	31.620	25.701

TABLE 13.16 SENSITIVITY COEFFICIENT OF DOPPLER IRON WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X 10 ⁻²)		
		FCA V-2	FCA VI-1	FCA VI-2
1	10.0 E+6	0.111	0.175	0.149
2	6.07 E+6	0.197	0.293	0.282
3	3.68 E+6	0.380	0.607	0.548
4	2.23 E+6	1.386	1.829	1.456
5	1.35 E+6	1.660	1.829	1.325
6	8.21 E+5	7.649	9.571	6.997
7	3.88 E+5	7.415	9.356	6.906
8	1.83 E+5	1.719	5.047	3.724
9	8.65 E+4	3.664	4.224	4.224
10	4.09 E+4	2.150	5.293	6.267
11	1.93 E+4	3.433	6.300	6.949
12	9.12 E+3	2.772	4.618	5.132
13	4.31 E+3	1.350	2.389	3.011
14	2.03 E+3	-1.671	-5.726	-9.682
15	9.61 E+2	0.131	0.458	0.887
16	4.54 E+2	0.009	0.037	0.063
TOTAL		32.355	46.300	38.237

TABLE 14.1 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO U-235 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO			(X 10 ⁻²)
		FCA V-1	FCA VI-1	FCA VI-2	
1	10.0 E+6	-0.344	-0.306	-0.734	
2	6.07 E+6	-1.044	-0.861	-2.072	
3	3.68 E+6	-2.473	-1.957	-4.648	
4	2.23 E+6	-3.397	-2.610	-6.240	
5	1.35 E+6	-4.265	-3.141	-7.561	
6	8.21 E+5	-10.437	-7.427	-15.836	
7	3.88 E+5	-14.304	-9.894	-20.306	
8	1.83 E+5	-12.533	-9.580	-17.533	
9	8.65 E+4	-9.601	-9.874	-17.574	
10	4.09 E+4	-4.882	-7.304	-13.528	
11	1.93 E+4	-3.748	-4.784	-7.913	
12	9.12 E+3	-3.904	-2.507	-4.067	
13	4.31 E+3	-3.612	-1.112	-1.838	
14	2.03 E+3	0.677	-1.215	-1.616	
15	9.61 E+2	2.643	-0.023	0.322	
16	4.54 E+2	0.338	0.079	0.542	
TOTAL		-70.883	-62.516	-120.603	

TABLE 14.2 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO U-235 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO			(X 10 ⁻²)
		FCA V-1	FCA VI-1	FCA VI-2	
1	10.0 E+6	0.000	0.000	0.000	
2	6.07 E+6	0.003	0.003	0.008	
3	3.68 E+6	0.042	0.044	0.107	
4	2.23 E+6	0.094	0.112	0.284	
5	1.35 E+6	0.084	0.119	0.312	
6	8.21 E+5	0.205	0.297	0.705	
7	3.88 E+5	0.048	0.551	1.352	
8	1.83 E+5	-0.650	0.654	1.559	
9	8.65 E+4	-1.776	0.762	1.873	
10	4.09 E+4	-1.894	0.639	1.736	
11	1.93 E+4	-1.709	0.503	1.272	
12	9.12 E+3	-1.667	0.358	0.867	
13	4.31 E+3	-1.571	0.209	0.494	
14	2.03 E+3	-6.107	0.162	0.359	
15	9.61 E+2	-1.119	0.005	-0.104	
16	4.54 E+2	-0.182	-0.039	-0.279	
TOTAL		-16.199	4.380	10.546	

TABLE 14.3 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO U-238 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	-1.825	-1.846	-1.957
2	6.07 E+6	-4.783	-4.572	-4.894
3	3.68 E+6	-9.217	-8.890	-9.228
4	2.23 E+6	-9.518	-9.196	-9.739
5	1.35 E+6	-1.120	-1.029	-1.144
6	8.21 E+5	-0.118	-0.106	-0.114
7	3.88 E+5	-0.018	-0.017	-0.018
8	1.83 E+5	-0.008	-0.008	-0.008
9	8.65 E+4	-0.006	-0.006	-0.006
10	4.09 E+4	-0.003	-0.004	-0.004
11	1.93 E+4	-0.002	-0.003	-0.003
12	9.12 E+3	-0.001	-0.001	-0.002
13	4.31 E+3	0	0	0
14	2.03 E+3	-0.000	0.001	0.003
15	9.61 E+2	0.001	0.005	0.010
16	4.54 E+2	0.000	0.000	0.000
TOTAL		-25.619	-25.672	-27.104

(X10⁻²)

TABLE 14.4 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO U-238 CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.005	0.005	0.005
2	6.07 E+6	0.029	0.027	0.029
3	3.68 E+6	0.122	0.114	0.116
4	2.23 E+6	0.321	0.296	0.308
5	1.35 E+6	0.834	0.747	0.832
6	8.21 E+5	2.831	2.494	2.795
7	3.88 E+5	3.022	2.749	3.001
8	1.83 E+5	1.788	1.502	2.003
9	8.65 E+4	-0.416	-0.015	0.240
10	4.09 E+4	-1.908	-2.300	-2.278
11	1.93 E+4	-2.591	-4.059	-5.239
12	9.12 E+3	-2.868	-5.020	-6.667
13	4.31 E+3	-2.325	-3.902	-5.881
14	2.03 E+3	-6.874	-16.422	-26.144
15	9.61 E+2	-1.334	-5.230	-9.914
16	4.54 E+2	-0.132	-1.252	-4.269
TOTAL		-9.497	-30.265	-51.061

(X10⁻²)

TABLE 14.5 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO U-238 SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	1.279	1.252	1.345
2	6.07 E+6	2.517	2.456	2.480
3	3.68 E+6	6.161	6.084	5.768
4	2.23 E+6	8.023	8.008	6.626
5	1.35 E+6	1.262	1.491	-0.162
6	8.21 E+5	-1.618	-0.847	-2.716
7	3.88 E+5	0.337	0.440	-1.368
8	1.83 E+5	1.528	2.332	1.106
9	8.65 E+4	2.847	2.545	1.407
10	4.09 E+4	1.515	0.925	0.499
11	1.93 E+4	1.456	0.961	0.865
12	9.12 E+3	0.726	0.527	0.650
13	4.31 E+3	0.502	0.373	0.698
14	2.03 E+3	0.921	0.558	0.342
15	9.61 E+2	0.138	0.288	0.286
16	4.54 E+2	0.013	0.062	0.103
TOTAL		27.605	27.455	17.929

(X10⁻²)

TABLE 14.6 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO PU-239 FISSION CROSS SECTION

GROUP	UP. ENERGY(EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	-0.280	-0.272	0.103
2	6.07 E+6	-1.031	-0.959	0.327
3	3.68 E+6	-2.455	-2.380	0.677
4	2.23 E+6	-3.368	-3.360	0.705
5	1.35 E+6	-3.901	-3.880	0.612
6	8.21 E+5	-8.857	-9.551	0.526
7	3.88 E+5	-10.051	-11.858	1.354
8	1.83 E+5	-7.194	-10.202	-0.552
9	8.65 E+4	-4.464	-6.850	0.702
10	4.09 E+4	-1.656	-3.790	-0.230
11	1.93 E+4	-1.160	-3.617	-0.819
12	9.12 E+3	-1.148	-3.683	-1.737
13	4.31 E+3	-1.151	-3.222	-2.185
14	2.03 E+3	0.952	9.996	14.149
15	9.61 E+2	1.324	12.106	17.723
16	4.54 E+2	0.175	3.603	9.716
TOTAL		-44.263	-37.918	41.072

(X10⁻²)

TABLE 14.7 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO CAPTURE CROSS SECTION

