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REVIEW OF FISSION PRODUCT YIELDS AND DELAYED NEUTRON DATA FOR THE ACTINIDES NP-237, PU-242, AM-242M, AM-243, CM-243 AND CM-245

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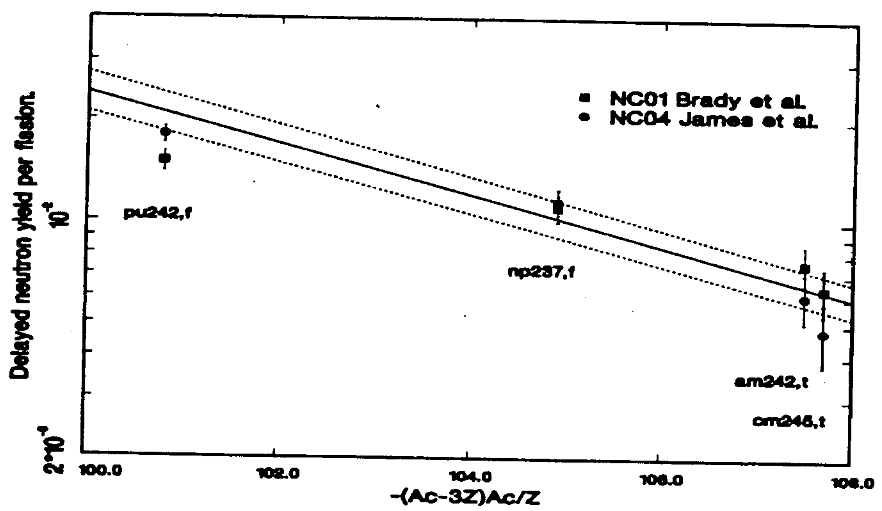

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Title:

Review of fission product yields and delayed neutron data for the actinides Np-237, Pu-242, Am-242m, Am-243, Cm-243 and Cm-245.

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Abstract:

A review of fission product yields and delayed neutron data for Np-237, Pu-242, Am-242m, Am-243, Cm-243 and Cm-245 has been undertaken. Gaps in understanding and inconsistencies in existing data were identified and priority areas for further experimental, theoretical and evaluation investigation detailed.

Introduction:

Since 1982 it has been recognised that long term basic research into utilisation of high level nuclear waste by separation into individual actinides and fission products could produce many benefits. It is currently planned that the actinides be disposed of in geological formations, unseparated from the fission products. However, they could, if separated, yield a more efficient approach to the utilization of the limited world nuclear resources and the reduction of long-lived nuclear waste. Fission products from the uranium and plutonium isotopes conventionally present in nuclear fuel could be a source of noble metals to be used as catalysts in industrial chemistry, and of radionuclides for use in medicine and industry. The higher actinides, on the other hand, could be introduced into reactors as fuel. This could have dual benefits; firstly by contributing to the generation of heat, and secondly by reducing the quantities of these materials through their being fissioned. Thus they would be present in lower concentrations in the high-level nuclear waste and, as the actinides are longer lived than most of the fission products, it would reduce the time high level waste must be monitored.

The Japanese government has decided to fund research and development in this field, through a project entitled 'OMEGA': "Options Making Extra Gains of Actinides and fission products generated in the nuclear fuel cycle".

This report was funded by the OMEGA project through the Nuclear Energy Agency (NEA). It represents a critical review of fission product yields and delayed neutron data for actinides of interest to the OMEGA project. The nuclides considered were the most important higher actinides Np-237, Pu-242, Am-242m, Am-243, Cm-243 and Cm-245. The objects of this study were the identification of gaps in understanding and inconsistencies in existing data and also to identify priority areas for further experimental, theoretical and evaluation efforts.

For fission products the open literature and available computer readable databases (CINDA and EXFOR) were scanned for chain, cumulative, independent and ternary yields. For data on delayed neutrons the quantities of interest were: total delayed neutron yields ν_d, the time dependence of the neutron activity, and the delayed neutron spectra. The same sources of data were searched as for fission yields.

The search for data was restricted to neutron induced and spontaneous fission, with the energy being specified as one of the three following classes:

(1) Thermal neutrons: Maxwellian distributed neutrons with a mean energy of 1/40 eV.

(2) Fast neutrons: here the definition is less precise as a fast reactor can have a wide range of average energies from a few hundred keV to several MeV, depending on the composition of the reactor. In practice, most fast reactor designs have a mean energy of about 400 keV.

(3) High energy neutrons: these are formed around 14-16 MeV by accelerator induced reactions, and if commercial fusion becomes viable would be produced by fusion reactors.

At the moment it is felt that charged particle and photon induced fission would not produce sufficiently great reaction rates both from consideration of the appropriate cross-sections and due to the low fluxes currently obtainable from accelerators. Also it is noted that within the data extracted there were no results from the use of monoenergetic neutron beams, except for those for the third class mentioned above "High Energy Neutrons".

In the medium term only thermal and fast reactors are available, however it should be noted that, if fusion becomes commonly available, the mass and charge distribution from fission can be greatly changed by changing the energy of the neutrons causing fissions from thermal or fast to 14MeV. On one hand this may enable, by variation of neutron energy, the minimisation of fission product activity in waste or the maximisation of the production of rare radionuclides or of highly valuable stable nuclides. Several papers on actinide burning reactors were presented at the PHYSOR conference at Marseilles, France during May 1990, proceedings of which are to be published.

For thermal and fast reactors the delayed neutron component of the reactor flux is of great importance in the control and design of the reactor. As, in the future, greater concentrations of the higher actinides will be generated both through use of recycled fuels and as reactor burnups are increased, there will be increasing need for their delayed neutron data in order to predict reactor kinetics, a procedure that had not, until recently, been attempted without the use of greatly simplified models (private communication, M.Brady, ORNL). In fusion reactors, on the other hand, the difference in the typical energies of delayed neutrons and those from fusion, plus the need to place the actinides outside the reactor core make it unlikely that delayed neutrons from actinides would have any major effects.

Fission Yields:

Fission yields are reported in 3 types:

(i) The independent yield, Yi(A,Z,I), is the yield of a particular nuclide of mass A, charge Z and isomeric state I produced directly from fission.

(ii) The cumulative yield Yc is the yield of a nuclide (A,Z,I) over all time, i.e. Yc is the independent yield for (A,Z,I) plus all the contributions from (A',Z',I') decaying into (A,Z,I) when multiplied by the appropriate decay branching fractions; these can be beta decays down the mass chains, but also the results of delayed neutron emission. Thus cumulative yields can be derived from independent yields by use of the decay data branching ratios and knowledge of the nature of the decays. Towards the end of the decay chain, where Yi(A,Z,I) is very small compared with Yc(A,Z,I), the yield is called the chain yield. It should be noted, however, that the more correct definition of the chain yield is the sum of all Yc for all stable nuclides of mass A; this takes account of chains where there are intermediate stable nuclei.

(iii) The third type of yield is the ternary yield; this is the cumulative yield of a light charged particle, e.g. 4He, 3H, 14C etc, which is well below the main double peak distribution.

Fission fragment yield measurements are available in the literature but can only be used for practical purposes if the fission fragments are summed over ionic charge and fragment energy as there can be considerable structure in the ionic charge and energy distributions.

The two main uses of fission product yields are (i) the determination of fission product inventories (in reactors or in spent fuel) for reprocessing or safety studies, and (ii) the calculation of decay heat (beta and gamma activities as well as thermal emission) for shielding and safety studies.

There are 3 methods of reporting fission product yields: absolute, relative and 'ratio of ratio' (sometimes known as R-value). In the absolute method the yield is given as a fraction with respect to the total number of fissions. For the relative method the yield is given relative to the yield of another 'reference' fission product. The 'ratio of ratio' method is more complicated; here the ratio of the measured product to the reference is divided by the same ratio of the measured product to reference product but either in a different target material or in the same target at some different incident irradiation energy. In order to compare yields, data from the last two types must be converted to absolute form using measured or estimated yields.

Literature search.

The primary source of references for this work was the CINDA database at the NEA Data Bank at Saclay, France. This was supplemented by the Crouch(1977), Rider(1980) and Mills(1990) reference databases, and a preliminary version of Rider(1990). Also a scan was made of the EXFOR database for appropriate data.

For each fissile nuclide of interest the reference is given in tables 1-7 in the standard CINDA format. References from a single experiments or a continuous strand of work are 'blocked' together, each block is assigned a reference number used in this report, the reference abbreviations used in this report are the standard notation from CINDA, except where otherwise stated.

Statistical treatment of data.

For each fissioning system the data were first converted to absolute values, then the weighted mean was calculated along with internal and external consistency errors and a χ^2 test applied to test for a normal distribution of the data. If a set of measurements of a quantity are described by a set of x_i with experimental variances σ_i^2 and a total of n measurements; then

Weighted mean, $\bar{x} = \sum_{i=1}^{n} x_i / W$, where $W = \sum_{i=1}^{n} w_i$ and $w_i = 1/\sigma_i^2$

$$\text{Internal consistency error} = \sqrt{1/W}$$

$$\text{External consistency error} = \sqrt{\sum_{i=1}^{n} \frac{w_i (x_i - \bar{x})^2}{W(n-1)}}$$

$$\chi^2 = \sum_{i=1}^{n} w_i (x_i - \bar{x})^2 \quad \text{with } (n-1) \text{ degrees of freedom.}$$

Detailed treatment of fission product references.

Np-237

For Np-237 there exists data for thermal, fast and 14MeV neutron induced fission. The references are shown in table 1.

Thermal.

YE09, Tracy et al, measured Kr and Xe isotopes relative to Kr-86 and Xe-132, using mass spectrometry. An estimate of Kr-86 and Xe-132 were produced by interpolation of YE45 chain yield measurements, which were used to convert the relative measurements to absolute values.

YE45, Jacobs et al, measured 32 chain yields and 2 fraction independent yields by gamma spectrometry of catcher foils.

YE47, Wageman et al, measured the absolute He-4 yield by detection of the energetic He-4 particles from fission.

Fast

YE07, Waldo et al, measured delayed neutron activity against time and by associating two of the 6 groups with sole components from I-137 and Br-87 calculated the cumulative yield from the Pn values, I have renormalised the yields using the more recent Lund and Rudstam NFL-60 (1989) Pn evaluation and adding the errors in quadrature. It should be noted that other delayed neutron emitters will add components to these 2 groups, however these should be negligible for the Br-87 group. For the I-137 group this may not be negligible.

YE09, Tracy et al, measured cumulative yields of Xe and Kr relative to Xe-132 and Kr-86, these were converted to cumulative yields using values of the standards from the table, in Appendix A.

YE34, Namboodiri et al, measured 26 cumulative yields using radiochemical techniques.

YE35, Stella et al, measured 18 cumulative yields relative to Ba-140 (assumed = 6.35); these were renormalised using an updated estimate of 5.899 %/fission from this work. An earlier work by Katcoff (Nucleonics 18, 201 [1960]) was used to convert the ratio of ratio R-value measured to a simpler relative value. For completeness the relative values can be converted back to the R-values (which were not published) and then reconverted using the latest evaluation.

YE36, Ramaswami et al, measured the fractional cumulative yield of 3 nuclides by radiochemical methods.

YE37, Petrzhak et al, measured 4 Xe yields by mass spectrometry. No experimental uncertainties were given and thus a 15% uncertainty was assumed. The yields were converted using the Xe-134 yield.

YE41, Gudkov et al, measured 29 cumulative yields and 2 fractional cumulative yields, by analysis of decay gamma spectra.

YE43, Dudley et al, measured 3 fission product cumulative yields using measurements of sample gamma spectra by 3 laboratories of irradiated samples and taking the average.

YE46, D'Hondt et al, measured the He-4 ternary fission yield by detection of He-4 particles.

YE52, Weshsler and Mc Elroy et al, measured absolutely 2 standard yields: Ba-140 and Cs-137 by radiochemistry. As no experimental uncertainties were given 15% was assumed, being a justifiable accuracy for the radiochemical techniques available in the late 1960's and early 1970's.

YE57, Chapman et al, used isotope dilution mass spectrometry and gamma spectrometry to measure the Ba-140 cumulative yield.

YE58, Koch, used isotope dilution mass spectrometry and gamma spectrometry to measure 28 chain yields in the high mass peak. No errors are given so 20% is assumed as a reasonable estimate.

YE59, Maeck used mass spectrometry to measure 43 chain yields in 2 neutron spectra, with average energies of 250keV and 485 keV. As the differences are within 2 standard deviations (most within 1) both datasets have been included in the fast fission cumulative yield tables.

YE61 Kirouac et al, using a Cf-252 neutron source, measured 5 chain yields. The data were taken from the EXFOR entry. Gamma spectrometry was used to determine the yields.

YE63, Ford et al, used radiochemical methods to measure ratio of ratio R-values for 14 fission products relative to U-235 thermal using Mo-99 as the standard. The values were converted to absolute cumulative yields using data from the current UK evaluation, UKFY2, for U-235 thermal values (reference 1). Nuclides with multiple determinations were weighted averaged before conversion.

YE65, Oldham et al, measured the Ba-140 cumulative yield using gamma ray spectrometry of a radiochemically separated sample.

YE66, Gilliam et al, measured by gamma ray spectrometry 5 fission product cumulative yields.

YE67, Kelloge et al, measured 3 important standard nuclides relative to Cs-137, these were converted using the Cs-137 value in Appendix A of this report.

YE71, Cottone et al, measured 12 cumulative yields by isotope dilution mass spectrometry and gamma ray spectrometry.

YE75, Blachot et al, reports the Cs-136 cumulative yield, this is also the independent Cs-136 yield as this nuclide is shielded.

YE83, Ferrieu reports 36 cumulative yields measured by radiochemistry and gamma ray spectrometry. As the original reference was unobtainable the data was taken from the 1980 Rider database, from a copy held at the NEA databank, Paris.

High energy.

YE33, Coleman et al, measured 19 fission product yields radiochemically.

YE37, Petrzhak et al, measured the relative yields of 4 Xe isotopes, using mass spectrometry, relative to the Xe-132 yield. I converted these to absolute cumulative yields by assuming the Te-132 yield is about equal to the Xe-132 yield because both are near the end of the 132 chain.

YE42, Adamov et al, measures the He-4 yield relative to thermal U-235, which was converted to absolute using the current UK evaluation. Also the H-1 and H-3 yields which were measured relative to He-4 were converted using the this absolute He-4 yield from value in Appendix A.

Discussion:

Np-237 is the most measured of the nuclides requested with, for the most important neutron energy i.e. fast fission, good coverage of chain yields. Discrepancies exist for Kr-85, Sr-92, Sr-89, Zr-95, Zr-97, Ru-103, Sb-127, Te-132, Xe-135, Xe-131, Ce-141, Ce-148, Ce-144, Nd-147, Nd-149 and 154-Chain yield. These discrepancies do not seem to be due to any work being wholly erroneous; rather, single measurements are discrepant or have measured values over a wide range of values (much greater than the standard deviations would suggest).

Very little fractional cumulative and independent data exists, however.

Pu-242

There are 8 reference blocks with data, as shown in table 2.

Spontaneous.

YE17, Nobles, measured the long range particles from fission, greater than 97% being He-4, using a multiple ionisation chamber.

YE22, Ganapathy and Kuroda, measured the cumulative yields of I isotopes relative to I-131. As no absolute measurements of I-131 have been measured the data could not be converted without making assumptions about this yield. Thus as this yield is expected to be significantly less than the chain yield, no attempt has been made to produce a value in this report.

Fast.

YE07, Waldo et al, using the same adjustment of Pn values as referred to under Np237, determined the cumulative yields of Br-87 and I-137.

YE20, Gudkov et al, measured 29 cumulative yields by gamma ray spectrometry.

YE57, Chapman et al, measured the Ba-136 cumulative yield using chemical separation and isotope dilution mass spectrometry.

YE58, Koch et al, measured 28 chain yields by isotope dilution mass spectrometry and gamma spectrometry. As no errors are given, 20% is assumed.

YE59, Maeck, measured 43 chain yields for a filtered neutron spectrum with a mean energy of 400keV.

High.

YE18, Winkelmann et al, measured 65 cumulative yields using a (d,T) neutron source with a mean energy of 15.1 + 0.7 MeV. 43 of these cumulative yields are close enough to the end of the chains to be assumed as equivalent to chain yields. Radiochemical methods were used for Pd, Ag, Cd, Sn, Sb and Ce, with β- and gamma spectrometry. Others nuclides were measured by gamma spectrometry alone.

Discussion:

Again the chain yield distribution is well mapped out, although far from complete. However, very little data exists to determine charge distribution and hence independent yields.

Also there are discrepancies for the chain yields of masses 133 and 135.

Am-242m

The references, shown in table 5, show 9 reference blocks.

Thermal.

YE01 Weinlaender et al, gives no usable data.

YE02 Gudkov et al, measured 32 thermal neutron induced cumulative yields of Am-242m relative to the Zr-97 cumulative yield and 4 fractional independent yields. The data was taken from the EXFOR entry. A value of 4.5 + 0.3 %/fission was assumed in the paper; this differs from the value in YE06, which used an assumption for the Ba-140 yield. As there are no Ba-140 or Zr-97 yields measured I have not renormalised these values, see YE06 for further discussion below.

YE03 Vorob'en et al, report ternary yields relative to the alpha yield for thermal neutron fission. The measurements were made using a mass spectrometer. As no measured alpha yield has been reported in the literature I have not converted these to absolute values.

YE05 Ford et al, report the fractional independent yields of Xe-133 and Xe-135 isomers for the thermal induced fission. The radiochemical samples were radiochemically separated before measurement of decay gamma activities.

YE06 Wolfsberg et al, measured the ratio of ratio R-value cumulative yield for 36 fission product nuclides and 1 independent yield: Cs-136 (a shielded nuclide). The measurements were made by radiochemical procedures. The values were converted to absolute values using thermal U-235 values from Mills et al (reference 1) and the Ba-140 values from YE02. The calculated Zr-97 value is 3.6 which is significantly different from the assumed 4.5 + 0.3 %/fission in YE02. The values in YE02 values were measured relative are to the Zr-97 value. Now the YE06 values used the Ba-140 value as a standard (which can be related to Zr-97 from YE02's Ba-140/Zr-97 ratio). Thus the YE06 values are inversely proportional to the value assumed for Zr-97 in YE02. Hence if the Zr-97 value assumed with the YE02 data is adjusted, the effect will be to alter the Zr-97 value predicted by YE06. This process can be continued until both Zr-97 values coincide. Alternatively, the adjustment can be arranged so that a more global agreement between the values for several fission products from the two experiments is achieved. However, it would be preferable to have absolute measurements of these two cumulative yield standards, as a simple renormalisation must assume no systematic errors in the experimental measurement of the 2 standards. Another method of renormalisation would be to fit the two datasets to a chain yield model (i.e. the 5 Gaussian model), not constraining the summation of the 2 peaks to equal 200 %/fission. Then the values of the standards can be calculated which ensures a summation equal to 200 %/fission, although again this assumes no systematic errors.

YE09, Tracy et al, measured the relative cumulative yields of Kr and Xe isotopes relative to Kr-84 and Xe-132 in thermal neutron induced fission. To normalise the values to absolute yields as Kr-84 and Xe-134 were not measured, the cumulative yields of Br-84 and I-132 (0.321 + 0.05 and 5.11 + 0.4) were used because the independent yields of Kr-84 and Xe-132 are negligible compared to the cumulative yields and thus approximately equal to the chain yield (calculating the fractional independent yields using a simple Zp model with a Gaussian width of 0.6 and assuming the unchanged charge distribution to calculate the most probable Z value in the 2 mass chains).

YE38 Rao et al, gives no data in this paper.

YE72 Fontenla et al, gives no useful fission product yield data in this paper.

Fast.

YE07 Waldo et al, measured the delayed neutron emissions after neutron irradiation with fast neutrons, removing the thermal component with sufficient completeness to avoid the effects of thermal neutron fission. From the dependence of the neutron activity to the 6 group temporal model, and assuming two groups as being from Br-87 and I-137 only, the group strengths were fitted and, by knowing the Pns (the delayed neutron branching ratios), the cumulative yields were calculated. The assumption that the two groups were dominated by single precursors is probably correct to the accuracy quoted for Br-87, although this is less clear for I-137.

The Pns used to renormalise the results are those which have been re-evaluated by Lund and Rudstam (NFL60, 1989).

At the present time this reference, YE07, is the only fast fission measurements available.

Discussion.

Am-242m fast neutron fission has very few measurements: only 2 cumulative yields. Thus to produce accurate predictions more measurements are required.

Am-242m thermal neutron fission has cumulative yield measurements for 70% of the total mass distribution, ternary yields relative to the alpha yield (but no actual alpha yield measurements), and 10 fractional independent yields.

It would be desirable to have measurements of absolute cumulative yields of Ba-140, Zr-97, Te-132 and I-135 in order to resolve discrepancies. Also more independent yields are needed in order to derive charge distribution parameters.

Am-243

The references, shown in table 3, from CINDA show 5 reference blocks.

Thermal.

YE8 Caitucoli et al, gives no data.

YE12 Asghar et al, gives no useable fission product yields only statistical fission fragment data.

YE78 Deruytter et al, refer to measurements of He-4 ternary yield, but have yet to publish a value.

Fast.

The work of Gusev in YK 1988 1 24 was unobtainable, but its CINDA comment suggests the work measures ternary yields of Li and Be between 1 and 10 MeV neutron energy.

YE11 Dickens et al, gives cumulative yields for several fission products in many fissioning systems, however problems in the experiment makes it inadvisable to use the data given in this report directly. Dickens published a paper in NSE 96 8 which extracted usable data from ORNL-6266 (for further details see the comments in Rider on reference 86DIC2). As Am243 was not included in the NSE paper these Am measurements should be ignored unless corrections can be applied. (See under Cm-243 below)

Discussion.

As yet no reliable fission product yield data exists for Am-243.

Cm-243

There are 3 reference blocks for Cm-243 fission product yields, as shown in table 4.

Thermal.

YE10 Dickens et al, measures 77 cumulative yields and 1 shielded nuclide: Cs-136 (i.e. no parent decays to this daughter and thus the cumulative yield is equal to the independent yield). The measurements were made using a 75ng sample of Cm-243 enriched to >99%; the yields were measured using the decay gammas from the fission products (7 were determined by multiple gamma lines).

YE64 Merriman et al, measures 12 fission product yields (Tc-105 being measured by 2 gamma lines), from thermal fission by measurements of decay gamma rays from a 77 ng sample of Cm-243.

Fast

YE11 Dickens et al, see notes on this reference under Am-243, only used yields published in NSE 96 8 (1987). These 4 cumulative yields are measured relative to Cs-137, but as no measurements of this exist for Cm-243 fast fission the value estimated by an empirical interpolation model in NSE 96 8 (1987) is used to normalise the yields to absolute values.

Discussion.

No ternary yields have been measured for neutron fission of Cm-243. Only 1 independent yield has been measured, this being the shielded Cs-136 from thermal fission. Cumulative yields for thermal fission have been the most measured results, and only 4 fast measurements exist. There are discrepancies between YE10 and YE11 for Tc-105 and Tc-106, which requires further investigation. For fast cumulative yields, the 4 measured fission product yields are a slim dataset on which to base models. It would be preferable to have Cs-137 measurements and a more extensive list of measured yields.

