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# ANALYSES OF PWR SPENT FUEL COMPOSITION USING SCALE AND SWAT CODE SYSTEMS TO FIND CORRECTION FACTORS FOR CRITICALITY SAFETY APPLICATIONS ADOPTING BURNUP CREDIT

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# Analyses of PWR Spent Fuel Composition Using SCALE and SWAT Code Systems to Find Correction Factors for Criticality Safety Applications Adopting Burnup Credit

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The isotopic composition calculations were performed for 26 spent fuel samples from the Obrigheim PWR reactor and 55 spent fuel samples from 7 PWR reactors using the SAS2H module of the SCALE4.4 code system with 27, 44 and 238 group cross-section libraries and the SWAT code system with the 107 group cross-section library. For the analyses of samples from the Obrigheim PWR reactor, geometrical models were constructed for each of SCALE4.4/SAS2H and SWAT. For the analyses of samples from 7 PWR reactors, the geometrical model already adopted in the SCALE/SAS2H was directly converted to the model of SWAT.

The four kinds of calculation results were compared with the measured data. For convenience, the ratio of the measured to calculated values was used as a parameter. When the ratio is less than unity, the calculation overestimates the measurement, and the ratio becomes closer to unity, they have a better agreement. For many important nuclides for burnup credit criticality safety evaluation, the four methods applied in this study showed good coincidence with measurements in general. More precise observations showed, however: (1) Less unity ratios were found for Pu-239 and -241 for selected 16 samples out of the 26 samples from the Obrigheim reactor (10 samples were deselected because their burnups were measured with Cs-137 non-destructive method, less reliable than Nd-148 method the rest 16 samples were measured with); (2) Larger than unity ratios were found for Am-241 and Cm-242 for both the 16 and 55 samples; (3) Larger than unity ratios were found for Sm-149 for the 55 samples; (4) SWAT was generally accompanied by larger ratios than those of SAS2H with some exceptions.

Based on the measured-to-calculated ratios for 71 samples of a combined set in which 16 selected samples and 55 samples were included, the correction factors that should be multiplied to the calculated isotopic compositions were generated for a conservative estimate of the neutron multiplication factor of a system containing PWR spent fuel, taking burnup credit into account.

Keywords: Correction Factor, Burnup Credit, Isotopic Composition, PWR Spent Fuel, Tolerance Limit Factor, Normality Test

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* On leave from the Korea Atomic Energy Research Institute (KAERI).

# SCALE及びSWATコードシステムを用いたPWR使用済燃料核種組成の解析に基づく燃焼度クレジットを採用した臨界安全への応用のための補正因子の決定

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（2000年10月31日受理）

同位体組成の計算をオブリハイムPWR型原子炉の 26 個の使用済燃料サンプル及び 7 つのPWR型原子炉の 55 個の使用済燃料サンプルを対象とし、SCALE4.4 コードシステムのSAS2Hモジュールで 27、44 及び 238 群の断面積ライブラリ、及びSWATコードシステムで 107 群断面積ライブラリを用いて実施した。オブリハイム原子炉からのサンプルの解析では、幾何形状モデルはSCALE4.4/SAS2HとSWATそれぞれに対して作成した。7 つのPWR型原子炉からのサンプルの解析では、SCALE4.4/SAS2Hに既に適用された幾何形状モデルをSWATのモデルに直接変換した。

これら 4 種類の計算結果を測定データと比較した。便宜上、測定値対計算値の比をパラメタとした。この比が 1 より小さいとき、計算値は測定値よりも大きく、1 に近いと測定値との一致がよい。燃焼度クレジットを採用した臨界安全評価のための多くの重要な核種について、この研究で適用した 4 つの計算手法は一般的に測定値とよい一致を示した。しかし、更に細かく見ると、以下の点に気付く：(1)オブリハイムPWR型原子炉の選ばれた 16 サンプル(26 サンプルのうち 16 サンプルはNd-148 法で測定されたが、10 サンプルはNd-148 法より信頼性の低いCs-137 非破壊法で測定された)では、Pu-239 及び-241 で 1 より小さな比となった；(2) Am-241 とCm-242 については、16 サンプル及び 55 サンプルともに、1 より大きな比となった；(3) Sm-149 は 55 サンプルで 1 より大きな比となった；(4) SWATは概してSAS2Hよりも大きな比の値を示した。

燃焼度クレジットを取り入れた，最近のPWR燃料などを含めた中性子増倍率の保守的な評価のために，核種組成の計算値に掛ける補正因子を、71 サンプル(選択した 16 サンプルと 55 サンプルとを併せたもの)の測定値対計算値の比に基づき生成した。

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# 1. Introduction

It is known that an application of burnup credit in the spent fuel management is economically beneficial if the nuclear criticality safety is ensured in the allowable limit. Since the burnup credit safety analysis is essentially based on nuclide inventories in a system under consideration, the prediction of the conservative isotopic composition is very important for burnup credit criticality safety analysis. One of the methods of the conservative isotopic composition determination is the application of the correction factors which are obtained by statistical analysis on the basis of the calculated and measured isotopic composition of PWR spent fuel. The conservative composition can be easily obtained by multiplying the calculated isotopic composition by them.

Since ORIGEN2 code[1,2] is world-widely used for the inventory calculation, the comparison of ORIGEN2 calculation results with the experimental data has been studied in a lot of papers. Although some papers have shown the comparison results of ORIGEN2-calculated composition with the experiments, the correction factors of isotopes contained in PWR spent fuel for conservative criticality calculation was not studied in the papers[3-11]. The experimental isotopic compositions of Mihama-3 and Genkai-1 spent fuel with assembly-averaged burnup from 8,400 to 38,600 MWD/MTU were presented in the references[3,12] and compared with SRAC-FPGS[3] and ORIGEN2 calculation results, respectively. The correction factors for ORIGEN2 composition calculation were determined and presented in reference[13] on the basis of experimental data of PWR spent fuel isotopic compositions [2,14].

SWAT(Step-Wise Burnup Analysis Code System)[15,16] which has been developed by Tohoku Univesity and JAERI can generate effective one-group cross-section sets for ORIGEN2.1 calculation. In comparison of SWAT and ORIGEN2.1 results, SWAT has seemed to be more precisely predict nuclide composition of the latest PWR assemblies than ORIGEN2.1[15,16].

Hermann et al. presented the validation results of SCALE4.2 (modular code system for performing standardized computer analysis for licensing evaluation version 4.2) SAS2H(shielding analysis sequence No 2 )[17] module and the 27 group cross section

library using 19 spent fuel experimental concentrations in 1995 [14]. DeHart et al. updated the results using 38 spent fuel experimental concentrations and presented the correction factors of 39 nuclides in 1996 [18]. Isotopic validation for actinide-only burnup credit using 55 spent fuel experimental data were presented in a U.S. DOE report in 1997 [19].

Isotopic validation of the SCALE4.4 SAS2H module with 27, 44 and 238 group cross-section libraries which are available was carried out for fifty-five chemical assay data[20]. A statistical treatment was performed to determine biases and corresponding uncertainties based on the benchmark set of chemical assay data, which gave rise to conservative correction factors for each isotope. Isotopic correction factors were then obtained on the basis of the measured and calculated concentrations of 38 isotopes for both selected actinides and fission products(FPs) [20].

In this work, using SAS2H with 27, 44 and 238 group cross-section libraries and SWAT with 107 group, the isotopic compositions are calculated and compared on the basis of 26 Obrigheim samples[21,22] and 55 experimental samples of PWR spent fuel of seven plants: Yankee Rowe, Mihama-3, Trino Vercellese, Turkey Point, Calvert Cliff, H. B. Robinson, and Obrigheim. Finally, the correction factors are generated on the basis of the measured-to-calculated ratios.

# 2. Experimental data

Fifty-five PWR spent fuel experimental samples of seven reactors and 26 Obrigheim spent fuel samples have been published to be available for the determination of isotopic correction factor.

## 2.1. 55 Experimental Samples

Fifty-five chemical assay data were obtained from fuel assemblies discharged at seven different nuclear reactors: Yankee Rowe, Mihama-3, Trino Vercellese, Turkey Point, Calvert Cliffs, H.B.Robinson, and Obrigheim as shown in Table. 2.1. Validation analysis results of the chemical assay data for all but Yankee Rowe and Mihama-3 were presented in the ORNL report [18]. All the chemical assays above-mentioned also were analyzed and described in the U.S. DOE report[19]. Operating parameters for each sample were presented in Table 2.2. Initial enrichments and burnups, which are important parameter for concentration calculations, range from 2.453 to 3.897 wt% and from 6.92 to 46.46 GWd/tU, respectively.

## 2.2. 26 Obrigheim Spent Fuel Samples[20,21]

The Obrigheim Nuclear Power Plant, operated by KWO, was equipped with a pressurized water reactor rated at 350 MW(e). Six fuel rods were chosen for examination. The fuel assemblies BE 124 (average burnup of 29,000 MWd/tU) and BE 210 (average burnup of 30,000 MWd/tU) selected for post-irradiation analyses were composed of 180 rods with initial U-235 enrichment of 3.00 wt% and 2.83 wt%, respectively. In Table 2.3 the main characteristics of the fuel assembly were presented. Although 27 experimental samples of Obrigheim spent fuel composition were included in the SFCOMPO database[21], only 26 samples were used for this work because one sample didn't have absolute isotopic composition data but ratio data.

## 2.3. Reliability of Experimental Data

Since the correction factors are determined on the basis of the experimental data, the reliability of the experimental data is very important for the assurance that the generated correction factors are applicable to burnup credit criticality calculation. Some of 55

experimental samples mentioned above were measured during 1960 – 1980. Considering the lower level of measuring technique in that time than now, the experimental data might be unreliable.

It is obvious that total depletion amount of actinide nuclides, the difference between the charged and discharged actinide amounts, are linearly proportioned to burnup. In Fig. 2.1 seven depletion amounts obtained from seven different institutes' experimental data are compared on the basis of the calculation values which are obtained by using SAS2H with 44 group cross-section library. It might be considered as a kind of inter-comparison. Fig. 2.1 shows that most experimental data appears closely to the line of the relative error of zero and Mihama-3 and Yankee Rowe experiments are more apart from the zero line than others. But the relative errors are not too much large to exclude two institutes' experimental data. Although Trino Vercellese's experimental data had been expected to have a large error because those are measured in 1964 and the oldest of the published experiments, all data are around zero line within ±3 % as shown in Fig.2.1.

The measurements of 26 Obrigheim samples were carried out at both Ispra and Karlsruhe Establishments. As shown in Table 2.4, Samples E3-P4, G7-P1, G7-P3 and G14-P3(1) were measured both institutes simultaneously. Since two measured burnup values of G7-P1 are much different, one of two institute's measurements must be not correct. As reported in reference[12], Karlsruhe's result might be not reliable. In the case of E3-P2, the burnup values measured with Nd-148 is also much different from that of Cs-137 non-destructive method. Therefore, it is expected that a big difference between experimental data and calculated values will appear in the cases. In this work, the depletion calculations were carried out on the basis of the burnup values of Nd-148 method which are known as the best burnup estimation method.

Recently, isotopic compositions of PWR and BWR spent fuels were measured in the PIEF(Post Irradiation Examination Facility) of JAERI. The experimental data are expected to be useful for the verification of the experimental data mentioned above.

Table 2.1. Nuclear Power Plants & Experimental Conditions

| Plant | | | | | | | | | | | | | | Measurement | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name (Location) | Reactor | | | Assembly | | | Rod | | | | | | | Irradiation History | Measuring Method | |
| | Core Size (cm) | Power (MWe) | | Assy. No. | Pitch (cm) | Rod No. | Lattice Array | Pitch (cm) | Pellet Density ($g/cm^3$) | Pellet Dia. (cm) | Cladding I.D (cm) | Cladding O.D (cm) | Active Fuel Length (cm) | | Burnup | Inventory |
| Yankee Rowe (U.S.A.) | 190.75 | | WEC[a)] | 76 | 19.46 | 305 | 18× 18 | 1.072 | 10.18 | 0.747 | 0.757 | 0.864 | 230.05 | | HE[f)] Method Nd-148 | Mass Spectrometry, Alpha Spectrographic Radiochemical Analyses |
| Mihama-3 (JAPAN) | 304 | 826 | JAERI[b)] | 157 | 21.50 | 204 | 15× 15 | 1.430 | 9.996 | 0.929 | 0.948 | 1.072 | 365.76 | 1975.2 ~ 1982.3 | Nd-148 | Mass Spectrometry, α,γ Spectrometry |
| Trino Vercellese (ITALY) | 249 | 260 | ISPRA Karlsruhe | 120 /112 | 20.0 | 221 | 15× 15 | 1.303 | 10.353 | 0.890 | 0.902 | 0.979 | 264.1 | 1964.10 ~ 1967.4 | Nd-148 Cs-137 | Mass Spectrometry, Alpha Spectrometry |
| Calvert Cliffs (U.S.A.) | | 2560th | PNL[c)] | 217 | 20.78 | 160 ~176 | 14× 14 | 1.4732 | 10.036 ~10.045 | 0.9563 ~ 0.9639 | 0.948 | 1.072 | 347.22 | 1977.3.22~ 1982.4.17 | Nd-148 Cs-137 | Alpha, Beta, Gamma Scan |
| Turkey Point (U.S.A) | | | HEDL[d)] & BCL[e)] | | 21.50 | 204 | 15× 15 | 1.430 | 10.235 | 0.9296 | 0.985 | 1.118 | 365.8 | 1972.1.12~ 1975.11.25 | Nd-148 | ASTM E-267, ASTM E-321 |
| H. B. Robinson (U.S.A.) | 304 | 700 | HEDL | 157 | 21.50 | 204 | 15× 15 | 1.430 | 9.944 | 0.9294 | 0.948 | 10.072 | 365.8 | 1971.3~ 1974.5.6 | Cs-137 | ASTM E-321 |
| Obrigheim (GERMANY) | 250 | 350 | ISPRA Karlsruhe | 121 | 20.12 | 180 | 14× 14 | 1.430 | 9.742 | 0.925 | 0.930 | 1.074 | 295.6 | 1970.9.30~ 1974.8.16 | Nd-148 Cs-137 | Mass Spectrometry |

a) WEC : Westinghouse Electric Corporation.

b) JAERI: Japan Atomic Energy Research Institute

c) PNL : Pacific Northwest Laboratory.

d) HEDL : Hanford Engineering Development Laboratory.

e) BCL : Battelle Columbus Laboratory.

f) HE : Heavy Element(Pu/U)

Table 2.2. Operating Parameters for 55 Spent PWR Fuel Samples

| Reactor | Assembly ID | Calculation Sample ID | Enrichment (U-235 wt%) | Burnup (GWd /tU) | Cooling Time (d) | Axial Location (cm) | Temperature(℃) | | | Water Density ($g/cm^3$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Fuel | Cladding | Coolant | |
| Yankee rowe | E6-C-f6 | ya1 | 3.400 | 15.95 | 281.5 | 220.22 | 771.3 | 559.1 | 548.7 | 0.770 |
| | E6-C-f6 | ya2 | 3.400 | 30.39 | 717.0 | 138.94 | 889.5 | 560.2 | 540.8 | 0.783 |
| | E6-C-f6 | ya3 | 3.400 | 31.33 | 281.5 | 57.66 | 876.6 | 550.8 | 531.7 | 0.797 |
| | E6-C-f6 | ya4 | 3.400 | 20.19 | 281.5 | 17.02 | 787.1 | 540.6 | 528.0 | 0.803 |
| | E6-SE-c2 | ya5 | 3.400 | 32.03 | 281.5 | 138.94 | 889.5 | 560.2 | 540.8 | 0.783 |
| | E6-SE-c2 | ya6 | 3.400 | 31.41 | 281.5 | 57.66 | 876.6 | 550.8 | 531.7 | 0.797 |
| | E6-SE-e4 | ya7 | 3.400 | 35.97 | 281.5 | 138.94 | 889.5 | 560.2 | 540.8 | 0.783 |
| | E6-SE-e4 | ya8 | 3.400 | 35.26 | 281.5 | 57.66 | 876.6 | 550.8 | 531.7 | 0.797 |
| Mihama-3 | 86b02 | mi1 | 3.208 | 8.30 | 1825 | | 923.0 | 600.4 | 560.4 | 0.752 |
| | 86b03 | mi2 | 3.208 | 6.92 | 1825 | | 863.0 | 633.6 | 593.6 | 0.679 |
| | 86g05 | mi3 | 3.208 | 15.36 | 1825 | | 823.0 | 611.7 | 71.7 | 0.730 |
| | 86g03 | mi4 | 3.203 | 21.29 | 1825 | | 933.0 | 625.4 | 585.4 | 0.700 |
| | 86g07 | mi5 | 3.203 | 14.22 | 1825 | | 863.0 | 600.3 | 560.3 | 0.755 |
| | 86c03 | mi6 | 3.203 | 29.50 | 1825 | | 863.0 | 600.3 | 560.3 | 0.752 |
| | 87c04 | mi7 | 3.210 | 32.20 | 1825 | | 891.0 | 607.0 | 567.0 | 0.739 |
| | 87c07 | mi8 | 3.210 | 33.71 | 1825 | | 905.0 | 600.8 | 560.8 | 0.751 |
| | 87c08 | mi9 | 3.210 | 34.32 | 1825 | | 913.0 | 625.9 | 585.9 | 0.698 |
| Trino Vercellese | 509-104-M11-7 | tr1 | 3.897 | 12.04 | 10 | 79.2 | 1001.0 | 570.0 | 543.0 | 0.780 |
| | 509-032-E11-4 | tr2 | 3.130 | 15.38 | 10 | 158.5 | 1015.0 | 570.0 | 557.0 | 0.755 |
| | 509-032-E11-7 | tr3 | 3.130 | 15.90 | 10 | 79.2 | 1001.0 | 570.0 | 543.0 | 0.780 |
| | 509-032-E11-9 | tr4 | 3.130 | 11.53 | 10 | 26.4 | 927.0 | 570.0 | 537.0 | 0.789 |
| | 509-069-E11-1 | tr5 | 3.130 | 12.86 | 10 | 237.7 | 915.0 | 570.0 | 563.0 | 0.737 |
| | 509-069-E11-2 | tr6 | 3.130 | 20.60 | 10 | 211.3 | 968.0 | 570.0 | 561.0 | 0.741 |
| | 509-069-E11-4 | tr7 | 3.130 | 23.72 | 10 | 158.5 | 1015.0 | 570.0 | 553.0 | 0.755 |
| | 509-069-E11-7 | tr8 | 3.130 | 24.30 | 10 | 79.2 | 1001.0 | 570.0 | 540.0 | 0.780 |
| | 509-069-E5-4 | tr9 | 3.130 | 23.87 | 10 | 158.5 | 1015.0 | 570.0 | 553.0 | 0.755 |
| | 509-069-E5-7 | tr10 | 3.130 | 24.55 | 10 | 79.2 | 1001.0 | 570.0 | 540.0 | 0.780 |
| | 509-069-L11-4 | tr11 | 3.130 | 23.93 | 10 | 158.5 | 1015.0 | 570.0 | 553.0 | 0.755 |
| | 509-069-L11-7 | tr12 | 3.130 | 24.36 | 10 | 79.2 | 1001.0 | 570.0 | 540.0 | 0.780 |
| | 509-069-L5-4 | tr13 | 3.130 | 24.33 | 10 | 158.5 | 1015.0 | 570.0 | 553.0 | 0.755 |
| | 509-069-L5-7 | tr14 | 3.130 | 24.31 | 10 | 79.2 | 1001.0 | 570.0 | 540.0 | 0.780 |
| Calvert Cliffs Units 1 | D047-MKP109 | ca1 | 3.038 | 27.35 | 1870 | 13.2 | 922.0 | 595.0 | 570.0 | 0.731 |
| | D047-MKP109 | ca2 | 3.038 | 37.12 | 1870 | 27.7 | 922.0 | 595.0 | 570.0 | 0.731 |
| | D047-MKP109 | ca3 | 3.038 | 44.34 | 1870 | 165.22 | 922.0 | 595.0 | 570.0 | 0.731 |
| | D101-MLA098 | ca4 | 2.720 | 18.68 | 2374 | 9.10 | 922.0 | 595.0 | 570.0 | 0.731 |
| | D101-MLA098 | ca5 | 2.720 | 26.62 | 2374 | 24.50 | 922.0 | 595.0 | 570.0 | 0.731 |
| | D101-MLA098 | ca6 | 2.720 | 33.17 | 2374 | 161.90 | 790.0 | 620.0 | 557.0 | 0.757 |
| | BT03-NBD107 | ca7 | 2.453 | 31.40 | 2447 | 11.28 | 841.0 | 620.0 | 558.0 | 0.757 |
| | BT03-NBD107 | ca8 | 2.453 | 37.27 | 2447 | 19.92 | 873.0 | 620.0 | 570.0 | 0.733 |
| | BT03-NBD107 | ca9 | 2.453 | 46.46 | 2447 | 161.21 | 816.0 | 620.0 | 557.0 | 0.758 |
| Turkey point 3 | D01-G9 | tk1 | 2.556 | 30.72 | 927 | | 880.0 | 620.0 | 558.0 | 0.757 |
| | D01-G10 | tk2 | 2.556 | 30.51 | 927 | | 910.0 | 620.0 | 570.0 | 0.734 |
| | D01-H9 | tk3 | 2.556 | 31.56 | 927 | | 790.0 | 620.0 | 557.0 | 0.758 |
| | D04-G9 | tk4 | 2.556 | 31.26 | 927 | | 841.0 | 620.0 | 557.0 | 0.758 |
| | D04-G10 | tk5 | 2.556 | 31.31 | 927 | | 873.0 | 620.0 | 570.0 | 0.758 |
| H. B. Rorinson | N-9B-S | ro1 | 2.560 | 16.02 | 3936 | | 743.0 | 595.0 | 559.0 | 0.687 |
| | N-9B-N | ro2 | 2.560 | 23.81 | 3936 | | 830.0 | 595.0 | 559.0 | 0.687 |
| | N-9C-J | ro3 | 2.560 | 28.47 | 3631 | | 883.0 | 595.0 | 576.0 | 0.656 |
| | N-9C-D | ro4 | 2.560 | 31.66 | 3631 | | 923.0 | 595.0 | 579.0 | 0.650 |
| Obrigheim | 170-94 | or1 | 3.130 | 25.93 | 10 | | 846.0 | 605.0 | 572.0 | 0.728 |
| | 172-92 | or2 | 3.130 | 26.54 | 10 | | 841.0 | 605.0 | 572.0 | 0.728 |
| | 176-91 | or3 | 3.130 | 27.99 | 10 | | 849.0 | 605.0 | 572.0 | 0.728 |
| | 168-86 | 0b4 | 3.130 | 28.40 | 10 | | 859.0 | 605.0 | 572.0 | 0.728 |
| | 171-89 | 0b5 | 3.130 | 29.04 | 10 | | 867.0 | 605.0 | 572.0 | 0.728 |
| | 176-90 | or6 | 3.130 | 29.52 | 10 | | 771.3 | 560.2 | 540.8 | 0.783 |

Table 2.3. Design Specifications for Obrigheim Spent Fuel

| Design Specification | Value |
|---|---|
| Fuel Rod | |
| -Pellet Density | 10.422 g/cm$^3$ |
| -Pellet Diameter | 0.9040 cm |
| -Cladding ID | 0.9318 cm |
| -Cladding OD | 1.0760 cm |
| -Pitch | 1.4300 cm |
| Assembly | |
| -Rod No | 180 |
| -Array | 14 x 14 |

Table 2.4. Operating Parameters for 26 Obrigheim Samples

| Calculation Sample ID | Sample ID | Measurement Institute | Enrichment (U-235wt%) | Burnup (GWd/tU) | Axial Location (cm) | Temperature(℃) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Fuel | Cladding | Coolant |
| or1 | D1-P1 | Karlsruhe | 3.00 | 21.17 | 15.0 | 900.0 | 600.0 | 556.3 |
| or2 | D1-P3 | Ispra | 3.00 | 33.75 | 143.5 | 900.0 | 600.0 | 570.5 |
| or3 | E3-P1 | Ispra | 3.00 | 20.18 | 15.0 | 900.0 | 600.0 | 556.3 |
| or4 | E3-P2 | Karlsruhe | 3.00 | 35.10 | 31.5 | 900.0 | 600.0 | 557.0 |
| or5 | E3-P3 | Ispra | 3.00 | 36.26 | 143.5 | 900.0 | 600.0 | 570.5 |
| or6 | E3-P4 | Ispra | 3.00 | 30.89 | 231.5 | 900.0 | 600.0 | 582.8 |
| or7 | E3-P4 | Karlsruhe | 3.00 | 30.94 | 231.5 | 900.0 | 600.0 | 582.8 |
| or8 | E3-P5 | Ispra | 3.00 | 22.86 | 258.5 | 900.0 | 600.0 | 585.0 |
| or9 | G7-P1 | Ispra | 3.00 | 17.13 | 15.0 | 900.0 | 600.0 | 556.3 |
| or10 | G7-P1 | Karlsruhe | 3.00 | 22.70 | 15.0 | 900.0 | 600.0 | 556.3 |
| or11 | G7-P2 | Ispra | 3.00 | 25.83 | 31.5 | 900.0 | 600.0 | 557.0 |
| or12 | G7-P3 | Ispra | 3.00 | 31.50 | 143.5 | 900.0 | 600.0 | 570.5 |
| or13 | G7-P3 | Karlsruhe | 3.00 | 31.14 | 143.5 | 900.0 | 600.0 | 570.5 |
| or14 | G7-P4 | Ispra | 3.00 | 27.71 | 231.5 | 900.0 | 600.0 | 582.8 |
| or15 | G7-P5 | Karlsruhe | 3.00 | 25.81 | 258.5 | 900.0 | 600.0 | 585.0 |
| or16 | M14-P1 | Karlsruhe | 3.00 | 15.60 | 15.0 | 900.0 | 600.0 | 556.3 |
| or17 | M14-P3 | Ispra | 3.00 | 29.36 | 143.5 | 900.0 | 600.0 | 570.5 |
| or18 | M14-P4 | Karlsruhe | 3.00 | 24.90 | 231.5 | 900.0 | 600.0 | 582.8 |
| or19 | G14-P3(1) | Ispra | 2.83 | 38.10 | 132.8 | 900.0 | 600.0 | 568.8 |
| or20 | G14-P3(1) | Karlsruhe | 2.83 | 36.88 | 132.8 | 900.0 | 600.0 | 568.8 |
| or21 | G14-P4(1) | Ipara | 2.83 | 35.64 | 220.6 | 900.0 | 600.0 | 581.6 |
| or22 | G14-P5(1) | Ispra | 2.83 | 30.16 | 242.6 | 900.0 | 600.0 | 583.8 |
| or23 | G14-P5(2) | Ispra | 2.83 | 24.22 | 254.7 | 900.0 | 600.0 | 584.8 |
| or24 | K14-P1 | Ispra | 2.83 | 25.45 | 15.0 | 900.0 | 600.0 | 556.3 |
| or25 | K14-P3(1) | Ispra | 2.83 | 36.67 | 132.8 | 900.0 | 600.0 | 568.8 |
| or26 | K14-P4(1) | Karlsruhe | 2.83 | 32.90 | 220.6 | 900.0 | 600.0 | 581.6 |

* Cooling Time: 0.0 day

*Cooling Water Density:

-SAS2H: 0.8238 g/cm$^3$

-SWAT: water density, corresponding to the coolant temperature, is calculated in SWAT.

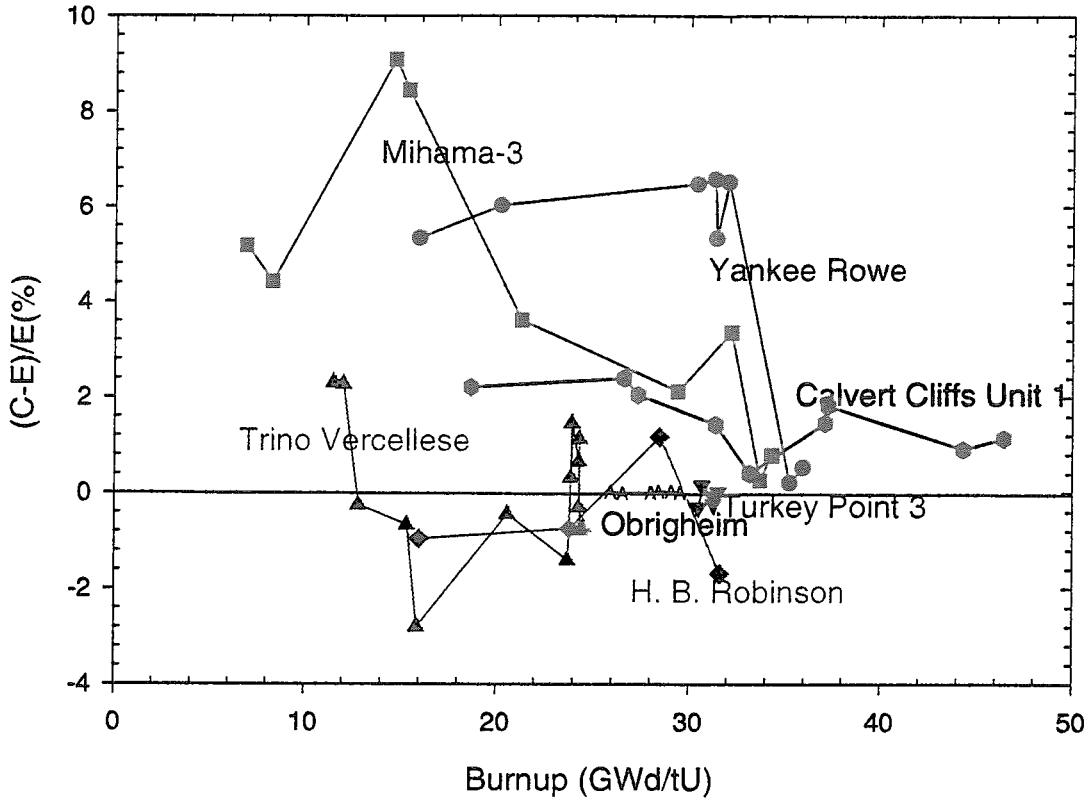


Fig. 2.1. Relative Errors of Total Depleted Actinide Amounts against Burnup except Effects of U-238.

# 3. Characteristics of SAS2H Module and SWAT Code System

## 3.1. SAS2H

SCALE(Modular Code System for Performing Standardized Computer Analysis for Licensing Evaluation) is a well-established code system that has been widely used in away-from-reactor (AFR) applications for spent fuel characterization via the SAS2H(Shielding Analysis Sequence No.2) analysis sequence. SAS2H is a multicode sequence that determines the isotopic composition of spent fuel using the ORIGEN-S code[22] for depletion and decay calculations and a 1-D neutronics model of an LWR fuel assembly to prepare burnup-dependent cross sections for ORIGEN-S.

The process used by SAS2H in calculation of spent fuel isotopes is illustrated schematically in Fig. 3.1. The calculation starts with input-specified data describing a fuel assembly as it is initially loaded into a reactor. The initial composition, average temperatures, geometry, and time-dependent specific power of the fuel assembly are required. The SAS2H sequence performs 1-D neutron transport analysis of the reactor fuel assembly using XSDRNPM and a two-part procedure with two separate unit-cell-lattice models.

As shown in Fig. 3.1, the first model is a unit fuel-pin cell from which cell-weighted cross sections are obtained. The second model represents a larger unit cell (e.g., an assembly) within an infinite lattice. The larger unit cell zones can be structured for different assembly designs to account for assembly-specific attributes (i.e., water holes, burnable poison rods, etc.). Problem-dependent resonance self-shielding of cross sections is performed prior to each XSDRNPM calculation using the BONAMI and NITAWL-II codes. The neutron flux spectrum obtained from the second (assembly) unit-cell model is used to determine the appropriate nuclide cross sections for the burnup-dependent fuel composition. The cross sections derived from XSDRNPM calculations at each time step are used in an ORIGEN-S point-depletion computation that produces the burnup-dependent fuel compositions to be used in the next spectrum calculation.

This sequence is repeated in user-specified burnup steps for a complete assembly operating history. The buildup and decay of nuclides in the fuel assembly is then computed by ORIGEN-S in the final pass based on the assembly's cooling time (i.e., the period of time after final exposure time). The neutron flux used to produce the ORIGEN-S cross sections is based on a radial average of an infinitely long uniform assembly with characteristics per input specifications. These specifications (e.g., burnup, specific power, moderator temperature, etc.) can be representative of any axial location along the fuel assembly or an axial average of the fuel assembly.

## 3.2. SWAT

SWAT is an integrated burnup code system, which are developed for analysis of post irradiation examination, transmutation of radioactive waste, and burnup credit problem. Fig. 3.2 shows the flow of analysis by SWAT. In SWAT calculation, the total burnup history is divided into burnup steps. SWAT calculates the neutron spectrum and effective cross sections with the SRAC code system[24] for each burnup step, prepares a one grouped cross section library for ORIGEN2, and performs burnup calculation with ORIGEN2 using that new library. SWAT consists of four codes: SRAC, ORIGEN2, TABMAK, and LIBMAK.

SRAC is a neutronics code widely used in Japanese research institutes. ORIGEN2 is one of the most famous point burnup codes. LIBMAK and TABMAK prepares libraries for ORIGEN2 using a calculated result of SRAC. TABMAK prepares input data for SRAC and ORIGEN2 from the result of ORIGEN2 for the next burnup step. Moreover, SWAT contains cross section library based on JENDL-3.2 [25], and decay and fission yield libraries based on JNDC FP library second version[26]. This means that we can carry out burnup calculation of more than thousands of isotopes by ORIGEN2 using the latest cross section libraries prepared by SRAC considering changes in the neutron spectrum and effective cross sections during the burnup.

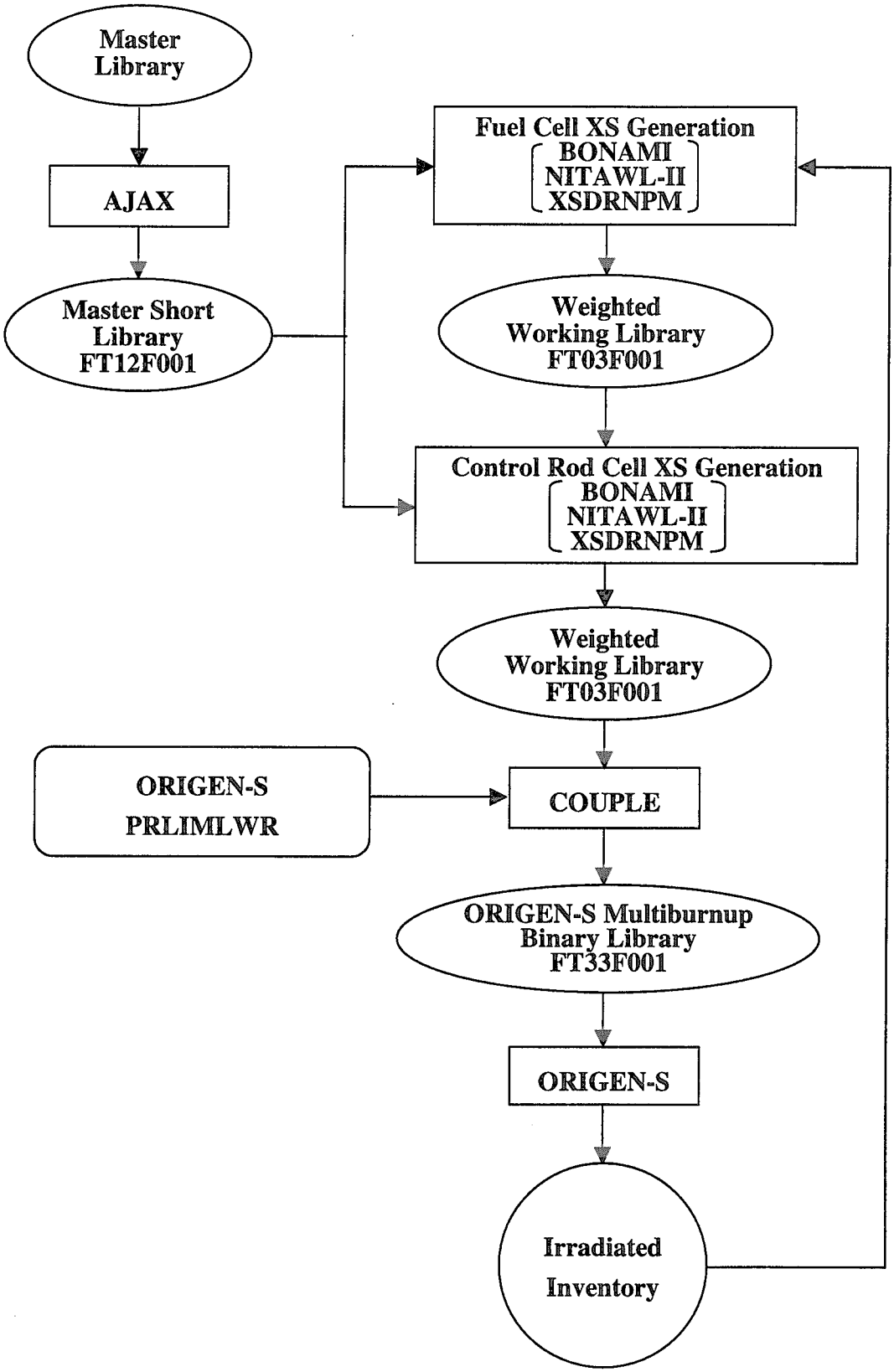


Fig. 3.1. Computational Flowchart of SAS2H Procedure.

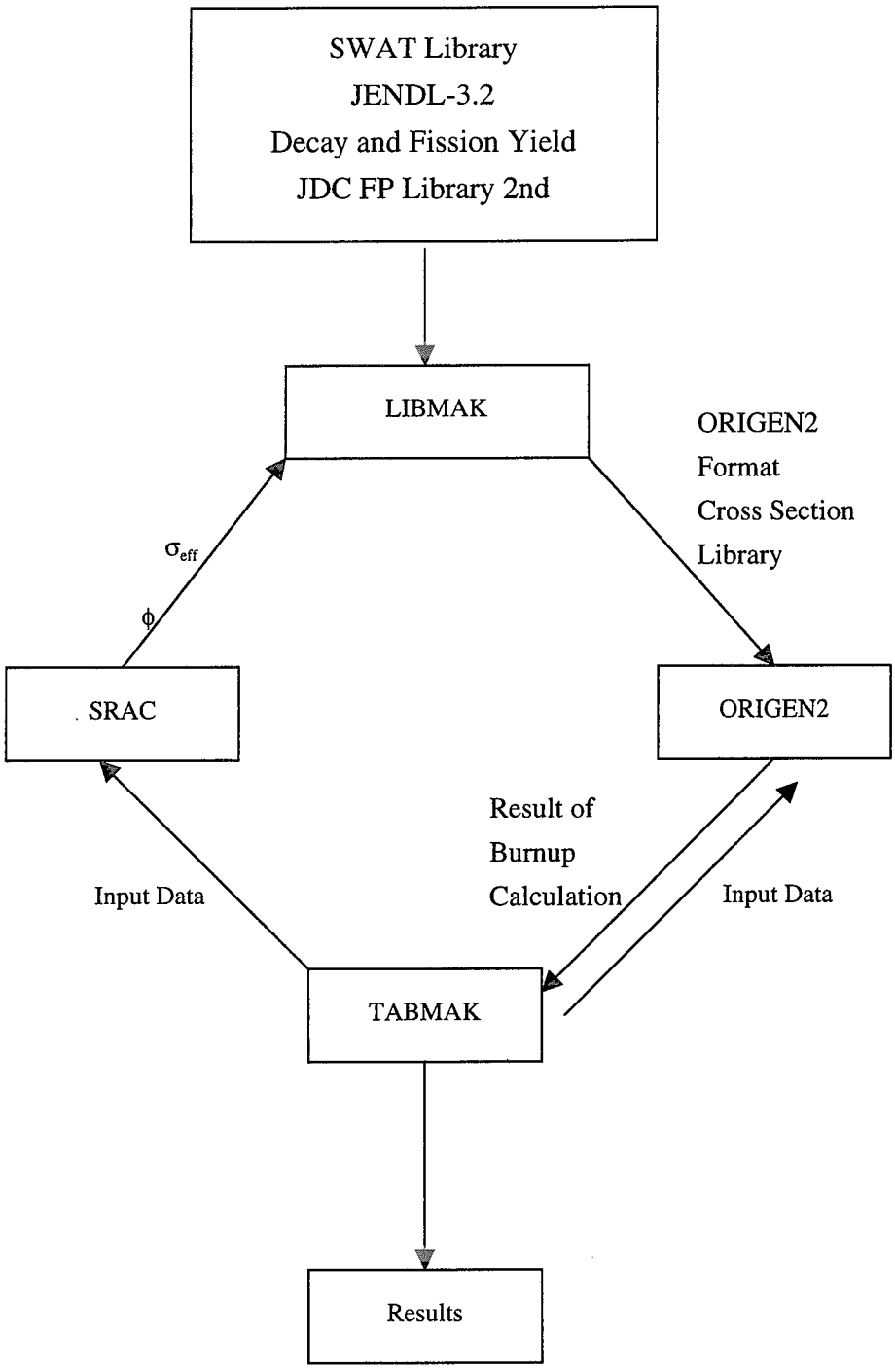


Fig. 3.2. Flow of Calculation in SWAT

# 4. Methods of Correction Factor Determination

The correction factors are determined on the basis of ratios of the calculated and measured data. Tolerance limit method and linear regression method are taken into accounted in this work.

## 4.1. Tolerance Limit Method[27-29]

Differences between calculated and measured isotopic compositions for any given fuel sample can be assumed to result from both the random fashion relative to modeled parameters and the random error associated with experimental measurements.

Given the measured isotopic composition and the corresponding calculated composition for an isotope, the ratio of the measured composition to the calculated isotopic composition for the isotope may be defined as

$$x_{ij} = \left[\frac{E_{ij}}{C_{ij}}\right] \tag{1}$$

where $E_{ij}$ and $C_{ij}$ are experimental value and calculated value for the nuclide $i$ and sample $j$ of the different initial enrichment, burnup, or/and cooling, respectively.

It is necessary to estimate the population mean and variance in terms of the mean and variance of a subset of samples selected to represent the entire population. The mean and the sample variance of the sample set for the nuclide $i$ are given as $\bar{x}_i$ and $s_i^2$, respectively, where for a sample set comprised of $N_i$ samples,

$$\bar{x}_i = \sum_{j=1}^{N_i}\left[\frac{x_{ij}}{N_i}\right] \tag{2}$$

$$s_i^{\,2} = \sum_{j=1}^{N_i}\left[\frac{(x_{ij}-\bar{x}_i)^2}{N_i-1}\right] \tag{3}$$

For a set of normally distributed data points, one may use a tolerance interval approach to assign a tolerance factor $k_{N_i}^{\alpha,\gamma}$ value for $N_i$. Under this approach, for a given $\alpha$ and $\gamma$, there is a probability $\gamma$ that a future value of $\frac{E_i'}{C_i'}$ will lie within the range $\bar{x} \pm k_{N_i}^{\alpha,\gamma} s_i$,

with an α confidence.

$$\bar{x}_i - k_{N_i}^{\alpha,\gamma} s_i \le \left[\frac{E_i'}{C_i'}\right] \le \bar{x}_i + k_{N_i}^{\alpha,\gamma} s_i \tag{4}$$

where $C_i'$ is a calculation value and $E_i'$ is the corresponding measured data, true value. References [27,28] provides tabulated values of $k_{N_i}^{\alpha,\gamma}$ for common values of α and γ and for a range of values of $N_i$. By multiplying $C_i'$ to eq.(4), the upper bound and lower bound of the true value are expressed by the following.

$$C_i' \cdot \left(\bar{x}_i - k_{N_i}^{\alpha,\gamma} s_i\right) \le E_i' \le C_i' \cdot \left(\bar{x}_i + k_{N_i}^{\alpha,\gamma} s_i\right) \tag{5}$$

In a spent fuel criticality calculation, a conservative approach in the prediction of the neutron multiplication factor, $k_{eff}$, is to assume the maximum concentration of fissile isotopes combined with the minimum concentration of non-fissile isotopes, to set an uppermost expected limit on $k_{eff}$. Thus for a set of isotopes present in a criticality calculation, one can determine the limiting isotopic composition by using a correction factor appropriate for each isotope. These correction factor may be written for each isotope $i$ as

$$f_i(fissile) = \bar{x}_i + k_{N_i}^{\alpha,\gamma} s_i \text{, or} \tag{6}$$

$$f_i(non-fissile) = \bar{x}_i - k_{N_i}^{\alpha,\gamma} s_i \tag{7}$$

The correction factors are applied conservatively to ensure that criticality safety evaluations employing the burnup credit method result in an overestimated value of the neutron multiplication factor for the system being evaluated.

As the number of experimental measurements increases, the terms $s_i$ and $k_{N_i}^{\alpha,\gamma}$ will generally decrease. Isotopic correction factors based on a limited number of experimental measurements are, therefore, excessively conservative, though the conservatism is statistically justified.

## 4.2. Linear Regression Method[19,27]

Having established the trends associated with the isotopic data, the correction factor for each isotope can now be determined. The correction factor for each isotope is determined to assure that the isotopic concentration is conservative. This implies adding an appropriate uncertainty to the fissile isotopes and subtracting the uncertainty in the absorber isotopes. The appropriate uncertainty is found using the prediction interval technique. This technique establishes an interval around the mean prediction in which there is 95 % confidence that the next observation will be within the interval. For this application only one side of the interval is of interest. Therefore, the uncertainty is established in a way that there is a 95% confidence that the next observation being above (absorbers) or below (fissile isotopes) the corrected isotopic concentration.

The generic correction factor formula for isotopes which exhibit trends with respect to one or more parameters such as burnup, initial enrichment, specific power and a multiplication value of the nuclear parameters is also determined based on a prediction interval. Therefore, the 95%-confidence correction factor is:

$$f_{buc} = 1.0 + \sum_{j=1}^{m} b_j * H_j - t_{95,n-m} \sqrt{(1 + \sum_{j=1}^{m} \frac{H_j^{\,2}}{\sum_{i=1}^{n} h_{ji}^{\,2}}) \frac{SS_R}{n-m}} \qquad (8)$$

Where

$$SS_r = \sum_{i=1}^{n} (x_i - 1 - \sum_{j=1}^{m} b_j * h_{ji})^2$$

$m$= number of parameters against which the specific isotope exihibited trends

$b_j$= the linear slope for the trending parameter $j$

$H_j$= the value of trending parameter variable $j$

$h_{ij}$= the value for trending parameter $j$ for the $i$th sample (The $h_{ji}$ values are predetermined by the samples set.)

$n$= number of data points

## 4.3. Statistical Tests

Two methods mentioned above can be used to determine the correction factor when the samples data pass the statistical tests. Although only normality test is required for application of tolerance limit method, in the case of linear regression method, additionally constant variance and power of $s$=0.05 test in the case of 95 % confidence level are required.

On the basis of the calculation value of SAS2H with 44 group cross-section library for 55 experimental samples, statistical tests have been preliminarily carried out. A few nuclides passed all three tests, which seemed to be resulted from the lack of experimental data. In this work, therefore, only tolerance limit method is applied to the determination of correction factors under the assumption of an approximate normal distribution.

# 5. Isotopic Composition Calculation for 26 Obrigheim Spent Fuel Samples

Using SAS2H and SWAT, isotopic compositions were calculated for 26 Obrigheim spent fuel samples.

## 5.1. Input Preparation

SWAT input was prepared using a fortran program which can read SFCOMPO data file. The basic nuclear parameters, cited from SFCOMPO database, such as fuel pellet and cladding radii, pitch, inlet and outlet temperatures, etc. were inputted in the program. The temperature at the axial location of the sample was also calculated in the program under the assumption of sine-curve power distribution. The depletion time step number per cycle was chosen to be 12 for the ORIGEN2 calculation. For the SRAC calculation, the cross section updating number per cycle was chosen to be 12. Two numbers were fixed for all SWAT calculations of 26 samples. The fuel design specifications and nuclear parameters which were used in the SWAT input were presented in Table 2.3.

A fortran program was made to generate SAS2H input on the basis of SWAT input and additional specification data such as assembly pitch, guide tube inner and outer diameters.

## 5.2. Comparison of Calculation Results with Experimental Data

### 5.2.1. Comparison of U-235 Measured-to-Calculated Ratio

Trend of U-235 measured-to-calculated ratio against each sample is shown in Fig. 5.1. The ratio is much higher than 1.0 in the case of samples 4 and 10. On the other hand, the ratios of samples 20-22 and 26 are much lower than 1.0. Although four kinds of calculation resulted different values on each sample, the trend patterns are similar to each other. It means that calculation mechanism and cross-section data are similar to each other. As shown in Fig. 5.1, any SWAT-calculated composition values except sample No 4 is a value between the minimum and maximum of three composition value which were calculated using SAS2H with 27, 44 and 238 group cross-section libraries.

### 5.2.2. Comparison of the Relative Errors

The relative errors of the calculated U-235 concentration are shown in Fig. 5.2. Maximum errors appeared to be about –25% at sample No 4 and about 30 % at sample No 26, respectively. The effects of axial location of the sample position are compared in Fig.5.3. As unexpected, the relative errors of the end point samples appeared to be rather smaller than the results of the fuel center area. It means that SAS2H and SWAT can take into account the spectrum hardening effect at the end of fuel rod very well. The big error of U-235 composition seems to be resulted from the inaccuracy of experimental data.

The relative errors of 16 nuclides which are separated into two initial enrichments and sorted against burnup in each part are shown in Figs. 5.4 – 5.19. The trend of the relative errors against burnup does not seem to be shown clearly in the Figs. The results of SWAT are under-estimated for all nuclides except U-235, U-238 and Pu-240 in comparison with three results of SAS2H. Specially, it is outstanding that the Pu-239 and Pu-241 relative errors of four calculations are over-estimated.

The relative error predictions of higher actinides such as americium and curium are much larger than the expected. It is necessary to certificate the validation of the experiment data. Uranium, plutonium and actinide compositions are compared in Figs. 5.20 – 5.22. In the cases of uranium and actinides, the U-238 composition is not included. If the composition was included, other nuclide trend could not be observed because U-238 composition is much larger than others. The actinide relative error is much lower, which means the basic condition is correct. But the detailed inspection of the experimental data seems to be required.

### 5.2.3. Selection of Available Samples

The sorted U-235 relative errors against burnup are presented in Table 5.1. As investigated above, in the cases of samples or4, or10 and almost all samples of the initial enrichment of 2.83 wt%, the relative errors are very large in comparison with others. The big errors seem to be resulted from burnup measuring errors. As shown in the

reference[12], the measurements were carried out by both Karlsruhe and Ispra using Nd-148, Cs-137 destructive and non-destructive methods. In this work, sample or4 was assumed to be 35.1 GWd/tU which were measured using Nd-148 method. But as shown in Table 3.3-4 of the reference, the measured burnup using Cs-137 non-destructive method was 29.35 GWd/tU. As considering an inverse proportion of U-235 composition to burnup and comparing with others, the value of 29.35 GWd/tU seems to be correct rather than 35.1 GWd/tU. In the case of sample or10 and some samples of 2.83 wt%, the measured burnup values seem to be incorrect because of the similar reason. Excepting 10 samples which seem to have some errors in measurement of burnup, 16 available samples are selected: samples or1-or3, or5-or9 and or11-or18.

### 5.2.4. Comparison of the Means and Standard Deviations of the Measured-to-Calculated Ratios

The means and standard deviations of the measured-to-calculated ratio for the 16 available samples are shown in the Fig. 5.23. Since Am-241, Am-242, Cm-242 and Eu-154 ratios are very larger than others, those are separately presented in Fig. 5.24.

The ratio of the measured to calculated values was used as a parameter. When the ratio is less than unity, the calculation overestimates the measurement, and the ratio becomes closer to unity, they have a better agreement. For many important nuclides for burnup credit criticality safety evaluation, the four methods applied in this study showed good coincidence with measurements in general. As shown in Fig. 5.23, by more precise observations, SWAT results for Pu-239, Pu-241, Am-243 and Cm-244 appear to be closer to unity than the SAS2H results.

It is strange that in the cases of Pu-242, Am-243 and Cm-244, the result of SAS2H with 27 group cross-section library is better than the results of SAS2H with 44 and 238 group cross-section library. It is found that the results of SAS2H with 44 and 238 group cross-section libraries are much improved in the case of Eu-154. The improvement must result from the updating libraries from ENDF/V to ENDF/VI.

Table 5.1. U-235 Relative errors of SAS2H and SWAT Calculated Compositions in the Case of 26 Obrigheim Spent Fuel Samples

| Sample Id | Enrich-ment (wt%) | Axial Location (cm) | Burnup (GWd/tU) | Exp. Data (g/tU,initial) | (Cal.-Exp.)/Exp. | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | SAS2H | | | SWAT |
| | | | | | 27 G | 44 G | 238 G | 107 G |
| or23 | 2.830 | 254.7 | 24.220 | 8.940E+03 | 9.351 | 9.620 | 11.454 | 11.857 |
| or24 | 2.830 | 15.00 | 25.450 | 1.000E+04 | -7.880 | -8.110 | -6.470 | -8.830 |
| or22 | 2.830 | 242.6 | 30.160 | 6.270E+03 | 16.571 | 16.938 | 19.569 | 19.522 |
| or26 | 2.830 | 220.6 | 32.900 | 5.040E+03 | 26.369 | 26.369 | 30.099 | 28.849 |
| or21 | 2.830 | 220.6 | 35.640 | 4.950E+03 | 11.576 | 11.576 | 15.374 | 13.798 |
| or25 | 2.830 | 132.8 | 36.670 | 4.860E+03 | 7.840 | 6.872 | 10.741 | 6.008 |
| or20 | 2.830 | 132.8 | 36.880 | 4.410E+03 | 17.234 | 16.712 | 20.975 | 15.488 |
| or19 | 2.830 | 132.8 | 38.100 | 5.050E+03 | -3.663 | -4.594 | -0.871 | -5.743 |
| or16 | 3.000 | 15.00 | 15.600 | 1.570E+04 | 1.338 | 1.338 | 1.911 | 1.720 |
| or9 | 3.000 | 15.00 | 17.130 | 1.520E+04 | -1.974 | -1.842 | -1.184 | -1.645 |
| or3 | 3.000 | 15.00 | 20.180 | 1.280E+04 | 2.109 | 2.109 | 2.969 | 2.031 |
| or1 | 3.000 | 15.00 | 21.170 | 1.370E+04 | -8.759 | -8.759 | -7.737 | -8.832 |
| or10 | 3.000 | 15.00 | 22.700 | 1.440E+04 | 18.889 | 18.889 | 17.917 | 19.167 |
| or8 | 3.000 | 258.0 | 22.860 | 1.190E+04 | -2.437 | -2.269 | -1.092 | -0.420 |
| or18 | 3.000 | 231.0 | 24.900 | 1.030E+04 | 2.718 | 2.913 | 4.466 | 4.757 |
| or15 | 3.000 | 258.0 | 25.810 | 1.010E+04 | 0.495 | 0.792 | 2.376 | 2.772 |
| or11 | 3.000 | 31.00 | 25.830 | 1.080E+04 | -6.204 | -6.389 | -4.907 | -6.944 |
| or14 | 3.000 | 231.0 | 27.710 | 1.010E+04 | -8.089 | -7.861 | -6.228 | -6.099 |
| or17 | 3.000 | 143.0 | 29.360 | 8.780E+03 | -2.301 | -2.301 | -0.159 | -1.970 |
| or6 | 3.000 | 231.0 | 30.890 | 7.480E+03 | 6.818 | 6.818 | 9.332 | 9.064 |
| or7 | 3.000 | 231.0 | 30.940 | 7.840E+03 | 1.620 | 1.620 | 4.018 | 3.814 |
| or13 | 3.000 | 143.0 | 31.140 | 7.500E+03 | 5.280 | 4.973 | 7.480 | 5.147 |
| or12 | 3.000 | 143.0 | 31.500 | 7.610E+03 | 1.905 | 1.603 | 4.074 | 1.787 |
| or2 | 3.000 | 143.0 | 33.750 | 6.930E+03 | 0.043 | -0.303 | 2.756 | -0.216 |
| or4 | 3.000 | 31.00 | 35.100 | 8.440E+03 | 23.152 | 23.709 | 21.481 | 25.616 |
| or5 | 3.000 | 143.5 | 36.260 | 6.090E+03 | 0.722 | -0.049 | 3.415 | -0.263 |

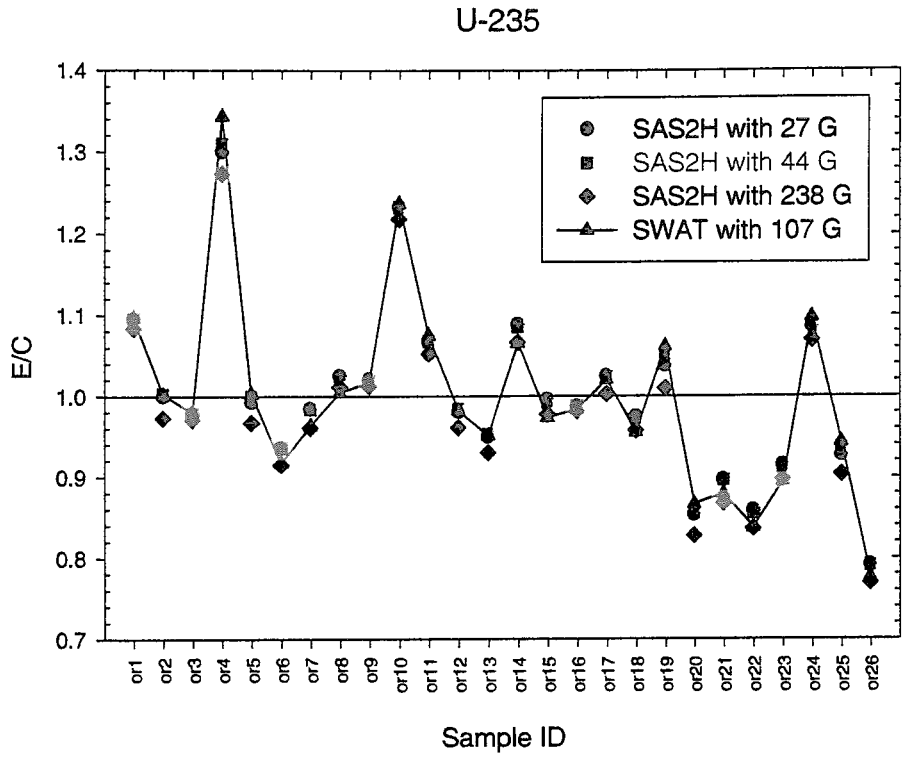


Fig. 5.1. Comparison of U-235 Measured-to-Calculated Ratios.

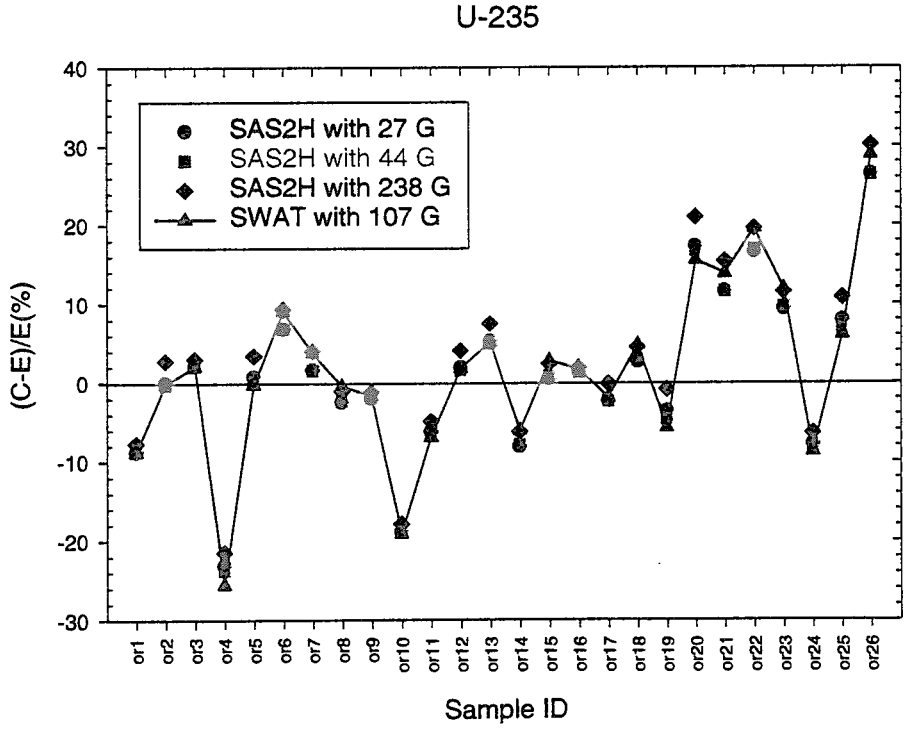


Fig. 5.2. Relative Errors of U-235 Calculated Compositions against Sample ID.

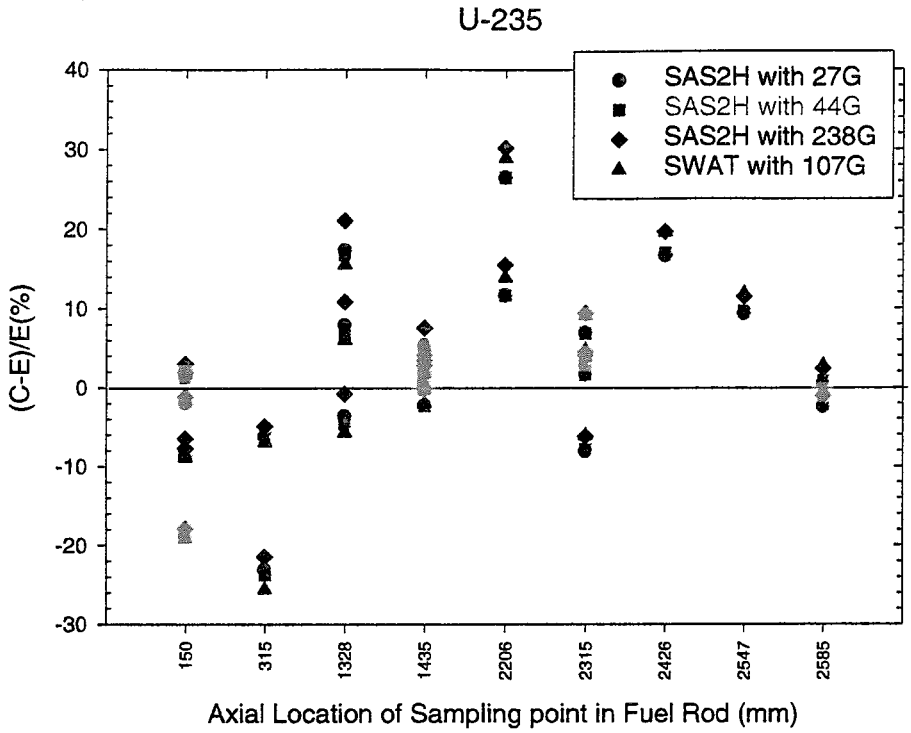


Fig. 5.3. Relative Errors of U-235 Calculated Compositions against Axial Location.