(X10⁻³)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.000	0.000	-0.000
2	6.07 E+6	0.000	0.000	-0.000
3	3.68 E+6	0.005	0.003	-0.006
4	2.23 E+6	0.013	0.005	-0.020
5	1.35 E+6	0.017	0.001	-0.039
6	8.21 E+5	0.062	0.003	-0.145
7	3.88 E+5	0.000	-0.179	-0.526
8	1.83 E+5	-0.249	-0.682	-0.780
9	8.65 E+4	-0.638	-1.251	-1.254
10	4.09 E+4	-0.786	-1.823	-1.760
11	1.93 E+4	-0.860	-2.448	-2.302
12	9.12 E+3	-1.052	-3.275	-3.029
13	4.31 E+3	-1.096	-3.167	-3.283
14	2.03 E+3	-3.667	-14.299	-15.576
15	9.61 E+2	-0.899	-5.773	-7.786
16	4.54 E+2	-0.126	-1.892	-4.636
TOTAL		-9.275	-34.778	-41.142

TABLE 14.8 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO CAPTURE CROSS SECTION

(X10⁻³)

GROUP	UP. ENERGY(EV)	FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.000	0.000	-0.000
2	6.07 E+6	0.000	0.000	-0.000
3	3.68 E+6	0.001	0.001	-0.001
4	2.23 E+6	0.002	0.001	-0.003
5	1.35 E+6	0.002	0.000	-0.005
6	8.21 E+5	0.008	0.000	-0.020
7	3.88 E+5	0.000	-0.018	-0.052
8	1.83 E+5	-0.028	-0.075	-0.086
9	8.65 E+4	-0.079	-0.153	-0.154
10	4.09 E+4	-0.092	-0.212	-0.204
11	1.93 E+4	-0.088	-0.247	-0.232
12	9.12 E+3	-0.084	-0.259	-0.239
13	4.31 E+3	-0.075	-0.216	-0.218
14	2.03 E+3	-0.304	-1.209	-1.299
15	9.61 E+2	-0.068	-0.430	-0.553
16	4.54 E+2	-0.013	-0.193	-0.482
TOTAL		-0.816	-3.011	-3.548

TABLE 14.9 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO PU-241 FISSION CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)			
		FCA V-1	FCA VI-1	FCA VI-2	FCA VI-2
1	10.0 E+6	-0.003	-0.002	0.001	0.001
2	6.07 E+6	-0.009	-0.008	0.002	0.002
3	3.68 E+6	-0.022	-0.020	0.005	0.005
4	2.23 E+6	-0.032	-0.030	0.006	0.006
5	1.35 E+6	-0.038	-0.036	0.005	0.005
6	8.21 E+5	-0.090	-0.092	0.005	0.005
7	3.88 E+5	-0.125	-0.140	0.015	0.015
8	1.83 E+5	-0.105	-0.141	-0.006	-0.006
9	8.65 E+4	-0.070	-0.101	0.010	0.010
10	4.09 E+4	-0.029	-0.064	-0.002	-0.002
11	1.93 E+4	-0.023	-0.068	-0.012	-0.012
12	9.12 E+3	-0.026	-0.081	-0.032	-0.032
13	4.31 E+3	-0.024	-0.065	-0.039	-0.039
14	2.03 E+3	0.027	0.251	0.297	0.297
15	9.61 E+2	0.025	0.222	0.267	0.267
16	4.54 E+2	0.004	0.086	0.181	0.181
TOTAL		-0.541	-0.290	0.703	0.703

TABLE 14.10 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO IRON CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)			
		FCA V-1	FCA VI-1	FCA VI-2	FCA VI-2
1	10.0 E+6	0.051	0.072	0.051	0.051
2	6.07 E+6	0.053	0.071	0.043	0.043
3	3.68 E+6	0.026	0.037	0.020	0.020
4	2.23 E+6	0.012	0.016	0.008	0.008
5	1.35 E+6	0.011	0.015	0.005	0.005
6	8.21 E+5	-0.074	-0.074	0.025	0.025
7	3.88 E+5	7.330	4.538	2.936	2.936
8	1.83 E+5	18.274	13.112	8.700	8.700
9	8.65 E+4	24.297	14.366	9.356	9.356
10	4.09 E+4	9.242	6.767	5.433	5.433
11	1.93 E+4	2.779	1.910	1.421	1.421
12	9.12 E+3	0.085	-0.111	-0.192	-0.192
13	4.31 E+3	-0.022	-0.049	-0.064	-0.064
14	2.03 E+3	20.206	38.678	44.505	44.505
15	9.61 E+2	-0.021	-0.097	-0.180	-0.180
16	4.54 E+2	-0.003	-0.041	-0.141	-0.141
TOTAL		82.247	79.271	71.927	71.927

TABLE 14.11 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO IRON SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.358	0.520	0.464
2	6.07 E+6	1.073	1.522	1.233
3	3.68 E+6	1.760	2.621	1.991
4	2.23 E+6	1.656	2.228	1.756
5	1.35 E+6	1.769	2.193	1.386
6	8.21 E+5	1.322	1.794	1.282
7	3.88 E+5	2.809	3.409	3.045
8	1.83 E+5	1.663	2.978	2.546
9	8.65 E+4	1.714	2.633	2.665
10	4.09 E+4	2.753	3.532	3.427
11	1.93 E+4	2.748	4.052	4.509
12	9.12 E+3	1.850	2.438	3.078
13	4.31 E+3	1.915	2.317	3.981
14	2.03 E+3	-0.322	-2.708	-6.649
15	9.61 E+2	0.155	0.587	0.822
16	4.54 E+2	0.013	0.095	0.147
TOTAL		23.236	30.212	25.683

TABLE 14.12 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO CHROMIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY(EV)	(X10 ⁻²)		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.055	0.081	0.073
2	6.07 E+6	0.160	0.238	0.198
3	3.68 E+6	0.538	0.782	0.617
4	2.23 E+6	0.571	0.738	0.535
5	1.35 E+6	0.113	0.164	0.070
6	8.21 E+5	0.290	0.420	0.266
7	3.88 E+5	0.798	0.972	0.967
8	1.83 E+5	0.678	1.008	0.659
9	8.65 E+4	0.448	0.484	0.348
10	4.09 E+4	0.272	0.496	0.569
11	1.93 E+4	0.969	1.470	1.617
12	9.12 E+3	2.410	3.231	4.105
13	4.31 E+3	0.702	0.829	1.336
14	2.03 E+3	-0.004	-0.374	-0.991
15	9.61 E+2	0.021	0.075	0.102
16	4.54 E+2	0.001	0.010	0.015
TOTAL		8.024	10.623	10.488

TABLE 14.13 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO NICKEL SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.022	0.032	0.028
2	6.07 E+6	0.106	0.148	0.119
3	3.68 E+6	0.263	0.371	0.285
4	2.23 E+6	0.234	0.302	0.216
5	1.35 E+6	0.042	0.064	0.022
6	8.21 E+5	0.142	0.205	0.131
7	3.88 E+5	0.420	0.494	0.332
8	1.83 E+5	0.331	0.539	0.381
9	8.65 E+4	0.465	0.563	0.465
10	4.09 E+4	0.704	1.269	1.402
11	1.93 E+4	1.121	1.321	1.328
12	9.12 E+3	0.993	1.331	1.707
13	4.31 E+3	0.566	0.670	1.120
14	2.03 E+3	-0.028	-0.525	-1.355
15	9.61 E+2	0.034	0.121	0.163
16	4.54 E+2	0.003	0.018	0.028
TOTAL		5.418	6.923	6.374

TABLE 14.14 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO SODIUM CAPTURE CROSS SECTION

GROUP	UP. ENERGY (EV)	WITH RESPECT TO		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.012	0.022	0.015
2	6.07 E+6	0.003	0.005	0.003
3	3.68 E+6	0.000	0.001	0.000
4	2.23 E+6	0.000	0.001	0.000
5	1.35 E+6	0.000	0.001	0.000
6	8.21 E+5	0.001	0.002	0.000
7	3.88 E+5	0.000	0.002	-0.005
8	1.83 E+5	-0.007	-0.007	-0.013
9	8.65 E+4	-0.011	-0.013	-0.020
10	4.09 E+4	-0.008	-0.016	-0.019
11	1.93 E+4	-0.000	-0.001	-0.001
12	9.12 E+3	-0.007	-0.016	-0.023
13	4.31 E+3	-0.113	-0.246	-0.383
14	2.03 E+3	-0.081	-0.253	-0.393
15	9.61 E+2	-0.005	-0.030	-0.057
16	4.54 E+2	-0.001	-0.008	-0.026
TOTAL		-0.215	-0.557	-0.920