Cm-245

Thermal

YE23, Troutner and Harbour, measured 2 fractional cumulative yields, Te-132 and Te-134, by radiochemical separation and gamma spectrometry.

YE24, Harbour et al, measured the fractional independent yield of Xe-135 and 21 cumulative yields by gamma spectrometry.

YE25, Ramaswami et al, measured ratio of ratio R-values. These were converted using the Mo-99 standard as 4.1076 + 0.02 from other references in this work and cumulative yields of U-235 thermal from the current UK evaluation (UKFY2). The measurements were made by gamma spectrometry and gamma counting of radiochemical separated nuclides.

YE26, Ramaswami, measured 14 cumulative yields by decay gamma spectrometry, using track etching to determine the number of fissions.

YE28, Von Gunten et al, measured the independent yield of 2 shielded nuclides and 38 cumulative yields (in 34 mass chains), by radiochemical separation, beta counting and NaI gamma spectrometry.

YE30, Dickens and McConnell measured 1 shielded nuclide (Cs-136) and 94 cumulative yield (using 105 gamma lines) by gamma ray spectrometry. Full data were given in the paper so that corrections to the gamma line data could be used to correct the yields, if an improved set of gamma line data becomes available.

YE31, Naik et al, measured the independent isomeric ratio Yi(meta)/(Yi(meta)+Yi(ground)) of I-132 by radiochemical separation and gamma ray spectrometry.

YE80, Manohar et al, measured fractional cumulative yields of I-135, I-140 and Mo-99 by gamma spectrometry of catcher foils.

Fast.

YE07, Waldo et al, measured the cumulative yields of Br-87 and I-137. The adjustment described under NP237 was applied to this data.

Discussion.

As with Cm-243 only a few cumulative yields have been measured for fast fission, although the thermal fission cumulative yields have been well mapped, although not completely. Again very little data on the independent yield distribution exists.

Models and fitting of data.

For even the best measured system some filling of gaps is required, particularly in the charge (independent yield) distribution. For the systems of interest these procedures are the only method of producing complete chain and independent yield sets, due to the sparsity of the available data. For the production of datasets for practical use, independent yields are required (cumulative yields being calculated from the independent yield and decay data). Currently, there are 2 acceptable models for fractional independent yields, these being Wahl's Ap' and Zp models, described in reference 2. In this paper Wahl describes the fitting of data for several important fissioning fuels; he extended this in reference 3 where he attempted to find trends in the derived parameters to allow extrapolation to other systems. It should be noted that these models are empirical, assuming distributions to be basically Gaussian, with some physical constraints from conservation laws and correction applied.

However, Wahl's models do require mass yields to convert the fractional independent yields to useable absolute yields. Therefore, even with the thermal fission of U-235, predictions have to be made for missing chain yields/ There are four prediction methods applied to chain yields. The first is interpolation and extrapolation of the graph of ln (Chain yield) vs mass, usually by using straight lines between points and a constant slope at the extremes of the distribution. The second is interpolation and extrapolation of the ln (Chain yield) vs fissioning mass (mass of compound nucleus); this gives good agreement for some masses and allows extrapolation to systems where no measurements are available or practical to make. However, it does not give good agreement for all required masses. The third method is the 5 Gaussian model of Musgrove et al (reference 4); here the double-humped mass distribution is approximated by 5 Gaussians (2 for each peak plus a central Gaussian to fill in the valley region). The requirements of conservation laws which can be applied to the model, reduce from 15 to 8 the number of parameters required. Mills et al (Washington 1989, reference 5) attempted fitting for the most populous systems, and extrapolation of trends in these to produce a general predictive technique for all systems with insufficient measurements to fit to the model. More recently they have suggested a renormalisation technique to force the model predictions to be constrainted to the experimental data; this work is to be published as a UK Atomic Energy Authority report during 1990 (reference 1).

Data libraries currently available for systems of interest.

The evaluation of experimental data and production of computer readable fission product data libraries started in the 1960's. However, the 3 current evaluations are those of the Japanese, the United Kingdom, and the United States (currently JENDL-3, UKFY2 and ENDF-6 [expected late 1990]). There are also evaluation efforts in France, China and the USSR. The fissioning systems currently available are :

Data available (T=thermal, F= fast, H= High energy, S = Spontaneous)

	Np237	Pu242	AM242m	AM243	Cm243	Cm245
ENDF-6	FH(T)	(TH)F	T	F	(TF)	T
JENDL-3	F	F				
UKFY2	TF	F	TF	TF	TF	TF

() are fissioning systems funded by the Japan/US Actinides Program, supported in part by JAERI.

It is planned that the UK evaluations will be compared with the US and other available files at the end of 1990 (when ENDF-6 is finalised) under the UK's current data evaluation program (reference 1).

The UK evaluation UKFY2 is available either from the authors or the NEA Data Bank at Saclay. Also the UKFY2 evaluation has been submitted to the JEF2 committee and was adopted for the JEF2 file.

Delayed Neutrons.

Delayed neutrons are produced following β^- decay of fission products, when a nucleus is left with sufficient excitation energy to throw off its most loosely bound neutron; this process removes a fraction of the decay along the initial β^- decay chain and instead feeds the A-1 decay chain. This effect is small in most mass chains for most fissioning systems. Despite this contribution being small relative to the overall neutron economy of a thermal or fast reactor, it is an important stabilising influence because it causes the effective neutron lifetime to be increased very significantly.

As the delayed neutron emission is governed purely by the decay of nuclides it depends upon the fission yields and the decay data (branching ratios and half-lives). It is possible to calculate the total delayed neutron activity, ν_d, the behaviour of neutron activity with time, and (using the spectra of delayed neutrons from individual precursors) the total delayed neutron spectrum. The ν_d can be calculated from the summation of the Cumulative yield multiplied by the delayed branching ratio, Pn, for each nuclide produced. The behaviour of neutron activity with time is more complicated as the rate of decay of each nuclide must be multiplied by the Pn values; this entails doing a inventory calculation of the fission products, and the results will depend on the system and the time of irradiation. A simplification of this is the Keepin 6 group model. This assumes that an infinitely short irradiation will lead to delayed neutron emission represented by the summation of 6 exponential decays. This crude model has not been amended significantly since 1956, although attempts at other numbers of exponential decays have been tried. From these 6 group parameters the reactor kinetics parameter β_{eff} can be calculated. Until recently no attempt was made to calculate β_{eff} from the fission yields and decay data because of the lack of basic data and the complexity of the calculation, however a simple GODIVA core has now been modelled (reference 6). However, the delayed neutron reactor kinetics parameters have not yet been calculated (believably) from the basic data for more complicated cores and reactor histories. The delayed neutron spectrum, which is not a fission spectrum, could affect the kinetic behaviour and fission rate of a reactor, although this has yet to be quantified. The ν_d values have been calculated by several groups in France, Japan, Sweden and the UK. However, the calculation of ν_d, neutron emission with time, and spectra has only been calculated by M.Brady (Oak Ridge, ORNL) for the nuclides of interest to this report.

As well as direct calculation, empirical models have been used in the past and are still used to estimate the ν_d for fissioning systems. The most recently published evaluation by Tuttle (reference 7 and 8) fitted ln (ν_d) against $(Ac-3Z)A_c/Z$ where Ac is the mass of the compound nucleus).

Experimental delayed neutron data references.

NE1, Waldo et al, measured the ν_d and the 6 group model parameters for fast fission, using a highly filtered neutron beam. The work measured Np237, Pu242, Am242m and Cm245. However the 400ms delay between irradiation and counting made determination of the shorter lived groups impractical, as is shown by the larger percentage uncertainties and the need to assume a value for the 6th group decay constant.

NE2, Maksjutenko et al, measured Np237 delayed neutrons using monoenergetic neutrons between 0.4 and 1.2 MeV in 0.1 MeV steps. The Keepin decay constants are assumed and the group strengths are measured relative to group 1. The 6 second delay between irradiation and counting made determination of group 5 and 6 unrealistic.

NE3, Benedetti et al, measured Np237 fast delayed neutron activity (ν_d and 6 group parameters). The 600ms irradiation to measurement time made group 6 measurement unreliable for calculation of group 6 parameters.

NE5, Krick and Evans, measured the ν_d value at 4 neutron energies between 0.64 and 1.25 MeV for Pu242. The technique used had a 10ms delay between irradiation and counting, a 50ms counting period and a 40 ms irradiation. As all the measurements lay within the standard deviations of each other the average of 1.5 + 0.5 per 100 fissions was assumed as the fast neutron fission value.

NE6, East et al, measured the delayed neutron activity with time for Pu242 assuming the 6 group model when using high energy neutrons from an accelerator. Both the normalised group yields and decay constants were measured, but the ν_d value was not measured.

NE7, Gudkov et al, measured Np237 with a fast neutron spectrum. The time from irradiation to counting was 0.8s. No uncertainties were estimated on the decay constants. The 6th group was calculated as the delay before counting made measurement of this group unrealistic.

As shown in table 7 references for delayed neutron data in the systems of interest are sparse, mostly being Np237. The experimental ν_d values are shown in table 8. Comparison of the 6 group parameters is difficult, as this is an empirical model with no theoretical justification (the only true model would have 1 group for each delayed neutron precursor). Therefore, comparison is only possible if the original decay with time is published with error bars or the full covariance matrix and x^2 of the fitting is given allowing calculation of the error bars. Although it is possible to produce graphs of delayed neutron emission with time after a fission pulse for the different sets of parameters, without corresponding information on the uncertainties the significance of discrepancies cannot be assessed.

Summation calculations.

As summation calculations depend upon fission yields, Pn values, and half-lives only the most recent data from publications is compared from the different groups. It should be noted that the work of Brady and England in the US are the most complete and current results including ν_d, 6 group parameters and delayed neutron spectra.

NC1, Brady and England, have used a preliminary version of ENDF-6 with Brady's database of 271 Pn values, half-life values and precursor spectra. Gaps have been filled by models, where necessary, to generate ν_d, 6 group parameters, and delayed neutron spectra. Results are available for Np-237(FH), Pu-242(F), Am-242m(T), Am-243(F) and Cm-245(T); a recent addition to the fission yields in ENDF-6 will add Np-237(T), Pu-242(TH) and Cm-243(TF) in the near future.

NC2, Tachibana et al, used the Japanese nuclear data committee file version 2 for fission yields and Pn values from several sources to calculate the ν_d value (without uncertainties), therefore uncertainties of 0.5 per 100 fissions was assumed in this report. I include in this report only the calculations using the JNDC-2 Pns.

NC3, Rudstam used ENDF-5 and his own half-life and Pn values for 67 precursors to generate ν_d and 6 group parameters. It should be noted that for U-235 he also calculated the delayed neutron spectra.

NC4, James et al, calculated ν_d values for Np-237(TF), Pu-242(F), Am-242m(TF), Am-243(TF), Cm-243(TF) and Cm-245(TF). The Pn values were taken from a Pn evaluation of Lund and Rudstam (1989) NFL-60, with gaps filled by a private communication from Klapdor (1989, March) and the 1986 Mann evaluation published in the proceedings of the Birmingham meeting in the UK (1986).

The results for ν_d are shown in table 9 with the weighted means of the experimental results from table 8. It should be noted that the summation results still disagree with experiments even for some of the more common nuclides, eg U-238, and thus these results should be used with care. However, the most recent NC01 and NC04 results do tend to follow the experimental results.

Comparison of experimental, summation and empirical results of ν_d.

To compare the experimental results with previous evaluations, the new data are plotted with the data from Tuttle (reference 7) in figure 1. The new data for Np-237 of Benedetti deviates from the straight line model of ν_d against -(Ac - 3Z)Ac/Z, when viewed from the rather small experimental uncertainty quoted by Benedetti. However, the Waldo results all lie within one standard deviation of Tuttle's model. To simplify comparison, figure 2 shows the Tuttle prediction with the new data only.

Figure 3 compares the Tuttle model and the summation calculation, in a similar manner to figure 2: the Tuttle prediction is plotted with the NC01 and NC04 results and again there is approximate agreement. However, it can be seen from figures 2 and 3 that there is a slight trend for the experimental results to agree better with the summation results rather than with the Tuttle model.

Therefore, I suggest that where experimental results are reported these should be used. If there are no experimental measurements the summation results should be used. Finally, if no summation results are reported, the Tuttle model should be used. For experimental results the weighted mean should be used along with the larger of the internal and external standard deviations. For summation calculations, I would recommend the NC01 and NC04 results as they are the most recent and use the two most complete fission yield evaluations to date. However, comparison of NC01 and NC04 shows definite differences and neither of these 2 sets of results are systematically closer to the experimental values than the other.

For the time dependence of the neutron activity, there are several references in table 7. However, in most of these the group decay constants and strengths are fitted with constraints, either the decay constants are assumed (usually to the Keepin values) or assumptions are made for the shorter lived group strengths. The most complete fitting of the six group data has been that in NC01, which employed the results from inventory calculations, and made no assumptions about any of the group parameters. In practice, if no unconstrained 6 group parameters exist, the Brady and England NC01 results should be used, until better data becomes available. For delayed neutron spectra the only published results for the nuclides under study are the predictions of Brady and England made for ENDF/6 and these should be used until better data becomes available.

Conclusion on data for nuclides of interest:

Fission yields.

The datasets for Np-237F, Pu-242F, Am-242mT, Cm-243T and Cm-245T have a good enough coverage of chain yields that the predictive models, interpolations and extrapolations described above will give a good estimate of values in the remaining gaps in the total chain yield distribution. Of the remaining reactions understudy, some have no experimental results at all, while the rest are only poorly defined. Appendix A lists cases where there are at least some data, but systems which have no published chain yield data are not mentioned in the tables. Clearly filling of gaps or estimating of the whole chain yield distribution is much less certain than if there is good coverage from experimental results.

There is need for new measurements of chain yields both to confirm previous results and to fill gaps in the unmeasured regions. New work should concentrate on those nuclides whose fission rates are highest for what are considered reasonable estimates of typical fuel composition in reactors of interest.

There is little data available for fractional independent yields of the nuclides under study. However, if it is required that complete yield sets be produced, then it is desirable to have some experimental values so as to be able to determine the appropiate model parameters. Thus, if large enough samples of these materials can be produced, the relatively new mass separators would be advantageous for new measurements because they allow the measurement of many independent yields without complicated and time consuming chemical separations. Examples of these mass separators are Lohengrin and Hiawatha.

Until now, only empirical models have been used for the modelling of fission yields; it would be useful to investigate whether nuclear physics theory of fission can provide a deeper insight into the processes involved and hence the form of equations which might be used to represent fission product emission.

Delayed neutron data.

Delayed neutron measurements are difficult to make accurately, and considering the small amount of data currently available, more measurements are required both of ν_d, the time dependence (allowing all parameters to vary and using a full covariance analysis), and measurement of spectra.

However, in the short and medium term, improvements in fission yields and decay data for the summation methods would in my opinion produce a greater improvement in the data. This would have to be followed up by experimental measurements, however, to confirm the results, because at present, the charge distributions for fission in these nuclides are produced by extrapolation from the charge distribution model parameters for better characterised systems. Thus the predicted charge distributions are uncertain and hence, as these distributions are very important in determining the delayed neutron precursor formation, so are the delayed neutron emission characteristics.

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References:

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Figure 1: Results from Tuttle 1979 evaluation and New data.

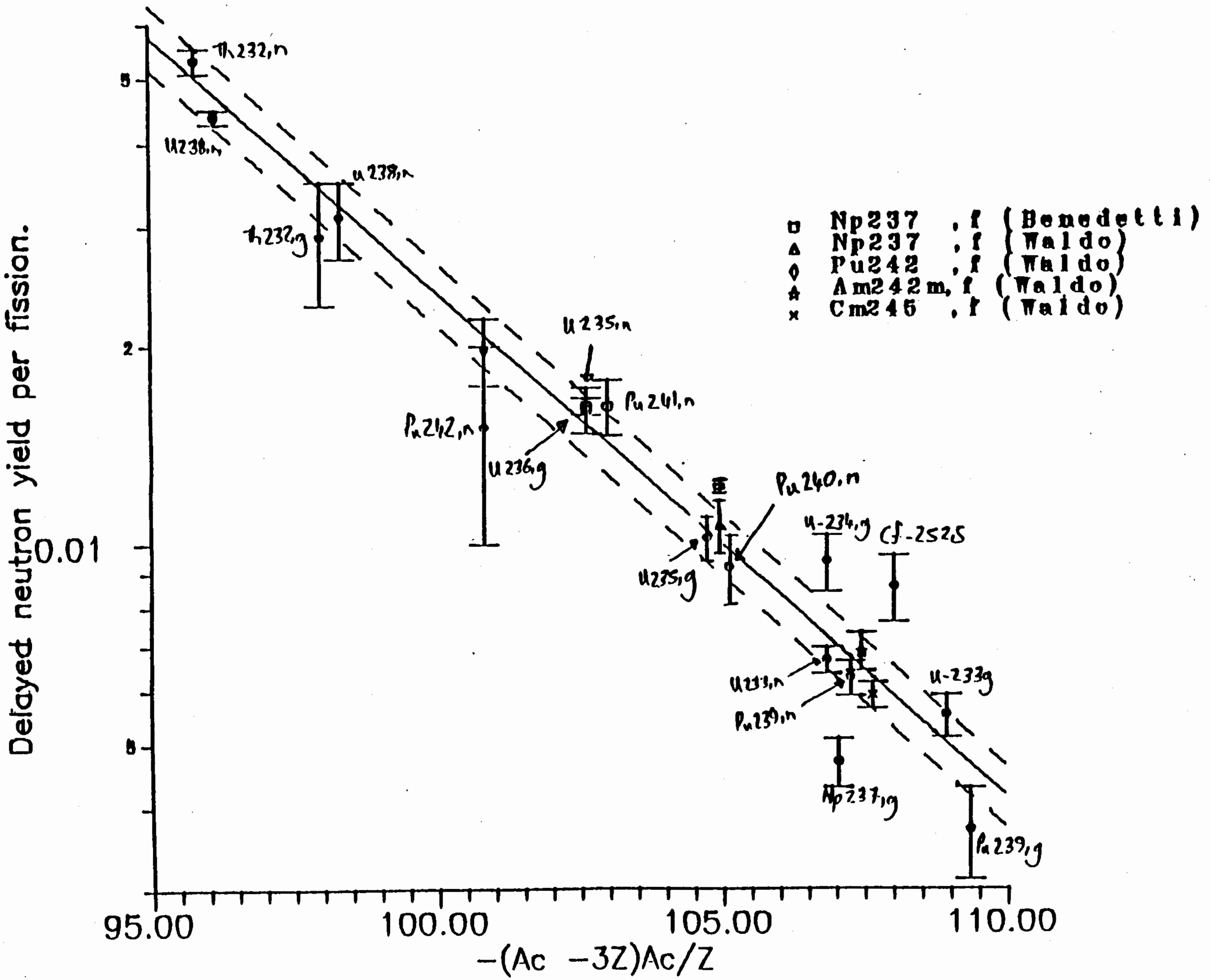

Figure 2: Prediction from Tuttle 1979 model and New data.

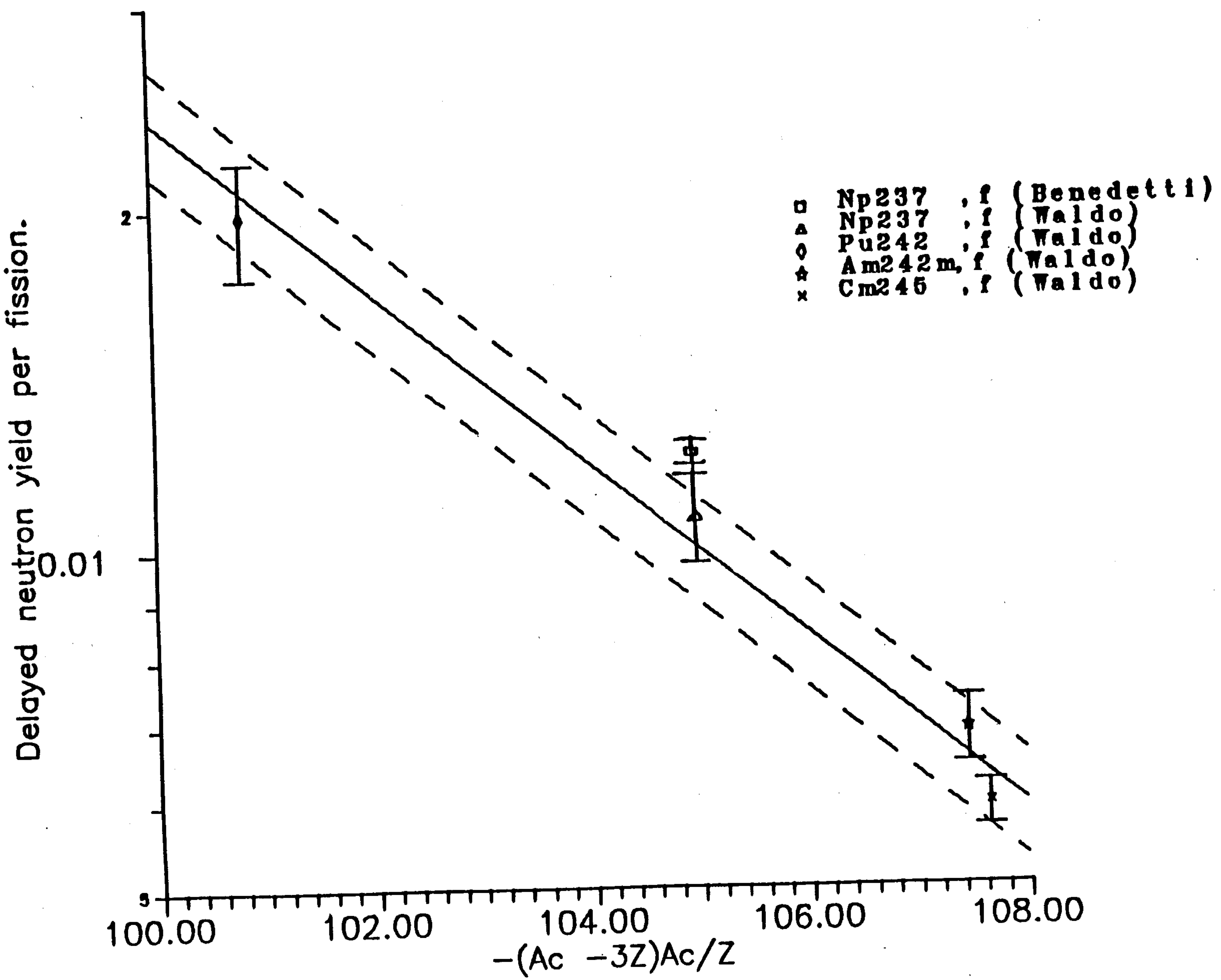

Figure 3: Prediction from Tuttle 1979 model and Summation data.