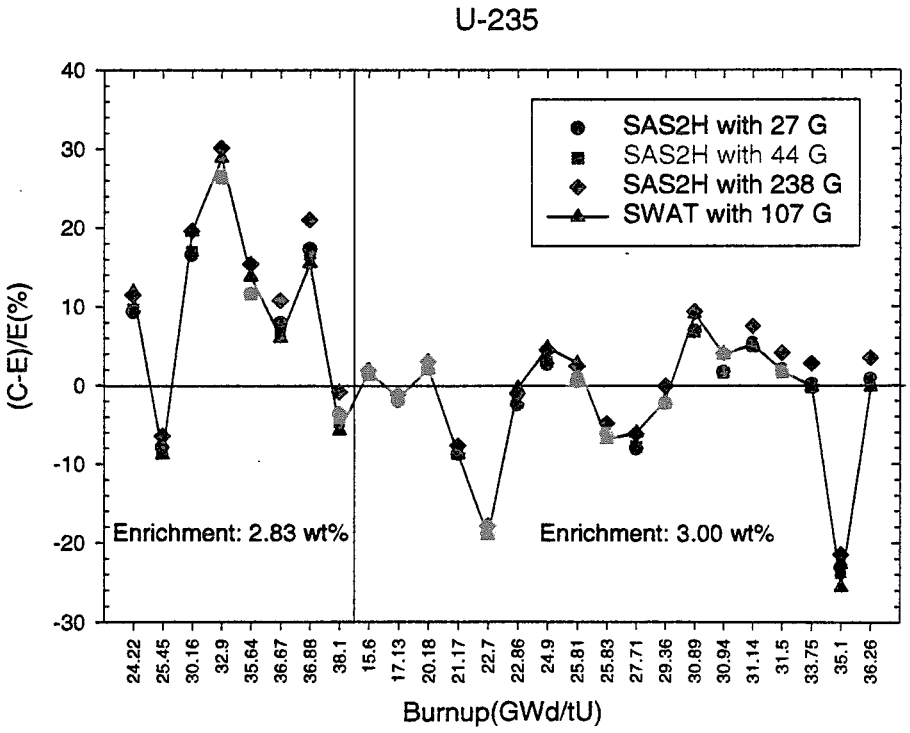


Fig. 5.4. Relative Errors of U-235 Calculated Compositions.

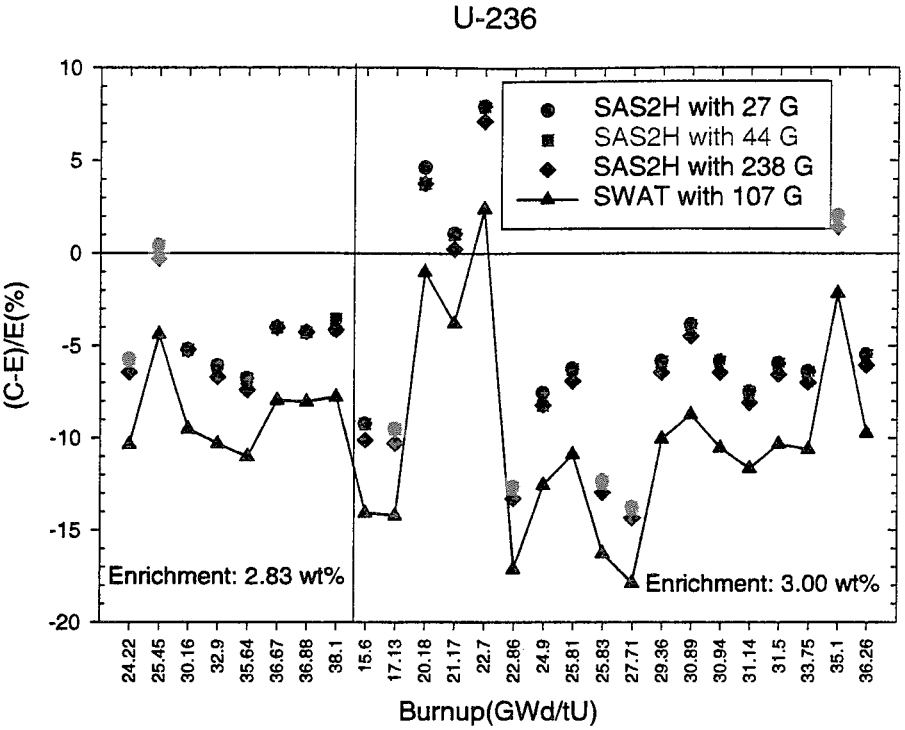


Fig. 5.5. Relative Errors of U-236 Calculated Compositions.

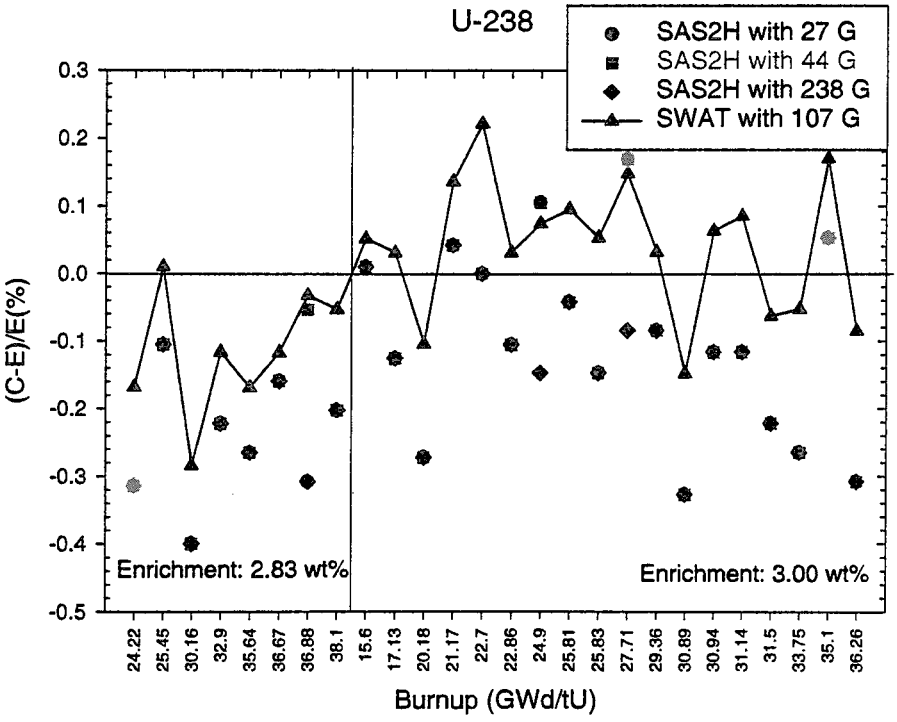


Fig. 5.6. Relative Errors of U-238 Calculated Compositions.

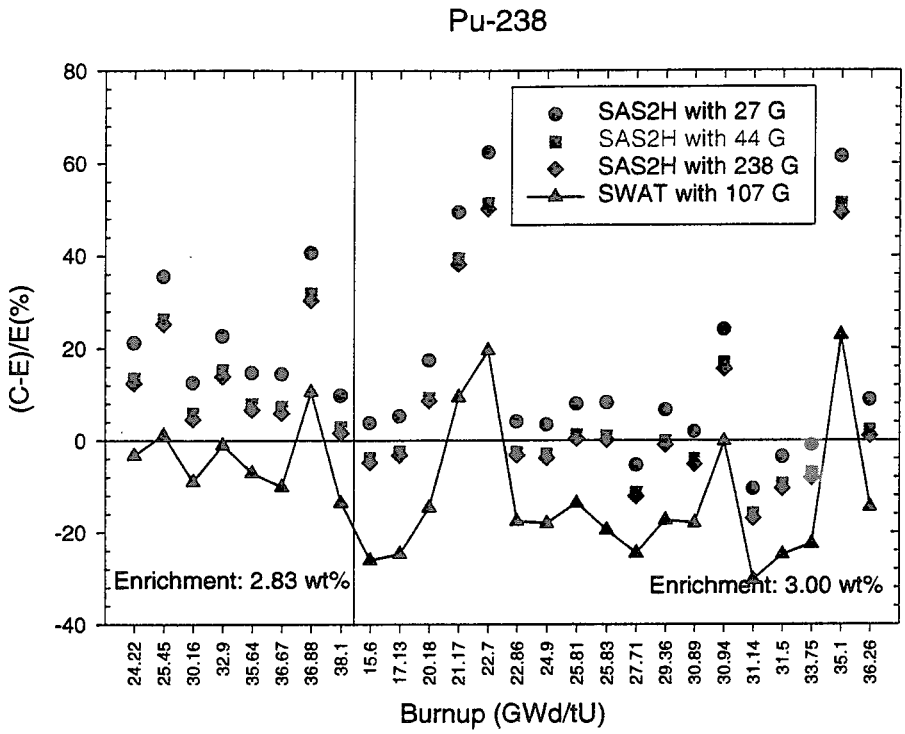


Fig. 5.7. Relative Errors of Pu-238 Calculated Compositions.

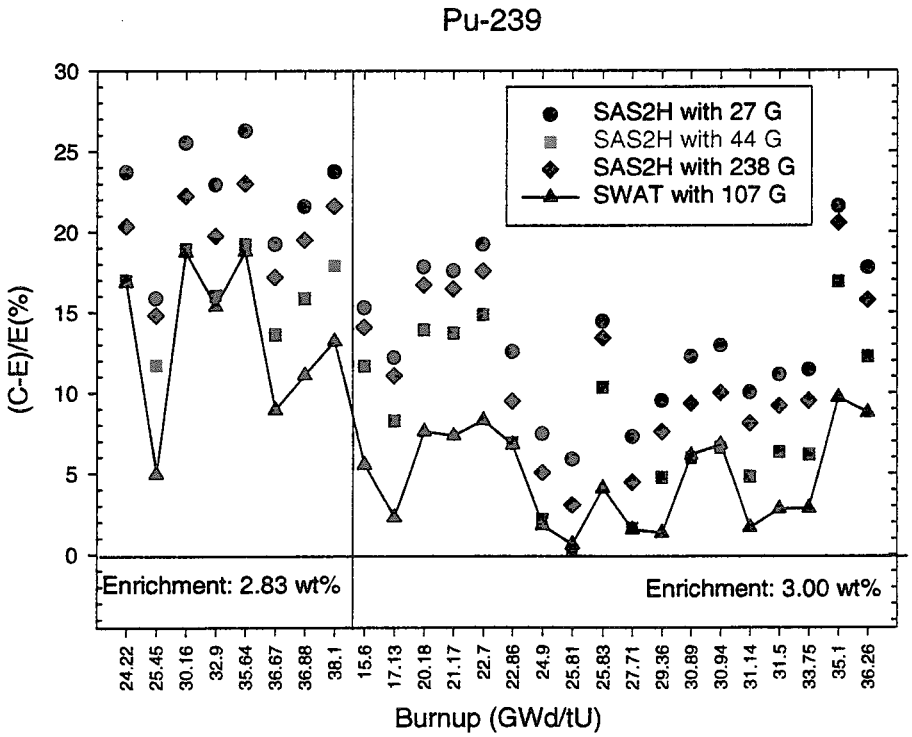


Fig. 5.8. Relative Errors of Pu-239 Calculated Compositions.

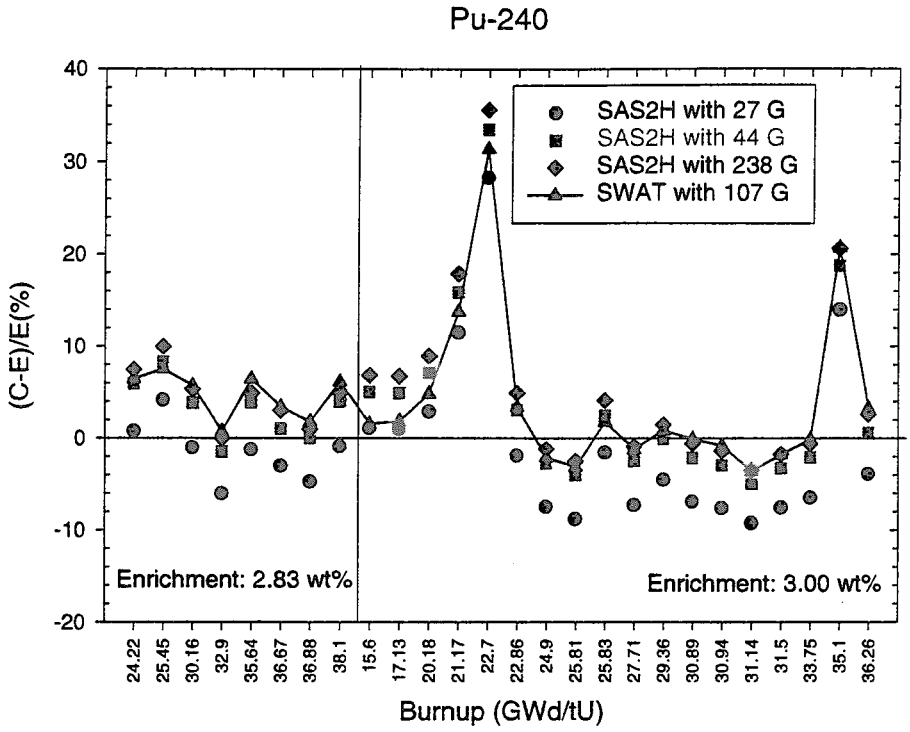


Fig. 5.9. Relative Errors of Pu-240 Calculated Compositions.

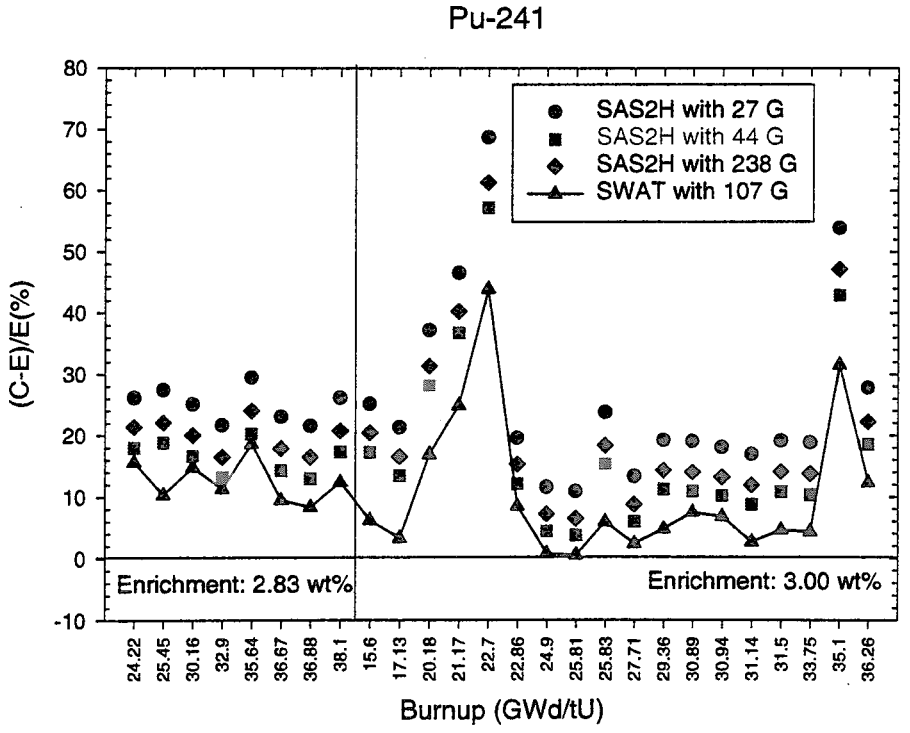


Fig. 5.10. Relative Errors of Pu-241 Calculated Compositions.

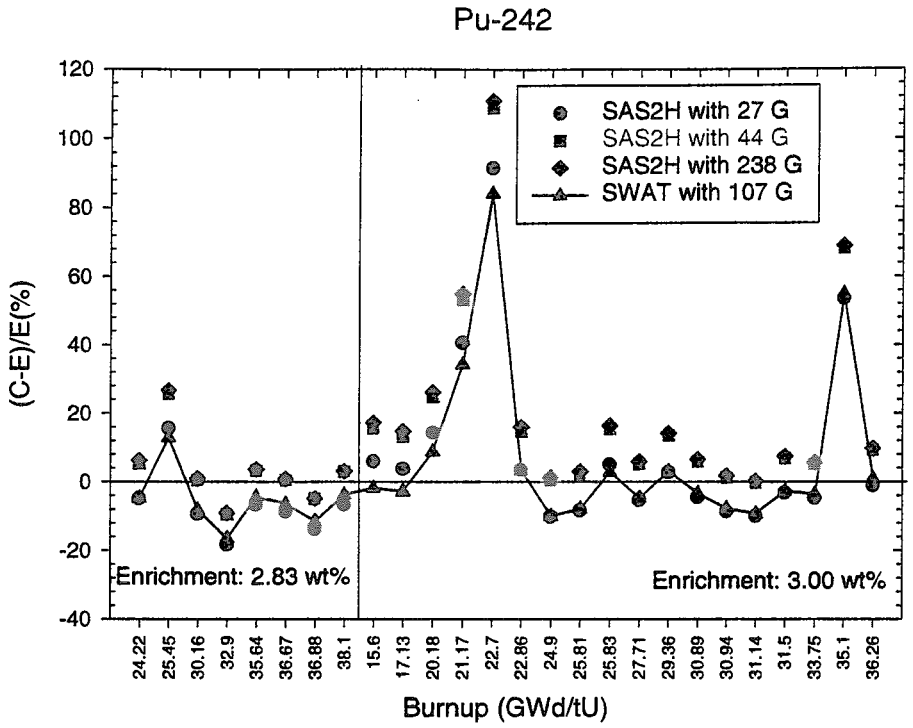


Fig. 5.11. Relative Errors of Pu-242 Calculated Compositions.

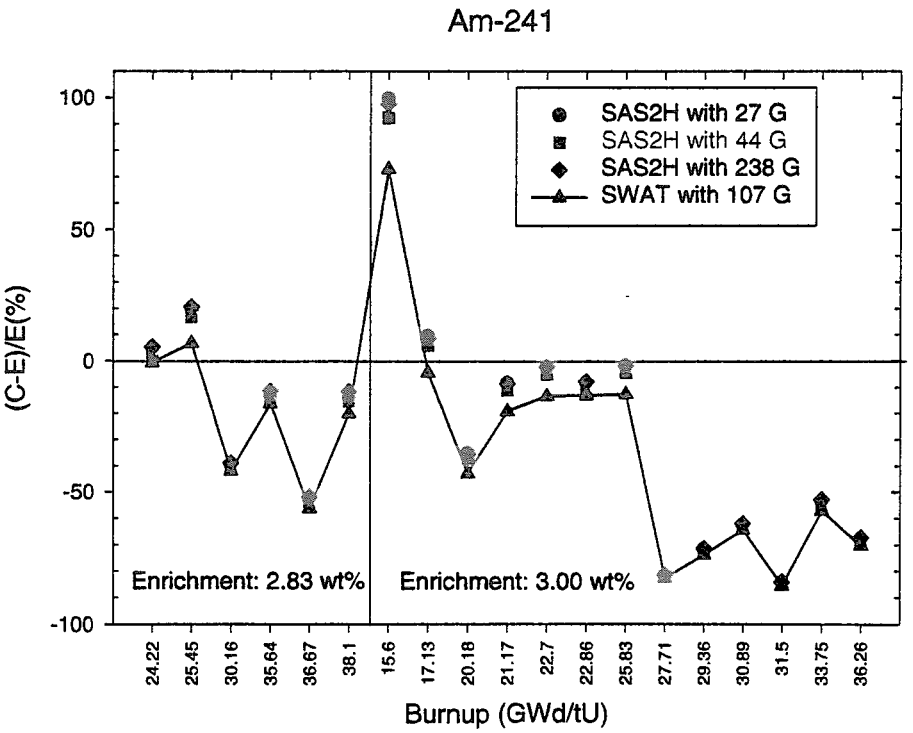


Fig. 5.12. Relative Errors of Am-241 Calculated Compositions.

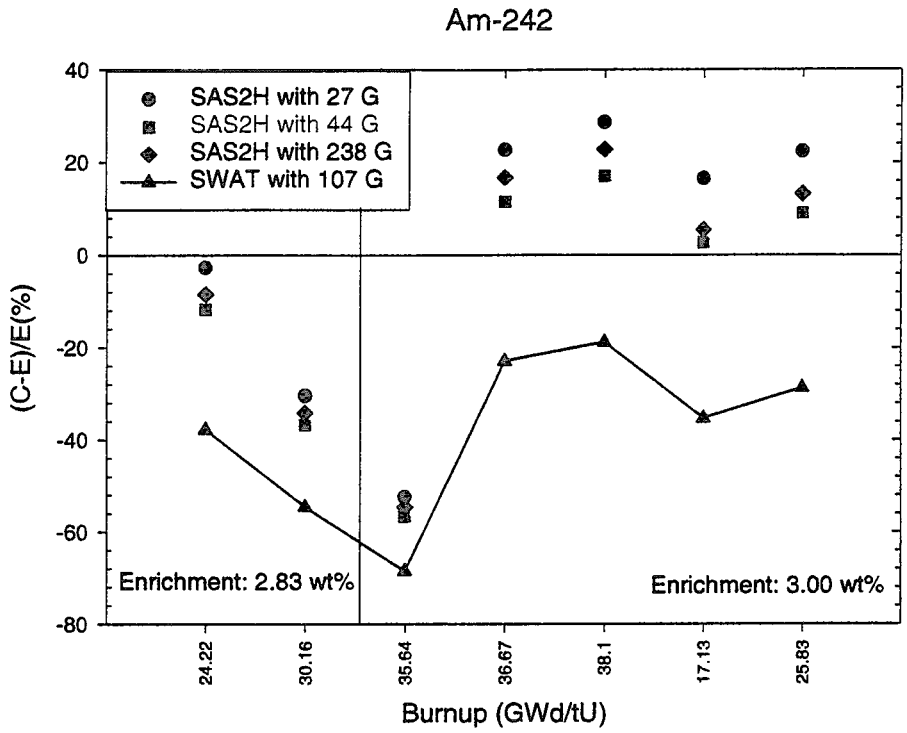


Fig. 5.13. Relative Errors of Am-242 Calculated Compositions.

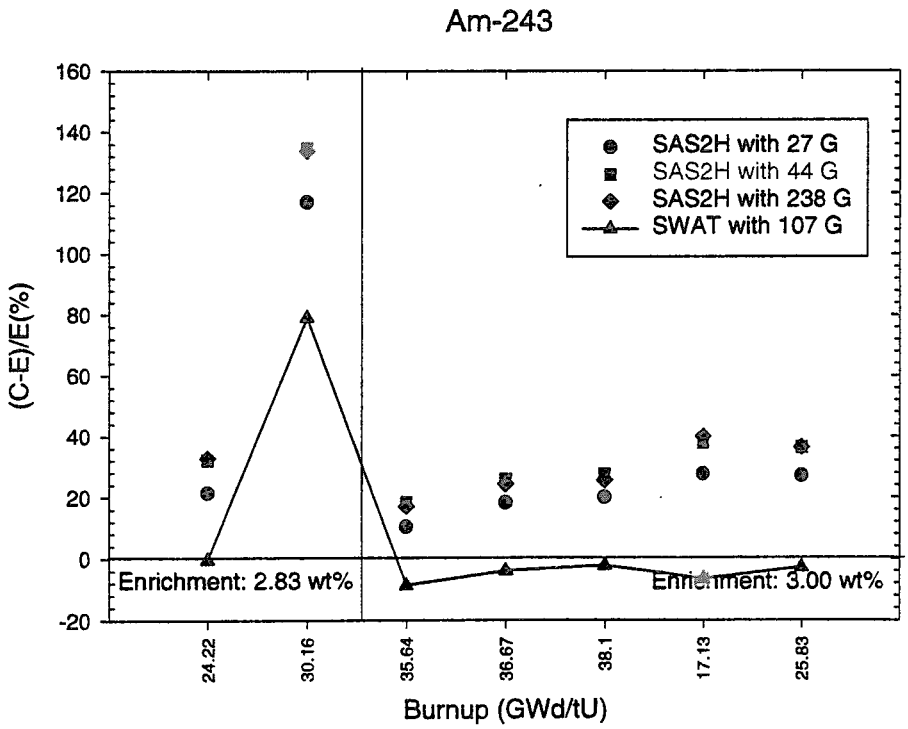


Fig. 5.14. Relative Errors of Am-243 Calculated Compositions.

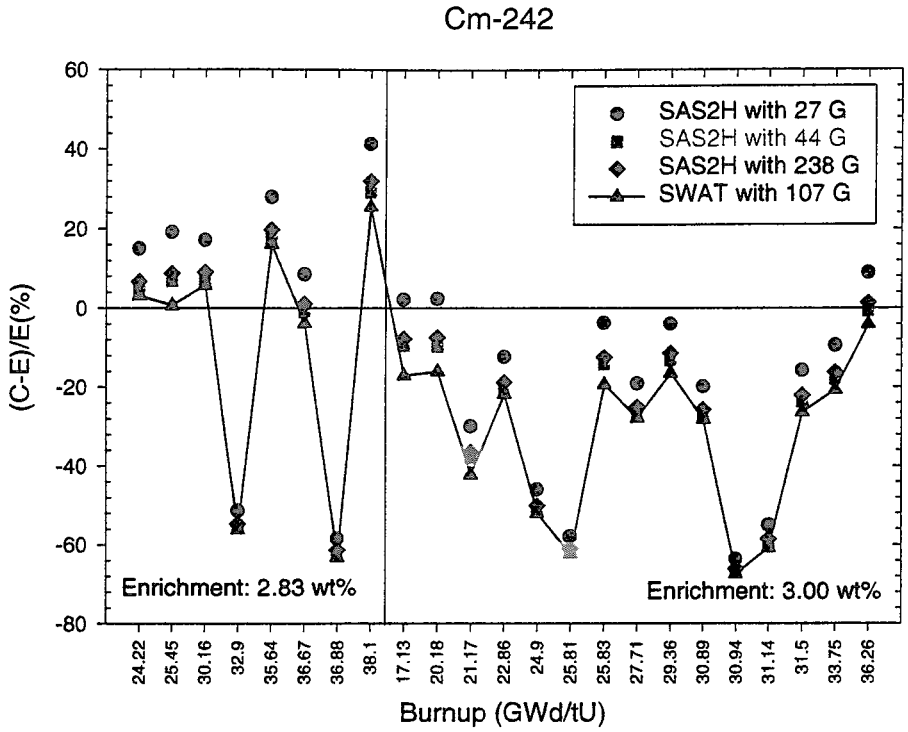


Fig. 5.15. Relative Errors of Cm-242 Calculated Compositions.

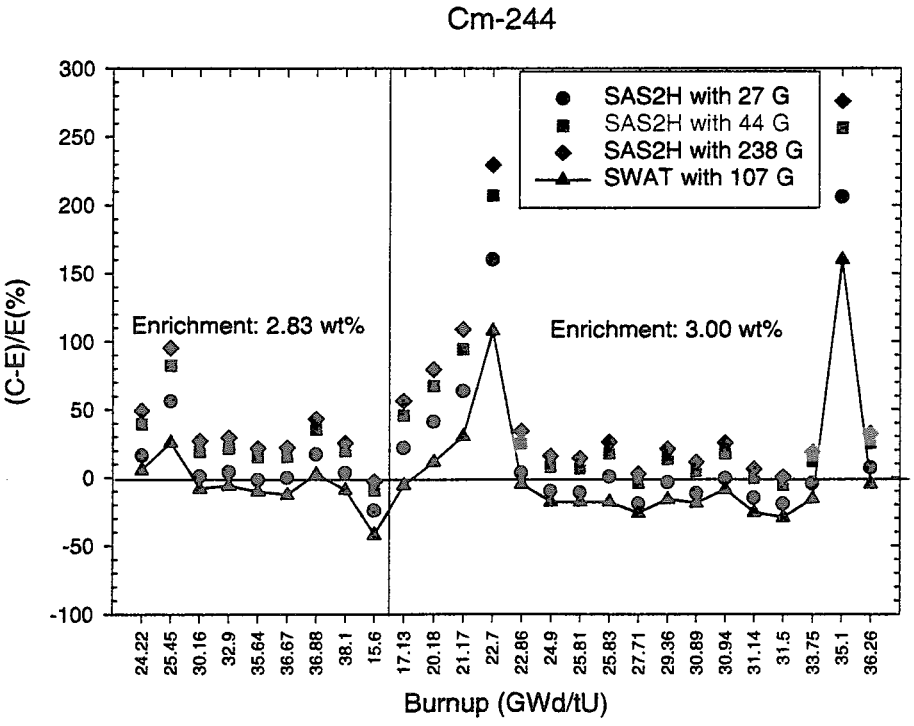


Fig. 5.16. Relative Errors of Cm-244 Calculated Compositions.

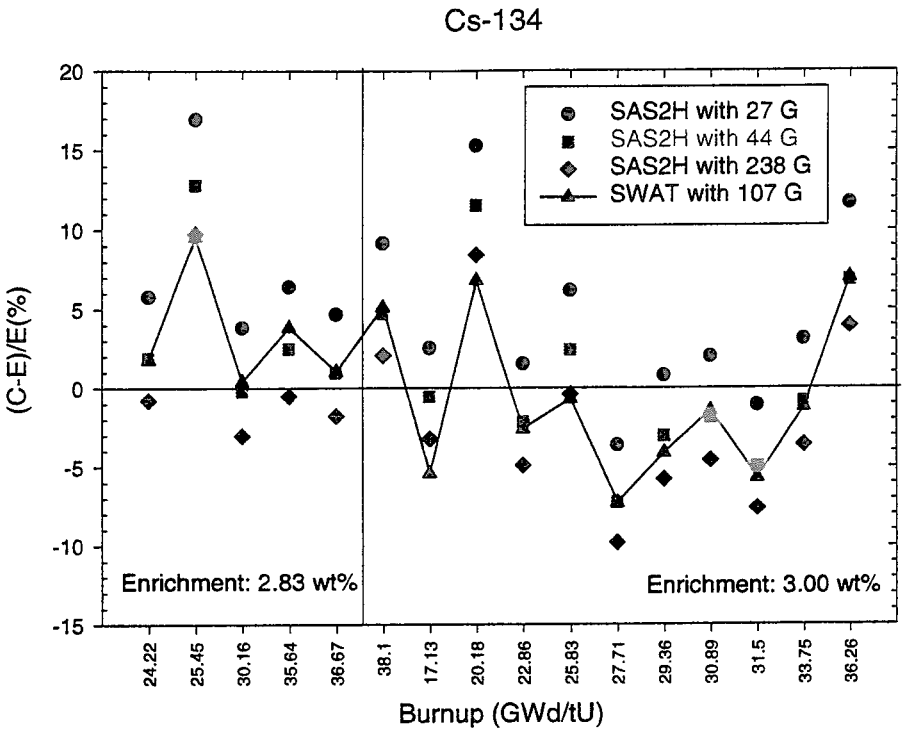


Fig. 5.17.Relative Errors of Cs-134 Calculated Compositions.

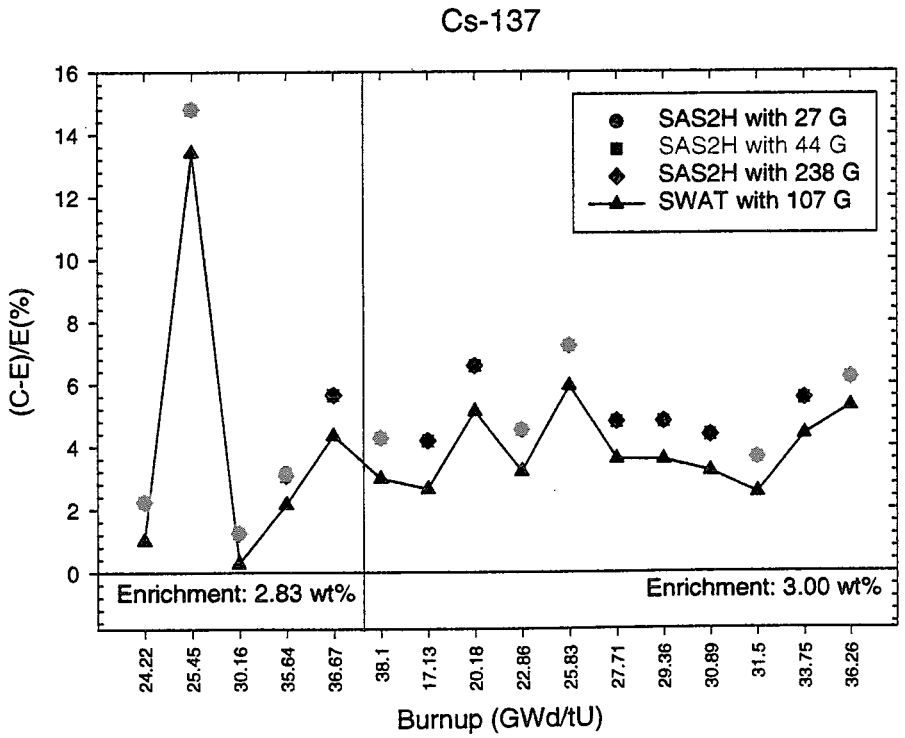


Fig. 5.18. Relative Errors of Cs-137 Calculated Compositions.

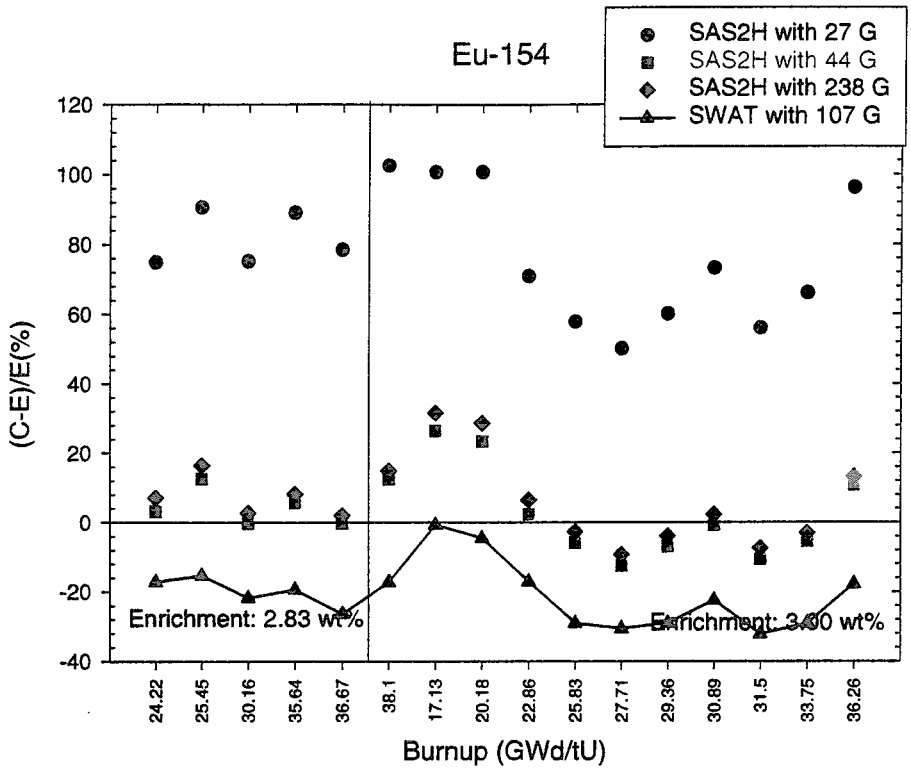


Fig. 5.19. Relative Errors of Eu-154 Calculated Compositions.

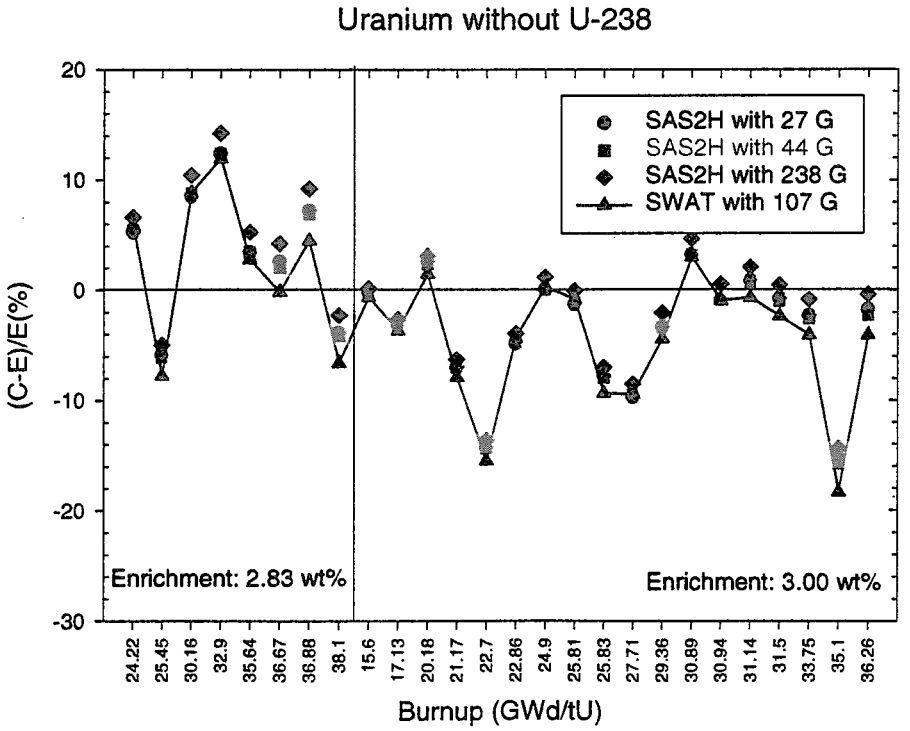


Fig. 5.20. Relative Errors of Uranium Calculated Compositions without U-238.

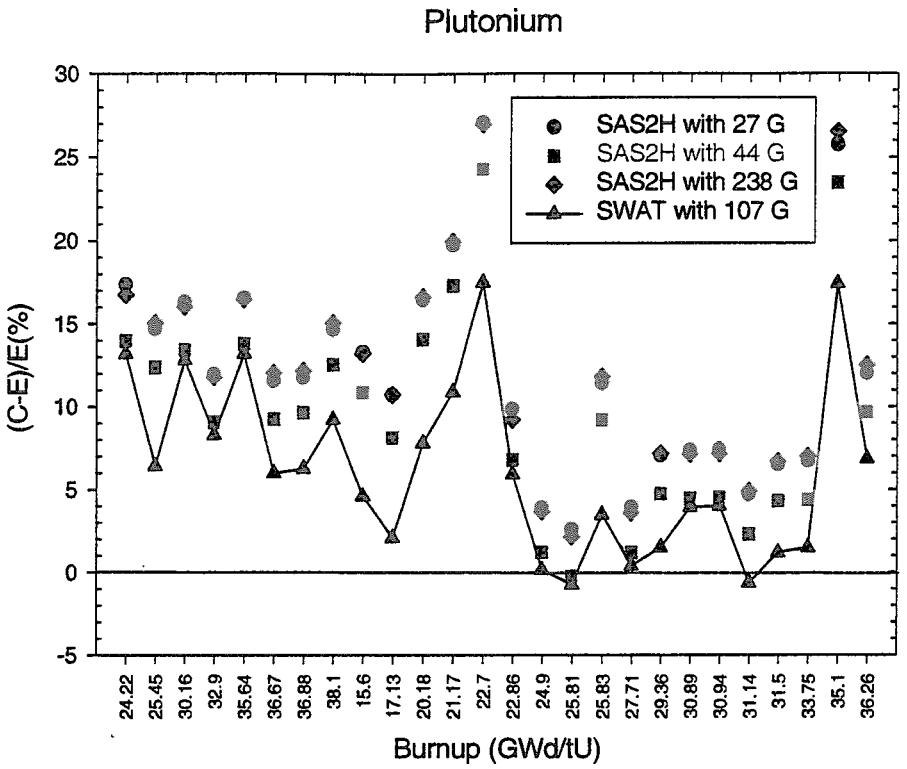


Fig. 5.21. Relative Errors of Plutonium Calculated Compositions.

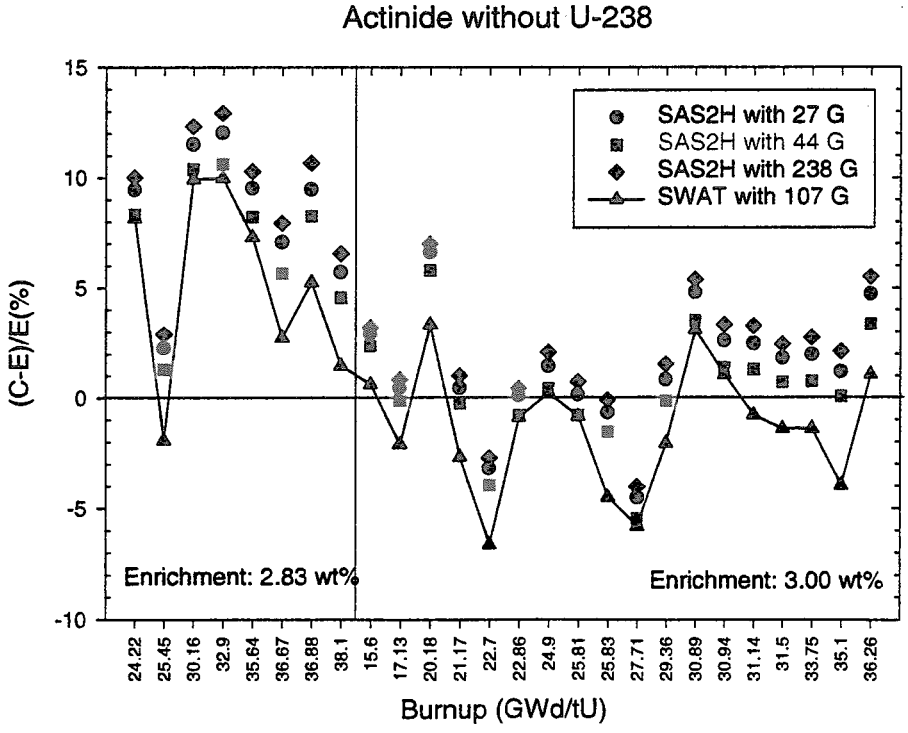


Fig. 5.22. Relative Errors of Actinide Calculated Compositions without U-238.

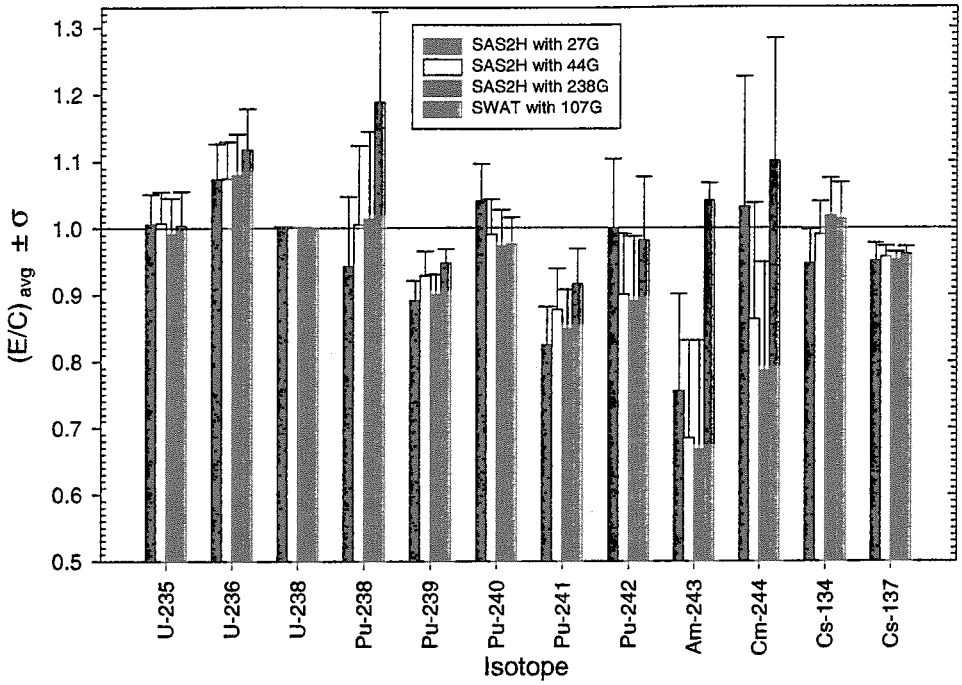


Fig. 5.23. Comparison of the Average Measured-to-calculated Ratios and Standard Deviations.

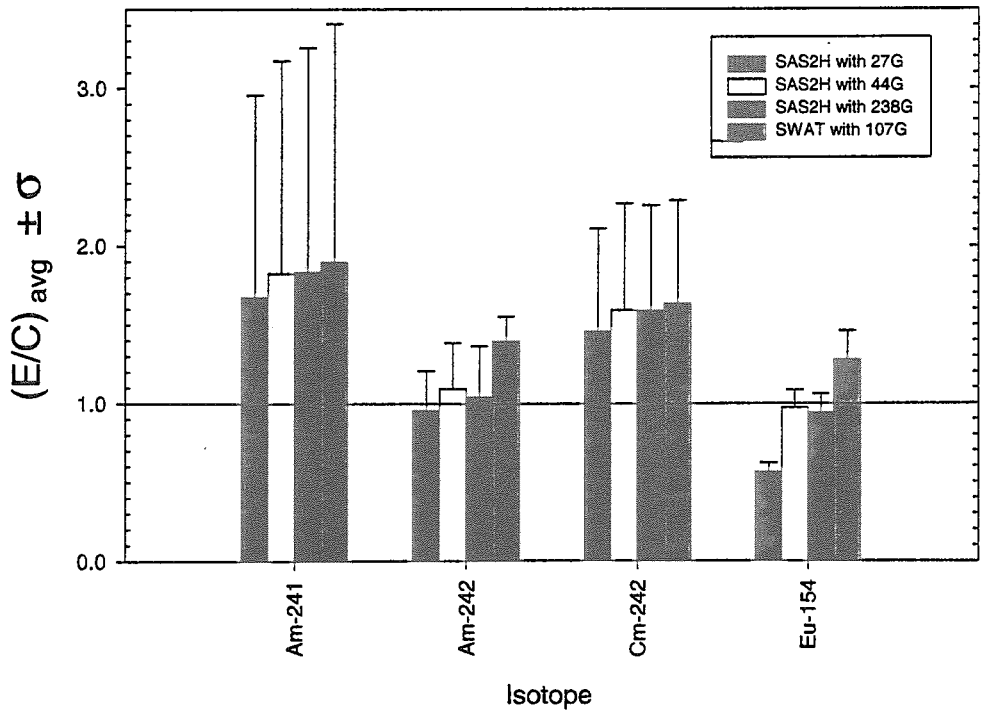


Fig.5.24. Comparison of the Average Measured-to-calculated Ratios and Standard Deviations for the large deviation nuclides.

# 6. Isotopic Composition Calculation for 55 Spent Fuel Samples

## 6.1. Input Preparation

Modeling optimization for SAS2H input for 55 samples were carried out in ORNL and DOE reports[18,19]. In this work, in the case of 27 group calculation the inputs listed in DOE report [19] were used without changing parameter values. In cases of calculation with 44 and 238 group libraries, neutron cross-section library and cladding material names were replaced by appropriate names. In the case of the calculation with 238 group library, some nuclides which were included in the fuel region to generate new cross-section library were excluded in order to reduce computer running time.

Fifty-five SWAT inputs were prepared by a fortran program which can extract fuel design specifications and operating parameters from the SAS2H inputs for 55 PWR samples and transform the data to SWAT input form. In the 55 samples some samples are different from modern PWR fuel. Some reactors have cross-form control devices and two kinds of enrichment fuel rods in the same assembly. However, in this work, the only simple modeling for SWAT calculation was carried out.

## 6.2. Comparison of Calculation Results with Experimental Data

Four measured-to-calculated ratios of U-235 against each sample are presented in Fig. 6.1. In two samples, ca8 and ca9, the ratios of SWAT calculation result are about 17 % difference, which is much lower than 26 Obrigheim samples. As shown in Fig. 6.1, the results of SWAT seem to be not much different from SAS2H results. In Fig. 6.2 the relative errors of U-235 composition are presented against the axis location of sampling point in the fuel rod. A special trend of the relative error against the axial location was not observed.

The relative errors of 21 nuclides against each sample were presented in Fig. 6.3 - 6.23. SWAT results are similar to SAS2H results in the cases of U-234, U-235 and U-238. Especially for U-234, the SWAT result is very close to SAS2H, as shown in Fig. 6.4. However in general, SWAT results seemed to be under-estimated in comparison to SAS2H results for all nuclides except Pu-240, Cs-134 and Nd148. In the cases of Am-242, Am-243,

Sm-149 and Eu-154, SWAT results are much different from SAS2H results and under-estimated.

The relative errors of uranium, plutonium and actinide calculation to experimental data are shown in Figs. 6.24-6.26. The trends of the materials are almost similar to the cases of 26 samples (see Figs. 5.20 - 5.22).

The mean and standard deviation of the measured-to-calculated ratios for actinide and fission products, respectively, are presented in Figs. 6.27 and 6.28, respectively, which indicate the bias and uncertainties in estimates of actinides and fission products using SAS2H with 27, 44 and 238 group cross-section libraries, and SWAT with the 107 group cross section library. Large biases are therefore required when these combinations are applied to the estimates of Am-241, Cm-242, Sn-126 and Sm-149. When SWAT with the 107 group cross section library is applied, further biasses are necessary for Am-242, -243 and Cm-244.

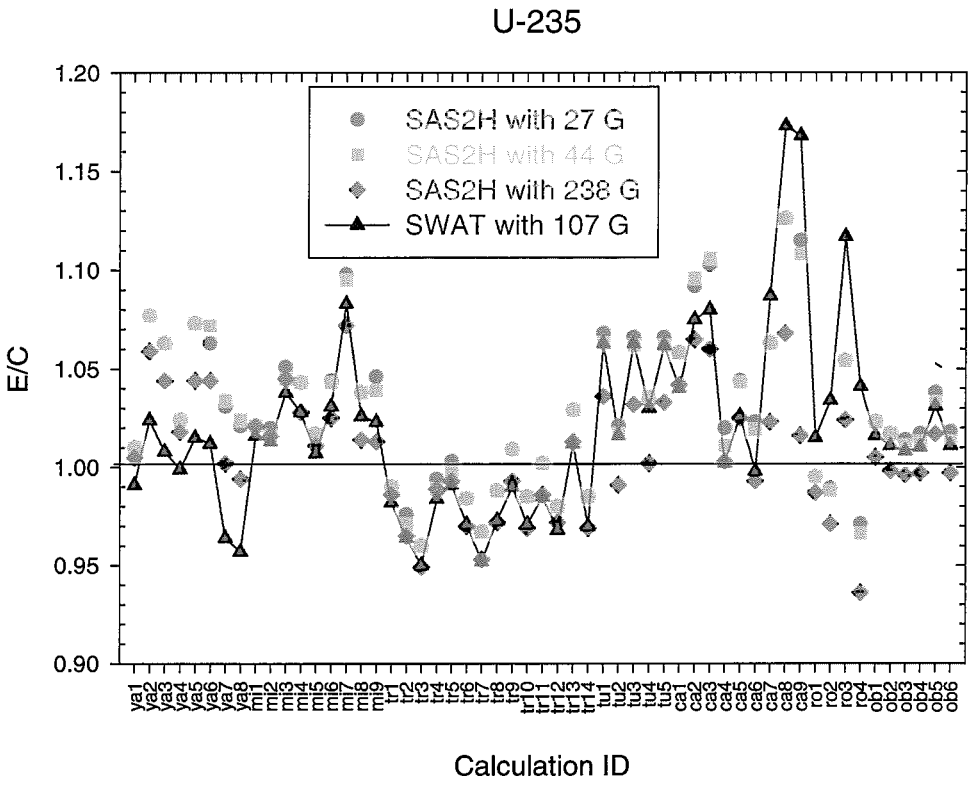


Fig. 6.1. Comparison of U-235 Measured-to-Calculated Ratios.

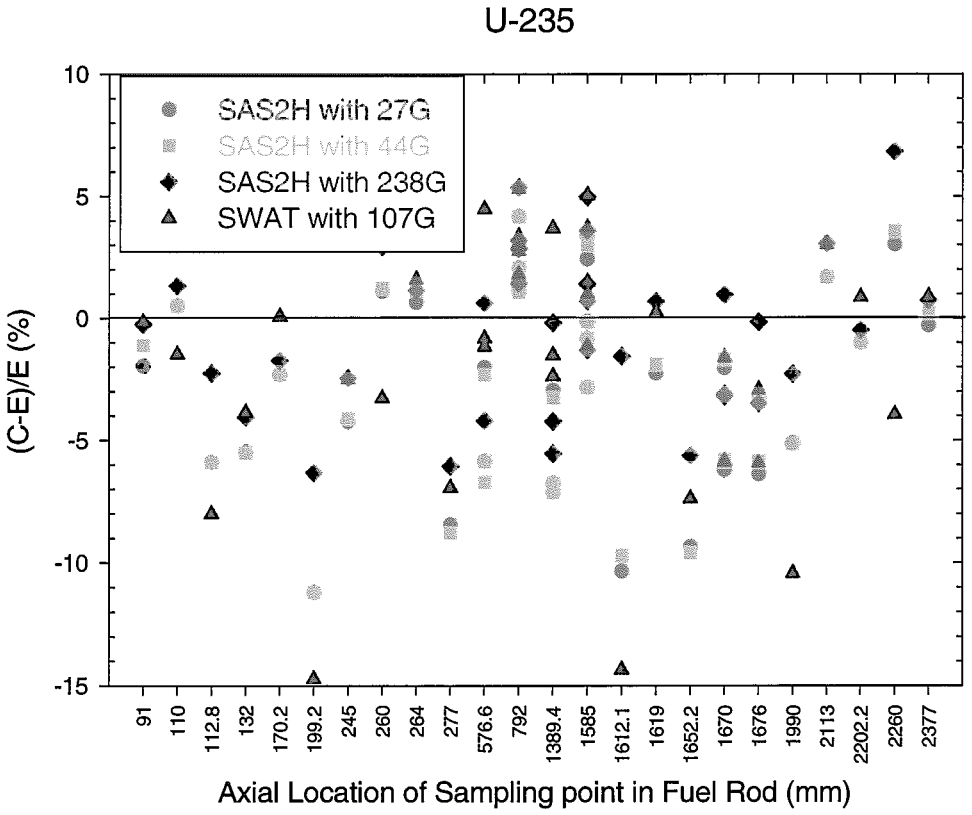


Fig. 6.2. Relative Errors of U-235 Calculated Compositions.

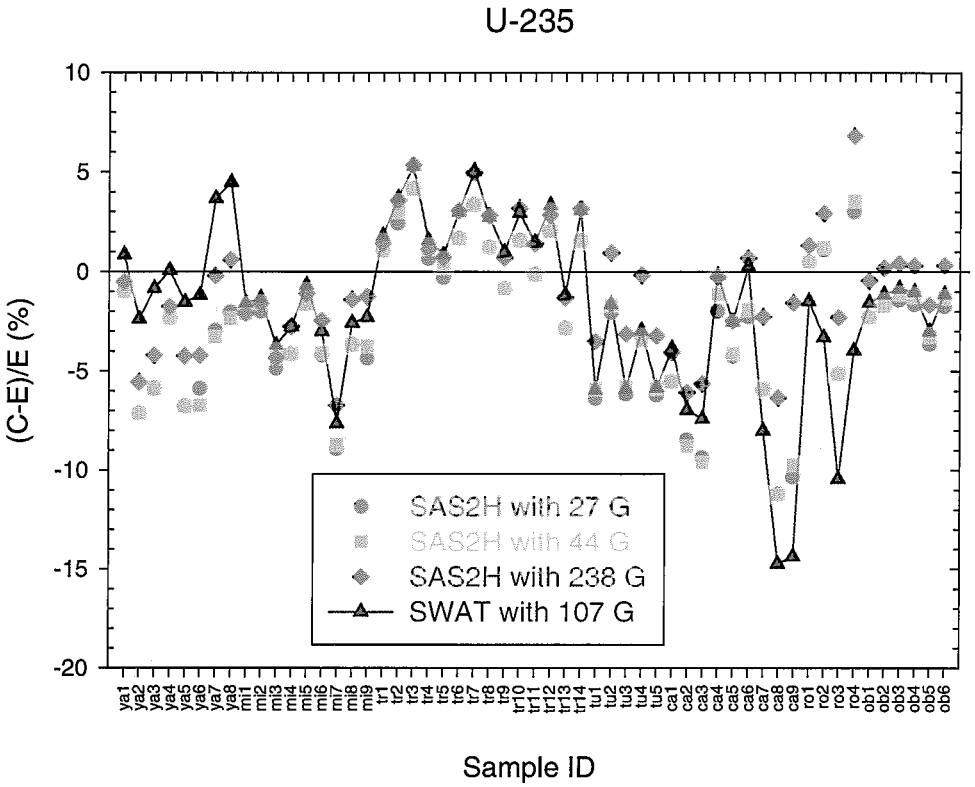


Fig. 6.3. Relative Errors of U-235 Calculated Compositions.

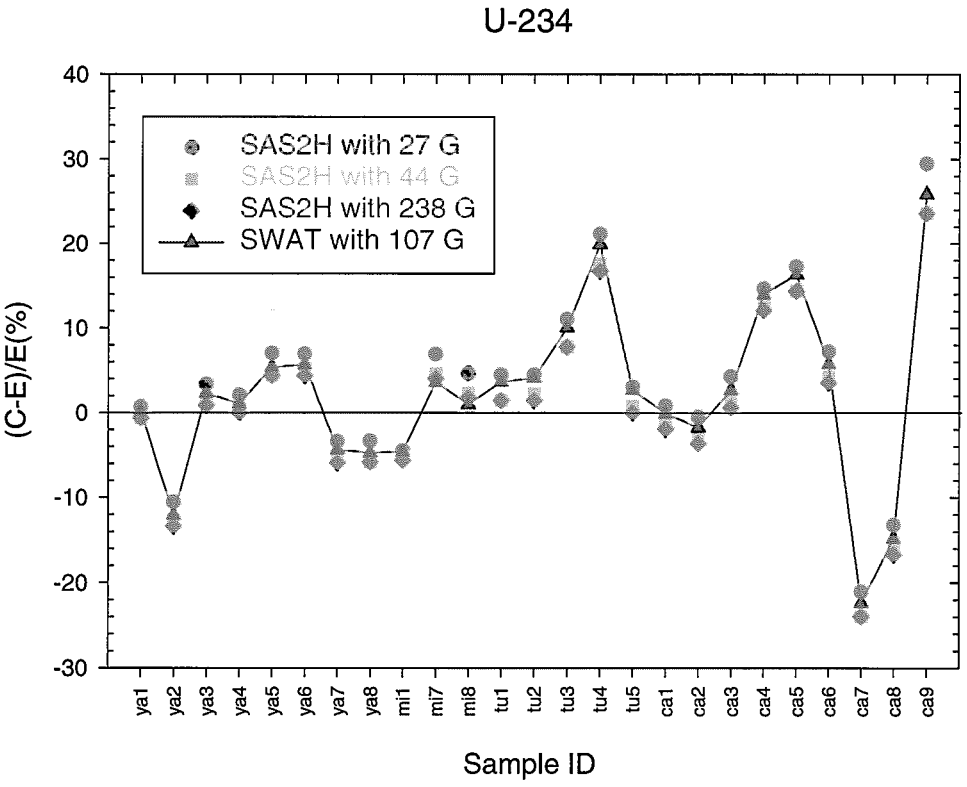


Fig. 6.4. Relative Errors of U-234 Calculated Compositions.

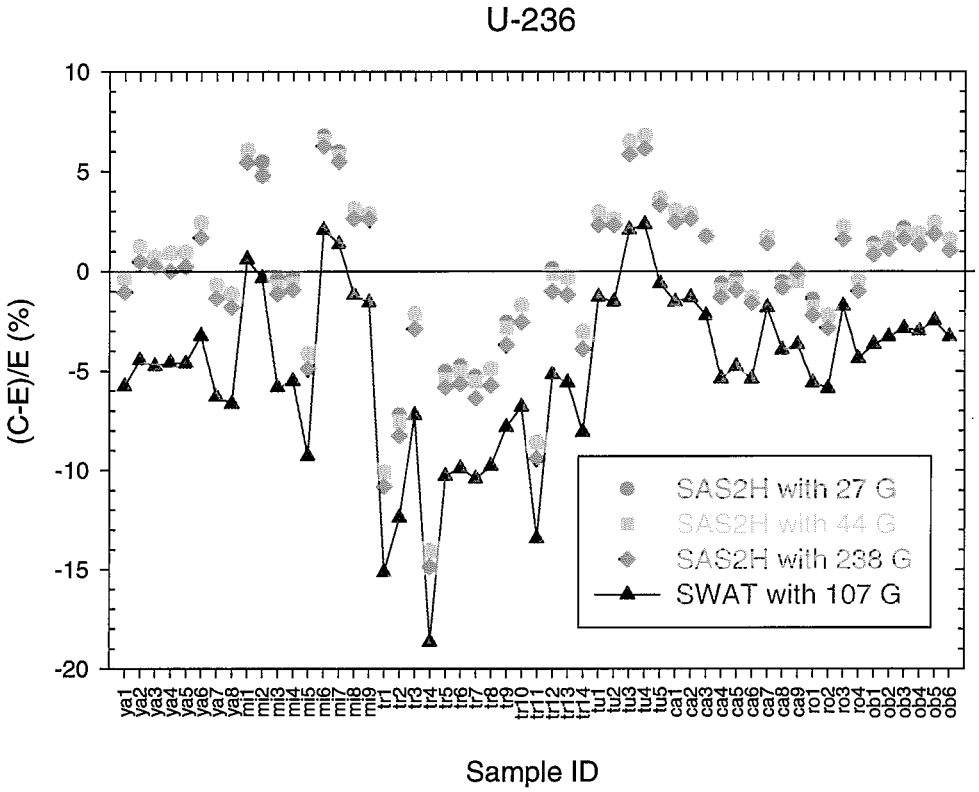


Fig. 6.5. Relative Errors of U-236 Calculated Compositions.

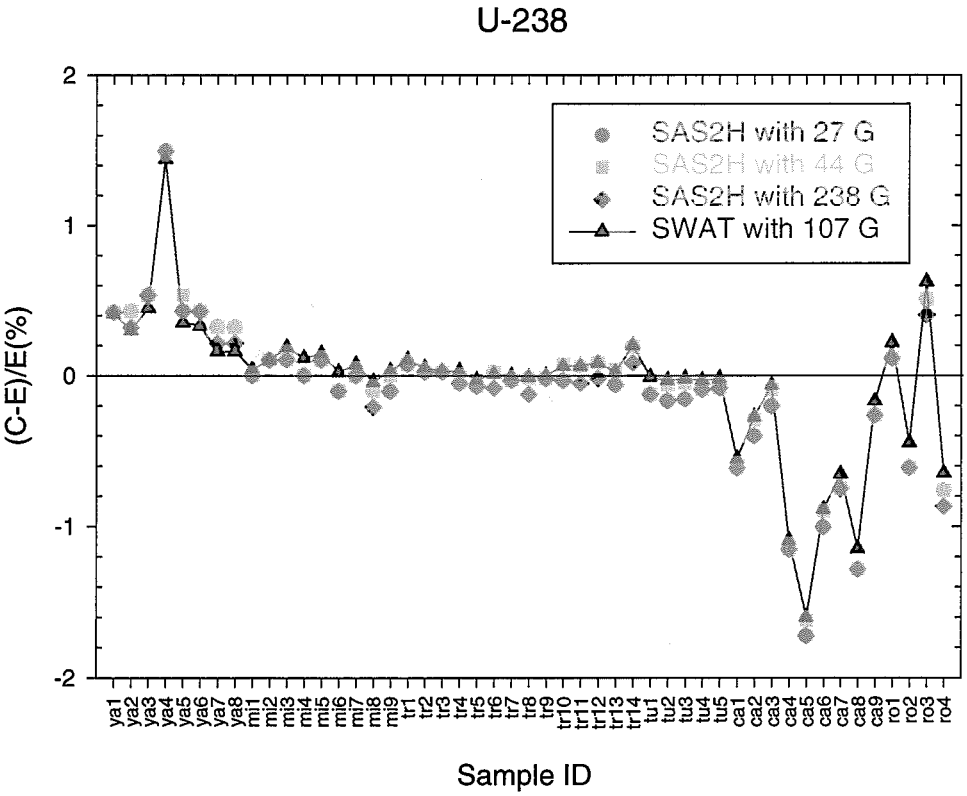


Fig. 6.6. Relative Errors of U-238 Calculated Compositions.