TABLE 14.15 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO SODIUM SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.146	0.247	0.223
2	6.07 E+6	0.434	0.692	0.572
3	3.68 E+6	0.725	1.196	0.975
4	2.23 E+6	0.664	1.026	0.852
5	1.35 E+6	0.630	0.796	0.563
6	8.21 E+5	2.483	3.563	2.622
7	3.88 E+5	2.345	3.418	2.522
8	1.83 E+5	1.080	2.525	1.927
9	8.65 E+4	1.109	2.366	2.164
10	4.09 E+4	1.244	2.657	2.913
11	1.93 E+4	2.233	3.741	3.967
12	9.12 E+3	4.096	6.255	8.312
13	4.31 E+3	5.883	7.745	10.571
14	2.03 E+3	-0.070	-1.419	-3.290
15	9.61 E+2	0.033	0.160	0.267
16	4.54 E+2	0.002	0.016	0.026
TOTAL		23.037	34.985	35.186

TABLE 14.16 SENSITIVITY COEFFICIENT OF DOPPLER SS WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION

GROUP	UP. ENERGY (EV)	(X10 ⁻²)		
		FCA V-1	FCA VI-1	FCA VI-2
1	10.0 E+6	0.139	0.176	0.152
2	6.07 E+6	0.251	0.296	0.301
3	3.68 E+6	0.481	0.614	0.575
4	2.23 E+6	1.552	1.775	1.457
5	1.35 E+6	1.853	1.762	1.381
6	8.21 E+5	9.145	9.334	7.481
7	3.88 E+5	8.780	9.613	7.876
8	1.83 E+5	3.500	6.543	5.530
9	8.65 E+4	2.330	5.134	5.505
10	4.09 E+4	3.642	6.184	7.677
11	1.93 E+4	5.843	7.413	8.447
12	9.12 E+3	4.428	5.094	6.961
13	4.31 E+3	2.858	2.772	6.044
14	2.03 E+3	-1.732	-6.384	-13.206
15	9.61 E+2	0.118	0.483	0.935
16	4.54 E+2	0.007	0.039	0.068
TOTAL		43.193	50.849	47.184

Table 15.1 Component-wise sensitivity of Doppler SS in FCA V-1 assembly with respect to $^{239}\text{Pu}(n,f)$ cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-2.21E-3	5.40E-4	-1.16E-3	-2.83E-3
2	6.07E+6	-7.51E-3	1.37E-3	-4.13E-3	-1.03E-2
3	3.68E+6	-1.80E-2	3.00E-3	-9.44E-3	-2.44E-2
4	2.23E+6	-2.39E-2	2.78E-3	-1.25E-2	-3.36E-2
5	1.35E+6	-2.57E-2	1.14E-3	-1.43E-2	-3.89E-2
6	8.21E+5	-5.45E-2	-1.03E-3	-3.31E-2	-8.86E-2
7	3.88E+5	-5.87E-2	-1.10E-2	-3.08E-2	-1.01E-1
8	1.83E+5	-4.56E-2	-1.68E-2	-9.34E-3	-7.17E-2
9	8.65E+4	-4.22E-2	-1.84E-2	1.66E-2	-4.40E-2
10	4.09E+4	-2.60E-2	-1.11E-2	2.14E-2	-1.57E-2
11	1.93E+4	-1.57E-2	-9.11E-3	1.37E-2	-1.10E-2
12	9.12E+3	-7.38E-3	-1.01E-2	6.22E-3	-1.13E-2
13	4.31E+3	-3.44E-3	-1.06E-2	2.70E-3	-1.13E-2
14	2.03E+3	-3.36E-3	-1.81E-2	3.06E-2	9.18E-3
15	9.61E+2	-9.97E-4	4.64E-4	1.35E-2	1.30E-2
16	4.54E+2	-1.56E-4	7.66E-5	1.81E-3	1.73E-3
Total		-3.35E-1	-9.68E-2	-8.14E-3	-4.40E-1

Table 15.2 Component-wise sensitivity of Doppler Fe in FCA VI-1 assembly with respect to $^{239}\text{Pu}(n,f)$ cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-3.37E-3	1.35E-3	-6.43E-4	-2.66E-3
2	6.07E+6	-1.09E-2	3.83E-3	-2.20E-3	-9.30E-3
3	3.68E+6	-2.62E-2	8.63E-3	-5.49E-3	-2.31E-2
4	2.23E+6	-3.42E-2	9.19E-3	-7.62E-3	-3.26E-2
5	1.35E+6	-3.63E-2	7.53E-3	-9.19E-3	-3.79E-2
6	8.21E+5	-7.95E-2	1.27E-2	-2.72E-2	-9.41E-2
7	3.88E+5	-8.69E-2	-2.30E-3	-2.68E-2	-1.16E-1
8	1.83E+5	-7.93E-2	-1.80E-2	5.47E-3	-9.19E-2
9	8.65E+4	-6.66E-2	-2.23E-2	3.35E-2	-5.54E-2
10	4.09E+4	-4.65E-2	-2.17E-2	4.10E-2	-2.72E-2
11	1.93E+4	-3.13E-2	-2.42E-2	2.94E-2	-2.60E-2
12	9.12E+3	-1.83E-2	-2.72E-2	1.71E-2	-2.84E-2
13	4.31E+3	-9.78E-3	-2.54E-2	8.82E-3	-2.64E-2
14	2.03E+3	-1.71E-2	-6.26E-2	1.62E-1	8.18E-2
15	9.61E+2	-8.66E-3	5.37E-3	1.18E-1	1.14E-1
16	4.54E+2	-2.72E-3	1.74E-3	3.50E-2	3.41E-2
Total		-5.58E-1	-1.53E-1	3.70E-1	-3.41E-1

Table 15.3 Component-wise sensitivity of Doppler Fe in FCA VI-2 assembly with respect to $^{239}\text{Pu}(n,f)$ cross section

Group	Up. energy(eV)	Direct	Flux	Adjoint flux	Total
1	10.0 E+6	-1.47E-3	1.49E-3	9.67E-4	9.85E-4
2	6.07E+6	-4.78E-3	4.59E-3	3.32E-3	3.12E-3
3	3.68E+6	-1.19E-2	1.10E-2	7.66E-3	6.72E-3
4	2.23E+6	-1.57E-2	1.32E-2	8.91E-3	6.42E-3
5	1.35E+6	-1.71E-2	1.33E-2	9.54E-3	5.80E-3
6	8.21E+5	-3.68E-2	2.67E-2	1.65E-2	6.30E-3
7	3.88E+5	-4.31E-2	2.23E-2	1.53E-2	-5.51E-3
8	1.83E+5	-3.93E-2	1.21E-2	2.42E-2	-3.02E-3
9	8.65E+4	-3.58E-2	6.62E-3	4.15E-2	1.23E-2
10	4.09E+4	-2.87E-2	-1.12E-4	4.17E-2	1.28E-2
11	1.93E+4	-1.93E-2	-7.60E-3	2.52E-2	-1.72E-3
12	9.12E+3	-1.25E-2	-1.42E-2	2.25E-2	-4.17E-3
13	4.31E+3	-7.40E-3	-1.59E-2	6.52E-3	-1.68E-2
14	2.03E+3	-1.41E-2	-4.33E-2	1.68E-1	1.10E-1
15	9.61E+2	-9.77E-3	1.36E-2	1.60E-1	1.64E-1
16	4.54E+2	-5.58E-3	7.59E-3	8.57E-2	8.77E-2
Total		-3.03E-1	5.13E-2	6.37E-1	3.85E-1