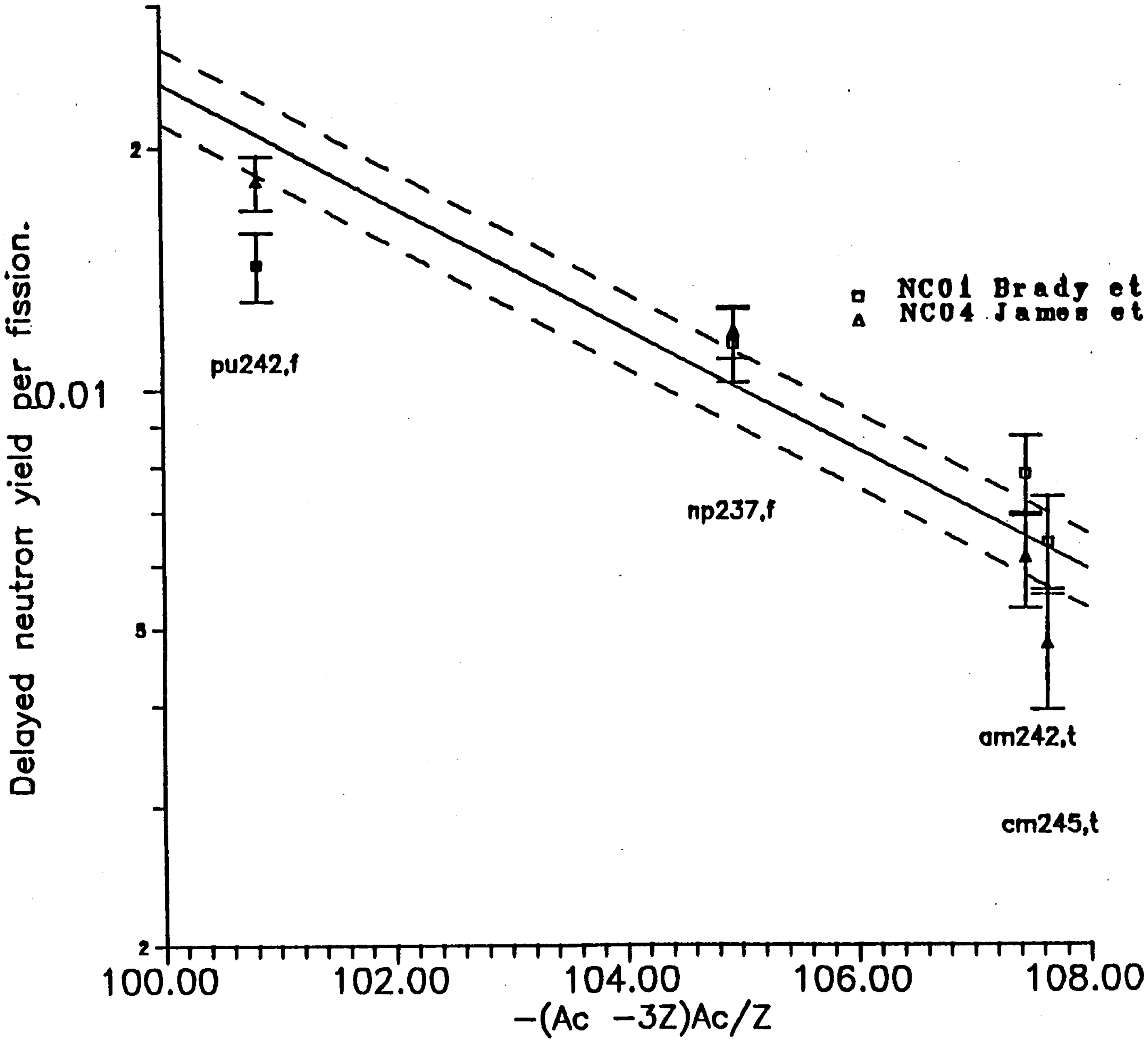

TABLE 1

References for Np237 fission yields (from CINDA).

Ref...	element	Q	lab	cou	A	blk	serial	N	W	Emin	Emax	reference	date	comments
YE33 P	93 NP 237	NFY	ALD	UK	2	150	638025	3	E	1.5+7		J JIN 14 8	6000	Coleman+ MASS YLD CURVE GIVEN
YE65 P	93 NP 237	NFY	ANL	USA	1	772	325375	5	E	FAST		P ANL-7879	7205	Larson+ YLD 140BA.
YE65	[Rider 72LAR1]													
YE43 P	93 NP 237	NFY	ANL	USA	1	775	325757	3	E	FAST		J NT 25 294	7502	Dudey+ ILRR RESULTS. EMC, CUM YLDS.
YE43	[Rider 75DUD1]													
YE04 U	93 NP 237	NFY	MHG	USA	1	784	311323	5	E	1.4+7		R DOE-NDC-33 126	8404	Agrawal+ FF. ANG DIST. NDG.
YE04 U	93 NP 237	NFY	ANL	USA	1	781	303752	5	E	2.6+5	9.6+5	P DOE-NDC-24 101	8104	Grady+ANL,MHG LABS.TBD.NDG.
YE04 U	93 NP 237	NFY	MHG	USA	1	780	301563	5	E	NDG		P DOE-NDC-19 109	8005	Grady+ANISOTROPY MEAS TBD.NDG.
YE8 P	93 NP 237	NFY	GRE	FR	2	153	767860	1	E	2.5-2		C 85SANTA 1 333	8505	Caitucoli+ GRPH, YLD.
YE8 P	93 NP 237	NFY	BOR	FR	2	150	759729	3	E	MAXW		P NEANDC(E)-242	8300	Caitucoli+EVEN-ODD AND SHELL EFFECT
YE68 P	93 NP 237	NFY	BOR	FR	2	151	759737	3	E	5.0+5	6.0+6	P NEANDC(E)-242	8300	Doan+ ENERGY CORRELATION STUDY
YE69 P	93 NP 237	NFY	BOR	FR	2	152	759739	3	E	1.0+6		P NEANDC(E)-242	8300	Benfoughal+FINE STRUCTURE STUDY
YE70 P	93 NP 237	NFY	BOR	FR	2	153	772343	5	E	NDG		P NEANDC(E)-262	8512	Martinez+DOUBLE CAPTURE REACTION
YE48 P	93 NP 237	NFY	FEI	CCP	4	001	574643	3	E	MAXW	1.6+7	C 69VIENNA 923	6907	Vorob'eva+PPR133. FRAG YLD+E(NEUT-E)
YE40 U	93 NP 237	NFY	FEI	CCP	4	002	574175	2	E	7.0+5	5.4+6	J YF 11 297	7002	Kuz'minov+ YIELD(FRAG-A)GRPH AT 8 ES
YE40 P	93 NP 237	NFY	FEI	CCP	4	002	574178	3	E	7.0+5	5.4+6	J SNP 11 166	7008	.TRANSLATN.*NO 2
YE40 P	93 NP 237	NFY	FEI	CCP	4	002	636592	6	E	8.0+5	2.2+6	4 EXFOR40172.	7311	.5 SUBENT FOR 5 ES,EACH 41 LINES
YE41 U	93 NP 237	NFY	FEI	CCP	4	482	760782	3	D	FAST		J YK 1/50 48	8303	Gudkov+ CUMUL YLD FOR 30 FISPROD,TBL
YE41 P	93 NP 237	NFY	FEI	CCP	4	482	768569	6	E	FAST		4 EXFOR40677.002	8403	30 PTS,CUM YIELDS
YE42 P	93 NP 237	NFY	FTI	CCP	4	001	574463	3	E	1.4+7		C 69VIENNA 900	6907	Adamov+PPR146.LONG-RANGE-YLD VAL GVN
YE42 U	93 NP 237	NFY	FTI	CCP	4	001	728298	3	E	1.4+7		J YF 9 732	6904	Adamov+ PROTON,T,D AND ALFA YLD GIVN
YE42 P	93 NP 237	NFY	FTI	CCP	4	001	728297	4	E	1.4+7		J SNP 9 424	6910	. ENGL OF YF 9 732
YE76 P	93 NP 237	NFY	GRE	FR	2	150	715081	3	E	MAXW		P CEA-N-2015	7700	Asghar+TABLE OF MEAN PARAMETERS
YE75 P	93 NP 237	NFY	GRE	FR	2	151	735294	3	E	1.0+0		P CEA-N-2074	7900	Blachot+EFFECT OF EVEN-ODD PROTON,FP
YE83 U	93 NP 237	NFY	GRE	FR						FAST		C 77PETTEN 1	7700	Blachot+RAD.CHEM.CUM YLDS.
YE83 P	93 NP 237	NFY	GRE	FR						FAST		W Rider 77BLA2	7700	Blachot+RAD.CHEM.CUM YLDS.
YE83	[Rider 77BLA2, data taken from Rider 1980 file.]													
YE53 P	93 NP 237	NFY	GRE	FR	2	152	739681	3	E	1.0+6	3.0+6	P CEA-N-2115 8	8000	Hamelin+ P/V-RATIO, TBL.
YE53 P	93 NP 237	NFY	GRE	FR	2	152	749851	3	E	1.0+6		* 79JUELIC# F29	7905	Blachot+ ODD-EVEN EFFECT,CS-136.NDG
YE72 P	93 NP 237	NFY	GRE	FR	2	154	772955	3	E	NDG		P CEA-N-2481 35	8500	Brissot+FISS OF NP239,DOUBLE CAPTURE
YE67 P	93 NP 237	NFY	HED	USA	1	777	325758	3	E	FAST		S NUREG/CP-0004	7710	Kellog+VOL3,P1307.TBL.YLDS REL 137CS
YE67	[Rider 77KEL1]													
YE67 U	93 NP 237	NFY	HED	USA	1	777	325759	3	E	FAST		P HEDL-TME-77-34	7805	Kellog+ VOL2,P27. YLDS REL 137CS.
YE81 U	93 NP 237	NFY	HED	USA	1	784	311320	5	E	FAST		R DOE-NDC-33 49	8404	Rawlins+ 13 FPROD. NDG.
YE12 P	93 NP 237	NFY	ILL	FR	2	150	742176	1	E	MAXW		4 EXFOR21543.	8102	2PTS.MASS OF LIGHT+HEAVY FRAGS.
YE12 U												P NEANDC(E)-212	8000	Asghar+P. P48, ABSTR, NDG.
YE12 P												C 79JUELIC 2 81	7905	Asghar+ FROM NP/A 292.CFD OTH NUCLEI
YE12 U												P CEA-N-2074 17	7900	Asghar+EVEN-EVEN,ODD-ODD EFFECT,TBL

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YE12 U                                                    R CEN(BG')-7908     7900   Asghar+ P17, ABSTR, NDG.
YE12 U                                                    P BLG-524     5-12 7800   Wagemans+
YE12 P                                                    J NP/A 292     225 7711   Asghar+ 2 KIN EN + DIFF TOF MEASURED

YE47 P 93 NP 237 NFY ILL FR  2 151 742988   1 E  MAXW     J NP/A 285      32 7707   Wagemans+ YIELD OF LONG-RANGE-ALPHAS
YE47 U                                                    P LYCEN/7901       7902   Emsallem+TERN FISS,SHORT ABSTR.,NDG
YE47 U                                                    P INDC(SEC)-62     7710   Wagemans+ ABST.LRA.
YE47 U                                                    P BLG-520          7700   Wagemans+ ABST.LRA.
YE47 P                                                    4 EXFOR20824.007 8006        1PNT.LRA YIELD.

YE55 P 93 NP 237 NFY ILL FR  2 154 749852   3 E  MAXW     * 79JUELIC#    F33 7905   Asghar+ GRPH MASS-DIST.SHELL EFFECTS

YE45 P 93 NP 237 NFY ILL FR  2 155 750096   1 E  MAXW     J NP/A 342     229 8006   Thierens+CUMUL YLDS OF 42 FP.
YE45 P 93 NP 237 NFY ILL FR  2 155 750097   6 E  MAXW     4 EXFOR21651.      8202      32PTS.CHN.YLD,2PTS.FRAC.IND.YLD.

YE44 P 93 NP 237 NFY ILL FR  2 158 772603   3 R  2.5-2    C 86HABAY       78 8605   Wagemans+TERN FISS CHARGED PRTCL DET
YE44 P 93 NP 237 NFY ILL FR  2 156 752623   1 E  MAXW     J NP/A 369       1 8110   Wagemans+MASS-ENERGY CORRELATIONS
YE44 U                                                    R BLG-539          8010   Wagemans+ ENERGY,YIELD HE4 PART
YE44 P                                                    4 EXFOR21752.009 8202        1PNT.FISSION FRAG AVERAGE MASS

YE56 P 93 NP 237 NFY ILL FR  2 153 749850   3 E  MAXW     * 79JUELIC#    F38 7905   Wagemans+ SUBBARRIER TERNRY YLDS.NDG

YE46 P 93 NP 237 NFY ILL FR  2 157 755968   3 E  MAXW     C 82ANTWER     147 8209   D'hondt+ REAC, TER A YIELDS.

YE59 P                                                    4 EXFOR10723.      8011   .130 PTS. CHN YLDS.
YE59 U 93 NP 237 NFY INL USA 1 777 312374   3 E  FAST     R ICP-1050-111     7709   Maeck+MASS SPEC.TBL OF YLDS.
YE59 [Rider 77MAE2        ]
YE59 P                                                    C 77NBS        146 7704   Maeck.MASS SPEC YLDS MEAS TBD

YE57 P 93 NP 237 NFY INL USA 1 783 312377   3 E  FAST     S BNL-51778  133 8405   Chapman+ 136BA,136CS TBL CFD ENDF.
YE57 U 93 NP 237 NFY INL USA 1 783 310761   3 E  FAST     R ENICO-10016      8310   Chapman+TBL.CUM.YLD.A=136,CFD ENDF
YE57 P 93 NP 237 NFY INL USA 1 783 310747   6 E  FAST     4 EXFOR10974.004 8401   .1 PT. CUM YLD. 136-BA.

YE71 P 93 NP 237 NFY ITU ZZZ 2 150 654596   3 E  FAST     P NEANDC(E)-162U 7502   Cottone+ SB-125,XE,CS,ND VOL.5.P.42.

YE61 U 93 NP 237 NFY KAP USA 1 782 305683   3 E  FISS     R KAPL-P-4005      7401   Kirouac+ CF252 FISS.SP.
YE61 P 93 NP 237 NFY KAP USA 1 782 305684   6 E  FISS     4 EXFOR10985.013 8112   .5 PTS. CHN.YLD.

YE51 P 93 NP 237 NFY KFK GER 2 154 772411   3 E  8.0+5  5.5+6  J PR/C  34   218 8607   Naqvi+ 2 ENS. GRPHS.
YE51 P 93 NP 237 NFY KFK GER 2 150 745050   1 E  8.0+5  5.5+6  P INDC(GER)22 L   8008   Naqvi.MASS DISTRIBUTION,GRPH
YE51 U 93 NP 237 NFY KFK GER 2 150 745050   1 E  8.0+5  5.5+6  R KFK-2919          8003   Naqvi.MASS DISTRIBUTION,GRPH
YE51 U 93 NP 237 NFY KFK GER 2 150 739951   3 E  8.0+5  5.5+6  P KFK-2868       17 7910   Naqvi+ PRIMARY MASS YIELDS, DIAGRAM
YE51 U 93 NP 237 NFY KFK GER 2 150 735565   3 E  8.0+5  5.5+6  P NEANDC(E)-202    7906   Naqvi+P. P.18 PROMPT FRAG MASS
YE51 U 93 NP 237 NFY KFK GER 2 150 728666   3 E  8.0+5  5.5+6  P KFK-2686       11 7810   Mueller+ TBC,PRELIM GRPH
YE51 P 93 NP 237 NFY KFK GER 2 150 745416   6 E  8.0+5  5.5+6  4 EXFOR21661.       8010     314PTS.PRI.AND.SEC.MASS YIELD.

YE62 U 93 NP 237 NFY KFK GER 2 152 752625   3 E  8.0+5  5.5+6  R KFK-3220          8112   Mueller+PRIMARY FRAG MASS Y,TBL,GRPH
YE62 P 93 NP 237 NFY KFK GER 2 152 759232   6 E  8.0+5  5.6+6  4 EXFOR21834.       8303     180PTS.FISSION FRAGMENT MASS YIELD

YE58 P 93 NP 237 NFY ITU ZZZ 2 151 767488   3 E  FAST     J RCA   29 2  61 8100   Koch. CUMULATIVE, MASS 125-152,TBL
YE58 U 93 NP 237 NFY ITU ZZZ 2 151 750100   3 E  FAST     R EUR-6738         8009   Koch+CUMUL FISS YIELDS A=125-152
YE58 P 93 NP 237 NFY KFK GER 2 153 771150   1 E  FAST     J RCA   29      61 8100   Koch.  MASS=125-152
YE58 P 93 NP 237 NFY KFK GER 2 153 771151   6 E  FAST     4 EXFOR21155.008 8602      28 PTS  MASS=125-152

     ? 93 NP 237 NFY KUR CCP 4 408 731646   3 C  1.4+7    R YK- 2(29)     70 7800   Lbov. TERN.H,T YLDS REL ALF YLD.TABL

YE39 U 93 NP 237 NFY KUR CCP 4 465 406971   2 E  4.0+5  4.2+6  J YF     2   243 6508   Borisova+.YLDS OF MO99
YE39 P                                                         J SNP    2   173 6602   .ENGLISH OF YF 2 243

YE63 P 93 NP 237 NFY LAS USA 1 701 325761   3 E  2.5-2  1.4+7  R LA-6129          7602   Ford+ COMP YLD. BIG-10, TOPSY.
YE63 [Rider 76for1        ]
YE63 U                                                    P ERDA-NDC-3    94 7605   Ford+NFY COMPILATION.SEE LA-6129.NDG
YE63 P 93 NP 237 NFY LAS USA 1 001 042848   3 E  FISS     R LA- 1997         5602   Ford+ DEGRADED SPEC 11MASS YIELDS
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YE63 [Rider 56FOR1        ]

YE50 P 93 NP 237 NFY LAS USA 1 002 022179   3 M   9.0+6  1.5+7   J PR/B 137   814 6502   Leachman+ RLTV ANGDIST FISS-FRAG.

YE82 U 93 NP 237 NFY LAS USA 1 003 022180   5 M   1.2+7  2.4+7   P WASH-1056    4 6503   Blumbrg.FISSION ANISOTROPY,NDG

YE49 P 93 NP 237 NFY LAS USA 1 004 033595   3 E   FISS           J PR   156  1277 6704   Stein+ SI DETECT,CURVE YIELDS,ENERGY


YE3  U 93 NP 237 NFY LIN CCP 4 477 749547   4 D   1.4+7          R INDC(CCP)-162  8106   No Np237 data. ENGLISH, OF BCDL-6 11
YE3  U 93 NP 237 NFY LIN CCP 4 477 749546   3 D   1.4+7          R BCDL-6  11     7709   Kondurov+ TERNARY YIELDS.TABLE,GRAPH

YE7  P 93 NP 237 NFY LRL USA 1 781 314344   3 E   FISS           J PR/C  23  1113 8103   Waldo+ TBLS.87BR,137I YLDS.
YE7  U                                                           P DOE-NDC-24  69 8104   Meyer+BR-87,I-137 YLDS.TBP PR/C.
YE7  P                                                           4 EXFOR12926.021 8602   .2 PTS. CUM YLD, 87-BR, 137-I.

YE9  P 93 NP 237 NFY MCM CAN 1 150 624297   3 E   MAXW    FAST   J JIN   35  2639 8909   Tracy+ CUMUL KR + XE YIELDS
YE9  [Rider 73TRA1        ]
YE9  U 93 NP 237 NFY MCM CAN 1 150 634434   5 E   MAXW    FAST   P EANDC(CAN)-40  6909   thode+ MASS-SPEC,REL CUM KR+XE GIVEN
YE9  P 93 NP 237 NFY MCM CAN 1 150 325668   6 E   MAXW    FAST   4 EXFOR13315.    8909   12 PTS. REL CUM YLD, KR,XE ISOT.

YE66 P 93 NP 237 NFY NBS USA 1 701 325760   3 E   FAST           S NUREG/CP-0004  7710   Gilliam+ VOL3,P1289. BM FIELD.
YE66 [Rider 77gil1        ]
YE66 U                                                           P ERDA-NDC-9 186 7704   Gilliam+FISS YLDS.TBL.FP HL GVN.

YE35 P 93 NP 237 NFY PAV ITY 2 001 575487   1 E   PILE           J JIN   31  3739 6912   Stella+ FISS YLD OF 17 MASS BETWEEN
YE35 [Rider 69ste1, extension of 67ste(1,2,3) in Ricera Scientifa RIC. SCI 37 p347-359 (1967) 3 articles.]
YE35 P                                                           4 EXFOR21412.    8003       34PTS. CUM.YLDS

YE38 U 93 NP 237 NFY PRA IND 3 407 731421   3 D   MAXW           C 77PUNE   2 253 7712   Rao. ABST,NDG.A=131-136 FINE STRUCT

     ? 93 NP 237 NFY RI  CCP 4 001 556582   3 M   1.4+7          C 68RIGA     196 6801   Adamov+ ABST,LONG-RANGE PARTICLES YL

YE37 U 93 NP 237 NFY RI  CCP 4 473 669097   3 E   PILE           J YF    15   860 7205   Petrzhak+ TBL REL XE YLDS,EPI-CD
YE37 [ Rider 72pet2       ]
YE37 P 93 NP 237 NFY RI  CCP 4 473 669098   4 E   PILE           J SNP   15   482 7211   . ENGL OF YF 15 860
YE37 P                                                           4 EXFOR40019.002 7807   4 PTS,REL YLDS XE-131,132,134,136
YE37 P 93 NP 237 NFY TIL CCP 4 478 751946   3 E   FAST   1.4+7   C 80KIEV   3 171 8009   Teplykh+ MASS-SPEC.TBL REL XE-YIELDS
YE37 U 93 NP 237 NFY TIL CCP 4 478 751947   3 E   FAST   1.4+7   J YF    29   293 7902   Teplykh+ REL XE YLDS CFD,TABLE,GRAPH
YE37 P 93 NP 237 NFY TIL CCP 4 478 751948   4 E   FAST   1.4+7   J SNP   29   144 7902   .ENGLISH OF YF 29 293.
YE37 P 93 NP 237 NFY TIL CCP 4 478 755417   6 E   FAST   1.4+7   4 EXFOR40545.    8009   REL YLDS FOR XE-131,132,134,136.

YE32 P 93 NP 237 NFY TRM IND 3 414 900161   3 R   PILE           J PRM   24   137 8501   Ramaniah. BARC EXPTS.SURVEY TBL,GRPH

YE34 P 93 NP 237 NFY TRM IND 3 468 638263   3 E   PILE           J JIN   30  2305 6809   Namboodini+ YLD OF 20  NUCLIDE
YE34 [Rider 68NAM1        ]
YE34 P 93 NP 237 NFY TRM IND 3 001 552804   3 E   FISS           C 65SALZBU 1 439 6503   Iyer.YLD OF VARIOUS ISOTOPS,TBL,GRPH
YE34 [Rider 65IYE1        ]   Preliminary study reported later as JIN 30 2305.