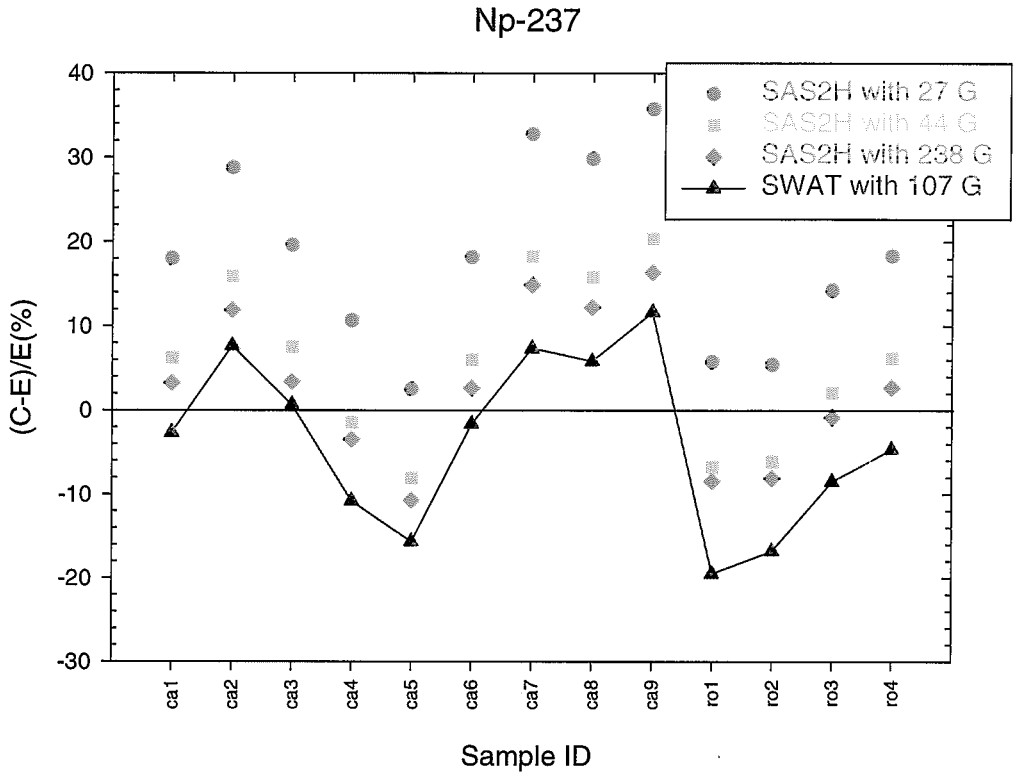


Fig. 6.7. Relative Errors of Np-237 Calculated Compositions.

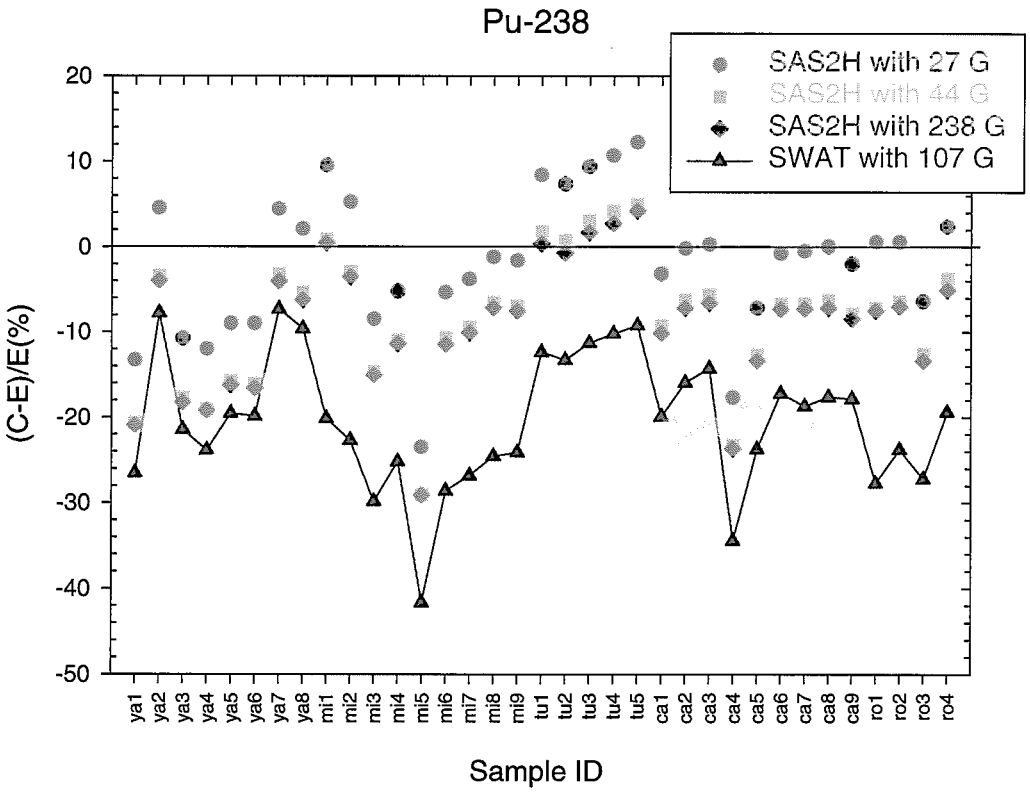


Fig. 6.8. Relative Errors of Pu-238 Calculated Compositions.

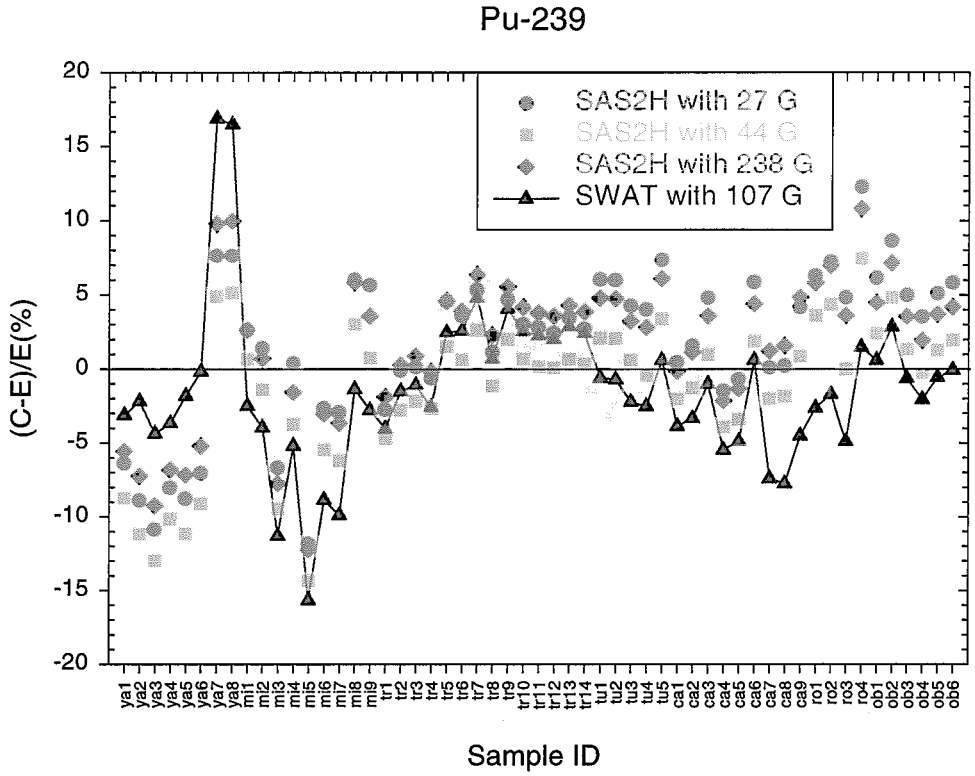


Fig. 6.9. Relative Errors of Pu-239 Calculated Compositions.

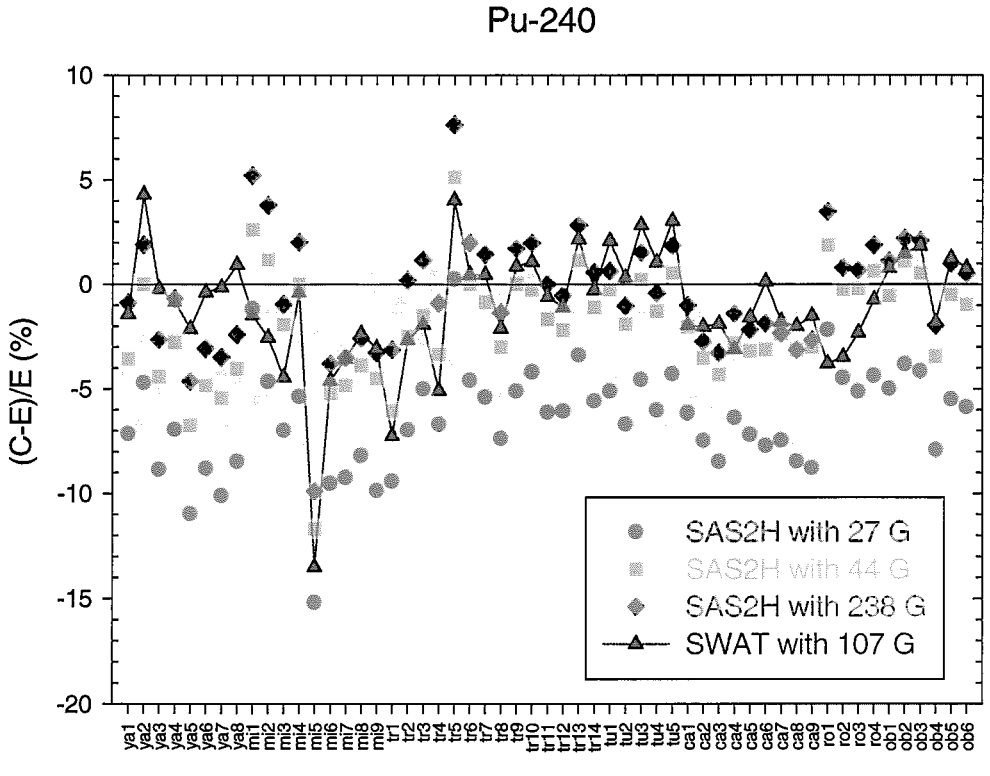


Fig. 6.10. Relative Errors of Pu-240 Calculated Compositions.

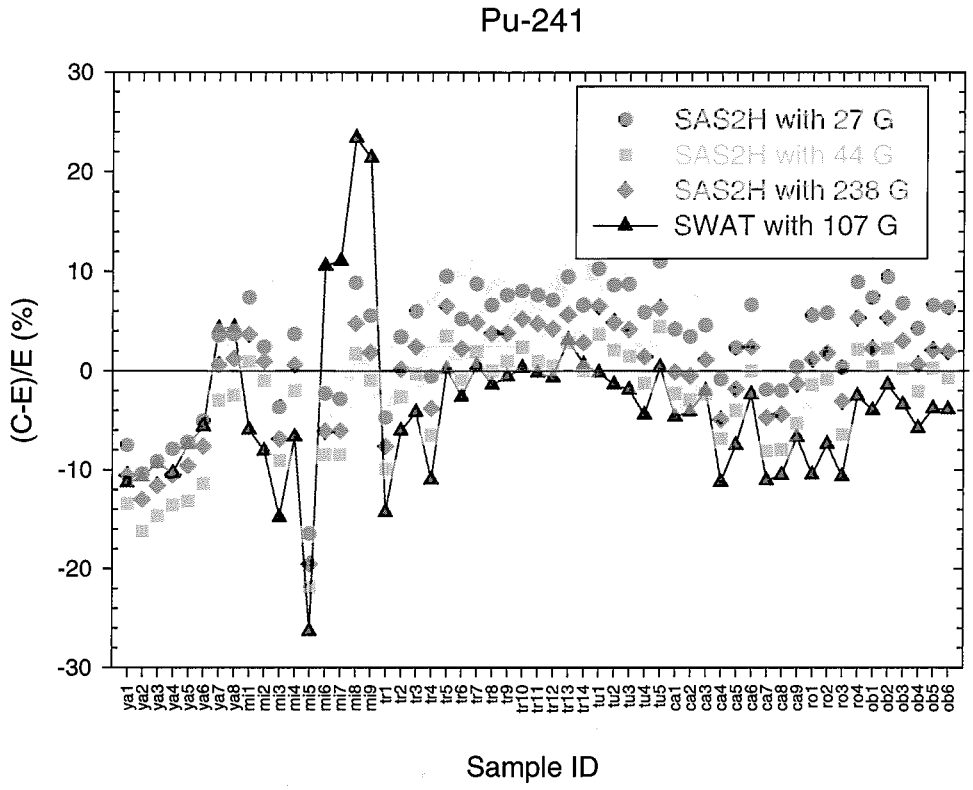


Fig. 6.11. Relative Errors of Pu-241 Calculated Compositions.

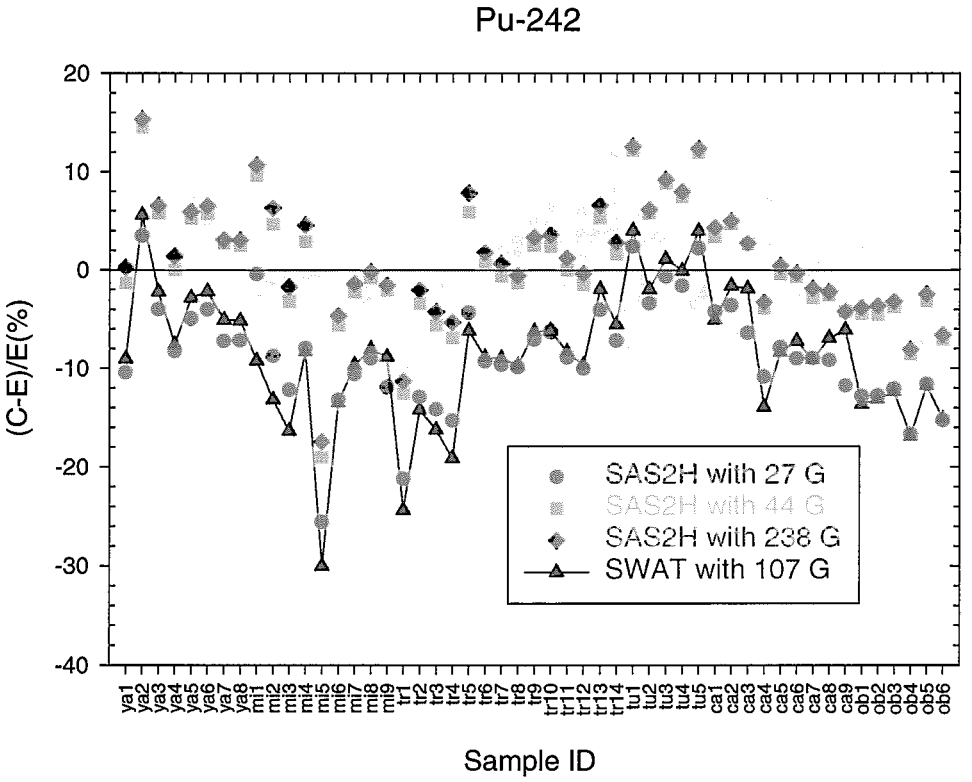


Fig. 6.12. Relative Errors of Pu-242 Calculated Compositions.

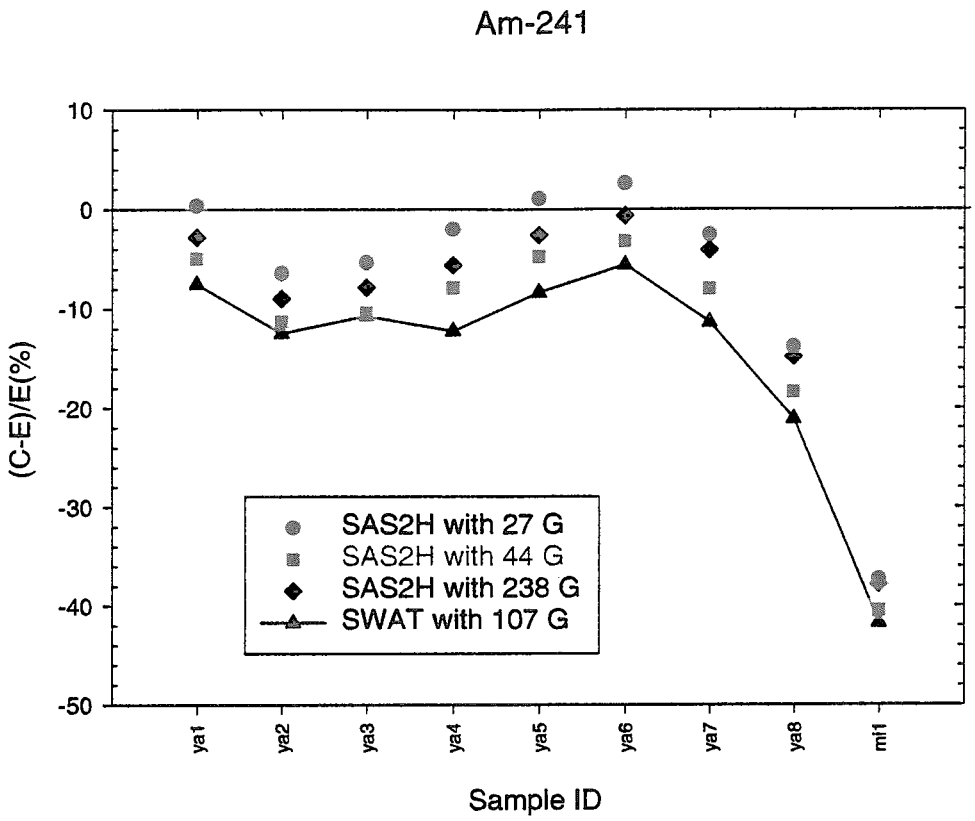


Fig. 6.13. Relative Errors of Am-241 Calculated Compositions.

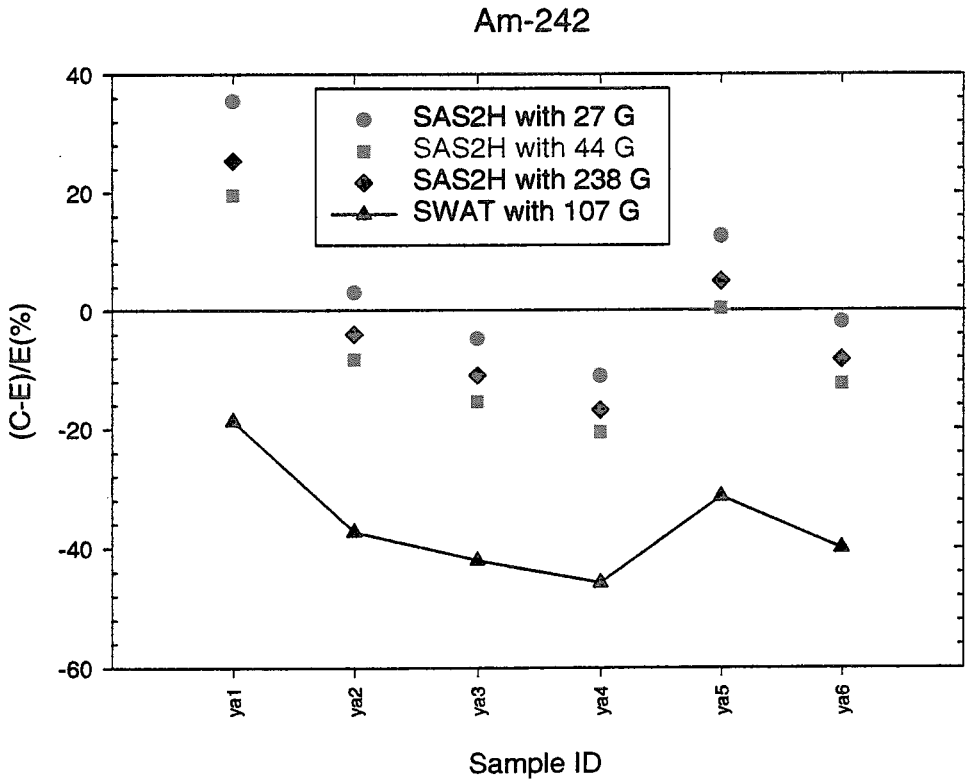


Fig. 6.14. Relative Errors of Am-242 Calculated Compositions.

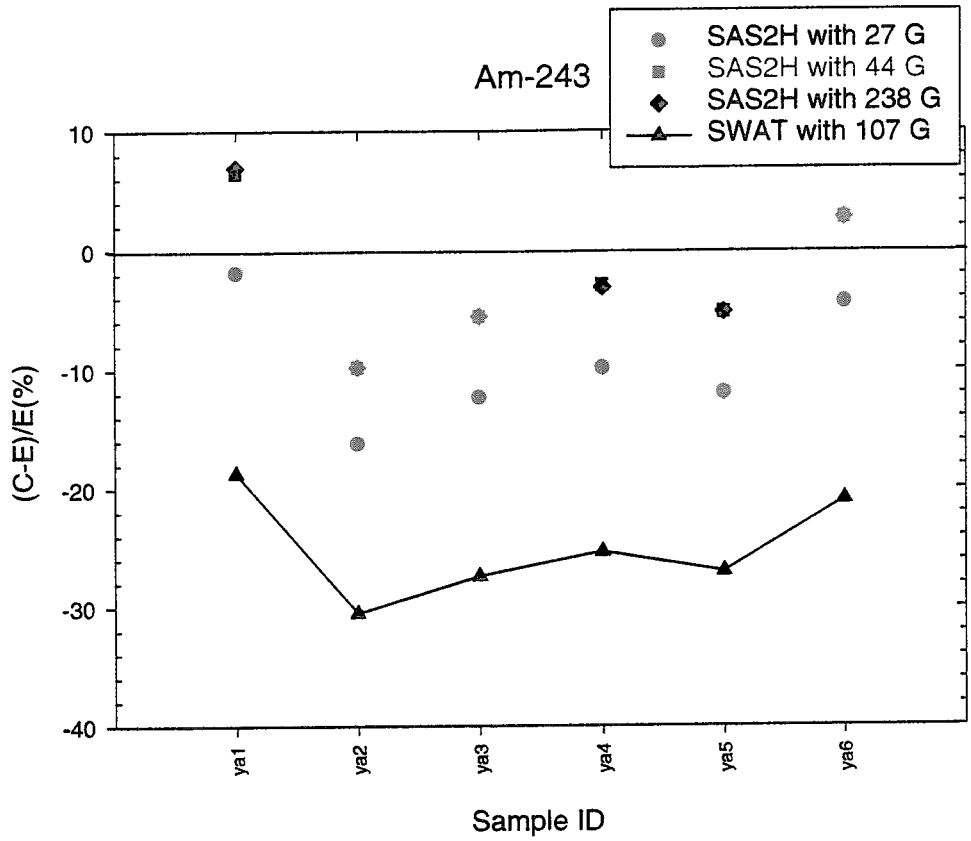


Fig. 6.15. Relative Errors of Am-243 Calculated Compositions.

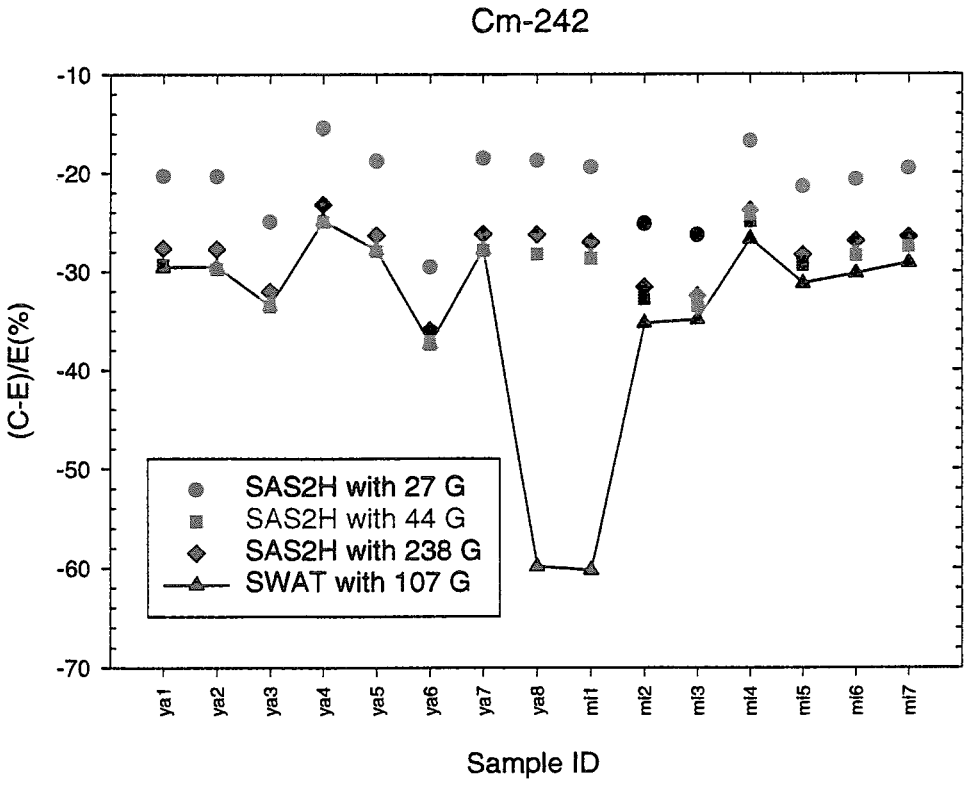


Fig. 6.16. Relative Errors of Cm-242 Calculated Compositions.

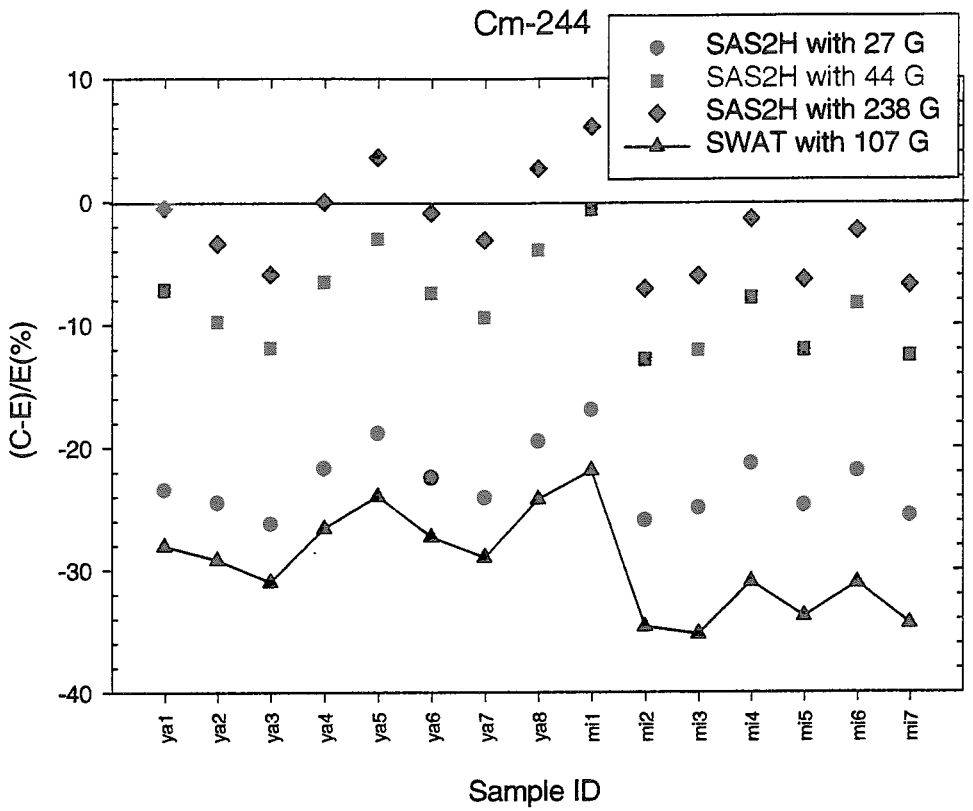


Fig. 6.17. Relative Errors of Cm-244 Calculated Compositions.

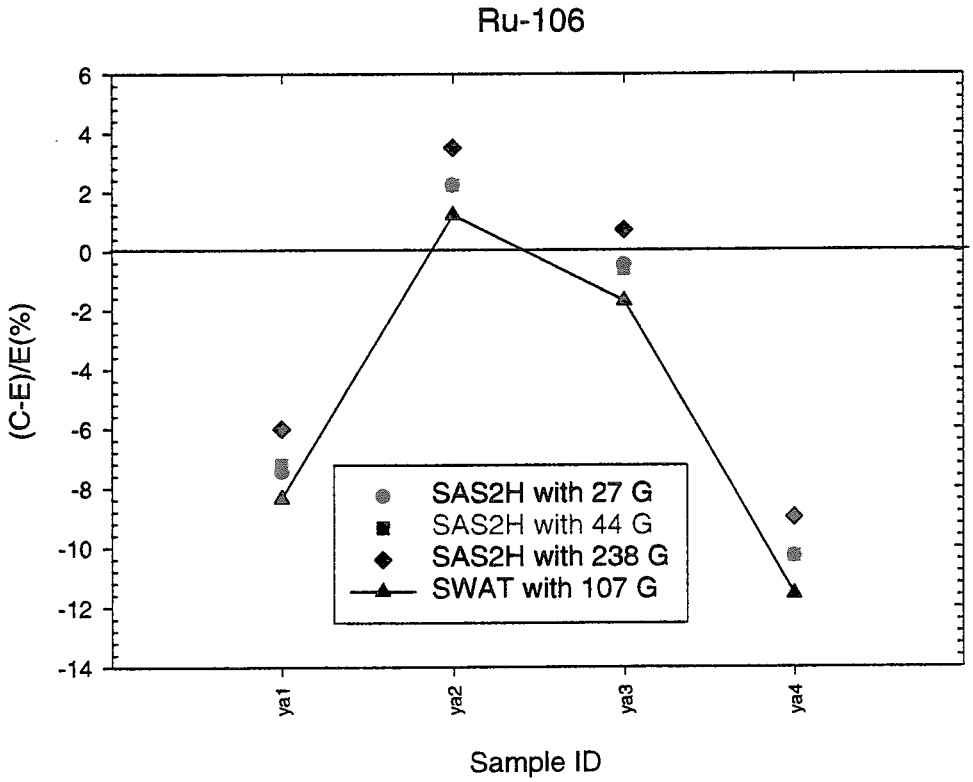


Fig. 6.18. Relative Errors of Ru-106 Calculated Compositions.

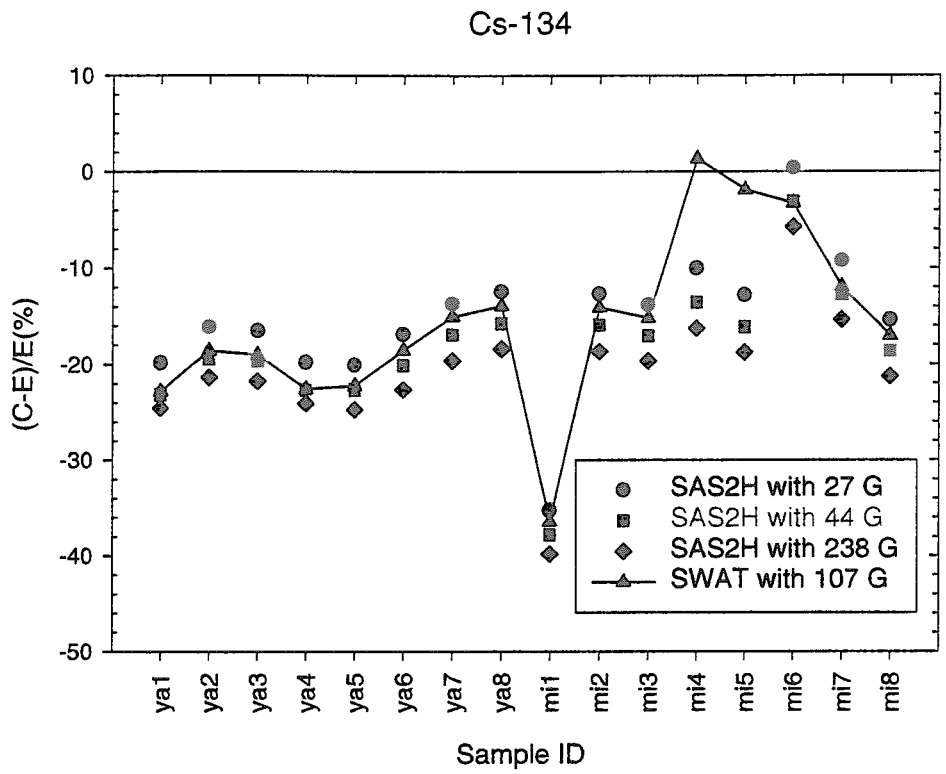


Fig. 6.19. Relative Errors of Cs-134 Calculated Compositions.

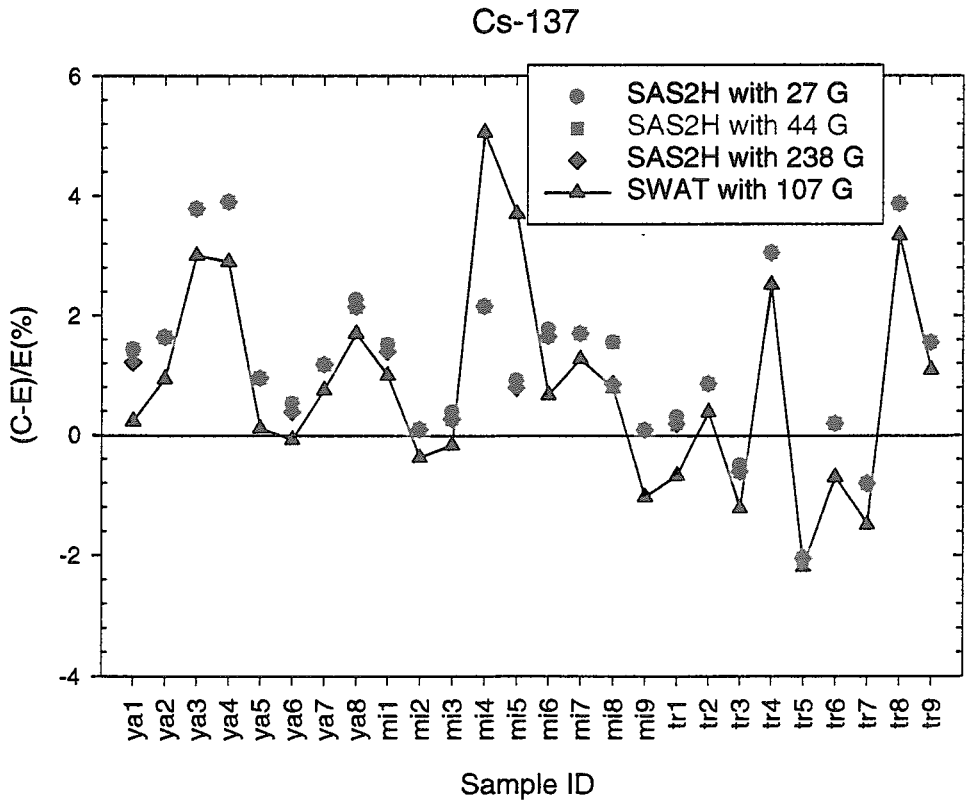


Fig. 6.20. Relative Errors of Cs-137 Calculated Compositions.

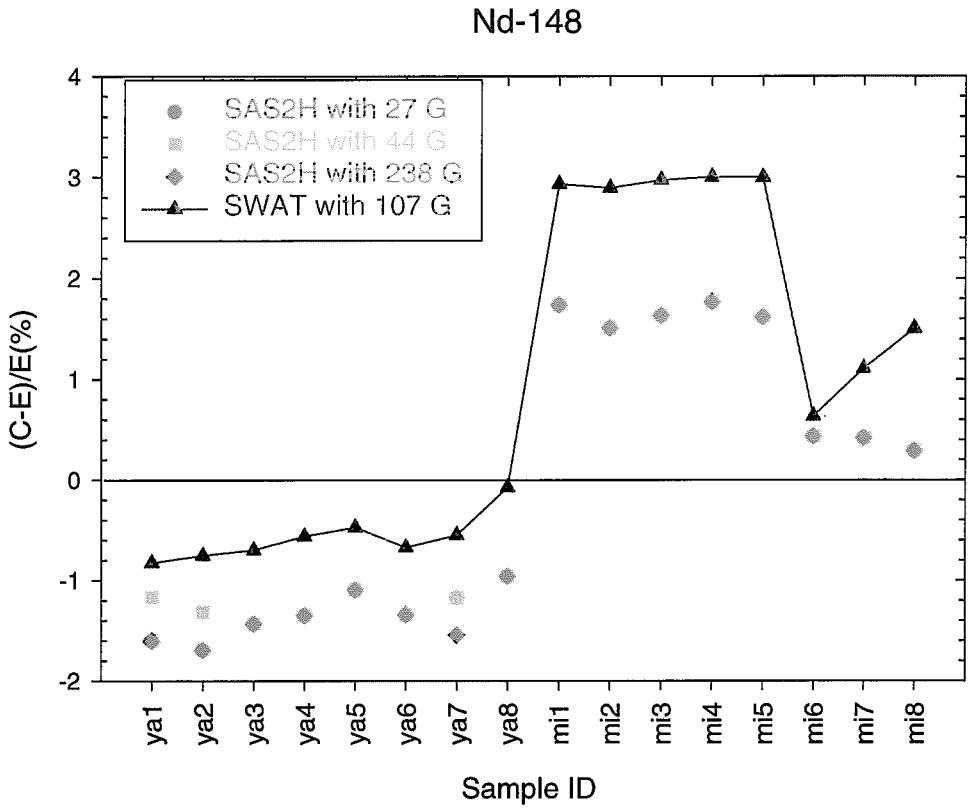


Fig. 6.21. Relative Errors of Nd-148 Calculated Compositions.

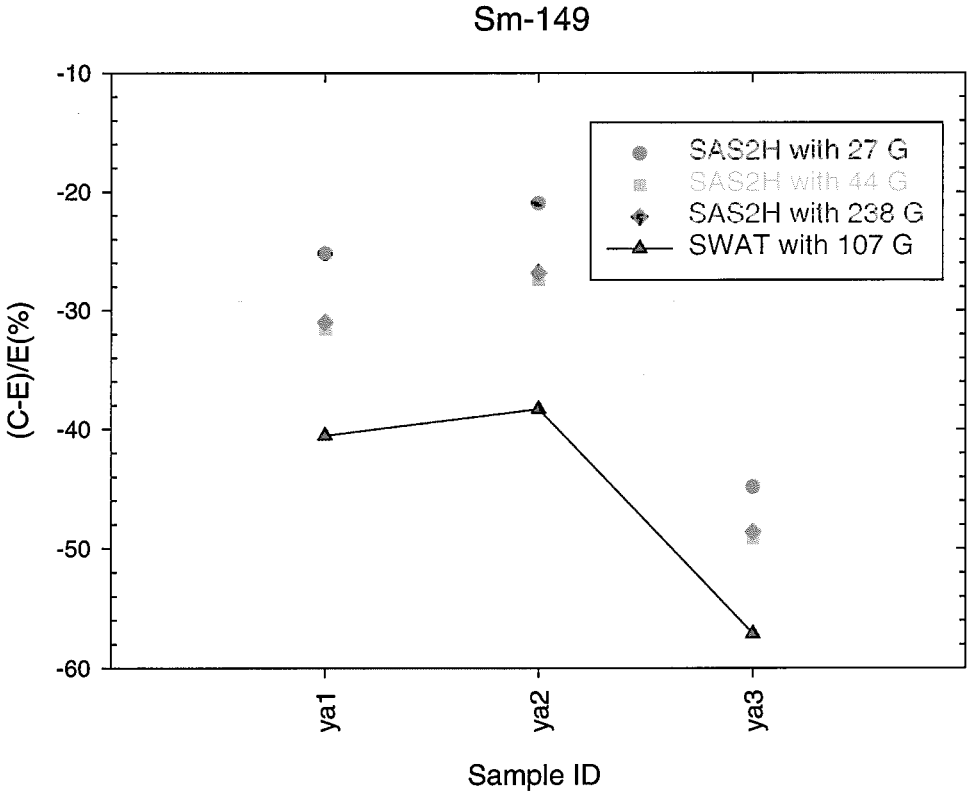


Fig. 6.22. Relative Errors of Sm-149 Calculated Compositions.

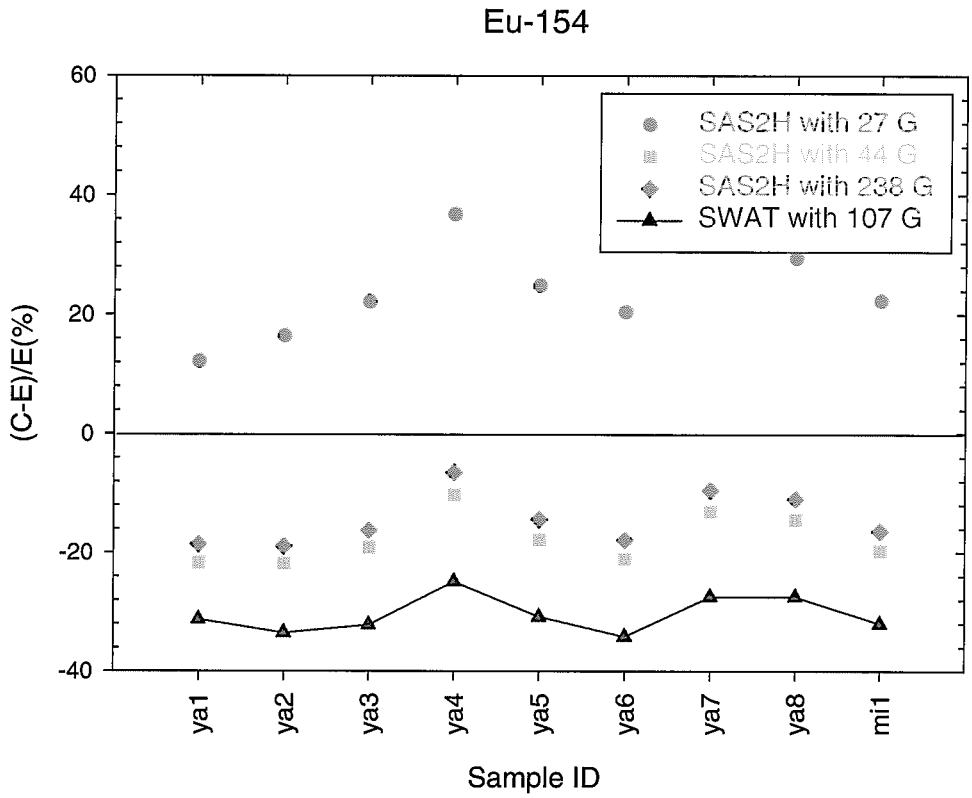


Fig. 6.23. Relative Errors of Eu-154 Calculated Compositions.

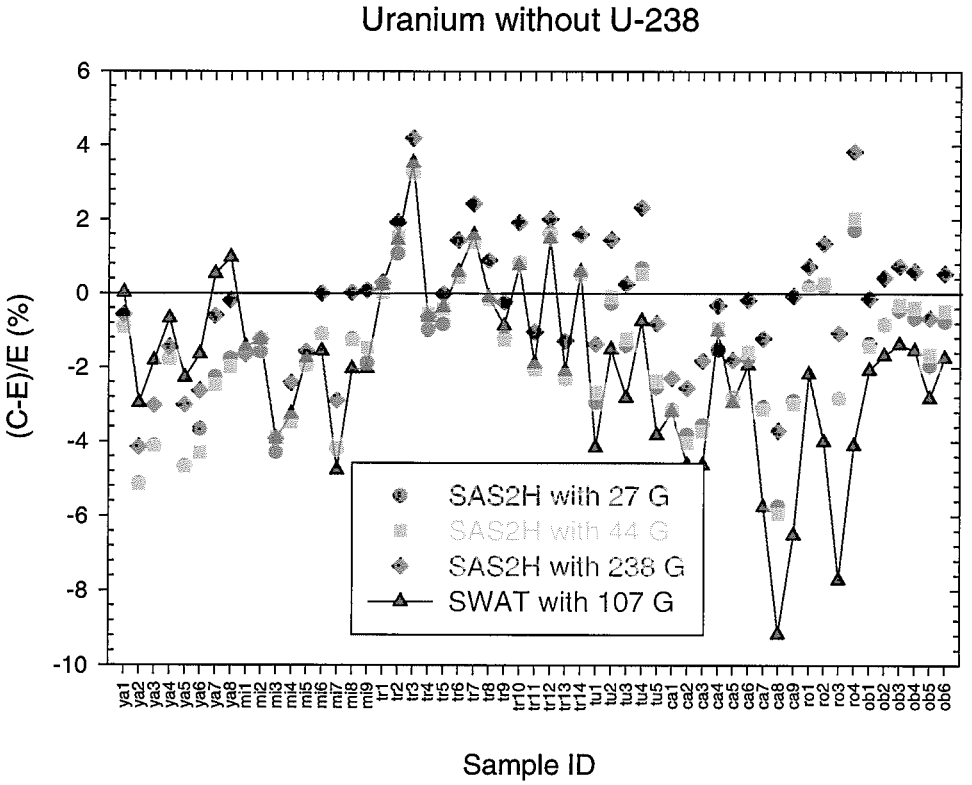


Fig. 6.24. Relative Errors of Uraninum Calculated Compositions without U-238.

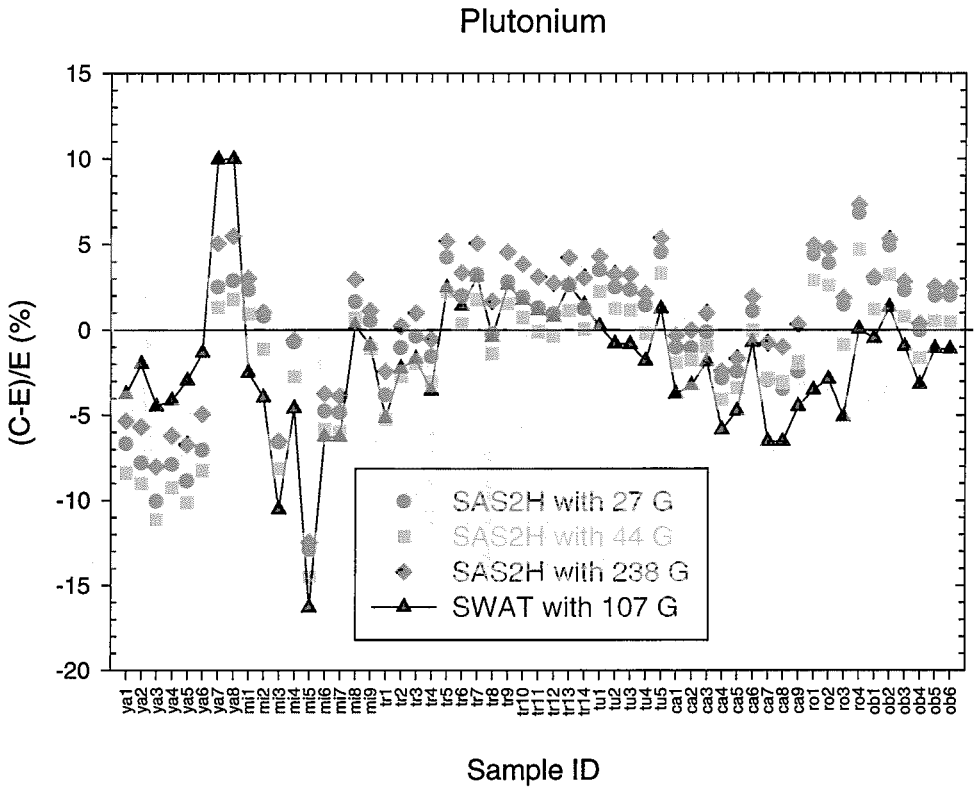


Fig. 6.25. Relative Errors of Plutonium Calculated Compositions.

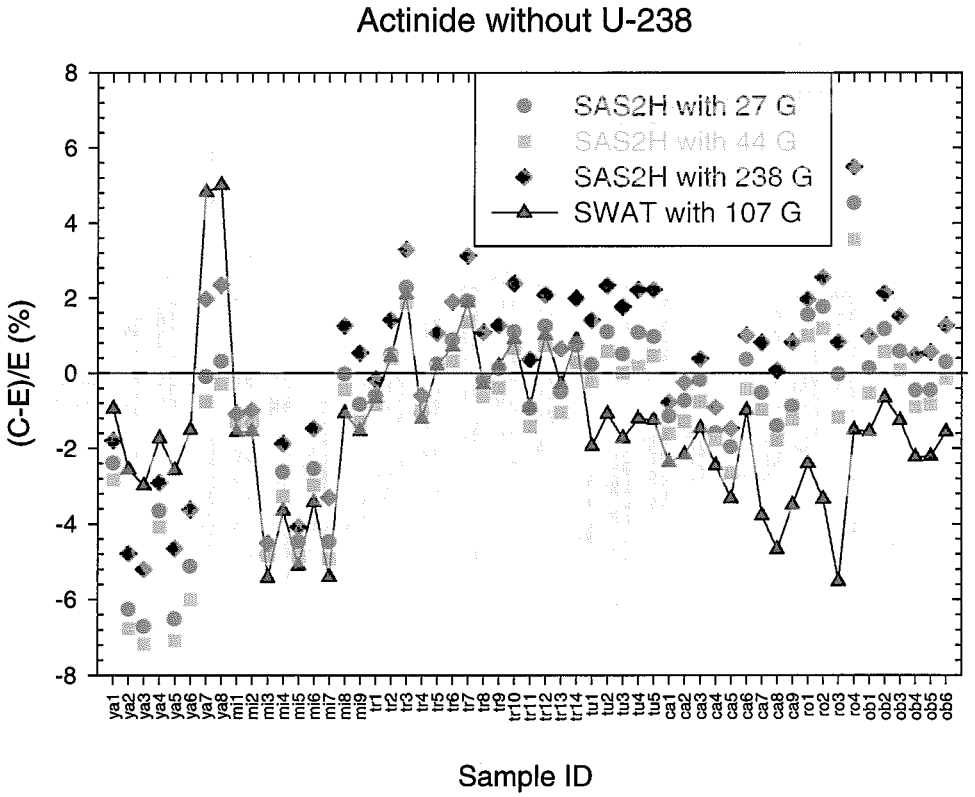


Fig. 6.26. Relative Errors of Actinide Calculated Compositions without U-238.

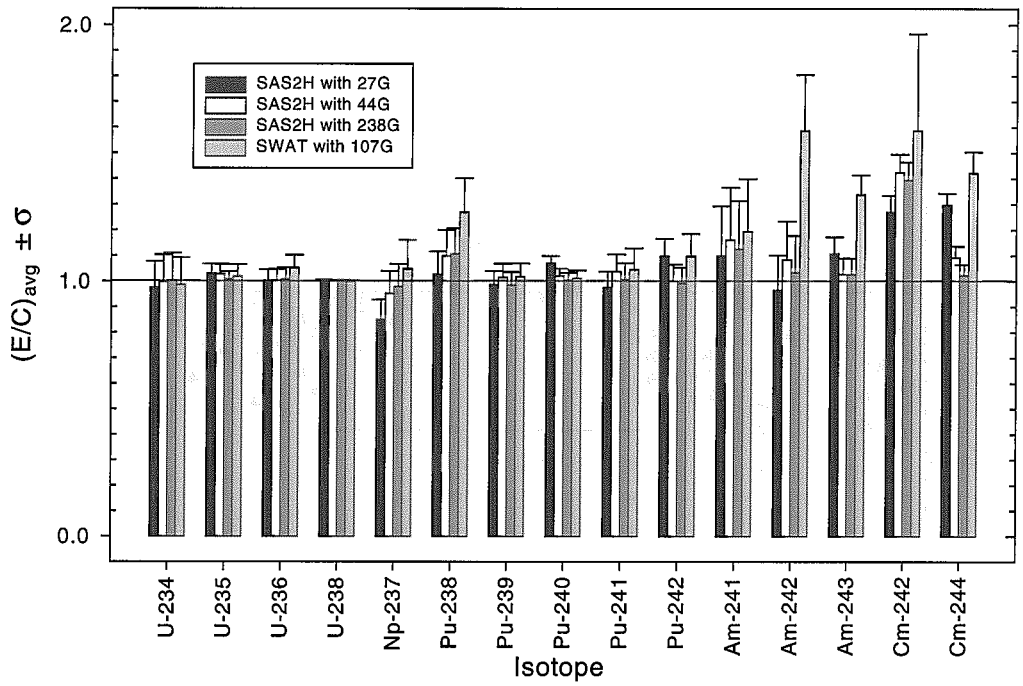


Fig. 6.27. Comparison of the Average Measured-to-Calculated Ratios and Standard Deviations for Actinides.

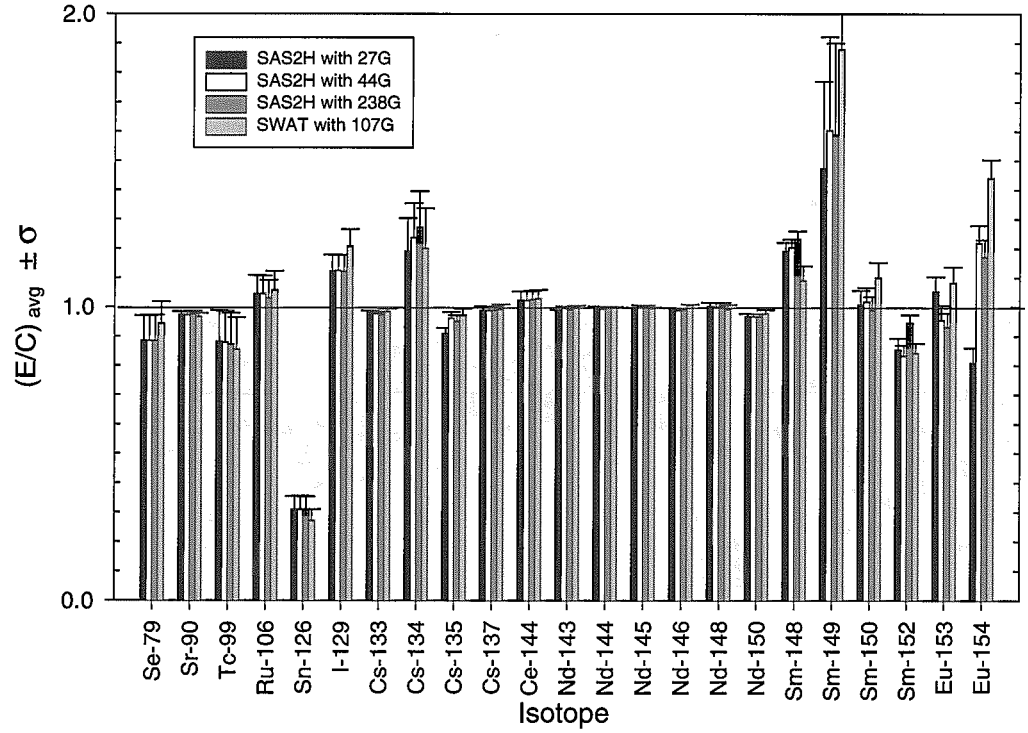


Fig. 6.28. Comparison of the Average Measured-to-Calculated Ratios and Standard Deviations for Fission Products.

# 7. Correction Factors

## 7.1. Selection of Samples

The correction factors of PWR spent fuel composition will be determined on the basis of the ratios of four calculated compositions to the experimental composition for 16 and 55 samples. Normality test have been carried out for 38 nuclides using the combined measured-to-calculated ratios. But some actinides didn't pass the normality test because the combined set consisted of 16 and 55 samples which were obtained from several different PWR types of 7 reactors. Therefore, it is necessary that some kinds of selection should be done before correction factors were generated.

A study on sample selection has been carried out to find the condition that the calculated composition ratios of all actinide nuclides can pass the normality test through selection of experimental data. There are a lot of ways to select experimental samples. Among them, the most important factors which affect experimental data, calculation method or the effective one-group cross-section are considered in selection of experimental data in this work. That is, the initial enrichment and/or burnup, axial location of sampling position in the fuel rod, burnup interval and experimental institute are taken into account in the selection. Although various selections have been tried to do changing the ranges of those factors, the sample sets have not been found that the ratios of all actinide nuclides can passed the normality test at a level of significance of $\alpha = 0.05$.

## 7.2. Determination of Correction Factors

Although further study is needed to get a sample set which can pass the normality test, it is out of scope of this work. More detailed analysis and application of high-level statistical methods are required to get the optimum sample set. In this work temporary correction factors will be generated on the basis of 71 samples which are slightly unsatisfied with normality. The correction factors may be used for an approximate burnup credit criticality analysis such as a preliminary calculation or feasibility study.

The correction factors have been determined at a level of significance of $\alpha = 0.05$ on

the basis of 71 samples of the combined set in which 16 and 55 samples are included, applying tolerance limit method shown in eqs.(4)-(7). The correction factors for 38 isotopes are determined and presented in Table 7.1. As shown in Table 7.1, four kinds of the correction factor for each nuclide are not much different except Pu-238, Am-242, Am-243, Cm-244, Sm-148, Eu-153 and Eu-154.

## 7.3. Conservative Prediction of Isotopic Composition

As shown in Table 7.1, in the case of Am-241 and Sm-149, all four kinds of the correction factors are determined to be zero because the standard deviations are very large. It means that Am-241 and Sm-149 are to be neglected in the burnup credit criticality calculation. The correction factors for fissile materials, U-235, Pu-239 and Pu-241 are determined to be larger than 1.0 and those for non-fissile materials are determined to be below 1.0. Therefore, the burnup credit criticality analysis will be conservative if $k_{eff}$ is calculated on the basis of the corrected compositions which are obtained from the multiplication of the calculated composition by the correction factor.

Table 7.1. Correction Factors for 38 nuclides

| Nuclide | Tolerance Limit Factor | Data# | Correction Factor | | | |
|---|---|---|---|---|---|---|
| | | | SAS2H | | | SWAT |
| | | | 27 G | 44 G | 238 G | 107 G |
| U-234 | 2.292 | 25 | 0.7386 | 0.7548 | 0.7581 | 0.7472 |
| U-235 | 1.987 | 71 | 1.1057 | 1.1047 | 1.0749 | 1.1091 |
| U-236 | 1.987 | 71 | 0.9103 | 0.9116 | 0.9140 | 0.9519 |
| U-238 | 2.005 | 65 | 0.9919 | 0.9918 | 0.9923 | 0.9920 |
| Np-237 | 2.671 | 13 | 0.6435 | 0.7173 | 0.7485 | 0.7462 |
| Pu-238 | 2.060 | 51 | 0.7905 | 0.8404 | 0.8516 | 0.9830 |
| Pu-239 | 1.987 | 71 | 1.0901 | 1.1166 | 1.0819 | 1.1104 |
| Pu-240 | 1.987 | 71 | 0.9864 | 0.9433 | 0.9274 | 0.9407 |
| Pu-241 | 1.987 | 71 | 1.1145 | 1.1858 | 1.1484 | 1.1984 |
| Pu-242 | 1.999 | 67 | 0.8986 | 0.8166 | 0.8113 | 0.8882 |
| Am-241 | 2.371 | 21 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Am-242 | 3.187 | 8 | 0.5196 | 0.5946 | 0.5793 | 0.9371 |
| Am-243 | 3.187 | 8 | 0.5205 | 0.4822 | 0.4727 | 0.7937 |
| Cm-242 | 2.220 | 30 | 0.4265 | 0.4974 | 0.4863 | 0.4665 |
| Cm-244 | 2.208 | 31 | 0.7302 | 0.6135 | 0.5742 | 0.8561 |
| Se-79 | 3.031 | 9 | 0.6218 | 0.6204 | 0.6197 | 0.7174 |
| Sr-90 | 3.031 | 9 | 0.9387 | 0.9371 | 0.9406 | 0.9308 |
| Tc-99 | 2.671 | 13 | 0.5931 | 0.5919 | 0.5820 | 0.5623 |
| Ru-106 | 5.144 | 4 | 0.7161 | 0.7200 | 0.7140 | 0.7180 |
| Sn-126 | 3.708 | 6 | 0.1405 | 0.1396 | 0.1392 | 0.1279 |
| I-129 | 7.656 | 3 | 0.6838 | 0.7162 | 0.6845 | 0.7592 |
| Cs-133 | 7.656 | 3 | 0.9399 | 0.9177 | 0.9027 | 0.9092 |
| Cs-134 | 2.275 | 26 | 0.7727 | 0.8013 | 0.8238 | 0.8056 |
| Cs-135 | 3.031 | 9 | 0.8513 | 0.9019 | 0.8883 | 0.9036 |
| Cs-137 | 2.158 | 36 | 0.9318 | 0.9317 | 0.9317 | 0.9394 |
| Ce-144 | 5.144 | 4 | 0.8669 | 0.8669 | 0.8773 | 0.8759 |
| Nd-143 | 7.656 | 3 | 0.9591 | 0.9719 | 0.9576 | 0.9759 |
| Nd-144 | 7.656 | 3 | 0.9869 | 0.9690 | 0.9869 | 0.9863 |
| Nd-145 | 7.656 | 3 | 0.9845 | 0.9774 | 0.9807 | 0.9828 |
| Nd-146 | 7.656 | 3 | 0.9884 | 0.9797 | 0.9873 | 0.9955 |
| Nd-148 | 2.524 | 16 | 0.9661 | 0.9671 | 0.9658 | 0.9519 |
| Nd-150 | 7.656 | 3 | 0.8992 | 0.8992 | 0.8992 | 0.8855 |
| Sm-148 | 7.656 | 3 | 0.9619 | 0.9862 | 1.0248 | 0.7183 |
| Sm-149 | 7.656 | 3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Sm-150 | 7.656 | 3 | 0.6426 | 0.6403 | 0.6436 | 0.6965 |
| Sm-152 | 7.656 | 3 | 0.5571 | 0.5620 | 0.7353 | 0.6010 |
| Eu-153 | 7.656 | 3 | 0.6654 | 0.5664 | 0.5699 | 0.6714 |
| Eu-154 | 2.423 | 19 | 0.3806 | 0.7385 | 0.7168 | 1.0064 |

## 8. Conclusions

In ideal situation, the burnup code predicts precisely the measurement. However, the reality is different. The code usually overestimates or underestimates the nuclide concentrations obtained by measurement. For a conservative estimate in burnup credit criticality application a correction factor is introduced for each nuclide based on the comparison of calculation results with measurements.

Four kinds of methods, i.e., SCALE4.4/SAS2H with 27, 44 and 238 group cross-section libraries and SWAT with 107 group library, were applied and the results were compared on the basis of 26 Obrigheim spent fuel samples and 55 spent fuel samples of 7 reactors. For convenience, the ratio of the measured to calculated values was used as a parameter. When the ratio is less than unity, the calculation overestimates the measurement, and the ratio becomes closer to unity, they have a better agreement. For many important nuclides for burnup credit criticality safety evaluation, the four methods applied in this study showed good coincidence with measurements in general. More precise observations showed, however: (1) Less unity ratios were found for Pu-239 and -241 for selected 16 samples out of the 26 samples from the Obrigheim reactor (10 samples were deselected because their burnups were measured with Cs-137 non-destructive method, less reliable than Nd-148 method the rest 16 samples were measured with); (2) Larger than unity ratios were found for Am-241 and Cm-242 for both the 16 and 55 samples; (3) Larger than unity ratios were found for Sm-149 for the 55 samples; (4) SWAT was generally accompanied by larger ratios than those of SAS2H with some exceptions.

Based on the measured-to-calculated ratios for 71 samples of a combined set in which 16 selected samples and 55 samples were included, the correction factors that should be multiplied to the calculated isotopic compositions were determined for a conservative estimate of the neutron multiplication factor of a system containing PWR spent fuel, taking burnup credit into account. However, some nuclides did not pass the normality test. Although, various sample selections were tried, the sample sets were not found that the ratios of all nuclides passed the normality test at a level of significance of $\alpha$=0.05.

It is necessary to investigate deeply the main reason of the big differences between calculations and experiments in several cases of 26 Obrigheim samples. In the case of the combined 71 samples, further study is required to find the set which pass normality test. The calculation results of SAS2H and SWAT are expected to be improved through modeling optimization.