TABLE 16.1 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO U-235 FISSION CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.489	-0.409	0.013	0.033	0.003	0.003
2	6.07 E+6	-1.309	-1.080	0.040	0.099	0.009	0.008
3	3.68 E+6	-2.827	-2.288	0.082	0.212	0.017	0.016
4	2.23 E+6	-3.974	-3.374	0.007	0.129	-0.007	-0.008
5	1.35 E+6	-4.573	-3.725	0.123	0.352	0.036	0.032
6	8.21 E+5	-7.861	-5.588	0.436	1.065	0.149	0.184
7	3.88 E+5	-8.483	-5.564	0.415	1.150	0.191	0.185
8	1.83 E+5	-6.732	-4.616	-0.012	0.540	0.113	0.103
9	8.65 E+4	-5.809	-3.553	0.004	0.633	0.204	0.226
10	4.09 E+4	-4.982	-3.683	-0.676	-0.491	-0.017	-0.038
11	1.93 E+4	-3.989	-3.770	-0.889	-0.889	-0.109	-0.128
12	9.12 E+3	-2.463	-2.486	-0.442	-0.207	0.052	0.004
13	4.31 E+3	-0.933	-0.905	0.307	0.875	0.210	0.225
14	2.03 E+3	-4.569	-5.542	-3.540	-5.138	-1.024	-0.912
15	9.61 E+2	-3.488	-4.602	-2.368	-3.322	-0.790	-0.828
16	4.54 E+2	-2.389	-3.078	-1.674	-1.720	-0.680	-0.721
TOTAL		-64.871	-54.262	-8.174	-6.690	-1.644	-1.648

TABLE 16.2 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO U-235 CAPTURE CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	0.000	0.000	-0.000	-0.000	-0.000	-0.000
2	6.07 E+6	0.003	0.002	-0.000	-0.001	-0.000	-0.000
3	3.68 E+6	0.041	0.023	-0.005	-0.010	-0.002	-0.002
4	2.23 E+6	0.126	0.085	-0.007	-0.015	-0.002	-0.002
5	1.35 E+6	0.122	0.066	-0.016	-0.029	-0.005	-0.005
6	8.21 E+5	0.157	-0.013	-0.048	-0.086	-0.016	-0.018
7	3.88 E+5	0.234	-0.089	-0.071	-0.131	-0.026	-0.025
8	1.83 E+5	0.317	0.016	-0.033	-0.075	-0.019	-0.018
9	8.65 E+4	0.316	-0.058	-0.026	-0.070	-0.026	-0.028
10	4.09 E+4	0.468	0.238	0.085	0.106	0.005	0.009
11	1.93 E+4	0.625	0.598	0.125	0.167	0.018	0.021
12	9.12 E+3	0.546	0.562	0.051	0.047	-0.007	0.001
13	4.31 E+3	0.292	0.287	-0.085	-0.172	-0.040	-0.041
14	2.03 E+3	1.477	1.856	0.688	1.068	0.183	0.174
15	9.61 E+2	1.347	1.830	0.508	0.784	0.155	0.163
16	4.54 E+2	1.239	1.623	0.430	0.599	0.171	0.184
TOTAL		7.309	7.024	1.595	2.183	0.388	0.414

TABLE 16.3 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO U-238 FISSION CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	0.710	0.925	0.999	2.618	0.871	0.808
2	6.07 E+6	2.149	2.715	2.750	6.845	2.156	2.048
3	3.68 E+6	4.664	5.680	4.998	12.847	3.706	3.394
4	2.23 E+6	-1.441	-0.776	0.329	5.997	-0.892	-1.003
5	1.35 E+6	0.226	0.340	0.475	1.349	0.449	0.386
6	8.21 E+5	0.068	0.083	0.093	0.194	0.095	0.134
7	3.88 E+5	-0.002	-0.001	0.005	0.015	0.008	0.008
8	1.83 E+5	-0.003	-0.003	-0.000	0.003	0.002	0.002
9	8.65 E+4	0.000	0.001	0.000	0.003	0.003	0.004
10	4.09 E+4	-0.003	-0.003	-0.003	-0.002	-0.000	-0.000
11	1.93 E+4	-0.004	-0.004	-0.004	-0.005	-0.002	-0.002
12	9.12 E+3	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001
13	4.31 E+3	0.	0.	0.	0.	0.	0.
14	2.03 E+3	-0.014	-0.014	-0.013	-0.019	-0.013	-0.014
15	9.61 E+2	-0.026	-0.027	-0.024	-0.035	-0.026	-0.028
16	4.54 E+2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
TOTAL		6.321	8.913	9.602	29.810	6.357	5.735

TABLE 16.4 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO U-238 CAPTURE CROSS SECTION
(X 10⁻²)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.007	-0.008	-0.008	-0.014	-0.009	-0.009
2	6.07 E+6	-0.040	-0.045	-0.044	-0.082	-0.056	-0.054
3	3.68 E+6	-0.231	-0.253	-0.215	-0.394	-0.254	-0.247
4	2.23 E+6	-0.255	-0.293	-0.320	-0.649	-0.327	-0.314
5	1.35 E+6	-1.458	-1.632	-1.530	-2.792	-1.613	-1.555
6	8.21 E+5	-4.628	-5.276	-4.966	-8.747	-5.387	-5.311
7	3.88 E+5	-2.986	-3.752	-4.521	-8.333	-5.467	-5.304
8	1.83 E+5	0.180	-0.244	-1.927	-4.390	-3.715	-3.438
9	8.65 E+4	-4.228	-4.978	-1.815	-5.049	-6.226	-6.738
10	4.09 E+4	6.441	6.577	7.249	9.154	1.782	2.753
11	1.93 E+4	10.996	11.789	10.413	14.267	5.358	6.288
12	9.12 E+3	3.712	4.227	4.813	5.385	-0.071	1.875
13	4.31 E+3	-3.377	-3.305	-1.249	-3.730	-2.670	-2.935
14	2.03 E+3	36.195	38.621	30.211	47.618	25.182	23.767
15	9.61 E+2	27.583	29.145	22.114	34.630	20.332	21.234
16	4.54 E+2	15.181	15.755	10.609	15.504	12.183	13.059
TOTAL		83.080	86.327	68.815	92.380	39.042	42.078

TABLE 16.5 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO U-238 SCATTERING CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.904	-1.055	-1.255	-2.293	-1.734	-1.685
2	6.07 E+6	-0.864	-0.978	-1.692	-3.143	-4.309	-4.212
3	3.68 E+6	-3.536	-3.719	-4.669	-8.599	-10.272	-9.979
4	2.23 E+6	-2.870	-2.802	-3.966	-6.371	-7.953	-7.901
5	1.35 E+6	-1.938	-1.252	-1.386	0.352	-4.259	-4.242
6	8.21 E+5	0.660	2.124	1.572	9.998	-4.016	-4.148
7	3.88 E+5	0.285	1.422	1.319	6.707	-3.992	-3.946
8	1.83 E+5	-0.084	0.361	-0.321	2.435	-4.209	-4.209
9	8.65 E+4	-0.112	0.446	-0.133	2.316	-2.335	-2.403
10	4.09 E+4	-0.202	0.030	-0.673	0.005	-1.006	-1.058
11	1.93 E+4	-0.313	-0.228	-0.571	-0.533	-0.503	-0.551
12	9.12 E+3	0.154	0.174	0.032	0.248	0.126	0.074
13	4.31 E+3	-0.033	-0.042	0.017	0.264	0.025	0.005
14	2.03 E+3	-1.211	-1.044	-1.447	-2.546	-0.938	-0.893
15	9.61 E+2	-0.584	-0.550	-0.590	-1.230	-0.337	-0.351
16	4.54 E+2	-0.240	-0.230	-0.058	-0.369	0.034	0.031
TOTAL		-11.792	-7.344	-13.823	-2.858	-45.679	-45.469