     ? 93 NP 237 CHG TRM IND 3 478 764321   3 E   MAXW           C 79MADRAS 2 228 7912   Manohar+ I135,BA140 FRACT CUMUL,TBL
     U 93 NP 237 CHG TRM IND 3 478 764322   5 E   MAXW           P BARC-1114   74 8100   Manohar+ I135,BA140 FCY,TBD,NDG

     ? 93 NP 237 NFY TRM IND 3 484 900275   3 E   PILE           C 85JAIPUR 2  28 8512   Reddy+ A=131-135 TE+I REL YLDS,TBL

YE36 P 93 NP 237 NFY TRM IND 3 485 902442   3 E   PILE           J RCA   41     9 8700   Ramaswami+ EPI-CD.3 FP:FRACT CUM YLD
YE36 P 93 NP 237 NFY TRM IND 3 485 903438   6 E   PILE           4 EXFOR30765.    8711   FRACT CUMUL YLDS OF TE134,I135,XE138

YE54 P 93 NP 237 NFY TUE GER 2 150 749853   3 E   5.0+5  5.6+6   * 79JUELIC#  F34 7905   Mueller+ PRIMARY+SECONDRY MASSES.NDG

YE52 P 93 NP 237 NFY WAD USA 1 770 325145   3 E   FAST           J ANS   13   868 7011   Mc Elroy+ PRELIM YLD 137CS.
YE52 [Rider 70MCE1        ]
YE52 N 93 NP 237 NFY ORL USA 1 768 325109   5 E   FISS           W WECHSLER       6800   Wechsler. PRIV COMM TO MC ELROY.
YE52 [Rider 68wec1        ]
YE52 P                                                           4 EXFOR13239.002 8906   .1 PT. CUM YLD 140BA.
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YE52 P 4 EXFOR13272.004 8908 .1 PT. CUM YLD, 137CS.

Key: P-Copy of reference U-unseen, but believed unnecessary N-unobtainable, Private communication.
?-Unobtainable.

TABLE 2

References for Pu242 fission yields (from CINDA).

Ref...		element	Q	lab	cou	A	blk	serial	M	W	Emin	Emax	reference	date	comments
YE16	P	94 PU 242	NFY	ANL	USA	1	001	034195	2	E	SPON		J PR 106 779	5705	Smith+,MASS-ENERGY DISTR CFD XPT+TH
YE16	U	94 PU 242	NFY	ANL	USA	1	001	033313	5	E	SPON		• BAP 1 81	5606	.ABST. B10
YE22	P	94 PU 242	NFY	ARK	USA	1	768	325124	6	E	SPON		J Earth and Planet Sci.let.3 1967/7/25 p89 in Rider 67Gan2		
YE22	U	94 PU 242	NFY	ARK	USA	1	768	709396	3	E	SPON		• DA/B 29 319	6807	Ganapathy.RADIOCHEM,I131 132 133 135
YE22	[Rider 68ganl]														
YE22	U	94 PU 242	NFY	ARK	USA	1	768	709397	3	E	SPON		R ORO-3235-11	6701	Ganapathy+,MASS YLD DISTR A=131-135
YE22	U	94 PU 242	NFY	ARK	USA	1	768	709398	3	E	SPON		P ORO-3235-7	6701	Ganapathy.I131 132 133 134YLD TBP PR
YE22	P	94 PU 242	NFY	ARK	USA	1	768	325124	6	E	SPON		4 EXFOR13229.002	8906	.4 PTS. CUM YLDS 132-135I REL 131I.
YE74	P	94 PU 242	NFY	BRC	FR	2	150	750026	3	E	SPON		P CEA-N-2214	8107	Yehia+SPON AND TH COMPARED,GRAPHS
YE21	U	94 PU 242	NFY	FEI	CCP	4	476	659506	3	E	7.0+5	5.0+6	J YF 23 269	7602	D'yachenko+ GRAPH,FRAG DISTR
YE21	P	94 PU 242	NFY	FEI	CCP	4	476	672457	4	E	7.0+5	5.0+6	J SNP 23 141	7602	. ENGL OF YF 23 269
YE21	U	94 PU 242	NFY	FEI	CCP	4	150	641100	4	E	SPON		R INDC(CCP)-48	7502	. ENGLISH OF YFI-17 3
YE21	U	94 PU 242	NFY	FEI	CCP	4	150	638591	3	E	SPON		R YFI-17 3	7408	D'yachenko+ YLD(FRAG MASS),TBL
YE21	U	94 PU 242	NFY	FEI	CCP	4	150	617146	3	E	SPON		J YF 17 696	7304	D'yachenko+ MASS-YLD+YLD(KIN-E),GRPH
YE21	P	94 PU 242	NFY	FEI	CCP	4	150	629353	4	E	SPON		J SNP 17 362	7310	.ENGLISH OF YF 17 696
YE21	P	94 PU 242	NFY	FEI	CCP	4	150	410887	6	E	SPON		4 EXFOR40194.002	8407	42 PTS,FF-YLDS VS FF-MASS
YE13	P	94 PU 242	NFY	FEI	CCP	4	473	633973	3	E	1.0+6	3.5+6	C 73KIEV 3 270	7305	Vorob'eva+ FRAGM MASS-DISTR,GRAPH
YE13	P	94 PU 242	NFY	FEI	CCP	4	473	633974	3	E	SPON		C 73KIEV 3 270	7305	Vorob'eva+ FRAGM-MASS DISTR,GRAPH
YE13	P	94 PU 242	NFY	FEI	CCP	4	473	683675	6	E	7.0+5	3.5+6	4 EXFOR40284.	7505	.PRIMARY FISS-FRAG YIELD AT 3N-E GVN
YE14	P	94 PU 242	NFY	GEL	ZZZ	2	150	758409	3	E	SPON		C 82ANTWER 737	8209	Allaert+ (+MOL) FRAG MASS+ENERG DIST
YE14	P	94 PU 242	NFY	GEL	ZZZ	2	150	754554	3	E	SPON		J NP/A 380 1 61	8205	Allaert+COMPARED TO PU241 THERM FISS
YE14	U	94 PU 242	NFY	GEL	ZZZ	2	150	760612	5	E	SPON		P NEANDC(E)-242U	8303	Allaert+
YE14	P	94 PU 242	NFY	GEL	ZZZ	2	150	758415	6	E	SPON		4 EXFOR21788.006	8301	1PNT.FISSION FRAGS AVERAGE MASS
YE73	P	94 PU 242	NFY	GEL	ZZZ	2	151	772350	5	E	SPON		P INDC(EUR)-2028	8609	Wagemans+
YE73	P	94 PU 242	NFY	GEL	ZZZ	2	151	769186	5	E	SPON		P INDC(EUR)19 40	8500	Schillebeeckx+PRENEUTRON FRAGM MASS
YE15	P	94 PU 242	NFY	GHT	BLG	2	150	761274	1	E	SPON		J PR/C 29 498	8402	Thierens+ GRAPHS
YE15	P	94 PU 242	NFY	GHT	BLG	2	150	761275	6	E	SPON		4 EXFOR21915.003	8407	1PNT.FISSION FRAG AVERAGE MASS
YE59	U	94 PU 242	NFY	INL	USA	1	777	312397	3	E	FAST		R ICP-1050-IV	7902	Maeck+MASS SPEC.TBLS FISS YLDS.
YE59	[Rider 79MAE1]														
YE59	P	94 PU 242	NFY	INL	USA	1	777	312398	3	E	FAST		C 77NBS 146	7704	Maeck.MASS SPEC YLDS MEAS TBD.
YE59	P	94 PU 242	NFY	INL	USA	1	777	312399	6	E	3.9+5	4.0+5	4 EXFOR10845.	8010	. 66 PTS.FISS YLDS.
YE57	P	94 PU 242	NFY	INL	USA	1	783	312400	3	E	FAST		S BNL-51778 133	8405	Chapman+ 136BA,136CS TBL CFD ENDF.
YE57	U	94 PU 242	NFY	INL	USA	1	783	310743	3	E	FAST		R ENICO-10016	8310	Chapman+TBL.CUM.YLD.A=136,CFD ENDF
YE57	P	94 PU 242	NFY	INL	USA	1	783	310751	6	E	FAST		4 EXFOR10974.008	8401	.1 PT. CUM YLD. 136-BA.
YE58	P	94 PU 242	NFY	ITU	ZZZ	2	150	767492	3	E	FAST		J RCA 29 2 61	8100	Koch. CUMULATIVE, MASS 125-152,TBL
YE58	U	94 PU 242	NFY	ITU	ZZZ	2	150	750104	3	E	FAST		R EUR-6738	8009	Koch+CUMUL FISS YIELDS A=125-152
YE58	U	94 PU 242	NFY	KFK	GER	2	150	696622	3	E	FAST		R AERE-R-8753	7705	Koch+ TBL MASS YLDS GIVEN P 46.
YE58	P	94 PU 242	NFY	KFK	GER	2	151	771159	6	E	FAST		4 EXFOR21155.010	8602	28 PTS MASS=125-152
	?	94 PU 242	NFY	KUR	CCP	4	408	731652	3	C	SPON		R YK- 2(29) 70	7800	Lbov. TERN.ALF YLDS COMPILED,TABLE
YE17	P	94 PU 242	NFY	LAS	USA	1	001	030994	3	E	SPON		J PR 126 1508	6205	Nobles. YIELD OF LONG RANGE FFRGM
YE19	P	94 PU 242	NFY	LAS	USA	1	002	022191	3	E	6.5+5	8.0+6	J PR/B 137 809	6502	Simmons+REL ANG DIST FISS FRAG
YE3	U	94 PU 242	NFY	LIN	CCP	4	477	749639	3	D	SPON		R BCDL-6 11	7709	Kondurov+ TERNARY YIELDS.TABLE,GRAPH
YE3	U	94 PU 242	NFY	LIN	CCP	4	477	749640	4	D	SPON		R INDC(CCP)-162	8106	No Pu242 data. ENGLISH OF BCDL-6 11

YE7	P	94	PU	242	NFY	LRL	USA	1	781	314340	3	E	FISS	J	PR/C	23	1113	8103	Waldo+ TBLS.87BR,137I YLDS.
YE7	U	94	PU	242	NFY	LRL	USA	1	781	303675	5	E	NDG	P	DOE-NDC-24		69	8104	Meyer+BR-87,I-137 YLDS.TBP PR/C.
YE7	P	94	PU	242	NFY	LRL	USA	1	781	319251	6	E	FISS	4	EXFOR12926.026			8602	.2 PTS. CUM YLD, 87-BR, 137-I.
YE20	U	94	PU	242	NFY	MIF	CCP	4	481	764515	3	E	FAST	J	AE	54	404	8306	Gudkov+ GE-LI,TBL 29 YLDS A=85-149
YE20	P	94	PU	242	NFY	MIF	CCP	4	481	764516	4	E	FAST	J	SJA	54	414	8312	.ENGLISH OF AE 54 404
YE20	P	94	PU	242	NFY	MIF	CCP	4	481	768602	6	E	FAST	4	EXFOR40678.002			8402	29 PTS,YIELDS
YE60	P	94	PU	242	NFY	MOL	BLG	2	150	774428	3	E	SPON	R	BLG-592			8611	Wagemans+
YE60	U	94	PU	242	NFY	MOL	BLG	2	150	774429	5	E	SPON	S	BLG-596		124	8605	Schillebeeckx+
YE60	P	94	PU	242	NFY	MOL	BLG	2	150	756003	3	E	PILE	C	82ANTWER		185	8209	De Raedt+ (+GEL) CHAIN YLDS.
YE60	P	94	PU	242	NFY	MOL	BLG	2	151	774431	6	E	SPON	4	EXFOR22070.006			8801	1 PT
YE60	P	94	PU	242	NFY	MOL	BLG	2	151	774430	3	E	SPON	R	BLG-592			8611	Wagemans+
YE18	P	94	PU	242	NFY	MUN	GER	2	150	770602	2	E	1.5+7	J	PR/C	30	934	8409	Winkelmann+ CUMUL,CHN YIELDS
YE18	P	94	PU	242	NFY	MUN	GER	2	150	770601	6	E	1.5+7	4	EXFOR21983.			8602	145PTS CUMUL,CHN YIELDS

Key: P-copy obtained. U-unseen, but believed unnecessary ?-unobtainable.

TABLE 3

References for Am243 fission yields (from CINDA).

Ref...		element	Q	lab	cou	A	blk	serial	H	W	Emin	Emax	reference	date	comments
YE8	P	95 AM 243	NFY	GRE	FR	2	150	767746	1	E	2.5-2		C 85SANTA 1 333	8505	Caitucoli+ NDG. MASS-ENERGY CORREL.
YE12	P	95 AM 243	NFY	ILL	FR	2	150	739674	1	E	MAXW		J NP/A 334 2 327	8002	Asghar+FP ENERGY CORRELATION,GRAPHS
YE12	P	95 AM 243	NFY	ILL	FR	2	150	764239	3	E	MAXW		C 79jueLIC 2 81	7905	Asghar+ FROM NP/A 334.CFD OTH NUCLEI
YE12	P	95 AM 243	NFY	ILL	FR	2	150	742147	6	E	MAXW		4 EXFOR21545.	8102	2PTS.LIGHT AND HEAVY MASSES,AP
YE12	P	95 AM 243	NFY	ILL	FR	2	151	744436	3	E	MAXW		J NP/A 341 3 388	8006	Asghar+FAR-OUT ASYMMETRIC MASS
YE78	P	95 AM 243	NFY	ILL	FR	2	152	773931	5	E	MAXW		P BLG-597 138	8703	De Ruytter+ ALPHA.TRITON EMISSION
YE78	U	95 AM 243	NFY	MOL	BLG	2	150	773513	5	E	MAXW		P BLG-584 148	8604	Wagemans+ ALPHA TRITON EMISSION
	?	95 AM 243	NFY	LIN	CCP	4	418	408954	3	R	+6	+7	J YK 1988 1 24	8803	Gusev+ YLD LI,BE,CALC CFD EXPT,GRPH
YE11	U	95 AM 243	NFY	ORL	USA	1	786	321042	3	E	FAST		R ORNL-6266	8604	Dickens+ JOINT US/UK EXPT.DOUNREAY
YE11	U	95 AM 243	NFY	ORL	USA	1	786	321694	5	E	FAST		R DOE-NDC-43 145	8704	Dickens.NDG.SEE ORNL-6266.
YE11	U	95 AM 243	NFY	ORL	USA	1	786	318022	5	E	FAST		R DOE-NDC-38 141	8605	Dickens+ NDG.
YE11	P	[NB Problems with reported yields Dickens gives those of use in *P* NSE 96 8 8705 ie NO AM-243 data see rider 86DIC2].													

Key: P-Copy of reference. U-unseen, but believed unnecessary. ?-unobtainable.

TABLE 4

References for Cm243 fission yields (from CINDA).

Ref...		element	Q	lab	cou	A	blk	serial	H	W	Emin	Emax	reference	date	comments
YE10	P	96 CM 243	NFY	ORL	USA	1	700	320552	3	E	MAXW		J PR/C 34 722	8608	Dickens+ GRPH.TBL.
YE10	U	96 CM 243	NFY	ORL	USA	1	700	321752	5	E	MAXW		R DOE-NDC-43 146	8704	Dickens.NDG.PR/C 34,702
YE10	P	96 CM 243	NFY	ORL	USA	1	700	322699	6	E	MAXW		4 EXFOR13102.002	8708	.78 CUM YLDS.
YE64	P	96 CM 243	NFY	ORL	USA	1	784	319605	5	E	2.5-2		P ORNL-6214 19	8602	Merriman. ABST.ORNL/TM-9049
YE64	P	96 CM 243	NFY	ORL	USA						2.5-2		P ORNL/TM-9049	8403	Merriman. 12 CUM. YIELDS.
YE64	U	96 CM 243	NFY	ORL	USA	1	781	311180	5	E	2.5-2		R DOE-NDC-33 147	8404	Merriman. 12 CUM. YIELDS.
YE64	U	96 CM 243	NFY	ORL	USA	1	781	308381	5	E	2.5-2		P DOE-NDC-30 138	8304	Breederland.NDG ABST ORNL-TM-8168
YE64	U	96 CM 243	NFY	ORL	USA	1	781	306251	5	E	2.5-2		P DOE-NDC-27 115	8204	Breederland.NDG.23 CUMUL.YLDS.
YE64	U	96 CM 243	NFY	ORL	USA	1	781	303870	5	E	MAXW		P DOE-NDC-24 124	8104	Dabbs+NDG.ANAL TBD.TBP.
YE11	U	96 CM 243	NFY	ORL	USA	1	786	321043	3	E	FAST		R ORNL-6266	8604	Dickens+ JOINT US/UK EXPT.DOUNREAY
YE11	U	96 CM 243	NFY	ORL	USA	1	786	321753	5	E	FAST		R DOE-NDC-43 145	8704	Dickens.NDG.SEE ORNL-6266.
YE11	U	96 CM 243	NFY	ORL	USA	1	786	318059	5	E	FAST		R DOE-NDC-38 141	8605	Dickens+ NDG.
YE11	P	[NB Problems with reported yields Dickens gives those of use in *P* NSE 96 8 8705 see rider 86DIC2].													
YE11	P	96 CM 243	NFY	ORL	USA	1	787	322195	3	T	FAST		J NSE 96 8	8705	Dickens.TBLS,GRPHS.FIT MASS-DIST.MDL
YE11	U	96 CM 243	NFY	ORL	USA	1	787	321754	5	T	FAST		R DOE-NDC-43 146	8704	Dickens.NDG.NSE.TBP.

Key: P-Copy of reference U-unseen, but believed unnecessary

TABLE 5

References for Am242m fission yields (from CINDA).

Ref...		element	Q	lab	cou	A	blk	serial	H	W	Emin	Emax	reference	date	comments
YE6	P	95 AM 242	NFY	LAS	USA	1	001	054858	3	E	PILE		J PR/C 3 1333	7103	Wolfsberg+ 35 CHN YLDS, XE+KR CUMULT
YE6	U	95 AM 242	NFY	LAS	USA	1	001	325126	5	E	PILE		R LA-DC-12142	7006	Wolfsberg+
YE6	P	95 AM 242	NFY	LAS	USA	1	001	325618	6	E	PILE		4 EXFOR13295.002	8908	.36 PTS. R-VAL REL 235U + CUM YLDS.
YE6	P	95 AM 242	NFY	LAS	USA	1	001	325619	6	E	PILE		4 EXFOR13295.003	8908	.1 PT. R-VAL REL 235U + IND YLD
YE6	P	95 AM 242	NFY	LAS	USA	1	001	325620	6	E	PILE		4 EXFOR13295.004	8908	.11 PTS. FRACT CUM YLDS, KR,XE ISOT.
YE5	P	95 AM 242	NFY	LAS	USA	1	701	312314	3	E	2.5-2		J PR/C 30 195	8407	Ford+IND.YLD.(133M,G),(135M,G)XE
YE5	P	95 AM 242	NFY	LAS	USA	1	701	325566	6	E	2.5-2		4 EXFOR12895.011	8409	.6 PTS. FR IND YLDS, 133,135XE.
YE3	P	95 AM 242	NFY	LIN	CCP	4	473	763469	4	E	PILE		J SNP 20 248	7503	.ENGLISH OF YF 20 461
YE3	U	95 AM 242	NFY	LIN	CCP	4	473	763468	3	E	PILE		J YF 20 461	7409	Vorob'ev+ TOF,MAG-SPEC,YLD Z=2-8,TBL
YE3	U	95 AM 242	NFY	LIN	CCP	4	473	636928	3	E	MAXW		C 73MUNICH 1 716	7308	Vorob'ev+ META. Z=1-8 MASS-SPEC,NDG
YE3	P	95 AM 242	NFY	LIN	CCP	4	473	763467	3	E	PILE		C 73KIEV 3 298	7305	Vorob'ev+ YLDS FOR H-3 TO C-14,TABLE
YE3	U	95 AM 242	NFY	LIN	CCP	4	477	749346	4	D	MAXW		R INDC(CCP)-162	8106	.ENGLISH,EXCERPT TRANSL OF BCDL-6 11
YE3	P	95 AM 242	NFY	LIN	CCP	4	477	763470	6	E	MAXW		4 EXFOR40503.005	8006	TERNARY YLDS,LITERAT DATA RENORMALZD
YE3	U	95 AM 242	NFY	LIN	CCP	4	477	749345	3	D	MAXW		R BCDL-6 11	7709	Kondurov+ TERNARY YLDS,TABLES,GRAPHS
YE3	P	95 AM 242	NFY	LIN	CCP	4	477	703843	3	D	MAXW		C 77KIEV 3 258	7704	Kondurov+ LIGHT PART YLDS,GRAPHS
YE7	P	95 AM 242	NFY	LRL	USA	1	781	319255	6	E	FISS		4 EXFOR12926.028	8602	.2 PTS. AM242M. CUM YLD,87-BR, 137-I
YE7	U	95 AM 242	NFY	LRL	USA	1	781	303677	5	E	NDG		P DOE-NDC-24 69	8104	Meyer+BR-87,I-137 YLDS.TBP PR/C.
YE7	P	95 AM 242	NFY	LRL	USA	1	781	314338	3	E	FISS		J PR/C 23 1113	8103	Waldo+ TBLS.87BR,137I YLDS.
YE9	P	95 AM 242	NFY	MCM	CAN	1	773	325675	6	E	PILE		4 EXFOR13315.	8909	.6 PTS. REL CUM YLD, KR,XE ISOT
YE9	P	95 AM 242	NFY	MCM	CAN	1	773	709119	3	E	PILE		J JIN 35 82639	7308	Tracy+ CUMUL KR + XE YIELDS
YE9	U	95 AM 242	NFY	MCM	CAN	1	773	709120	5	E	MAXW		P EANDC(CAN)-32	6701	Thode+ YLDS OF STABLE KR+XE ISOTOPES
YE2	P	95 AM 242	NFY	MIF	CCP	4	484	400195	6	E	MAXW		4 EXFOR40869.	8509	32 PTS CUM FIS YLD,4 PTS IND FIS YLD
YE2	U	95 AM 242	NFY	MIF	CCP	4	484	768729	3	E	MAXW		J YF 41 573	8503	Gudkov+ FISS PROD YIELDS FOR AM242M
YE2	P	95 AM 242	NFY	MIF	CCP	4	484	400001	4	E	MAXW		J SNP 41 365	8503	.ENGLISH OF YF 41 573.
YE1	P	95 AM 242	NFY	MUN	GER	2	001	574719	3	E	MAXW		C 69VIENNA 951	6907	Weinlaender.PPR72. META AM242,YLD(A)
YE38	U	95 AM 242	NFY	PRA	IND	3	407	731427	3	D	MAXW		C 77PUNE 2 253	7712	Rao. ABST,NDG.A=131-136 FINE STRUCT
YE77	U	95 AM 242	NFY	USP	BZL	3	473	637010	3	E	MAXW		C 73MUNICH 1 588	7308	Fontenla+ PROMPT+ISOM AVG FRGM-MASS

Key: P-Copy obtained. U-unseen, but believed unnecessary.

TABLE 6

References for Cm245 fission yields (from CINDA).