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# Appendix : Input and Output Listings

A.1. SAS2H Input for Sample Or1 of 26 Obrigheim samples, 44 group,

```
=sas2h      parm='halt03,skipshipdata'
'id   arr frd   burnup enrch pitch actlgth zposit h2oden gdia1 gdia2   dtemp      voi
ob1   18 308   21.17 3.000 1.4300 295.60    0.00 0.7283 0.6413 0.6845    300.       0.
44group latticecell
uo2   1 den=10.4215   1 900.0000
              92234          0.0055
              92235          3.0000
              92238          96.9945                                              end
Np-237     1 0 1-20        900.0000                                               end
Pu-238     1 0 1-20        900.0000                                               end
Pu-239     1 0 1-20        900.0000                                               end
Pu-240     1 0 1-20        900.0000                                               end
Pu-241     1 0 1-20        900.0000                                               end
Pu-242     1 0 1-20        900.0000                                               end
Am-241     1 0 1-20        900.0000                                               end
Am-243     1 0 1-20        900.0000                                               end
Cm-244     1 0 1-20        900.0000                                               end
Gd-154     1 0 1-20        900.0000                                               end
Gd-155     1 0 1-20        900.0000                                               end
Gd-156     1 0 1-20        900.0000                                               end
Gd-157     1 0 1-20        900.0000                                               end
Gd-158     1 0 1-20        900.0000                                               end
Gd-160     1 0 1-20        900.0000                                               end
Xe-135     1 0 1-20        900.0000                                               end
Nd-143     1 0 1-20        900.0000                                               end
Rh-103     1 0 1-20        900.0000                                               end
Xe-131     1 0 1-20        900.0000                                               end
Cs-133     1 0 1-20        900.0000                                               end
Sm-149     1 0 1-20        900.0000                                               end
Tc-99      1 0 1-20        900.0000                                               end
Sm-152     1 0 1-20        900.0000                                               end
Sm-151     1 0 1-20        900.0000                                               end
Pm-147     1 0 1-20        900.0000                                               end
Eu-153     1 0 1-20        900.0000                                               end
Nd-145     1 0 1-20        900.0000                                               end
Eu-155     1 0 1-20        900.0000                                               end
Eu-154     1 0 1-20        900.0000                                               end
Sm-150     1 0 1-20        900.0000                                               end
Mo-95      1 0 1-20        900.0000                                               end
Ag-109     1 0 1-20        900.0000                                               end
Ru-101     1 0 1-20        900.0000                                               end
Cs-134     1 0 1-20        900.0000                                               end
Pd-105     1 0 1-20        900.0000                                               end
Pm-148     1 0 1-20        900.0000                                               end
Rh-105     1 0 1-20        900.0000                                               end
Pr-141     1 0 1-20        900.0000                                               end
Kr-83      1 0 1-20        900.0000                                               end
Pd-108     1 0 1-20        900.0000                                               end
Sm-147     1 0 1-20        900.0000                                               end
Pd-107     1 0 1-20        900.0000                                               end
Mo-97      1 0 1-20        900.0000                                               end
Cd-113     1 0 1-20        900.0000                                               end
Cs-135     1 0 1-20        900.0000                                               end
Mo-98      1 0 1-20        900.0000                                               end
Xe-133     1 0 1-20        900.0000                                               end
In-115     1 0 1-20        900.0000                                               end
Pr-143     1 0 1-20        900.0000                                               end
Eu-156     1 0 1-20        900.0000                                               end
Ru-103     1 0 1-20        900.0000                                               end
Sm-148     1 0 1-20        900.0000                                               end
Nd-147     1 0 1-20        900.0000                                               end
Pm-149     1 0 1-20        900.0000                                               end
O-16       1 0 1-20        900.0000                                               end
zircalloy      2               1                                  600.0000     end
h2o              3 den= 0.7283 1                                    556.3400     end
arbm-bormod              0.7283 1 1 0 0 5000 100   3 0.50E-03   556.3400      end
end comp
'
squarepitch 1.43000 0.90400   1   3 1.07600   2 0.93180   0                     end
'
fuellnght= 550.654 npin/assm=    308    ncycles=          3
nlib/cyc=        1    printlevel=    10    lightel=          0
inplevel=        2    numztotal=      5                                        end
  3   0.6413      2   0.6845      3   0.8068    500   3.6306      3   3.6446
power=  18.674   burn=  258.000    down=  370.000                                 end
power=  30.954   burn=  283.000    down=   23.000 bfrac=2.000                     end
power=  33.153   burn=  229.000                   bfrac=1.000                    end
end
```

A.2. SWAT Input for Sample Or1 of 26 Obrigheim samples

```
===== PDS FILE ALOCATION ======
FASTP  : pfast
THERMP : pthml
FASTU  : fastu
THERMU : thermalu
MACWRK : macrowrk
FLUX   : flux
MACRO  : macro
MCROSSP: pmcrs
MICREF : micref
UMCROS : umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
ob1  18 308  21.170 3.0000 1.4300 295.60  15.00 0.7283 0.9318 0.6413 0.6845
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.45200  0.53800  0.83806
1
3
67 1 0 0 0 4 4(0) 1.0 0.904 0.0 10.42150 3.000 0.0 4(0.0) / UO2 (3.000wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
```

```
461050  2 1 0 0 1 0
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340        55.00
922350     30000.00
922360         0.00
922380    969945.00
 4.64956E-02          / O-16 constant density
3       9(0) 0.0   0.31651 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02   1.4838E-04   7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   0.94891 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1    0
  1
 38  12
 12(2)    1   12(2)    1   12(2)
  3    4 /  1
  3    4 /  2
  3    4 /  3
  3    4 /  4
  3    4 /  5
  3    4 /  6
  3    4 /  7
  3    4 /  8
  3    4 /  9
  3    4 / 10
  3    4 / 11
  3    4 / 12
  4      / 13
  3    4 / 14
  3    4 / 15
  3    4 / 16
  3    4 / 17
  3    4 / 18
  3    4 / 19
  3    4 / 20
  3    4 / 21
  3    4 / 22
  3    4 / 23
  3    4 / 24
  3    4 / 25
  4      / 26
  3    4 / 27
  3    4 / 28
  3    4 / 29
  3    4 / 30
  3    4 / 31
  3    4 / 32
  3    4 / 33
  3    4 / 34
  3    4 / 35
  3    4 / 36
  3    4 / 37
  3    4 / 38
```

```
 12(1)   0  12(1)   0  12(1)
  21.500   18.674 /    1   21.500= 258.000/  12.000
  21.500   18.674 /    2   18.674=  6600.0/ 258.000*  21.170/  29.000
  21.500   18.674 /    3
  21.500   18.674 /    4
  21.500   18.674 /    5
  21.500   18.674 /    6
  21.500   18.674 /    7
  21.500   18.674 /    8
  21.500   18.674 /    9
  21.500   18.674 /   10
  21.500   18.674 /   11
  21.500   18.674 /   12
 370.000          /   13
  23.583   30.954 /   14   23.583= 283.000/  12.000
  23.583   30.954 /   15   30.954= 12000.0/ 283.000*  21.170/  29.000
  23.583   30.954 /   16
  23.583   30.954 /   17
  23.583   30.954 /   18
  23.583   30.954 /   19
  23.583   30.954 /   20
  23.583   30.954 /   21
  23.583   30.954 /   22
  23.583   30.954 /   23
  23.583   30.954 /   24
  23.583   30.954 /   25
  23.000          /   26
  19.083   33.153 /   27   19.083= 229.000/  12.000
  19.083   33.153 /   28   33.153= 10400.0/ 229.000*  21.170/  29.000
  19.083   33.153 /   29
  19.083   33.153 /   30
  19.083   33.153 /   31
  19.083   33.153 /   32
  19.083   33.153 /   33
  19.083   33.153 /   34
  19.083   33.153 /   35
  19.083   33.153 /   36
  19.083   33.153 /   37
  19.083   33.153 /   38
 900.000  600.000  556.340 /    1
 900.000  600.000  556.340 /    2
 900.000  600.000  556.340 /    3
 900.000  600.000  556.340 /    4
 900.000  600.000  556.340 /    5
 900.000  600.000  556.340 /    6
 900.000  600.000  556.340 /    7
 900.000  600.000  556.340 /    8
 900.000  600.000  556.340 /    9
 900.000  600.000  556.340 /   10
 900.000  600.000  556.340 /   11
 900.000  600.000  556.340 /   12
3( 300.0)                  /   13
 900.000  600.000  556.340 /   14
 900.000  600.000  556.340 /   15
 900.000  600.000  556.340 /   16
 900.000  600.000  556.340 /   17
 900.000  600.000  556.340 /   18
 900.000  600.000  556.340 /   19
 900.000  600.000  556.340 /   20
 900.000  600.000  556.340 /   21
 900.000  600.000  556.340 /   22
 900.000  600.000  556.340 /   23
 900.000  600.000  556.340 /   24
 900.000  600.000  556.340 /   25
3( 300.0)                  /   26
 900.000  600.000  556.340 /   27
 900.000  600.000  556.340 /   28
 900.000  600.000  556.340 /   29
 900.000  600.000  556.340 /   30
 900.000  600.000  556.340 /   31
 900.000  600.000  556.340 /   32
 900.000  600.000  556.340 /   33
 900.000  600.000  556.340 /   34
 900.000  600.000  556.340 /   35
 900.000  600.000  556.340 /   36
 900.000  600.000  556.340 /   37
 900.000  600.000  556.340 /   38
   1 0 0 0 0 0 14(    0.0)    /    1 result control
   1 0 0 0 0 0 14(    0.0)    /    2 result control
```

```
   1 0 0 0 0 0 14(    0.0)    /    3 result control
   1 0 0 0 0 0 14(    0.0)    /    4 result control
   1 0 0 0 0 0 14(    0.0)    /    5 result control
   1 0 0 0 0 0 14(    0.0)    /    6 result control
   1 0 0 0 0 0 14(    0.0)    /    7 result control
   1 0 0 0 0 0 14(    0.0)    /    8 result control
   1 0 0 0 0 0 14(    0.0)    /    9 result control
   1 0 0 0 0 0 14(    0.0)    /   10 result control
   1 0 0 0 0 0 14(    0.0)    /   11 result control
   1 0 0 0 0 0 14(    0.0)    /   12 result control
   1 0 0 0 0 0 14(    0.0)    /   13 result control
   1 0 0 0 0 0 14(    0.0)    /   14 result control
   1 0 0 0 0 0 14(    0.0)    /   15 result control
   1 0 0 0 0 0 14(    0.0)    /   16 result control
   1 0 0 0 0 0 14(    0.0)    /   17 result control
   1 0 0 0 0 0 14(    0.0)    /   18 result control
   1 0 0 0 0 0 14(    0.0)    /   19 result control
   1 0 0 0 0 0 14(    0.0)    /   20 result control
   1 0 0 0 0 0 14(    0.0)    /   21 result control
   1 0 0 0 0 0 14(    0.0)    /   22 result control
   1 0 0 0 0 0 14(    0.0)    /   23 result control
   1 0 0 0 0 0 14(    0.0)    /   24 result control
   1 0 0 0 0 0 14(    0.0)    /   25 result control
   1 0 0 0 0 0 14(    0.0)    /   26 result control
   1 0 0 0 0 0 14(    0.0)    /   27 result control
   1 0 0 0 0 0 14(    0.0)    /   28 result control
   1 0 0 0 0 0 14(    0.0)    /   29 result control
   1 0 0 0 0 0 14(    0.0)    /   30 result control
   1 0 0 0 0 0 14(    0.0)    /   31 result control
   1 0 0 0 0 0 14(    0.0)    /   32 result control
   1 0 0 0 0 0 14(    0.0)    /   33 result control
   1 0 0 0 0 0 14(    0.0)    /   34 result control
   1 0 0 0 0 0 14(    0.0)    /   35 result control
   1 0 0 0 0 0 14(    0.0)    /   36 result control
   1 0 0 0 0 0 14(    0.0)    /   37 result control
   1 0 0 0 0 0 14(    0.0)    /   38 result control
0 / PWR
 38(   0.000) / void ratio (%)
 12( -500.0)   1(-1000.0)  12( -500.0)   1(-1000.0)  12( -500.0)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.1. SWAT input for Sample NO 1 of Yankee Rowe.

```
===== PDS FILE ALOCATION ======
FASTP  : pfast
THERMP : pthml
FASTU  : fastu
THERMU : thermalu
MACWRK : macrowrk
FLUX   : flux
MACRO  : macro
MCROSSP: pmcrs
MICREF : micref
UMCROS : umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
ya1  18 305  15.950 3.4000 1.0719 230.05 220.22 0.7702 0.7569 0.3785 0.4318
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.37084  0.43180  0.62113
1
3
67 1 0 0 0 4 4(0) 1.0 0.742 0.0 10.18000 3.400 0.0 4(0.0) / UO2 (3.400wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
461050  2 1 0 0 1 0
```

```
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       200.00
922350     34000.00
922360       200.00
922380    965600.00
 4.64956E-02          / O-16 constant density
3      9(0) 0.0   0.22663 8(0.0)
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
280000  2 1 1 0 0 1 / Ni
5.7872E-2 1.7408E-2 8.1116E-3 / Fe, Cr, Ni
4 0 1 7(0) 0.0   0.64190 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1   0
  1
 39  12
 12(2)    1   12(2)    1   12(2)    1
  3   4 /  1
  3   4 /  2
  3   4 /  3
  3   4 /  4
  3   4 /  5
  3   4 /  6
  3   4 /  7
  3   4 /  8
  3   4 /  9
  3   4 / 10
  3   4 / 11
  3   4 / 12
  4     / 13
  3   4 / 14
  3   4 / 15
  3   4 / 16
  3   4 / 17
  3   4 / 18
  3   4 / 19
  3   4 / 20
  3   4 / 21
  3   4 / 22
  3   4 / 23
  3   4 / 24
  3   4 / 25
  4     / 26
  3   4 / 27
  3   4 / 28
  3   4 / 29
  3   4 / 30
  3   4 / 31
  3   4 / 32
  3   4 / 33
  3   4 / 34
  3   4 / 35
  3   4 / 36
  3   4 / 37
  3   4 / 38
  4     / 39
```

```
 12(1)   0  12(1)   0  12(1)   0
  37.628    13.066 /    1
  37.628    13.066 /    2
  37.628    13.066 /    3
  37.628    13.066 /    4
  37.628    13.066 /    5
  37.628    13.066 /    6
  37.628    13.066 /    7
  37.628    13.066 /    8
  37.628    13.066 /    9
  37.628    13.066 /   10
  37.628    13.066 /   11
  37.628    13.066 /   12
 128.960           /   13
  27.760    13.004 /   14
  27.760    13.004 /   15
  27.760    13.004 /   16
  27.760    13.004 /   17
  27.760    13.004 /   18
  27.760    13.004 /   19
  27.760    13.004 /   20
  27.760    13.004 /   21
  27.760    13.004 /   22
  27.760    13.004 /   23
  27.760    13.004 /   24
  27.760    13.004 /   25
 369.960           /   26
  28.087    16.965 /   27
  28.087    16.965 /   28
  28.087    16.965 /   29
  28.087    16.965 /   30
  28.087    16.965 /   31
  28.087    16.965 /   32
  28.087    16.965 /   33
  28.087    16.965 /   34
  28.087    16.965 /   35
  28.087    16.965 /   36
  28.087    16.965 /   37
  28.087    16.965 /   38
 281.500           /   39
  771.310  559.090  548.650 /    1
  771.310  559.090  548.650 /    2
  771.310  559.090  548.650 /    3
  771.310  559.090  548.650 /    4
  771.310  559.090  548.650 /    5
  771.310  559.090  548.650 /    6
  771.310  559.090  548.650 /    7
  771.310  559.090  548.650 /    8
  771.310  559.090  548.650 /    9
  771.310  559.090  548.650 /   10
  771.310  559.090  548.650 /   11
  771.310  559.090  548.650 /   12
3( 300.0)                   /   13
  771.310  559.090  548.650 /   14
  771.310  559.090  548.650 /   15
  771.310  559.090  548.650 /   16
  771.310  559.090  548.650 /   17
  771.310  559.090  548.650 /   18
  771.310  559.090  548.650 /   19
  771.310  559.090  548.650 /   20
  771.310  559.090  548.650 /   21
  771.310  559.090  548.650 /   22
  771.310  559.090  548.650 /   23
  771.310  559.090  548.650 /   24
  771.310  559.090  548.650 /   25
3( 300.0)                   /   26
  771.310  559.090  548.650 /   27
  771.310  559.090  548.650 /   28
  771.310  559.090  548.650 /   29
  771.310  559.090  548.650 /   30
  771.310  559.090  548.650 /   31
  771.310  559.090  548.650 /   32
  771.310  559.090  548.650 /   33
  771.310  559.090  548.650 /   34
  771.310  559.090  548.650 /   35
  771.310  559.090  548.650 /   36
  771.310  559.090  548.650 /   37
  771.310  559.090  548.650 /   38
3( 300.0)                   /   39
```

```
    1 0 0 0 0 0 14(    0.0)    /    1 result control
    1 0 0 0 0 0 14(    0.0)    /    2 result control
    1 0 0 0 0 0 14(    0.0)    /    3 result control
    1 0 0 0 0 0 14(    0.0)    /    4 result control
    1 0 0 0 0 0 14(    0.0)    /    5 result control
    1 0 0 0 0 0 14(    0.0)    /    6 result control
    1 0 0 0 0 0 14(    0.0)    /    7 result control
    1 0 0 0 0 0 14(    0.0)    /    8 result control
    1 0 0 0 0 0 14(    0.0)    /    9 result control
    1 0 0 0 0 0 14(    0.0)    /   10 result control
    1 0 0 0 0 0 14(    0.0)    /   11 result control
    1 0 0 0 0 0 14(    0.0)    /   12 result control
    1 0 0 0 0 0 14(    0.0)    /   13 result control
    1 0 0 0 0 0 14(    0.0)    /   14 result control
    1 0 0 0 0 0 14(    0.0)    /   15 result control
    1 0 0 0 0 0 14(    0.0)    /   16 result control
    1 0 0 0 0 0 14(    0.0)    /   17 result control
    1 0 0 0 0 0 14(    0.0)    /   18 result control
    1 0 0 0 0 0 14(    0.0)    /   19 result control
    1 0 0 0 0 0 14(    0.0)    /   20 result control
    1 0 0 0 0 0 14(    0.0)    /   21 result control
    1 0 0 0 0 0 14(    0.0)    /   22 result control
    1 0 0 0 0 0 14(    0.0)    /   23 result control
    1 0 0 0 0 0 14(    0.0)    /   24 result control
    1 0 0 0 0 0 14(    0.0)    /   25 result control
    1 0 0 0 0 0 14(    0.0)    /   26 result control
    1 0 0 0 0 0 14(    0.0)    /   27 result control
    1 0 0 0 0 0 14(    0.0)    /   28 result control
    1 0 0 0 0 0 14(    0.0)    /   29 result control
    1 0 0 0 0 0 14(    0.0)    /   30 result control
    1 0 0 0 0 0 14(    0.0)    /   31 result control
    1 0 0 0 0 0 14(    0.0)    /   32 result control
    1 0 0 0 0 0 14(    0.0)    /   33 result control
    1 0 0 0 0 0 14(    0.0)    /   34 result control
    1 0 0 0 0 0 14(    0.0)    /   35 result control
    1 0 0 0 0 0 14(    0.0)    /   36 result control
    1 0 0 0 0 0 14(    0.0)    /   37 result control
    1 0 0 0 0 0 14(    0.0)    /   38 result control
    1 0 0 0 0 0 14(    0.0)    /   39 result control
0 / PWR
 39(   0.000) / void ratio (%)
12(-0.1E-05)  1(-0.1E-05)
12(-0.1E-05)  1(-0.1E-05)
12(-0.3E-03)  1(-0.3E-03)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.2. SWAT input for Mihama-3 Sample NO 1.

```
===== PDS FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
mi1  15 204   8.301 3.2080 1.4300 365.76  -1.00 0.7518 0.9484 0.6502 0.6934
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.46470  0.53595  0.84350
1
3
67 1 0 0 0 4 4(0) 1.0 0.929 0.0  9.99600 3.208 0.0 4(0.0) / UO2 (3.208wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
```

```
461050  2 1 0 0 1 0
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       285.00
922350     32080.00
922360       208.00
922380    967419.94
 4.64956E-02          / O-16 constant density
3      9(0) 0.0   0.26606 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02  1.4838E-04  7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   1.00593 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1   0
  1
 13  12
 12(2)   1
  3   4 /  1
  3   4 /  2
  3   4 /  3
  3   4 /  4
  3   4 /  5
  3   4 /  6
  3   4 /  7
  3   4 /  8
  3   4 /  9
  3   4 / 10
  3   4 / 11
  3   4 / 12
  4     / 13
 12(1)   0
  17.917   38.610 /    1
  17.917   38.610 /    2
  17.917   38.610 /    3
  17.917   38.610 /    4
  17.917   38.610 /    5
  17.917   38.610 /    6
  17.917   38.610 /    7
  17.917   38.610 /    8
  17.917   38.610 /    9
  17.917   38.610 /   10
  17.917   38.610 /   11
  17.917   38.610 /   12
1825.000          /   13
 923.000  600.400  560.400 /    1
 923.000  600.400  560.400 /    2
 923.000  600.400  560.400 /    3
 923.000  600.400  560.400 /    4
 923.000  600.400  560.400 /    5
 923.000  600.400  560.400 /    6
 923.000  600.400  560.400 /    7
 923.000  600.400  560.400 /    8
 923.000  600.400  560.400 /    9
 923.000  600.400  560.400 /   10
 923.000  600.400  560.400 /   11
```

```
 923.000   600.400   560.400 /    12
3( 300.0)                     /   13
   1 0 0 0 0 0 14(    0.0)    /     1 result control
   1 0 0 0 0 0 14(    0.0)    /     2 result control
   1 0 0 0 0 0 14(    0.0)    /     3 result control
   1 0 0 0 0 0 14(    0.0)    /     4 result control
   1 0 0 0 0 0 14(    0.0)    /     5 result control
   1 0 0 0 0 0 14(    0.0)    /     6 result control
   1 0 0 0 0 0 14(    0.0)    /     7 result control
   1 0 0 0 0 0 14(    0.0)    /     8 result control
   1 0 0 0 0 0 14(    0.0)    /     9 result control
   1 0 0 0 0 0 14(    0.0)    /    10 result control
   1 0 0 0 0 0 14(    0.0)    /    11 result control
   1 0 0 0 0 0 14(    0.0)    /    12 result control
   1 0 0 0 0 0 14(    0.0)    /    13 result control
0 / PWR
 13(   0.000) / void ratio (%)
12(-0.4E-03)  1(-0.4E-03)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.3. SWAT input for Trino Vercellese Sample NO 1.

```
===== PDS FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists ****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
tr1   15 221   12.042 3.8970 1.3030 264.10  79.20 0.7795 0.9020 0.7351 ******
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.44500  0.48930  0.74132
1
3
67 1 0 0 0 4 4(0) 1.0 0.890 0.0 10.35300 3.897 0.0 4(0.0) / UO2 (3.897wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
461050  2 1 0 0 1 0
```

```
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       350.00
922350     38970.00
922360       180.00
922380    960500.00
 4.64956E-02           / O-16 constant density
3      9(0) 0.0   0.16918 8(0.0)
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
280000  2 1 1 0 0 1 / Ni
5.7872E-2 1.7408E-2 8.1116E-3 / Fe, Cr, Ni
4 0 1 7(0) 0.0   0.83673 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1    0
  1
 39   12
 12(2)    1   12(2)    1   12(2)    1
  3    4 /  1
  3    4 /  2
  3    4 /  3
  3    4 /  4
  3    4 /  5
  3    4 /  6
  3    4 /  7
  3    4 /  8
  3    4 /  9
  3    4 / 10
  3    4 / 11
  3    4 / 12
  4      / 13
  3    4 / 14
  3    4 / 15
  3    4 / 16
  3    4 / 17
  3    4 / 18
  3    4 / 19
  3    4 / 20
  3    4 / 21
  3    4 / 22
  3    4 / 23
  3    4 / 24
  3    4 / 25
  4      / 26
  3    4 / 27
  3    4 / 28
  3    4 / 29
  3    4 / 30
  3    4 / 31
  3    4 / 32
  3    4 / 33
  3    4 / 34
  3    4 / 35
  3    4 / 36
  3    4 / 37
  3    4 / 38
  4      / 39
```

```
 12(1)   0  12(1)    0  12(1)    0
  18.833    10.390 /    1
  18.833    10.390 /    2
  18.833    10.390 /    3
  18.833    10.390 /    4
  18.833    10.390 /    5
  18.833    10.390 /    6
  18.833    10.390 /    7
  18.833    10.390 /    8
  18.833    10.390 /    9
  18.833    10.390 /   10
  18.833    10.390 /   11
  18.833    10.390 /   12
  86.000           /   13
  21.917    16.138 /   14
  21.917    16.138 /   15
  21.917    16.138 /   16
  21.917    16.138 /   17
  21.917    16.138 /   18
  21.917    16.138 /   19
  21.917    16.138 /   20
  21.917    16.138 /   21
  21.917    16.138 /   22
  21.917    16.138 /   23
  21.917    16.138 /   24
  21.917    16.138 /   25
  51.000           /   26
  24.333    18.663 /   27
  24.333    18.663 /   28
  24.333    18.663 /   29
  24.333    18.663 /   30
  24.333    18.663 /   31
  24.333    18.663 /   32
  24.333    18.663 /   33
  24.333    18.663 /   34
  24.333    18.663 /   35
  24.333    18.663 /   36
  24.333    18.663 /   37
  24.333    18.663 /   38
  10.000           /   39
1001.000  570.000  543.000 /    1
1001.000  570.000  543.000 /    2
1001.000  570.000  543.000 /    3
1001.000  570.000  543.000 /    4
1001.000  570.000  543.000 /    5
1001.000  570.000  543.000 /    6
1001.000  570.000  543.000 /    7
1001.000  570.000  543.000 /    8
1001.000  570.000  543.000 /    9
1001.000  570.000  543.000 /   10
1001.000  570.000  543.000 /   11
1001.000  570.000  543.000 /   12
3( 300.0)                 /   13
1001.000  570.000  543.000 /   14
1001.000  570.000  543.000 /   15
1001.000  570.000  543.000 /   16
1001.000  570.000  543.000 /   17
1001.000  570.000  543.000 /   18
1001.000  570.000  543.000 /   19
1001.000  570.000  543.000 /   20
1001.000  570.000  543.000 /   21
1001.000  570.000  543.000 /   22
1001.000  570.000  543.000 /   23
1001.000  570.000  543.000 /   24
1001.000  570.000  543.000 /   25
3( 300.0)                 /   26
1001.000  570.000  543.000 /   27
1001.000  570.000  543.000 /   28
1001.000  570.000  543.000 /   29
1001.000  570.000  543.000 /   30
1001.000  570.000  543.000 /   31
1001.000  570.000  543.000 /   32
1001.000  570.000  543.000 /   33
1001.000  570.000  543.000 /   34
1001.000  570.000  543.000 /   35
1001.000  570.000  543.000 /   36
1001.000  570.000  543.000 /   37
1001.000  570.000  543.000 /   38
3( 300.0)                 /   39
```

```
 1 0 0 0 0 0 14(   0.0)   /    1 result control
 1 0 0 0 0 0 14(   0.0)   /    2 result control
 1 0 0 0 0 0 14(   0.0)   /    3 result control
 1 0 0 0 0 0 14(   0.0)   /    4 result control
 1 0 0 0 0 0 14(   0.0)   /    5 result control
 1 0 0 0 0 0 14(   0.0)   /    6 result control
 1 0 0 0 0 0 14(   0.0)   /    7 result control
 1 0 0 0 0 0 14(   0.0)   /    8 result control
 1 0 0 0 0 0 14(   0.0)   /    9 result control
 1 0 0 0 0 0 14(   0.0)   /   10 result control
 1 0 0 0 0 0 14(   0.0)   /   11 result control
 1 0 0 0 0 0 14(   0.0)   /   12 result control
 1 0 0 0 0 0 14(   0.0)   /   13 result control
 1 0 0 0 0 0 14(   0.0)   /   14 result control
 1 0 0 0 0 0 14(   0.0)   /   15 result control
 1 0 0 0 0 0 14(   0.0)   /   16 result control
 1 0 0 0 0 0 14(   0.0)   /   17 result control
 1 0 0 0 0 0 14(   0.0)   /   18 result control
 1 0 0 0 0 0 14(   0.0)   /   19 result control
 1 0 0 0 0 0 14(   0.0)   /   20 result control
 1 0 0 0 0 0 14(   0.0)   /   21 result control
 1 0 0 0 0 0 14(   0.0)   /   22 result control
 1 0 0 0 0 0 14(   0.0)   /   23 result control
 1 0 0 0 0 0 14(   0.0)   /   24 result control
 1 0 0 0 0 0 14(   0.0)   /   25 result control
 1 0 0 0 0 0 14(   0.0)   /   26 result control
 1 0 0 0 0 0 14(   0.0)   /   27 result control
 1 0 0 0 0 0 14(   0.0)   /   28 result control
 1 0 0 0 0 0 14(   0.0)   /   29 result control
 1 0 0 0 0 0 14(   0.0)   /   30 result control
 1 0 0 0 0 0 14(   0.0)   /   31 result control
 1 0 0 0 0 0 14(   0.0)   /   32 result control
 1 0 0 0 0 0 14(   0.0)   /   33 result control
 1 0 0 0 0 0 14(   0.0)   /   34 result control
 1 0 0 0 0 0 14(   0.0)   /   35 result control
 1 0 0 0 0 0 14(   0.0)   /   36 result control
 1 0 0 0 0 0 14(   0.0)   /   37 result control
 1 0 0 0 0 0 14(   0.0)   /   38 result control
 1 0 0 0 0 0 14(   0.0)   /   39 result control
0 / PWR
 39(   0.000) / void ratio (%)
12(-0.1E-02)  1(-0.1E-02)
12(-0.8E-03)  1(-0.8E-03)
12(-0.3E-03)  1(-0.3E-03)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.4. SWAT input for Turky Point Sample NO 1.

```
===== FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists ****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
tu1   15 204   30.720 2.5560 1.4300 365.80 167.60 0.7310 0.9484 0.6502 0.6934
1 1 1 0 0   0 0 1 1 1  / Library Control
1 1 1 1 2    1 4 3 -2 1     0 0 0 0 2    0 1 0 0 0  / SRAC General Control
1.0000E-25
63   44    1 /fast thermal lethergy
3 3 3 3 3     0 3 0 0 0    0 0 8 15 0   0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000   0.46482   0.53595   0.84350
1
3
67 1 0 0 0 4 4(0) 1.0 0.930 0.0 10.23500 2.556 0.0 4(0.0) / UO2 (2.556wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
```

```
461050  2 1 0 0 1 0
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       230.00
922350     25560.00
922360       120.00
922380    974089.94
 4.64956E-02          / O-16 constant density
3       9(0) 0.0   0.26564 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02   1.4838E-04   7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   1.00593 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1    0
  1
 39  12
 12(2)    1   12(2)    1   12(2)    1
  3    4 /  1
  3    4 /  2
  3    4 /  3
  3    4 /  4
  3    4 /  5
  3    4 /  6
  3    4 /  7
  3    4 /  8
  3    4 /  9
  3    4 / 10
  3    4 / 11
  3    4 / 12
  4      / 13
  3    4 / 14
  3    4 / 15
  3    4 / 16
  3    4 / 17
  3    4 / 18
  3    4 / 19
  3    4 / 20
  3    4 / 21
  3    4 / 22
  3    4 / 23
  3    4 / 24
  3    4 / 25
  4      / 26
  3    4 / 27
  3    4 / 28
  3    4 / 29
  3    4 / 30
  3    4 / 31
  3    4 / 32
  3    4 / 33
  3    4 / 34
  3    4 / 35
  3    4 / 36
  3    4 / 37
  3    4 / 38
```

```
  4      / 39
 12(1)   0  12(1)    0  12(1)    0
  26.167    32.235 /    1
  26.167    32.235 /    2
  26.167    32.235 /    3
  26.167    32.235 /    4
  26.167    32.235 /    5
  26.167    32.235 /    6
  26.167    32.235 /    7
  26.167    32.235 /    8
  26.167    32.235 /    9
  26.167    32.235 /   10
  26.167    32.235 /   11
  26.167    32.235 /   12
  58.000           /   13
  27.250    32.235 /   14
  27.250    32.235 /   15
  27.250    32.235 /   16
  27.250    32.235 /   17
  27.250    32.235 /   18
  27.250    32.235 /   19
  27.250    32.235 /   20
  27.250    32.235 /   21
  27.250    32.235 /   22
  27.250    32.235 /   23
  27.250    32.235 /   24
  27.250    32.235 /   25
  62.000           /   26
  26.000    32.235 /   27
  26.000    32.235 /   28
  26.000    32.235 /   29
  26.000    32.235 /   30
  26.000    32.235 /   31
  26.000    32.235 /   32
  26.000    32.235 /   33
  26.000    32.235 /   34
  26.000    32.235 /   35
  26.000    32.235 /   36
  26.000    32.235 /   37
  26.000    32.235 /   38
 927.000           /   39
 922.000   595.000  570.000 /    1
 922.000   595.000  570.000 /    2
 922.000   595.000  570.000 /    3
 922.000   595.000  570.000 /    4
 922.000   595.000  570.000 /    5
 922.000   595.000  570.000 /    6
 922.000   595.000  570.000 /    7
 922.000   595.000  570.000 /    8
 922.000   595.000  570.000 /    9
 922.000   595.000  570.000 /   10
 922.000   595.000  570.000 /   11
 922.000   595.000  570.000 /   12
3( 300.0)                  /   13
 922.000   595.000  570.000 /   14
 922.000   595.000  570.000 /   15
 922.000   595.000  570.000 /   16
 922.000   595.000  570.000 /   17
 922.000   595.000  570.000 /   18
 922.000   595.000  570.000 /   19
 922.000   595.000  570.000 /   20
 922.000   595.000  570.000 /   21
 922.000   595.000  570.000 /   22
 922.000   595.000  570.000 /   23
 922.000   595.000  570.000 /   24
 922.000   595.000  570.000 /   25
3( 300.0)                  /   26
 922.000   595.000  570.000 /   27
 922.000   595.000  570.000 /   28
 922.000   595.000  570.000 /   29
 922.000   595.000  570.000 /   30
 922.000   595.000  570.000 /   31
 922.000   595.000  570.000 /   32
 922.000   595.000  570.000 /   33
 922.000   595.000  570.000 /   34
 922.000   595.000  570.000 /   35
 922.000   595.000  570.000 /   36
 922.000   595.000  570.000 /   37
 922.000   595.000  570.000 /   38
```

```
3( 300.0)                    /  39
   1 0 0 0 0 0 14(   0.0)    /   1 result control
   1 0 0 0 0 0 14(   0.0)    /   2 result control
   1 0 0 0 0 0 14(   0.0)    /   3 result control
   1 0 0 0 0 0 14(   0.0)    /   4 result control
   1 0 0 0 0 0 14(   0.0)    /   5 result control
   1 0 0 0 0 0 14(   0.0)    /   6 result control
   1 0 0 0 0 0 14(   0.0)    /   7 result control
   1 0 0 0 0 0 14(   0.0)    /   8 result control
   1 0 0 0 0 0 14(   0.0)    /   9 result control
   1 0 0 0 0 0 14(   0.0)    /  10 result control
   1 0 0 0 0 0 14(   0.0)    /  11 result control
   1 0 0 0 0 0 14(   0.0)    /  12 result control
   1 0 0 0 0 0 14(   0.0)    /  13 result control
   1 0 0 0 0 0 14(   0.0)    /  14 result control
   1 0 0 0 0 0 14(   0.0)    /  15 result control
   1 0 0 0 0 0 14(   0.0)    /  16 result control
   1 0 0 0 0 0 14(   0.0)    /  17 result control
   1 0 0 0 0 0 14(   0.0)    /  18 result control
   1 0 0 0 0 0 14(   0.0)    /  19 result control
   1 0 0 0 0 0 14(   0.0)    /  20 result control
   1 0 0 0 0 0 14(   0.0)    /  21 result control
   1 0 0 0 0 0 14(   0.0)    /  22 result control
   1 0 0 0 0 0 14(   0.0)    /  23 result control
   1 0 0 0 0 0 14(   0.0)    /  24 result control
   1 0 0 0 0 0 14(   0.0)    /  25 result control
   1 0 0 0 0 0 14(   0.0)    /  26 result control
   1 0 0 0 0 0 14(   0.0)    /  27 result control
   1 0 0 0 0 0 14(   0.0)    /  28 result control
   1 0 0 0 0 0 14(   0.0)    /  29 result control
   1 0 0 0 0 0 14(   0.0)    /  30 result control
   1 0 0 0 0 0 14(   0.0)    /  31 result control
   1 0 0 0 0 0 14(   0.0)    /  32 result control
   1 0 0 0 0 0 14(   0.0)    /  33 result control
   1 0 0 0 0 0 14(   0.0)    /  34 result control
   1 0 0 0 0 0 14(   0.0)    /  35 result control
   1 0 0 0 0 0 14(   0.0)    /  36 result control
   1 0 0 0 0 0 14(   0.0)    /  37 result control
   1 0 0 0 0 0 14(   0.0)    /  38 result control
   1 0 0 0 0 0 14(   0.0)    /  39 result control
0 / PWR
 39(  0.000) / void ratio (%)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.5. SWAT input for Calvert Cliffs Sample NO 1.

```
===== PDS FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
cal  14 176  27.348 3.0380 1.4732 347.22  13.20 0.7575 0.9855 1.3140 1.4160
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.47815  0.55880  0.87261
1
3
67 1 0 0 0 4 4(0) 1.0 0.956 0.0 10.04500 3.038 0.0 4(0.0) / UO2 (3.038wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
461050  2 1 0 0 1 0
```

```
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       270.00
922350     30380.00
922360       140.00
922380    969210.00
 4.64956E-02          / O-16 constant density.
3       9(0) 0.0   0.29932 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02  1.4838E-04  7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   1.02953 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1   0
  1
 52  12
 12(2)   1  12(2)   1  12(2)   1  12(2)   1
  3   4 /  1
  3   4 /  2
  3   4 /  3
  3   4 /  4
  3   4 /  5
  3   4 /  6
  3   4 /  7
  3   4 /  8
  3   4 /  9
  3   4 / 10
  3   4 / 11
  3   4 / 12
  4     / 13
  3   4 / 14
  3   4 / 15
  3   4 / 16
  3   4 / 17
  3   4 / 18
  3   4 / 19
  3   4 / 20
  3   4 / 21
  3   4 / 22
  3   4 / 23
  3   4 / 24
  3   4 / 25
  4     / 26
  3   4 / 27
  3   4 / 28
  3   4 / 29
  3   4 / 30
  3   4 / 31
  3   4 / 32
  3   4 / 33
  3   4 / 34
  3   4 / 35
  3   4 / 36
  3   4 / 37
  3   4 / 38
  4     / 39
```

```
  3   4 / 40
  3   4 / 41
  3   4 / 42
  3   4 / 43
  3   4 / 44
  3   4 / 45
  3   4 / 46
  3   4 / 47
  3   4 / 48
  3   4 / 49
  3   4 / 50
  3   4 / 51
  4     / 52
 12(1)   0  12(1)   0  12(1)   0  12(1)   0
  25.500   17.240 /   1
  25.500   17.240 /   2
  25.500   17.240 /   3
  25.500   17.240 /   4
  25.500   17.240 /   5
  25.500   17.240 /   6
  25.500   17.240 /   7
  25.500   17.240 /   8
  25.500   17.240 /   9
  25.500   17.240 /  10
  25.500   17.240 /  11
  25.500   17.240 /  12
  71.000           /  13
  31.808   19.426 /  14
  31.808   19.426 /  15
  31.808   19.426 /  16
  31.808   19.426 /  17
  31.808   19.426 /  18
  31.808   19.426 /  19
  31.808   19.426 /  20
  31.808   19.426 /  21
  31.808   19.426 /  22
  31.808   19.426 /  23
  31.808   19.426 /  24
  31.808   19.426 /  25
  81.300           /  26
  38.833   17.037 /  27
  38.833   17.037 /  28
  38.833   17.037 /  29
  38.833   17.037 /  30
  38.833   17.037 /  31
  38.833   17.037 /  32
  38.833   17.037 /  33
  38.833   17.037 /  34
  38.833   17.037 /  35
  38.833   17.037 /  36
  38.833   17.037 /  37
  38.833   17.037 /  38
  85.000           /  39
  38.425   14.570 /  40
  38.425   14.570 /  41
  38.425   14.570 /  42
  38.425   14.570 /  43
  38.425   14.570 /  44
  38.425   14.570 /  45
  38.425   14.570 /  46
  38.425   14.570 /  47
  38.425   14.570 /  48
  38.425   14.570 /  49
  38.425   14.570 /  50
  38.425   14.570 /  51
1870.000           /  52
 790.000  620.000  557.000 /   1
 790.000  620.000  557.000 /   2
 790.000  620.000  557.000 /   3
 790.000  620.000  557.000 /   4
 790.000  620.000  557.000 /   5
 790.000  620.000  557.000 /   6
 790.000  620.000  557.000 /   7
 790.000  620.000  557.000 /   8
 790.000  620.000  557.000 /   9
 790.000  620.000  557.000 /  10
 790.000  620.000  557.000 /  11
 790.000  620.000  557.000 /  12
3( 300.0)                 /  13
```

```
 790.000  620.000  557.000 /   14
 790.000  620.000  557.000 /   15
 790.000  620.000  557.000 /   16
 790.000  620.000  557.000 /   17
 790.000  620.000  557.000 /   18
 790.000  620.000  557.000 /   19
 790.000  620.000  557.000 /   20
 790.000  620.000  557.000 /   21
 790.000  620.000  557.000 /   22
 790.000  620.000  557.000 /   23
 790.000  620.000  557.000 /   24
 790.000  620.000  557.000 /   25
3( 300.0)                  /   26
 790.000  620.000  557.000 /   27
 790.000  620.000  557.000 /   28
 790.000  620.000  557.000 /   29
 790.000  620.000  557.000 /   30
 790.000  620.000  557.000 /   31
 790.000  620.000  557.000 /   32
 790.000  620.000  557.000 /   33
 790.000  620.000  557.000 /   34
 790.000  620.000  557.000 /   35
 790.000  620.000  557.000 /   36
 790.000  620.000  557.000 /   37
 790.000  620.000  557.000 /   38
3( 300.0)                  /   39
 790.000  620.000  557.000 /   40
 790.000  620.000  557.000 /   41
 790.000  620.000  557.000 /   42
 790.000  620.000  557.000 /   43
 790.000  620.000  557.000 /   44
 790.000  620.000  557.000 /   45
 790.000  620.000  557.000 /   46
 790.000  620.000  557.000 /   47
 790.000  620.000  557.000 /   48
 790.000  620.000  557.000 /   49
 790.000  620.000  557.000 /   50
 790.000  620.000  557.000 /   51
3( 300.0)                  /   52
   1 0 0 0 0 0 14(   0.0)   /    1 result control
   1 0 0 0 0 0 14(   0.0)   /    2 result control
   1 0 0 0 0 0 14(   0.0)   /    3 result control
   1 0 0 0 0 0 14(   0.0)   /    4 result control
   1 0 0 0 0 0 14(   0.0)   /    5 result control
   1 0 0 0 0 0 14(   0.0)   /    6 result control
   1 0 0 0 0 0 14(   0.0)   /    7 result control
   1 0 0 0 0 0 14(   0.0)   /    8 result control
   1 0 0 0 0 0 14(   0.0)   /    9 result control
   1 0 0 0 0 0 14(   0.0)   /   10 result control
   1 0 0 0 0 0 14(   0.0)   /   11 result control
   1 0 0 0 0 0 14(   0.0)   /   12 result control
   1 0 0 0 0 0 14(   0.0)   /   13 result control
   1 0 0 0 0 0 14(   0.0)   /   14 result control
   1 0 0 0 0 0 14(   0.0)   /   15 result control
   1 0 0 0 0 0 14(   0.0)   /   16 result control
   1 0 0 0 0 0 14(   0.0)   /   17 result control
   1 0 0 0 0 0 14(   0.0)   /   18 result control
   1 0 0 0 0 0 14(   0.0)   /   19 result control
   1 0 0 0 0 0 14(   0.0)   /   20 result control
   1 0 0 0 0 0 14(   0.0)   /   21 result control
   1 0 0 0 0 0 14(   0.0)   /   22 result control
   1 0 0 0 0 0 14(   0.0)   /   23 result control
   1 0 0 0 0 0 14(   0.0)   /   24 result control
   1 0 0 0 0 0 14(   0.0)   /   25 result control
   1 0 0 0 0 0 14(   0.0)   /   26 result control
   1 0 0 0 0 0 14(   0.0)   /   27 result control
   1 0 0 0 0 0 14(   0.0)   /   28 result control
   1 0 0 0 0 0 14(   0.0)   /   29 result control
   1 0 0 0 0 0 14(   0.0)   /   30 result control
   1 0 0 0 0 0 14(   0.0)   /   31 result control
   1 0 0 0 0 0 14(   0.0)   /   32 result control
   1 0 0 0 0 0 14(   0.0)   /   33 result control
   1 0 0 0 0 0 14(   0.0)   /   34 result control
   1 0 0 0 0 0 14(   0.0)   /   35 result control
   1 0 0 0 0 0 14(   0.0)   /   36 result control
   1 0 0 0 0 0 14(   0.0)   /   37 result control
   1 0 0 0 0 0 14(   0.0)   /   38 result control
   1 0 0 0 0 0 14(   0.0)   /   39 result control
   1 0 0 0 0 0 14(   0.0)   /   40 result control
```

```
   1 0 0 0 0 0 14(    0.0)    /   41 result control
   1 0 0 0 0 0 14(    0.0)    /   42 result control
   1 0 0 0 0 0 14(    0.0)    /   43 result control
   1 0 0 0 0 0 14(    0.0)    /   44 result control
   1 0 0 0 0 0 14(    0.0)    /   45 result control
   1 0 0 0 0 0 14(    0.0)    /   46 result control
   1 0 0 0 0 0 14(    0.0)    /   47 result control
   1 0 0 0 0 0 14(    0.0)    /   48 result control
   1 0 0 0 0 0 14(    0.0)    /   49 result control
   1 0 0 0 0 0 14(    0.0)    /   50 result control
   1 0 0 0 0 0 14(    0.0)    /   51 result control
   1 0 0 0 0 0 14(    0.0)    /   52 result control
0 / PWR
 52(  0.000) / void ratio (%)
12(-0.3E-03)  1(-0.3E-03)
12(-0.5E-03)  1(-0.5E-03)
12(-0.5E-03)  1(-0.5E-03)
12(-0.5E-03)  1(-0.5E-03)
0     /xs val.
0     /branching
0     /weight factor

comment statement
            0 h2ofrac
            9 light element inclued in fresh fuel
o            135.000
cr           5.90000
mn           0.330000
fe           12.9000
co          0.750000E-01
ni           9.90000
zr           221.000
nb          0.710000
sn           3.60000
```

A.3.6. SWAT input for H. B. Robinson Sample NO 1.

```
===== PDS FILE ALOCATION ======
FASTP  : pfast
THERMP : pthml
FASTU  : fastu
THERMU : thermalu
MACWRK : macrowrk
FLUX   : flux
MACRO  : macro
MCROSSP: pmcrs
MICREF : micref
UMCROS : umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
ro1  15 204  16.020 2.5610 1.4300 365.80  11.00 0.7544 0.9484 0.2839 0.3004
1 1 1 0 0  0 0 1 1 1  / Library Control
1 1 1 1 2   1 4 3 -2 1    0 0 0 0 2   0 1 0 0 0  / SRAC General Control
1.0000E-25
63  44   1 /fast thermal lethergy
3 3 3 3 3    0 3 0 0 0   0 0 8 15 0  0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000  0.46470  0.53595  0.84350
1
3
67 1 0 0 0 4 4(0) 1.0 0.929 0.0  9.94400 2.561 0.0 4(0.0) / UO2 (2.561wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
461050  2 1 0 0 1 0
```

```
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       230.00
922350     25610.00
922360       130.00
922380    974030.00
 4.64956E-02           / O-16 constant density
3       9(0) 0.0   0.26606 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02   1.4838E-04   7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   1.00593 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1   0
  1
 52  12
 12(2)   1   12(2)   1   12(2)   1   12(2)   1
  3   4 /  1
  3   4 /  2
  3   4 /  3
  3   4 /  4
  3   4 /  5
  3   4 /  6
  3   4 /  7
  3   4 /  8
  3   4 /  9
  3   4 / 10
  3   4 / 11
  3   4 / 12
  4     / 13
  3   4 / 14
  3   4 / 15
  3   4 / 16
  3   4 / 17
  3   4 / 18
  3   4 / 19
  3   4 / 20
  3   4 / 21
  3   4 / 22
  3   4 / 23
  3   4 / 24
  3   4 / 25
  4     / 26
  3   4 / 27
  3   4 / 28
  3   4 / 29
  3   4 / 30
  3   4 / 31
  3   4 / 32
  3   4 / 33
  3   4 / 34
  3   4 / 35
  3   4 / 36
  3   4 / 37
  3   4 / 38
  4     / 39
```

```
  3    4 / 40
  3    4 / 41
  3    4 / 42
  3    4 / 43
  3    4 / 44
  3    4 / 45
  3    4 / 46
  3    4 / 47
  3    4 / 48
  3    4 / 49
  3    4 / 50
  3    4 / 51
  4      / 52
 12(1)    0  12(1)    0  12(1)    0  12(1)    0
  20.292    20.861 /    1
  20.292    20.861 /    2
  20.292    20.861 /    3
  20.292    20.861 /    4
  20.292    20.861 /    5
  20.292    20.861 /    6
  20.292    20.861 /    7
  20.292    20.861 /    8
  20.292    20.861 /    9
  20.292    20.861 /   10
  20.292    20.861 /   11
  20.292    20.861 /   12
  40.000           /   13
  20.292    20.150 /   14
  20.292    20.150 /   15
  20.292    20.150 /   16
  20.292    20.150 /   17
  20.292    20.150 /   18
  20.292    20.150 /   19
  20.292    20.150 /   20
  20.292    20.150 /   21
  20.292    20.150 /   22
  20.292    20.150 /   23
  20.292    20.150 /   24
  20.292    20.150 /   25
  64.000           /   26
  13.000    19.566 /   27
  13.000    19.566 /   28
  13.000    19.566 /   29
  13.000    19.566 /   30
  13.000    19.566 /   31
  13.000    19.566 /   32
  13.000    19.566 /   33
  13.000    19.566 /   34
  13.000    19.566 /   35
  13.000    19.566 /   36
  13.000    19.566 /   37
  13.000    19.566 /   38
  39.000           /   39
  13.000    19.111 /   40
  13.000    19.111 /   41
  13.000    19.111 /   42
  13.000    19.111 /   43
  13.000    19.111 /   44
  13.000    19.111 /   45
  13.000    19.111 /   46
  13.000    19.111 /   47
  13.000    19.111 /   48
  13.000    19.111 /   49
  13.000    19.111 /   50
  13.000    19.111 /   51
3936.000           /   52
 743.000   595.000   559.000 /    1
 743.000   595.000   559.000 /    2
 743.000   595.000   559.000 /    3
 743.000   595.000   559.000 /    4
 743.000   595.000   559.000 /    5
 743.000   595.000   559.000 /    6
 743.000   595.000   559.000 /    7
 743.000   595.000   559.000 /    8
 743.000   595.000   559.000 /    9
 743.000   595.000   559.000 /   10
 743.000   595.000   559.000 /   11
 743.000   595.000   559.000 /   12
3( 300.0)                    /   13
```

```
 743.000  595.000  559.000 /   14
 743.000  595.000  559.000 /   15
 743.000  595.000  559.000 /   16
 743.000  595.000  559.000 /   17
 743.000  595.000  559.000 /   18
 743.000  595.000  559.000 /   19
 743.000  595.000  559.000 /   20
 743.000  595.000  559.000 /   21
 743.000  595.000  559.000 /   22
 743.000  595.000  559.000 /   23
 743.000  595.000  559.000 /   24
 743.000  595.000  559.000 /   25
3( 300.0)                  /   26
 743.000  595.000  559.000 /   27
 743.000  595.000  559.000 /   28
 743.000  595.000  559.000 /   29
 743.000  595.000  559.000 /   30
 743.000  595.000  559.000 /   31
 743.000  595.000  559.000 /   32
 743.000  595.000  559.000 /   33
 743.000  595.000  559.000 /   34
 743.000  595.000  559.000 /   35
 743.000  595.000  559.000 /   36
 743.000  595.000  559.000 /   37
 743.000  595.000  559.000 /   38
3( 300.0)                  /   39
 743.000  595.000  559.000 /   40
 743.000  595.000  559.000 /   41
 743.000  595.000  559.000 /   42
 743.000  595.000  559.000 /   43
 743.000  595.000  559.000 /   44
 743.000  595.000  559.000 /   45
 743.000  595.000  559.000 /   46
 743.000  595.000  559.000 /   47
 743.000  595.000  559.000 /   48
 743.000  595.000  559.000 /   49
 743.000  595.000  559.000 /   50
 743.000  595.000  559.000 /   51
3( 300.0)                  /   52
   1 0 0 0 0 0 14(    0.0)    /    1 result control
   1 0 0 0 0 0 14(    0.0)    /    2 result control
   1 0 0 0 0 0 14(    0.0)    /    3 result control
   1 0 0 0 0 0 14(    0.0)    /    4 result control
   1 0 0 0 0 0 14(    0.0)    /    5 result control
   1 0 0 0 0 0 14(    0.0)    /    6 result control
   1 0 0 0 0 0 14(    0.0)    /    7 result control
   1 0 0 0 0 0 14(    0.0)    /    8 result control
   1 0 0 0 0 0 14(    0.0)    /    9 result control
   1 0 0 0 0 0 14(    0.0)    /   10 result control
   1 0 0 0 0 0 14(    0.0)    /   11 result control
   1 0 0 0 0 0 14(    0.0)    /   12 result control
   1 0 0 0 0 0 14(    0.0)    /   13 result control
   1 0 0 0 0 0 14(    0.0)    /   14 result control
   1 0 0 0 0 0 14(    0.0)    /   15 result control
   1 0 0 0 0 0 14(    0.0)    /   16 result control
   1 0 0 0 0 0 14(    0.0)    /   17 result control
   1 0 0 0 0 0 14(    0.0)    /   18 result control
   1 0 0 0 0 0 14(    0.0)    /   19 result control
   1 0 0 0 0 0 14(    0.0)    /   20 result control
   1 0 0 0 0 0 14(    0.0)    /   21 result control
   1 0 0 0 0 0 14(    0.0)    /   22 result control
   1 0 0 0 0 0 14(    0.0)    /   23 result control
   1 0 0 0 0 0 14(    0.0)    /   24 result control
   1 0 0 0 0 0 14(    0.0)    /   25 result control
   1 0 0 0 0 0 14(    0.0)    /   26 result control
   1 0 0 0 0 0 14(    0.0)    /   27 result control
   1 0 0 0 0 0 14(    0.0)    /   28 result control
   1 0 0 0 0 0 14(    0.0)    /   29 result control
   1 0 0 0 0 0 14(    0.0)    /   30 result control
   1 0 0 0 0 0 14(    0.0)    /   31 result control
   1 0 0 0 0 0 14(    0.0)    /   32 result control
   1 0 0 0 0 0 14(    0.0)    /   33 result control
   1 0 0 0 0 0 14(    0.0)    /   34 result control
   1 0 0 0 0 0 14(    0.0)    /   35 result control
   1 0 0 0 0 0 14(    0.0)    /   36 result control
   1 0 0 0 0 0 14(    0.0)    /   37 result control
   1 0 0 0 0 0 14(    0.0)    /   38 result control
   1 0 0 0 0 0 14(    0.0)    /   39 result control
   1 0 0 0 0 0 14(    0.0)    /   40 result control
```

```
   1 0 0 0 0 0 14(    0.0)    /   41 result control
   1 0 0 0 0 0 14(    0.0)    /   42 result control
   1 0 0 0 0 0 14(    0.0)    /   43 result control
   1 0 0 0 0 0 14(    0.0)    /   44 result control
   1 0 0 0 0 0 14(    0.0)    /   45 result control
   1 0 0 0 0 0 14(    0.0)    /   46 result control
   1 0 0 0 0 0 14(    0.0)    /   47 result control
   1 0 0 0 0 0 14(    0.0)    /   48 result control
   1 0 0 0 0 0 14(    0.0)    /   49 result control
   1 0 0 0 0 0 14(    0.0)    /   50 result control
   1 0 0 0 0 0 14(    0.0)    /   51 result control
   1 0 0 0 0 0 14(    0.0)    /   52 result control
0 / PWR
 52(   0.000) / void ratio (%)
12(-0.7E-03)  1(-0.7E-03)
12(-0.2E-03)  1(-0.2E-03)
12(-0.7E-03)  1(-0.7E-03)
12(-0.2E-03)  1(-0.2E-03)
0     /xs val.
0     /branching
0     /weight factor
```

```
===== PDS FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists *****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
ob1   14 180   25.929 3.1300 1.4300 295.60   -1.00 0.7283 0.9300 0.6413 0.6845
1 1 1 0 0   0 0 1 1 1   / Library Control
1 1 1 1 2    1 4 3 -2 1     0 0 0 0 2    0 1 0 0 0   / SRAC General Control
1.0000E-25
63   44    1 /fast thermal lethergy
3 3 3 3 3     0 3 0 0 0    0 0 8 15 0   0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000   0.45650   0.53700   0.83807
1
3
67 1 0 0 0 4 4(0) 1.0 0.913 0.0 10.05000 3.130 0.0 4(0.0) / UO2 (3.130wt%)
922340   2 1 0 0 1 2 / U -234
922350   2 1 0 0 1 2 / U -235
922360   2 1 0 0 1 2 / U -236
922380   2 1 0 0 1 2 / U -238
932370   2 1 0 0 1 0
942380   2 1 0 0 1 0
942390   2 1 0 0 1 0
942400   2 1 0 0 1 0
942410   2 1 0 0 1 0
942420   2 1 0 0 1 0
952410   2 1 0 0 1 0
952421   2 1 3 0 1 0
952420   2 1 2 0 1 0
952430   2 1 0 0 1 0
962420   2 1 0 0 1 0
962430   2 1 0 0 1 0
962440   2 1 0 0 1 0
962450   2 1 0 0 1 0
962460   2 1 0 0 1 0
641520   2 1 0 0 1 0
641540   2 1 0 0 1 0
641550   2 1 0 0 1 0
641560   2 1 0 0 1 0
641570   2 1 0 0 1 0
641580   2 1 0 0 1 0
641600   2 1 0 0 1 0
541350   2 1 0 0 1 0
601430   2 1 0 0 1 0
451030   2 1 0 0 1 0
541310   2 1 0 0 1 0
551330   2 1 0 0 1 0
621490   2 1 0 0 1 0
430990   2 1 0 0 1 0
621520   2 1 0 0 1 0
621510   2 1 0 0 1 0
611470   2 1 0 0 1 0
631530   2 1 0 0 1 0
601450   2 1 0 0 1 0
631550   2 1 0 0 1 0
631540   2 1 0 0 1 0
621500   2 1 0 0 1 0
420950   2 1 0 0 1 0
471090   2 1 0 0 1 0
611481   2 1 3 0 1 0
441010   2 1 0 0 1 0
551340   2 1 0 0 1 0
461050   2 1 0 0 1 0
611480   2 1 2 0 1 0
451050   2 1 0 0 1 0
```

```
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       300.00
922350     31300.00
922360       140.00
922380    968259.94
 4.64956E-02          / O-16 constant density
3      9(0) 0.0   0.29787 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02  1.4838E-04  7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   0.98796 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1    0
  1
 39  12
 12(2)    1   12(2)    1   12(2)    1
  3    4 /  1
  3    4 /  2
  3    4 /  3
  3    4 /  4
  3    4 /  5
  3    4 /  6
  3    4 /  7
  3    4 /  8
  3    4 /  9
  3    4 / 10
  3    4 / 11
  3    4 / 12
  4      / 13
  3    4 / 14
  3    4 / 15
  3    4 / 16
  3    4 / 17
  3    4 / 18
  3    4 / 19
  3    4 / 20
  3    4 / 21
  3    4 / 22
  3    4 / 23
  3    4 / 24
  3    4 / 25
  4      / 26
  3    4 / 27
  3    4 / 28
  3    4 / 29
  3    4 / 30
  3    4 / 31
  3    4 / 32
  3    4 / 33
  3    4 / 34
  3    4 / 35
  3    4 / 36
  3    4 / 37
  3    4 / 38
  4      / 39
 12(1)    0   12(1)    0   12(1)    0
  24.000    20.929 /     1
```

```
   24.000   20.929 /    2
   24.000   20.929 /    3
   24.000   20.929 /    4
   24.000   20.929 /    5
   24.000   20.929 /    6
   24.000   20.929 /    7
   24.000   20.929 /    8
   24.000   20.929 /    9
   24.000   20.929 /   10
   24.000   20.929 /   11
   24.000   20.929 /   12
   81.000          /   13
   25.750   37.468 /   14
   25.750   37.468 /   15
   25.750   37.468 /   16
   25.750   37.468 /   17
   25.750   37.468 /   18
   25.750   37.468 /   19
   25.750   37.468 /   20
   25.750   37.468 /   21
   25.750   37.468 /   22
   25.750   37.468 /   23
   25.750   37.468 /   24
   25.750   37.468 /   25
  396.000          /   26
   20.667   33.564 /   27
   20.667   33.564 /   28
   20.667   33.564 /   29
   20.667   33.564 /   30
   20.667   33.564 /   31
   20.667   33.564 /   32
   20.667   33.564 /   33
   20.667   33.564 /   34
   20.667   33.564 /   35
   20.667   33.564 /   36
   20.667   33.564 /   37
   20.667   33.564 /   38
   10.000          /   39
  846.000  605.000  572.000 /    1
  846.000  605.000  572.000 /    2
  846.000  605.000  572.000 /    3
  846.000  605.000  572.000 /    4
  846.000  605.000  572.000 /    5
  846.000  605.000  572.000 /    6
  846.000  605.000  572.000 /    7
  846.000  605.000  572.000 /    8
  846.000  605.000  572.000 /    9
  846.000  605.000  572.000 /   10
  846.000  605.000  572.000 /   11
  846.000  605.000  572.000 /   12
3( 300.0)                  /   13
  846.000  605.000  572.000 /   14
  846.000  605.000  572.000 /   15
  846.000  605.000  572.000 /   16
  846.000  605.000  572.000 /   17
  846.000  605.000  572.000 /   18
  846.000  605.000  572.000 /   19
  846.000  605.000  572.000 /   20
  846.000  605.000  572.000 /   21
  846.000  605.000  572.000 /   22
  846.000  605.000  572.000 /   23
  846.000  605.000  572.000 /   24
  846.000  605.000  572.000 /   25
3( 300.0)                  /   26
  846.000  605.000  572.000 /   27
  846.000  605.000  572.000 /   28
  846.000  605.000  572.000 /   29
  846.000  605.000  572.000 /   30
  846.000  605.000  572.000 /   31
  846.000  605.000  572.000 /   32
  846.000  605.000  572.000 /   33
  846.000  605.000  572.000 /   34
  846.000  605.000  572.000 /   35
  846.000  605.000  572.000 /   36
  846.000  605.000  572.000 /   37
  846.000  605.000  572.000 /   38
3( 300.0)                  /   39
   1 0 0 0 0 0 14(    0.0)    /    1 result control
   1 0 0 0 0 0 14(    0.0)    /    2 result control
```

```
   1 0 0 0 0 0 14(   0.0)   /    3 result control
   1 0 0 0 0 0 14(   0.0)   /    4 result control
   1 0 0 0 0 0 14(   0.0)   /    5 result control
   1 0 0 0 0 0 14(   0.0)   /    6 result control
   1 0 0 0 0 0 14(   0.0)   /    7 result control
   1 0 0 0 0 0 14(   0.0)   /    8 result control
   1 0 0 0 0 0 14(   0.0)   /    9 result control
   1 0 0 0 0 0 14(   0.0)   /   10 result control
   1 0 0 0 0 0 14(   0.0)   /   11 result control
   1 0 0 0 0 0 14(   0.0)   /   12 result control
   1 0 0 0 0 0 14(   0.0)   /   13 result control
   1 0 0 0 0 0 14(   0.0)   /   14 result control
   1 0 0 0 0 0 14(   0.0)   /   15 result control
   1 0 0 0 0 0 14(   0.0)   /   16 result control
   1 0 0 0 0 0 14(   0.0)   /   17 result control
   1 0 0 0 0 0 14(   0.0)   /   18 result control
   1 0 0 0 0 0 14(   0.0)   /   19 result control
   1 0 0 0 0 0 14(   0.0)   /   20 result control
   1 0 0 0 0 0 14(   0.0)   /   21 result control
   1 0 0 0 0 0 14(   0.0)   /   22 result control
   1 0 0 0 0 0 14(   0.0)   /   23 result control
   1 0 0 0 0 0 14(   0.0)   /   24 result control
   1 0 0 0 0 0 14(   0.0)   /   25 result control
   1 0 0 0 0 0 14(   0.0)   /   26 result control
   1 0 0 0 0 0 14(   0.0)   /   27 result control
   1 0 0 0 0 0 14(   0.0)   /   28 result control
   1 0 0 0 0 0 14(   0.0)   /   29 result control
   1 0 0 0 0 0 14(   0.0)   /   30 result control
   1 0 0 0 0 0 14(   0.0)   /   31 result control
   1 0 0 0 0 0 14(   0.0)   /   32 result control
   1 0 0 0 0 0 14(   0.0)   /   33 result control
   1 0 0 0 0 0 14(   0.0)   /   34 result control
   1 0 0 0 0 0 14(   0.0)   /   35 result control
   1 0 0 0 0 0 14(   0.0)   /   36 result control
   1 0 0 0 0 0 14(   0.0)   /   37 result control
   1 0 0 0 0 0 14(   0.0)   /   38 result control
   1 0 0 0 0 0 14(   0.0)   /   39 result control
0 / PWR
 39(   0.000) / void ratio (%)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
0     /xs val.
0     /branching
0     /weight factor
```

A.3.7. SWAT input for Obrigheim-b Sample NO 1.