TABLE 16.6 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO PU-239 FISSION CROSS SECTION
($\times 10^{-2}$)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	0.998	0.998	0.401	0.917	-0.100	-0.119
2	6.07 E+6	3.550	3.567	1.556	3.445	-0.299	-0.349
3	3.68 E+6	8.073	8.051	3.314	7.416	-0.905	-1.056
4	2.23 E+6	5.306	5.039	0.257	3.411	-4.405	-4.499
5	1.35 E+6	11.020	11.005	4.987	11.207	-0.932	-1.244
6	8.21 E+5	29.924	29.927	17.676	33.220	4.788	8.190
7	3.88 E+5	21.725	20.841	14.701	27.690	4.905	4.536
8	1.83 E+5	5.478	3.747	1.391	5.471	-1.223	-1.646
9	8.65 E+4	15.686	14.504	2.416	6.891	5.461	6.909
10	4.09 E+4	-3.739	-5.522	-11.840	-16.732	-5.470	-6.289
11	1.93 E+4	-9.830	-11.309	-13.971	-20.502	-7.114	-7.770
12	9.12 E+3	-1.025	-1.832	-5.444	-6.879	0.322	-1.470
13	4.31 E+3	18.823	19.008	8.044	15.093	8.868	9.741
14	2.03 E+3	-51.097	-53.778	-46.807	-75.671	-34.860	-32.894
15	9.61 E+2	-44.250	-45.906	-38.442	-61.994	-32.289	-33.854
16	4.54 E+2	-32.881	-33.594	-23.062	-36.956	-25.179	-27.113
TOTAL		-22.240	-35.254	-84.821	-103.974	-88.431	-88.925

TABLE 16.7 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO				ZPPR-9 NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
		FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2					
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
2	6.07 E+6	-0.003	-0.003	-0.002	-0.003	-0.003	-0.001	-0.001	-0.000	
3	3.68 E+6	-0.040	-0.040	-0.040	-0.040	-0.042	-0.010	-0.010	-0.010	
4	2.23 E+6	-0.066	-0.064	-0.037	-0.064	-0.064	0.007	0.007	0.008	
5	1.35 E+6	-0.184	-0.182	-0.126	-0.182	-0.201	-0.036	-0.036	-0.032	
6	8.21 E+5	-0.810	-0.802	-0.612	-0.802	-0.904	-0.271	-0.271	-0.334	
7	3.88 E+5	-1.249	-1.212	-1.042	-1.212	-1.552	-0.465	-0.465	-0.441	
8	1.83 E+5	-0.487	-0.382	-0.434	-0.382	-0.542	-0.058	-0.058	-0.019	
9	8.65 E+4	-1.345	-1.274	-0.372	-1.274	-0.476	-0.293	-0.293	-0.374	
10	4.09 E+4	0.652	0.854	1.291	0.854	2.124	0.846	0.846	0.976	
11	1.93 E+4	2.081	2.345	2.386	2.345	3.776	1.462	1.462	1.620	
12	9.12 E+3	0.568	0.547	1.215	0.547	1.730	0.238	0.238	0.703	
13	4.31 E+3	-3.783	-3.825	-1.672	-3.825	-3.033	-1.521	-1.521	-1.550	
14	2.03 E+2	18.710	19.905	15.315	19.905	24.791	10.650	10.650	9.922	
15	9.61 E+2	19.945	20.859	15.509	20.859	24.911	12.183	12.183	12.821	
16	4.54 E+2	15.779	16.206	9.730	16.206	15.533	9.918	9.918	10.681	
TOTAL		49.568	52.934	41.124	52.934	66.047	32.648	32.648	33.971	

(X 10⁻²)

TABLE 16.8 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO CAPTURE CROSS SECTION

GROUP	UP. ENERGY(EV)	SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO				ZPPR-9 NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
		FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2					
1	10.0 E+6	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
2	6.07 E+6	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000	-0.000	
3	3.68 E+6	-0.009	-0.009	-0.011	-0.009	-0.020	-0.003	-0.003	-0.003	
4	2.23 E+6	-0.011	-0.011	-0.012	-0.011	-0.023	0.002	0.002	0.002	
5	1.35 E+6	-0.025	-0.025	-0.036	-0.025	-0.060	-0.007	-0.007	-0.007	
6	8.21 E+5	-0.112	-0.111	-0.179	-0.111	-0.273	-0.056	-0.056	-0.070	
7	3.88 E+5	-0.122	-0.122	-0.118	-0.122	-0.329	-0.067	-0.067	-0.064	
8	1.83 E+5	-0.054	-0.043	-0.084	-0.043	-0.119	-0.100	-0.100	-0.004	
9	8.65 E+4	-0.161	-0.152	-0.068	-0.152	-0.103	-0.050	-0.050	-0.064	
10	4.09 E+4	0.077	0.101	0.374	0.101	0.585	0.149	0.149	0.171	
11	1.93 E+4	0.208	0.235	0.567	0.235	0.870	0.218	0.218	0.241	
12	9.12 E+3	0.031	0.045	0.242	0.045	0.328	0.030	0.030	0.087	
13	4.31 E+3	-0.331	-0.338	-0.307	-0.338	-0.565	-0.192	-0.192	-0.197	
14	2.03 E+3	1.525	1.624	2.805	1.624	4.498	1.282	1.282	1.205	
15	9.61 E+2	1.397	1.462	2.421	1.462	3.862	1.255	1.255	1.310	
16	4.54 E+2	1.658	1.702	2.066	1.702	3.264	1.467	1.467	1.595	
TOTAL		4.070	4.361	7.565	4.361	11.913	4.015	4.015	4.202	

(X 10⁻²)

TABLE 16.9 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO PU-241 FISSION CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	0.008	0.008	0.007	0.022	-0.001	-0.001
2	6.07 E+6	0.025	0.025	0.028	0.076	-0.002	-0.003
3	3.68 E+6	0.059	0.059	0.060	0.167	-0.007	-0.009
4	2.23 E+6	0.042	0.039	-0.028	0.063	-0.049	-0.050
5	1.35 E+6	0.089	0.089	0.101	0.281	-0.007	-0.011
6	8.21 E+5	0.248	0.248	0.424	0.882	0.070	0.111
7	3.88 E+5	0.225	0.216	0.417	0.898	0.092	0.086
8	1.83 E+5	0.068	0.047	-0.052	0.146	-0.006	-0.014
9	8.65 E+4	0.199	0.183	-0.002	0.216	0.118	0.145
10	4.09 E+4	-0.056	-0.083	-0.696	-0.923	-0.112	-0.131
11	1.93 E+4	-0.163	-0.188	-0.870	-1.225	-0.172	-0.189
12	9.12 E+3	-0.010	-0.025	-0.393	-0.457	0.027	-0.024
13	4.31 E+3	0.276	0.277	0.375	0.748	0.216	0.233
14	2.03 E+3	-1.042	-1.097	-3.349	-5.346	-1.076	-0.981
15	9.61 E+2	-0.656	-0.681	-2.010	-3.203	-0.732	-0.762
16	4.54 E+2	-0.592	-0.605	-1.454	-2.298	-0.671	-0.716
TOTAL		-1.281	-1.488	-7.441	-9.953	-2.313	-2.316