Ref...		element	Q	lab	cou	A	blk	serial	R	W	Emin	Emax	reference	date	comments
YE28	P	96 CM 245	NFY	ANL	USA	1	001	041691	3	E	PILE		J PR 161 1192	6709	Von Gunten+ YIELD VS MASS CURVE
YE28	[Rider 67GUN1]														
YE28	P												4 EXFOR13230.002	8906	.37 PTS. CUM YLDS.
YE28	P												4 EXFOR13230.003	8906	.2 PTS. IND YLDS 86RB, 136CS.
YE27	P	96 CM 245	NFY	ANL	USA	1	150	629572	3	E	PILE		C 73ROCH 2 19	7308	Unik+ PROMPT YLDS,MASS DISTRIB,GRPHS
YE27	U	96 CM 245	NFY	ANL	USA	1	150	670025	5	E	MAXW		P USNDC-9 30	7312	Unik+. CURVE OF FRAG MASS DIST GIVEN
YE27	P	96 CM 245	NFY	ANL	USA	1	150	670026	5	E	MAXW		* BAP 18 627	7304	Unik+. MASS+MASS/E CORRELATS. NDG
YE55	P	96 CM 245	NFY	ILL	FR	2	150	749813	3	E	MAXW		* 79JUELIC# F33	7905	Asghar+ GRPH MASS-DIST.SHELL EFFECTS
YE29	P	96 CM 245	NFY	ILL	FR	2	151	767789	1	E	2.5-2		C 85SANTA 1 385	8505	Koczon+ GRPH CFD OTHER EXPT.
YE7	P	96 CM 245	NFY	LRL	USA	1	781	314337	3	E	FISS		J PR/C 23 1113	8103	Waldo+ TBLS.87BR,137I YLDS.
YE7	U	96 CM 245	NFY	LRL	USA	1	781	303678	5	E	NDG		P DOE-NDC-24 69	8104	Meyer+BR-87,I-137 YLDS.TBP PR/C.
YE7	P	96 CM 245	NFY	LRL	USA	1	781	319253	6	E	FISS		4 EXFOR12926.029	8602	.2 PTS. CUM YLD, 87-BR, 137-I.
YE60	P	96 CM 245	NFY	MOL	BLG	2	150	755826	3	E	PILE		C 82ANTWER 185	8209	De Raedt+ (+GEL) CHAIN YLDS.
YE30	P	96 CM 245	NFY	ORL	USA	1	780	303204	3	E	MAXW		J PR/C 23 1 331	8101	Dickens+CUMUL,CHAIN FISS YLDS.CFD.
YE30	U												P DOE-NDC-24 124	8104	Dabbs+NDG.SEE PR/C 23 P.331.
YE30	U												P DOE-NDC-24 125	8104	Dickens+ABST.SEE PR/C 23 P.331 1/81.
YE30	U												P DOE-NDC-19 133	8005	Dabbs+GREATER THAN 80 ISOTOPES.NDG
YE30	U												P ORNL-TM-7309	8004	.EQUIVALENT TO DOE-NDC-19 MAY,1980.
YE30	P												4 EXFOR10962.002	8106	.97 PTS. CUM YLD.
YE30	P												4 EXFOR10962.003	8106	.1 PT. IND YLD CS136.
YE30	P												4 EXFOR10962.004	8106	.66 PTS. CHN YLD.
YE38	U	96 CM 245	NFY	PRA	IND	3	407	731429	3	D	MAXW		C 77PUNE 2 253	7712	Rao. ABST,NDG.A=131-136 FINE STRUCT
YE79	P	96 CM 245	NFY	SAH	IND	3	408	720186	5	T	MAXW		P BARC-990 44	7809	Chatterjee+ NDG.DOUBL-CORE CFD SPONT
YE79	U	96 CM 245	NFY	SAH	IND	3	408	731447	5	T	MAXW		C 77PUNE 2 235	7712	Chatterjee+ ABSTRACT,NDG
YE23	P	96 CM 245	NFY	SRL	USA	1	001	057621	3	E	PILE		J PR/C 4 505	7108	Troutner+.TE132,134 FRACT CUMUL YLDS
YE23	[Rider 71TRO2]														
YE23	P												4 EXFOR13294.002	8908	.2 PTS. FRACT CUM YLDS, 132,134TE.
YE24	P	96 CM 245	NFY	SRL	USA	1	150	617752	3	E	MAXW		J JIN 34 2109	7207	Harbour+ YLD OF 21 MASS CHAINS
YE24	[Rider 72HAR2]														
YE24	P												J PR/C 10 769	7408	Harbour+ XE135 YIELD,TBL,GRPH.
YE24	[Rider 74HAR1]														
YE24	U												R DP- MS-73-29	7300	Harbour+. XE135 FRACTNL INDEPEND YLD
YE24	P												4 EXFOR13320.003	8909	.1 PT. FRACT IND YLD, 135XE.
YE24	P												4 EXFOR13325.002	8909	.21 PTs. CUM/CHAIN YLD, 135XE.
YE32	P	96 CM 245	NFY	TRM	IND	3	414	900118	3	R	PILE		J PRM 24 137	8501	Ramaniah. BARC EXPTS.SURVEY TBL,GRPH
YE25	P	96 CM 245	NFY	TRM	IND	3	474	737855	3	E	MAXW		J JIN 41 1649	7912	Ramaswami+ R-VALUE (U-235).TBL,GRAPH
YE25	[Rider 79RAM2]														
YE25	U												P BARC-900 87	7600	Ramaswami+ 17MASS YLDS,CFD.TBL+GRPH
YE25	U												P BARC-872 104	7600	Ramaswami+ PRELIM.RESULTS
YE25	P												4 EXFOR30437.002	8002	.19 FISS-PROD R-VALUES AND YIELDS
YE80	U	96 CM 245	CHG	TRM	IND	3	477	763849	3	E	MAXW		P BARC-1114 72	8100	Datta+ FRACT CUM YLD ZR95,BA140,TBL
YE80	P	96 CM 245	CHG	TRM	IND	3	477	743547	3	E	MAXW		J PR/C 21 1411	8004	Datta+ FRACT YLDS I135,BA140,ZP.TBLS
YE80	U	96 CM 245	CHG	TRM	IND	3	477	763848	3	E	MAXW		C 79MADRAS 2 228	7912	Manohar+ I135,BA140 FRACT CUM,ZP,TBL
YE80	U	96 CM 245	CHG	TRM	IND	3	477	731844	3	E	MAXW		P BARC-974 72	7800	Manohar+ FRAC CUM YLD MO99,BA140.TBL

YE80	U	96	CM	245	CHG	TRM	IND	3	477	733587	3	E	MAXW	C	77PUNE	2	249	7712	Singh+ FRAC CUM Y MO99,I135.DATA+FIG
YE80	U	96	CM	245	CHG	TRM	IND	3	477	751640	5	E	MAXW	P	BARC-1126		8	8106	Datta+ I135,BA140,GAUSS'N WID GIVEN
YE80	U	96	CM	245	CHG	TRM	IND	3	477	736527	5	E	MAXW	P	BARC-990		11	7809	Datta+ ABST,NDG.A=99,135 CHARGE DIST
YE80	P	96	CM	245	CHG	TRM	IND	3	477	736286	6	E	MAXW	4	EXFOR30516.003			7909	.FRACT CUMUL YLD MO-99,I-135
YE26	P	96	CM	245	NFY	TRM	IND	3	480	758782	3	E	MAXW	J	RCA	30	11	8200	Ramaswami+ ABSOL YLDS 14 FISPROD,TBL
YE26	U	96	CM	245	NFY	TRM	IND	3	480	751642	5	E	MAXW	P	BARC-1126		10	8106	Iyer+ EXPT COMPLETED.MASS YLDS.TBL
YE26	P	96	CM	245	NFY	TRM	IND	3	480	760792	6	E	MAXW	4	EXFOR30631.			8211	ABSOLUTE YIELDS OF 14 FISS PRODUCTS
YE31	P	96	CM	245	NFY	TRM	IND	3	487	904972	3	E	MAXW	J	ZP/A	331	335	8811	Naik+ I132M,G ISOMERIC YLDRATIO,TBL

Key: P-Copy of reference U-unseen, but believed unnecessary

TABLE 7

Delayed neutron references for experiment and summation calculations.

KEY: refereneces NC are calculated by summation, NE are experimental.
p-photocopied. X-seen. U-unseen, believed unimportant. ?- unobtainable.