```
===== PDS FILE ALOCATION ======
FASTP  :  pfast
THERMP :  pthml
FASTU  :  fastu
THERMU :  thermalu
MACWRK :  macrowrk
FLUX   :  flux
MACRO  :  macro
MCROSSP:  pmcrs
MICREF :  micref
UMCROS :  umcros
==== for libmak ======
usacti :/home5/codes/swat9906/xslib/acti.j32.v2.1
usfp   :/home5/codes/swat9906/xslib/fp.j32.v2.4
ori2ori:/home5/codes/swat9906/ori2origlib/decaydat.fp-j3.v7
==== for origen2 =====
photo  :/home5/codes/swat9906/ori2origlib/photodat
************************ global data lists ****************
Template of SWAT Input Data for The Obrigheim Reactor By SHIN, Hee Sung
ob1   14 180   25.929 3.1300 1.4300 295.60   -1.00 0.7283 0.9300 0.6413 0.6845
1 1 1 0 0   0 0 1 1 1   / Library Control
1 1 1 1 2    1 4 3 -2 1     0 0 0 0 2    0 1 0 0 0   / SRAC General Control
1.0000E-25
63   44    1 /fast thermal lethergy
3 3 3 3 3     0 3 0 0 0    0 0 8 15 0   0 30 0 1 /COL.PROB.CONT
1 2 3
 0.00000   0.45650   0.53700   0.83807
1
3
67 1 0 0 0 4 4(0) 1.0 0.913 0.0 10.05000 3.130 0.0 4(0.0) / UO2 (3.130wt%)
922340  2 1 0 0 1 2 / U -234
922350  2 1 0 0 1 2 / U -235
922360  2 1 0 0 1 2 / U -236
922380  2 1 0 0 1 2 / U -238
932370  2 1 0 0 1 0
942380  2 1 0 0 1 0
942390  2 1 0 0 1 0
942400  2 1 0 0 1 0
942410  2 1 0 0 1 0
942420  2 1 0 0 1 0
952410  2 1 0 0 1 0
952421  2 1 3 0 1 0
952420  2 1 2 0 1 0
952430  2 1 0 0 1 0
962420  2 1 0 0 1 0
962430  2 1 0 0 1 0
962440  2 1 0 0 1 0
962450  2 1 0 0 1 0
962460  2 1 0 0 1 0
641520  2 1 0 0 1 0
641540  2 1 0 0 1 0
641550  2 1 0 0 1 0
641560  2 1 0 0 1 0
641570  2 1 0 0 1 0
641580  2 1 0 0 1 0
641600  2 1 0 0 1 0
541350  2 1 0 0 1 0
601430  2 1 0 0 1 0
451030  2 1 0 0 1 0
541310  2 1 0 0 1 0
551330  2 1 0 0 1 0
621490  2 1 0 0 1 0
430990  2 1 0 0 1 0
621520  2 1 0 0 1 0
621510  2 1 0 0 1 0
611470  2 1 0 0 1 0
631530  2 1 0 0 1 0
601450  2 1 0 0 1 0
631550  2 1 0 0 1 0
631540  2 1 0 0 1 0
621500  2 1 0 0 1 0
420950  2 1 0 0 1 0
471090  2 1 0 0 1 0
611481  2 1 3 0 1 0
441010  2 1 0 0 1 0
551340  2 1 0 0 1 0
461050  2 1 0 0 1 0
```

```
611480  2 1 2 0 1 0
451050  2 1 0 0 1 0
591410  2 1 0 0 1 0
360830  2 1 0 0 1 0
461080  2 1 0 0 1 0
621470  2 1 0 0 1 0
461070  2 1 0 0 1 0
420970  2 1 0 0 1 0
481130  2 1 0 0 1 0
551350  2 1 0 0 1 0
420980  2 1 0 0 1 0
541330  2 1 0 0 1 0
491150  2 1 0 0 1 0
591430  2 1 0 0 1 0
631560  2 1 0 0 1 0
441030  2 1 0 0 1 0
621480  2 1 0 0 1 0
601470  2 1 0 0 1 0
611490  2 1 0 0 1 0
 80160  0 0 0 0 0 1
922340       300.00
922350     31300.00
922360       140.00
922380    968259.94
 4.64956E-02           / O-16 constant density
3      9(0) 0.0   0.29787 8(0.0)
400000  2 1 1 0 0 1 / Zr
260000  2 1 1 0 0 1 / Fe
240000  2 1 1 0 0 1 / Cr
4.2982E-02   1.4838E-04   7.5891E-05 / Zr,Fe,Cr
4 0 1 7(0) 0.0   0.98796 8(0.0)
 10010  2 1 0 9 0 1 / H-1
 80160  2 1 0 0 0 1 / O-16
 50100  2 1 0 0 0 1 / B-10
 50110  2 1 0 0 0 1 / B-11
 4(1.0E-2) /
  1    0
  1
 39   12
 12(2)    1   12(2)    1   12(2)    1
  3    4 /  1
  3    4 /  2
  3    4 /  3
  3    4 /  4
  3    4 /  5
  3    4 /  6
  3    4 /  7
  3    4 /  8
  3    4 /  9
  3    4 / 10
  3    4 / 11
  3    4 / 12
  4      / 13
  3    4 / 14
  3    4 / 15
  3    4 / 16
  3    4 / 17
  3    4 / 18
  3    4 / 19
  3    4 / 20
  3    4 / 21
  3    4 / 22
  3    4 / 23
  3    4 / 24
  3    4 / 25
  4      / 26
  3    4 / 27
  3    4 / 28
  3    4 / 29
  3    4 / 30
  3    4 / 31
  3    4 / 32
  3    4 / 33
  3    4 / 34
  3    4 / 35
  3    4 / 36
  3    4 / 37
  3    4 / 38
  4      / 39
```

```
 12(1)    0  12(1)    0  12(1)    0
  24.000     20.929 /     1
  24.000     20.929 /     2
  24.000     20.929 /     3
  24.000     20.929 /     4
  24.000     20.929 /     5
  24.000     20.929 /     6
  24.000     20.929 /     7
  24.000     20.929 /     8
  24.000     20.929 /     9
  24.000     20.929 /    10
  24.000     20.929 /    11
  24.000     20.929 /    12
  81.000            /    13
  25.750     37.468 /    14
  25.750     37.468 /    15
  25.750     37.468 /    16
  25.750     37.468 /    17
  25.750     37.468 /    18
  25.750     37.468 /    19
  25.750     37.468 /    20
  25.750     37.468 /    21
  25.750     37.468 /    22
  25.750     37.468 /    23
  25.750     37.468 /    24
  25.750     37.468 /    25
 396.000            /    26
  20.667     33.564 /    27
  20.667     33.564 /    28
  20.667     33.564 /    29
  20.667     33.564 /    30
  20.667     33.564 /    31
  20.667     33.564 /    32
  20.667     33.564 /    33
  20.667     33.564 /    34
  20.667     33.564 /    35
  20.667     33.564 /    36
  20.667     33.564 /    37
  20.667     33.564 /    38
  10.000            /    39
 846.000  605.000  572.000 /     1
 846.000  605.000  572.000 /     2
 846.000  605.000  572.000 /     3
 846.000  605.000  572.000 /     4
 846.000  605.000  572.000 /     5
 846.000  605.000  572.000 /     6
 846.000  605.000  572.000 /     7
 846.000  605.000  572.000 /     8
 846.000  605.000  572.000 /     9
 846.000  605.000  572.000 /    10
 846.000  605.000  572.000 /    11
 846.000  605.000  572.000 /    12
3( 300.0)                 /    13
 846.000  605.000  572.000 /    14
 846.000  605.000  572.000 /    15
 846.000  605.000  572.000 /    16
 846.000  605.000  572.000 /    17
 846.000  605.000  572.000 /    18
 846.000  605.000  572.000 /    19
 846.000  605.000  572.000 /    20
 846.000  605.000  572.000 /    21
 846.000  605.000  572.000 /    22
 846.000  605.000  572.000 /    23
 846.000  605.000  572.000 /    24
 846.000  605.000  572.000 /    25
3( 300.0)                 /    26
 846.000  605.000  572.000 /    27
 846.000  605.000  572.000 /    28
 846.000  605.000  572.000 /    29
 846.000  605.000  572.000 /    30
 846.000  605.000  572.000 /    31
 846.000  605.000  572.000 /    32
 846.000  605.000  572.000 /    33
 846.000  605.000  572.000 /    34
 846.000  605.000  572.000 /    35
 846.000  605.000  572.000 /    36
 846.000  605.000  572.000 /    37
 846.000  605.000  572.000 /    38
3( 300.0)                 /    39
```

```
   1 0 0 0 0 0 14(    0.0)    /    1 result control
   1 0 0 0 0 0 14(    0.0)    /    2 result control
   1 0 0 0 0 0 14(    0.0)    /    3 result control
   1 0 0 0 0 0 14(    0.0)    /    4 result control
   1 0 0 0 0 0 14(    0.0)    /    5 result control
   1 0 0 0 0 0 14(    0.0)    /    6 result control
   1 0 0 0 0 0 14(    0.0)    /    7 result control
   1 0 0 0 0 0 14(    0.0)    /    8 result control
   1 0 0 0 0 0 14(    0.0)    /    9 result control
   1 0 0 0 0 0 14(    0.0)    /   10 result control
   1 0 0 0 0 0 14(    0.0)    /   11 result control
   1 0 0 0 0 0 14(    0.0)    /   12 result control
   1 0 0 0 0 0 14(    0.0)    /   13 result control
   1 0 0 0 0 0 14(    0.0)    /   14 result control
   1 0 0 0 0 0 14(    0.0)    /   15 result control
   1 0 0 0 0 0 14(    0.0)    /   16 result control
   1 0 0 0 0 0 14(    0.0)    /   17 result control
   1 0 0 0 0 0 14(    0.0)    /   18 result control
   1 0 0 0 0 0 14(    0.0)    /   19 result control
   1 0 0 0 0 0 14(    0.0)    /   20 result control
   1 0 0 0 0 0 14(    0.0)    /   21 result control
   1 0 0 0 0 0 14(    0.0)    /   22 result control
   1 0 0 0 0 0 14(    0.0)    /   23 result control
   1 0 0 0 0 0 14(    0.0)    /   24 result control
   1 0 0 0 0 0 14(    0.0)    /   25 result control
   1 0 0 0 0 0 14(    0.0)    /   26 result control
   1 0 0 0 0 0 14(    0.0)    /   27 result control
   1 0 0 0 0 0 14(    0.0)    /   28 result control
   1 0 0 0 0 0 14(    0.0)    /   29 result control
   1 0 0 0 0 0 14(    0.0)    /   30 result control
   1 0 0 0 0 0 14(    0.0)    /   31 result control
   1 0 0 0 0 0 14(    0.0)    /   32 result control
   1 0 0 0 0 0 14(    0.0)    /   33 result control
   1 0 0 0 0 0 14(    0.0)    /   34 result control
   1 0 0 0 0 0 14(    0.0)    /   35 result control
   1 0 0 0 0 0 14(    0.0)    /   36 result control
   1 0 0 0 0 0 14(    0.0)    /   37 result control
   1 0 0 0 0 0 14(    0.0)    /   38 result control
   1 0 0 0 0 0 14(    0.0)    /   39 result control
0 / PWR
 39(  0.000) / void ratio (%)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
12(-0.4E-03)  1(-0.4E-03)
0     /xs val.
0     /branching
0     /weight factor