TABLE 16.10 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO IRON CAPTURE CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY(EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.284	-0.301	-0.278	-0.498	-0.193	-0.186
2	6.07 E+6	-0.293	-0.307	-0.278	-0.505	-0.210	-0.208
3	3.68 E+6	-0.168	-0.175	-0.161	-0.288	-0.112	-0.107
4	2.23 E+6	-0.046	-0.047	-0.044	-0.086	-0.021	-0.020
5	1.35 E+6	-0.102	-0.106	-0.099	-0.174	-0.058	-0.056
6	8.21 E+5	-0.548	-0.573	-0.533	-0.907	-0.355	-0.427
7	3.88 E+5	-0.359	-0.375	-0.398	-0.713	-0.302	-0.287
8	1.83 E+5	-0.014	0.003	-0.055	-0.176	-0.131	-0.111
9	8.65 E+4	-0.164	-0.162	0.061	0.020	-0.125	-0.158
10	4.09 E+4	0.396	0.445	0.622	0.873	0.221	0.258
11	1.93 E+4	0.304	0.337	0.402	0.558	0.141	0.167
12	9.12 E+3	0.224	0.256	0.290	0.372	0.063	0.163
13	4.31 E+3	-0.104	-0.106	-0.055	-0.111	-0.063	-0.064
14	2.03 E+3	6.373	6.807	6.288	9.832	3.999	4.430
15	9.61 E+2	0.440	0.465	0.385	0.597	0.280	0.295
16	4.54 E+2	0.473	0.491	0.348	0.474	0.329	0.355
TOTAL		6.128	6.652	6.495	9.269	3.463	4.045

TABLE 16.11 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO IRON SCATTERING CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY (EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.998	-1.087	-1.056	-1.785	-0.922	-0.895
2	6.07 E+6	-0.901	-0.942	-1.220	-2.118	-2.684	-2.619
3	3.68 E+6	-0.817	-0.753	-1.259	-1.594	-3.844	-3.738
4	2.23 E+6	-0.917	-0.965	-1.173	-1.203	-2.270	-2.152
5	1.35 E+6	-0.385	-0.130	-0.776	0.754	-2.096	-2.095
6	8.21 E+5	2.650	3.137	2.138	9.218	-1.697	-1.559
7	3.88 E+5	0.849	1.129	0.916	4.269	-2.907	-2.844
8	1.83 E+5	0.062	0.114	-0.341	0.957	-2.476	-2.420
9	8.65 E+4	0.169	0.298	-0.204	1.141	-1.465	-1.440
10	4.09 E+4	0.282	0.274	-0.943	-0.072	-0.982	-1.055
11	1.93 E+4	0.246	0.201	-0.193	0.053	-0.015	-0.146
12	9.12 E+3	0.945	0.912	0.345	0.890	0.633	0.525
13	4.31 E+3	-0.594	-0.639	-0.240	-0.135	-0.033	-0.109
14	2.03 E+3	-2.980	-2.908	-2.894	-4.770	-1.904	-1.902
15	9.61 E+2	-1.524	-1.493	-1.230	-2.344	-0.780	-0.832
16	4.54 E+2	-0.302	-0.279	-0.120	-0.550	-0.012	-0.016
TOTAL		-4.215	-3.128	-8.250	2.711	-23.455	-23.299

TABLE 16.12 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO SODIUM CAPTURE CROSS SECTION
(X10⁻²)

GROUP	UP. ENERGY (EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	0.758	0.806	0.719	1.146	0.524	0.517
2	6.07 E+6	0.216	0.230	0.210	0.335	0.167	0.165
3	3.68 E+6	0.028	0.030	0.026	0.041	0.021	0.020
4	2.23 E+6	0.040	0.042	0.038	0.061	0.029	0.028
5	1.35 E+6	0.043	0.046	0.040	0.065	0.031	0.030
6	8.21 E+5	0.150	0.160	0.144	0.234	0.107	0.102
7	3.88 E+5	0.410	0.438	0.377	0.612	0.286	0.282
8	1.83 E+5	0.727	0.777	0.652	1.064	0.493	0.486
9	8.65 E+4	0.595	0.636	0.472	0.772	0.359	0.347
10	4.09 E+4	0.455	0.486	0.473	0.777	0.364	0.361
11	1.93 E+4	0.022	0.024	0.020	0.033	0.016	0.016
12	9.12 E+3	0.275	0.292	0.233	0.385	0.195	0.197
13	4.31 E+3	2.412	2.555	1.720	2.814	1.594	1.534
14	2.03 E+3	1.738	1.824	1.685	2.821	1.324	1.277
15	9.61 E+2	0.457	0.474	0.434	0.736	0.382	0.383
16	4.54 E+2	0.229	0.234	0.174	0.302	0.196	0.199
TOTAL		8.555	9.056	7.418	12.200	6.087	5.944

TABLE 16.13 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO SODIUM SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	3.067	3.221	2.842	4.031	2.026	2.001
2	6.07 E+6	5.663	5.847	5.664	7.226	5.900	5.810
3	3.68 E+6	11.790	12.160	11.451	13.888	10.722	10.572
4	2.23 E+6	12.755	13.217	13.015	15.422	11.398	11.237
5	1.35 E+6	5.763	5.739	7.096	6.044	5.311	5.320
6	8.21 E+5	12.022	11.561	13.951	9.464	10.809	10.230
7	3.88 E+5	13.217	12.892	12.464	10.133	11.274	11.046
8	1.83 E+5	11.997	11.834	11.385	11.032	10.678	10.480
9	8.65 E+4	8.805	8.613	6.680	5.080	5.668	5.427
10	4.09 E+4	2.111	1.916	0.052	-2.785	0.146	0.031
11	1.93 E+4	-2.122	-2.076	-2.976	-6.621	-3.149	-3.246
12	9.12 E+3	-6.447	-6.553	-4.251	-7.792	-5.460	-5.916
13	4.31 E+3	-7.417	-8.057	-4.291	-7.291	-5.191	-5.325
14	2.03 E+3	-5.900	-5.955	-5.400	-9.687	-5.067	-4.807
15	9.61 E+2	-1.607	-1.628	-0.981	-1.742	-1.079	-1.079
16	4.54 E+2	-0.057	-0.060	-0.030	0.029	-0.009	-0.010
TOTAL		63.641	62.673	66.672	46.432	53.977	51.772

TABLE 16.14 SENSITIVITY COEFFICIENT OF NA-VOID WORTH WITH RESPECT TO OXYGEN SCATTERING CROSS SECTION (X 10⁻²)

GROUP	UP. ENERGY (EV)	FCA VI-2 NO.1	FCA VI-2 NO.2	MZB NO.1	MZB NO.2	ZPPR-9 NO.1	ZPPR-9 NO.2
1	10.0 E+6	-0.297	-0.326	-0.210	-0.374	-0.317	-0.310
2	6.07 E+6	0.711	0.738	0.509	0.771	-0.552	-0.554
3	3.68 E+6	1.134	1.202	0.848	1.349	-1.007	-1.012
4	2.23 E+6	-0.696	-0.759	-0.261	-0.463	-2.404	-2.323
5	1.35 E+6	1.900	2.201	1.219	2.979	-2.046	-1.888
6	8.21 E+5	2.901	4.327	0.341	8.185	-9.940	-9.857
7	3.88 E+5	-0.388	0.263	-0.409	1.415	-8.742	-8.540
8	1.83 E+5	-1.378	-1.206	-2.199	-2.417	-6.330	-6.164
9	8.65 E+4	-2.044	-1.765	-1.567	-1.097	-3.789	-3.798
10	4.09 E+4	-0.463	-0.361	-0.384	-0.095	-1.040	-1.230
11	1.93 E+4	0.598	0.510	0.233	0.529	0.283	0.051
12	9.12 E+3	2.611	2.611	1.245	2.205	1.913	1.676
13	4.31 E+3	-1.898	-2.008	-0.548	-0.660	-0.186	-0.366
14	2.03 E+3	-5.370	-5.463	-3.535	-5.583	-2.852	-2.903
15	9.61 E+2	-2.014	-2.031	-0.999	-1.599	-0.848	-0.919
16	4.54 E+2	-0.139	-0.127	-0.063	-0.130	0.015	0.014
TOTAL		-4.796	-2.194	-5.781	5.016	-37.843	-38.121

3. 炉心核特性の誤差解析

各核特性の感度係数及び断面積の共分散データを用いて核特性計算値の予測誤差を計算した。断面積の共分散データはオークリッジ研究所で作成され、⁽⁷⁾日本原子力研究所で16群に縮約されたものを用いた。核種 ℓ の g 群と g' 群の断面積間の共分散は

$$M_{gg', \ell} = \left\langle \frac{(\sigma_{\ell}^g - \bar{\sigma}_{\ell}^g) \cdot (\sigma_{\ell}^{g'} - \bar{\sigma}_{\ell}^{g'})}{\bar{\sigma}_{\ell}^g \bar{\sigma}_{\ell}^{g'}} \right\rangle$$