Ref.		element	Q	lab	cou	A	blk	serial	H	W	Emin	Emax	reference	date	comments
NC1	P	95 AM 242	NUD	LAS	USA	1	701	325696	3	D	2.5-2		R LA-UR-88-4118	8910	Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1	P	95 AM 242	NUD	LAS	USA	1	701	325696	3	D	2.5-2		J NSE 103 129	8910	Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1	X	95 AM 242	NUD	LAS	USA	1	701	324945	3	D	2.5-2		R LA- 11534	8904	Brady.CALC BEH... Thesis.
NC1	P	95 AM 242	NUD	LAS	USA	1	700	324847	3	D	2.5-2		C 88JACKHO 3 229	8809	England+ TBL. 6 GROUP PARAMETERS.
NC1	P	95 AM 242	NUD	LAS	USA	1	700	311837	3	D	2.5-2		S BNL-51778 33	8405	England+ TBL. 242-M TARGET.
NE1	P	95 AM 242	NUD	LRL	USA	1	780	319238	6	E	FISS		4 EXFOR12962.013	8602	.6 PTS. AM-242M.PARTL D/DE.6 HL GRPS
NE1	P	95 AM 242	NUD	LRL	USA	1	780	305372	3	E	NDG		* ANS 39 1 879	8111	Waldo+GRPH YLD VS FCN Z,A OF CN
NE1	U	95 AM 242	NUD	LRL	USA	1	780	303174	3	M	NDG		* DA/B 41 41471	8010	Waldo+EMISSION YLD MEAS AND CALC.NDG
NE1	P	95 AM 242	NUD	LRL	USA	1	780	314331	1	M	FISS		J PR/C 23 1113	8103	Waldo+GRPHS,TBLS NEUT.GROUPS
NE1	U	95 AM 242	NUD	LRL	USA	1	780	301296	5	M	NDG		P DOE-NDC-19 101	8005	Waldo+BETA-DELAY YLDS MEAS,CALC.TBL.
NE1	U	95 AM 242	NUD	LRL	USA	1	780	301297	5	M	NDG		P UCID-18577 19	8003	.EQUIVALENT TO DOE-NDC-19 MAY,1980.
NC4	P	95 AM 242	NUD	WIN	UK				MAXM		FAST		W Priv Comm M.F.James		Calulation of total dn.
NC1	P	95 AM 243	NUD	LAS	USA	1	701	325697	3	D	FAST		J NSE 103 129	8910	Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1	P	95 AM 243	NUD	LAS	USA	1	701	325696	3	D	2.5-2		R LA-UR-88-4118	8910	Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1	X	95 AM 243	NUD	LAS	USA	1	701	324946	3	D	FAST		R LA- 11534	8904	Brady.CALC BEHAVIOR FROM PRECURSORS.
NC1	P	95 AM 243	NUD	LAS	USA	1	700	324848	3	D	FAST		C 88JACKHO 3 229	8809	England+ TBL. 6 GROUP PARAMETERS.
NC1	P	95 AM 243	NUD	LAS	USA	1	700	311839	3	D	FAST		S BNL-51778 33	8405	England+ TBL.
NC4	P	95 AM 243	NUD	WIN	UK				MAXM		FAST		W Priv Comm M.F.James		Calulation of total dn.
NC4	P	96 CM 243	NUD	WIN	UK				MAXM		FAST		W Priv Comm M.F.James		Calulation of total dn.

```
NC1 P 96 CM 245 NUD LAS USA 1 701 325696  3 D  2.5-2        R LA-UR-88-4118  8910  Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 P 96 CM 245 NUD LAS USA 1 701 325702  3 D  2.5-2        J NSE  103   129 8910  Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 X 96 CM 245 NUD LAS USA 1 701 324951  3 D  2.5-2        R LA- 11534      8904  Brady.CALC BEHAVIOR FROM PRECURSORS.
NC1 P 96 CM 245 NUD LAS USA 1 700 324854  3 D  2.5-2        C 88JACKHO 3 229 8809  England+ TBL. 6 GROUP PARAMETERS.
NC1 P 96 CM 245 NUD LAS USA 1 700 311877  3 D  2.5-2        S BNL-51778   33 8405  England+ TBL.
NE1 P 96 CM 245 NUD LRL USA 1 780 319239  6 E  FISS         4 EXFOR12962.014 8602  .6 PTS. PARTL D/DE. 6 HL GRPS.
NE1 P 96 CM 245 NUD LRL USA 1 780 305377  3 E  NDG          * ANS   39 1 879 8111  Waldo+GRPH YLD VS FCN Z,A OF CN
NE1 P 96 CM 245 NUD LRL USA 1 780 314332  1 M  FISS         J PR/C  23  1113 8103  Waldo+GRPHS,TBLS NEUT.GROUPS
NE1 U 96 CM 245 NUD LRL USA 1 780 303176  3 M  NDG          * DA/B  41 41471 8010  Waldo+EMISSION YLD MEAS AND CALC.NDG
NE1 U 96 CM 245 NUD LRL USA 1 780 301389  5 M  NDG          P DOE-NDC-19 101 8005  Waldo+BETA-DELAY YLDS MEAS,CALC.TBL.
NE1 U 96 CM 245 NUD LRL USA 1 780 301390  5 M  NDG          P UCID-18577  19 8003  .EQUIVALENT TO DOE-NDC-19 MAY,1980.

NC4 P 96 CM 245 NUD WIN UK                  MAXM   FAST   W Priv Comm M.F.James  Calulation of total dn.
*********************************************************************************************************************

NE2 P 93 NP 237 NUD FEI CCP 4 473 407915  6 E  4.0+5  1.2+6  4 EXFOR40353.002 8312  9 DATA LINES,YLDS OF DEL NS
NE2 P 93 NP 237 NUD FEI CCP 4 473 689118  6 E  4.0+5  1.2+6  4 EXFOR40303.     7602  .DATA AT 9 ES GVN
NE2 U 93 NP 237 NUD FEI CCP 4 473 727241  3 E  4.0+5  5.1+6  R INDC(CCP)-51    7500  Maksyutenko+ 10H-L GROUPS,YLD(E) TBL
NE2 U 93 NP 237 NUD FEI CCP 4 473 645462  5 E  4.0+5  1.2+6  R INDC(CCP)-65    7412  .P1. ENGL OF YFI-19,3
NE2 U 93 NP 237 NUD FEI CCP 4 473 645463  5 E  4.0+5  1.2+6  R YFI-19 3        7412  Maksyutenko+ REL GROUP-YLDS(N-E),TBL
NE2 P 93 NP 237 NUD FEI CCP 4 473 638133  4 E  4.0+5  1.2+6  J SNP   19   380 7410  . ENGLISH OF YF 19 748
NE2 U 93 NP 237 NUD FEI CCP 4 473 639870  3 E  4.0+5  1.2+6  J YF    19   748 7404  Maksyutenko+ REL GROUP-YLDS,TBL+GRPH

NC1 P 93 NP 237 NUD LAS USA 1 701 325696  3 D  2.5-2        R LA-UR-88-4118  8910  Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 P 93 NP 237 NUD LAS USA 1 703 325706  3 D  FAST 1.4+7    J NSE  103   129 8910  Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 X 93 NP 237 NUD LAS USA 1 703 324955  3 D  FAST 1.4+7    R LA- 11534      8904  Brady.CALC BEHAVIOR FROM PRECURSORS.
NC1 P 93 NP 237 NUD LAS USA 1 700 324863  3 D  FAST         C 88JACKHO 3 229 8809  England+ TBL. 6 GROUP PARAMETERS.
NC1 P 93 NP 237 NUD BNW USA 1 700 314239  3 D  FISS         J NSE   87   181 8406  Reeder+TBL.CFD ENDF/B,EVALS.
NC1 P 93 NP 237 NUD LAS USA 1 700 311893  3 D  FAST         S BNL-51778   33 8405  England+ TBL.
NC1 P 93 NP 237 NUD LAS USA 1 700 310191  3 D  FAST         J NSE   85   139 8310  England+DELAYED YLDS,AVG SPECTRA E'S
NC1 P 93 NP 237 NUD LAS USA 1 700 306517  3 D  FAST         * ANS   41   567 8206  England+TBL.6 DECAY GP.FRACTIONS
NC1 P 93 NP 237 NUD LAS USA 1 778 301125  3 T  1.0+6        C 79KNOX     800 7910  England+CALC CFD EVAL,EXPTS.TBL.
NC1 P 93 NP 237 NUD OKL USA 1 150 708845  3 T  FAST   1.4+7  * ANS   28   750 7806  Liaw+NUD CALC.TBL.CFD.
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NE1 P 93 NP 237 NUD LRL USA 1 780 319232 6 E FISS 4 EXFOR12962.007 8602 Waldo+.6 PTS. PARTL D/DE. 6 HL GRPS.
NE1 P 93 NP 237 NUD LRL USA 1 780 314325 1 M FISS J PR/C 23 1113 8103 Waldo+GRPHS,TBLS NEUT.GROUPS
NE1 U 93 NP 237 NUD LRL USA 1 780 303169 3 M NDG * DA/B 41 41471 8010 Waldo+EMISSION YLD MEAS AND CALC.NDG

NE7 P 93 NP 237 NUD MIF CCP 4 488 410788 3 E FAST J AE 66 100 8902 Gudkov+ REAC,YLD OF 6 N-GROUPS,TBL
NE7 ? 93 NP 237 NUD MIF CCP 4 487 410787 3 E FAST 1.5+7 R MIF-058-88 8809 Gudkov+ REAC,DELAY N-PRECURS YLD,TBL

NE3 P 93 NP 237 NUD MIP ITY 2 150 753757 3 E FAST J NSE 80 3 379 8203 Benedetti+ TBL,GRPH, CFD EXPT,GPS.TO
NE3 U 93 NP 237 NUD MIL ITY 2 150 745238 5 E FAST W CESANA 8010 Cesana+ TABLE. (Within Exfor)
NE3 P 93 NP 237 NUD MIL ITY 2 150 743875 6 E FAST 4 EXFOR21644.003 8008 1PNT. TOTAL NUD.
NE3 P 93 NP 237 NUD MIL ITY 2 150 743874 1 E FAST P INDC(NDS)-113 8006 Cesana+ LONGCOUNTER+GELI.

NC3 P 93 NP 237 NUD SWR SWD 2 150 753766 3 T 5.0+5 J NSE 80 2 238 8202 Rudstam.GP.AVG.FROM NUCL.DATA

NC2 P 93 NP 237 NUD WDA JPN 2 150 775679 3 T FAST C 88MITO 885 8805 Tachibana+.GROSS TH.DN-YIELD IN TBL

NC4 P 93 NP 237 NUD WIN UK MAXM FAST W Priv Comm M.F.James Calulation of total dn.

? 94 PU 242 NUD FEI CCP 4 409 749642 3 R FAST R YK- 38(3) 29 8000 Sluchevskaya+ REL+ABS YLD,ESPEC,TBLS

NE5 P 94 PU 242 NUD LAS USA 1 002 653563 6 E 6.4+5 1.3+6 4 EXFOR10117.009 7407 4PTS.
NE5 P 94 PU 242 NUD LAS USA 1 150 636650 3 R 1.0+5 1.5+7 S IAEA-169 3 377 7400 Evans. TBL YLD,AT 3 ES+FAST FISSION
NE5 P 94 PU 242 NUD LAS USA 1 002 653562 1 E 6.4+5 1.3+6 J NSE 50 80 7301 Evans+REVISED NUD DATA.TBLS.
NE5 P 94 PU 242 NUD LAS USA 1 002 062816 3 E 7.0+5 1.3+6 J NSE 47 311 7203 Krick+SPRSDD.DATA REVISED.

NC1 P 94 PU 242 NUD LAS USA 1 701 325696 3 D 2.5-2 R LA-UR-88-4118 8910 Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 P 94 PU 242 NUD LAS USA 1 701 325717 3 D FAST J NSE 103 129 8910 Brady+CALC BEHAVIOR FROM PRECURSORS.
NC1 X 94 PU 242 NUD LAS USA 1 701 324966 3 D FAST R LA- 11534 8904 Brady.CALC BEHAVIOR FROM PRECURSORS.
NC1 P 94 PU 242 NUD LAS USA 1 700 324883 3 D FAST C 88JACKHO 3 229 8809 England+ TBL. 6 GROUP PARAMETERS.
NC1 P 94 PU 242 NUD LAS USA 1 700 316231 1 D FAST C 85SANTA 1 739 8505 England+ TBL. CFD ENDF-5, OTHR EVAL.
NC1 P 94 PU 242 NUD BNW USA 1 700 314236 3 D FISS J NSE 87 181 8406 Reeder+TBL.CFD ENDF/B,EVALS.
NC1 P 94 PU 242 NUD LAS USA 1 700 311920 3 D FAST S BNL-51778 33 8405 England+ TBL.CFD ENDF/B-V.
NC1 P 94 PU 242 NUD LAS USA 1 700 310196 3 D FAST J NSE 85 139 8310 England+DELAYED YLDS,AVG SPECTRA E'S
NC1 P 94 PU 242 NUD LAS USA 1 700 306516 3 D FAST * ANS 41 567 8206 England+TBL.6 DECAY GP.FRACTIONS

NC1	P	94	PU	242	NUD	LAS	USA	1	778	301127	3	T	1.0+6	C 79KNOX 800 7910	England+CALC CFD EVAL,EXPTS.TBL.
NC1	P	94	PU	242	NUD	OKL	USA	1	150	708849	3	T	FAST	* ANS 28 750 7806	Liaw+NUD CALC.TBL.CFD.
NE6	P	94	PU	242	NUD	LAS	USA	1	707	069152	3	E	1.5+7	* ANS 13 760 7011	East+.NEUT ABUNDANCES+HALF-LIVES.
NE1	P	94	PU	242	NUD	LRL	USA	1	780	319236	6	E	FISS	4 EXFOR12962.011 8602	.6 PTS. PARTL D/DE. 6 HL GRPS.
NE1	P	94	PU	242	NUD	LRL	USA	1	780	305371	3	E	NDG	* ANS 39 1 879 8111	Waldo+GRPH YLD VS FCN Z,A OF CN
NE1	P	94	PU	242	NUD	LRL	USA	1	780	314329	1	M	FISS	J PR/C 23 1113 8103	Waldo+GRPHS,TBLS NEUT.GROUPS
NE1	U	94	PU	242	NUD	LRL	USA	1	780	303173	3	M	NDG	* DA/B 41 41471 8010	Waldo+EMISSION YLD MEAS AND CALC.NDG
NE7	?	94	PU	242	NUD	MIF	CCP	4	487	410888	3	E	1.5+7	R MIF-058-88 8809	Gudkov+ C-W,DELAY N-PRECURS YLDS,TBL
NC3	P	94	PU	242	NUD	SWR	SWD	2	150	753770	3	T	5.0+5	J NSE 80 2 238 8202	Rudstam.GP.AVG.FROM NUCL.DATA
NC2	P	94	PU	242	NUD	WDA	JPN	2	150	775741	3	T	FAST	C 88MITO 885 8805	Tachibana+.GROSS TH.DN-YIELD IN TBL
NC4	P	94	CM	242	NUD	WIN	UK						FAST	W Priv Comm M.F.James	Calulation of total dn.

Table 8

Experimental $\bar{\nu}_d$ values (per 100 fissions).

Nuclide	Ref.	Value from experiment	Weighted. Mean.	internal error	external error	Chi-test
237-NP-93F	NE01	1.0680E+00 +/- 9.8000E-02	1.2070E+00	2.8686E-02	4.2544E-02	13.81
	NE03	1.2200E+00 +/- 3.0000E-02				
242-PU-94F	NE05	1.5000E+00 +/- 5.0000E-01	1.8879E+00	2.0895E-01	1.7844E-01	39.31
	NE01	1.9700E+00 +/- 2.3000E-01				
242-AM-95T	NE01	6.8800E-01 +/- 4.5000E-02				
245-CM-96T	NE01	5.9200E-01 +/- 3.9000E-02				

Table 9

ν_d values from summation calculations (per 100 fissions).

Nuclide	Ref.	Value from summation.	Wt. mean from experiments.
237-NP-93F	NC01	1.1400E+00 +/- 1.2000E-01	1.2070 +/- 0.05
	NC02	1.3100E+00 +/- 5.0000E-01	
	NC03	1.2000E+00 +/- 1.5000E-01	
	NC04	1.1812E+00 +/- 8.6000E-02	
237-NP-93H	NC01	9.7000E-01 +/- 1.1000E-01	
237-NP-93T	NC04	1.1779E+00 +/- 1.4600E-01	
242-PU-94F	NC01	1.4300E+00 +/- 1.4000E-01	1.8879 +/- 0.18
	NC02	1.3920E+00 +/- 5.0000E-01	
	NC03	1.2400E+00 +/- 1.3000E-01	
	NC04	1.8183E+00 +/- 1.4000E-01	
242-AM-95F	NC04	5.6540E-01 +/- 9.2000E-02	
242-AM-95T	NC01	7.8000E-01 +/- 9.0000E-02	0.688 +/- 0.05
	NC04	6.1210E-01 +/- 8.3000E-02	
243-AM-95F	NC01	8.0000E-01 +/- 9.0000E-02	
	NC04	8.6610E-01 +/- 1.1800E-01	
243-AM-95T	NC04	8.7010E-01 +/- 1.4300E-01	
243-CM-96T	NC04	2.0910E-01 +/- 4.4000E-02	
243-CM-96F	NC04	2.2970E-01 +/- 6.6000E-02	
245-CM-96T	NC01	6.4000E-01 +/- 9.0000E-02	0.592 +/- 0.04
	NC04	4.7650E-01 +/- 8.3000E-02	
245-CM-96F	NC04	4.8870E-01 +/- 1.0900E-01	

APPENDIX A:

Data tables of fission product yields.

LIST OF CONTENTS:

In the tables chain yields are shown as, for example, '101-CH-0' for the chain yield of mass 101.

Weighted averages are only shown where 2 or more experimental measurements exist. Where only one measurement exists, the single measurement itself is recommended. It is stressed that for global calculations where many fission yields values are to be used, a dataset which has been adjusted for conservation laws is recommended, eg as in UKFY2.

A1.1 Np237

Cumulative Yield data table for Np237 Fast neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
83-BR-35	YE34	2.6500E-01 +/- 9.0000E-03				
83-KR-36	YE09	4.7560E-01 +/- 8.0000E-03				
83-CH- 0	YE59	4.8000E-01 +/- 9.0000E-03	4.8600E-01	6.3640E-03	6.0000E-03	34.58
	YE59	4.9200E-01 +/- 9.0000E-03				
84-KR-36	YE09	7.0550E-01 +/- 4.0000E-02				
84-CH- 0	YE59	7.6200E-01 +/- 1.1000E-02	7.6900E-01	7.7782E-03	7.0000E-03	36.81
	YE59	7.7600E-01 +/- 1.1000E-02				
85-KR-36	YE09	9.9690E-01 +/- 1.7000E-02	9.8062E-01	1.6629E-02	7.6631E-02	0.00
	YE41	6.2000E-01 +/- 8.0000E-02				
85-KR-36M	YE83	8.4705E-01 +/- 3.0479E-01				
85-CH- 0	YE59	9.4800E-01 +/- 6.0000E-03	9.5012E-01	4.5555E-03	2.4706E-03	58.76
	YE59	9.5300E-01 +/- 7.0000E-03				
86-CH- 0	YE59	1.2960E+00 +/- 1.9000E-02	1.3065E+00	1.3435E-02	1.0500E-02	43.45
	YE59	1.3170E+00 +/- 1.9000E-02				
87-BR-35	YE07	1.5540E+00 +/- 2.2000E-01				
87-KR-36	YE41	2.0100E+00 +/- 1.4000E-01				

87-CH- 0	YE59	1.7270E+00 +/- 1.2000E-02	1.7275E+00	8.4853E-03	5.0000E-04	95.30
	YE59	1.7280E+00 +/- 1.2000E-02				
88-KR-36	YE41	1.7900E+00 +/- 3.7000E-01	1.8449E+00	2.4332E-01	4.7907E-02	84.39
	YE83	1.8867E+00 +/- 3.2298E-01				
88-CH- 0	YE59	2.1890E+00 +/- 2.8000E-02	2.2000E+00	1.9799E-02	1.1000E-02	57.85
	YE59	2.2110E+00 +/- 2.8000E-02				
89-SR-38	YE34	2.0400E+00 +/- 8.0000E-02	1.8796E+00	6.8133E-02	2.6067E-01	0.01
	YE63	1.4560E+00 +/- 1.3000E-01				
90-CH- 0	YE59	3.2980E+00 +/- 5.2000E-02	3.3320E+00	3.6770E-02	3.4000E-02	35.51
	YE59	3.3660E+00 +/- 5.2000E-02				
91-SR-38	YE34	4.0400E+00 +/- 1.0300E-01	3.9779E+00	9.2476E-02	1.2652E-01	17.13
	YE41	3.7200E+00 +/- 2.1000E-01				
91-Y -39	YE83	4.3094E+00 +/- 4.2363E-01				
91-CH- 0	YE59	3.8950E+00 +/- 8.3000E-02	3.9039E+00	4.4757E-02	7.7150E-02	22.64
	YE59	3.9240E+00 +/- 5.4000E-02				
	YE61	3.4000E+00 +/- 3.0000E-01				
92-SR-38	YE41	3.7800E+00 +/- 1.6000E-01	3.8737E+00	1.5139E-01	2.7384E-01	7.05
	YE83	4.6743E+00 +/- 4.6779E-01				
92-Y -39	YE41	3.3700E+00 +/- 2.3000E-01				
92-CH- 0	YE59	4.4490E+00 +/- 6.4000E-02	4.4536E+00	5.1907E-02	1.0168E-01	14.68
	YE59	4.5020E+00 +/- 9.1000E-02				
	YE61	3.7000E+00 +/- 4.0000E-01				

93-CH- 0	YE59	5.1070E+00 +/- 1.0000E-01	5.1261E+00	5.6231E-02	1.3020E-02	81.69
	YE59	5.1350E+00 +/- 6.8000E-02				
94-CH- 0	YE59	5.0970E+00 +/- 6.6000E-02	5.1114E+00	5.5250E-02	2.1980E-02	69.08
	YE59	5.1450E+00 +/- 1.0100E-01				
95-ZR-40	YE35	5.3697E+00 +/- 3.2059E-01	5.8371E+00	1.2098E-01	4.5534E-01	2.78
	YE41	5.1200E+00 +/- 4.1000E-01				
	YE43	6.0500E+00 +/- 2.5000E-01				
	YE63	7.2070E+00 +/- 5.6000E-01				
	YE66	5.9300E+00 +/- 3.0000E-01				
	YE67	5.5670E+00 +/- 2.8000E-01				
	YE83	6.1974E+00 +/- 3.2298E-01				
95-CH- 0	YE59	5.6320E+00 +/- 5.8000E-02	5.6544E+00	4.0654E-02	2.1997E-02	58.85
	YE59	5.6760E+00 +/- 5.7000E-02				
96-CH- 0	YE59	5.4730E+00 +/- 7.6000E-02	5.5078E+00	6.4052E-02	5.4435E-02	39.54
	YE59	5.5930E+00 +/- 1.1900E-01				
97-ZR-40	YE34	6.9500E+00 +/- 1.6500E-01	6.5420E+00	1.0366E-01	4.0275E-01	0.45
	YE35	5.6900E+00 +/- 3.1739E-01				
	YE41	6.3700E+00 +/- 1.7000E-01				
	YE63	7.0350E+00 +/- 7.0000E-01				
	YE66	6.3800E+00 +/- 3.2000E-01				
97-NB-41	YE83	6.9989E+00 +/- 4.2363E-01				
97-CH- 0	YE59	6.0780E+00 +/- 5.6000E-02	6.1076E+00	3.9882E-02	6.7721E-02	23.65
	YE59	6.1310E+00 +/- 5.7000E-02				
	YE61	7.2000E+00 +/- 7.0000E-01				
98-CH- 0	YE59	6.0910E+00 +/- 5.6000E-02	6.1170E+00	3.9947E-02	2.6496E-02	50.72

99-MO-42	YE34	6.9800E+00 +/- 4.0000E-01	6.3481E+00	2.1557E-01	4.6668E-01	9.60
	YE35	6.3870E+00 +/- 3.7565E-01				
	YE83	5.8319E+00 +/- 3.4958E-01				
100-CH- 0	YE59	6.5150E+00 +/- 6.4000E-02	6.5524E+00	4.5604E-02	3.7995E-02	40.48
	YE59	6.5910E+00 +/- 6.5000E-02				
101-CH- 0	YE59	6.1180E+00 +/- 1.5500E-01	6.2147E+00	5.0149E-02	3.3063E-02	50.97
	YE59	6.2260E+00 +/- 5.3000E-02				
102-CH- 0	YE59	5.8260E+00 +/- 1.4800E-01	5.9161E+00	4.6517E-02	2.9837E-02	52.12
	YE59	5.9260E+00 +/- 4.9000E-02				
103-RU-44	YE34	4.0400E+00 +/- 2.7000E-01	5.4083E+00	1.3159E-01	8.0459E-01	0.00
	YE41	4.7400E+00 +/- 6.4000E-01				
	YE43	5.7500E+00 +/- 2.9000E-01				
	YE66	5.8900E+00 +/- 3.0000E-01				
	YE67	6.0800E+00 +/- 3.1000E-01				
	YE83	5.8965E+00 +/- 3.4958E-01				
104-CH- 0	YE59	4.1620E+00 +/- 1.0600E-01	4.2235E+00	3.4933E-02	2.1469E-02	53.88
	YE59	4.2310E+00 +/- 3.7000E-02				
105-RU-44	YE41	2.9400E+00 +/- 1.9000E-01				
105-RH-45	YE34	2.7500E+00 +/- 1.6400E-01	2.8324E+00	1.4623E-01	1.6224E-01	26.72
	YE83	3.1519E+00 +/- 3.2298E-01				
106-RU-44	YE34	1.5600E+00 +/- 2.0000E-02	1.5614E+00	1.9957E-02	2.1268E-02	28.66
	YE83	1.8867E+00 +/- 3.0591E-01				
106-CH- 0	YE59	2.3130E+00 +/- 2.6000E-01	2.5346E+00	1.3991E-01	1.4151E-01	31.18
	YE59	2.6250E+00 +/- 1.6600E-01				

111-AG-47	YE34	8.5000E-02 +/- 1.0000E-03	8.5035E-02	9.9979E-04	1.7362E-03	22.14
	YE35	1.1493E-01 +/- 3.0007E-01				
	YE63	1.7170E-01 +/- 5.0000E-02				
112-PD-46	YE34	7.2000E-02 +/- 3.0000E-03				
113-AG-47	YE34	4.5000E-02 +/- 3.0000E-03				
115-CD-48	YE35	4.9929E-02 +/- 3.0001E-01				
115-CD-48G	YE83	3.4097E-02 +/- 3.0003E-01				
115-CD-48T	YE34	4.1000E-02 +/- 1.0000E-03	4.0973E-02	9.9705E-04	3.5176E-04	72.42
	YE63	3.6400E-02 +/- 1.3000E-02				
121-SN-50	YE34	4.7000E-02 +/- 1.3000E-03				
125-SN-50	YE34	1.2600E-01 +/- 3.0000E-03	1.2681E-01	2.9417E-03	4.0385E-03	16.98
	YE63	1.4700E-01 +/- 1.5000E-02				
125-SB-51	YE71	1.5800E-01 +/- 8.0000E-03	1.5801E-01	7.9972E-03	3.5946E-04	96.41
	YE83	1.7150E-01 +/- 3.0024E-01				
125-CH- 0	YE58	9.0000E-02 +/- 9.0000E-03	8.7018E-02	5.3689E-03	5.2770E-03	61.69
	YE59	8.0000E-02 +/- 9.0000E-03				
	YE59	9.2000E-02 +/- 1.0000E-02				
126-CH- 0	YE58	1.5000E-01 +/- 1.5000E-02				