comment statement
          0 h2ofrac
          9 light element inclued in fresh fuel
o          135.000
cr         5.90000
mn         0.330000
fe         12.9000
co        0.750000E-01
ni         9.90000
zr         221.000
nb        0.710000
sn         3.60000
```

## A.4. Relative Errors of the Calculated Compositions for 26 Obrigheim Samples Using SAS2H with 27, 44 and 238 g and SWAT with 107 g

26 U-235

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.370E+04 | -8.759 | -8.759 | -7.737 | -8.832 | 3.000 | 21.170 | 150.000 | or1 |
| 6.930E+03 | 0.043 | -0.303 | 2.756 | -0.216 | 3.000 | 33.750 | 1435.000 | or2 |
| 1.280E+04 | 2.109 | 2.109 | 2.969 | 2.031 | 3.000 | 20.180 | 150.000 | or3 |
| 8.440E+03 | -23.152 | -23.709 | -21.481 | -25.616 | 3.000 | 35.100 | 315.000 | or4 |
| 6.090E+03 | 0.722 | -0.049 | 3.415 | -0.263 | 3.000 | 36.260 | 1435.000 | or5 |
| 7.480E+03 | 6.818 | 6.818 | 9.332 | 9.064 | 3.000 | 30.890 | 2315.000 | or6 |
| 7.840E+03 | 1.620 | 1.620 | 4.018 | 3.814 | 3.000 | 30.940 | 2315.000 | or7 |
| 1.190E+04 | -2.437 | -2.269 | -1.092 | -0.420 | 3.000 | 22.860 | 2585.000 | or8 |
| 1.520E+04 | -1.974 | -1.842 | -1.184 | -1.645 | 3.000 | 17.130 | 150.000 | or9 |
| 1.440E+04 | -18.889 | -18.889 | -17.917 | -19.167 | 3.000 | 22.700 | 150.000 | or10 |
| 1.080E+04 | -6.204 | -6.389 | -4.907 | -6.944 | 3.000 | 25.830 | 315.000 | or11 |
| 7.610E+03 | 1.905 | 1.603 | 4.074 | 1.787 | 3.000 | 31.500 | 1435.000 | or12 |
| 7.500E+03 | 5.280 | 4.973 | 7.480 | 5.147 | 3.000 | 31.140 | 1435.000 | or13 |
| 1.010E+04 | -8.089 | -7.861 | -6.228 | -6.099 | 3.000 | 27.710 | 2315.000 | or14 |
| 1.010E+04 | 0.495 | 0.792 | 2.376 | 2.772 | 3.000 | 25.810 | 2585.000 | or15 |
| 1.570E+04 | 1.338 | 1.338 | 1.911 | 1.720 | 3.000 | 15.600 | 150.000 | or16 |
| 8.780E+03 | -2.301 | -2.301 | -0.159 | -1.970 | 3.000 | 29.360 | 1435.000 | or17 |
| 1.030E+04 | 2.718 | 2.913 | 4.466 | 4.757 | 3.000 | 24.900 | 2315.000 | or18 |
| 5.050E+03 | -3.663 | -4.594 | -0.871 | -5.743 | 2.830 | 38.100 | 1328.000 | or19 |
| 4.410E+03 | 17.234 | 16.712 | 20.975 | 15.488 | 2.830 | 36.880 | 1328.000 | or20 |
| 4.950E+03 | 11.576 | 11.576 | 15.374 | 13.798 | 2.830 | 35.640 | 2206.000 | or21 |
| 6.270E+03 | 16.571 | 16.938 | 19.569 | 19.522 | 2.830 | 30.160 | 2426.000 | or22 |
| 8.940E+03 | 9.351 | 9.620 | 11.454 | 11.857 | 2.830 | 24.220 | 2547.000 | or23 |
| 1.000E+04 | -7.880 | -8.110 | -6.470 | -8.830 | 2.830 | 25.450 | 150.000 | or24 |
| 4.860E+03 | 7.840 | 6.872 | 10.741 | 6.008 | 2.830 | 36.670 | 1328.000 | or25 |
| 5.040E+03 | 26.369 | 26.369 | 30.099 | 28.849 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 1.10 | 0.968 | 3.19 | 1.57 | | | | |
| err-sd | 10.5 | 10.6 | 11.2 | 11.4 | | | | |

26 U-236

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.990E+03 | 1.037 | 1.037 | 0.234 | -3.779 | 3.000 | 21.170 | 150.000 | or1 |
| 4.060E+03 | -6.404 | -6.404 | -6.995 | -10.616 | 3.000 | 33.750 | 1435.000 | or2 |
| 2.820E+03 | 4.610 | 3.759 | 3.759 | -0.993 | 3.000 | 20.180 | 150.000 | or3 |
| 3.770E+03 | 2.042 | 2.042 | 1.406 | -2.149 | 3.000 | 35.100 | 315.000 | or4 |
| 4.120E+03 | -5.485 | -5.485 | -6.068 | -9.733 | 3.000 | 36.260 | 1435.000 | or5 |
| 3.830E+03 | -3.864 | -3.864 | -4.491 | -8.721 | 3.000 | 30.890 | 2315.000 | or6 |
| 3.910E+03 | -5.831 | -5.831 | -6.445 | -10.537 | 3.000 | 30.940 | 2315.000 | or7 |
| 3.620E+03 | -12.652 | -12.652 | -13.287 | -17.127 | 3.000 | 22.860 | 2585.000 | or8 |
| 2.920E+03 | -9.486 | -9.486 | -10.274 | -14.212 | 3.000 | 17.130 | 150.000 | or9 |
| 2.930E+03 | 7.918 | 7.918 | 7.133 | 2.389 | 3.000 | 22.700 | 150.000 | or10 |
| 3.850E+03 | -12.338 | -12.338 | -12.961 | -16.260 | 3.000 | 25.830 | 315.000 | or11 |
| 3.940E+03 | -5.964 | -5.964 | -6.548 | -10.330 | 3.000 | 31.500 | 1435.000 | or12 |
| 3.980E+03 | -7.487 | -7.487 | -8.090 | -11.658 | 3.000 | 31.140 | 1435.000 | or13 |
| 4.050E+03 | -13.753 | -13.753 | -14.346 | -17.877 | 3.000 | 27.710 | 2315.000 | or14 |
| 3.600E+03 | -6.250 | -6.250 | -6.917 | -10.889 | 3.000 | 25.810 | 2585.000 | or15 |
| 2.730E+03 | -9.231 | -9.231 | -10.110 | -14.066 | 3.000 | 15.600 | 150.000 | or16 |
| 3.810E+03 | -5.853 | -5.853 | -6.457 | -10.052 | 3.000 | 29.360 | 1435.000 | or17 |
| 3.600E+03 | -7.556 | -8.222 | -8.222 | -12.556 | 3.000 | 24.900 | 2315.000 | or18 |
| 3.890E+03 | -4.139 | -3.548 | -4.139 | -7.763 | 2.830 | 38.100 | 1328.000 | or19 |
| 3.870E+03 | -4.264 | -4.264 | -4.264 | -8.036 | 2.830 | 36.880 | 1328.000 | or20 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3.950E+03 | -6.785 | -6.785 | -7.392 | -11.013 | 2.830 | 35.640 | 2206.000 | or21 |
| 3.660E+03 | -5.219 | -5.219 | -5.219 | -9.508 | 2.830 | 30.160 | 2426.000 | or22 |
| 3.330E+03 | -5.736 | -5.736 | -6.456 | -10.360 | 2.830 | 24.220 | 2547.000 | or23 |
| 3.220E+03 | 0.404 | 0.404 | -0.311 | -4.379 | 2.830 | 25.450 | 150.000 | or24 |
| 3.860E+03 | -4.016 | -4.016 | -4.016 | -7.953 | 2.830 | 36.670 | 1328.000 | or25 |
| 3.820E+03 | -6.099 | -6.099 | -6.702 | -10.314 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | -5.09 | -5.13 | -5.66 | -9.56 | | | | |
| err-sd | 5.01 | 4.97 | 5.00 | 4.80 | | | | |

26 U-238

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.540E+05 | 0.042 | 0.042 | 0.042 | 0.136 | 3.000 | 21.170 | 150.000 | or1 |
| 9.450E+05 | -0.265 | -0.265 | -0.265 | -0.053 | 3.000 | 33.750 | 1435.000 | or2 |
| 9.570E+05 | -0.272 | -0.272 | -0.272 | -0.104 | 3.000 | 20.180 | 150.000 | or3 |
| 9.420E+05 | 0.053 | 0.053 | 0.053 | 0.170 | 3.000 | 35.100 | 315.000 | or4 |
| 9.430E+05 | -0.308 | -0.308 | -0.308 | -0.085 | 3.000 | 36.260 | 1435.000 | or5 |
| 9.480E+05 | -0.327 | -0.327 | -0.327 | -0.148 | 3.000 | 30.890 | 2315.000 | or6 |
| 9.460E+05 | -0.116 | -0.116 | -0.116 | 0.063 | 3.000 | 30.940 | 2315.000 | or7 |
| 9.530E+05 | -0.105 | -0.105 | -0.105 | 0.031 | 3.000 | 22.860 | 2585.000 | or8 |
| 9.580E+05 | -0.125 | -0.125 | -0.125 | 0.031 | 3.000 | 17.130 | 150.000 | or9 |
| 9.520E+05 | 0.000 | 0.000 | 0.000 | 0.221 | 3.000 | 22.700 | 150.000 | or10 |
| 9.510E+05 | -0.147 | -0.147 | -0.147 | 0.053 | 3.000 | 25.830 | 315.000 | or11 |
| 9.470E+05 | -0.222 | -0.222 | -0.222 | -0.063 | 3.000 | 31.500 | 1435.000 | or12 |
| 9.460E+05 | -0.116 | -0.116 | -0.116 | 0.085 | 3.000 | 31.140 | 1435.000 | or13 |
| 9.480E+05 | 0.169 | 0.169 | -0.084 | 0.148 | 3.000 | 27.710 | 2315.000 | or14 |
| 9.500E+05 | -0.042 | -0.042 | -0.042 | 0.095 | 3.000 | 25.810 | 2585.000 | or15 |
| 9.590E+05 | 0.010 | 0.010 | 0.010 | 0.052 | 3.000 | 15.600 | 150.000 | or16 |
| 9.480E+05 | -0.084 | -0.084 | -0.084 | 0.032 | 3.000 | 29.360 | 1435.000 | or17 |
| 9.510E+05 | 0.105 | 0.105 | -0.147 | 0.074 | 3.000 | 24.900 | 2315.000 | or18 |
| 9.420E+05 | -0.202 | -0.202 | -0.202 | -0.053 | 2.830 | 38.100 | 1328.000 | or19 |
| 9.430E+05 | -0.308 | -0.053 | -0.308 | -0.032 | 2.830 | 36.880 | 1328.000 | or20 |
| 9.450E+05 | -0.265 | -0.265 | -0.265 | -0.169 | 2.830 | 35.640 | 2206.000 | or21 |
| 9.510E+05 | -0.400 | -0.400 | -0.400 | -0.284 | 2.830 | 30.160 | 2426.000 | or22 |
| 9.550E+05 | -0.314 | -0.314 | -0.314 | -0.168 | 2.830 | 24.220 | 2547.000 | or23 |
| 9.530E+05 | -0.105 | -0.105 | -0.105 | 0.010 | 2.830 | 25.450 | 150.000 | or24 |
| 9.440E+05 | -0.159 | -0.159 | -0.159 | -0.117 | 2.830 | 36.670 | 1328.000 | or25 |
| 9.470E+05 | -0.222 | -0.222 | -0.222 | -0.116 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | -0.143 | -0.133 | -0.163 | -0.736E-02 | | | | |
| err-sd | 0.147 | 0.144 | 0.122 | 0.121 | | | | |

26 Pu-238

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.600E+01 | 49.417 | 39.500 | 38.167 | 9.333 | 3.000 | 21.170 | 150.000 | or1 |
| 1.560E+02 | -1.154 | -6.923 | -8.141 | -22.564 | 3.000 | 33.750 | 1435.000 | or2 |
| 4.100E+01 | 17.268 | 9.122 | 8.561 | -14.634 | 3.000 | 20.180 | 150.000 | or3 |
| 1.040E+02 | 61.346 | 51.250 | 49.231 | 22.788 | 3.000 | 35.100 | 315.000 | or4 |
| 1.650E+02 | 8.788 | 2.242 | 0.970 | -14.545 | 3.000 | 36.260 | 1435.000 | or5 |
| 1.250E+02 | 1.840 | -4.000 | -5.200 | -18.000 | 3.000 | 30.890 | 2315.000 | or6 |
| 1.030E+02 | 24.078 | 16.893 | 15.534 | -0.194 | 3.000 | 30.940 | 2315.000 | or7 |
| 6.200E+01 | 4.032 | -2.500 | -3.258 | -17.548 | 3.000 | 22.860 | 2585.000 | or8 |
| 3.100E+01 | 5.194 | -2.484 | -3.258 | -24.710 | 3.000 | 17.130 | 150.000 | or9 |
| 3.900E+01 | 62.333 | 51.333 | 50.128 | 19.538 | 3.000 | 22.700 | 150.000 | or10 |
| 7.900E+01 | 8.152 | 0.924 | 0.025 | -19.481 | 3.000 | 25.830 | 315.000 | or11 |
| 1.380E+02 | -3.623 | -9.493 | -10.507 | -24.855 | 3.000 | 31.500 | 1435.000 | or12 |
| 1.450E+02 | -10.552 | -15.931 | -16.966 | -30.345 | 3.000 | 31.140 | 1435.000 | or13 |
| 1.060E+02 | -5.472 | -11.311 | -12.208 | -24.566 | 3.000 | 27.710 | 2315.000 | or14 |
| 7.900E+01 | 7.848 | 1.228 | 0.316 | -13.671 | 3.000 | 25.810 | 2585.000 | or15 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.500E+01 | 3.760 | -3.840 | -4.800 | -26.080 | 3.000 | 15.600 | 150.000 | or16 |
| 1.070E+02 | 6.542 | -0.093 | -1.028 | -17.374 | 3.000 | 29.360 | 1435.000 | or17 |
| 7.600E+01 | 3.342 | -2.921 | -3.855 | -18.079 | 3.000 | 24.900 | 2315.000 | or18 |
| 1.900E+02 | 9.737 | 2.947 | 1.579 | -13.579 | 2.830 | 38.100 | 1328.000 | or19 |
| 1.390E+02 | 40.576 | 31.871 | 30.288 | 10.576 | 2.830 | 36.880 | 1328.000 | or20 |
| 1.590E+02 | 14.654 | 7.925 | 6.604 | -7.107 | 2.830 | 35.640 | 2206.000 | or21 |
| 1.140E+02 | 12.544 | 5.877 | 4.561 | -9.035 | 2.830 | 30.160 | 2426.000 | or22 |
| 6.500E+01 | 21.200 | 13.508 | 12.415 | -3.292 | 2.830 | 24.220 | 2547.000 | or23 |
| 6.500E+01 | 35.477 | 26.323 | 25.231 | 1.169 | 2.830 | 25.450 | 150.000 | or24 |
| 1.690E+02 | 14.379 | 7.337 | 5.917 | -10.118 | 2.830 | 36.670 | 1328.000 | or25 |
| 1.260E+02 | 22.619 | 15.238 | 13.889 | -1.032 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 15.9 | 8.62 | 7.47 | -10.3 | | | | |
| err-sd | 19.4 | 18.0 | 17.8 | 14.1 | | | | |

26 Pu-239

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.350E+03 | 17.586 | 13.724 | 16.483 | 7.356 | 3.000 | 21.170 | 150.000 | or1 |
| 5.020E+03 | 11.414 | 6.175 | 9.502 | 2.849 | 3.000 | 33.750 | 1435.000 | or2 |
| 4.280E+03 | 17.827 | 13.925 | 16.706 | 7.617 | 3.000 | 20.180 | 150.000 | or3 |
| 4.620E+03 | 21.580 | 16.905 | 20.541 | 9.697 | 3.000 | 35.100 | 315.000 | or4 |
| 4.770E+03 | 17.757 | 12.243 | 15.744 | 8.763 | 3.000 | 36.260 | 1435.000 | or5 |
| 4.940E+03 | 12.247 | 5.951 | 9.332 | 6.134 | 3.000 | 30.890 | 2315.000 | or6 |
| 4.910E+03 | 12.933 | 6.599 | 10.000 | 6.802 | 3.000 | 30.940 | 2315.000 | or7 |
| 4.650E+03 | 12.559 | 6.903 | 9.484 | 6.796 | 3.000 | 22.860 | 2585.000 | or8 |
| 4.260E+03 | 12.207 | 8.286 | 11.080 | 2.300 | 3.000 | 17.130 | 150.000 | or9 |
| 4.390E+03 | 19.226 | 14.875 | 17.585 | 8.314 | 3.000 | 22.700 | 150.000 | or10 |
| 4.700E+03 | 14.426 | 10.340 | 13.404 | 4.085 | 3.000 | 25.830 | 315.000 | or11 |
| 4.990E+03 | 11.122 | 6.333 | 9.198 | 2.806 | 3.000 | 31.500 | 1435.000 | or12 |
| 5.040E+03 | 10.020 | 4.802 | 8.115 | 1.647 | 3.000 | 31.140 | 1435.000 | or13 |
| 5.080E+03 | 7.264 | 1.614 | 4.449 | 1.516 | 3.000 | 27.710 | 2315.000 | or14 |
| 5.080E+03 | 5.866 | 0.217 | 3.031 | 0.591 | 3.000 | 25.810 | 2585.000 | or15 |
| 3.980E+03 | 15.302 | 11.683 | 14.095 | 5.553 | 3.000 | 15.600 | 150.000 | or16 |
| 5.020E+03 | 9.502 | 4.741 | 7.590 | 1.315 | 3.000 | 29.360 | 1435.000 | or17 |
| 4.960E+03 | 7.460 | 2.157 | 5.040 | 1.794 | 3.000 | 24.900 | 2315.000 | or18 |
| 4.520E+03 | 23.739 | 17.920 | 21.615 | 13.230 | 2.830 | 38.100 | 1328.000 | or19 |
| 4.600E+03 | 21.587 | 15.870 | 19.500 | 11.109 | 2.830 | 36.880 | 1328.000 | or20 |
| 4.410E+03 | 26.281 | 19.229 | 23.016 | 18.821 | 2.830 | 35.640 | 2206.000 | or21 |
| 4.360E+03 | 25.528 | 18.945 | 22.248 | 18.761 | 2.830 | 30.160 | 2426.000 | or22 |
| 4.270E+03 | 23.700 | 16.979 | 20.351 | 16.862 | 2.830 | 24.220 | 2547.000 | or23 |
| 4.600E+03 | 15.870 | 11.717 | 14.826 | 4.957 | 2.830 | 25.450 | 150.000 | or24 |
| 4.690E+03 | 19.254 | 13.646 | 17.207 | 8.955 | 2.830 | 36.670 | 1328.000 | or25 |
| 4.510E+03 | 22.949 | 16.053 | 19.756 | 15.388 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 16.0 | 10.7 | 13.8 | 7.46 | | | | |
| err-sd | 5.95 | 5.70 | 5.90 | 5.46 | | | | |

26 Pu-240

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.320E+03 | 11.439 | 15.833 | 17.803 | 13.712 | 3.000 | 21.170 | 150.000 | or1 |
| 2.360E+03 | -6.525 | -2.076 | -0.636 | -0.127 | 3.000 | 33.750 | 1435.000 | or2 |
| 1.360E+03 | 2.868 | 7.132 | 8.897 | 4.779 | 3.000 | 20.180 | 150.000 | or3 |
| 1.990E+03 | 13.970 | 18.794 | 20.603 | 20.704 | 3.000 | 35.100 | 315.000 | or4 |
| 2.410E+03 | -3.900 | 0.581 | 2.573 | 3.278 | 3.000 | 36.260 | 1435.000 | or5 |
| 2.220E+03 | -6.937 | -2.162 | -0.631 | -0.090 | 3.000 | 30.890 | 2315.000 | or6 |
| 2.240E+03 | -7.634 | -2.946 | -1.429 | -0.848 | 3.000 | 30.940 | 2315.000 | or7 |
| 1.620E+03 | -1.914 | 3.086 | 4.877 | 3.395 | 3.000 | 22.860 | 2585.000 | or8 |
| 1.160E+03 | 0.948 | 4.914 | 6.724 | 1.810 | 3.000 | 17.130 | 150.000 | or9 |
| 1.230E+03 | 28.211 | 33.496 | 35.610 | 31.382 | 3.000 | 22.700 | 150.000 | or10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.810E+03 | -1.602 | 2.486 | 4.088 | 1.768 | 3.000 | 25.830 | 315.000 | or11 |
| 2.270E+03 | -7.577 | -3.260 | -1.762 | -1.806 | 3.000 | 31.500 | 1435.000 | or12 |
| 2.290E+03 | -9.258 | -4.934 | -3.493 | -3.624 | 3.000 | 31.140 | 1435.000 | or13 |
| 2.040E+03 | -7.304 | -2.451 | -0.931 | -1.225 | 3.000 | 27.710 | 2315.000 | or14 |
| 1.950E+03 | -8.821 | -4.000 | -2.513 | -3.128 | 3.000 | 25.810 | 2585.000 | or15 |
| 1.040E+03 | 1.058 | 5.000 | 6.827 | 1.538 | 3.000 | 15.600 | 150.000 | or16 |
| 2.080E+03 | -4.567 | -0.096 | 1.442 | 0.865 | 3.000 | 29.360 | 1435.000 | or17 |
| 1.860E+03 | -7.473 | -2.688 | -1.183 | -2.097 | 3.000 | 24.900 | 2315.000 | or18 |
| 2.470E+03 | -0.891 | 3.968 | 4.939 | 6.113 | 2.830 | 38.100 | 1328.000 | or19 |
| 2.520E+03 | -4.762 | 0.000 | 0.952 | 1.746 | 2.830 | 36.880 | 1328.000 | or20 |
| 2.380E+03 | -1.261 | 3.866 | 4.874 | 6.429 | 2.830 | 35.640 | 2206.000 | or21 |
| 2.110E+03 | -1.043 | 3.839 | 5.308 | 5.687 | 2.830 | 30.160 | 2426.000 | or22 |
| 1.720E+03 | 0.756 | 5.930 | 7.442 | 6.453 | 2.830 | 24.220 | 2547.000 | or23 |
| 1.740E+03 | 4.138 | 8.276 | 9.943 | 7.529 | 2.830 | 25.450 | 150.000 | or24 |
| 2.470E+03 | -3.036 | 1.053 | 2.996 | 3.401 | 2.830 | 36.670 | 1328.000 | or25 |
| 2.370E+03 | -6.034 | -1.477 | -0.042 | 0.717 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | -1.04 | 3.54 | 5.13 | 4.17 | | | | |
| err-sd | 8.28 | 8.37 | 8.52 | 7.65 | | | | |

26 Pu-241

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 6.200E+02 | 46.548 | 36.823 | 40.323 | 24.952 | 3.000 | 21.170 | 150.000 | or1 |
| 1.280E+03 | 18.828 | 10.313 | 13.750 | 4.297 | 3.000 | 33.750 | 1435.000 | or2 |
| 6.200E+02 | 37.210 | 28.274 | 31.387 | 16.935 | 3.000 | 20.180 | 150.000 | or3 |
| 1.020E+03 | 53.824 | 42.941 | 47.157 | 31.569 | 3.000 | 35.100 | 315.000 | or4 |
| 1.260E+03 | 27.778 | 18.571 | 22.222 | 12.302 | 3.000 | 36.260 | 1435.000 | or5 |
| 1.180E+03 | 19.068 | 10.932 | 13.983 | 7.458 | 3.000 | 30.890 | 2315.000 | or6 |
| 1.190E+03 | 18.067 | 10.168 | 13.193 | 6.723 | 3.000 | 30.940 | 2315.000 | or7 |
| 8.400E+02 | 19.643 | 12.179 | 15.333 | 8.476 | 3.000 | 22.860 | 2585.000 | or8 |
| 5.500E+02 | 21.382 | 13.491 | 16.564 | 3.291 | 3.000 | 17.130 | 150.000 | or9 |
| 5.900E+02 | 68.695 | 57.254 | 61.356 | 43.983 | 3.000 | 22.700 | 150.000 | or10 |
| 9.400E+02 | 23.830 | 15.426 | 18.404 | 5.904 | 3.000 | 25.830 | 315.000 | or11 |
| 1.200E+03 | 19.083 | 10.833 | 14.083 | 4.583 | 3.000 | 31.500 | 1435.000 | or12 |
| 1.210E+03 | 16.942 | 8.760 | 11.901 | 2.645 | 3.000 | 31.140 | 1435.000 | or13 |
| 1.110E+03 | 13.333 | 5.946 | 8.739 | 2.342 | 3.000 | 27.710 | 2315.000 | or14 |
| 1.050E+03 | 10.857 | 3.714 | 6.476 | 0.476 | 3.000 | 25.810 | 2585.000 | or15 |
| 4.600E+02 | 25.217 | 17.348 | 20.500 | 6.217 | 3.000 | 15.600 | 150.000 | or16 |
| 1.120E+03 | 19.196 | 11.250 | 14.286 | 4.732 | 3.000 | 29.360 | 1435.000 | or17 |
| 1.000E+03 | 11.600 | 4.400 | 7.200 | 0.700 | 3.000 | 24.900 | 2315.000 | or18 |
| 1.300E+03 | 26.231 | 17.385 | 20.846 | 12.462 | 2.830 | 38.100 | 1328.000 | or19 |
| 1.320E+03 | 21.591 | 13.030 | 16.515 | 8.333 | 2.830 | 36.880 | 1328.000 | or20 |
| 1.210E+03 | 29.504 | 20.331 | 24.050 | 18.678 | 2.830 | 35.640 | 2206.000 | or21 |
| 1.090E+03 | 25.138 | 16.697 | 20.092 | 14.862 | 2.830 | 30.160 | 2426.000 | or22 |
| 8.600E+02 | 26.163 | 18.023 | 21.395 | 15.651 | 2.830 | 24.220 | 2547.000 | or23 |
| 9.000E+02 | 27.444 | 18.889 | 22.111 | 10.333 | 2.830 | 25.450 | 150.000 | or24 |
| 1.300E+03 | 23.077 | 14.385 | 17.923 | 9.538 | 2.830 | 36.670 | 1328.000 | or25 |
| 1.210E+03 | 21.736 | 13.306 | 16.529 | 11.322 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 25.8 | 17.3 | 20.6 | 11.1 | | | | |
| err-sd | 13.0 | 12.0 | 12.3 | 9.96 | | | | |

26 Pu-242

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.280E+02 | 40.469 | 53.125 | 54.844 | 34.219 | 3.000 | 21.170 | 150.000 | or1 |
| 5.640E+02 | -4.752 | 5.124 | 5.550 | -3.741 | 3.000 | 33.750 | 1435.000 | or2 |
| 1.390E+02 | 14.245 | 24.676 | 26.043 | 8.705 | 3.000 | 20.180 | 150.000 | or3 |
| 3.800E+02 | 53.474 | 68.132 | 68.763 | 54.763 | 3.000 | 35.100 | 315.000 | or4 |
| 6.290E+02 | -1.129 | 9.269 | 9.650 | 0.827 | 3.000 | 36.260 | 1435.000 | or5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4.640E+02 | -4.547 | 5.884 | 6.401 | -3.405 | 3.000 | 30.890 | 2315.000 | or6 |
| 4.880E+02 | -8.750 | 1.168 | 1.660 | -7.828 | 3.000 | 30.940 | 2315.000 | or7 |
| 2.110E+02 | 3.460 | 14.692 | 15.829 | 3.270 | 3.000 | 22.860 | 2585.000 | or8 |
| 9.900E+01 | 3.636 | 13.131 | 14.646 | -2.899 | 3.000 | 17.130 | 150.000 | or9 |
| 1.120E+02 | 91.429 | 108.929 | 110.893 | 84.196 | 3.000 | 22.700 | 150.000 | or10 |
| 2.790E+02 | 4.946 | 15.376 | 16.237 | 2.796 | 3.000 | 25.830 | 315.000 | or11 |
| 4.780E+02 | -3.305 | 6.820 | 7.322 | -2.699 | 3.000 | 31.500 | 1435.000 | or12 |
| 5.000E+02 | -9.980 | -0.300 | 0.180 | -9.380 | 3.000 | 31.140 | 1435.000 | or13 |
| 3.660E+02 | -5.437 | 5.137 | 5.792 | -4.809 | 3.000 | 27.710 | 2315.000 | or14 |
| 3.200E+02 | -8.500 | 2.094 | 2.844 | -8.000 | 3.000 | 25.810 | 2585.000 | or15 |
| 7.500E+01 | 5.840 | 15.520 | 17.133 | -1.907 | 3.000 | 15.600 | 150.000 | or16 |
| 3.840E+02 | 2.734 | 13.438 | 14.063 | 2.969 | 3.000 | 29.360 | 1435.000 | or17 |
| 2.990E+02 | -10.167 | 0.368 | 1.171 | -10.033 | 3.000 | 24.900 | 2315.000 | or18 |
| 7.730E+02 | -6.701 | 3.001 | 3.001 | -3.777 | 2.830 | 38.100 | 1328.000 | or19 |
| 7.870E+02 | -13.901 | -4.981 | -4.981 | -11.576 | 2.830 | 36.880 | 1328.000 | or20 |
| 6.800E+02 | -6.765 | 3.206 | 3.559 | -4.412 | 2.830 | 35.640 | 2206.000 | or21 |
| 4.940E+02 | -9.372 | 0.425 | 0.911 | -8.198 | 2.830 | 30.160 | 2426.000 | or22 |
| 2.850E+02 | -4.912 | 5.298 | 6.140 | -4.772 | 2.830 | 24.220 | 2547.000 | or23 |
| 2.640E+02 | 15.492 | 25.568 | 26.515 | 12.879 | 2.830 | 25.450 | 150.000 | or24 |
| 7.350E+02 | -8.803 | 0.422 | 0.748 | -6.435 | 2.830 | 36.670 | 1328.000 | or25 |
| 6.580E+02 | -18.359 | -9.529 | -9.164 | -16.626 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 4.24 | 14.8 | 15.6 | 3.62 | | | | |
| err-sd | 23.8 | 25.5 | 25.9 | 22.0 | | | | |

19 Am-241

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.190E+01 | -8.539 | -11.187 | -8.767 | -19.269 | 3.000 | 21.170 | 150.000 | or1 |
| 6.080E+01 | -53.618 | -54.408 | -52.829 | -57.007 | 3.000 | 33.750 | 1435.000 | or2 |
| 2.930E+01 | -35.256 | -37.235 | -35.597 | -43.072 | 3.000 | 20.180 | 150.000 | or3 |
| 9.000E+01 | -68.133 | -68.667 | -67.333 | -70.400 | 3.000 | 36.260 | 1435.000 | or4 |
| 7.300E+01 | -62.699 | -63.356 | -62.027 | -64.411 | 3.000 | 30.890 | 2315.000 | or5 |
| 2.370E+01 | -8.397 | -10.422 | -7.890 | -13.249 | 3.000 | 22.860 | 2585.000 | or6 |
| 1.400E+01 | 9.500 | 5.857 | 8.429 | -4.571 | 3.000 | 17.130 | 150.000 | or7 |
| 2.210E+01 | -2.398 | -5.023 | -2.398 | -13.529 | 3.000 | 22.700 | 150.000 | or8 |
| 2.480E+01 | -1.855 | -4.395 | -1.855 | -12.702 | 3.000 | 25.830 | 315.000 | or9 |
| 1.760E+02 | -84.392 | -84.665 | -84.114 | -85.563 | 3.000 | 31.500 | 1435.000 | or10 |
| 1.400E+02 | -81.750 | -82.100 | -81.579 | -82.671 | 3.000 | 27.710 | 2315.000 | or11 |
| 6.700E+00 | 99.701 | 92.388 | 97.463 | 72.836 | 3.000 | 15.600 | 150.000 | or12 |
| 9.390E+01 | -71.768 | -72.279 | -71.512 | -73.951 | 3.000 | 29.360 | 1435.000 | or13 |
| 4.100E+01 | -14.171 | -15.366 | -11.829 | -20.195 | 2.830 | 38.100 | 1328.000 | or14 |
| 4.030E+01 | -13.300 | -14.491 | -11.489 | -16.352 | 2.830 | 35.640 | 2206.000 | or15 |
| 5.530E+01 | -39.855 | -40.723 | -38.987 | -42.098 | 2.830 | 30.160 | 2426.000 | or16 |
| 2.770E+01 | 4.404 | 1.805 | 5.271 | -0.758 | 2.830 | 24.220 | 2547.000 | or17 |
| 2.520E+01 | 19.563 | 16.667 | 20.516 | 6.706 | 2.830 | 25.450 | 150.000 | or18 |
| 7.490E+01 | -53.017 | -53.672 | -52.056 | -56.409 | 2.830 | 36.670 | 1328.000 | or19 |
| err-avg | -24.5 | -26.4 | -24.1 | -31.4 | | | | |
| err-sd | 44.5 | 42.9 | 44.0 | 38.7 | | | | |

7 Am-242

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.880E-01 | 16.458 | 2.674 | 5.382 | -35.347 | 3.000 | 17.130 | 150.000 | or1 |
| 4.940E-01 | 22.328 | 9.008 | 13.158 | -28.725 | 3.000 | 25.830 | 315.000 | or2 |
| 7.290E-01 | 28.601 | 17.010 | 22.730 | -18.848 | 2.830 | 38.100 | 1328.000 | or3 |
| 1.930E+00 | -52.430 | -56.617 | -54.611 | -68.539 | 2.830 | 35.640 | 2206.000 | or4 |
| 1.210E+00 | -30.397 | -36.719 | -34.157 | -54.554 | 2.830 | 30.160 | 2426.000 | or5 |
| 7.100E-01 | -2.690 | -11.718 | -8.479 | -37.775 | 2.830 | 24.220 | 2547.000 | or6 |
| 7.570E-01 | 22.629 | 11.506 | 16.658 | -22.946 | 2.830 | 36.670 | 1328.000 | or7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| err-avg | 0.643 | -9.27 | -5.62 | -38.1 | | | | |
| err-sd | 31.0 | 27.7 | 28.9 | 17.8 | | | | |

7 Am-243

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 8.600E+00 | 27.674 | 37.907 | 39.884 | -6.640 | 3.000 | 17.130 | 150.000 | or1 |
| 3.900E+01 | 27.103 | 36.462 | 36.462 | -2.923 | 3.000 | 25.830 | 315.000 | or2 |
| 1.540E+02 | 20.065 | 27.662 | 25.584 | -2.273 | 2.830 | 38.100 | 1328.000 | or3 |
| 1.380E+02 | 10.435 | 18.478 | 17.101 | -8.696 | 2.830 | 35.640 | 2206.000 | or4 |
| 4.200E+01 | 116.976 | 134.905 | 133.738 | 79.167 | 2.830 | 30.160 | 2426.000 | or5 |
| 3.620E+01 | 21.492 | 32.238 | 32.901 | -0.497 | 2.830 | 24.220 | 2547.000 | or6 |
| 1.400E+02 | 18.357 | 26.000 | 24.286 | -4.000 | 2.830 | 36.670 | 1328.000 | or7 |
| err-avg | 34.6 | 44.8 | 44.3 | 7.73 | | | | |
| err-sd | 36.8 | 40.3 | 40.2 | 31.6 | | | | |

23 Cm-242

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 7.400E+00 | -30.014 | -37.865 | -36.554 | -42.324 | 3.000 | 21.170 | 150.000 | or1 |
| 1.570E+01 | -9.490 | -17.834 | -16.306 | -20.701 | 3.000 | 33.750 | 1435.000 | or2 |
| 4.500E+00 | 2.178 | -9.644 | -7.511 | -16.111 | 3.000 | 20.180 | 150.000 | or3 |
| 1.480E+01 | 8.919 | -0.743 | 1.216 | -4.122 | 3.000 | 36.260 | 1435.000 | or4 |
| 1.500E+01 | -20.000 | -27.067 | -25.800 | -28.333 | 3.000 | 30.890 | 2315.000 | or5 |
| 3.320E+01 | -63.765 | -66.988 | -66.325 | -67.500 | 3.000 | 30.940 | 2315.000 | or6 |
| 7.100E+00 | -12.408 | -20.577 | -18.873 | -21.817 | 3.000 | 22.860 | 2585.000 | or7 |
| 2.940E+00 | 2.075 | -9.456 | -7.823 | -17.143 | 3.000 | 17.130 | 150.000 | or8 |
| 8.580E+00 | -3.823 | -14.254 | -12.564 | -19.382 | 3.000 | 25.830 | 315.000 | or9 |
| 1.480E+01 | -15.811 | -23.649 | -22.162 | -26.419 | 3.000 | 31.500 | 1435.000 | or10 |
| 2.720E+01 | -55.147 | -59.412 | -58.640 | -60.882 | 3.000 | 31.140 | 1435.000 | or11 |
| 1.190E+01 | -19.269 | -26.588 | -25.160 | -28.000 | 3.000 | 27.710 | 2315.000 | or12 |
| 1.960E+01 | -58.020 | -61.847 | -61.107 | -62.429 | 3.000 | 25.810 | 2585.000 | or13 |
| 1.130E+01 | -4.071 | -13.265 | -11.549 | -16.566 | 3.000 | 29.360 | 1435.000 | or14 |
| 1.410E+01 | -46.106 | -51.085 | -50.227 | -52.149 | 3.000 | 24.900 | 2315.000 | or15 |
| 1.450E+01 | 41.172 | 29.172 | 31.862 | 25.517 | 2.830 | 38.100 | 1328.000 | or16 |
| 4.700E+01 | -58.553 | -62.106 | -61.383 | -63.255 | 2.830 | 36.880 | 1328.000 | or17 |
| 1.440E+01 | 27.917 | 17.500 | 19.653 | 16.042 | 2.830 | 35.640 | 2206.000 | or18 |
| 1.170E+01 | 17.094 | 6.923 | 8.974 | 5.726 | 2.830 | 30.160 | 2426.000 | or19 |
| 7.560E+00 | 14.921 | 4.669 | 6.601 | 3.095 | 2.830 | 24.220 | 2547.000 | or20 |
| 8.130E+00 | 19.065 | 6.863 | 8.647 | 0.578 | 2.830 | 25.450 | 150.000 | or21 |
| 1.780E+01 | 8.371 | -0.899 | 1.011 | -3.876 | 2.830 | 36.670 | 1328.000 | or22 |
| 3.310E+01 | -51.450 | -55.559 | -54.743 | -56.133 | 2.830 | 32.900 | 2206.000 | or23 |
| err-avg | -13.3 | -21.5 | -19.9 | -24.2 | | | | |
| err-sd | 30.4 | 27.6 | 28.2 | 26.8 | | | | |

26 Cm-244

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.220E+00 | 63.784 | 94.550 | 108.829 | 30.270 | 3.000 | 21.170 | 150.000 | or1 |
| 3.400E+01 | -4.559 | 11.941 | 18.412 | -15.824 | 3.000 | 33.750 | 1435.000 | or2 |
| 2.040E+00 | 41.127 | 67.451 | 79.412 | 11.275 | 3.000 | 20.180 | 150.000 | or3 |
| 1.260E+01 | 205.952 | 256.349 | 275.714 | 160.000 | 3.000 | 35.100 | 315.000 | or4 |
| 4.160E+01 | 6.755 | 24.928 | 31.971 | -5.216 | 3.000 | 36.260 | 1435.000 | or5 |
| 2.480E+01 | -11.935 | 4.274 | 11.169 | -19.153 | 3.000 | 30.890 | 2315.000 | or6 |
| 2.220E+01 | -0.991 | 17.613 | 25.315 | -9.054 | 3.000 | 30.940 | 2315.000 | or7 |
| 5.130E+00 | 3.216 | 25.088 | 34.133 | -4.971 | 3.000 | 22.860 | 2585.000 | or8 |
| 1.040E+00 | 21.731 | 45.673 | 56.250 | -5.827 | 3.000 | 17.130 | 150.000 | or9 |
| 1.970E+00 | 160.102 | 207.157 | 229.442 | 108.071 | 3.000 | 22.700 | 150.000 | or10 |
| 9.490E+00 | 0.274 | 17.808 | 26.027 | -18.240 | 3.000 | 25.830 | 315.000 | or11 |
| 2.970E+01 | -19.663 | -5.522 | 0.236 | -29.630 | 3.000 | 31.500 | 1435.000 | or12 |
| 2.670E+01 | -15.206 | -0.375 | 5.993 | -25.768 | 3.000 | 31.140 | 1435.000 | or13 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.650E+01 | -19.697 | -4.000 | 2.485 | -26.606 | 3.000 | 27.710 | 2315.000 | or14 |
| 1.070E+01 | -11.290 | 6.729 | 14.019 | -18.224 | 3.000 | 25.810 | 2585.000 | or15 |
| 1.040E+00 | -24.452 | -9.442 | -2.885 | -42.202 | 3.000 | 15.600 | 150.000 | or16 |
| 1.800E+01 | -3.889 | 13.611 | 20.889 | -16.222 | 3.000 | 29.360 | 1435.000 | or17 |
| 8.910E+00 | -10.180 | 7.901 | 15.600 | -18.204 | 3.000 | 24.900 | 2315.000 | or18 |
| 5.980E+01 | 3.227 | 19.548 | 25.268 | -9.465 | 2.830 | 38.100 | 1328.000 | or19 |
| 4.590E+01 | 16.950 | 35.556 | 43.007 | 2.527 | 2.830 | 36.880 | 1328.000 | or20 |
| 4.720E+01 | -1.780 | 15.275 | 21.483 | -10.614 | 2.830 | 35.640 | 2206.000 | or21 |
| 2.210E+01 | 0.814 | 19.231 | 26.968 | -8.235 | 2.830 | 30.160 | 2426.000 | or22 |
| 6.950E+00 | 16.201 | 39.381 | 49.209 | 5.439 | 2.830 | 24.220 | 2547.000 | or23 |
| 6.530E+00 | 56.202 | 82.389 | 95.100 | 25.727 | 2.830 | 25.450 | 150.000 | or24 |
| 5.260E+01 | -0.266 | 15.513 | 21.996 | -12.719 | 2.830 | 36.670 | 1328.000 | or25 |
| 3.170E+01 | 3.912 | 21.609 | 29.306 | -6.278 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 18.3 | 39.6 | 48.7 | 1.57 | | | | |
| err-sd | 53.4 | 62.3 | 66.3 | 42.7 | | | | |

16 Cs-134

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.300E+02 | 3.077 | -0.846 | -3.615 | -1.231 | 3.000 | 33.750 | 1435.000 | or1 |
| 4.290E+01 | 15.268 | 11.515 | 8.392 | 6.807 | 3.000 | 20.180 | 150.000 | or2 |
| 1.380E+02 | 11.667 | 6.812 | 3.913 | 6.957 | 3.000 | 36.260 | 1435.000 | or3 |
| 1.110E+02 | 1.982 | -1.892 | -4.595 | -1.441 | 3.000 | 30.890 | 2315.000 | or4 |
| 6.230E+01 | 1.525 | -2.135 | -4.928 | -2.616 | 3.000 | 22.860 | 2585.000 | or5 |
| 3.490E+01 | 2.521 | -0.544 | -3.238 | -5.415 | 3.000 | 17.130 | 150.000 | or6 |
| 7.550E+01 | 6.146 | 2.411 | -0.424 | -0.702 | 3.000 | 25.830 | 315.000 | or7 |
| 1.190E+02 | -1.092 | -4.958 | -7.647 | -5.714 | 3.000 | 31.500 | 1435.000 | or8 |
| 9.540E+01 | -3.637 | -7.285 | -9.822 | -7.306 | 3.000 | 27.710 | 2315.000 | or9 |
| 1.020E+02 | 0.784 | -3.039 | -5.804 | -4.147 | 3.000 | 29.360 | 1435.000 | or10 |
| 1.510E+02 | 9.139 | 4.702 | 2.053 | 5.099 | 2.830 | 38.100 | 1328.000 | or11 |
| 1.360E+02 | 6.397 | 2.500 | -0.515 | 3.824 | 2.830 | 35.640 | 2206.000 | or12 |
| 1.020E+02 | 3.824 | -0.196 | -3.039 | 0.392 | 2.830 | 30.160 | 2426.000 | or13 |
| 6.550E+01 | 5.771 | 1.893 | -0.779 | 1.786 | 2.830 | 24.220 | 2547.000 | or14 |
| 6.520E+01 | 16.948 | 12.837 | 9.755 | 9.555 | 2.830 | 25.450 | 150.000 | or15 |
| 1.460E+02 | 4.658 | 0.959 | -1.781 | 1.027 | 2.830 | 36.670 | 1328.000 | or16 |
| err-avg | 5.31 | 1.42 | -1.38 | 0.430 | | | | |
| err-sd | 5.62 | 5.45 | 5.33 | 4.98 | | | | |

16 Cs-137

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.210E+03 | 5.537 | 5.537 | 5.537 | 4.380 | 3.000 | 33.750 | 1435.000 | or1 |
| 7.160E+02 | 6.578 | 6.578 | 6.578 | 5.126 | 3.000 | 20.180 | 150.000 | or2 |
| 1.290E+03 | 6.202 | 6.202 | 6.202 | 5.271 | 3.000 | 36.260 | 1435.000 | or3 |
| 1.120E+03 | 4.375 | 4.375 | 4.375 | 3.214 | 3.000 | 30.890 | 2315.000 | or4 |
| 8.270E+02 | 4.534 | 4.534 | 4.534 | 3.192 | 3.000 | 22.860 | 2585.000 | or5 |
| 6.220E+02 | 4.180 | 4.180 | 4.180 | 2.637 | 3.000 | 17.130 | 150.000 | or6 |
| 9.110E+02 | 7.223 | 7.223 | 7.223 | 5.928 | 3.000 | 25.830 | 315.000 | or7 |
| 1.150E+03 | 3.652 | 3.652 | 3.652 | 2.522 | 3.000 | 31.500 | 1435.000 | or8 |
| 1.000E+03 | 4.800 | 4.800 | 4.800 | 3.600 | 3.000 | 27.710 | 2315.000 | or9 |
| 1.060E+03 | 4.811 | 4.811 | 4.811 | 3.585 | 3.000 | 29.360 | 1435.000 | or10 |
| 1.380E+03 | 4.275 | 4.275 | 4.275 | 2.971 | 2.830 | 38.100 | 1328.000 | or11 |
| 1.300E+03 | 3.154 | 3.077 | 3.077 | 2.154 | 2.830 | 35.640 | 2206.000 | or12 |
| 1.120E+03 | 1.250 | 1.250 | 1.250 | 0.268 | 2.830 | 30.160 | 2426.000 | or13 |
| 8.910E+02 | 2.245 | 2.245 | 2.245 | 1.010 | 2.830 | 24.220 | 2547.000 | or14 |
| 8.340E+02 | 14.820 | 14.820 | 14.820 | 13.417 | 2.830 | 25.450 | 150.000 | or15 |
| 1.310E+03 | 5.649 | 5.649 | 5.649 | 4.351 | 2.830 | 36.670 | 1328.000 | or16 |
| err-avg | 5.21 | 5.20 | 5.20 | 3.98 | | | | |
| err-sd | 2.99 | 2.99 | 2.99 | 2.93 | | | | |

16 Eu-154

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.590E+01 | 65.907 | -5.444 | -3.089 | -29.189 | 3.000 | 33.750 | 1435.000 | or1 |
| 7.750E+00 | 100.645 | 23.394 | 28.568 | -4.581 | 3.000 | 20.180 | 150.000 | or2 |
| 2.490E+01 | 96.064 | 10.723 | 13.173 | -17.871 | 3.000 | 36.260 | 1435.000 | or3 |
| 2.110E+01 | 72.986 | -0.758 | 2.180 | -22.464 | 3.000 | 30.890 | 2315.000 | or4 |
| 1.180E+01 | 70.932 | 2.288 | 6.356 | -17.102 | 3.000 | 22.860 | 2585.000 | or5 |
| 5.460E+00 | 100.549 | 26.355 | 31.429 | -0.769 | 3.000 | 17.130 | 150.000 | or6 |
| 1.630E+01 | 57.791 | -5.890 | -2.699 | -29.080 | 3.000 | 25.830 | 315.000 | or7 |
| 2.430E+01 | 55.885 | -10.658 | -7.490 | -32.263 | 3.000 | 31.500 | 1435.000 | or8 |
| 1.970E+01 | 50.102 | -12.437 | -9.340 | -30.660 | 3.000 | 27.710 | 2315.000 | or9 |
| 2.070E+01 | 59.952 | -7.005 | -4.010 | -29.082 | 3.000 | 29.360 | 1435.000 | or10 |
| 2.670E+01 | 102.434 | 12.472 | 14.794 | -17.303 | 2.830 | 38.100 | 1328.000 | or11 |
| 2.550E+01 | 89.020 | 5.686 | 8.118 | -19.373 | 2.830 | 35.640 | 2206.000 | or12 |
| 2.040E+01 | 75.147 | -0.343 | 2.647 | -21.814 | 2.830 | 30.160 | 2426.000 | or13 |
| 1.330E+01 | 74.812 | 3.158 | 7.068 | -17.218 | 2.830 | 24.220 | 2547.000 | or14 |
| 1.350E+01 | 90.519 | 12.593 | 16.370 | -15.333 | 2.830 | 25.450 | 150.000 | or15 |
| 2.840E+01 | 78.415 | -0.211 | 1.937 | -26.408 | 2.830 | 36.670 | 1328.000 | or16 |
| err-avg | 77.6 | 3.37 | 6.63 | -20.7 | | | | |
| err-sd | 17.2 | 11.3 | 11.9 | 9.00 | | | | |

26 U

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.669E+04 | -7.004 | -7.004 | -6.309 | -7.927 | 3.000 | 21.170 | 150.000 | or1 |
| 1.099E+04 | -2.338 | -2.557 | -0.846 | -4.058 | 3.000 | 33.750 | 1435.000 | or2 |
| 1.562E+04 | 2.561 | 2.407 | 3.111 | 1.485 | 3.000 | 20.180 | 150.000 | or3 |
| 1.221E+04 | -15.373 | -15.758 | -14.414 | -18.370 | 3.000 | 35.100 | 315.000 | or4 |
| 1.021E+04 | -1.783 | -2.243 | -0.411 | -4.084 | 3.000 | 36.260 | 1435.000 | or5 |
| 1.131E+04 | 3.201 | 3.201 | 4.651 | 3.042 | 3.000 | 30.890 | 2315.000 | or6 |
| 1.175E+04 | -0.860 | -0.860 | 0.536 | -0.962 | 3.000 | 30.940 | 2315.000 | or7 |
| 1.552E+04 | -4.820 | -4.691 | -3.937 | -4.317 | 3.000 | 22.860 | 2585.000 | or8 |
| 1.812E+04 | -3.184 | -3.074 | -2.649 | -3.670 | 3.000 | 17.130 | 150.000 | or9 |
| 1.733E+04 | -14.357 | -14.357 | -13.681 | -15.522 | 3.000 | 22.700 | 150.000 | or10 |
| 1.465E+04 | -7.816 | -7.952 | -7.024 | -9.392 | 3.000 | 25.830 | 315.000 | or11 |
| 1.155E+04 | -0.779 | -0.978 | 0.450 | -2.346 | 3.000 | 31.500 | 1435.000 | or12 |
| 1.148E+04 | 0.854 | 0.653 | 2.082 | -0.679 | 3.000 | 31.140 | 1435.000 | or13 |
| 1.415E+04 | -9.710 | -9.548 | -8.551 | -9.470 | 3.000 | 27.710 | 2315.000 | or14 |
| 1.370E+04 | -1.277 | -1.058 | -0.066 | -0.818 | 3.000 | 25.810 | 2585.000 | or15 |
| 1.843E+04 | -0.228 | -0.228 | 0.130 | -0.619 | 3.000 | 15.600 | 150.000 | or16 |
| 1.259E+04 | -3.376 | -3.376 | -2.065 | -4.416 | 3.000 | 29.360 | 1435.000 | or17 |
| 1.390E+04 | 0.058 | 0.029 | 1.180 | 0.273 | 3.000 | 24.900 | 2315.000 | or18 |
| 8.940E+03 | -3.870 | -4.139 | -2.293 | -6.622 | 2.830 | 38.100 | 1328.000 | or19 |
| 8.280E+03 | 7.186 | 6.908 | 9.179 | 4.493 | 2.830 | 36.880 | 1328.000 | or20 |
| 8.900E+03 | 3.427 | 3.427 | 5.270 | 2.787 | 2.830 | 35.640 | 2206.000 | or21 |
| 9.930E+03 | 8.540 | 8.771 | 10.433 | 8.822 | 2.830 | 30.160 | 2426.000 | or22 |
| 1.227E+04 | 5.257 | 5.452 | 6.593 | 5.827 | 2.830 | 24.220 | 2547.000 | or23 |
| 1.322E+04 | -5.862 | -6.036 | -4.970 | -7.746 | 2.830 | 25.450 | 150.000 | or24 |
| 8.720E+03 | 2.592 | 2.053 | 4.209 | -0.172 | 2.830 | 36.670 | 1328.000 | or25 |
| 8.860E+03 | 12.370 | 12.370 | 14.233 | 11.964 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | -1.41 | -1.48 | -0.198 | -2.40 | | | | |
| err-sd | 6.46 | 6.48 | 6.74 | 6.81 | | | | |

26 Pu

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 6.454E+03 | 19.743 | 17.300 | 19.925 | 10.890 | 3.000 | 21.170 | 150.000 | or1 |
| 9.380E+03 | 6.731 | 4.383 | 7.000 | 1.479 | 3.000 | 33.750 | 1435.000 | or2 |
| 6.440E+03 | 16.453 | 14.074 | 16.620 | 7.797 | 3.000 | 20.180 | 150.000 | or3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8.114E+03 | 25.770 | 23.480 | 26.528 | 17.424 | 3.000 | 35.100 | 315.000 | or4 |
| 9.234E+03 | 12.025 | 9.682 | 12.511 | 6.857 | 3.000 | 36.260 | 1435.000 | or5 |
| 8.929E+03 | 7.360 | 4.450 | 7.114 | 3.928 | 3.000 | 30.890 | 2315.000 | or6 |
| 8.931E+03 | 7.402 | 4.502 | 7.167 | 3.993 | 3.000 | 30.940 | 2315.000 | or7 |
| 7.383E+03 | 9.858 | 6.810 | 9.213 | 5.936 | 3.000 | 22.860 | 2585.000 | or8 |
| 6.100E+03 | 10.718 | 8.138 | 10.731 | 2.075 | 3.000 | 17.130 | 150.000 | or9 |
| 6.361E+03 | 27.087 | 24.286 | 26.973 | 17.488 | 3.000 | 22.700 | 150.000 | or10 |
| 7.808E+03 | 11.440 | 9.217 | 11.812 | 3.482 | 3.000 | 25.830 | 315.000 | or11 |
| 9.076E+03 | 6.514 | 4.314 | 6.704 | 1.177 | 3.000 | 31.500 | 1435.000 | or12 |
| 9.185E+03 | 4.712 | 2.291 | 4.892 | -0.641 | 3.000 | 31.140 | 1435.000 | or13 |
| 8.702E+03 | 3.934 | 1.204 | 3.588 | 0.395 | 3.000 | 27.710 | 2315.000 | or14 |
| 8.479E+03 | 2.583 | -0.240 | 2.151 | -0.736 | 3.000 | 25.810 | 2585.000 | or15 |
| 5.580E+03 | 13.285 | 10.887 | 13.225 | 4.617 | 3.000 | 15.600 | 150.000 | or16 |
| 8.711E+03 | 7.054 | 4.747 | 7.162 | 1.490 | 3.000 | 29.360 | 1435.000 | or17 |
| 8.195E+03 | 3.894 | 1.219 | 3.668 | 0.162 | 3.000 | 24.900 | 2315.000 | or18 |
| 9.253E+03 | 14.684 | 12.567 | 15.089 | 9.251 | 2.830 | 38.100 | 1328.000 | or19 |
| 9.366E+03 | 11.798 | 9.685 | 12.192 | 6.284 | 2.830 | 36.880 | 1328.000 | or20 |
| 8.839E+03 | 16.555 | 13.807 | 16.480 | 13.211 | 2.830 | 35.640 | 2206.000 | or21 |
| 8.168E+03 | 16.320 | 13.440 | 16.047 | 12.845 | 2.830 | 30.160 | 2426.000 | or22 |
| 7.200E+03 | 17.358 | 13.971 | 16.758 | 13.192 | 2.830 | 24.220 | 2547.000 | or23 |
| 7.569E+03 | 14.704 | 12.387 | 15.067 | 6.431 | 2.830 | 25.450 | 150.000 | or24 |
| 9.364E+03 | 11.615 | 9.275 | 12.062 | 6.019 | 2.830 | 36.670 | 1328.000 | or25 |
| 8.874E+03 | 11.975 | 9.088 | 11.801 | 8.309 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 12.0 | 9.42 | 12.0 | 6.28 | | | | |
| err-sd | 6.28 | 6.29 | 6.39 | 5.31 | | | | |

19 Am

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.190E+01 | -8.539 | -11.187 | -8.767 | -19.269 | 3.000 | 21.170 | 150.000 | or1 |
| 6.080E+01 | -53.618 | -54.408 | -52.829 | -57.007 | 3.000 | 33.750 | 1435.000 | or2 |
| 2.930E+01 | -35.256 | -37.235 | -35.597 | -43.072 | 3.000 | 20.180 | 150.000 | or3 |
| 9.000E+01 | -68.133 | -68.667 | -67.333 | -70.400 | 3.000 | 36.260 | 1435.000 | or4 |
| 7.300E+01 | -62.699 | -63.356 | -62.027 | -64.411 | 3.000 | 30.890 | 2315.000 | or5 |
| 2.370E+01 | -8.397 | -10.422 | -7.890 | -13.249 | 3.000 | 22.860 | 2585.000 | or6 |
| 2.289E+01 | 16.416 | 17.860 | 20.209 | -5.736 | 3.000 | 17.130 | 150.000 | or7 |
| 2.210E+01 | -2.398 | -5.023 | -2.398 | -13.529 | 3.000 | 22.700 | 150.000 | or8 |
| 6.429E+01 | 15.896 | 20.491 | 21.503 | -6.893 | 3.000 | 25.830 | 315.000 | or9 |
| 1.760E+02 | -84.392 | -84.665 | -84.114 | -85.563 | 3.000 | 31.500 | 1435.000 | or10 |
| 1.400E+02 | -81.750 | -82.100 | -81.579 | -82.671 | 3.000 | 27.710 | 2315.000 | or11 |
| 6.700E+00 | 99.701 | 92.388 | 97.463 | 72.836 | 3.000 | 15.600 | 150.000 | or12 |
| 9.390E+01 | -71.768 | -72.279 | -71.512 | -73.951 | 3.000 | 29.360 | 1435.000 | or13 |
| 1.957E+02 | 12.925 | 18.609 | 17.737 | -6.089 | 2.830 | 38.100 | 1328.000 | or14 |
| 1.802E+02 | 4.454 | 10.302 | 9.941 | -11.049 | 2.830 | 35.640 | 2206.000 | or15 |
| 9.851E+01 | 27.126 | 34.205 | 34.714 | 9.451 | 2.830 | 30.160 | 2426.000 | or16 |
| 6.461E+01 | 13.900 | 18.707 | 20.600 | -1.019 | 2.830 | 24.220 | 2547.000 | or17 |
| 2.520E+01 | 19.563 | 16.667 | 20.516 | 6.706 | 2.830 | 25.450 | 150.000 | or18 |
| 2.157E+02 | -6.417 | -1.722 | -2.255 | -22.269 | 2.830 | 36.670 | 1328.000 | or19 |
| err-avg | -14.4 | -13.8 | -12.3 | -25.6 | | | | |
| err-sd | 47.1 | 47.4 | 48.0 | 39.6 | | | | |

26 Cm

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.620E+00 | -8.368 | -7.308 | -3.004 | -25.572 | 3.000 | 21.170 | 150.000 | or1 |
| 4.970E+01 | -6.117 | 2.535 | 7.445 | -17.364 | 3.000 | 33.750 | 1435.000 | or2 |
| 6.540E+00 | 14.327 | 14.404 | 19.602 | -7.569 | 3.000 | 20.180 | 150.000 | or3 |
| 1.260E+01 | 205.952 | 256.349 | 275.714 | 160.000 | 3.000 | 35.100 | 315.000 | or4 |
| 5.640E+01 | 7.323 | 18.191 | 23.901 | -4.929 | 3.000 | 36.260 | 1435.000 | or5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3.980E+01 | -14.975 | -7.538 | -2.764 | -22.613 | 3.000 | 30.890 | 2315.000 | or6 |
| 5.540E+01 | -38.610 | -33.087 | -29.603 | -44.079 | 3.000 | 30.940 | 2315.000 | or7 |
| 1.223E+01 | -5.854 | -1.423 | 3.361 | -14.751 | 3.000 | 22.860 | 2585.000 | or8 |
| 3.980E+00 | 7.211 | 4.950 | 8.920 | -14.186 | 3.000 | 17.130 | 150.000 | or9 |
| 1.970E+00 | 160.102 | 207.157 | 229.442 | 108.071 | 3.000 | 22.700 | 150.000 | or10 |
| 1.807E+01 | -1.671 | 2.584 | 7.703 | -18.783 | 3.000 | 25.830 | 315.000 | or11 |
| 4.450E+01 | -18.382 | -11.551 | -7.213 | -28.562 | 3.000 | 31.500 | 1435.000 | or12 |
| 5.390E+01 | -35.362 | -30.167 | -26.623 | -43.488 | 3.000 | 31.140 | 1435.000 | or13 |
| 2.840E+01 | -19.518 | -13.465 | -9.099 | -27.190 | 3.000 | 27.710 | 2315.000 | or14 |
| 3.030E+01 | -41.518 | -37.630 | -34.578 | -46.818 | 3.000 | 25.810 | 2585.000 | or15 |
| 1.040E+00 | -24.452 | -9.442 | -2.885 | -42.202 | 3.000 | 15.600 | 150.000 | or16 |
| 2.930E+01 | -3.959 | 3.246 | 8.379 | -16.355 | 3.000 | 29.360 | 1435.000 | or17 |
| 2.301E+01 | -32.195 | -28.244 | -24.737 | -39.005 | 3.000 | 24.900 | 2315.000 | or18 |
| 7.430E+01 | 10.633 | 21.427 | 26.555 | -2.638 | 2.830 | 38.100 | 1328.000 | or19 |
| 9.290E+01 | -21.249 | -13.854 | -9.806 | -30.753 | 2.830 | 36.880 | 1328.000 | or20 |
| 6.160E+01 | 5.162 | 15.795 | 21.055 | -4.383 | 2.830 | 35.640 | 2206.000 | or21 |
| 3.380E+01 | 6.450 | 14.970 | 20.740 | -3.402 | 2.830 | 30.160 | 2426.000 | or22 |
| 1.451E+01 | 15.534 | 21.296 | 27.009 | 4.218 | 2.830 | 24.220 | 2547.000 | or23 |
| 1.466E+01 | 35.607 | 40.505 | 47.156 | 11.780 | 2.830 | 25.450 | 150.000 | or24 |
| 7.040E+01 | 1.918 | 11.364 | 16.690 | -10.483 | 2.830 | 36.670 | 1328.000 | or25 |
| 6.480E+01 | -24.367 | -17.809 | -13.627 | -31.744 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 6.68 | 16.3 | 22.3 | -8.18 | | | | |
| err-sd | 55.5 | 66.6 | 70.9 | 45.3 | | | | |

16 Cs

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.340E+03 | 5.299 | 4.918 | 4.649 | 3.836 | 3.000 | 33.750 | 1435.000 | or1 |
| 7.589E+02 | 7.069 | 6.857 | 6.681 | 5.221 | 3.000 | 20.180 | 150.000 | or2 |
| 1.428E+03 | 6.730 | 6.261 | 5.980 | 5.434 | 3.000 | 36.260 | 1435.000 | or3 |
| 1.231E+03 | 4.159 | 3.810 | 3.566 | 2.794 | 3.000 | 30.890 | 2315.000 | or4 |
| 8.893E+02 | 4.324 | 4.067 | 3.872 | 2.785 | 3.000 | 22.860 | 2585.000 | or5 |
| 6.569E+02 | 4.092 | 3.929 | 3.786 | 2.209 | 3.000 | 17.130 | 150.000 | or6 |
| 9.865E+02 | 7.140 | 6.855 | 6.638 | 5.420 | 3.000 | 25.830 | 315.000 | or7 |
| 1.269E+03 | 3.207 | 2.845 | 2.593 | 1.749 | 3.000 | 31.500 | 1435.000 | or8 |
| 1.095E+03 | 4.065 | 3.747 | 3.527 | 2.650 | 3.000 | 27.710 | 2315.000 | or9 |
| 1.162E+03 | 4.458 | 4.122 | 3.880 | 2.906 | 3.000 | 29.360 | 1435.000 | or10 |
| 1.531E+03 | 4.755 | 4.317 | 4.056 | 3.181 | 2.830 | 38.100 | 1328.000 | or11 |
| 1.436E+03 | 3.461 | 3.022 | 2.737 | 2.312 | 2.830 | 35.640 | 2206.000 | or12 |
| 1.222E+03 | 1.465 | 1.129 | 0.892 | 0.278 | 2.830 | 30.160 | 2426.000 | or13 |
| 9.565E+02 | 2.486 | 2.221 | 2.038 | 1.063 | 2.830 | 24.220 | 2547.000 | or14 |
| 8.992E+02 | 14.974 | 14.676 | 14.453 | 13.137 | 2.830 | 25.450 | 150.000 | or15 |
| 1.456E+03 | 5.549 | 5.179 | 4.904 | 4.018 | 2.830 | 36.670 | 1328.000 | or16 |
| err-avg | 5.20 | 4.87 | 4.64 | 3.69 | | | | |
| err-sd | 3.04 | 3.05 | 3.05 | 2.92 | | | | |

16 Eu

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.590E+01 | 65.907 | -5.444 | -3.089 | -29.189 | 3.000 | 33.750 | 1435.000 | or1 |
| 7.750E+00 | 100.645 | 23.394 | 28.568 | -4.581 | 3.000 | 20.180 | 150.000 | or2 |
| 2.490E+01 | 96.064 | 10.723 | 13.173 | -17.871 | 3.000 | 36.260 | 1435.000 | or3 |
| 2.110E+01 | 72.986 | -0.758 | 2.180 | -22.464 | 3.000 | 30.890 | 2315.000 | or4 |
| 1.180E+01 | 70.932 | 2.288 | 6.356 | -17.102 | 3.000 | 22.860 | 2585.000 | or5 |
| 5.460E+00 | 100.549 | 26.355 | 31.429 | -0.769 | 3.000 | 17.130 | 150.000 | or6 |
| 1.630E+01 | 57.791 | -5.890 | -2.699 | -29.080 | 3.000 | 25.830 | 315.000 | or7 |
| 2.430E+01 | 55.885 | -10.658 | -7.490 | -32.263 | 3.000 | 31.500 | 1435.000 | or8 |
| 1.970E+01 | 50.102 | -12.437 | -9.340 | -30.660 | 3.000 | 27.710 | 2315.000 | or9 |
| 2.070E+01 | 59.952 | -7.005 | -4.010 | -29.082 | 3.000 | 29.360 | 1435.000 | or10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.670E+01 | 102.434 | 12.472 | 14.794 | -17.303 | 2.830 | 38.100 | 1328.000 | or11 |
| 2.550E+01 | 89.020 | 5.686 | 8.118 | -19.373 | 2.830 | 35.640 | 2206.000 | or12 |
| 2.040E+01 | 75.147 | -0.343 | 2.647 | -21.814 | 2.830 | 30.160 | 2426.000 | or13 |
| 1.330E+01 | 74.812 | 3.158 | 7.068 | -17.218 | 2.830 | 24.220 | 2547.000 | or14 |
| 1.350E+01 | 90.519 | 12.593 | 16.370 | -15.333 | 2.830 | 25.450 | 150.000 | or15 |
| 2.840E+01 | 78.415 | -0.211 | 1.937 | -26.408 | 2.830 | 36.670 | 1328.000 | or16 |
| err-avg | 77.6 | 3.37 | 6.63 | -20.7 | | | | |
| err-sd | 17.2 | 11.3 | 11.9 | 9.00 | | | | |

26 TO

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.318E+04 | 0.442 | -0.240 | 0.996 | -2.705 | 3.000 | 21.170 | 150.000 | or1 |
| 2.185E+04 | 1.954 | 0.745 | 2.731 | -1.404 | 3.000 | 33.750 | 1435.000 | or2 |
| 2.286E+04 | 6.612 | 5.801 | 6.999 | 3.325 | 3.000 | 20.180 | 150.000 | or3 |
| 2.034E+04 | 1.180 | 0.066 | 2.101 | -3.978 | 3.000 | 35.100 | 315.000 | or4 |
| 2.104E+04 | 4.710 | 3.353 | 5.488 | 1.061 | 3.000 | 36.260 | 1435.000 | or5 |
| 2.160E+04 | 4.786 | 3.503 | 5.366 | 3.094 | 3.000 | 30.890 | 2315.000 | or6 |
| 2.074E+04 | 2.598 | 1.364 | 3.312 | 1.057 | 3.000 | 30.940 | 2315.000 | or7 |
| 2.384E+04 | 0.100 | -0.803 | 0.432 | -0.898 | 3.000 | 22.860 | 2585.000 | or8 |
| 2.491E+04 | 0.455 | -0.117 | 0.828 | -2.111 | 3.000 | 17.130 | 150.000 | or9 |
| 2.372E+04 | -3.215 | -3.965 | -2.746 | -6.656 | 3.000 | 22.700 | 150.000 | or10 |
| 2.354E+04 | -0.688 | -1.551 | -0.112 | -4.516 | 3.000 | 25.830 | 315.000 | or11 |
| 2.214E+04 | 1.801 | 0.713 | 2.441 | -1.414 | 3.000 | 31.500 | 1435.000 | or12 |
| 2.072E+04 | 2.470 | 1.299 | 3.253 | -0.774 | 3.000 | 31.140 | 1435.000 | or13 |
| 2.414E+04 | -4.546 | -5.495 | -4.051 | -5.826 | 3.000 | 27.710 | 2315.000 | or14 |
| 2.221E+04 | 0.141 | -0.796 | 0.733 | -0.849 | 3.000 | 25.810 | 2585.000 | or15 |
| 2.402E+04 | 2.938 | 2.380 | 3.200 | 0.617 | 3.000 | 15.600 | 150.000 | or16 |
| 2.261E+04 | 0.819 | -0.141 | 1.519 | -2.091 | 3.000 | 29.360 | 1435.000 | or17 |
| 2.212E+04 | 1.446 | 0.440 | 2.075 | 0.191 | 3.000 | 24.900 | 2315.000 | or18 |
| 2.002E+04 | 5.724 | 4.568 | 6.552 | 1.469 | 2.830 | 38.100 | 1328.000 | or19 |
| 1.774E+04 | 9.472 | 8.266 | 10.670 | 5.254 | 2.830 | 36.880 | 1328.000 | or20 |
| 1.944E+04 | 9.525 | 8.222 | 10.276 | 7.311 | 2.830 | 35.640 | 2206.000 | or21 |
| 1.947E+04 | 11.519 | 10.380 | 12.322 | 9.923 | 2.830 | 30.160 | 2426.000 | or22 |
| 2.052E+04 | 9.453 | 8.342 | 10.007 | 8.152 | 2.830 | 24.220 | 2547.000 | or23 |
| 2.174E+04 | 2.277 | 1.304 | 2.887 | -1.921 | 2.830 | 25.450 | 150.000 | or24 |
| 1.985E+04 | 7.072 | 5.677 | 7.934 | 2.741 | 2.830 | 36.670 | 1328.000 | or25 |
| 1.780E+04 | 12.040 | 10.624 | 12.919 | 9.982 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 3.50 | 2.46 | 4.16 | 0.732 | | | | |
| err-sd | 4.33 | 4.20 | 4.44 | 4.49 | | | | |

26 T2

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.785E+05 | -0.122 | -0.139 | -0.109 | -0.197 | 3.000 | 21.170 | 150.000 | or1 |
| 9.663E+05 | 0.096 | 0.069 | 0.113 | 0.020 | 3.000 | 33.750 | 1435.000 | or2 |
| 9.789E+05 | 0.257 | 0.238 | 0.266 | 0.180 | 3.000 | 20.180 | 150.000 | or3 |
| 9.639E+05 | -0.141 | -0.165 | -0.122 | -0.250 | 3.000 | 35.100 | 315.000 | or4 |
| 9.632E+05 | 0.186 | 0.156 | 0.203 | 0.106 | 3.000 | 36.260 | 1435.000 | or5 |
| 9.682E+05 | 0.251 | 0.223 | 0.264 | 0.214 | 3.000 | 30.890 | 2315.000 | or6 |
| 9.673E+05 | -0.006 | -0.033 | 0.009 | -0.039 | 3.000 | 30.940 | 2315.000 | or7 |
| 9.771E+05 | -0.028 | -0.050 | -0.020 | -0.053 | 3.000 | 22.860 | 2585.000 | or8 |
| 9.832E+05 | -0.019 | -0.033 | -0.010 | -0.084 | 3.000 | 17.130 | 150.000 | or9 |
| 9.778E+05 | -0.293 | -0.311 | -0.281 | -0.376 | 3.000 | 22.700 | 150.000 | or10 |
| 9.750E+05 | -0.068 | -0.089 | -0.054 | -0.160 | 3.000 | 25.830 | 315.000 | or11 |
| 9.685E+05 | 0.103 | 0.078 | 0.118 | 0.030 | 3.000 | 31.500 | 1435.000 | or12 |
| 9.675E+05 | -0.030 | -0.055 | -0.013 | -0.099 | 3.000 | 31.140 | 1435.000 | or13 |
| 9.735E+05 | -0.257 | -0.280 | -0.244 | -0.288 | 3.000 | 27.710 | 2315.000 | or14 |
| 9.731E+05 | -0.089 | -0.111 | -0.076 | -0.112 | 3.000 | 25.810 | 2585.000 | or15 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.835E+05 | 0.021 | 0.007 | 0.027 | -0.036 | 3.000 | 15.600 | 150.000 | or16 |
| 9.709E+05 | -0.012 | -0.034 | 0.004 | -0.080 | 3.000 | 29.360 | 1435.000 | or17 |
| 9.738E+05 | -0.039 | -0.062 | -0.025 | -0.068 | 3.000 | 24.900 | 2315.000 | or18 |
| 9.615E+05 | 0.171 | 0.147 | 0.188 | 0.083 | 2.830 | 38.100 | 1328.000 | or19 |
| 9.604E+05 | 0.206 | 0.184 | 0.228 | 0.128 | 2.830 | 36.880 | 1328.000 | or20 |
| 9.628E+05 | 0.359 | 0.332 | 0.374 | 0.314 | 2.830 | 35.640 | 2206.000 | or21 |
| 9.678E+05 | 0.511 | 0.488 | 0.527 | 0.479 | 2.830 | 30.160 | 2426.000 | or22 |
| 9.739E+05 | 0.363 | 0.340 | 0.375 | 0.336 | 2.830 | 24.220 | 2547.000 | or23 |
| 9.748E+05 | 0.041 | 0.019 | 0.054 | -0.053 | 2.830 | 25.450 | 150.000 | or24 |
| 9.628E+05 | 0.260 | 0.231 | 0.278 | 0.171 | 2.830 | 36.670 | 1328.000 | or25 |
| 9.637E+05 | 0.337 | 0.310 | 0.353 | 0.299 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | 0.791E-01 | 0.562E-01 | 0.934E-01 | 0.178E-01 | | | | |
| err-sd | 0.200 | 0.198 | 0.201 | 0.206 | | | | |

26 U2

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.720E+05 | -0.254 | -0.254 | -0.242 | -0.270 | 3.000 | 21.170 | 150.000 | or1 |
| 9.555E+05 | 0.025 | 0.023 | 0.043 | 0.006 | 3.000 | 33.750 | 1435.000 | or2 |
| 9.716E+05 | 0.144 | 0.142 | 0.153 | 0.127 | 3.000 | 20.180 | 150.000 | or3 |
| 9.558E+05 | -0.364 | -0.369 | -0.352 | -0.402 | 3.000 | 35.100 | 315.000 | or4 |
| 9.524E+05 | 0.065 | 0.060 | 0.080 | 0.040 | 3.000 | 36.260 | 1435.000 | or5 |
| 9.579E+05 | 0.184 | 0.184 | 0.201 | 0.182 | 3.000 | 30.890 | 2315.000 | or6 |
| 9.584E+05 | -0.073 | -0.073 | -0.056 | -0.074 | 3.000 | 30.940 | 2315.000 | or7 |
| 9.688E+05 | -0.108 | -0.106 | -0.094 | -0.100 | 3.000 | 22.860 | 2585.000 | or8 |
| 9.764E+05 | -0.090 | -0.088 | -0.080 | -0.099 | 3.000 | 17.130 | 150.000 | or9 |
| 9.714E+05 | -0.472 | -0.472 | -0.460 | -0.493 | 3.000 | 22.700 | 150.000 | or10 |
| 9.662E+05 | -0.170 | -0.172 | -0.158 | -0.194 | 3.000 | 25.830 | 315.000 | or11 |
| 9.580E+05 | 0.053 | 0.051 | 0.068 | 0.034 | 3.000 | 31.500 | 1435.000 | or12 |
| 9.583E+05 | -0.073 | -0.076 | -0.059 | -0.092 | 3.000 | 31.140 | 1435.000 | or13 |
| 9.636E+05 | -0.288 | -0.286 | -0.271 | -0.284 | 3.000 | 27.710 | 2315.000 | or14 |
| 9.646E+05 | -0.111 | -0.108 | -0.094 | -0.105 | 3.000 | 25.810 | 2585.000 | or15 |
| 9.779E+05 | -0.055 | -0.055 | -0.049 | -0.063 | 3.000 | 15.600 | 150.000 | or16 |
| 9.609E+05 | -0.075 | -0.075 | -0.058 | -0.089 | 3.000 | 29.360 | 1435.000 | or17 |
| 9.656E+05 | -0.072 | -0.072 | -0.056 | -0.069 | 3.000 | 24.900 | 2315.000 | or18 |
| 9.504E+05 | 0.016 | 0.014 | 0.031 | -0.010 | 2.830 | 38.100 | 1328.000 | or19 |
| 9.510E+05 | 0.094 | 0.092 | 0.111 | 0.071 | 2.830 | 36.880 | 1328.000 | or20 |
| 9.523E+05 | 0.200 | 0.200 | 0.217 | 0.194 | 2.830 | 35.640 | 2206.000 | or21 |
| 9.582E+05 | 0.370 | 0.373 | 0.390 | 0.373 | 2.830 | 30.160 | 2426.000 | or22 |
| 9.657E+05 | 0.232 | 0.235 | 0.249 | 0.240 | 2.830 | 24.220 | 2547.000 | or23 |
| 9.663E+05 | -0.091 | -0.093 | -0.078 | -0.116 | 2.830 | 25.450 | 150.000 | or24 |
| 9.516E+05 | 0.139 | 0.134 | 0.154 | 0.114 | 2.830 | 36.670 | 1328.000 | or25 |
| 9.548E+05 | 0.230 | 0.230 | 0.247 | 0.226 | 2.830 | 32.900 | 2206.000 | or26 |
| err-avg | -0.209E-01 | -0.217E-01 | -0.622E-02 | -0.328E-01 | | | | |
| err-sd | 0.196 | 0.196 | 0.197 | 0.200 | | | | |

## A.5. Relative Errors of the Calculated Compositions for 38 Nuclides Using SAS2H with 27, 44 and 238 g and SWAT with 107 g

25 U-234

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.550E+02 | 0.645 | -0.645 | -0.645 | 0.129 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.420E+02 | -10.563 | -12.676 | -13.380 | -12.113 | 3.400 | 30.390 | 138.940 | ya2 |
| 1.190E+02 | 3.361 | 1.681 | 0.840 | 2.269 | 3.400 | 31.330 | 57.660 | ya3 |
| 1.440E+02 | 2.083 | 0.694 | 0.000 | 1.042 | 3.400 | 20.190 | 17.020 | ya4 |
| 1.140E+02 | 7.018 | 4.386 | 4.386 | 5.351 | 3.400 | 32.030 | 138.940 | ya5 |
| 1.150E+02 | 6.957 | 5.217 | 4.348 | 5.652 | 3.400 | 31.410 | 57.660 | ya6 |