で与えられ、核種 ℓ による炉心核特性の不確かさ(相対標準偏差)は、

$$(\delta R/R) = \left(\sum_g \sum_{g'} G_{\ell}^g M_{gg', \ell} G_{\ell}^{g'} \right)^{1/2}$$

但し G_{ℓ}^g : 核種 ℓ の g 群断面積に対する感度係数

で計算した。ここで異なる核種間の相関は考慮しなかった。また²³⁸U-散乱断面積については、基の共分散ファイルになかったので亀井、吉田の4群データ⁽⁸⁾を参考にして16群のうちの1~5群の断面積の標準偏差を20%とし、エネルギー群間の相関は全て0.8とした。

Table 17に k_{eff} , 中心反応率比 28 f / 25 f , 49 f / 25 f , 28 c / 49 f , ²³⁹Pu (n, f) 径方向分布, UO₂ , Fe, SS ドップラー-反応度, Na ボイド値の主要核種ごとの不確かさを示す。 k_{eff} については各集合体とも²³⁸U (n, γ) 断面積による不確かさが大きい。U (Pu+U) 炉心では²³⁵U (n, f) , ²³⁵U (n, γ) 断面積, Pu 炉心では²³⁹Pu (n, f) , ²³⁹Pu (n, γ) 断面積による寄与が大きい。28 f / 25 f については²³⁵U (n, f) , ²³⁸U (n, f) 断面積による不確かさが大きい。各集合体とも²³⁸U-散乱断面積による不確かさが最大になっている。49 f / 25 f 及び 28 c / 49 f については、それぞれ²³⁹Pu (n, f) , ²³⁵U (n, f) 及び²³⁸U (n, γ) , ²³⁹Pu (n, f) 断面積による寄与が大きく、それぞれについて各集合体とも不確かさはほぼ同じ値になっている。²³⁹Pu (n, f) 径方向分布については各集合体とも内側炉心よりも外側炉心での不確かさの方が大きい。UO₂ ドップラー-反応度については FCA V-1, V-2 では²³⁸U (n, γ) 断面積による不確かさが大きく、FCA VI-1, VI-2, ZPPR-9 では²³⁹Pu (n, f) 断面積による不確かさが大きくなっている。Fe 及び SS ドップラー-反応度については Fe (n, γ) 断面積による不確かさが大きく、²³⁸U-散乱断面積による寄与も大きい。また FCA VI-1, VI-2 では²³⁹Pu (n, γ) 断面積による不確かさが大きくなっている。Na ボイド値については ZPPR-9 以外ではボイドパターンが広がるにつれて不確かさが大きくなる傾向を示している。FCA VI-2, MZB では²³⁸U (n, γ) , ²³⁹Pu (n, f) , ²³⁹Pu (n, γ) 断面積による不確かさが大きい。ZPPR-9 ではこれら以外に²³⁸U-散乱断面積による不確かさが大きい。

Table 17.1 Standard deviation of k_{eff} due to cross section uncertainty

Cross section	(%)									
	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPPR-9	ZPPR-10A	ZPR-6/7	ZPR-6/6A
$^{235}\text{U}(n,f)$	0.68	0.62	0.41	0.73	0.07	0.02	0.03	0.03	0.02	1.32
$^{235}\text{U}(n,\gamma)$	0.56	0.50	0.29	0.59	0.03	0.01	0.01	0.01	0.01	0.95
$^{238}\text{U}(n,f)$	0.21	0.19	0.21	0.21	0.18	0.19	0.22	0.21	0.20	0.18
$^{238}\text{U}(n,\gamma)$	1.35	1.31	1.46	1.61	1.49	1.51	1.83	1.76	1.68	1.89
^{238}U -scat.	0.15	0.15	0.24	0.27	0.50	0.50	0.92	0.81	0.62	0.29
$^{239}\text{Pu}(n,f)$	0.43	0.50	0.71	0.38	0.99	1.06	1.06	1.07	1.07	0.
$^{239}\text{Pu}(n,\gamma)$	0.12	0.16	0.25	0.17	0.43	0.48	0.44	0.45	0.51	0.
$^{240}\text{Pu}(n,\gamma)$	0.03	0.04	0.05	0.03	0.16	0.11	0.10	0.10	0.11	0.
$^{241}\text{Pu}(n,f)$	0.01	0.01	0.01	0.01	0.08	0.04	0.04	0.03	0.04	0.
O-scat.	0.06	0.05	0.04	0.02	0.01	0.01	0.03	0.03	0.02	0.05
Na(n, γ)	0.01	0.01	0.01	0.02	0.03	0.03	0.02	0.03	0.03	0.03
Fe(n, γ)	0.05	0.06	0.08	0.08	0.16	0.16	0.14	0.16	0.17	0.18
Stand. Dev.	1.70	1.64	1.75	1.94	1.94	1.99	2.37	2.28	2.16	2.52

Table 17.2 Standard deviation of $28f/25f$ due to cross section uncertainty

Cross section	(%)						
	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPPR-2	ZPR-6/6A
$^{235}\text{U}(n,f)$	1.58	1.66	2.58	3.04	2.45	2.53	1.51
$^{235}\text{U}(n,\gamma)$	0.66	0.59	0.26	0.54	0.04	0.01	1.03
$^{238}\text{U}(n,f)$	2.23	2.22	2.23	2.23	2.24	2.25	2.24
$^{238}\text{U}(n,\gamma)$	1.37	1.37	1.99	2.44	2.24	2.32	2.05
^{238}U -scat.	4.98	4.19	5.71	6.69	5.80	5.83	5.53
$^{239}\text{Pu}(n,f)$	0.26	0.31	0.88	1.11	0.56	0.59	0.
$^{239}\text{Pu}(n,\gamma)$	0.16	0.22	0.57	0.57	0.72	0.81	0.
$^{240}\text{Pu}(n,\gamma)$	0.05	0.05	0.10	0.08	0.25	0.17	0.
$^{241}\text{Pu}(n,f)$	0.01	0.01	0.02	0.03	0.04	0.02	0.
O-scat.	0.19	0.17	0.27	0.29	0.20	0.22	0.16
Na(n, γ)	0.01	0.02	0.02	0.03	0.04	0.04	0.03
Fe(n, γ)	0.05	0.07	0.13	0.17	0.25	0.26	0.20
Stand. Dev.	5.89	5.26	7.03	8.18	7.12	7.21	6.57

Table 17.3 Standard deviation of $^{49}\text{F}/^{25}\text{f}$ due to cross section uncertainty

Cross section	(%)				
	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-2
$^{235}\text{U}(n, f)$	1.96	2.01	2.33	2.60	2.54
$^{235}\text{U}(n, \gamma)$	0.16	0.15	0.05	0.09	0.00
$^{238}\text{U}(n, f)$	0.01	0.01	0.01	0.01	0.00
$^{238}\text{U}(n, \gamma)$	0.35	0.36	0.55	0.62	0.58
$^{238}\text{U}\text{-scat.}$	0.49	0.40	0.53	0.58	0.47
$^{239}\text{Pu}(n, f)$	1.92	1.90	1.99	2.00	1.94
$^{239}\text{Pu}(n, \gamma)$	0.06	0.08	0.23	0.22	0.24
$^{240}\text{Pu}(n, \gamma)$	0.01	0.01	0.03	0.02	0.04
$^{241}\text{Pu}(n, f)$	0.00	0.00	0.00	0.01	0.01
O-scat.	0.10	0.09	0.14	0.16	0.13
Na(n, γ)	0.00	0.00	0.01	0.01	0.01
Fe(n, γ)	0.01	0.02	0.05	0.06	0.08
Stand. Dev.	2.82	2.83	3.18	3.40	3.29