127-SB-51	YE34	9.1600E-01 +/- 4.0000E-02	6.6447E-01	2.8160E-02	2.4950E-01	0.00
	YE63	4.1900E-01 +/- 4.0000E-02				
	YE83	3.2183E-01 +/- 3.0095E-01				
127-CH- 0	YE58	3.3000E-01 +/- 3.3000E-02				

129-SB-51	YE41	1.0700E+00 +/- 1.1000E-01				
129-TE-52	YE34	2.6000E+00 +/- 1.0000E-01				
129-I -53	YE83	1.6726E+00 +/- 3.0479E-01				
129-CH- 0	YE58	1.5200E+00 +/- 1.5200E-01				
130-SB-51	YE41	6.4000E-01 +/- 1.3000E-01				
130-CH- 0	YE58	2.3700E+00 +/- 2.3700E-01				
131-TE-52	YE41	7.1000E-01 +/- 8.0000E-02				
131-I -53	YE35	3.2689E+00 +/- 3.9947E-01	3.8044E+00	1.7315E-01	3.6451E-01	10.91
	YE41	3.7400E+00 +/- 2.3000E-01				
	YE83	4.3633E+00 +/- 3.4958E-01				
131-XE-54	YE09	3.6260E+00 +/- 2.0000E-02	3.6202E+00	1.9846E-02	4.6277E-02	1.97
	YE71	3.2500E+00 +/- 1.6000E-01				
131-CH- 0	YE58	4.2070E+00 +/- 4.2070E-01	3.7246E+00	4.2909E-02	6.3171E-02	33.83
	YE59	3.6800E+00 +/- 6.1000E-02				
	YE59	3.7590E+00 +/- 6.1000E-02				
132-TE-52	YE34	6.3300E+00 +/- 3.6000E-02	6.2644E+00	3.5328E-02	4.0462E-01	0.00
	YE35	6.3308E+00 +/- 3.6463E-01				
	YE41	3.6800E+00 +/- 2.3000E-01				
	YE63	5.5650E+00 +/- 5.6000E-01				
132-I -53	YE83	5.6817E+00 +/- 4.6779E-01				
132-XE-54	YE71	4.8600E+00 +/- 2.4000E-01				

	YE59	5.0340E+00 +/- 3.6000E-02				
	YE59	5.0620E+00 +/- 3.5000E-02				
	YE61	5.1000E+00 +/- 5.0000E-01				
133-TE-52	YE41	3.6800E+00 +/- 3.4000E-01				
133-I -53	YE35	6.0478E+00 +/- 6.2333E-01	7.1363E+00	2.6256E-01	5.1928E-01	14.15
	YE41	7.4600E+00 +/- 3.5000E-01				
	YE83	7.1784E+00 +/- 5.1511E-01				
133-XE-54	YE09	6.4152E+00 +/- 1.0000E-01				
133-CS-55	YE71	6.9600E+00 +/- 3.5000E-01				
133-CH- 0	YE58	6.8700E+00 +/- 6.8700E-01	6.7042E+00	3.9879E-02	2.3983E-02	83.46
	YE59	6.6820E+00 +/- 5.6000E-02				
	YE59	6.7260E+00 +/- 5.7000E-02				
134-TE-52	YE41	3.6800E+00 +/- 6.6000E-01				
134-I -53	YE41	6.0500E+00 +/- 7.0000E-01	6.2104E+00	3.6243E-01	9.7051E-02	78.89
	YE83	6.2691E+00 +/- 4.2363E-01				
134-XE-54	YE09	7.1442E+00 +/- 3.1000E-02				
134-CH- 0	YE58	7.9370E+00 +/- 7.9370E-01	7.4954E+00	3.5668E-02	1.9871E-02	85.63
	YE59	7.4940E+00 +/- 5.1000E-02				
	YE59	7.4950E+00 +/- 5.0000E-02				
135-I -53	YE41	6.3500E+00 +/- 2.5000E-01	6.4885E+00	2.2491E-01	2.8545E-01	20.44
	YE83	7.0767E+00 +/- 5.1511E-01				
135-XE-54	YE35	5.0400E+00 +/- 3.2403E-01	6.0792E+00	2.2014E-01	9.6214E-01	0.00
	YE41	6.9700E+00 +/- 3.0000E-01				

135-CH- 0	YE58	7.5100E+00 +/- 7.5100E-01	7.5835E+00	4.2341E-02	3.9137E-02	65.23
	YE59	7.5460E+00 +/- 5.9000E-02				
	YE59	7.6240E+00 +/- 6.1000E-02				
136-XE-54	YE09	6.6388E+00 +/- 4.4000E-02	6.6379E+00	4.3614E-02	6.3930E-03	88.35
	YE71	6.5900E+00 +/- 3.3000E-01				
136-BA-56	YE57	6.1800E-02 +/- 1.5000E+00				
136-CH- 0	YE58	6.5900E+00 +/- 6.5900E-01	6.8394E+00	3.5651E-02	1.4403E-02	92.16
	YE59	6.8350E+00 +/- 5.1000E-02				
	YE59	6.8450E+00 +/- 5.0000E-02				
137-I -53	YE07	2.4360E+00 +/- 5.0000E-01				
137-CS-55	YE52	6.4000E+00 +/- 1.0000E+00	6.5052E+00	2.3768E-01	2.9678E-02	99.95
	YE63	6.5420E+00 +/- 6.5000E-01				
	YE66	6.5000E+00 +/- 3.2000E-01				
	YE83	6.5204E+00 +/- 4.6779E-01				
137-CH- 0	YE58	6.2030E+00 +/- 6.2030E-01	6.3942E+00	3.5645E-02	3.5203E-02	61.41
	YE59	6.3620E+00 +/- 5.0000E-02				
	YE59	6.4290E+00 +/- 5.1000E-02				
138-CS-55	YE41	6.4800E+00 +/- 6.3000E-01				
138-CH- 0	YE58	6.2900E+00 +/- 6.2900E-01	6.2260E+00	3.2126E-02	1.6796E-02	87.23
	YE59	6.2090E+00 +/- 4.6000E-02				
	YE59	6.2420E+00 +/- 4.5000E-02				
139-BA-56	YE41	5.1100E+00 +/- 6.2000E-01	5.8227E+00	3.4978E-01	4.8700E-01	16.38
	YE83	6.1555E+00 +/- 4.2363E-01				

	YE59	5.8160E+00 +/- 1.9300E-01				
140-CS-55	YE65	5.4100E+00 +/- 2.0000E-01				
140-BA-56	YE41	6.4000E+00 +/- 2.8000E-01	5.8994E+00	1.3840E-01	2.9018E-01	49.39
	YE43	5.7900E+00 +/- 2.9000E-01				
	YE52	5.8000E+00 +/- 1.0000E+00				
	YE63	5.8550E+00 +/- 6.0000E-01				
	YE66	5.7400E+00 +/- 2.9000E-01				
	YE67	5.6500E+00 +/- 2.9000E-01				
140-LA-57	YE41	6.0800E+00 +/- 2.7000E-01				
140-CH- 0	YE58	5.5930E+00 +/- 5.5930E-01	5.4899E+00	2.7700E-02	2.4037E-02	86.07
	YE59	5.4730E+00 +/- 4.2000E-02				
	YE59	5.5010E+00 +/- 3.7000E-02				
	YE61	5.9000E+00 +/- 6.0000E-01				
141-CE-58	YE34	4.9700E+00 +/- 2.3400E-01	5.7298E+00	1.6581E-01	7.8064E-01	0.00
	YE35	6.2835E+00 +/- 3.1739E-01				
	YE83	6.7537E+00 +/- 3.4958E-01				
141-CH- 0	YE58	5.0470E+00 +/- 5.0470E-01				
142-LA-57	YE41	4.2600E+00 +/- 2.0000E-01	4.3202E+00	1.8644E-01	1.5514E-01	40.53
	YE83	4.7198E+00 +/- 5.1511E-01				
142-CH- 0	YE58	4.5430E+00 +/- 4.5430E-01	4.9190E+00	2.4879E-02	2.1459E-02	68.94
	YE59	4.9150E+00 +/- 3.3000E-02				
	YE59	4.9270E+00 +/- 3.8000E-02				
143-CE-58	YE34	3.6000E+00 +/- 7.4000E-01	4.3634E+00	1.7017E-01	9.1670E-01	0.00
	YE35	5.2189E+00 +/- 3.2059E-01				
	YE41	3.3900E+00 +/- 2.6000E-01				

143-ND-60	YE71	5.0400E+00 +/- 2.5000E-01				
143-CH- 0	YE58	4.5470E+00 +/- 4.5470E-01	4.7141E+00	2.5057E-02	1.7583E-02	78.18
	YE59	4.7000E+00 +/- 3.5000E-02				
	YE59	4.7300E+00 +/- 3.6000E-02				
144-CE-58	YE34	2.3500E+00 +/- 1.3000E-02	2.3587E+00	1.2976E-02	1.4241E-01	0.00
	YE35	4.7762E+00 +/- 3.4007E-01				
	YE63	4.6390E+00 +/- 5.0000E-01				
	YE83	4.6121E+00 +/- 3.2298E-01				
144-ND-60	YE71	4.4600E+00 +/- 2.2000E-01				
144-CH- 0	YE58	4.0070E+00 +/- 4.0070E-01	4.1730E+00	2.0822E-02	1.7285E-02	70.85
	YE59	4.1590E+00 +/- 2.9000E-02				
	YE59	4.1890E+00 +/- 3.0000E-02				
145-ND-60	YE71	3.7000E+00 +/- 1.8000E-01				
145-CH- 0	YE58	3.3500E+00 +/- 3.3500E-01	3.4942E+00	1.7290E-02	1.3266E-02	74.50
	YE59	3.4840E+00 +/- 2.4000E-02				
	YE59	3.5060E+00 +/- 2.5000E-02				
146-ND-60	YE71	2.9800E+00 +/- 1.5000E-01				
146-CH- 0	YE58	2.7270E+00 +/- 2.7270E-01	2.8074E+00	1.4462E-02	9.0495E-03	82.22
	YE59	2.8000E+00 +/- 2.0000E-02				
	YE59	2.8160E+00 +/- 2.1000E-02				
147-ND-60	YE34	1.7300E+00 +/- 2.5000E-01	2.3165E+00	1.4603E-01	4.7218E-01	1.51
	YE35	3.0240E+00 +/- 3.3161E-01				
	YE63	2.4510E+00 +/- 3.0000E-01				
	YE83	2.4526E+00 +/- 3.0591E-01				

	YE59	2.2220E+00 +/- 1.8000E-02				
148-CH- 0	YE58	1.6800E+00 +/- 1.6800E-01	1.7398E+00	1.0216E-02	3.6418E-03	93.84
	YE59	1.7400E+00 +/- 1.4000E-02				
	YE59	1.7400E+00 +/- 1.5000E-02				
149-ND-60	YE41	9.8000E-01 +/- 2.2000E-01	1.2363E+00	1.8183E-01	3.7622E-01	3.85
	YE83	1.7886E+00 +/- 3.2298E-01				
149-PM-61	YE35	1.7710E+00 +/- 3.2771E-01				
149-CH- 0	YE58	1.2730E+00 +/- 1.2730E-01	1.2745E+00	6.3560E-03	4.4950E-03	77.87
	YE59	1.2700E+00 +/- 9.0000E-03				
	YE59	1.2790E+00 +/- 9.0000E-03				
150-ND-60	YE71	1.0400E+00 +/- 5.0000E-02				
150-CH- 0	YE58	9.6000E-01 +/- 9.6000E-02	9.8636E-01	7.0520E-03	3.9941E-03	85.18
	YE59	9.8300E-01 +/- 1.0000E-02				
	YE59	9.9000E-01 +/- 1.0000E-02				
151-PM-61	YE35	1.0080E+00 +/- 3.0368E-01	8.4097E-01	2.2124E-01	1.7764E-01	42.20
	YE83	6.5204E-01 +/- 3.2298E-01				
151-CH- 0	YE58	6.4300E-01 +/- 6.4300E-02	7.1170E-01	4.2334E-03	6.7409E-03	28.15
	YE59	7.0700E-01 +/- 6.0000E-03				
	YE59	7.1700E-01 +/- 6.0000E-03				
152-CH- 0	YE58	4.5000E-01 +/- 4.5000E-02	4.5747E-01	2.8229E-03	4.5156E-03	27.82
	YE59	4.5300E-01 +/- 4.0000E-03				
	YE59	4.6200E-01 +/- 4.0000E-03				
153-PM-61	YE83	4.7258E-01 +/- 3.0149E-01				

154-ND-60	YE71	1.8400E+00 +/- 9.0000E-02				
154-CH- 0	YE59	1.8300E-01 +/- 2.0000E-03	1.8550E-01	1.4142E-03	2.5000E-03	7.71
	YE59	1.8800E-01 +/- 2.0000E-03				
156-EU-63	YE34	9.0000E-02 +/- 1.0000E-03	9.0073E-02	9.9875E-04	1.4663E-03	14.21
	YE63	1.1940E-01 +/- 2.0000E-02				
157-EU-63	YE34	9.4000E-02 +/- 3.0000E-02				
159-GD-64	YE34	6.9000E-02 +/- 3.0000E-02				

A1.2 Np237

Cumulative Yield data table for Np237 High energy neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
91-SR-38	YE33	2.7100E+00 +/- 2.5000E-01				
93-Y -39	YE33	4.9400E+00 +/- 2.5000E-01				
97-ZR-40	YE33	5.4300E+00 +/- 4.9000E-01				
99-MO-42	YE33	4.9400E+00 +/- 2.0000E-01				
105-RH-45	YE33	3.5000E+00 +/- 2.0000E-01				
109-PD-46	YE33	1.4800E+00 +/- 2.5000E-01				
111-AG-47	YE33	1.2300E+00 +/- 5.0000E-02				
112-PD-46	YE33	1.2300E+00 +/- 5.0000E-02				
115-CD-48T	YE33	1.2300E+00 +/- 5.0000E-02				
127-SB-51	YE33	2.5200E+00 +/- 1.5000E-01				
131-I -53	YE33	3.5500E+00 +/- 5.9000E-01				
131-Xe-54	YE37	4.0120E+00 +/- 8.2000E-01				
132-TE-52	YE33	4.2900E+00 +/- 7.4000E-01				
134-Xe-54	YE37	5.5650E+00 +/- 1.2000E+00				
136-Xe-54	YE37	4.9934E+00 +/- 1.0000E+00				
139-BA-56	YE33	4.8400E+00 +/- 3.5000E-01				
140-BA-56	YE33	4.8900E+00 +/- 3.5000E-01				
143-CE-58	YE33	3.6000E+00 +/- 7.4000E-01				
147-ND-60	YE33	1.7300E+00 +/- 2.5000E-01				
153-SM-62	YE33	3.2000E-01 +/- 2.5000E-02				
157-EU-63	YE33	9.4000E-02 +/- 3.0000E-02				
159-GD-64	YE33	6.9000E-02 +/- 3.0000E-02				

A1.3 Np237

Cumulative Yield data table for Np237 Thermal neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
83-KR-36	YE09	4.5700E-01 +/- 1.9600E-01				
85-KR-36	YE09	9.5070E-01 +/- 2.8000E-02				
85-CH- 0	YE45	1.0400E+00 +/- 8.0000E-02				
87-CH- 0	YE45	1.8800E+00 +/- 1.6000E-01				
88-CH- 0	YE45	2.2400E+00 +/- 1.7000E-01				
91-CH- 0	YE45	3.6700E+00 +/- 2.6000E-01				
92-CH- 0	YE45	4.1800E+00 +/- 2.4000E-01				
93-CH- 0	YE45	4.8000E+00 +/- 4.5000E-01				
94-CH- 0	YE45	5.0200E+00 +/- 5.5000E-01				
95-CH- 0	YE45	5.7200E+00 +/- 4.4000E-01				
97-CH- 0	YE45	5.8800E+00 +/- 2.9000E-01				
99-CH- 0	YE45	6.6500E+00 +/- 3.7000E-01				
101-CH- 0	YE45	6.8000E+00 +/- 6.2000E-01				
103-CH- 0	YE45	5.8700E+00 +/- 4.3000E-01				
104-CH- 0	YE45	3.8900E+00 +/- 2.9000E-01				
105-CH- 0	YE45	2.6000E+00 +/- 2.5000E-01				
115-CH- 0	YE45	1.3100E-02 +/- 1.2000E-03				
127-CH- 0	YE45	1.7000E-01 +/- 4.0000E-02				
129-CH- 0	YE45	9.9000E-01 +/- 1.3000E-01				
131-XE-54	YE09	2.8940E+00 +/- 5.0000E-02				
131-CH- 0	YE45	3.5100E+00 +/- 2.8000E-01				
132-CH- 0	YE45	4.3000E+00 +/- 3.4000E-01				
133-CH- 0	YE45	6.5500E+00 +/- 3.6000E-01				
134-XE-54	YE09	7.0520E+00 +/- 1.3000E-01				
134-CH- 0	YE45	6.6200E+00 +/- 5.5000E-01				
135-CH- 0	YE45	7.7700E+00 +/- 3.5000E-01				
136-XE-54	YE09	6.7940E+00 +/- 1.3000E-01				

138-CH- 0	YE45	6.2300E+00 +/- 3.8000E-01
140-CH- 0	YE45	6.1100E+00 +/- 4.0000E-01
141-CH- 0	YE45	6.1400E+00 +/- 4.7000E-01
142-CH- 0	YE45	5.0300E+00 +/- 4.0000E-01
143-CH- 0	YE45	5.1000E+00 +/- 3.7000E-01
146-CH- 0	YE45	2.8700E+00 +/- 3.6000E-01
147-CH- 0	YE45	2.5700E+00 +/- 2.1000E-01
149-CH- 0	YE45	1.7000E+00 +/- 2.5000E-01
151-CH- 0	YE45	8.1000E-01 +/- 1.2000E-01
156-CH- 0	YE45	1.2000E-01 +/- 4.0000E-02

A1.4 Np237

Fractional Cumulative Yield data table for Np237 Fast neutron fission.

Nuclide	Ref.	Fractional Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
134-TE-52	YE36	5.8900E-01 +/- 2.6000E-02				
135-I -53	YE36	9.1600E-01 +/- 1.4000E-01				
138-XE-54	YE36	8.8500E-01 +/- 8.4000E-02				

A1.5 Np237

Fractional Independent Yield data table for Np237 Thermal neutron fission.

Nuclide	Ref.	Fractional Independent Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
134-I -53	YE45	3.2600E-01 +/- 7.4000E-02				
135-XE-54	YE45	1.0200E-01 +/- 1.8000E-02				
136-CS-55	YE63	1.4330E-03 +/- 1.0000E-04	1.6965E-03	7.6822E-05	3.1623E-04	0.00
	YE75	2.0760E-03 +/- 1.2000E-04				

A1.6 Np237

Fractional Independent Yield data table for Np237 Fast neutron fission.

Nuclide	Ref.	Fractional Independent Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
134-I -53	YE41	3.4000E-01 +/- 2.0000E-01				
135-XE-54	YE41	3,3000E-02 +/- 1.5000E-02				

A1.7 Np237

Ternary yield data table for Np237 for Fast fission.

Nuclide	Ref.	Ternary yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
4-HE- 2	YE46	2.0300E-01 +/- 1.0000E-02				

A1.8 Np237

Ternary yield data table for Np237 for High energy fission.

Nuclide	Ref.	Ternary yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
4-HE- 2	YE42	2.4470E-01 +/- 1.9000E-02				
1-H - 1	YE42	1.9580E-02 +/- 5.0000E-03				
3-H - 1	YE42	3.4260E-02 +/- 7.0000E-03				

A1.9 Np237

Ternary yield data table for Np237 for Thermal fission.

Nuclide	Ref.	Ternary yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
4-HE- 2	YE47	1.6700E-01 +/- 1.1000E-02				

A2.1 Pu242

Cumulative Yield data table for Pu242 Fast neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
83-CH- 0	YE59	1.7900E-01 +/- 1.0000E-03				
84-CH- 0	YE59	3.4400E-01 +/- 2.0000E-03				
85-KR-36M	YE20	3.7000E-01 +/- 4.0000E-02				
85-CH- 0	YE59	3.2300E-01 +/- 5.0000E-03				
86-CH- 0	YE59	5.4200E-01 +/- 4.0000E-03				
87-BR-35	YE07	8.2320E-01 +/- 1.5880E-01				
87-KR-36	YE20	1.4700E+00 +/- 2.3000E-01				
87-CH- 0	YE59	6.2300E-01 +/- 1.1000E-02				
88-KR-36	YE20	7.7000E-01 +/- 1.0000E-01				
88-CH- 0	YE59	8.3600E-01 +/- 7.0000E-03				
90-CH- 0	YE59	1.3620E+00 +/- 1.2000E-02				
91-SR-38	YE20	1.7700E+00 +/- 1.4000E-01				
91-CH- 0	YE59	1.8070E+00 +/- 4.8000E-02				
92-SR-38	YE20	1.9300E+00 +/- 1.1000E-01				
92-Y -39	YE20	2.1500E+00 +/- 2.5000E-01				
92-CH- 0	YE59	2.1780E+00 +/- 5.6000E-02				
93-Y -39	YE20	3.3200E+00 +/- 6.0000E-01				
93-CH- 0	YE59	2.8190E+00 +/- 7.2000E-02				
94-CH- 0	YE59	3.1340E+00 +/- 8.1000E-02				
95-ZR-40	YE20	3.2400E+00 +/- 3.8000E-01				
95-CH- 0	YE59	3.6310E+00 +/- 3.6000E-02				
96-CH- 0	YE59	4.2920E+00 +/- 1.1000E-01				
97-ZR-40	YE20	4.7800E+00 +/- 3.2000E-01				
97-CH- 0	YE59	4.4500E+00 +/- 4.1000E-02				
98-CH- 0	YE59	4.8420E+00 +/- 4.3000E-02				
100-CH- 0	YE59	6.0990E+00 +/- 5.9000E-02				
101-CH- 0	YE59	6.0280E+00 +/- 3.3500E-01				
102-CH- 0	YE59	6.4760E+00 +/- 3.6000E-01				
104-TC-43	YE20	5.5200E+00 +/- 5.5000E-01				

104-CH- 0	YE59	6.8440E+00 +/- 3.7800E-01				
105-RU-44	YE20	6.9200E+00 +/- 4.3000E-01				
105-RH-45	YE20	7.4800E+00 +/- 4.7000E-01				
106-CH- 0	YE59	5.8060E+00 +/- 3.2800E-01				
125-CH- 0	YE58 YE59	6.0000E-02 +/- 3.0000E-03 5.5000E-02 +/- 6.0000E-03	5.9000E-02	2.6833E-03	2.0000E-03	45.61
126-CH- 0	YE58	1.7500E-01 +/- 3.5000E-02				
127-CH- 0	YE58	3.4000E-01 +/- 6.8000E-02				
128-SN-50	YE20	6.3000E-01 +/- 4.1000E-01				
128-CH- 0	YE58	5.4000E-01 +/- 1.0800E-01				
129-SB-51	YE20	2.2300E+00 +/- 7.4000E-01				
129-CH- 0	YE58	1.0700E+00 +/- 2.1400E-01				
130-SB-51M	YE20	7.1000E-01 +/- 7.0000E-02				
130-CH- 0	YE58	1.9200E+00 +/- 3.8400E-01				
131-TE-52M	YE20	4.1000E-01 +/- 6.0000E-02				
131-I -53	YE20	3.1900E+00 +/- 2.1000E-01				
131-CH- 0	YE58 YE59	3.1650E+00 +/- 6.3300E-01 3.0890E+00 +/- 2.4000E-02	3.0891E+00	2.3983E-02	2.8774E-03	90.45
132-I -53	YE20	4.6400E+00 +/- 3.8000E-01				
132-CH- 0	YE58 YE59	4.4050E+00 +/- 8.8100E-01 4.4930E+00 +/- 3.5000E-02	4.4929E+00	3.4972E-02	3.4905E-03	92.05
133-I -53	YE20	7.0400E+00 +/- 4.2000E-01				
133-CH- 0	YE58 YE59	6.4600E+00 +/- 1.2920E-01 6.8270E+00 +/- 4.6000E-02	6.7857E+00	4.3335E-02	1.1597E-01	0.75
134-TE-52	YE20	6.7500E+00 +/- 7.8000E-01				
134-I -53	YE20	6.8300E+00 +/- 3.8000E-01				
134-CH- 0	YE58 YE59	7.2900E+00 +/- 1.4580E+00 7.5040E+00 +/- 5.1000E-02	7.5037E+00	5.0969E-02	7.4764E-03	88.34
135-I -53	YE20	6.8300E+00 +/- 3.8000E-01				
135-XE-54	YE20	6.9900E+00 +/- 4.1000E-01				
135-CH- 0	YE58 YE59	7.0800E+00 +/- 1.4200E+00 6.9820E+00 +/- 4.3000E-02	6.9821E+00	4.2980E-02	2.9649E-03	94.50
136-BA-56	YE57	8.1000E-03 +/- 4.4000E+00				
136-CH- 0	YE58 YE59	6.7050E+00 +/- 1.3410E+00 6.9210E+00 +/- 5.1000E-02	6.9207E+00	5.0963E-02	8.2029E-03	87.21

137-I -53	YE07	3.5525E+00 +/- 1.5700E+00				
137-CH- 0	YE58	6.3100E+00 +/- 1.2620E+00	6.3400E+00	4.3973E-02	1.0447E-03	98.10
	YE59	6.3400E+00 +/- 4.4000E-02				
138-CH- 0	YE58	6.2500E+00 +/- 1.2500E+00	6.2191E+00	6.8895E-02	1.7060E-03	98.02
	YE59	6.2190E+00 +/- 6.9000E-02				
139-BA-56	YE20	5.8700E+00 +/- 3.7000E-01				
139-CH- 0	YE58	6.0800E+00 +/- 1.2200E+00	6.0671E+00	1.2336E-01	1.3078E-03	99.15
	YE59	6.0670E+00 +/- 1.2400E-01				
140-BA-56	YE20	6.7000E+00 +/- 6.9000E-01				
140-LA-57	YE20	6.4900E+00 +/- 7.8000E-01				
140-CH- 0	YE58	5.7750E+00 +/- 1.1550E+00	5.5607E+00	6.7882E-02	1.2614E-02	85.26
	YE59	5.5600E+00 +/- 6.8000E-02				
141-CH- 0	YE58	5.2550E+00 +/- 1.0510E+00				
142-LA-57	YE20	4.6300E+00 +/- 3.7000E-01				
142-CH- 0	YE58	4.6550E+00 +/- 9.3100E-01	4.6371E+00	5.6893E-02	1.0979E-03	98.46
	YE59	4.6370E+00 +/- 5.7000E-02				
143-CE-58	YE20	3.9500E+00 +/- 3.0000E-01				
143-CH- 0	YE58	4.5000E+00 +/- 9.0000E-01	4.5979E+00	3.1980E-02	3.4800E-03	91.33
	YE59	4.5980E+00 +/- 3.2000E-02				
144-CH- 0	YE58	4.1650E+00 +/- 8.3300E-01	4.2849E+00	2.7984E-02	4.0291E-03	88.55
	YE59	4.2850E+00 +/- 2.8000E-02				
145-CH- 0	YE58	3.3400E+00 +/- 6.6800E-01	3.4069E+00	2.1988E-02	2.2042E-03	92.01
	YE59	3.4070E+00 +/- 2.2000E-02				
146-CH- 0	YE58	2.8850E+00 +/- 5.8000E-01	2.9220E+00	1.8990E-02	1.2108E-03	94.92
	YE59	2.9220E+00 +/- 1.9000E-02				
147-CH- 0	YE58	2.3750E+00 +/- 4.8000E-01	2.3800E+00	1.6989E-02	1.7686E-04	99.17
	YE59	2.3800E+00 +/- 1.7000E-02				
148-CH- 0	YE58	1.9750E+00 +/- 3.9400E-01	2.0179E+00	1.5987E-02	1.7433E-03	91.32
	YE59	2.0180E+00 +/- 1.6000E-02				
149-ND-60	YE20	1.5100E+00 +/- 1.4000E-01				
149-CH- 0	YE58	1.6400E+00 +/- 3.2800E-01	1.6020E+00	9.9954E-03	1.1575E-03	90.78
	YE59	1.6020E+00 +/- 1.0000E-02				
150-CH- 0	YE58	1.3050E+00 +/- 2.6100E-01	1.3279E+00	1.2984E-02	1.1428E-03	92.99
	YE59	1.3280E+00 +/- 1.3000E-02				
151-CH- 0	YE58	1.0200E+00 +/- 2.0400E-01	9.9703E-01	6.9959E-03	7.8829E-04	91.03
	YE59	9.9700E-01 +/- 7.0000E-03				
152-CH- 0	YE58	8.4500E-01 +/- 1.7000E-02	7.7831E-01	5.6579E-03	2.3538E-02	0.00
	YE59	7.7000E-01 +/- 6.0000E-03				