| 1.180E+02 | -3.390 | -5.085 | -5.932 | -4.407 | 3.400 | 35.970 | 138.940 | ya7 |
| 1.200E+02 | -3.333 | -5.833 | -5.833 | -4.750 | 3.400 | 35.260 | 57.660 | ya8 |
| 2.670E+02 | -4.494 | -5.243 | -5.618 | -4.607 | 3.208 | 8.300 | -1.000 | mi1 |
| 1.740E+02 | 6.897 | 4.598 | 4.023 | 3.563 | 3.210 | 32.200 | -1.000 | mi2 |
| 1.740E+02 | 4.598 | 2.299 | 1.724 | 0.977 | 3.210 | 33.710 | -1.000 | mi3 |
| 1.321E+02 | 4.466 | 1.438 | 1.438 | 3.634 | 2.556 | 30.720 | 167.600 | mi4 |
| 1.321E+02 | 4.466 | 2.195 | 1.438 | 4.088 | 2.556 | 30.510 | 167.000 | mi5 |
| 1.225E+02 | 11.020 | 7.755 | 7.755 | 10.041 | 2.556 | 31.560 | 167.000 | mi6 |
| 1.131E+02 | 21.132 | 17.595 | 16.711 | 19.894 | 2.556 | 31.260 | 167.600 | mi7 |
| 1.320E+02 | 3.030 | 0.758 | 0.000 | 2.652 | 2.556 | 31.310 | 167.000 | mi8 |
| 1.815E+02 | 0.826 | -1.377 | -1.928 | -0.110 | 3.038 | 27.350 | 13.200 | mi9 |
| 1.588E+02 | -0.504 | -3.023 | -3.652 | -1.763 | 3.038 | 37.120 | 27.700 | tr1 |
| 1.362E+02 | 4.258 | 1.322 | 0.587 | 2.643 | 3.038 | 44.340 | 165.220 | tr2 |
| 1.588E+02 | 14.610 | 12.720 | 12.091 | 13.980 | 2.720 | 18.680 | 9.100 | tr3 |
| 1.373E+02 | 17.261 | 14.348 | 14.348 | 16.315 | 2.720 | 26.620 | 24.500 | tr4 |
| 1.362E+02 | 7.195 | 4.258 | 3.524 | 5.727 | 2.720 | 33.170 | 161.900 | tr5 |
| 1.736E+02 | -21.083 | -23.963 | -23.963 | -22.408 | 2.453 | 31.400 | 11.280 | tr6 |
| 1.441E+02 | -13.255 | -16.031 | -16.725 | -14.851 | 2.453 | 37.270 | 19.920 | tr7 |
| 8.497E+01 | 29.457 | 23.573 | 23.573 | 25.809 | 2.453 | 46.460 | 161.210 | tr8 |
| err-avg | 3.71 | 1.24 | 0.764 | 2.35 | | | | |
| err-sd | 10.6 | 10.1 | 10.1 | 10.4 | | | | |

55 U-235

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.980E+04 | -1.010 | -1.010 | -0.505 | 0.859 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.260E+04 | -7.143 | -7.143 | -5.556 | -2.381 | 3.400 | 30.390 | 138.940 | ya2 |
| 1.190E+04 | -5.882 | -5.882 | -4.202 | -0.840 | 3.400 | 31.330 | 57.660 | ya3 |
| 1.720E+04 | -2.326 | -2.326 | -1.744 | 0.058 | 3.400 | 20.190 | 17.020 | ya4 |
| 1.180E+04 | -6.780 | -6.780 | -4.237 | -1.525 | 3.400 | 32.030 | 138.940 | ya5 |
| 1.190E+04 | -5.882 | -6.723 | -4.202 | -1.176 | 3.400 | 31.410 | 57.660 | ya6 |
| 9.780E+03 | -2.965 | -3.272 | -0.204 | 3.681 | 3.400 | 35.970 | 138.940 | ya7 |
| 9.840E+03 | -2.033 | -2.337 | 0.610 | 4.472 | 3.400 | 35.260 | 57.660 | ya8 |
| 2.390E+04 | -2.092 | -2.092 | -2.092 | -1.548 | 3.208 | 8.300 | -1.000 | mi1 |
| 2.520E+04 | -1.984 | -1.587 | -1.587 | -1.310 | 3.208 | 6.900 | -1.000 | mi2 |
| 1.850E+04 | -4.865 | -4.324 | -4.324 | -3.676 | 3.203 | 15.360 | -1.000 | mi3 |
| 1.450E+04 | -4.138 | -4.138 | -2.759 | -2.759 | 3.203 | 21.290 | -1.000 | mi4 |
| 1.840E+04 | -1.630 | -1.630 | -1.087 | -0.652 | 3.203 | 14.660 | -1.000 | mi5 |
| 9.790E+03 | -4.188 | -4.086 | -2.451 | -2.983 | 3.210 | 29.500 | -1.000 | mi6 |
| 9.070E+03 | -8.931 | -8.710 | -6.725 | -7.641 | 3.210 | 32.200 | -1.000 | mi7 |
| 7.890E+03 | -3.676 | -3.676 | -1.394 | -2.573 | 3.210 | 33.710 | -1.000 | mi8 |
| 8.040E+03 | -4.353 | -3.731 | -1.244 | -2.276 | 3.210 | 34.320 | -1.000 | mi9 |
| 2.662E+04 | 1.052 | 1.052 | 1.427 | 1.803 | 3.897 | 12.040 | 79.200 | tr1 |
| 1.728E+04 | 2.431 | 3.009 | 3.588 | 3.704 | 3.130 | 15.380 | 158.500 | tr2 |
| 1.661E+04 | 4.154 | 4.154 | 5.358 | 5.298 | 3.130 | 15.900 | 79.200 | tr3 |
| 2.017E+04 | 0.645 | 1.140 | 1.140 | 1.587 | 3.130 | 11.530 | 26.400 | tr4 |
| 1.946E+04 | -0.308 | 0.206 | 0.719 | 0.874 | 3.130 | 12.860 | 237.700 | tr5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.436E+04 | 1.671 | 1.671 | 3.064 | 2.994 | 3.130 | 20.600 | 211.300 | tr6 |
| 1.248E+04 | 3.365 | 3.365 | 4.968 | 5.048 | 3.130 | 23.720 | 158.500 | tr7 |
| 1.235E+04 | 1.215 | 1.215 | 2.834 | 2.753 | 3.130 | 4.300 | 79.200 | tr8 |
| 1.291E+04 | -0.852 | -0.852 | 0.697 | 1.007 | 3.130 | 23.870 | 158.500 | tr9 |
| 1.221E+04 | 1.556 | 1.556 | 3.194 | 2.948 | 3.130 | 24.550 | 79.200 | tr10 |
| 1.282E+04 | -0.156 | -0.156 | 1.404 | 1.482 | 3.130 | 23.930 | 158.500 | tr11 |
| 1.225E+04 | 2.041 | 2.041 | 2.857 | 3.347 | 3.130 | 24.360 | 79.200 | tr12 |
| 1.297E+04 | -2.853 | -2.853 | -1.311 | -1.157 | 3.130 | 24.330 | 158.500 | tr13 |
| 1.231E+04 | 1.543 | 1.543 | 3.168 | 3.087 | 3.130 | 24.310 | 79.200 | tr14 |
| 5.865E+03 | -6.394 | -5.882 | -3.495 | -5.934 | 2.556 | 30.720 | 167.600 | tu1 |
| 5.676E+03 | -2.044 | -1.691 | 0.951 | -1.621 | 2.556 | 30.510 | 167.000 | tu2 |
| 5.584E+03 | -6.160 | -5.802 | -3.116 | -5.892 | 2.556 | 31.560 | 167.000 | tu3 |
| 5.509E+03 | -3.249 | -3.431 | -0.163 | -2.941 | 2.556 | 31.260 | 167.600 | tu4 |
| 5.662E+03 | -6.217 | -5.864 | -3.214 | -5.828 | 2.556 | 31.310 | 167.000 | tu5 |
| 9.610E+03 | -5.515 | -5.515 | -4.058 | -3.861 | 3.038 | 27.350 | 13.200 | ca1 |
| 5.866E+03 | -8.456 | -8.796 | -6.069 | -6.955 | 3.038 | 37.120 | 27.700 | ca2 |
| 4.016E+03 | -9.363 | -9.612 | -5.627 | -7.395 | 3.038 | 44.340 | 165.220 | ca3 |
| 1.163E+04 | -1.978 | -1.118 | -0.258 | -0.172 | 2.720 | 18.680 | 9.100 | ca4 |
| 7.874E+03 | -4.242 | -4.115 | -2.464 | -2.515 | 2.720 | 26.620 | 24.500 | ca5 |
| 5.423E+03 | -2.268 | -1.899 | 0.682 | 0.240 | 2.720 | 33.170 | 161.900 | ca6 |
| 4.379E+03 | -5.915 | -5.915 | -2.261 | -8.016 | 2.453 | 31.400 | 11.280 | ca7 |
| 3.075E+03 | -11.220 | -11.220 | -6.341 | -14.732 | 2.453 | 37.270 | 19.920 | ca8 |
| 1.595E+03 | -10.345 | -9.718 | -1.567 | -14.357 | 2.453 | 46.460 | 161.210 | ca9 |
| 1.214E+04 | 0.494 | 0.494 | 1.318 | -1.483 | 2.561 | 16.020 | 11.000 | ro1 |
| 8.180E+03 | 1.100 | 1.222 | 2.934 | -3.289 | 2.561 | 23.810 | 26.000 | ro2 |
| 7.011E+03 | -5.149 | -5.149 | -2.296 | -10.441 | 2.561 | 28.470 | 199.000 | ro3 |
| 5.514E+03 | 3.011 | 3.555 | 6.819 | -3.954 | 2.561 | 31.660 | 226.000 | ro4 |
| 1.095E+04 | -2.283 | -2.283 | -0.457 | -1.553 | 3.130 | 25.930 | -1.000 | ob1 |
| 1.058E+04 | -1.701 | -1.701 | 0.189 | -1.134 | 3.130 | 26.540 | -1.000 | ob2 |
| 9.850E+03 | -1.421 | -1.117 | 0.406 | -0.832 | 3.130 | 27.990 | -1.000 | ob3 |
| 9.680E+03 | -1.653 | -1.240 | 0.310 | -0.992 | 3.130 | 28.400 | -1.000 | ob4 |
| 9.580E+03 | -3.653 | -3.236 | -1.670 | -2.985 | 3.130 | 29.040 | -1.000 | ob5 |
| 9.180E+03 | -1.743 | -1.307 | 0.327 | -1.111 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -2.74 | -2.61 | -0.722 | -1.73 | | | | |
| err-sd | 3.59 | 3.63 | 3.06 | 4.28 | | | | |

55 U-236

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.880E+03 | -0.347 | -0.347 | -1.042 | -5.764 | 3.400 | 15.950 | 220.220 | ya1 |
| 4.080E+03 | 1.225 | 1.225 | 0.490 | -4.461 | 3.400 | 30.390 | 138.940 | ya2 |
| 4.150E+03 | 0.723 | 0.723 | 0.241 | -4.747 | 3.400 | 31.330 | 57.660 | ya3 |
| 3.300E+03 | 0.909 | 0.909 | 0.000 | -4.576 | 3.400 | 20.190 | 17.020 | ya4 |
| 4.180E+03 | 0.957 | 0.957 | 0.239 | -4.617 | 3.400 | 32.030 | 138.940 | ya5 |
| 4.090E+03 | 2.445 | 2.445 | 1.711 | -3.227 | 3.400 | 31.410 | 57.660 | ya6 |
| 4.450E+03 | -0.674 | -0.674 | -1.348 | -6.270 | 3.400 | 35.970 | 138.940 | ya7 |
| 4.440E+03 | -1.126 | -1.126 | -1.802 | -6.644 | 3.400 | 35.260 | 57.660 | ya8 |
| 1.650E+03 | 6.061 | 6.061 | 5.455 | 0.606 | 3.208 | 8.300 | -1.000 | mi1 |
| 1.460E+03 | 5.479 | 4.795 | 4.795 | -0.342 | 3.208 | 6.900 | -1.000 | mi2 |
| 2.650E+03 | -0.377 | -0.755 | -1.132 | -5.811 | 3.203 | 15.360 | -1.000 | mi3 |
| 3.270E+03 | -0.306 | -0.612 | -0.917 | -5.505 | 3.203 | 21.290 | -1.000 | mi4 |
| 2.660E+03 | -4.135 | -4.135 | -4.887 | -9.286 | 3.203 | 14.660 | -1.000 | mi5 |
| 3.830E+03 | 6.789 | 6.527 | 6.266 | 2.063 | 3.210 | 29.500 | -1.000 | mi6 |
| 4.000E+03 | 6.000 | 5.750 | 5.500 | 1.375 | 3.210 | 32.200 | -1.000 | mi7 |
| 4.180E+03 | 3.110 | 3.110 | 2.632 | -1.172 | 3.210 | 33.710 | -1.000 | mi8 |
| 4.200E+03 | 2.857 | 2.857 | 2.619 | -1.571 | 3.210 | 34.320 | -1.000 | mi9 |
| 2.736E+03 | -10.088 | -10.088 | -10.819 | -15.132 | 3.897 | 12.040 | 79.200 | tr1 |
| 2.834E+03 | -7.198 | -7.551 | -8.257 | -12.385 | 3.130 | 15.380 | 158.500 | tr2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.739E+03 | -2.154 | -2.154 | -2.884 | -7.229 | 3.130 | 15.900 | 79.200 | tr3 |
| 2.502E+03 | -14.069 | -14.069 | -14.868 | -18.665 | 3.130 | 11.530 | 26.400 | tr4 |
| 2.453E+03 | -5.014 | -5.422 | -5.830 | -10.273 | 3.130 | 12.860 | 237.700 | tr5 |
| 3.317E+03 | -4.733 | -5.035 | -5.638 | -9.888 | 3.130 | 20.600 | 211.300 | tr6 |
| 3.610E+03 | -5.263 | -5.540 | -6.371 | -10.416 | 3.130 | 23.720 | 158.500 | tr7 |
| 3.638E+03 | -4.893 | -4.893 | -5.717 | -9.786 | 3.130 | 4.300 | 79.200 | tr8 |
| 3.520E+03 | -2.557 | -2.841 | -3.693 | -7.813 | 3.130 | 23.870 | 158.500 | tr9 |
| 3.540E+03 | -1.695 | -1.695 | -2.542 | -6.808 | 3.130 | 24.550 | 79.200 | tr10 |
| 3.753E+03 | -8.606 | -8.606 | -9.406 | -13.429 | 3.130 | 23.930 | 158.500 | tr11 |
| 3.465E+03 | 0.144 | -0.144 | -1.010 | -5.166 | 3.130 | 24.360 | 79.200 | tr12 |
| 3.471E+03 | -0.317 | -0.317 | -1.181 | -5.589 | 3.130 | 24.330 | 158.500 | tr13 |
| 3.569E+03 | -3.054 | -3.054 | -3.895 | -8.069 | 3.130 | 24.310 | 79.200 | tr14 |
| 3.254E+03 | 2.950 | 2.950 | 2.336 | -1.291 | 2.556 | 30.720 | 167.600 | tu1 |
| 3.255E+03 | 2.611 | 2.611 | 2.304 | -1.536 | 2.556 | 30.510 | 167.000 | tu2 |
| 3.174E+03 | 6.490 | 6.490 | 5.860 | 2.079 | 2.556 | 31.560 | 167.000 | tu3 |
| 3.156E+03 | 6.781 | 6.781 | 6.147 | 2.345 | 2.556 | 31.260 | 167.600 | tu4 |
| 3.252E+03 | 3.629 | 3.629 | 3.321 | -0.615 | 2.556 | 31.310 | 167.000 | tu5 |
| 3.562E+03 | 3.032 | 3.032 | 2.471 | -1.544 | 3.038 | 27.350 | 13.200 | ca1 |
| 4.005E+03 | 2.871 | 2.871 | 2.622 | -1.323 | 3.038 | 37.120 | 27.700 | ca2 |
| 4.187E+03 | 1.743 | 1.743 | 1.743 | -2.221 | 3.038 | 44.340 | 165.220 | ca3 |
| 2.837E+03 | -0.599 | -0.952 | -1.304 | -5.393 | 2.720 | 18.680 | 9.100 | ca4 |
| 3.392E+03 | -0.354 | -0.649 | -0.943 | -4.776 | 2.720 | 26.620 | 24.500 | ca5 |
| 3.699E+03 | -1.325 | -1.325 | -1.595 | -5.407 | 2.720 | 33.170 | 161.900 | ca6 |
| 3.245E+03 | 1.695 | 1.695 | 1.387 | -1.818 | 2.453 | 31.400 | 11.280 | ca7 |
| 3.438E+03 | -0.524 | -0.814 | -0.814 | -3.956 | 2.453 | 37.270 | 19.920 | ca8 |
| 3.449E+03 | -0.261 | -0.551 | 0.029 | -3.682 | 2.453 | 46.460 | 161.210 | ca9 |
| 2.485E+03 | -1.408 | -1.811 | -2.213 | -5.594 | 2.561 | 16.020 | 11.000 | ro1 |
| 3.109E+03 | -2.219 | -2.219 | -2.863 | -5.886 | 2.561 | 23.810 | 26.000 | ro2 |
| 3.199E+03 | 2.219 | 2.219 | 1.594 | -1.751 | 2.561 | 28.470 | 199.000 | ro3 |
| 3.404E+03 | -0.411 | -0.411 | -0.999 | -4.377 | 2.561 | 31.660 | 226.000 | ro4 |
| 3.590E+03 | 1.393 | 1.114 | 0.836 | -3.677 | 3.130 | 25.930 | -1.000 | ob1 |
| 3.620E+03 | 1.657 | 1.657 | 1.105 | -3.287 | 3.130 | 26.540 | -1.000 | ob2 |
| 3.700E+03 | 2.162 | 1.892 | 1.622 | -2.865 | 3.130 | 27.990 | -1.000 | ob3 |
| 3.730E+03 | 1.877 | 1.877 | 1.340 | -2.976 | 3.130 | 28.400 | -1.000 | ob4 |
| 3.750E+03 | 2.400 | 2.400 | 1.867 | -2.480 | 3.130 | 29.040 | -1.000 | ob5 |
| 3.810E+03 | 1.575 | 1.575 | 1.050 | -3.281 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -0.350E-01 | -0.144 | -0.662 | -4.83 | | | | |
| err-sd | 4.13 | 4.14 | 4.24 | 4.24 | | | | |

49 U-238

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.490E+05 | 0.421 | 0.421 | 0.421 | 0.411 | 3.400 | 15.950 | 220.220 | ya1 |
| 9.370E+05 | 0.427 | 0.427 | 0.320 | 0.299 | 3.400 | 30.390 | 138.940 | ya2 |
| 9.350E+05 | 0.535 | 0.535 | 0.535 | 0.449 | 3.400 | 31.330 | 57.660 | ya3 |
| 9.360E+05 | 1.496 | 1.496 | 1.496 | 1.442 | 3.400 | 20.190 | 17.020 | ya4 |
| 9.350E+05 | 0.428 | 0.535 | 0.428 | 0.353 | 3.400 | 32.030 | 138.940 | ya5 |
| 9.360E+05 | 0.427 | 0.427 | 0.427 | 0.331 | 3.400 | 31.410 | 57.660 | ya6 |
| 9.330E+05 | 0.322 | 0.322 | 0.214 | 0.161 | 3.400 | 35.970 | 138.940 | ya7 |
| 9.340E+05 | 0.321 | 0.321 | 0.214 | 0.161 | 3.400 | 35.260 | 57.660 | ya8 |
| 9.620E+05 | 0.000 | 0.000 | 0.000 | 0.042 | 3.208 | 8.300 | -1.000 | mi1 |
| 9.620E+05 | 0.104 | 0.104 | 0.104 | 0.104 | 3.208 | 6.900 | -1.000 | mi2 |
| 9.560E+05 | 0.105 | 0.105 | 0.105 | 0.188 | 3.203 | 15.360 | -1.000 | mi3 |
| 9.520E+05 | 0.000 | 0.000 | 0.000 | 0.116 | 3.203 | 21.290 | -1.000 | mi4 |
| 9.570E+05 | 0.104 | 0.104 | 0.104 | 0.146 | 3.203 | 14.660 | -1.000 | mi5 |
| 9.470E+05 | -0.106 | -0.106 | -0.106 | 0.021 | 3.210 | 29.500 | -1.000 | mi6 |
| 9.440E+05 | 0.000 | 0.000 | 0.000 | 0.074 | 3.210 | 32.200 | -1.000 | mi7 |
| 9.440E+05 | -0.106 | -0.106 | -0.212 | -0.042 | 3.210 | 33.710 | -1.000 | mi8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.420E+05 | -0.106 | 0.000 | -0.106 | 0.032 | 3.210 | 34.320 | -1.000 | mi9 |
| 9.513E+05 | 0.074 | 0.074 | 0.074 | 0.105 | 3.897 | 12.040 | 79.200 | tr1 |
| 9.558E+05 | 0.021 | 0.021 | 0.021 | 0.052 | 3.130 | 15.380 | 158.500 | tr2 |
| 9.558E+05 | 0.021 | 0.021 | 0.021 | 0.031 | 3.130 | 15.900 | 79.200 | tr3 |
| 9.595E+05 | -0.052 | -0.052 | -0.052 | 0.031 | 3.130 | 11.530 | 26.400 | tr4 |
| 9.587E+05 | -0.073 | -0.073 | -0.073 | -0.031 | 3.130 | 12.860 | 237.700 | tr5 |
| 9.518E+05 | 0.021 | 0.021 | -0.084 | 0.011 | 3.130 | 20.600 | 211.300 | tr6 |
| 9.493E+05 | -0.032 | -0.032 | -0.032 | 0.000 | 3.130 | 23.720 | 158.500 | tr7 |
| 9.492E+05 | -0.021 | -0.021 | -0.126 | -0.011 | 3.130 | 4.300 | 79.200 | tr8 |
| 9.492E+05 | -0.021 | -0.021 | -0.021 | 0.000 | 3.130 | 23.870 | 158.500 | tr9 |
| 9.483E+05 | -0.032 | 0.074 | -0.032 | 0.063 | 3.130 | 24.550 | 79.200 | tr10 |
| 9.485E+05 | 0.053 | 0.053 | -0.053 | 0.063 | 3.130 | 23.930 | 158.500 | tr11 |
| 9.482E+05 | 0.084 | 0.084 | -0.021 | 0.084 | 3.130 | 24.360 | 79.200 | tr12 |
| 9.486E+05 | -0.063 | 0.042 | -0.063 | 0.021 | 3.130 | 24.330 | 158.500 | tr13 |
| 9.472E+05 | 0.190 | 0.190 | 0.084 | 0.201 | 3.130 | 24.310 | 79.200 | tr14 |
| 9.502E+05 | -0.126 | -0.126 | -0.126 | -0.011 | 2.556 | 30.720 | 167.600 | tu1 |
| 9.506E+05 | -0.168 | -0.063 | -0.168 | -0.032 | 2.556 | 30.510 | 167.000 | tu2 |
| 9.495E+05 | -0.158 | -0.053 | -0.158 | -0.021 | 2.556 | 31.560 | 167.000 | tu3 |
| 9.499E+05 | -0.095 | -0.095 | -0.095 | -0.032 | 2.556 | 31.260 | 167.600 | tu4 |
| 9.498E+05 | -0.084 | -0.084 | -0.084 | -0.021 | 2.556 | 31.310 | 167.000 | tu5 |
| 9.559E+05 | -0.617 | -0.617 | -0.617 | -0.554 | 3.038 | 27.350 | 13.200 | ca1 |
| 9.448E+05 | -0.402 | -0.296 | -0.402 | -0.275 | 3.038 | 37.120 | 27.700 | ca2 |
| 9.359E+05 | -0.203 | -0.096 | -0.203 | -0.064 | 3.038 | 44.340 | 165.220 | ca3 |
| 9.702E+05 | -1.154 | -1.154 | -1.154 | -1.093 | 2.720 | 18.680 | 9.100 | ca4 |
| 9.687E+05 | -1.724 | -1.621 | -1.724 | -1.600 | 2.720 | 26.620 | 24.500 | ca5 |
| 9.556E+05 | -1.005 | -0.900 | -1.005 | -0.889 | 2.720 | 33.170 | 161.900 | ca6 |
| 9.582E+05 | -0.751 | -0.751 | -0.751 | -0.657 | 2.453 | 31.400 | 11.280 | ca7 |
| 9.573E+05 | -1.285 | -1.285 | -1.285 | -1.149 | 2.453 | 37.270 | 19.920 | ca8 |
| 9.385E+05 | -0.266 | -0.266 | -0.266 | -0.170 | 2.453 | 46.460 | 161.210 | ca9 |
| 9.609E+05 | 0.114 | 0.114 | 0.114 | 0.219 | 2.561 | 16.020 | 11.000 | ro1 |
| 9.609E+05 | -0.614 | -0.614 | -0.614 | -0.447 | 2.561 | 23.810 | 26.000 | ro2 |
| 9.462E+05 | 0.507 | 0.507 | 0.402 | 0.624 | 2.561 | 28.470 | 199.000 | ro3 |
| 9.553E+05 | -0.764 | -0.764 | -0.869 | -0.649 | 2.561 | 31.660 | 226.000 | ro4 |
| err-avg | -0.868E-01 | -0.653E-01 | -0.111 | -0.391E-01 | | | | |
| err-sd | 0.515 | 0.506 | 0.508 | 0.472 | | | | |

13 Np-237

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.041E+02 | 18.053 | 6.215 | 3.256 | -2.664 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.039E+02 | 28.745 | 15.870 | 11.909 | 7.650 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.310E+02 | 19.586 | 7.533 | 3.390 | 0.640 | 3.038 | 44.340 | 165.220 | ya3 |
| 1.979E+02 | 10.662 | -1.465 | -3.487 | -10.814 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.395E+02 | 2.504 | -8.100 | -10.751 | -15.670 | 2.720 | 26.620 | 24.500 | ya5 |
| 3.877E+02 | 18.133 | 6.010 | 2.657 | -1.625 | 2.720 | 33.170 | 161.900 | ya6 |
| 2.960E+02 | 32.770 | 18.243 | 14.865 | 7.365 | 2.453 | 31.400 | 11.280 | ya7 |
| 3.636E+02 | 29.813 | 15.787 | 12.211 | 5.831 | 2.453 | 37.270 | 19.920 | ya8 |
| 4.280E+02 | 35.748 | 20.327 | 16.355 | 11.636 | 2.453 | 46.460 | 161.210 | mi1 |
| 1.759E+02 | 5.742 | -6.765 | -8.471 | -19.500 | 2.561 | 16.020 | 11.000 | mi2 |
| 2.950E+02 | 5.424 | -6.102 | -8.136 | -16.814 | 2.561 | 23.810 | 26.000 | mi3 |
| 3.449E+02 | 14.236 | 2.059 | -0.841 | -8.524 | 2.561 | 28.470 | 199.000 | mi4 |
| 3.778E+02 | 18.317 | 6.141 | 2.700 | -4.685 | 2.561 | 31.660 | 226.000 | mi5 |
| err-avg | 18.4 | 5.83 | 2.74 | -3.63 | | | | |
| err-sd | 10.8 | 9.70 | 9.06 | 10.2 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.730E+01 | -13.319 | -20.719 | -20.930 | -26.575 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.760E+02 | 4.545 | -3.409 | -3.977 | -7.784 | 3.400 | 30.390 | 138.940 | ya2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.140E+02 | -10.748 | -17.757 | -18.224 | -21.449 | 3.400 | 31.330 | 57.660 | ya3 |
| 7.910E+01 | -12.010 | -19.090 | -19.216 | -23.881 | 3.400 | 20.190 | 17.020 | ya4 |
| 2.220E+02 | -9.009 | -15.766 | -16.216 | -19.550 | 3.400 | 32.030 | 138.940 | ya5 |
| 2.110E+02 | -9.005 | -16.114 | -16.588 | -19.905 | 3.400 | 31.410 | 57.660 | ya6 |
| 2.470E+02 | 4.453 | -3.239 | -4.049 | -7.328 | 3.400 | 35.970 | 138.940 | ya7 |
| 2.400E+02 | 2.083 | -5.417 | -6.250 | -9.625 | 3.400 | 35.260 | 57.660 | ya8 |
| 4.510E+00 | 9.534 | 0.887 | 0.443 | -20.177 | 3.208 | 8.300 | -1.000 | mi1 |
| 3.410E+00 | 5.279 | -2.933 | -3.519 | -22.727 | 3.208 | 6.900 | -1.000 | mi2 |
| 2.590E+01 | -8.494 | -14.672 | -15.058 | -29.884 | 3.203 | 15.360 | -1.000 | mi3 |
| 5.720E+01 | -5.245 | -11.014 | -11.364 | -25.210 | 3.203 | 21.290 | -1.000 | mi4 |
| 2.680E+01 | -23.507 | -29.104 | -29.104 | -41.679 | 3.203 | 14.660 | -1.000 | mi5 |
| 1.310E+02 | -5.344 | -10.687 | -11.450 | -28.626 | 3.210 | 29.500 | -1.000 | mi6 |
| 1.590E+02 | -3.774 | -9.434 | -10.063 | -26.855 | 3.210 | 32.200 | -1.000 | mi7 |
| 1.680E+02 | -1.190 | -6.548 | -7.143 | -24.583 | 3.210 | 33.710 | -1.000 | mi8 |
| 1.860E+02 | -1.613 | -6.989 | -7.527 | -24.140 | 3.210 | 34.320 | -1.000 | mi9 |
| 1.365E+02 | 8.425 | 1.832 | 0.366 | -12.381 | 2.556 | 30.720 | 167.600 | tr1 |
| 1.360E+02 | 7.353 | 0.735 | -0.735 | -13.309 | 2.556 | 30.510 | 167.000 | tr2 |
| 1.426E+02 | 9.397 | 3.086 | 1.683 | -11.290 | 2.556 | 31.560 | 167.000 | tr3 |
| 1.382E+02 | 10.709 | 4.197 | 2.750 | -10.203 | 2.556 | 31.260 | 167.600 | tr4 |
| 1.372E+02 | 12.245 | 4.956 | 4.227 | -9.257 | 2.556 | 31.310 | 167.000 | tr5 |
| 1.146E+02 | -3.141 | -9.250 | -10.122 | -19.948 | 3.038 | 27.350 | 13.200 | tr6 |
| 2.144E+02 | -0.187 | -6.250 | -7.183 | -15.951 | 3.038 | 37.120 | 27.700 | tr7 |
| 3.052E+02 | 0.262 | -5.636 | -6.619 | -14.286 | 3.038 | 44.340 | 165.220 | tr8 |
| 5.503E+01 | -17.681 | -23.315 | -23.678 | -34.472 | 2.720 | 18.680 | 9.100 | tr9 |
| 1.099E+02 | -7.188 | -12.739 | -13.376 | -23.758 | 2.720 | 26.620 | 24.500 | tr10 |
| 1.683E+02 | -0.772 | -6.714 | -7.308 | -17.231 | 2.720 | 33.170 | 161.900 | tr11 |
| 1.618E+02 | -0.494 | -6.675 | -7.293 | -18.727 | 2.453 | 31.400 | 11.280 | tr12 |
| 2.209E+02 | 0.045 | -6.292 | -7.198 | -17.655 | 2.453 | 37.270 | 19.920 | tr13 |
| 3.224E+02 | -1.985 | -7.878 | -8.499 | -17.866 | 2.453 | 46.460 | 161.210 | tr14 |
| 3.211E+01 | 0.592 | -7.194 | -7.505 | -27.748 | 2.561 | 16.020 | 11.000 | tu1 |
| 7.885E+01 | 0.571 | -6.405 | -7.039 | -23.817 | 2.561 | 23.810 | 26.000 | tu2 |
| 1.293E+02 | -6.419 | -12.606 | -13.380 | -27.247 | 2.561 | 28.470 | 199.000 | tu3 |
| 1.475E+02 | 2.373 | -3.729 | -5.085 | -19.458 | 2.561 | 31.660 | 226.000 | tu4 |
| err-avg | -1.81 | -8.34 | -9.04 | -20.4 | | | | |
| err-sd | 8.14 | 7.85 | 7.58 | 7.75 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 5.950E+03 | -6.387 | -8.739 | -5.546 | -3.109 | 3.400 | 15.950 | 220.220 | ya1 |
| 7.870E+03 | -8.895 | -11.182 | -7.243 | -2.186 | 3.400 | 30.390 | 138.940 | ya2 |
| 8.010E+03 | -10.861 | -12.984 | -9.238 | -4.370 | 3.400 | 31.330 | 57.660 | ya3 |
| 6.600E+03 | -8.030 | -10.152 | -6.818 | -3.667 | 3.400 | 20.190 | 17.020 | ya4 |
| 7.980E+03 | -8.772 | -11.153 | -7.143 | -1.817 | 3.400 | 32.030 | 138.940 | ya5 |
| 7.680E+03 | -7.031 | -9.115 | -5.208 | -0.182 | 3.400 | 31.410 | 57.660 | ya6 |
| 6.950E+03 | 7.626 | 4.892 | 9.784 | 16.878 | 3.400 | 35.970 | 138.940 | ya7 |
| 6.820E+03 | 7.625 | 5.132 | 9.971 | 16.481 | 3.400 | 35.260 | 57.660 | ya8 |
| 3.020E+03 | 2.649 | 0.662 | 2.649 | -2.483 | 3.208 | 8.300 | -1.000 | mi1 |
| 2.830E+03 | 1.413 | -1.413 | 0.707 | -3.958 | 3.208 | 6.900 | -1.000 | mi2 |
| 4.650E+03 | -6.667 | -9.462 | -7.742 | -11.290 | 3.203 | 15.360 | -1.000 | mi3 |
| 5.080E+03 | 0.394 | -3.740 | -1.575 | -5.197 | 3.203 | 21.290 | -1.000 | mi4 |
| 4.740E+03 | -11.814 | -14.346 | -12.236 | -15.675 | 3.203 | 14.660 | -1.000 | mi5 |
| 5.300E+03 | -2.642 | -5.472 | -3.019 | -8.849 | 3.210 | 29.500 | -1.000 | mi6 |
| 5.470E+03 | -2.925 | -6.216 | -3.656 | -9.890 | 3.210 | 32.200 | -1.000 | mi7 |
| 4.970E+03 | 6.036 | 3.018 | 5.835 | -1.368 | 3.210 | 33.710 | -1.000 | mi8 |
| 5.320E+03 | 5.639 | 0.752 | 3.571 | -2.782 | 3.210 | 34.320 | -1.000 | mi9 |
| 4.586E+03 | -2.747 | -4.710 | -1.875 | -4.012 | 3.897 | 12.040 | 79.200 | tr1 |
| 5.266E+03 | -0.114 | -2.773 | 0.266 | -1.519 | 3.130 | 15.380 | 158.500 | tr2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5.234E+03 | 0.115 | -2.178 | 0.879 | -1.089 | 3.130 | 15.900 | 79.200 | tr3 |
| 4.418E+03 | -0.634 | -2.671 | -0.181 | -2.558 | 3.130 | 11.530 | 26.400 | tr4 |
| 4.580E+03 | 4.585 | 1.528 | 4.585 | 2.467 | 3.130 | 12.860 | 237.700 | tr5 |
| 5.755E+03 | 3.562 | 0.608 | 3.910 | 2.572 | 3.130 | 20.600 | 211.300 | tr6 |
| 5.895E+03 | 5.344 | 2.629 | 6.361 | 4.801 | 3.130 | 23.720 | 158.500 | tr7 |
| 6.070E+03 | 1.153 | -1.153 | 2.306 | 0.675 | 3.130 | 4.300 | 79.200 | tr8 |
| 5.950E+03 | 4.706 | 2.017 | 5.546 | 4.067 | 3.130 | 23.870 | 158.500 | tr9 |
| 5.980E+03 | 3.010 | 0.669 | 4.181 | 2.542 | 3.130 | 24.550 | 79.200 | tr10 |
| 6.060E+03 | 2.805 | 0.165 | 3.795 | 2.277 | 3.130 | 23.930 | 158.500 | tr11 |
| 5.995E+03 | 2.419 | 0.083 | 3.586 | 2.018 | 3.130 | 24.360 | 79.200 | tr12 |
| 6.060E+03 | 3.465 | 0.660 | 4.290 | 2.888 | 3.130 | 24.330 | 158.500 | tr13 |
| 5.970E+03 | 2.680 | 0.335 | 3.853 | 2.412 | 3.130 | 24.310 | 79.200 | tr14 |
| 4.838E+03 | 6.036 | 2.108 | 4.795 | -0.620 | 2.556 | 30.720 | 167.600 | tu1 |
| 4.840E+03 | 5.992 | 2.066 | 4.752 | -0.723 | 2.556 | 30.510 | 167.000 | tu2 |
| 4.930E+03 | 4.260 | 0.609 | 3.245 | -2.231 | 2.556 | 31.560 | 167.000 | tu3 |
| 4.941E+03 | 4.028 | -0.425 | 2.813 | -2.530 | 2.556 | 31.260 | 167.600 | tu4 |
| 4.788E+03 | 7.352 | 3.383 | 6.099 | 0.585 | 2.556 | 31.310 | 167.000 | tu5 |
| 4.838E+03 | 0.455 | -2.026 | -0.165 | -3.865 | 3.038 | 27.350 | 13.200 | ca1 |
| 4.943E+03 | 1.558 | -1.275 | 1.153 | -3.338 | 3.038 | 37.120 | 27.700 | ca2 |
| 4.943E+03 | 4.795 | 0.951 | 3.581 | -1.012 | 3.038 | 44.340 | 165.220 | ca3 |
| 4.476E+03 | -1.475 | -3.932 | -2.145 | -5.474 | 2.720 | 18.680 | 9.100 | ca4 |
| 4.824E+03 | -0.705 | -3.400 | -1.327 | -4.892 | 2.720 | 26.620 | 24.500 | ca5 |
| 4.751E+03 | 5.872 | 1.873 | 4.399 | 0.610 | 2.720 | 33.170 | 161.900 | ca6 |
| 4.327E+03 | 0.069 | -2.011 | 1.225 | -7.419 | 2.453 | 31.400 | 11.280 | ca7 |
| 4.351E+03 | 0.207 | -1.862 | 1.586 | -7.768 | 2.453 | 37.270 | 19.920 | ca8 |
| 4.273E+03 | 4.142 | 0.866 | 4.844 | -4.517 | 2.453 | 46.460 | 161.210 | ca9 |
| 4.130E+03 | 6.295 | 3.632 | 5.811 | -2.639 | 2.561 | 16.020 | 11.000 | ro1 |
| 4.561E+03 | 7.213 | 4.363 | 6.994 | -1.710 | 2.561 | 23.810 | 26.000 | ro2 |
| 4.980E+03 | 4.819 | 0.000 | 3.614 | -4.900 | 2.561 | 28.470 | 199.000 | ro3 |
| 4.765E+03 | 12.277 | 7.450 | 10.808 | 1.469 | 2.561 | 31.660 | 226.000 | ro4 |
| 4.805E+03 | 6.139 | 2.393 | 4.475 | 0.583 | 3.130 | 25.930 | -1.000 | ob1 |
| 4.713E+03 | 8.636 | 4.816 | 7.150 | 2.843 | 3.130 | 26.540 | -1.000 | ob2 |
| 4.925E+03 | 4.975 | 1.320 | 3.553 | -0.650 | 3.130 | 27.990 | -1.000 | ob3 |
| 5.013E+03 | 3.531 | -0.259 | 1.935 | -2.055 | 3.130 | 28.400 | -1.000 | ob4 |
| 4.957E+03 | 5.104 | 1.271 | 3.692 | -0.565 | 3.130 | 29.040 | -1.000 | ob5 |
| 4.943E+03 | 5.806 | 1.962 | 4.188 | -0.061 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | 1.73 | -1.28 | 1.67 | -1.40 | | | | |
| err-sd | 5.29 | 4.87 | 4.94 | 5.26 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.120E+03 | -7.143 | -3.571 | -0.893 | -1.429 | 3.400 | 15.950 | 220.220 | ya1 |
| 2.120E+03 | -4.717 | 0.000 | 1.887 | 4.292 | 3.400 | 30.390 | 138.940 | ya2 |
| 2.260E+03 | -8.850 | -4.425 | -2.655 | -0.221 | 3.400 | 31.330 | 57.660 | ya3 |
| 1.440E+03 | -6.944 | -2.778 | -0.694 | -0.833 | 3.400 | 20.190 | 17.020 | ya4 |
| 2.370E+03 | -10.970 | -6.751 | -4.641 | -2.152 | 3.400 | 32.030 | 138.940 | ya5 |
| 2.270E+03 | -8.811 | -4.846 | -3.084 | -0.396 | 3.400 | 31.410 | 57.660 | ya6 |
| 2.570E+03 | -10.117 | -5.447 | -3.502 | -0.156 | 3.400 | 35.970 | 138.940 | ya7 |
| 2.480E+03 | -8.468 | -4.032 | -2.419 | 0.927 | 3.400 | 35.260 | 57.660 | ya8 |
| 4.220E+02 | -1.185 | 2.607 | 5.213 | -1.469 | 3.208 | 8.300 | -1.000 | mi1 |
| 3.440E+02 | -4.651 | 1.163 | 3.779 | -2.558 | 3.208 | 6.900 | -1.000 | mi2 |
| 1.030E+03 | -6.990 | -1.942 | -0.971 | -4.456 | 3.203 | 15.360 | -1.000 | mi3 |
| 1.490E+03 | -5.369 | 0.000 | 2.013 | -0.403 | 3.203 | 21.290 | -1.000 | mi4 |
| 1.060E+03 | -15.189 | -11.698 | -9.906 | -13.519 | 3.203 | 14.660 | -1.000 | mi5 |
| 2.100E+03 | -9.524 | -5.238 | -3.810 | -4.619 | 3.210 | 29.500 | -1.000 | mi6 |
| 2.270E+03 | -9.251 | -4.846 | -3.524 | -3.568 | 3.210 | 32.200 | -1.000 | mi7 |
| 2.320E+03 | -8.190 | -3.879 | -2.586 | -2.371 | 3.210 | 33.710 | -1.000 | mi8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.430E+03 | -9.877 | -4.527 | -3.292 | -3.086 | 3.210 | 34.320 | -1.000 | mi9 |
| 7.165E+02 | -9.421 | -6.071 | -3.140 | -7.258 | 3.897 | 12.040 | 79.200 | tr1 |
| 1.118E+03 | -6.977 | -2.504 | 0.179 | -2.683 | 3.130 | 15.380 | 158.500 | tr2 |
| 1.137E+03 | -5.013 | -1.495 | 1.143 | -1.935 | 3.130 | 15.900 | 79.200 | tr3 |
| 7.750E+02 | -6.710 | -3.355 | -0.903 | -5.097 | 3.130 | 11.530 | 26.400 | tr4 |
| 8.400E+02 | 0.238 | 5.119 | 7.619 | 4.024 | 3.130 | 12.860 | 237.700 | tr5 |
| 1.520E+03 | -4.605 | 0.000 | 1.974 | 0.461 | 3.130 | 20.600 | 211.300 | tr6 |
| 1.755E+03 | -5.413 | -0.855 | 1.425 | 0.456 | 3.130 | 23.720 | 158.500 | tr7 |
| 1.825E+03 | -7.397 | -3.014 | -1.370 | -2.137 | 3.130 | 4.300 | 79.200 | tr8 |
| 1.760E+03 | -5.114 | 0.000 | 1.705 | 0.852 | 3.130 | 23.870 | 158.500 | tr9 |
| 1.785E+03 | -4.202 | -0.280 | 1.961 | 1.064 | 3.130 | 24.550 | 79.200 | tr10 |
| 1.790E+03 | -6.145 | -1.676 | 0.000 | -0.615 | 3.130 | 23.930 | 158.500 | tr11 |
| 1.810E+03 | -6.077 | -2.210 | -0.552 | -1.105 | 3.130 | 24.360 | 79.200 | tr12 |
| 1.770E+03 | -3.390 | 1.130 | 2.825 | 2.147 | 3.130 | 24.330 | 158.500 | tr13 |
| 1.790E+03 | -5.587 | -1.117 | 0.559 | -0.279 | 3.130 | 24.310 | 79.200 | tr14 |
| 2.266E+03 | -5.119 | -0.265 | 0.618 | 2.074 | 2.556 | 30.720 | 167.600 | tu1 |
| 2.294E+03 | -6.713 | -1.918 | -1.046 | 0.305 | 2.556 | 30.510 | 167.000 | tu2 |
| 2.295E+03 | -4.575 | 0.218 | 1.525 | 2.832 | 2.556 | 31.560 | 167.000 | tu3 |
| 2.320E+03 | -6.034 | -1.293 | -0.431 | 1.034 | 2.556 | 31.260 | 167.600 | tu4 |
| 2.278E+03 | -4.302 | 0.527 | 1.844 | 3.029 | 2.556 | 31.310 | 167.000 | tu5 |
| 1.950E+03 | -6.154 | -2.051 | -1.026 | -1.949 | 3.038 | 27.350 | 13.200 | ca1 |
| 2.540E+03 | -7.480 | -3.543 | -2.756 | -2.047 | 3.038 | 37.120 | 27.700 | ca2 |
| 2.885E+03 | -8.492 | -4.333 | -3.293 | -1.906 | 3.038 | 44.340 | 165.220 | ca3 |
| 1.410E+03 | -6.383 | -2.837 | -1.418 | -3.121 | 2.720 | 18.680 | 9.100 | ca4 |
| 2.004E+03 | -7.186 | -3.194 | -2.196 | -1.597 | 2.720 | 26.620 | 24.500 | ca5 |
| 2.395E+03 | -7.724 | -3.132 | -1.879 | 0.125 | 2.720 | 33.170 | 161.900 | ca6 |
| 2.345E+03 | -7.463 | -2.345 | -2.345 | -1.791 | 2.453 | 31.400 | 11.280 | ca7 |
| 2.633E+03 | -8.469 | -3.152 | -3.152 | -2.013 | 2.453 | 37.270 | 19.920 | ca8 |
| 2.949E+03 | -8.783 | -3.018 | -2.679 | -1.526 | 2.453 | 46.460 | 161.210 | ca9 |
| 1.237E+03 | -2.183 | 1.859 | 3.476 | -3.800 | 2.561 | 16.020 | 11.000 | ro1 |
| 1.895E+03 | -4.485 | -0.264 | 0.792 | -3.483 | 2.561 | 23.810 | 26.000 | ro2 |
| 2.235E+03 | -5.145 | -0.224 | 0.671 | -2.327 | 2.561 | 28.470 | 199.000 | ro3 |
| 2.405E+03 | -4.366 | 0.624 | 1.871 | -0.748 | 2.561 | 31.660 | 226.000 | ro4 |
| 1.800E+03 | -5.000 | -0.556 | 1.111 | 0.778 | 3.130 | 25.930 | -1.000 | ob1 |
| 1.830E+03 | -3.825 | 1.093 | 2.186 | 1.475 | 3.130 | 26.540 | -1.000 | ob2 |
| 1.920E+03 | -4.167 | 0.521 | 2.083 | 1.823 | 3.130 | 27.990 | -1.000 | ob3 |
| 2.020E+03 | -7.921 | -3.465 | -1.980 | -1.832 | 3.130 | 28.400 | -1.000 | ob4 |
| 2.000E+03 | -5.500 | -0.500 | 1.000 | 1.250 | 3.130 | 29.040 | -1.000 | ob5 |
| 2.040E+03 | -5.882 | -0.980 | 0.490 | 0.784 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -6.46 | -1.98 | -0.404 | -1.10 | | | | |
| err-sd | 2.53 | 2.69 | 2.81 | 2.85 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 6.630E+02 | -7.541 | -13.424 | -10.558 | -11.312 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.540E+03 | -10.390 | -16.234 | -12.987 | -10.714 | 3.400 | 30.390 | 138.940 | ya2 |
| 1.640E+03 | -9.146 | -14.634 | -11.585 | -9.329 | 3.400 | 31.330 | 57.660 | ya3 |
| 9.150E+02 | -7.869 | -13.552 | -10.492 | -10.317 | 3.400 | 20.190 | 17.020 | ya4 |
| 1.670E+03 | -7.186 | -13.174 | -9.581 | -7.425 | 3.400 | 32.030 | 138.940 | ya5 |
| 1.580E+03 | -5.063 | -11.392 | -7.595 | -5.633 | 3.400 | 31.410 | 57.660 | ya6 |
| 1.680E+03 | 3.571 | -2.976 | 0.595 | 4.286 | 3.400 | 35.970 | 138.940 | ya7 |
| 1.620E+03 | 3.704 | -2.469 | 1.235 | 4.383 | 3.400 | 35.260 | 57.660 | ya8 |
| 1.090E+02 | 7.339 | 0.917 | 3.670 | -5.963 | 3.208 | 8.300 | -1.000 | mi1 |
| 8.280E+01 | 2.415 | -0.966 | 0.966 | -8.068 | 3.208 | 6.900 | -1.000 | mi2 |
| 4.080E+02 | -3.676 | -9.069 | -6.863 | -14.779 | 3.203 | 15.360 | -1.000 | mi3 |
| 6.510E+02 | 3.687 | -1.997 | 0.614 | -6.651 | 3.203 | 21.290 | -1.000 | mi4 |
| 4.250E+02 | -16.471 | -21.882 | -19.529 | -26.329 | 3.203 | 14.660 | -1.000 | mi5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.550E+02 | -2.304 | -8.482 | -6.073 | 10.576 | 3.210 | 29.500 | -1.000 | mi6 |
| 1.060E+03 | -2.830 | -8.491 | -6.038 | 11.038 | 3.210 | 32.200 | -1.000 | mi7 |
| 9.830E+02 | 8.850 | 1.729 | 4.781 | 23.398 | 3.210 | 33.710 | -1.000 | mi8 |
| 1.080E+03 | 5.556 | -0.926 | 1.852 | 21.389 | 3.210 | 34.320 | -1.000 | mi9 |
| 3.475E+02 | -4.748 | -9.928 | -7.626 | -14.273 | 3.897 | 12.040 | 79.200 | tr1 |
| 6.140E+02 | 3.420 | -2.606 | 0.163 | -6.042 | 3.130 | 15.380 | 158.500 | tr2 |
| 6.180E+02 | 5.987 | -0.324 | 2.427 | -4.191 | 3.130 | 15.900 | 79.200 | tr3 |
| 3.690E+02 | -0.542 | -6.504 | -3.794 | -11.003 | 3.130 | 11.530 | 26.400 | tr4 |
| 4.000E+02 | 9.500 | 3.500 | 6.500 | 0.175 | 3.130 | 12.860 | 237.700 | tr5 |
| 8.850E+02 | 5.198 | -0.904 | 2.260 | -2.655 | 3.130 | 20.600 | 211.300 | tr6 |
| 1.030E+03 | 8.738 | 1.942 | 4.854 | 0.583 | 3.130 | 23.720 | 158.500 | tr7 |
| 1.060E+03 | 6.604 | 0.000 | 3.774 | -1.415 | 3.130 | 4.300 | 79.200 | tr8 |
| 1.050E+03 | 7.619 | 0.952 | 3.810 | -0.571 | 3.130 | 23.870 | 158.500 | tr9 |
| 1.055E+03 | 8.057 | 2.370 | 5.213 | 0.284 | 3.130 | 24.550 | 79.200 | tr10 |
| 1.050E+03 | 7.619 | 0.952 | 4.762 | -0.190 | 3.130 | 23.930 | 158.500 | tr11 |
| 1.055E+03 | 7.109 | 0.474 | 4.265 | -0.664 | 3.130 | 24.360 | 79.200 | tr12 |
| 1.060E+03 | 9.434 | 2.830 | 5.660 | 3.113 | 3.130 | 24.330 | 158.500 | tr13 |
| 1.060E+03 | 6.604 | 0.000 | 2.830 | 0.660 | 3.130 | 24.310 | 79.200 | tr14 |
| 1.061E+03 | 10.273 | 3.676 | 6.503 | -0.189 | 2.556 | 30.720 | 167.600 | tu1 |
| 1.068E+03 | 8.614 | 2.060 | 4.869 | -1.404 | 2.556 | 30.510 | 167.000 | tu2 |
| 1.104E+03 | 8.696 | 1.449 | 4.167 | -1.902 | 2.556 | 31.560 | 167.000 | tu3 |
| 1.124E+03 | 5.872 | -1.246 | 1.423 | -4.448 | 2.556 | 31.260 | 167.600 | tu4 |
| 1.072E+03 | 11.007 | 4.478 | 6.343 | 0.373 | 2.556 | 31.310 | 167.000 | tu5 |
| 7.727E+02 | 4.180 | -2.291 | -0.091 | -4.633 | 3.038 | 27.350 | 13.200 | ca1 |
| 1.025E+03 | 3.415 | -2.927 | -0.488 | -4.098 | 3.038 | 37.120 | 27.700 | ca2 |
| 1.157E+03 | 4.581 | -2.334 | 1.124 | -1.988 | 3.038 | 44.340 | 165.220 | ca3 |
| 5.153E+02 | -0.834 | -6.850 | -4.910 | -11.217 | 2.720 | 18.680 | 9.100 | ca4 |
| 7.740E+02 | 2.326 | -4.005 | -1.809 | -7.481 | 2.720 | 26.620 | 24.500 | ca5 |
| 9.219E+02 | 6.628 | 0.011 | 2.397 | -2.397 | 2.720 | 33.170 | 161.900 | ca6 |
| 8.237E+02 | -1.906 | -8.098 | -4.698 | -11.060 | 2.453 | 31.400 | 11.280 | ca7 |
| 9.224E+02 | -1.995 | -7.958 | -4.380 | -10.538 | 2.453 | 37.270 | 19.920 | ca8 |
| 1.006E+03 | 0.398 | -5.268 | -1.292 | -6.670 | 2.453 | 46.460 | 161.210 | ca9 |
| 3.449E+02 | 5.538 | -1.421 | 1.189 | -10.496 | 2.561 | 16.020 | 11.000 | ro1 |
| 5.718E+02 | 5.806 | -0.839 | 1.784 | -7.398 | 2.561 | 23.810 | 26.000 | ro2 |
| 7.726E+02 | 0.311 | -6.420 | -3.055 | -10.691 | 2.561 | 28.470 | 199.000 | ro3 |
| 7.851E+02 | 8.903 | 2.153 | 5.337 | -2.522 | 2.561 | 31.660 | 226.000 | ro4 |
| 9.780E+02 | 7.362 | 0.409 | 2.249 | -3.978 | 3.130 | 25.930 | -1.000 | ob1 |
| 9.780E+02 | 9.407 | 2.249 | 5.317 | -1.411 | 3.130 | 26.540 | -1.000 | ob2 |
| 1.058E+03 | 6.805 | 0.189 | 3.025 | -3.403 | 3.130 | 27.990 | -1.000 | ob3 |
| 1.103E+03 | 4.261 | -2.085 | 0.635 | -5.802 | 3.130 | 28.400 | -1.000 | ob4 |
| 1.107E+03 | 6.594 | 0.271 | 2.078 | -3.794 | 3.130 | 29.040 | -1.000 | ob5 |
| 1.128E+03 | 6.383 | -0.709 | 1.950 | -3.901 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | 3.02 | -3.27 | -0.415 | -3.61 | | | | |
| err-sd | 6.12 | 5.78 | 5.76 | 7.99 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 8.030E+01 | -10.461 | -1.370 | 0.249 | -9.054 | 3.400 | 15.950 | 220.220 | ya1 |
| 3.460E+02 | 3.468 | 14.451 | 15.318 | 5.578 | 3.400 | 30.390 | 138.940 | ya2 |
| 3.980E+02 | -4.020 | 5.779 | 6.533 | -2.236 | 3.400 | 31.330 | 57.660 | ya3 |
| 1.450E+02 | -8.276 | 0.000 | 1.379 | -7.586 | 3.400 | 20.190 | 17.020 | ya4 |
| 4.220E+02 | -4.976 | 5.213 | 5.924 | -2.867 | 3.400 | 32.030 | 138.940 | ya5 |
| 4.000E+02 | -4.000 | 5.750 | 6.500 | -2.200 | 3.400 | 31.410 | 57.660 | ya6 |
| 5.520E+02 | -7.246 | 2.717 | 3.080 | -5.109 | 3.400 | 35.970 | 138.940 | ya7 |
| 5.290E+02 | -7.183 | 2.457 | 3.025 | -5.198 | 3.400 | 35.260 | 57.660 | ya8 |
| 9.490E+00 | -0.421 | 9.589 | 10.643 | -9.231 | 3.208 | 8.300 | -1.000 | mi1 |
| 6.040E+00 | -8.775 | 4.636 | 6.291 | -13.195 | 3.208 | 6.900 | -1.000 | mi2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7.390E+01 | -12.179 | -3.248 | -1.759 | -16.387 | 3.203 | 15.360 | -1.000 | mi3 |
| 1.760E+02 | -7.955 | 2.841 | 4.545 | -8.295 | 3.203 | 21.290 | -1.000 | mi4 |
| 7.510E+01 | -25.566 | -19.041 | -17.443 | -30.053 | 3.203 | 14.660 | -1.000 | mi5 |
| 4.080E+02 | -13.235 | -5.637 | -4.657 | -13.505 | 3.210 | 29.500 | -1.000 | mi6 |
| 4.900E+02 | -10.612 | -2.245 | -1.429 | -9.673 | 3.210 | 32.200 | -1.000 | mi7 |
| 5.340E+02 | -8.989 | -0.749 | -0.187 | -8.052 | 3.210 | 33.710 | -1.000 | mi8 |
| 5.700E+02 | -11.930 | -2.105 | -1.579 | -8.842 | 3.210 | 34.320 | -1.000 | mi9 |
| 3.135E+01 | -21.212 | -12.600 | -11.324 | -24.370 | 3.897 | 12.040 | 79.200 | tr1 |
| 8.638E+01 | -12.943 | -3.450 | -2.061 | -14.228 | 3.130 | 15.380 | 158.500 | tr2 |
| 9.487E+01 | -14.198 | -5.660 | -4.290 | -16.264 | 3.130 | 15.900 | 79.200 | tr3 |
| 3.803E+01 | -15.330 | -6.916 | -5.338 | -19.169 | 3.130 | 11.530 | 26.400 | tr4 |
| 4.600E+01 | -4.348 | 5.870 | 7.826 | -6.196 | 3.130 | 12.860 | 237.700 | tr5 |
| 1.720E+02 | -9.302 | 0.581 | 1.744 | -8.895 | 3.130 | 20.600 | 211.300 | tr6 |
| 2.435E+02 | -9.651 | -0.616 | 0.616 | -8.994 | 3.130 | 23.720 | 158.500 | tr7 |
| 2.575E+02 | -9.903 | -1.359 | -0.583 | -9.709 | 3.130 | 4.300 | 79.200 | tr8 |
| 2.400E+02 | -7.083 | 2.500 | 3.333 | -6.250 | 3.130 | 23.870 | 158.500 | tr9 |
| 2.540E+02 | -6.299 | 2.362 | 3.543 | -6.181 | 3.130 | 24.550 | 79.200 | tr10 |
| 2.470E+02 | -8.907 | 0.000 | 1.215 | -8.340 | 3.130 | 23.930 | 158.500 | tr11 |
| 2.590E+02 | -10.039 | -1.544 | -0.386 | -9.691 | 3.130 | 24.360 | 79.200 | tr12 |
| 2.440E+02 | -4.098 | 5.328 | 6.557 | -1.967 | 3.130 | 24.330 | 158.500 | tr13 |
| 2.500E+02 | -7.200 | 1.600 | 2.800 | -5.560 | 3.130 | 24.310 | 79.200 | tr14 |
| 5.020E+02 | 2.390 | 12.151 | 12.550 | 3.984 | 2.556 | 30.720 | 167.600 | tu1 |
| 5.248E+02 | -3.392 | 5.755 | 6.136 | -2.020 | 2.556 | 30.510 | 167.000 | tu2 |
| 5.477E+02 | -0.676 | 8.819 | 9.184 | 1.095 | 2.556 | 31.560 | 167.000 | tu3 |
| 5.428E+02 | -1.621 | 7.406 | 7.959 | -0.092 | 2.556 | 31.260 | 167.600 | tu4 |
| 5.235E+02 | 2.197 | 11.939 | 12.321 | 3.954 | 2.556 | 31.310 | 167.000 | tu5 |
| 3.279E+02 | -4.239 | 3.385 | 4.300 | -5.093 | 3.038 | 27.350 | 13.200 | ca1 |
| 6.535E+02 | -3.596 | 4.667 | 4.973 | -1.622 | 3.038 | 37.120 | 27.700 | ca2 |
| 9.531E+02 | -6.411 | 2.613 | 2.717 | -1.910 | 3.038 | 44.340 | 165.220 | ca3 |
| 1.582E+02 | -10.872 | -3.919 | -3.287 | -13.970 | 2.720 | 18.680 | 9.100 | ca4 |
| 3.745E+02 | -7.877 | -0.401 | 0.401 | -8.358 | 2.720 | 26.620 | 24.500 | ca5 |
| 6.211E+02 | -9.032 | -0.660 | -0.338 | -7.245 | 2.720 | 33.170 | 161.900 | ca6 |
| 6.198E+02 | -9.003 | -2.872 | -1.904 | -9.116 | 2.453 | 31.400 | 11.280 | ca7 |
| 8.796E+02 | -9.163 | -2.569 | -2.228 | -6.958 | 2.453 | 37.270 | 19.920 | ca8 |
| 1.326E+03 | -11.765 | -4.223 | -4.223 | -6.109 | 2.453 | 46.460 | 161.210 | ca9 |
| 3.120E+02 | -12.821 | -4.487 | -3.846 | -13.622 | 3.130 | 25.930 | -1.000 | ro1 |
| 3.280E+02 | -12.805 | -4.573 | -3.659 | -13.171 | 3.130 | 26.540 | -1.000 | ro2 |
| 3.720E+02 | -12.097 | -3.763 | -3.226 | -12.392 | 3.130 | 27.990 | -1.000 | ro3 |
| 4.070E+02 | -16.708 | -8.600 | -8.108 | -16.929 | 3.130 | 28.400 | -1.000 | ro4 |
| 4.050E+02 | -11.605 | -3.210 | -2.469 | -11.753 | 3.130 | 29.040 | -1.000 | ob1 |
| 4.380E+02 | -15.297 | -7.078 | -6.621 | -15.137 | 3.130 | 29.520 | -1.000 | ob2 |
| err-avg | -8.57 | 0.304 | 1.19 | -8.40 | | | | |
| err-sd | 5.53 | 6.19 | 6.11 | 6.76 | | | | |

9 Am-241

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.829E+02 | 0.389 | -4.913 | -2.793 | -7.494 | 3.038 | 27.350 | 13.200 | ya1 |
| 3.900E+02 | -6.410 | -11.282 | -8.974 | -12.462 | 3.038 | 37.120 | 27.700 | ya2 |
| 4.330E+02 | -5.312 | -10.393 | -7.852 | -10.716 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.204E+02 | -1.996 | -7.895 | -5.626 | -12.250 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.275E+02 | 1.069 | -4.733 | -2.595 | -8.366 | 2.720 | 26.620 | 24.500 | ya5 |
| 3.966E+02 | 2.622 | -3.177 | -0.656 | -5.572 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.900E+02 | -2.564 | -7.949 | -4.103 | -11.333 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.825E+02 | -13.782 | -18.342 | -14.819 | -21.078 | 2.453 | 37.270 | 19.920 | ya8 |
| 7.205E+02 | -37.266 | -40.458 | -37.821 | -41.721 | 2.453 | 46.460 | 161.210 | mi1 |
| err-avg | -7.03 | -12.1 | -9.47 | -14.6 | | | | |
| err-sd | 12.4 | 11.5 | 11.4 | 11.1 | | | | |

6 Am-242

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.388E+00 | 35.447 | 19.597 | 25.360 | -18.660 | 3.130 | 20.600 | 211.300 | ya1 |
| 2.125E+00 | 3.059 | -8.235 | -4.000 | -37.271 | 3.130 | 23.720 | 158.500 | ya2 |
| 2.257E+00 | -4.741 | -15.374 | -10.944 | -42.047 | 3.130 | 4.300 | 79.200 | ya3 |
| 2.440E+00 | -11.066 | -20.492 | -16.803 | -45.779 | 3.130 | 24.550 | 79.200 | ya4 |
| 1.962E+00 | 12.640 | 0.408 | 4.995 | -31.346 | 3.130 | 23.930 | 158.500 | ya5 |
| 2.191E+00 | -1.871 | -12.369 | -8.261 | -40.119 | 3.130 | 24.360 | 79.200 | ya6 |
| err-avg | 5.58 | -6.08 | -1.61 | -35.9 | | | | |
| err-sd | 16.7 | 14.4 | 15.1 | 9.73 | | | | |

6 Am-243

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.394E+01 | -1.838 | 6.516 | 6.934 | -18.713 | 3.130 | 20.600 | 211.300 | ya1 |
| 4.533E+01 | -16.170 | -9.773 | -9.773 | -30.488 | 3.130 | 23.720 | 158.500 | ya2 |
| 4.584E+01 | -12.304 | -5.541 | -5.541 | -27.378 | 3.130 | 4.300 | 79.200 | ya3 |
| 4.615E+01 | -9.859 | -2.925 | -3.142 | -25.330 | 3.130 | 24.550 | 79.200 | ya4 |
| 4.452E+01 | -11.950 | -5.211 | -5.211 | -27.022 | 3.130 | 23.930 | 158.500 | ya5 |
| 4.247E+01 | -4.403 | 2.661 | 2.661 | -20.956 | 3.130 | 24.360 | 79.200 | ya6 |
| err-avg | -9.42 | -2.38 | -2.35 | -25.0 | | | | |
| err-sd | 5.35 | 5.96 | 6.09 | 4.38 | | | | |

15 Cm-242

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.769E+01 | -20.294 | -29.339 | -27.643 | -29.565 | 3.130 | 20.600 | 211.300 | ya1 |
| 2.435E+01 | -20.329 | -29.774 | -27.721 | -29.487 | 3.130 | 23.720 | 158.500 | ya2 |
| 2.664E+01 | -24.925 | -33.559 | -32.057 | -33.483 | 3.130 | 4.300 | 79.200 | ya3 |
| 2.318E+01 | -15.444 | -24.935 | -23.210 | -24.849 | 3.130 | 23.870 | 158.500 | ya4 |
| 2.512E+01 | -18.790 | -27.946 | -26.354 | -27.826 | 3.130 | 24.550 | 79.200 | ya5 |
| 2.796E+01 | -29.542 | -37.411 | -35.980 | -37.339 | 3.130 | 23.930 | 158.500 | ya6 |
| 2.466E+01 | -18.491 | -27.818 | -26.196 | -27.737 | 3.130 | 24.360 | 79.200 | ya7 |
| 2.522E+01 | -18.715 | -28.232 | -26.249 | -59.833 | 3.130 | 24.330 | 158.500 | ya8 |
| 2.481E+01 | -19.387 | -28.658 | -27.046 | -60.210 | 3.130 | 24.310 | 79.200 | mi1 |
| 1.710E+01 | -25.146 | -32.749 | -31.579 | -35.263 | 3.130 | 25.930 | -1.000 | mi2 |
| 1.940E+01 | -26.289 | -33.505 | -32.474 | -34.897 | 3.130 | 26.540 | -1.000 | mi3 |
| 1.850E+01 | -16.757 | -24.865 | -23.784 | -26.703 | 3.130 | 27.990 | -1.000 | mi4 |
| 2.010E+01 | -21.393 | -29.353 | -28.358 | -31.244 | 3.130 | 28.400 | -1.000 | mi5 |
| 2.080E+01 | -20.673 | -28.365 | -26.923 | -30.240 | 3.130 | 29.040 | -1.000 | mi6 |
| 2.150E+01 | -19.535 | -27.442 | -26.512 | -29.163 | 3.130 | 29.520 | -1.000 | mi7 |
| err-avg | -21.0 | -29.6 | -28.1 | -34.5 | | | | |
| err-sd | 3.82 | 3.39 | 3.45 | 10.9 | | | | |

15 Cm-244

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.675E+00 | -23.422 | -7.166 | -0.535 | -28.021 | 3.130 | 20.600 | 211.300 | ya1 |
| 9.017E+00 | -24.476 | -9.726 | -3.405 | -29.167 | 3.130 | 23.720 | 158.500 | ya2 |
| 9.904E+00 | -26.191 | -11.854 | -5.897 | -30.977 | 3.130 | 4.300 | 79.200 | ya3 |
| 8.960E+00 | -21.652 | -6.473 | 0.000 | -26.585 | 3.130 | 23.870 | 158.500 | ya4 |
| 9.422E+00 | -18.807 | -2.993 | 3.587 | -23.965 | 3.130 | 24.550 | 79.200 | ya5 |
| 9.155E+00 | -22.447 | -7.373 | -0.928 | -27.286 | 3.130 | 23.930 | 158.500 | ya6 |
| 9.734E+00 | -24.081 | -9.390 | -3.123 | -28.981 | 3.130 | 24.360 | 79.200 | ya7 |
| 9.524E+00 | -19.467 | -3.927 | 2.688 | -24.234 | 3.130 | 24.330 | 158.500 | ya8 |
| 8.786E+00 | -16.913 | -0.637 | 6.078 | -21.876 | 3.130 | 24.310 | 79.200 | mi1 |
| 1.030E+01 | -25.922 | -12.816 | -7.087 | -34.631 | 3.130 | 25.930 | -1.000 | mi2 |
| 1.160E+01 | -24.914 | -12.069 | -6.034 | -35.250 | 3.130 | 26.540 | -1.000 | mi3 |
| 1.410E+01 | -21.277 | -7.801 | -1.418 | -30.965 | 3.130 | 27.990 | -1.000 | mi4 |
| 1.580E+01 | -24.684 | -12.025 | -6.329 | -33.797 | 3.130 | 28.400 | -1.000 | mi5 |
| 1.690E+01 | -21.893 | -8.284 | -2.367 | -31.065 | 3.130 | 29.040 | -1.000 | mi6 |
| 1.920E+01 | -25.521 | -12.500 | -6.771 | -34.375 | 3.130 | 29.520 | -1.000 | mi7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| err-avg | -22.8 | -8.34 | -2.10 | -29.4 | | | | |
| err-sd | 2.77 | 3.72 | 4.04 | 4.15 | | | | |

9 Se-79

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.765E+00 | 8.898 | 8.898 | 8.632 | 4.223 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.995E+00 | 8.909 | 8.909 | 8.709 | 1.842 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.370E+00 | 18.808 | 18.808 | 18.808 | 9.237 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.838E+00 | 0.070 | -0.282 | -0.282 | -2.819 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.798E+00 | 4.529 | 4.529 | 4.265 | -0.184 | 2.720 | 26.620 | 24.500 | ya5 |
| 4.584E+00 | 6.021 | 6.021 | 6.021 | -0.218 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.459E+00 | 32.986 | 32.986 | 32.986 | 24.371 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.659E+00 | 15.261 | 15.261 | 15.261 | 5.752 | 2.453 | 37.270 | 19.920 | ya8 |
| 4.957E+00 | 31.935 | 31.935 | 31.935 | 17.369 | 2.453 | 46.460 | 161.210 | mi1 |
| err-avg | 14.2 | 14.1 | 14.0 | 6.62 | | | | |
| err-sd | 11.8 | 11.8 | 11.9 | 9.01 | | | | |

9 Sr-90

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.815E+02 | 5.374 | 5.374 | 5.111 | 5.505 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.904E+02 | 2.569 | 2.569 | 2.365 | 3.079 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.470E+02 | 3.473 | 3.656 | 3.291 | 4.205 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.793E+02 | 1.683 | 1.683 | 1.325 | 1.719 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.665E+02 | 2.592 | 2.592 | 2.319 | 2.701 | 2.720 | 26.620 | 24.500 | ya5 |
| 4.347E+02 | 1.219 | 1.219 | 0.989 | 1.610 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.857E+02 | 2.670 | 2.930 | 2.411 | 3.759 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.305E+02 | 3.368 | 3.600 | 3.136 | 4.599 | 2.453 | 37.270 | 19.920 | ya8 |
| 5.021E+02 | 2.171 | 2.171 | 1.972 | 3.366 | 2.453 | 46.460 | 161.210 | mi1 |
| err-avg | 2.79 | 2.87 | 2.55 | 3.39 | | | | |
| err-sd | 1.21 | 1.24 | 1.22 | 1.29 | | | | |

13 Tc-99

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 6.415E+02 | 4.131 | 4.443 | 5.066 | 7.825 | 3.038 | 27.350 | 13.200 | ya1 |
| 8.228E+02 | 5.372 | 5.858 | 6.952 | 10.112 | 3.038 | 37.120 | 27.700 | ya2 |
| 9.033E+02 | 10.594 | 11.812 | 12.919 | 16.462 | 3.038 | 44.340 | 165.220 | ya3 |
| 4.730E+02 | -0.423 | -0.211 | 0.211 | 2.262 | 2.720 | 18.680 | 9.100 | ya4 |
| 6.268E+02 | 3.542 | 3.861 | 4.499 | 6.892 | 2.720 | 26.620 | 24.500 | ya5 |
| 7.560E+02 | 3.571 | 4.101 | 5.026 | 7.659 | 2.720 | 33.170 | 161.900 | ya6 |
| 5.151E+02 | 44.438 | 44.826 | 45.991 | 50.320 | 2.453 | 31.400 | 11.280 | ya7 |
| 5.994E+02 | 42.976 | 43.477 | 45.145 | 49.683 | 2.453 | 37.270 | 19.920 | ya8 |
| 7.292E+02 | 39.879 | 39.879 | 42.622 | 47.422 | 2.453 | 46.460 | 161.210 | mi1 |
| 3.639E+02 | 11.569 | 11.844 | 12.119 | 12.091 | 2.561 | 16.020 | 11.000 | mi2 |
| 5.412E+02 | 7.908 | 8.093 | 8.832 | 8.962 | 2.561 | 23.810 | 26.000 | mi3 |
| 5.987E+02 | 13.913 | 14.415 | 15.250 | 15.600 | 2.561 | 28.470 | 199.000 | mi4 |
| 6.756E+02 | 10.568 | 11.012 | 12.049 | 12.493 | 2.561 | 31.660 | 226.000 | mi5 |
| err-avg | 15.2 | 15.6 | 16.7 | 19.1 | | | | |
| err-sd | 16.0 | 16.0 | 16.5 | 17.6 | | | | |

4 Ru-106

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.192E+01 | -7.443 | -7.204 | -6.011 | -8.349 | 3.897 | 12.040 | 79.200 | ya1 |
| 6.328E+01 | 2.244 | 2.244 | 3.508 | 1.233 | 3.130 | 15.380 | 158.500 | ya2 |
| 6.761E+01 | -0.459 | -0.606 | 0.725 | -1.686 | 3.130 | 15.900 | 79.200 | ya3 |
| 4.637E+01 | -10.287 | -10.287 | -8.993 | -11.581 | 3.130 | 11.530 | 26.400 | ya4 |
| err-avg | -3.99 | -3.96 | -2.69 | -5.10 | | | | |
| err-sd | 5.86 | 5.78 | 5.80 | 5.90 | | | | |

6 Sn-126

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.438E+00 | 179.232 | 178.650 | 180.396 | 220.244 | 2.720 | 18.680 | 9.100 | ya1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5.437E+00 | 181.405 | 179.566 | 181.405 | 220.765 | 2.720 | 26.620 | 24.500 | ya2 |
| 6.756E+00 | 201.954 | 201.954 | 203.434 | 244.435 | 2.720 | 33.170 | 161.900 | ya3 |
| 5.637E+00 | 247.703 | 247.703 | 249.477 | 293.294 | 2.453 | 31.400 | 11.280 | ya4 |
| 6.397E+00 | 282.992 | 281.429 | 284.555 | 333.172 | 2.453 | 37.270 | 19.920 | ya5 |
| 8.396E+00 | 285.898 | 285.898 | 287.089 | 338.423 | 2.453 | 46.460 | 161.210 | ya6 |
| err-avg | 230. | 229. | 231. | 275. | | | | |
| err-sd | 48.9 | 49.1 | 49.3 | 54.1 | | | | |

3 I-129

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.124E+02 | -11.655 | -11.655 | -11.477 | -17.749 | 2.720 | 18.680 | 9.100 | ya1 |
| 1.548E+02 | -5.685 | -6.331 | -5.685 | -12.662 | 2.720 | 26.620 | 24.500 | ya2 |
| 2.159E+02 | -14.775 | -14.775 | -14.775 | -20.704 | 2.720 | 33.170 | 161.900 | ya3 |
| err-avg | -10.7 | -10.9 | -10.6 | -17.0 | | | | |
| err-sd | 4.62 | 4.27 | 4.60 | 4.07 | | | | |

3 Cs-133

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.644E+02 | 1.203 | 1.514 | 1.825 | 0.601 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.237E+03 | 1.859 | 2.668 | 2.668 | 1.536 | 3.038 | 37.120 | 27.700 | ya2 |
| 1.407E+03 | 2.345 | 3.056 | 3.767 | 2.630 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 1.80 | 2.41 | 2.75 | 1.59 | | | | |
| err-sd | 0.573 | 0.802 | 0.974 | 1.02 | | | | |

16 Cs-134

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.108E+01 | -19.829 | -23.150 | -24.573 | -22.818 | 3.897 | 12.040 | 79.200 | ya1 |
| 3.598E+01 | -16.064 | -19.400 | -21.345 | -18.566 | 3.130 | 15.380 | 158.500 | ya2 |
| 3.808E+01 | -16.492 | -19.643 | -21.744 | -18.986 | 3.130 | 15.900 | 79.200 | ya3 |
| 2.095E+01 | -19.809 | -22.673 | -24.105 | -22.578 | 3.130 | 11.530 | 26.400 | ya4 |
| 1.927E+01 | -20.083 | -22.678 | -24.754 | -22.263 | 3.130 | 12.860 | 237.700 | ya5 |
| 4.682E+01 | -16.916 | -20.120 | -22.683 | -18.582 | 3.130 | 20.600 | 211.300 | ya6 |
| 5.877E+01 | -13.731 | -16.964 | -19.687 | -15.110 | 3.130 | 23.720 | 158.500 | ya7 |
| 6.022E+01 | -12.488 | -15.809 | -18.466 | -13.999 | 3.130 | 4.300 | 79.200 | ya8 |
| 7.943E+01 | -35.289 | -37.807 | -39.821 | -36.409 | 3.130 | 23.870 | 158.500 | mi1 |
| 6.151E+01 | -12.697 | -15.949 | -18.712 | -14.128 | 3.130 | 24.550 | 79.200 | mi2 |
| 6.138E+01 | -13.816 | -17.074 | -19.681 | -15.233 | 3.130 | 24.360 | 79.200 | mi3 |
| 5.925E+01 | -10.042 | -13.586 | -16.287 | 1.367 | 3.130 | 24.330 | 158.500 | mi4 |
| 6.046E+01 | -12.835 | -16.143 | -18.789 | -1.886 | 3.130 | 24.310 | 79.200 | mi5 |
| 1.135E+01 | 0.441 | -3.084 | -5.727 | -3.260 | 3.038 | 27.350 | 13.200 | mi6 |
| 2.269E+01 | -9.211 | -12.737 | -15.381 | -11.944 | 3.038 | 37.120 | 27.700 | mi7 |
| 3.404E+01 | -15.394 | -18.625 | -21.269 | -17.039 | 3.038 | 44.340 | 165.220 | mi8 |
| err-avg | -15.3 | -18.5 | -20.8 | -15.7 | | | | |
| err-sd | 7.33 | 7.08 | 6.84 | 9.15 | | | | |

9 Cs-135

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.085E+02 | 9.425 | 3.794 | 4.774 | 4.137 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.538E+02 | 8.197 | 2.027 | 3.129 | 1.697 | 3.038 | 37.120 | 27.700 | ya2 |
| 4.879E+02 | 7.399 | 1.250 | 2.480 | 0.615 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.748E+02 | 9.534 | 4.076 | 4.803 | 5.022 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.073E+02 | 9.990 | 3.807 | 4.784 | 4.100 | 2.720 | 26.620 | 24.500 | ya5 |
| 3.270E+02 | 11.315 | 4.893 | 6.116 | 4.832 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.979E+02 | 12.088 | 5.805 | 7.565 | 3.242 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.087E+02 | 14.754 | 8.148 | 9.861 | 4.698 | 2.453 | 37.270 | 19.920 | ya8 |
| 4.718E+02 | 7.885 | 1.738 | 3.646 | -1.823 | 2.453 | 46.460 | 161.210 | mi1 |
| err-avg | 10.1 | 3.95 | 5.24 | 2.95 | | | | |
| err-sd | 2.34 | 2.18 | 2.31 | 2.33 | | | | |

26 Cs-137

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4.476E+02 | 1.430 | 1.430 | 1.206 | 0.223 | 3.897 | 12.040 | 79.200 | ya1 |
| 5.687E+02 | 1.635 | 1.635 | 1.635 | 0.932 | 3.130 | 15.380 | 158.500 | ya2 |
| 5.762E+02 | 3.783 | 3.783 | 3.783 | 3.002 | 3.130 | 15.900 | 79.200 | ya3 |
| 4.177E+02 | 3.902 | 3.902 | 3.902 | 2.897 | 3.130 | 11.530 | 26.400 | ya4 |
| 4.527E+02 | 0.950 | 0.950 | 0.950 | 0.110 | 3.130 | 12.860 | 237.700 | ya5 |