Table 17.4 Standard deviation of $^{28}\text{c}/^{49}\text{f}$ due to cross section uncertainty

Cross section	(%)					
	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	MZB	ZPR-6/7
$^{235}\text{U}(n, f)$	0.35	0.34	0.08	0.12	0.01	0.00
$^{235}\text{U}(n, \gamma)$	0.35	0.31	0.10	0.15	0.01	0.00
$^{238}\text{U}(n, f)$	0.02	0.03	0.02	0.01	0.01	0.01
$^{238}\text{U}(n, \gamma)$	7.39	7.23	6.74	6.42	6.39	6.31
$^{238}\text{U}\text{-scat.}$	1.17	0.94	1.16	1.09	0.91	0.88
$^{239}\text{Pu}(n, f)$	1.99	1.97	2.14	2.10	1.98	1.96
$^{239}\text{Pu}(n, \gamma)$	0.10	0.13	0.26	0.14	0.20	0.18
$^{240}\text{Pu}(n, \gamma)$	0.03	0.03	0.05	0.03	0.09	0.06
$^{241}\text{Pu}(n, f)$	0.00	0.00	0.01	0.00	0.01	0.00
O-scat.	0.21	0.19	0.25	0.22	0.19	0.18
Na(n, γ)	0.00	0.00	0.01	0.01	0.01	0.01
Fe(n, γ)	0.03	0.03	0.05	0.04	0.07	0.06
Stand. Dev.	7.76	7.57	7.17	6.85	6.76	6.68

Table 17.5 Standard deviation of $^{239}\text{Pu}(n,f)$ distribution due to cross section uncertainty

Cross section	(%)					
	MZB		ZPPR-9		ZPPR-10A	
	No.1	No.2	No.1	No.2	No.1	No.2
$^{235}\text{U}(n,f)$	0.00	0.02	0.00	0.01	0.00	0.02
$^{235}\text{U}(n,\gamma)$	0.00	0.00	0.00	0.01	0.00	0.01
$^{238}\text{U}(n,f)$	0.00	0.01	0.00	0.05	0.00	0.03
$^{238}\text{U}(n,\gamma)$	0.05	0.23	0.06	1.48	0.09	1.70
^{238}U -scat.	0.04	0.19	0.06	1.28	0.09	1.54
$^{239}\text{Pu}(n,f)$	0.02	0.19	0.03	0.73	0.11	0.94
$^{239}\text{Pu}(n,\gamma)$	0.01	0.02	0.01	0.26	0.03	0.42
$^{240}\text{Pu}(n,\gamma)$	0.00	0.04	0.00	0.02	0.00	0.02
$^{241}\text{Pu}(n,f)$	0.00	0.02	0.00	0.03	0.00	0.04
O-scatter.	0.00	0.09	0.01	0.15	0.01	0.21
Na(n, γ)	0.00	0.01	0.00	0.02	0.01	0.05
Fe(n, γ)	0.01	0.04	0.01	0.14	0.04	0.29
Stand. Dev.	0.07	0.37	0.10	2.12	0.18	2.54

Table 17.6 Standard deviation of Doppler UO_2 due to cross section uncertainty

Cross section	(%)				
	FCA V-1	FCA V-2	FCA VI-1	FCA VI-2	ZPPR-9
$^{235}\text{U}(n,f)$	2.15	1.65	1.44	2.69	0.02
$^{235}\text{U}(n,\gamma)$	2.05	1.55	0.48	1.30	0.07
$^{238}\text{U}(n,f)$	0.61	0.58	0.59	0.62	0.49
$^{238}\text{U}(n,\gamma)$	4.93	5.60	3.07	2.12	1.57
^{238}U -scat.	3.92	3.20	3.77	2.94	1.64
$^{239}\text{Pu}(n,f)$	1.18	1.33	1.91	1.46	3.02
$^{239}\text{Pu}(n,\gamma)$	1.65	1.63	4.97	4.40	3.59
$^{240}\text{Pu}(n,\gamma)$	0.11	0.11	0.28	0.25	0.18
$^{241}\text{Pu}(n,f)$	0.03	0.03	0.09	0.10	0.18
O-scatter.	1.05	0.78	1.12	1.02	0.60
Na(n, γ)	0.05	0.06	0.09	0.11	0.12
Fe(n, γ)	0.33	0.35	0.86	0.96	1.04
Stand. Dev.	7.36	7.23	7.54	6.78	5.38

Table 17.7 Standard deviation of Doppler IRON due to cross section uncertainty

Cross section	(%)		
	FCA V-2	FCA VI-1	FCA VI-2
$^{235}\text{U}(n, f)$	1.30	1.34	2.52
$^{235}\text{U}(n, \gamma)$	0.99	0.53	1.32
$^{238}\text{U}(n, f)$	0.58	0.60	0.61
$^{238}\text{U}(n, \gamma)$	1.31	2.43	3.42
^{238}U -scat.	3.02	3.53	2.72
$^{239}\text{Pu}(n, f)$	1.03	1.27	1.37
$^{239}\text{Pu}(n, \gamma)$	1.10	3.35	3.38
$^{240}\text{Pu}(n, \gamma)$	0.09	0.24	0.24
$^{241}\text{Pu}(n, f)$	0.02	0.07	0.09
O-sc.	0.47	0.65	0.52
Na(n, γ)	0.04	0.06	0.08
Fe(n, γ)	9.03	11.36	13.47
Stand. Dev.	9.90	12.77	14.92

Table 17.8 Standard deviation of Doppler SS due to cross section uncertainty

Cross section	(%)		
	FCA V-1	FCA VI-1	FCA VI-2
$^{235}\text{U}(n, f)$	1.51	1.35	2.51
$^{235}\text{U}(n, \gamma)$	1.21	0.52	1.28
$^{238}\text{U}(n, f)$	0.62	0.60	0.63
$^{238}\text{U}(n, \gamma)$	1.43	2.76	4.26
^{238}U -scat.	3.57	3.58	2.99
$^{239}\text{Pu}(n, f)$	0.89	1.37	1.51
$^{239}\text{Pu}(n, \gamma)$	0.97	3.78	4.23
$^{240}\text{Pu}(n, \gamma)$	0.09	0.26	0.28
$^{241}\text{Pu}(n, f)$	0.02	0.08	0.10
O-sc.	0.61	0.70	0.64
Na(n, γ)	0.03	0.07	0.11
Fe(n, γ)	7.65	10.28	11.20
Stand. Dev.	8.92	12.05	13.47

Table 17.9 Standard deviation of Na-void worth due to cross section uncertainty

Cross section	(%)					
	FCA VI-2		M2B		ZPPR-9	
	No.1	No.2	No.1	No.2	No.1	No.2
$^{235}\text{U}(n,f)$	1.32	1.15	0.32	0.37	0.07	0.07
$^{235}\text{U}(n,\gamma)$	0.57	0.48	0.11	0.16	0.03	0.03
$^{238}\text{U}(n,f)$	0.19	0.25	0.25	0.73	0.18	0.17
$^{238}\text{U}(n,\gamma)$	6.05	6.45	5.36	8.04	4.21	4.25
$^{238}\text{U-scatt.}$	1.87	1.81	2.39	3.75	5.26	5.17
$^{239}\text{Pu}(n,f)$	4.85	5.04	4.42	7.04	3.35	3.46
$^{239}\text{Pu}(n,\gamma)$	5.37	5.69	4.44	7.11	3.24	3.23
$^{240}\text{Pu}(n,\gamma)$	0.15	0.16	0.30	0.47	0.15	0.15
$^{241}\text{Pu}(n,f)$	0.30	0.31	0.89	1.42	0.33	0.33
O-scatt.	0.13	0.15	0.10	0.24	0.56	0.56
Na(n, γ)	0.89	0.95	0.79	1.29	0.63	0.62
Fe(n, γ)	1.67	1.79	1.65	2.59	1.05	1.16
Stand. Dev.	9.92	10.42	8.84	13.79	8.31	8.33

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