| 7.282E+02 | 0.522 | 0.522 | 0.385 | -0.082 | 3.130 | 20.600 | 211.300 | ya6 |
| 8.322E+02 | 1.178 | 1.178 | 1.178 | 0.745 | 3.130 | 23.720 | 158.500 | ya7 |
| 8.449E+02 | 2.261 | 2.142 | 2.142 | 1.693 | 3.130 | 4.300 | 79.200 | ya8 |
| 8.354E+02 | 1.508 | 1.508 | 1.389 | 0.994 | 3.130 | 23.870 | 158.500 | mi1 |
| 8.712E+02 | 0.092 | 0.092 | 0.092 | -0.379 | 3.130 | 24.550 | 79.200 | mi2 |
| 8.627E+02 | 0.383 | 0.267 | 0.267 | -0.174 | 3.130 | 24.360 | 79.200 | mi3 |
| 8.458E+02 | 2.152 | 2.152 | 2.152 | 5.060 | 3.130 | 24.330 | 158.500 | mi4 |
| 8.562E+02 | 0.911 | 0.911 | 0.794 | 3.702 | 3.130 | 24.310 | 79.200 | mi5 |
| 8.736E+02 | 1.763 | 1.648 | 1.648 | 0.664 | 3.038 | 27.350 | 13.200 | mi6 |
| 1.180E+03 | 1.695 | 1.695 | 1.695 | 1.271 | 3.038 | 37.120 | 27.700 | mi7 |
| 1.418E+03 | 1.551 | 1.551 | 0.846 | 0.776 | 3.038 | 44.340 | 165.220 | mi8 |
| 5.985E+02 | 0.084 | 0.084 | 0.084 | -1.036 | 2.720 | 18.680 | 9.100 | mi9 |
| 8.514E+02 | 0.305 | 0.188 | 0.188 | -0.681 | 2.720 | 26.620 | 24.500 | tr1 |
| 1.051E+03 | 0.856 | 0.856 | 0.856 | 0.381 | 2.720 | 33.170 | 161.900 | tr2 |
| 9.739E+02 | -0.503 | -0.606 | -0.606 | -1.222 | 2.453 | 31.400 | 11.280 | tr3 |
| 1.116E+03 | 3.047 | 3.047 | 3.047 | 2.509 | 2.453 | 37.270 | 19.920 | tr4 |
| 1.460E+03 | -2.055 | -2.055 | -2.055 | -2.192 | 2.453 | 46.460 | 161.210 | tr5 |
| 4.681E+02 | 0.192 | 0.192 | 0.192 | -0.705 | 2.561 | 16.020 | 11.000 | tr6 |
| 7.027E+02 | -0.811 | -0.811 | -0.811 | -1.494 | 2.561 | 23.810 | 26.000 | tr7 |
| 8.174E+02 | 3.866 | 3.866 | 3.866 | 3.340 | 2.561 | 28.470 | 199.000 | tr8 |
| 9.296E+02 | 1.549 | 1.549 | 1.549 | 1.086 | 2.561 | 31.660 | 226.000 | tr9 |
| err-avg | 1.24 | 1.22 | 1.17 | 0.824 | | | | |
| err-sd | 1.43 | 1.43 | 1.43 | 1.75 | | | | |

4 Ce-144

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.810E+02 | -2.210 | -2.210 | -2.762 | -3.094 | 3.897 | 12.040 | 79.200 | ya1 |
| 2.245E+02 | -3.341 | -3.341 | -3.786 | -4.009 | 3.130 | 15.380 | 158.500 | ya2 |
| 2.197E+02 | 1.957 | 1.957 | 1.502 | 1.365 | 3.130 | 15.900 | 79.200 | ya3 |
| 1.746E+02 | -4.926 | -4.926 | -4.926 | -5.212 | 3.130 | 11.530 | 26.400 | ya4 |
| err-avg | -2.13 | -2.13 | -2.49 | -2.74 | | | | |
| err-sd | 2.94 | 2.94 | 2.81 | 2.87 | | | | |

3 Nd-143

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 6.955E+02 | 1.222 | 0.503 | 0.791 | -0.129 | 3.038 | 27.350 | 13.200 | ya1 |
| 8.124E+02 | 1.059 | -0.172 | 0.566 | -0.517 | 3.038 | 37.120 | 27.700 | ya2 |
| 8.657E+02 | 1.767 | 0.266 | 1.421 | 0.150 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 1.35 | 0.199 | 0.926 | -0.165 | | | | |
| err-sd | 0.371 | 0.343 | 0.443 | 0.335 | | | | |

3 Nd-144

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.070E+03 | 0.000 | 0.935 | 0.000 | 0.000 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.518E+03 | 0.132 | 0.791 | 0.132 | 0.264 | 3.038 | 37.120 | 27.700 | ya2 |
| 1.864E+03 | -0.215 | 0.322 | -0.215 | -0.054 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -0.276E-01 | 0.682 | -0.276E-01 | 0.700E-01 | | | | |
| err-sd | 0.175 | 0.320 | 0.175 | 0.170 | | | | |

3 Nd-145

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 5.787E+02 | 0.570 | 0.052 | 0.052 | 0.242 | 3.038 | 27.350 | 13.200 | ya1 |
| 7.409E+02 | 0.283 | -0.391 | -0.391 | 0.243 | 3.038 | 37.120 | 27.700 | ya2 |
| 8.441E+02 | 0.344 | -0.604 | -0.486 | 0.557 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 0.399 | -0.315 | -0.275 | 0.347 | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| err-sd | 0.151 | 0.335 | 0.287 | 0.182 | | | | |
| 3 | Nd-146 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 5.560E+02 | 0.540 | 1.079 | 0.899 | -0.809 | 3.038 | 27.350 | 13.200 | ya1 |
| 7.738E+02 | 0.414 | 1.189 | 0.930 | -0.685 | 3.038 | 37.120 | 27.700 | ya2 |
| 9.417E+02 | 0.350 | 1.306 | 0.988 | -0.520 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 0.435 | 1.19 | 0.939 | -0.672 | | | | |
| err-sd | 0.963E-01 | 0.114 | 0.448E-01 | 0.145 | | | | |
| 16 | Nd-148 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 2.307E+02 | -1.604 | -1.170 | -1.604 | -0.824 | 3.130 | 20.600 | 211.300 | ya1 |
| 2.655E+02 | -1.695 | -1.318 | -1.695 | -0.753 | 3.130 | 23.720 | 158.500 | ya2 |
| 2.719E+02 | -1.434 | -1.434 | -1.434 | -0.699 | 3.130 | 4.300 | 79.200 | ya3 |
| 2.666E+02 | -1.350 | -1.350 | -1.350 | -0.563 | 3.130 | 23.870 | 158.500 | ya4 |
| 2.740E+02 | -1.095 | -1.095 | -1.095 | -0.474 | 3.130 | 24.550 | 79.200 | ya5 |
| 2.676E+02 | -1.345 | -1.345 | -1.345 | -0.673 | 3.130 | 23.930 | 158.500 | ya6 |
| 2.722E+02 | -1.176 | -1.176 | -1.543 | -0.551 | 3.130 | 24.360 | 79.200 | ya7 |
| 2.706E+02 | -0.961 | -0.961 | -0.961 | -0.074 | 3.130 | 24.330 | 158.500 | ya8 |
| 3.342E+02 | 1.735 | 1.735 | 1.735 | 2.932 | 2.556 | 30.720 | 167.600 | mi1 |
| 3.320E+02 | 1.506 | 1.506 | 1.506 | 2.892 | 2.556 | 30.510 | 167.000 | mi2 |
| 3.434E+02 | 1.631 | 1.631 | 1.631 | 2.970 | 2.556 | 31.560 | 167.000 | mi3 |
| 3.400E+02 | 1.765 | 1.765 | 1.765 | 3.000 | 2.556 | 31.260 | 167.600 | mi4 |
| 3.405E+02 | 1.615 | 1.615 | 1.615 | 2.996 | 2.556 | 31.310 | 167.000 | mi5 |
| 3.007E+02 | 0.432 | 0.432 | 0.432 | 0.632 | 3.038 | 27.350 | 13.200 | mi6 |
| 4.073E+02 | 0.417 | 0.417 | 0.417 | 1.105 | 3.038 | 37.120 | 27.700 | mi7 |
| 4.856E+02 | 0.288 | 0.288 | 0.288 | 1.503 | 3.038 | 44.340 | 165.220 | mi8 |
| err-avg | -0.794E-01 | -0.287E-01 | -0.102 | 0.839 | | | | |
| err-sd | 1.38 | 1.33 | 1.40 | 1.62 | | | | |
| 3 | Nd-150 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 1.407E+02 | 2.345 | 2.345 | 2.345 | 0.995 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.952E+02 | 3.484 | 3.484 | 3.484 | 2.305 | 3.038 | 37.120 | 27.700 | ya2 |
| 2.360E+02 | 4.237 | 4.237 | 4.237 | 3.517 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 3.36 | 3.36 | 3.36 | 2.27 | | | | |
| err-sd | 0.952 | 0.952 | 0.952 | 1.26 | | | | |
| 3 | Sm-148 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 1.203E+02 | -16.874 | -17.706 | -19.867 | -12.801 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.861E+02 | -13.487 | -14.562 | -16.711 | -5.373 | 3.038 | 37.120 | 27.700 | ya2 |
| 2.519E+02 | -17.428 | -18.222 | -19.809 | -6.511 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -15.9 | -16.8 | -18.8 | -8.23 | | | | |
| err-sd | 2.13 | 1.98 | 1.81 | 4.00 | | | | |
| 3 | Sm-149 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 3.290E+00 | -25.228 | -31.611 | -31.003 | -40.547 | 3.038 | 27.350 | 13.200 | ya1 |
| 3.404E+00 | -20.975 | -27.438 | -26.851 | -38.337 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.333E+00 | -44.872 | -49.184 | -48.622 | -57.135 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -30.4 | -36.1 | -35.5 | -45.3 | | | | |
| err-sd | 12.7 | 11.5 | 11.6 | 10.3 | | | | |
| 3 | Sm-150 | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 2.349E+02 | -2.086 | -2.512 | -0.809 | -9.706 | 3.038 | 27.350 | 13.200 | ya1 |
| 3.075E+02 | 4.715 | 3.740 | 6.667 | -4.130 | 3.038 | 37.120 | 27.700 | ya2 |
| 4.096E+02 | -4.541 | -5.762 | -2.100 | -12.842 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -0.637 | -1.51 | 1.25 | -8.89 | | | | |
| err-sd | 4.80 | 4.83 | 4.73 | 4.41 | | | | |

3 Sm-152

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.871E+01 | 11.438 | 14.477 | 3.333 | 13.970 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.180E+02 | 21.186 | 23.729 | 9.322 | 22.627 | 3.038 | 37.120 | 27.700 | ya2 |
| 1.373E+02 | 19.446 | 22.360 | 4.880 | 19.665 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | 17.4 | 20.2 | 5.84 | 18.8 | | | | |
| err-sd | 5.20 | 4.99 | 3.11 | 4.40 | | | | |

3 Eu-153

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 8.963E+01 | -5.724 | 0.971 | 5.099 | -9.885 | 3.038 | 27.350 | 13.200 | ya1 |
| 1.237E+02 | 0.243 | 11.560 | 13.985 | -2.021 | 3.038 | 37.120 | 27.700 | ya2 |
| 1.679E+02 | -8.874 | 2.442 | 3.633 | -10.482 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -4.79 | 4.99 | 7.57 | -7.46 | | | | |
| err-sd | 4.63 | 5.74 | 5.60 | 4.72 | | | | |

9 Eu-154

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 5.074E+00 | 12.140 | -21.758 | -18.605 | -31.297 | 3.130 | 12.860 | 237.700 | ya1 |
| 1.357E+01 | 16.433 | -21.887 | -18.939 | -33.552 | 3.130 | 20.600 | 211.300 | ya2 |
| 1.720E+01 | 22.093 | -19.186 | -16.279 | -32.209 | 3.130 | 23.720 | 158.500 | ya3 |
| 1.594E+01 | 36.763 | -10.289 | -6.524 | -24.906 | 3.130 | 4.300 | 79.200 | ya4 |
| 1.706E+01 | 24.853 | -17.937 | -14.420 | -30.832 | 3.130 | 23.870 | 158.500 | ya5 |
| 1.852E+01 | 20.410 | -21.166 | -17.927 | -34.179 | 3.130 | 24.550 | 79.200 | ya6 |
| 1.658E+01 | 32.690 | -13.148 | -9.530 | -27.503 | 3.130 | 24.360 | 79.200 | ya7 |
| 1.708E+01 | 29.391 | -14.520 | -11.007 | -27.459 | 3.130 | 24.330 | 158.500 | ya8 |
| 1.783E+01 | 22.266 | -19.798 | -16.433 | -32.025 | 3.130 | 24.310 | 79.200 | mi1 |
| err-avg | 24.1 | -17.7 | -14.4 | -30.4 | | | | |
| err-sd | 7.79 | 4.16 | 4.41 | 3.13 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.718E+05 | 0.390 | 0.390 | 0.398 | 0.402 | 3.400 | 15.950 | 220.220 | ya1 |
| 9.538E+05 | 0.329 | 0.328 | 0.241 | 0.241 | 3.400 | 30.390 | 138.940 | ya2 |
| 9.512E+05 | 0.456 | 0.455 | 0.474 | 0.411 | 3.400 | 31.330 | 57.660 | ya3 |
| 9.566E+05 | 1.425 | 1.425 | 1.432 | 1.397 | 3.400 | 20.190 | 17.020 | ya4 |
| 9.511E+05 | 0.342 | 0.446 | 0.370 | 0.308 | 3.400 | 32.030 | 138.940 | ya5 |
| 9.521E+05 | 0.358 | 0.347 | 0.375 | 0.298 | 3.400 | 31.410 | 57.660 | ya6 |
| 9.473E+05 | 0.282 | 0.279 | 0.202 | 0.166 | 3.400 | 35.970 | 138.940 | ya7 |
| 9.484E+05 | 0.290 | 0.286 | 0.208 | 0.173 | 3.400 | 35.260 | 57.660 | ya8 |
| 9.878E+05 | -0.042 | -0.042 | -0.043 | 0.003 | 3.208 | 8.300 | -1.000 | mi1 |
| 9.887E+05 | 0.059 | 0.068 | 0.068 | 0.067 | 3.208 | 6.900 | -1.000 | mi2 |
| 9.772E+05 | 0.009 | 0.018 | 0.017 | 0.099 | 3.203 | 15.360 | -1.000 | mi3 |
| 9.698E+05 | -0.063 | -0.064 | -0.044 | 0.054 | 3.203 | 21.290 | -1.000 | mi4 |
| 9.781E+05 | 0.060 | 0.060 | 0.069 | 0.106 | 3.203 | 14.660 | -1.000 | mi5 |
| 9.606E+05 | -0.120 | -0.120 | -0.104 | -0.001 | 3.210 | 29.500 | -1.000 | mi6 |
| 9.572E+05 | -0.058 | -0.058 | -0.040 | 0.007 | 3.210 | 32.200 | -1.000 | mi7 |
| 9.562E+05 | -0.120 | -0.121 | -0.209 | -0.068 | 3.210 | 33.710 | -1.000 | mi8 |
| 9.542E+05 | -0.129 | -0.019 | -0.104 | 0.005 | 3.210 | 34.320 | -1.000 | mi9 |
| 9.807E+05 | 0.072 | 0.072 | 0.080 | 0.109 | 3.897 | 12.040 | 79.200 | tr1 |
| 9.759E+05 | 0.043 | 0.052 | 0.060 | 0.081 | 3.130 | 15.380 | 158.500 | tr2 |
| 9.751E+05 | 0.085 | 0.085 | 0.104 | 0.101 | 3.130 | 15.900 | 79.200 | tr3 |
| 9.822E+05 | -0.074 | -0.063 | -0.065 | 0.016 | 3.130 | 11.530 | 26.400 | tr4 |
| 9.806E+05 | -0.090 | -0.081 | -0.072 | -0.039 | 3.130 | 12.860 | 237.700 | tr5 |
| 9.695E+05 | 0.029 | 0.028 | -0.056 | 0.021 | 3.130 | 20.600 | 211.300 | tr6 |
| 9.654E+05 | -0.007 | -0.008 | 0.009 | 0.026 | 3.130 | 23.720 | 158.500 | tr7 |
| 9.652E+05 | -0.024 | -0.024 | -0.110 | -0.012 | 3.130 | 4.300 | 79.200 | tr8 |
| 9.656E+05 | -0.041 | -0.042 | -0.025 | -0.015 | 3.130 | 23.870 | 158.500 | tr9 |
| 9.641E+05 | -0.018 | 0.086 | 0.000 | 0.075 | 3.130 | 24.550 | 79.200 | tr10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.651E+05 | 0.016 | 0.016 | -0.070 | 0.030 | 3.130 | 23.930 | 158.500 | tr11 |
| 9.639E+05 | 0.109 | 0.108 | 0.012 | 0.107 | 3.130 | 24.360 | 79.200 | tr12 |
| 9.650E+05 | -0.102 | 0.002 | -0.084 | -0.015 | 3.130 | 24.330 | 158.500 | tr13 |
| 9.631E+05 | 0.195 | 0.195 | 0.109 | 0.207 | 3.130 | 24.310 | 79.200 | tr14 |
| 9.595E+05 | -0.154 | -0.151 | -0.138 | -0.051 | 2.556 | 30.720 | 167.600 | tu1 |
| 9.597E+05 | -0.169 | -0.063 | -0.153 | -0.045 | 2.556 | 30.510 | 167.000 | tu2 |
| 9.584E+05 | -0.170 | -0.063 | -0.154 | -0.047 | 2.556 | 31.560 | 167.000 | tu3 |
| 9.587E+05 | -0.088 | -0.089 | -0.073 | -0.038 | 2.556 | 31.260 | 167.600 | tu4 |
| 9.588E+05 | -0.107 | -0.106 | -0.091 | -0.057 | 2.556 | 31.310 | 167.000 | tu5 |
| 9.693E+05 | -0.652 | -0.653 | -0.640 | -0.591 | 3.038 | 27.350 | 13.200 | ca1 |
| 9.548E+05 | -0.438 | -0.336 | -0.425 | -0.321 | 3.038 | 37.120 | 27.700 | ca2 |
| 9.442E+05 | -0.233 | -0.128 | -0.217 | -0.104 | 3.038 | 44.340 | 165.220 | ca3 |
| 9.848E+05 | -1.160 | -1.151 | -1.142 | -1.092 | 2.720 | 18.680 | 9.100 | ca4 |
| 9.801E+05 | -1.737 | -1.635 | -1.725 | -1.616 | 2.720 | 26.620 | 24.500 | ca5 |
| 9.649E+05 | -1.012 | -0.906 | -0.997 | -0.900 | 2.720 | 33.170 | 161.900 | ca6 |
| 9.660E+05 | -0.770 | -0.771 | -0.755 | -0.699 | 2.453 | 31.400 | 11.280 | ca7 |
| 9.640E+05 | -1.316 | -1.317 | -1.302 | -1.204 | 2.453 | 37.270 | 19.920 | ca8 |
| 9.436E+05 | -0.281 | -0.281 | -0.265 | -0.205 | 2.453 | 46.460 | 161.210 | ca9 |
| 9.755E+05 | 0.115 | 0.114 | 0.124 | 0.183 | 2.561 | 16.020 | 11.000 | ro1 |
| 9.722E+05 | -0.605 | -0.604 | -0.591 | -0.489 | 2.561 | 23.810 | 26.000 | ro2 |
| 9.564E+05 | 0.472 | 0.472 | 0.386 | 0.534 | 2.561 | 28.470 | 199.000 | ro3 |
| 9.642E+05 | -0.741 | -0.738 | -0.825 | -0.681 | 2.561 | 31.660 | 226.000 | ro4 |
| 1.454E+04 | -1.376 | -1.444 | -0.138 | -2.077 | 3.130 | 25.930 | -1.000 | ob1 |
| 1.420E+04 | -0.845 | -0.845 | 0.423 | -1.683 | 3.130 | 26.540 | -1.000 | ob2 |
| 1.355E+04 | -0.443 | -0.295 | 0.738 | -1.387 | 3.130 | 27.990 | -1.000 | ob3 |
| 1.341E+04 | -0.671 | -0.373 | 0.597 | -1.544 | 3.130 | 28.400 | -1.000 | ob4 |
| 1.333E+04 | -1.950 | -1.650 | -0.675 | -2.843 | 3.130 | 29.040 | -1.000 | ob5 |
| 1.299E+04 | -0.770 | -0.462 | 0.539 | -1.747 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -0.208 | -0.170 | -0.782E-01 | -0.261 | | | | |
| err-sd | 0.578 | 0.552 | 0.510 | 0.741 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.041E+02 | 18.053 | 6.215 | 3.256 | -2.664 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.039E+02 | 28.745 | 15.870 | 11.909 | 7.650 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.310E+02 | 19.586 | 7.533 | 3.390 | 0.640 | 3.038 | 44.340 | 165.220 | ya3 |
| 1.979E+02 | 10.662 | -1.465 | -3.487 | -10.814 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.395E+02 | 2.504 | -8.100 | -10.751 | -15.670 | 2.720 | 26.620 | 24.500 | ya5 |
| 3.877E+02 | 18.133 | 6.010 | 2.657 | -1.625 | 2.720 | 33.170 | 161.900 | ya6 |
| 2.960E+02 | 32.770 | 18.243 | 14.865 | 7.365 | 2.453 | 31.400 | 11.280 | ya7 |
| 3.636E+02 | 29.813 | 15.787 | 12.211 | 5.831 | 2.453 | 37.270 | 19.920 | ya8 |
| 4.280E+02 | 35.748 | 20.327 | 16.355 | 11.636 | 2.453 | 46.460 | 161.210 | mi1 |
| 1.759E+02 | 5.742 | -6.765 | -8.471 | -19.500 | 2.561 | 16.020 | 11.000 | mi2 |
| 2.950E+02 | 5.424 | -6.102 | -8.136 | -16.814 | 2.561 | 23.810 | 26.000 | mi3 |
| 3.449E+02 | 14.236 | 2.059 | -0.841 | -8.524 | 2.561 | 28.470 | 199.000 | mi4 |
| 3.778E+02 | 18.317 | 6.141 | 2.700 | -4.685 | 2.561 | 31.660 | 226.000 | mi5 |
| err-avg | 18.4 | 5.83 | 2.74 | -3.63 | | | | |
| err-sd | 10.8 | 9.70 | 9.06 | 10.2 | | | | |

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| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 7.861E+03 | -6.675 | -8.395 | -5.339 | -3.764 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.205E+04 | -7.800 | -9.011 | -5.675 | -1.995 | 3.400 | 30.390 | 138.940 | ya2 |
| 1.252E+04 | -10.054 | -11.140 | -8.010 | -4.494 | 3.400 | 31.330 | 57.660 | ya3 |
| 9.179E+03 | -7.882 | -9.250 | -6.201 | -4.121 | 3.400 | 20.190 | 17.020 | ya4 |
| 1.266E+04 | -8.852 | -10.131 | -6.720 | -2.965 | 3.400 | 32.030 | 138.940 | ya5 |
| 1.214E+04 | -7.042 | -8.245 | -4.934 | -1.341 | 3.400 | 31.410 | 57.660 | ya6 |
| 1.200E+04 | 2.509 | 1.308 | 5.059 | 9.957 | 3.400 | 35.970 | 138.940 | ya7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.169E+04 | 2.883 | 1.797 | 5.484 | 9.987 | 3.400 | 35.260 | 57.660 | ya8 |
| 3.565E+03 | 2.339 | 0.924 | 3.002 | -2.510 | 3.208 | 8.300 | -1.000 | mi1 |
| 3.266E+03 | 0.785 | -1.121 | 1.043 | -3.951 | 3.208 | 6.900 | -1.000 | mi2 |
| 6.188E+03 | -6.597 | -8.132 | -6.516 | -10.521 | 3.203 | 15.360 | -1.000 | mi3 |
| 7.454E+03 | -0.711 | -2.741 | -0.597 | -4.592 | 3.203 | 21.290 | -1.000 | mi4 |
| 6.327E+03 | -12.905 | -14.527 | -12.469 | -16.310 | 3.203 | 14.660 | -1.000 | mi5 |
| 8.894E+03 | -4.756 | -5.824 | -3.733 | -6.269 | 3.210 | 29.500 | -1.000 | mi6 |
| 9.449E+03 | -4.847 | -5.990 | -3.884 | -6.298 | 3.210 | 32.200 | -1.000 | mi7 |
| 8.975E+03 | 1.638 | 0.691 | 2.942 | 0.253 | 3.210 | 33.710 | -1.000 | mi8 |
| 9.586E+03 | 0.511 | -1.095 | 1.116 | -0.911 | 3.210 | 34.320 | -1.000 | mi9 |
| 5.681E+03 | -3.813 | -5.244 | -2.439 | -5.161 | 3.897 | 12.040 | 79.200 | tr1 |
| 7.084E+03 | -1.047 | -2.724 | 0.215 | -2.250 | 3.130 | 15.380 | 158.500 | tr2 |
| 7.084E+03 | -0.388 | -1.953 | 0.987 | -1.699 | 3.130 | 15.900 | 79.200 | tr3 |
| 5.600E+03 | -1.568 | -3.047 | -0.554 | -3.578 | 3.130 | 11.530 | 26.400 | tr4 |
| 5.866E+03 | 4.228 | 2.211 | 5.176 | 2.466 | 3.130 | 12.860 | 237.700 | tr5 |
| 8.332E+03 | 1.980 | 0.336 | 3.337 | 1.395 | 3.130 | 20.600 | 211.300 | tr6 |
| 8.924E+03 | 3.211 | 1.776 | 5.060 | 3.083 | 3.130 | 23.720 | 158.500 | tr7 |
| 9.213E+03 | -0.223 | -1.395 | 1.666 | -0.412 | 3.130 | 4.300 | 79.200 | tr8 |
| 9.000E+03 | 2.811 | 1.511 | 4.533 | 2.622 | 3.130 | 23.870 | 158.500 | tr9 |
| 9.074E+03 | 1.918 | 0.727 | 3.846 | 1.745 | 3.130 | 24.550 | 79.200 | tr10 |
| 9.147E+03 | 1.290 | -0.109 | 3.094 | 1.141 | 3.130 | 23.930 | 158.500 | tr11 |
| 9.119E+03 | 0.921 | -0.373 | 2.731 | 0.756 | 3.130 | 24.360 | 79.200 | tr12 |
| 9.134E+03 | 2.628 | 1.128 | 4.226 | 2.641 | 3.130 | 24.330 | 158.500 | tr13 |
| 9.070E+03 | 1.235 | 0.044 | 3.054 | 1.456 | 3.130 | 24.310 | 79.200 | tr14 |
| 8.804E+03 | 3.504 | 2.255 | 4.299 | 0.206 | 2.556 | 30.720 | 167.600 | tu1 |
| 8.863E+03 | 2.485 | 1.232 | 3.263 | -0.809 | 2.556 | 30.510 | 167.000 | tu2 |
| 9.019E+03 | 2.336 | 1.150 | 3.256 | -0.844 | 2.556 | 31.560 | 167.000 | tu3 |
| 9.066E+03 | 1.445 | -0.210 | 2.118 | -1.827 | 2.556 | 31.260 | 167.600 | tu4 |
| 8.799E+03 | 4.550 | 3.311 | 5.368 | 1.239 | 2.556 | 31.310 | 167.000 | tu5 |
| 8.003E+03 | -1.040 | -1.939 | -0.327 | -3.753 | 3.038 | 27.350 | 13.200 | ca1 |
| 9.376E+03 | -1.087 | -1.769 | -0.010 | -3.240 | 3.038 | 37.120 | 27.700 | ca2 |
| 1.024E+04 | -0.149 | -0.950 | 0.983 | -1.853 | 3.038 | 44.340 | 165.220 | ca3 |
| 6.615E+03 | -2.831 | -4.087 | -2.412 | -5.864 | 2.720 | 18.680 | 9.100 | ca4 |
| 8.086E+03 | -2.441 | -3.395 | -1.672 | -4.740 | 2.720 | 26.620 | 24.500 | ca5 |
| 8.857E+03 | 1.103 | -0.015 | 1.939 | -0.724 | 2.720 | 33.170 | 161.900 | ca6 |
| 8.277E+03 | -2.951 | -2.867 | -0.777 | -6.535 | 2.453 | 31.400 | 11.280 | ca7 |
| 9.007E+03 | -3.474 | -3.041 | -0.998 | -6.533 | 2.453 | 37.270 | 19.920 | ca8 |
| 9.876E+03 | -2.434 | -1.887 | 0.320 | -4.493 | 2.453 | 46.460 | 161.210 | ca9 |
| 5.744E+03 | 4.392 | 2.886 | 4.956 | -3.501 | 2.561 | 16.020 | 11.000 | ro1 |
| 7.107E+03 | 3.907 | 2.591 | 4.765 | -2.886 | 2.561 | 23.810 | 26.000 | ro2 |
| 8.117E+03 | 1.467 | -0.873 | 1.899 | -5.098 | 2.561 | 28.470 | 199.000 | ro3 |
| 8.103E+03 | 6.830 | 4.707 | 7.336 | 0.043 | 2.561 | 31.660 | 226.000 | ro4 |
| 7.895E+03 | 3.002 | 1.203 | 3.103 | -0.499 | 3.130 | 25.930 | -1.000 | ob1 |
| 7.849E+03 | 4.931 | 3.236 | 5.313 | 1.325 | 3.130 | 26.540 | -1.000 | ob2 |
| 8.275E+03 | 2.320 | 0.761 | 2.840 | -0.956 | 3.130 | 27.990 | -1.000 | ob3 |
| 8.543E+03 | -0.047 | -1.650 | 0.363 | -3.194 | 3.130 | 28.400 | -1.000 | ob4 |
| 8.469E+03 | 1.996 | 0.508 | 2.550 | -1.093 | 3.130 | 29.040 | -1.000 | ob5 |
| 8.549E+03 | 2.012 | 0.444 | 2.456 | -1.138 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -0.445 | -1.75 | 0.735 | -1.86 | | | | |
| err-sd | 4.22 | 4.12 | 4.11 | 4.13 | | | | |

15 Am

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.533E+01 | 0.205 | 7.233 | 7.944 | -18.711 | 3.130 | 20.600 | 211.300 | ya1 |
| 4.746E+01 | -15.309 | -9.704 | -9.514 | -30.791 | 3.130 | 23.720 | 158.500 | ya2 |
| 4.810E+01 | -11.949 | -6.002 | -5.795 | -28.066 | 3.130 | 4.300 | 79.200 | ya3 |
| 4.859E+01 | -9.920 | -3.807 | -3.828 | -26.357 | 3.130 | 24.550 | 79.200 | ya4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4.648E+01 | -10.912 | -4.974 | -4.780 | -27.204 | 3.130 | 23.930 | 158.500 | ya5 |
| 4.466E+01 | -4.279 | 1.923 | 2.125 | -21.896 | 3.130 | 24.360 | 79.200 | ya6 |
| 2.829E+02 | 0.389 | -4.913 | -2.793 | -7.494 | 3.038 | 27.350 | 13.200 | ya7 |
| 3.900E+02 | -6.410 | -11.282 | -8.974 | -12.462 | 3.038 | 37.120 | 27.700 | ya8 |
| 4.330E+02 | -5.312 | -10.393 | -7.852 | -10.716 | 3.038 | 44.340 | 165.220 | mi1 |
| 2.204E+02 | -1.996 | -7.895 | -5.626 | -12.250 | 2.720 | 18.680 | 9.100 | mi2 |
| 3.275E+02 | 1.069 | -4.733 | -2.595 | -8.366 | 2.720 | 26.620 | 24.500 | mi3 |
| 3.966E+02 | 2.622 | -3.177 | -0.656 | -5.572 | 2.720 | 33.170 | 161.900 | mi4 |
| 3.900E+02 | -2.564 | -7.949 | -4.103 | -11.333 | 2.453 | 31.400 | 11.280 | mi5 |
| 4.825E+02 | -13.782 | -18.342 | -14.819 | -21.078 | 2.453 | 37.270 | 19.920 | mi6 |
| 7.205E+02 | -37.266 | -40.458 | -37.821 | -41.721 | 2.453 | 46.460 | 161.210 | mi7 |
| err-avg | -7.69 | -8.30 | -6.61 | -18.9 | | | | |
| err-sd | 9.97 | 10.6 | 10.1 | 10.4 | | | | |

15 Cm

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.237E+01 | -20.948 | -24.704 | -21.976 | -29.242 | 3.130 | 20.600 | 211.300 | ya1 |
| 3.337E+01 | -21.449 | -24.356 | -21.150 | -29.400 | 3.130 | 23.720 | 158.500 | ya2 |
| 3.654E+01 | -25.268 | -27.676 | -24.967 | -32.804 | 3.130 | 4.300 | 79.200 | ya3 |
| 3.214E+01 | -17.175 | -19.788 | -16.739 | -25.333 | 3.130 | 23.870 | 158.500 | ya4 |
| 3.454E+01 | -18.795 | -21.139 | -18.187 | -26.773 | 3.130 | 24.550 | 79.200 | ya5 |
| 3.711E+01 | -27.792 | -30.001 | -27.334 | -34.859 | 3.130 | 23.930 | 158.500 | ya6 |
| 3.439E+01 | -20.073 | -22.603 | -19.666 | -28.089 | 3.130 | 24.360 | 79.200 | ya7 |
| 3.474E+01 | -18.921 | -21.569 | -18.317 | -50.075 | 3.130 | 24.330 | 158.500 | ya8 |
| 3.360E+01 | -18.740 | -21.330 | -18.383 | -50.185 | 3.130 | 24.310 | 79.200 | mi1 |
| 2.740E+01 | -25.438 | -25.255 | -22.372 | -35.026 | 3.130 | 25.930 | -1.000 | mi2 |
| 3.100E+01 | -25.774 | -25.484 | -22.581 | -35.029 | 3.130 | 26.540 | -1.000 | mi3 |
| 3.260E+01 | -18.712 | -17.485 | -14.110 | -28.546 | 3.130 | 27.990 | -1.000 | mi4 |
| 3.590E+01 | -22.841 | -21.727 | -18.663 | -32.368 | 3.130 | 28.400 | -1.000 | mi5 |
| 3.770E+01 | -21.220 | -19.363 | -15.915 | -30.610 | 3.130 | 29.040 | -1.000 | mi6 |
| 4.070E+01 | -22.359 | -20.393 | -17.199 | -31.622 | 3.130 | 29.520 | -1.000 | mi7 |
| err-avg | -21.7 | -22.9 | -19.8 | -33.3 | | | | |
| err-sd | 3.16 | 3.35 | 3.55 | 7.43 | | | | |

9 Se

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.765E+00 | 8.898 | 8.898 | 8.632 | 4.223 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.995E+00 | 8.909 | 8.909 | 8.709 | 1.842 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.370E+00 | 18.808 | 18.808 | 18.808 | 9.237 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.838E+00 | 0.070 | -0.282 | -0.282 | -2.819 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.798E+00 | 4.529 | 4.529 | 4.265 | -0.184 | 2.720 | 26.620 | 24.500 | ya5 |
| 4.584E+00 | 6.021 | 6.021 | 6.021 | -0.218 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.459E+00 | 32.986 | 32.986 | 32.986 | 24.371 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.659E+00 | 15.261 | 15.261 | 15.261 | 5.752 | 2.453 | 37.270 | 19.920 | ya8 |
| 4.957E+00 | 31.935 | 31.935 | 31.935 | 17.369 | 2.453 | 46.460 | 161.210 | mi1 |
| err-avg | 14.2 | 14.1 | 14.0 | 6.62 | | | | |
| err-sd | 11.8 | 11.8 | 11.9 | 9.01 | | | | |

9 Sr

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 3.815E+02 | 5.374 | 5.374 | 5.111 | 5.505 | 3.038 | 27.350 | 13.200 | ya1 |
| 4.904E+02 | 2.569 | 2.569 | 2.365 | 3.079 | 3.038 | 37.120 | 27.700 | ya2 |
| 5.470E+02 | 3.473 | 3.656 | 3.291 | 4.205 | 3.038 | 44.340 | 165.220 | ya3 |
| 2.793E+02 | 1.683 | 1.683 | 1.325 | 1.719 | 2.720 | 18.680 | 9.100 | ya4 |
| 3.665E+02 | 2.592 | 2.592 | 2.319 | 2.701 | 2.720 | 26.620 | 24.500 | ya5 |
| 4.347E+02 | 1.219 | 1.219 | 0.989 | 1.610 | 2.720 | 33.170 | 161.900 | ya6 |
| 3.857E+02 | 2.670 | 2.930 | 2.411 | 3.759 | 2.453 | 31.400 | 11.280 | ya7 |
| 4.305E+02 | 3.368 | 3.600 | 3.136 | 4.599 | 2.453 | 37.270 | 19.920 | ya8 |
| 5.021E+02 | 2.171 | 2.171 | 1.972 | 3.366 | 2.453 | 46.460 | 161.210 | mi1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| err-avg | 2.79 | 2.87 | 2.55 | 3.39 | | | | |
| err-sd | 1.21 | 1.24 | 1.22 | 1.29 | | | | |
| 13 Tc | | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 6.415E+02 | 4.131 | 4.443 | 5.066 | 7.825 | 3.038 | 27.350 | 13.200 | ya1 |
| 8.228E+02 | 5.372 | 5.858 | 6.952 | 10.112 | 3.038 | 37.120 | 27.700 | ya2 |
| 9.033E+02 | 10.594 | 11.812 | 12.919 | 16.462 | 3.038 | 44.340 | 165.220 | ya3 |
| 4.730E+02 | -0.423 | -0.211 | 0.211 | 2.262 | 2.720 | 18.680 | 9.100 | ya4 |
| 6.268E+02 | 3.542 | 3.861 | 4.499 | 6.892 | 2.720 | 26.620 | 24.500 | ya5 |
| 7.560E+02 | 3.571 | 4.101 | 5.026 | 7.659 | 2.720 | 33.170 | 161.900 | ya6 |
| 5.151E+02 | 44.438 | 44.826 | 45.991 | 50.320 | 2.453 | 31.400 | 11.280 | ya7 |
| 5.994E+02 | 42.976 | 43.477 | 45.145 | 49.683 | 2.453 | 37.270 | 19.920 | ya8 |
| 7.292E+02 | 39.879 | 39.879 | 42.622 | 47.422 | 2.453 | 46.460 | 161.210 | mi1 |
| 3.639E+02 | 11.569 | 11.844 | 12.119 | 12.091 | 2.561 | 16.020 | 11.000 | mi2 |
| 5.412E+02 | 7.908 | 8.093 | 8.832 | 8.962 | 2.561 | 23.810 | 26.000 | mi3 |
| 5.987E+02 | 13.913 | 14.415 | 15.250 | 15.600 | 2.561 | 28.470 | 199.000 | mi4 |
| 6.756E+02 | 10.568 | 11.012 | 12.049 | 12.493 | 2.561 | 31.660 | 226.000 | mi5 |
| err-avg | 15.2 | 15.6 | 16.7 | 19.1 | | | | |
| err-sd | 16.0 | 16.0 | 16.5 | 17.6 | | | | |
| 4 Ru | | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 4.192E+01 | -7.443 | -7.204 | -6.011 | -8.349 | 3.897 | 12.040 | 79.200 | ya1 |
| 6.328E+01 | 2.244 | 2.244 | 3.508 | 1.233 | 3.130 | 15.380 | 158.500 | ya2 |
| 6.761E+01 | -0.459 | -0.606 | 0.725 | -1.686 | 3.130 | 15.900 | 79.200 | ya3 |
| 4.637E+01 | -10.287 | -10.287 | -8.993 | -11.581 | 3.130 | 11.530 | 26.400 | ya4 |
| err-avg | -3.99 | -3.96 | -2.69 | -5.10 | | | | |
| err-sd | 5.86 | 5.78 | 5.80 | 5.90 | | | | |
| 6 Sn | | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 3.438E+00 | 179.232 | 178.650 | 180.396 | 220.244 | 2.720 | 18.680 | 9.100 | ya1 |
| 5.437E+00 | 181.405 | 179.566 | 181.405 | 220.765 | 2.720 | 26.620 | 24.500 | ya2 |
| 6.756E+00 | 201.954 | 201.954 | 203.434 | 244.435 | 2.720 | 33.170 | 161.900 | ya3 |
| 5.637E+00 | 247.703 | 247.703 | 249.477 | 293.294 | 2.453 | 31.400 | 11.280 | ya4 |
| 6.397E+00 | 282.992 | 281.429 | 284.555 | 333.172 | 2.453 | 37.270 | 19.920 | ya5 |
| 8.396E+00 | 285.898 | 285.898 | 287.089 | 338.423 | 2.453 | 46.460 | 161.210 | ya6 |
| err-avg | 230. | 229. | 231. | 275. | | | | |
| err-sd | 48.9 | 49.1 | 49.3 | 54.1 | | | | |
| 3 I | | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 1.124E+02 | -11.655 | -11.655 | -11.477 | -17.749 | 2.720 | 18.680 | 9.100 | ya1 |
| 1.548E+02 | -5.685 | -6.331 | -5.685 | -12.662 | 2.720 | 26.620 | 24.500 | ya2 |
| 2.159E+02 | -14.775 | -14.775 | -14.775 | -20.704 | 2.720 | 33.170 | 161.900 | ya3 |
| err-avg | -10.7 | -10.9 | -10.6 | -17.0 | | | | |
| err-sd | 4.62 | 4.27 | 4.60 | 4.07 | | | | |
| 26 Cs | | | | | | | | |
| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
| 4.687E+02 | 0.474 | 0.324 | 0.047 | -0.813 | 3.897 | 12.040 | 79.200 | ya1 |
| 6.047E+02 | 0.582 | 0.384 | 0.268 | -0.228 | 3.130 | 15.380 | 158.500 | ya2 |
| 6.143E+02 | 2.527 | 2.331 | 2.201 | 1.639 | 3.130 | 15.900 | 79.200 | ya3 |
| 4.387E+02 | 2.770 | 2.633 | 2.565 | 1.680 | 3.130 | 11.530 | 26.400 | ya4 |
| 4.720E+02 | 0.091 | -0.015 | -0.100 | -0.803 | 3.130 | 12.860 | 237.700 | ya5 |
| 7.750E+02 | -0.532 | -0.725 | -1.009 | -1.200 | 3.130 | 20.600 | 211.300 | ya6 |
| 8.910E+02 | 0.194 | -0.019 | -0.199 | -0.301 | 3.130 | 23.720 | 158.500 | ya7 |
| 9.051E+02 | 1.279 | 0.948 | 0.771 | 0.649 | 3.130 | 4.300 | 79.200 | ya8 |
| 9.148E+02 | -1.687 | -1.905 | -2.189 | -2.254 | 3.130 | 23.870 | 158.500 | mi1 |
| 9.327E+02 | -0.752 | -0.966 | -1.148 | -1.286 | 3.130 | 24.550 | 79.200 | mi2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.241E+02 | -0.561 | -0.885 | -1.058 | -1.174 | 3.130 | 24.360 | 79.200 | mi3 |
| 9.050E+02 | 1.354 | 1.121 | 0.945 | 4.819 | 3.130 | 24.330 | 158.500 | mi4 |
| 9.167E+02 | 0.004 | -0.214 | -0.497 | 3.334 | 3.130 | 24.310 | 79.200 | mi5 |
| 2.258E+03 | 2.903 | 1.955 | 2.252 | 1.246 | 3.038 | 27.350 | 13.200 | mi6 |
| 2.893E+03 | 2.700 | 2.050 | 2.202 | 1.348 | 3.038 | 37.120 | 27.700 | mi7 |
| 3.347E+03 | 2.565 | 1.935 | 2.087 | 1.350 | 3.038 | 44.340 | 165.220 | mi8 |
| 8.733E+02 | 3.057 | 1.340 | 1.569 | 0.870 | 2.720 | 18.680 | 9.100 | mi9 |
| 1.159E+03 | 2.874 | 1.148 | 1.407 | 0.587 | 2.720 | 26.620 | 24.500 | tr1 |
| 1.378E+03 | 3.338 | 1.814 | 2.104 | 1.437 | 2.720 | 33.170 | 161.900 | tr2 |
| 1.372E+03 | 3.149 | 1.254 | 1.764 | 0.073 | 2.453 | 31.400 | 11.280 | tr3 |
| 1.525E+03 | 6.185 | 4.414 | 4.873 | 3.096 | 2.453 | 37.270 | 19.920 | tr4 |
| 1.932E+03 | 0.373 | -1.128 | -0.663 | -2.102 | 2.453 | 46.460 | 161.210 | tr5 |
| 4.681E+02 | 0.192 | 0.192 | 0.192 | -0.705 | 2.561 | 16.020 | 11.000 | tr6 |
| 7.027E+02 | -0.811 | -0.811 | -0.811 | -1.494 | 2.561 | 23.810 | 26.000 | tr7 |
| 8.174E+02 | 3.866 | 3.866 | 3.866 | 3.340 | 2.561 | 28.470 | 199.000 | tr8 |
| 9.296E+02 | 1.549 | 1.549 | 1.549 | 1.086 | 2.561 | 31.660 | 226.000 | tr9 |
| err-avg | 1.45 | 0.869 | 0.884 | 0.546 | | | | |
| err-sd | 1.84 | 1.54 | 1.67 | 1.80 | | | | |

4 Ce

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.810E+02 | -2.210 | -2.210 | -2.762 | -3.094 | 3.897 | 12.040 | 79.200 | ya1 |
| 2.245E+02 | -3.341 | -3.341 | -3.786 | -4.009 | 3.130 | 15.380 | 158.500 | ya2 |
| 2.197E+02 | 1.957 | 1.957 | 1.502 | 1.365 | 3.130 | 15.900 | 79.200 | ya3 |
| 1.746E+02 | -4.926 | -4.926 | -4.926 | -5.212 | 3.130 | 11.530 | 26.400 | ya4 |
| err-avg | -2.13 | -2.13 | -2.49 | -2.74 | | | | |
| err-sd | 2.94 | 2.94 | 2.81 | 2.87 | | | | |

16 Nd

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.307E+02 | -1.604 | -1.170 | -1.604 | -0.824 | 3.130 | 20.600 | 211.300 | ya1 |
| 2.655E+02 | -1.695 | -1.318 | -1.695 | -0.753 | 3.130 | 23.720 | 158.500 | ya2 |
| 2.719E+02 | -1.434 | -1.434 | -1.434 | -0.699 | 3.130 | 4.300 | 79.200 | ya3 |
| 2.666E+02 | -1.350 | -1.350 | -1.350 | -0.563 | 3.130 | 23.870 | 158.500 | ya4 |
| 2.740E+02 | -1.095 | -1.095 | -1.095 | -0.474 | 3.130 | 24.550 | 79.200 | ya5 |
| 2.676E+02 | -1.345 | -1.345 | -1.345 | -0.673 | 3.130 | 23.930 | 158.500 | ya6 |
| 2.722E+02 | -1.176 | -1.176 | -1.543 | -0.551 | 3.130 | 24.360 | 79.200 | ya7 |
| 2.706E+02 | -0.961 | -0.961 | -0.961 | -0.074 | 3.130 | 24.330 | 158.500 | ya8 |
| 3.342E+02 | 1.735 | 1.735 | 1.735 | 2.932 | 2.556 | 30.720 | 167.600 | mi1 |
| 3.320E+02 | 1.506 | 1.506 | 1.506 | 2.892 | 2.556 | 30.510 | 167.000 | mi2 |
| 3.434E+02 | 1.631 | 1.631 | 1.631 | 2.970 | 2.556 | 31.560 | 167.000 | mi3 |
| 3.400E+02 | 1.765 | 1.765 | 1.765 | 3.000 | 2.556 | 31.260 | 167.600 | mi4 |
| 3.405E+02 | 1.615 | 1.615 | 1.615 | 2.996 | 2.556 | 31.310 | 167.000 | mi5 |
| 3.342E+03 | 0.581 | 0.730 | 0.461 | -0.021 | 3.038 | 27.350 | 13.200 | mi6 |
| 4.448E+03 | 0.549 | 0.571 | 0.436 | 0.119 | 3.038 | 37.120 | 27.700 | mi7 |
| 5.237E+03 | 0.552 | 0.514 | 0.475 | 0.300 | 3.038 | 44.340 | 165.220 | mi8 |
| err-avg | -0.454E-01 | 0.136E-01 | -0.877E-01 | 0.661 | | | | |
| err-sd | 1.40 | 1.34 | 1.41 | 1.63 | | | | |

3 Sm

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 4.572E+02 | -3.224 | -3.051 | -5.147 | -5.631 | 3.038 | 27.350 | 13.200 | ya1 |
| 6.150E+02 | 2.225 | 1.864 | -0.084 | 0.438 | 3.038 | 37.120 | 27.700 | ya2 |
| 8.041E+02 | -4.750 | -5.151 | -6.764 | -5.602 | 3.038 | 44.340 | 165.220 | ya3 |
| err-avg | -1.92 | -2.11 | -4.00 | -3.60 | | | | |
| err-sd | 3.67 | 3.60 | 3.49 | 3.50 | | | | |

12 Eu

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 5.074E+00 | 12.140 | -21.758 | -18.605 | -31.297 | 3.130 | 12.860 | 237.700 | ya1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.357E+01 | 16.433 | -21.887 | -18.939 | -33.552 | 3.130 | 20.600 | 211.300 | ya2 |
| 1.720E+01 | 22.093 | -19.186 | -16.279 | -32.209 | 3.130 | 23.720 | 158.500 | ya3 |
| 1.594E+01 | 36.763 | -10.289 | -6.524 | -24.906 | 3.130 | 4.300 | 79.200 | ya4 |
| 1.706E+01 | 24.853 | -17.937 | -14.420 | -30.832 | 3.130 | 23.870 | 158.500 | ya5 |
| 1.852E+01 | 20.410 | -21.166 | -17.927 | -34.179 | 3.130 | 24.550 | 79.200 | ya6 |
| 1.658E+01 | 32.690 | -13.148 | -9.530 | -27.503 | 3.130 | 24.360 | 79.200 | ya7 |
| 1.708E+01 | 29.391 | -14.520 | -11.007 | -27.459 | 3.130 | 24.330 | 158.500 | ya8 |
| 1.783E+01 | 22.266 | -19.798 | -16.433 | -32.025 | 3.130 | 24.310 | 79.200 | mi1 |
| 8.963E+01 | -5.724 | 0.971 | 5.099 | -9.885 | 3.038 | 27.350 | 13.200 | mi2 |
| 1.237E+02 | 0.243 | 11.560 | 13.985 | -2.021 | 3.038 | 37.120 | 27.700 | mi3 |
| 1.679E+02 | -8.874 | 2.442 | 3.633 | -10.482 | 3.038 | 44.340 | 165.220 | mi4 |
| err-avg | 16.9 | -12.1 | -8.91 | -24.7 | | | | |
| err-sd | 14.8 | 11.1 | 10.9 | 10.9 | | | | |

55 TO

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 9.797E+05 | 0.333 | 0.319 | 0.352 | 0.368 | 3.400 | 15.950 | 220.220 | ya1 |
| 9.659E+05 | 0.227 | 0.212 | 0.167 | 0.213 | 3.400 | 30.390 | 138.940 | ya2 |
| 9.637E+05 | 0.319 | 0.305 | 0.364 | 0.347 | 3.400 | 31.330 | 57.660 | ya3 |
| 9.658E+05 | 1.337 | 1.323 | 1.360 | 1.344 | 3.400 | 20.190 | 17.020 | ya4 |
| 9.638E+05 | 0.221 | 0.307 | 0.276 | 0.265 | 3.400 | 32.030 | 138.940 | ya5 |
| 9.642E+05 | 0.265 | 0.239 | 0.309 | 0.277 | 3.400 | 31.410 | 57.660 | ya6 |
| 9.593E+05 | 0.310 | 0.292 | 0.263 | 0.289 | 3.400 | 35.970 | 138.940 | ya7 |
| 9.601E+05 | 0.321 | 0.304 | 0.272 | 0.292 | 3.400 | 35.260 | 57.660 | ya8 |
| 9.914E+05 | -0.033 | -0.038 | -0.032 | -0.006 | 3.208 | 8.300 | -1.000 | mi1 |
| 9.919E+05 | 0.061 | 0.064 | 0.071 | 0.054 | 3.208 | 6.900 | -1.000 | mi2 |
| 9.833E+05 | -0.032 | -0.033 | -0.024 | 0.032 | 3.203 | 15.360 | -1.000 | mi3 |
| 9.772E+05 | -0.068 | -0.084 | -0.049 | 0.018 | 3.203 | 21.290 | -1.000 | mi4 |
| 9.844E+05 | -0.023 | -0.033 | -0.012 | 0.000 | 3.203 | 14.660 | -1.000 | mi5 |
| 9.695E+05 | -0.162 | -0.172 | -0.137 | -0.059 | 3.210 | 29.500 | -1.000 | mi6 |
| 9.667E+05 | -0.105 | -0.116 | -0.078 | -0.055 | 3.210 | 32.200 | -1.000 | mi7 |
| 9.652E+05 | -0.104 | -0.113 | -0.180 | -0.065 | 3.210 | 33.710 | -1.000 | mi8 |
| 9.638E+05 | -0.123 | -0.030 | -0.092 | -0.004 | 3.210 | 34.320 | -1.000 | mi9 |
| 9.870E+05 | 0.049 | 0.041 | 0.065 | 0.077 | 3.897 | 12.040 | 79.200 | tr1 |
| 9.839E+05 | 0.034 | 0.031 | 0.061 | 0.063 | 3.130 | 15.380 | 158.500 | tr2 |
| 9.831E+05 | 0.084 | 0.072 | 0.112 | 0.089 | 3.130 | 15.900 | 79.200 | tr3 |
| 9.884E+05 | -0.082 | -0.080 | -0.068 | -0.006 | 3.130 | 11.530 | 26.400 | tr4 |
| 9.870E+05 | -0.064 | -0.067 | -0.041 | -0.025 | 3.130 | 12.860 | 237.700 | tr5 |
| 9.789E+05 | 0.045 | 0.029 | -0.029 | 0.030 | 3.130 | 20.600 | 211.300 | tr6 |
| 9.756E+05 | 0.021 | 0.006 | 0.053 | 0.051 | 3.130 | 23.720 | 158.500 | tr7 |
| 9.757E+05 | -0.026 | -0.038 | -0.094 | -0.018 | 3.130 | 4.300 | 79.200 | tr8 |
| 9.759E+05 | -0.017 | -0.031 | 0.014 | 0.006 | 3.130 | 23.870 | 158.500 | tr9 |
| 9.744E+05 | -0.001 | 0.089 | 0.033 | 0.086 | 3.130 | 24.550 | 79.200 | tr10 |
| 9.746E+05 | 0.026 | 0.013 | -0.042 | 0.037 | 3.130 | 23.930 | 158.500 | tr11 |
| 9.743E+05 | 0.116 | 0.102 | 0.035 | 0.109 | 3.130 | 24.360 | 79.200 | tr12 |
| 9.754E+05 | -0.075 | 0.012 | -0.044 | 0.012 | 3.130 | 24.330 | 158.500 | tr13 |
| 9.731E+05 | 0.205 | 0.192 | 0.135 | 0.219 | 3.130 | 24.310 | 79.200 | tr14 |
| 9.686E+05 | -0.120 | -0.128 | -0.097 | -0.047 | 2.556 | 30.720 | 167.600 | tu1 |
| 9.689E+05 | -0.144 | -0.051 | -0.121 | -0.051 | 2.556 | 30.510 | 167.000 | tu2 |
| 9.677E+05 | -0.146 | -0.052 | -0.122 | -0.053 | 2.556 | 31.560 | 167.000 | tu3 |
| 9.681E+05 | -0.073 | -0.090 | -0.051 | -0.054 | 2.556 | 31.260 | 167.600 | tu4 |
| 9.680E+05 | -0.064 | -0.074 | -0.041 | -0.044 | 2.556 | 31.310 | 167.000 | tu5 |
| 9.850E+05 | -0.633 | -0.647 | -0.622 | -0.608 | 3.038 | 27.350 | 13.200 | ca1 |
| 9.744E+05 | -0.412 | -0.326 | -0.398 | -0.333 | 3.038 | 37.120 | 27.700 | ca2 |
| 9.665E+05 | -0.202 | -0.117 | -0.185 | -0.109 | 3.038 | 44.340 | 165.220 | ca3 |
| 9.936E+05 | -1.165 | -1.169 | -1.149 | -1.125 | 2.720 | 18.680 | 9.100 | ca4 |
| 9.912E+05 | -1.729 | -1.644 | -1.718 | -1.639 | 2.720 | 26.620 | 24.500 | ca5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.773E+05 | -0.974 | -0.890 | -0.960 | -0.892 | 2.720 | 33.170 | 161.900 | ca6 |
| 9.772E+05 | -0.747 | -0.756 | -0.721 | -0.718 | 2.453 | 31.400 | 11.280 | ca7 |
| 9.764E+05 | -1.287 | -1.294 | -1.258 | -1.218 | 2.453 | 37.270 | 19.920 | ca8 |
| 9.578E+05 | -0.279 | -0.286 | -0.244 | -0.238 | 2.453 | 46.460 | 161.210 | ca9 |
| 9.823E+05 | 0.146 | 0.134 | 0.155 | 0.161 | 2.561 | 16.020 | 11.000 | ro1 |
| 9.808E+05 | -0.566 | -0.578 | -0.550 | -0.507 | 2.561 | 23.810 | 26.000 | ro2 |
| 9.663E+05 | 0.496 | 0.472 | 0.410 | 0.496 | 2.561 | 28.470 | 199.000 | ro3 |
| 9.743E+05 | -0.661 | -0.680 | -0.745 | -0.666 | 2.561 | 31.660 | 226.000 | ro4 |
| 2.246E+04 | 0.134 | -0.543 | 0.974 | -1.563 | 3.130 | 25.930 | -1.000 | ob1 |
| 2.208E+04 | 1.173 | 0.571 | 2.129 | -0.661 | 3.130 | 26.540 | -1.000 | ob2 |
| 2.186E+04 | 0.576 | 0.079 | 1.512 | -1.265 | 3.130 | 27.990 | -1.000 | ob3 |
| 2.199E+04 | -0.465 | -0.904 | 0.474 | -2.235 | 3.130 | 28.400 | -1.000 | ob4 |
| 2.184E+04 | -0.453 | -0.844 | 0.550 | -2.213 | 3.130 | 29.040 | -1.000 | ob5 |
| 2.158E+04 | 0.291 | -0.140 | 1.265 | -1.562 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -0.772E-01 | -0.124 | 0.274E-01 | -0.238 | | | | |
| err-sd | 0.504 | 0.483 | 0.631 | 0.674 | | | | |

55 T2

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 2.680E+04 | 26.744 | 26.232 | 27.427 | 28.021 | 3.400 | 15.950 | 220.220 | ya1 |
| 2.607E+04 | 19.157 | 18.586 | 16.940 | 18.641 | 3.400 | 30.390 | 138.940 | ya2 |
| 2.449E+04 | 29.705 | 29.141 | 31.473 | 30.799 | 3.400 | 31.330 | 57.660 | ya3 |
| 1.632E+04 | 161.792 | 161.010 | 163.147 | 162.237 | 3.400 | 20.190 | 17.020 | ya4 |
| 2.546E+04 | 21.317 | 24.597 | 23.427 | 23.009 | 3.400 | 32.030 | 138.940 | ya5 |
| 2.515E+04 | 22.481 | 21.494 | 24.163 | 22.953 | 3.400 | 31.410 | 57.660 | ya6 |
| 2.485E+04 | 18.018 | 17.310 | 16.179 | 17.187 | 3.400 | 35.970 | 138.940 | ya7 |
| 2.459E+04 | 18.638 | 17.988 | 16.731 | 17.515 | 3.400 | 35.260 | 57.660 | ya8 |
| 2.898E+04 | 0.246 | 0.065 | 0.283 | 1.167 | 3.208 | 8.300 | -1.000 | mi1 |
| 2.893E+04 | 5.551 | 5.647 | 5.891 | 5.310 | 3.208 | 6.900 | -1.000 | mi2 |
| 2.554E+04 | 5.802 | 5.783 | 6.135 | 8.282 | 3.203 | 15.360 | -1.000 | mi3 |
| 2.412E+04 | 1.811 | 1.143 | 2.593 | 5.296 | 3.203 | 21.290 | -1.000 | mi4 |
| 2.599E+04 | 4.516 | 4.121 | 4.930 | 5.391 | 3.203 | 14.660 | -1.000 | mi5 |
| 2.231E+04 | -6.153 | -6.579 | -5.073 | -1.661 | 3.210 | 29.500 | -1.000 | mi6 |
| 2.199E+04 | -1.437 | -1.901 | -0.227 | 0.787 | 3.210 | 32.200 | -1.000 | mi7 |
| 2.162E+04 | -6.499 | -6.911 | -9.866 | -4.753 | 3.210 | 33.710 | -1.000 | mi8 |
| 2.153E+04 | -4.093 | 0.070 | -2.708 | 1.225 | 3.210 | 34.320 | -1.000 | mi9 |
| 3.473E+04 | 4.268 | 4.032 | 4.717 | 5.067 | 3.897 | 12.040 | 79.200 | tr1 |
| 2.759E+04 | 3.042 | 2.933 | 3.975 | 4.060 | 3.130 | 15.380 | 158.500 | tr2 |
| 2.703E+04 | 4.154 | 3.739 | 5.172 | 4.341 | 3.130 | 15.900 | 79.200 | tr3 |
| 2.863E+04 | -1.785 | -1.727 | -1.308 | 0.857 | 3.130 | 11.530 | 26.400 | tr4 |
| 2.856E+04 | -3.271 | -3.378 | -2.454 | -1.901 | 3.130 | 12.860 | 237.700 | tr5 |
| 2.698E+04 | 1.994 | 1.431 | -0.690 | 1.450 | 3.130 | 20.600 | 211.300 | tr6 |
| 2.627E+04 | 0.773 | 0.224 | 1.983 | 1.883 | 3.130 | 23.720 | 158.500 | tr7 |
| 2.658E+04 | -1.317 | -1.755 | -3.817 | -1.051 | 3.130 | 4.300 | 79.200 | tr8 |
| 2.666E+04 | -0.628 | -1.142 | 0.512 | 0.208 | 3.130 | 23.870 | 158.500 | tr9 |
| 2.553E+04 | 2.297 | 5.761 | 3.618 | 5.623 | 3.130 | 24.550 | 79.200 | tr10 |
| 2.547E+04 | 3.361 | 2.866 | 0.762 | 3.780 | 3.130 | 23.930 | 158.500 | tr11 |
| 2.533E+04 | 7.610 | 7.070 | 4.512 | 7.358 | 3.130 | 24.360 | 79.200 | tr12 |
| 2.660E+04 | -2.003 | 1.201 | -0.854 | 1.197 | 3.130 | 24.330 | 158.500 | tr13 |
| 2.402E+04 | 16.200 | 15.707 | 13.383 | 16.789 | 3.130 | 24.310 | 79.200 | tr14 |
| 1.849E+04 | -6.809 | -7.263 | -5.640 | -3.014 | 2.556 | 30.720 | 167.600 | tu1 |
| 1.856E+04 | -9.160 | -4.278 | -7.948 | -4.304 | 2.556 | 30.510 | 167.000 | tu2 |
| 1.844E+04 | -8.720 | -3.791 | -7.478 | -3.885 | 2.556 | 31.560 | 167.000 | tu3 |
| 1.848E+04 | -5.432 | -6.320 | -4.318 | -4.441 | 2.556 | 31.260 | 167.600 | tu4 |
| 1.839E+04 | -4.483 | -4.983 | -3.243 | -3.412 | 2.556 | 31.310 | 167.000 | tu5 |
| 3.442E+04 | -33.517 | -33.908 | -33.211 | -32.809 | 3.038 | 27.350 | 13.200 | ca1 |
| 3.220E+04 | -20.557 | -17.951 | -20.112 | -18.146 | 3.038 | 37.120 | 27.700 | ca2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3.116E+04 | -8.197 | -5.557 | -7.655 | -5.292 | 3.038 | 44.340 | 165.220 | ca3 |
| 3.400E+04 | -65.206 | -65.344 | -64.744 | -64.043 | 2.720 | 18.680 | 9.100 | ca4 |
| 3.797E+04 | -85.960 | -83.736 | -85.673 | -83.611 | 2.720 | 26.620 | 24.500 | ca5 |
| 3.020E+04 | -59.689 | -56.940 | -59.228 | -57.012 | 2.720 | 33.170 | 161.900 | ca6 |
| 2.534E+04 | -53.666 | -54.001 | -52.663 | -52.560 | 2.453 | 31.400 | 11.280 | ca7 |
| 3.008E+04 | -78.362 | -78.598 | -77.427 | -76.118 | 2.453 | 37.270 | 19.920 | ca8 |
| 2.093E+04 | -20.403 | -20.732 | -18.830 | -18.525 | 2.453 | 46.460 | 161.210 | ca9 |
| 1.928E+04 | 18.314 | 17.705 | 18.778 | 19.123 | 2.561 | 16.020 | 11.000 | ro1 |
| 2.423E+04 | -40.637 | -41.118 | -39.993 | -38.246 | 2.561 | 23.810 | 26.000 | ro2 |
| 1.419E+04 | 75.369 | 73.755 | 69.526 | 75.343 | 2.561 | 28.470 | 199.000 | ro3 |
| 2.520E+04 | -50.150 | -50.884 | -53.396 | -50.337 | 2.561 | 31.660 | 226.000 | ro4 |
| -9.266E+05 | 0.666 | 0.682 | 0.645 | 0.707 | 3.130 | 25.930 | -1.000 | ob1 |
| -9.270E+05 | 0.641 | 0.655 | 0.618 | 0.685 | 3.130 | 26.540 | -1.000 | ob2 |
| -9.272E+05 | 0.655 | 0.667 | 0.633 | 0.698 | 3.130 | 27.990 | -1.000 | ob3 |
| -9.271E+05 | 0.680 | 0.690 | 0.657 | 0.722 | 3.130 | 28.400 | -1.000 | ob4 |
| -9.273E+05 | 0.679 | 0.689 | 0.656 | 0.721 | 3.130 | 29.040 | -1.000 | ob5 |
| -9.275E+05 | 0.662 | 0.672 | 0.639 | 0.705 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | -1.84 | -1.55 | -1.79 | -0.472 | | | | |
| err-sd | 35.2 | 34.9 | 35.0 | 34.8 | | | | |

55 U2

| exp. data | SAS-27G | SAS-44G | SAS-238G | SWAT | Enrich. | Burnup | z-locat. | Sample Id |
|---|---|---|---|---|---|---|---|---|
| 1.894E+04 | 40.618 | 40.607 | 41.030 | 41.216 | 3.400 | 15.950 | 220.220 | ya1 |
| 1.402E+04 | 42.326 | 42.305 | 36.379 | 36.377 | 3.400 | 30.390 | 138.940 | ya2 |
| 1.197E+04 | 71.301 | 71.284 | 72.780 | 67.722 | 3.400 | 31.330 | 57.660 | ya3 |
| 7.144E+03 | 379.801 | 379.773 | 380.739 | 375.987 | 3.400 | 20.190 | 17.020 | ya4 |
| 1.279E+04 | 51.180 | 58.973 | 53.267 | 48.719 | 3.400 | 32.030 | 138.940 | ya5 |
| 1.301E+04 | 50.042 | 49.258 | 51.326 | 45.632 | 3.400 | 31.410 | 57.660 | ya6 |
| 1.285E+04 | 32.503 | 32.254 | 26.564 | 23.940 | 3.400 | 35.970 | 138.940 | ya7 |
| 1.290E+04 | 32.915 | 32.659 | 26.922 | 24.336 | 3.400 | 35.260 | 57.660 | ya8 |
| 2.542E+04 | -0.047 | -0.055 | -0.098 | 1.683 | 3.208 | 8.300 | -1.000 | mi1 |
| 2.566E+04 | 6.157 | 6.508 | 6.508 | 6.489 | 3.208 | 6.900 | -1.000 | mi2 |
| 1.935E+04 | 9.767 | 10.233 | 10.181 | 14.295 | 3.203 | 15.360 | -1.000 | mi3 |
| 1.667E+04 | 2.939 | 2.879 | 4.019 | 9.718 | 3.203 | 21.290 | -1.000 | mi4 |
| 1.966E+04 | 10.122 | 10.122 | 10.529 | 12.375 | 3.203 | 14.660 | -1.000 | mi5 |
| 1.342E+04 | -7.079 | -7.079 | -5.961 | 1.393 | 3.210 | 29.500 | -1.000 | mi6 |
| 1.254E+04 | 1.132 | 1.180 | 2.527 | 6.124 | 3.210 | 32.200 | -1.000 | mi7 |
| 1.264E+04 | -12.275 | -12.306 | -18.958 | -8.307 | 3.210 | 33.710 | -1.000 | mi8 |
| 1.194E+04 | -7.789 | 1.005 | -5.779 | 2.940 | 3.210 | 34.320 | -1.000 | mi9 |
| 2.836E+04 | 6.009 | 6.009 | 6.291 | 7.286 | 3.897 | 12.040 | 79.200 | tr1 |
| 1.961E+04 | 4.670 | 5.129 | 5.537 | 6.572 | 3.130 | 15.380 | 158.500 | tr2 |
| 1.905E+04 | 5.937 | 5.937 | 6.882 | 6.730 | 3.130 | 15.900 | 79.200 | tr3 |
| 2.237E+04 | -1.886 | -1.439 | -1.529 | 2.025 | 3.130 | 11.530 | 26.400 | tr4 |
| 2.221E+04 | -5.326 | -4.921 | -4.515 | -3.070 | 3.130 | 12.860 | 237.700 | tr5 |
| 1.758E+04 | 2.179 | 2.122 | -2.543 | 1.718 | 3.130 | 20.600 | 211.300 | tr6 |
| 1.609E+04 | -0.435 | -0.497 | 0.559 | 1.579 | 3.130 | 23.720 | 158.500 | tr7 |
| 1.609E+04 | -2.039 | -2.039 | -7.198 | -1.343 | 3.130 | 4.300 | 79.200 | tr8 |
| 1.643E+04 | -2.435 | -2.495 | -1.461 | -0.883 | 3.130 | 23.870 | 158.500 | tr9 |
| 1.515E+04 | 2.838 | 9.439 | 3.960 | 8.706 | 3.130 | 24.550 | 79.200 | tr10 |
| 1.597E+04 | 4.739 | 4.739 | -0.457 | 5.547 | 3.130 | 23.930 | 158.500 | tr11 |
| 1.492E+04 | 12.437 | 12.370 | 6.135 | 12.276 | 3.130 | 24.360 | 79.200 | tr12 |
| 1.624E+04 | -4.809 | 1.348 | -3.762 | 0.345 | 3.130 | 24.330 | 158.500 | tr13 |
| 1.398E+04 | 27.048 | 27.048 | 21.110 | 27.842 | 3.130 | 24.310 | 79.200 | tr14 |
| 9.351E+03 | -16.823 | -16.545 | -15.262 | -6.259 | 2.556 | 30.720 | 167.600 | tu1 |
| 9.363E+03 | -20.561 | -9.699 | -18.895 | -7.867 | 2.556 | 30.510 | 167.000 | tu2 |
| 9.081E+03 | -20.093 | -8.904 | -18.485 | -7.166 | 2.556 | 31.560 | 167.000 | tu3 |
| 9.078E+03 | -12.570 | -12.724 | -10.973 | -7.331 | 2.556 | 31.260 | 167.600 | tu4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9.246E+03 | -13.303 | -13.119 | -11.616 | -8.074 | 2.556 | 31.310 | 167.000 | tu5 |
| 1.865E+04 | -62.297 | -62.318 | -61.680 | -59.111 | 3.038 | 27.350 | 13.200 | ca1 |
| 1.263E+04 | -53.697 | -45.969 | -52.707 | -44.845 | 3.038 | 37.120 | 27.700 | ca2 |
| 8.939E+03 | -31.291 | -20.261 | -29.669 | -17.746 | 3.038 | 44.340 | 165.220 | ca3 |
| 2.523E+04 | -87.307 | -86.962 | -86.609 | -84.639 | 2.720 | 18.680 | 9.100 | ca4 |
| 2.690E+04 | -120.886 | -117.184 | -120.455 | -116.482 | 2.720 | 26.620 | 24.500 | ca5 |
| 1.776E+04 | -102.838 | -97.117 | -102.022 | -96.740 | 2.720 | 33.170 | 161.900 | ca6 |
| 1.410E+04 | -97.468 | -97.503 | -96.439 | -92.561 | 2.453 | 31.400 | 11.280 | ca7 |
| 1.766E+04 | -134.122 | -134.201 | -133.358 | -128.053 | 2.453 | 37.270 | 19.920 | ca8 |
| 6.729E+03 | -63.145 | -63.219 | -60.990 | -52.521 | 2.453 | 46.460 | 161.210 | ca9 |
| 1.253E+04 | 25.749 | 25.669 | 26.387 | 30.986 | 2.561 | 16.020 | 11.000 | ro1 |
| 1.559E+04 | -65.296 | -65.232 | -64.462 | -58.067 | 2.561 | 23.810 | 26.000 | ro2 |
| 4.310E+03 | 241.531 | 241.531 | 222.506 | 255.499 | 2.561 | 28.470 | 199.000 | ro3 |
| 1.512E+04 | -88.292 | -88.094 | -93.650 | -84.449 | 2.561 | 31.660 | 226.000 | ro4 |
| -9.346E+05 | 0.685 | 0.686 | 0.666 | 0.696 | 3.130 | 25.930 | -1.000 | ob1 |
| -9.349E+05 | 0.676 | 0.676 | 0.657 | 0.689 | 3.130 | 26.540 | -1.000 | ob2 |
| -9.356E+05 | 0.669 | 0.667 | 0.652 | 0.683 | 3.130 | 27.990 | -1.000 | ob3 |
| -9.357E+05 | 0.672 | 0.668 | 0.654 | 0.685 | 3.130 | 28.400 | -1.000 | ob4 |
| -9.358E+05 | 0.690 | 0.686 | 0.672 | 0.703 | 3.130 | 29.040 | -1.000 | ob5 |
| -9.361E+05 | 0.673 | 0.669 | 0.655 | 0.687 | 3.130 | 29.520 | -1.000 | ob6 |
| err-avg | 0.616 | 2.08 | -0.625E-01 | 3.72 | | | | |
| err-sd | 75.3 | 74.9 | 74.1 | 74.1 | | | | |

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# 国際単位系（SI）と換算表

表1　SI基本単位および補助単位

| 量 | 名称 | 記号 |
|---|---|---|
| 長さ | メートル | m |
| 質量 | キログラム | kg |
| 時間 | 秒 | s |
| 電流 | アンペア | A |
| 熱力学温度 | ケルビン | K |
| 物質量 | モル | mol |
| 光度 | カンデラ | cd |
| 平面角 | ラジアン | rad |
| 立体角 | ステラジアン | sr |

表2　SIと併用される単位

| 名称 | 記号 |
|---|---|
| 分，時，日 | min，h，d |
| 度，分，秒 | °，′，″ |
| リットル | l，L |
| トン | t |
| 電子ボルト | eV |
| 原子質量単位 | u |

1 eV=1.60218×10$^{-19}$J

1 u=1.66054×10$^{-27}$kg

表5　SI接頭語

| 倍数 | 接頭語 | 記号 |
|---|---|---|
| $10^{18}$ | エクサ | E |
| $10^{15}$ | ペタ | P |
| $10^{12}$ | テラ | T |
| $10^{9}$ | ギガ | G |
| $10^{6}$ | メガ | M |
| $10^{3}$ | キロ | k |
| $10^{2}$ | ヘクト | h |
| $10^{1}$ | デカ | da |
| $10^{-1}$ | デシ | d |
| $10^{-2}$ | センチ | c |
| $10^{-3}$ | ミリ | m |
| $10^{-6}$ | マイクロ | μ |
| $10^{-9}$ | ナノ | n |
| $10^{-12}$ | ピコ | p |
| $10^{-15}$ | フェムト | f |
| $10^{-18}$ | アト | a |

表3　固有の名称をもつSI組立単位

| 量 | 名称 | 記号 | 他のSI単位による表現 |
|---|---|---|---|
| 周波数 | ヘルツ | Hz | $s^{-1}$ |
| 力 | ニュートン | N | $m\cdot kg/s^2$ |
| 圧力，応力 | パスカル | Pa | $N/m^2$ |
| エネルギー，仕事，熱量 | ジュール | J | N·m |
| 工率，放射束 | ワット | W | J/s |
| 電気量，電荷 | クーロン | C | A·s |
| 電位，電圧，起電力 | ボルト | V | W/A |
| 静電容量 | ファラド | F | C/V |
| 電気抵抗 | オーム | Ω | V/A |
| コンダクタンス | ジーメンス | S | A/V |
| 磁束 | ウェーバ | Wb | V·s |
| 磁束密度 | テスラ | T | $Wb/m^2$ |
| インダクタンス | ヘンリー | H | Wb/A |
| セルシウス温度 | セルシウス度 | ℃ | |
| 光束 | ルーメン | lm | cd·sr |
| 照度 | ルクス | lx | $lm/m^2$ |
| 放射能 | ベクレル | Bq | $s^{-1}$ |
| 吸収線量 | グレイ | Gy | J/kg |
| 線量等量 | シーベルト | Sv | J/kg |

表4　SIと共に暫定的に維持される単位

| 名称 | 記号 |
|---|---|
| オングストローム | Å |
| バーン | b |
| バール | bar |
| ガル | Gal |
| キュリー | Ci |
| レントゲン | R |
| ラド | rad |
| レム | rem |

1 Å=0.1nm=10$^{-10}$m

1 b=100fm$^2$=10$^{-28}$m$^2$

1 bar=0.1MPa=10$^5$Pa

1 Gal=1cm/s$^2$=10$^{-2}$m/s$^2$

1 Ci=3.7×10$^{10}$Bq

1 R=2.58×10$^{-4}$C/kg

1 rad=1cGy=10$^{-2}$Gy

1 rem=1cSv=10$^{-2}$Sv

(注)

1．表1－5は「国際単位系」第5版，国際度量衡局1985年刊行による。ただし，1 eVおよび1 uの値はCODATAの1986年推奨値によった。

2．表4には海里，ノット，アール，ヘクタールも含まれているが日常の単位なのでここでは省略した。

3．barは，JISでは流体の圧力を表わす場合に限り表2のカテゴリーに分類されている。

4．EC閣僚理事会指令ではbar，barnおよび「血圧の単位」mmHgを表2のカテゴリーに入れている。

換　算　表

| 力 | N(=10$^5$dyn) | kgf | lbf |
|---|---|---|---|
| | 1 | 0.101972 | 0.224809 |
| | 9.80665 | 1 | 2.20462 |
| | 4.44822 | 0.453592 | 1 |

粘度　1 Pa·s(N·s/m$^2$)=10 P(ポアズ)(g/(cm·s))

動粘度　1m$^2$/s=10$^4$St(ストークス)(cm$^2$/s)

| 圧力 | MPa(=10bar) | kgf/cm$^2$ | atm | mmHg(Torr) | lbf/in$^2$(psi) |
|---|---|---|---|---|---|
| | 1 | 10.1972 | 9.86923 | 7.50062×10$^3$ | 145.038 |
| | 0.0980665 | 1 | 0.967841 | 735.559 | 14.2233 |
| | 0.101325 | 1.03323 | 1 | 760 | 14.6959 |
| | 1.33322×10$^{-4}$ | 1.35951×10$^{-3}$ | 1.31579×10$^{-3}$ | 1 | 1.93368×10$^{-2}$ |
| | 6.89476×10$^{-3}$ | 7.03070×10$^{-2}$ | 6.80460×10$^{-2}$ | 51.7149 | 1 |

| エネルギー・仕事・熱量 | J(=10$^7$ erg) | kgf·m | kW·h | cal(計量法) | Btu | ft·lbf | eV |
|---|---|---|---|---|---|---|---|
| | 1 | 0.101972 | 2.77778×10$^{-7}$ | 0.238889 | 9.47813×10$^{-4}$ | 0.737562 | 6.24150×10$^{18}$ |
| | 9.80665 | 1 | 2.72407×10$^{-6}$ | 2.34270 | 9.29487×10$^{-3}$ | 7.23301 | 6.12082×10$^{19}$ |
| | 3.6×10$^6$ | 3.67098×10$^5$ | 1 | 8.59999×10$^5$ | 3412.13 | 2.65522×10$^6$ | 2.24694×10$^{25}$ |
| | 4.18605 | 0.426858 | 1.16279×10$^{-6}$ | 1 | 3.96759×10$^{-3}$ | 3.08747 | 2.61272×10$^{19}$ |
| | 1055.06 | 107.586 | 2.93072×10$^{-4}$ | 252.042 | 1 | 778.172 | 6.58515×10$^{21}$ |
| | 1.35582 | 0.138255 | 3.76616×10$^{-7}$ | 0.323890 | 1.28506×10$^{-3}$ | 1 | 8.46233×10$^{18}$ |
| | 1.60218×10$^{-19}$ | 1.63377×10$^{-20}$ | 4.45050×10$^{-26}$ | 3.82743×10$^{-20}$ | 1.51857×10$^{-22}$ | 1.18171×10$^{-19}$ | 1 |

1 cal= 4.18605J（計量法）

= 4.184J（熱化学）

= 4.1855J（15℃）

= 4.1868J（国際蒸気表

仕事率　1 PS(仏馬力)

= 75 kgf·m/s

= 735.499W

| 放射能 | Bq | Ci |
|---|---|---|
| | 1 | 2.70270×10$^{-11}$ |
| | 3.7×10$^{10}$ | 1 |

| 吸収線量 | Gy | rad |
|---|---|---|
| | 1 | 100 |
| | 0.01 | 1 |

| 照射線量 | C/kg | R |
|---|---|---|
| | 1 | 3876 |
| | 2.58×10$^{-4}$ | 1 |

| 線量当量 | Sv | rem |
|---|---|---|
| | 1 | 100 |
| | 0.01 | 1 |

(86年12月26日現在)