154-CH- 0	YE59	4.3000E-01 +/- 4.0000E-03				

A2.2 Pu242

Cumulative Yield data table for Pu242 High energy neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
85-KR-36M	YE18	6.7200E-01 +/- 7.1000E+00				
87-KR-36	YE18	9.9300E-01 +/- 7.6000E+00				
88-KR-36	YE18	1.1600E+00 +/- 8.1000E+00				
89-RB-37	YE18	1.3300E+00 +/- 1.1000E+01				
91-SR-38	YE18	2.1100E+00 +/- 7.1000E+00				
91-Y -39M	YE18	2.0300E+00 +/- 7.9000E+00				
92-SR-38	YE18	2.2600E+00 +/- 1.3000E+01				
92-Y -39	YE18	2.4900E+00 +/- 1.2000E+01				
93-Y -39	YE18	2.6000E+00 +/- 1.3000E+01				
94-Y -39	YE18	2.7900E+00 +/- 1.0000E+01				
95-ZR-40	YE18	3.3700E+00 +/- 8.9000E+00				
97-ZR-40	YE18	4.2300E+00 +/- 7.5000E+00				
97-NB-41	YE18	4.2200E+00 +/- 7.1000E+00				
99-MO-42	YE18	4.9700E+00 +/- 7.2000E+00				
99-TC-43M	YE18	4.7000E+00 +/- 7.4000E+00				
101-TC-43	YE18	5.0400E+00 +/- 9.9000E+01				
103-RU-44	YE18	5.6400E+00 +/- 7.9000E+01				
104-TC-43	YE18	5.4500E+00 +/- 1.2000E+01				
105-RU-44	YE18	5.5800E+00 +/- 7.5000E+00				
105-RH-45	YE18	5.4200E+00 +/- 7.9000E+00				
107-RH-45	YE18	3.8000E+00 +/- 1.0000E+01				
109-PD-46	YE18	2.5300E+00 +/- 8.6000E+00				
111-PD-46M	YE18	9.4000E-05 +/- 6.4000E+01				
111-AG-47	YE18	2.2000E+00 +/- 1.1000E+01				
112-PD-46	YE18	1.9200E+00 +/- 7.2000E+00				
113-AG-47G	YE18	1.6000E+00 +/- 1.0000E+01				
115-CD-48M	YE18	0.0000E+00 +/- 3.5000E+01				
115-CD-48G	YE18	1.1200E+00 +/- 1.3000E+01				

117-CD-48M	YE18	1.5100E-01 +/- 2.0000E+01
117-CD-48G	YE18	5.0300E-01 +/- 2.0000E+01
118-CD-48	YE18	4.2000E-01 +/- 1.6000E+01
121-SN-50G	YE18	6.5800E-01 +/- 2.000E+01
125-SN-50G	YE18	6.8400E-01 +/- 1.6000E+01
125-SB-51	YE18	1.3500E+00 +/- 1.8000E+01
126-SB-51G	YE18	1.2000E-01 +/- 6.0000E+01
127-SN-50G	YE18	1.6600E+00 +/- 1.1000E+01
127-SB-51	YE18	1.8700E+00 +/- 1.1200E+01
128-SN-50	YE18	1.3000E+00 +/- 1.7000E+01
128-SB-51M	YE18	1.2900E+00 +/- 2.0000E+01
128-SB-51G	YE18	6.7800E-01 +/- 1.1000E+01
129-SB-51	YE18	2.0000E+00 +/- 1.0000E+01
129-TE-52	YE18	2.1600E+00 +/- 1.0000E+01
130-SB-51G	YE18	1.4200E+00 +/- 1.2000E+01
131-SB-51	YE18	2.4000E+00 +/- 1.3000E+01
131-TE-52M	YE18	1.5900E+00 +/- 1.0000E+01
131-I -53	YE18	3.9100E+00 +/- 6.1000E+00
132-TE-52	YE18	4.5600E+00 +/- 7.4000E+00
132-I -53	YE18	5.2700E+00 +/- 5.3000E+00
133-TE-52M	YE18	1.4300E+00 +/- 1.3000E+01
133-I -53	YE18	5.5200E+01 +/- 7.2000E+00
133-XE-54	YE18	5.6600E+01 +/- 7.6000E+00
134-I -53	YE18	5.9900E+01 +/- 1.2000E+01
135-I -53	YE18	5.1000E+01 +/- 8.7000E+00
135-XE-54	YE18	5.5200E+01 +/- 8.9000E+00
138-CS-55	YE18	5.0000E+01 +/- 9.1000E+00
139-BA-56	YE18	4.9300E+01 +/- 7.7000E+00
140-BA-56	YE18	4.8400E+01 +/- 9.0000E+00
140-LA-57	YE18	4.9500E+01 +/- 7.8000E+00
141-CE-58	YE18	4.8600E+01 +/- 8.2000E+00
142-LA-57	YE18	4.3400E+01 +/- 7.6000E+00

143-CE-58	YE18	3.6600E+01 +/- 7.1000E+00
144-CE-58	YE18	3.1900E+01 +/- 8.4000E+00
146-PR-59	YE18	2.1800E+01 +/- 8.7000E+00
149-ND-60	YE18	1.6100E+01 +/- 9.9000E+00
151-PM-61	YE18	9.1500E+01 +/- 9.7000E+00

A2.3 Pu242

Ternary yield data table for Pu242 for Spontaneous fission.

Nuclide	Ref.	Ternary yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
4-HE- 2	YE17	2.7390E-01 +/- 2.1800E-02				

Cumulative yield data table for Pu242 for Spontaneous fission,relative to I-131.

Nuclide	Ref.	Cumulative yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
131-I -53	YE22	1.0000E+00				
132-I -53	YE22	5.0000E+00 +/- 7.0000E-01				
133-I -53	YE22	5.3000E+00 +/- 7.0000E-01				
134-I -53	YE22	6.7000E+00 +/- 1.0000E+00				
135-I -53	YE22	4.9000E+00 +/- 8.0000E-01				

Fractional independent yield data table for Am242m Thermal fission.

Nuclide	Ref.	Fract. independent yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
132-I -53	YE02	4.3000E-02 +/- 1.4000E-02				
133-XE-54G	YE05	1.6400E-03 +/- 1.3000E-04				
133-XE-54M	YE05	4.7100E-03 +/- 4.9000E-04				
133-XE-54T	YE05	6.4000E-03 +/- 4.1000E-04				
134-I -53	YE02	4.1000E-01 +/- 2.4000E-01				
135-XE-54G	YE05	5.0000E-02 +/- 7.5000E-03				
135-XE-54M	YE05	8.6900E-02 +/- 5.4000E-03				
135-XE-54T	YE02	1.3000E-01 +/- 4.0000E-02	1.3888E-01	4.6679E-03	1.0431E-03	82.32
	YE05	1.3900E-01 +/- 4.7000E-03				
136-CS-55	YE06	1.0500E-02 +/- 1.3000E-03				
140-LA-57	YE02	6.5000E-02 +/- 2.0000E-02				

A3.2 Am242m

Ternary yield data table for Am242m for Thermal fission, relative to He-4 yield.

Nuclide	Ref.	Relative ternary yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
3-H - 1	YE03	6.2000E-02 +/- 6.0000E-03				
4-HE- 2	YE03	1.0000E+00 +/- 0.0000E+00				
6-HE- 2	YE03	2.1400E-02 +/- 6.0000E-04				
7-LI- 3	YE03	8.2000E-04 +/- 2.6000E-04				
8-LI- 3	YE03	3.6000E-04 +/- 4.0000E-05				
9-LI- 3	YE03	6.4000E-04 +/- 1.3000E-04				
9-BE- 4	YE03	7.5000E-04 +/- 1.5000E-04				
10-BE- 4	YE03	5.7000E-04 +/- 6.0000E-04				
14-C - 6	YE03	1.4500E-03 +/- 1.5000E-04				

A3.3 Am242m

Cumulative Yield data table for Am242m Fast neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
87-BR-35	YE07	7.3059E-01 +/- 9.2100E-02				
137-I -53	YE07	2.4360E+00 +/- 2.3000E-01				

A3.4 Am242m

Cumulative yield data table for Am242m for thermal fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
83-BR-35	YE06	2.1100E+00 +/- 4.0000E-01				
83-KR-36	YE09	2.0870E-01 +/- 4.0000E-02				
84-BR-35	YE06	3.2100E-01 +/- 5.0000E-02				
85-KR-36	YE09	3.5310E-01 +/- 7.0000E-02				
86-KR-36	YE09	4.8150E-01 +/- 9.0000E-02				
88-KR-36	YE02	9.5000E-01 +/- 2.9000E-01				
89-SR-38	YE06	9.9500E-01 +/- 1.5000E-01				
90-SR-38	YE06	1.1860E+00 +/- 1.8000E-01				
91-SR-38	YE02	2.5700E+00 +/- 4.5000E-01				
91-Y -39	YE06	1.4610E+00 +/- 2.1000E-01				
92-SR-38	YE02	2.0900E+00 +/- 2.2000E-01	1.9398E+00	1.6794E-01	1.7752E-01	29.05
	YE06	1.7300E+00 +/- 2.6000E-01				
92-Y -39	YE02	2.2200E+00 +/- 2.2000E-01				
93-Y -39	YE06	2.1390E+00 +/- 3.2000E-01				
95-ZR-40	YE06	2.7650E+00 +/- 4.1500E-01				
97-ZR-40	YE06	3.6000E+00 +/- 5.4400E-01				
99-MO-42	YE06	4.5100E+00 +/- 6.8000E-01				
101-MO-42	YE02	8.0000E+00 +/- 1.6000E+00				
101-TC-43	YE02	7.7000E+00 +/- 2.7000E+00				
103-RU-44	YE06	5.8670E+00 +/- 8.8000E-01				
104-TC-43	YE02	3.5200E+00 +/- 4.3000E-01				
105-RU-44	YE02	6.9700E+00 +/- 7.7000E-01				
105-RH-45	YE02	7.4000E+00 +/- 1.1000E+00				
109-PD-46	YE06	2.6600E+00 +/- 5.3000E-01				
111-AG-47	YE06	2.1000E+00 +/- 6.0000E-01				
112-AG-47	YE06	7.3450E-01 +/- 2.0000E-01				
115-CD-48G	YE06	5.9000E-02 +/- 9.0000E-03				
115-CD-48M	YE06	4.1300E-02 +/- 7.0000E-03				

121-SN-50	YE06	1.5100E-02 +/- 3.0000E-03				
125-SN-50	YE06	6.5000E-02 +/- 1.0000E-02				
125-SB-51	YE06	9.5000E-02 +/- 1.5000E-02				
128-SN-50	YE02	3.0000E-01 +/- 6.0000E-02				
128-SB-51	YE02	3.9000E-01 +/- 1.8000E-01				
129-SB-51	YE02	1.5600E+00 +/- 5.6000E-01				
130-SB-51	YE02	6.5000E-01 +/- 8.0000E-02				
131-SB-51	YE02	2.6900E+00 +/- 5.0000E-01				
131-I -53	YE06	2.6510E+00 +/- 4.0000E-01				
131-XE-54	YE09	3.7050E+00 +/- 2.9600E-01				
132-TE-52	YE02 YE06	4.8400E+00 +/- 3.8000E-01 3.4340E+00 +/- 5.2000E-01	4.3505E+00	3.0681E-01	6.6978E-01	2.90
132-I -53	YE02	5.1100E+00 +/- 4.0000E-01				
133-TE-52	YE02	4.4600E+00 +/- 5.9000E-01				
133-I -53	YE02 YE06	5.7800E+00 +/- 6.8000E-01 4.8390E+00 +/- 7.2000E-01	5.3364E+00	4.9437E-01	4.6973E-01	34.20
134-TE-52	YE02	6.2000E+00 +/- 6.5000E-01				
134-I -53	YE02 YE06	6.1000E+00 +/- 5.3000E-01 4.9996E+00 +/- 7.5000E-01	5.7335E+00	4.3283E-01	5.1863E-01	23.08
134-XE-54	YE09	8.1760E+00 +/- 6.5400E-01				
135-I -53	YE02 YE06	4.1900E+00 +/- 3.3000E-01 5.5360E+00 +/- 8.3000E-01	4.3737E+00	3.0665E-01	4.6211E-01	13.18
135-XE-54	YE02	4.4100E+00 +/- 3.7000E-01				
136-XE-54	YE09	9.7090E+00 +/- 7.8000E-01				
137-CS-55	YE06	4.9690E+00 +/- 7.5000E-01				
138-XE-54	YE02	6.0000E+00 +/- 2.4000E+00				
139-BA-56	YE02 YE06	6.2000E+00 +/- 1.3000E+00 4.7160E+00 +/- 7.1000E-01	5.0570E+00	6.2312E-01	6.2428E-01	31.64
140-BA-56	YE02	4.9800E+00 +/- 5.2000E-01				
140-LA-57	YE02	5.2600E+00 +/- 5.1000E-01				
141-CE-58	YE06	4.3160E+00 +/- 6.5000E-01				
142-LA-57	YE02	4.3000E+00 +/- 5.3000E-01				
143-CE-58	YE02 YE06	4.9900E+00 +/- 7.7000E-01 3.6670E+00 +/- 5.5000E-01	4.1140E+00	4.4755E-01	6.2574E-01	16.21
144-CE-58	YE06	3.0960E+00 +/- 4.6000E-01				

147-ND-60	YE06	2.0160E+00 +/- 3.0000E-01
149-PM-61	YE06	1.3680E+00 +/- 2.0500E-01
151-PM-61	YE06	9.7900E-01 +/- 1.5000E-01
153-SM-62	YE06	6.2760E-01 +/- 1.0000E-01
156-EU-63	YE06	2.2700E-01 +/- 4.0000E-02
157-EU-63	YE06	1.2830E-01 +/- 2.6000E-02
161-TB-65	YE06	1.5400E-02 +/- 5.0000E-03

A4.1 Cm243

Cumulative Yield data table for Cm243 Fast neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
95-ZR-40	YE11	3.2200E+00 +/- 3.3000E-01				
125-SB-51	YE11	2.1500E-01 +/- 2.6000E-02				
137-CS-55	YE11	6.7600E+00 +/- 6.6000E-01	Estimate from empirical function, used to normalise YE11 data measured relative to 137-Cs.			
141-CE-58	YE11	4.8400E+00 +/- 5.3000E-01				
144-CE-58	YE11	3.7000E+00 +/- 4.0000E-01				

Cumulative Yield data tables for Cm243 Thermal neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
89-RB-37	YE10	1.2400E+00 +/- 3.2000E-01				
91-SR-38	YE10	1.4500E+00 +/- 1.4000E-01				
91-Y -39M	YE10	8.4000E-01 +/- 8.0000E-02				
92-SR-38	YE10	1.4500E+00 +/- 2.6000E-01				
93-SR-38	YE10	1.7600E+00 +/- 2.0000E-01				
94-SR-38	YE10	1.8800E+00 +/- 2.2000E-01				
94-Y -39	YE10	2.3400E+00 +/- 3.9000E-01				
95-ZR-40	YE10	2.3100E+00 +/- 2.2000E-01				
95-NB-41G	YE10	2.8100E+00 +/- 2.5000E-01				
97-ZR-40	YE10	3.7700E+00 +/- 3.2000E-01				
97-NB-41G	YE10	3.7000E+00 +/- 3.2000E-01				
98-NB-41M	YE10	3.7000E-01 +/- 4.0000E-02				
99-MO-42	YE10	4.6400E+00 +/- 4.0000E-01				
99-TC-43M	YE64	5.4100E+00 +/- 4.2000E-01	5.3515E+00	3.6527E-01	1.0303E-01	77.79
	YE10	5.1700E+00 +/- 7.4000E-01				
101-MO-42	YE10	5.7900E+00 +/- 8.3000E-01	5.6929E+00	6.8262E-01	1.4035E-01	83.71
	YE64	5.4900E+00 +/- 1.2000E+00				
101-TC-43	YE10	6.5300E+00 +/- 7.2000E-01				
102-TC-43G	YE10	6.5800E+00 +/- 1.3900E+00				
102-TC-43M	YE10	4.0000E-02 +/- 4.0000E-02				
103-TC-43	YE10	5.4000E+00 +/- 1.2900E+00				
103-RU-44	YE10	6.0800E+00 +/- 5.1000E-01				
104-TC-43	YE10	7.0200E+00 +/- 5.9000E-01				
105-TC-43	YE10	5.5400E+00 +/- 4.7000E-01	6.0917E+00	3.8297E-01	8.3218E-01	9.43
	YE64	6.5900E+00 +/- 1.0000E+00				
	YE64	7.6400E+00 +/- 8.8000E-01				
105-RU-44	YE10	6.1300E+00 +/- 6.2000E-01	6.2746E+00	4.3116E-01	1.3992E-01	74.55
	YE10	6.4100E+00 +/- 6.0000E-01				
105-RH-45G	YE10	6.5200E+00 +/- 5.4000E-01				
106-TC-43	YE10	5.1000E+00 +/- 5.9000E-01	5.8994E+00	4.3379E-01	8.6713E-01	4.56
	YE64	6.8400E+00 +/- 6.4000E-01				

107-RU-44	YE10	6.0600E+00 +/- 1.7200E+00				
107-RH-45	YE10	6.2200E+00 +/- 1.2200E+00	5.6454E+00	5.1642E-01	2.6845E-01	60.32
	YE64	5.5200E+00 +/- 5.7000E-01				
108-RU-44	YE10	4.1800E+00 +/- 1.1800E+00	3.5282E+00	6.8969E-01	4.6951E-01	49.60
	YE64	3.1900E+00 +/- 8.5000E-01				
109-RH-45	YE10	4.3400E+00 +/- 6.6000E-01				
112-AG-47	YE10	2.1200E+00 +/- 3.1000E-01				
115-IN-49M	YE10	3.5000E-01 +/- 1.7000E-01				
127-SB-51	YE10	6.4000E-01 +/- 6.0000E-02				
128-SN-50G	YE10	3.4000E-01 +/- 8.0000E-02				
128-SB-51G	YE10	2.1000E-01 +/- 2.0000E-02				
128-SB-51M	YE10	5.8000E-01 +/- 8.0000E-02				
129-SB-51G	YE10	1.1300E+00 +/- 1.7000E-01				
130-SN-50G	YE10	2.6000E-01 +/- 9.0000E-02				
130-SB-51G	YE10	8.9000E-01 +/- 9.0000E-02	9.0505E-01	5.5085E-02	2.6008E-02	89.45
	YE10	8.9000E-01 +/- 9.0000E-02				
	YE10	9.5000E-01 +/- 1.1000E-01				
130-SB-51M	YE10	1.0500E+00 +/- 1.5000E-01	9.3923E-01	8.3205E-02	7.3846E-02	37.48
	YE10	8.9000E-01 +/- 1.0000E-01				
131-SB-51	YE10	1.5900E+00 +/- 2.6000E-01				
131-TE-52G	YE64	2.1000E+00 +/- 1.6000E-01	2.1199E+00	1.4118E-01	3.7370E-02	79.12
	YE10	2.1900E+00 +/- 3.0000E-01				
131-TE-52M	YE10	1.1700E+00 +/- 1.1000E-01				
131-I -53	YE10	3.3500E+00 +/- 2.8000E-01				
132-SB-51	YE10	7.4000E-01 +/- 1.2000E-01				
132-TE-52	YE10	4.5000E+00 +/- 4.1000E-01				
132-I -53G	YE10	4.3400E+00 +/- 3.8000E-01				
133-I -53G	YE10	5.1700E+00 +/- 4.4000E-01				
134-I -53M	YE10	1.9100E+00 +/- 1.9000E-01				
135-I -53	YE10	3.8300E+00 +/- 4.0000E-01	3.8650E+00	2.8284E-01	3.5000E-02	90.15
	YE10	3.9000E+00 +/- 4.0000E-01				
135-XE-54G	YE64	6.1400E+00 +/- 5.1000E-01	6.0810E+00	4.2349E-01	8.7912E-02	83.55
	YE10	5.9500E+00 +/- 7.6000E-01				
135-XE-54M	YE10	7.2000E-01 +/- 6.0000E-02				
136-I -53G	YE10	6.8000E-01 +/- 2.1000E-01				
136-I -53M	YE10	8.0000E-01 +/- 1.1000E-01	8.0521E-01	9.9997E-02	1.1363E-02	90.95
	YE10	8.3000E-01 +/- 2.4000E-01				

136-CS-55G	YE10	4.3000E-01 +/- 5.0000E-02	4.5500E-01	3.5355E-02	2.5000E-02	47.95
	YE10	4.8000E-01 +/- 5.0000E-02				
138-XE-54	YE10	3.3200E+00 +/- 4.7000E-01	3.1443E+00	1.9435E-01	2.6331E-01	39.94
	YE10	3.5600E+00 +/- 4.1000E-01				
	YE64	2.9400E+00 +/- 2.5000E-01				
139-XE-54	YE10	1.9700E+00 +/- 3.6000E-01				
139-CS-55	YE10	6.3200E+00 +/- 8.8000E-01				
139-BA-56	YE10	6.8400E+00 +/- 2.1000E+00	6.4809E+00	1.3623E+00	3.0609E-01	82.22
	YE64	6.2200E+00 +/- 1.7900E+00				
140-CS-55	YE10	2.7100E+00 +/- 4.1000E-01				
140-BA-56	YE10	4.9100E+00 +/- 4.1000E-01				
140-LA-57	YE10	4.9400E+00 +/- 4.7000E-01	5.0319E+00	3.4562E-01	9.9667E-02	77.31
	YE10	5.1400E+00 +/- 5.1000E-01				
141-BA-56	YE10	4.8400E+00 +/- 7.1000E-01	4.9851E+00	4.1421E-01	1.0424E-01	80.13
	YE64	5.0600E+00 +/- 5.1000E-01				
142-BA-56	YE10	2.5400E+00 +/- 5.0000E-01				
143-CE-58	YE10	3.9300E+00 +/- 3.9000E-01				
144-LA-57	YE10	3.1300E+00 +/- 3.9000E-01				
145-BA-56	YE10	3.2400E+00 +/- 4.2000E-01				
146-BA-56	YE10	2.2600E+00 +/- 4.5000E-01				
146-CE-58	YE64	2.4500E+00 +/- 4.3000E-01				
147-ND-60	YE10	1.9400E+00 +/- 2.1000E-01				

Cumulative Yield data table for Cm245 Fast neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
87-BR-35	YE07	5.2500E-01 +/- 6.9000E-02				
137-I -53	YE07	2.2330E+00 +/- 2.4000E-01				

Cumulative Yield data table for Cm245 Thermal neutron fission.

Nuclide	Ref.	Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
77-AS-33	YE28	5.0000E-03 +/- 1.2000E-03				
83-BR-35	YE28	2.3000E-01 +/- 5.0000E-02				
84-BR-35	YE30	2.9000E-01 +/- 9.0000E-02				
85-KR-36M	YE24	2.9000E-01 +/- 2.0000E-02				
87-KR-36	YE30	5.0000E-01 +/- 4.0000E-02				
88-KR-36	YE24	6.1000E-01 +/- 4.0000E-02	6.0077E-01	3.3282E-02	1.3846E-02	67.74
	YE30	5.8000E-01 +/- 6.0000E-02				
89-RB-37	YE30	8.2000E-01 +/- 9.0000E-02				
89-SR-38	YE25	8.3090E-01 +/- 8.0000E-02	8.3835E-01	6.2470E-02	9.3171E-03	88.14
	YE28	8.5000E-01 +/- 1.0000E-01				
90-KR-36	YE30	8.3000E-01 +/- 2.1000E-01				
90-SR-38	YE28	1.0800E+00 +/- 1.5000E-01				
91-SR-38	YE24	1.1100E+00 +/- 2.0000E-02	1.1104E+00	1.8606E-02	3.8815E-02	22.59
	YE25	9.4570E-01 +/- 9.5000E-02				
	YE30	1.1800E+00 +/- 6.0000E-02				
	YE26	9.8000E-01 +/- 6.9000E+00				
91-Y -39	YE28	1.2700E+00 +/- 3.0000E-01	6.8941E-01	2.2933E-02	4.4512E-02	5.23
	YE30	6.8600E-01 +/- 2.3000E-02				
92-SR-38	YE24	1.2500E+00 +/- 1.1000E-01	1.2745E+00	6.9026E-02	2.2697E-02	94.74
	YE30	1.3100E+00 +/- 1.5000E-01				
	YE26	1.2800E+00 +/- 1.0990E-01				
93-SR-38	YE30	9.3000E-01 +/- 2.0000E-01				
93-Y -39	YE24	1.7500E+00 +/- 1.1000E-01	1.7952E+00	9.5197E-02	7.8050E-02	41.23
	YE30	1.9300E+00 +/- 1.9000E-01				
94-SR-38	YE30	1.5200E+00 +/- 1.4000E-01				
94-Y -39	YE30	1.6100E+00 +/- 1.1000E-01				
95-ZR-40	YE24	2.3600E+00 +/- 6.0000E-02	2.3533E+00	5.4722E-02	3.1928E-02	95.23
	YE25	2.2211E+00 +/- 2.4000E-01				
	YE28	2.4000E+00 +/- 3.0000E-01				
	YE30	2.3500E+00 +/- 1.9000E-01				
95-NB-41	YE30	2.2800E+00 +/- 7.0000E-02				
97-ZR-40	YE24	3.0000E+00 +/- 6.0000E-02	2.9282E+00	4.1468E-02	1.6303E-01	0.86
	YE25	2.9760E+00 +/- 1.5000E-01				
	YE28	3.1000E+00 +/- 3.5000E-01				
	YE30	2.8400E+00 +/- 1.1000E-01				

	YE30	2.9900E+00 +/- 9.0000E-02				
	YE26	2.4000E+00 +/- 1.4900E-01				
99-NB-41	YE30	2.3400E+00 +/- 1.8000E-01				
99-MO-42	YE28	4.1800E+00 +/- 4.0000E-01	4.0956E+00	1.0991E-01	3.1428E-02	95.99
	YE30	4.1000E+00 +/- 1.3000E-01				
	YE26	4.0500E+00 +/- 2.4000E-01				
99-TC-43M	YE24	4.0900E+00 +/- 1.2000E-01				
101-MO-42	YE30	5.7000E+00 +/- 5.2000E-01				
102-MO-42	YE30	5.8000E+00 +/- 1.2000E+00				
103-TC-43	YE30	7.0000E+00 +/- 1.6000E+00				
103-RU-44	YE24	5.8500E+00 +/- 4.2000E-01	6.1460E+00	1.6519E-01	1.3965E-01	86.98
	YE25	6.4320E+00 +/- 7.0000E-01				
	YE28	6.2700E+00 +/- 9.0000E-01				
	YE30	6.1800E+00 +/- 1.9000E-01				
104-TC-43	YE30	6.6700E+00 +/- 4.2000E-01				
105-RU-44	YE28	5.7800E+00 +/- 1.2000E+00	6.5228E+00	1.7337E-01	1.3823E-01	88.82
	YE30	6.5300E+00 +/- 2.5000E-01				
	YE30	6.6400E+00 +/- 3.1000E-01				
	YE26	6.3900E+00 +/- 4.0260E-01				
105-RH-45	YE30	6.0300E+00 +/- 3.2000E-01	5.9669E+00	2.3721E-01	6.9656E-02	76.90
	YE26	5.8900E+00 +/- 3.5340E-01				
106-TC-43	YE30	5.3200E+00 +/- 5.3000E-01				
106-RU-44	YE28	5.7500E+00 +/- 1.4000E+00				
106-RH-45	YE30	5.7000E+00 +/- 4.0000E-01				
107-RH-45	YE30	5.5000E+00 +/- 5.0000E-01				
108-RU-44	YE30	5.5000E+00 +/- 1.4000E+00				
109-RH-45	YE30	3.7300E+00 +/- 5.2000E-01				
109-PD-46	YE28	5.2300E+00 +/- 6.0000E-01				
111-AG-47	YE25	6.5950E+00 +/- 2.1000E+00	3.8467E+00	5.3436E-01	7.2388E-01	39.95
	YE28	3.6300E+00 +/- 7.0000E-01				
	YE30	3.7000E+00 +/- 9.0000E-01				
112-PD-46	YE28	1.6000E+00 +/- 4.0000E-01				
112-AG-47	YE30	3.4200E+00 +/- 4.3000E-01				
113-AG-47G	YE28	2.0200E+00 +/- 5.0000E-01				
114-CD-48	YE30	1.8000E+00 +/- 7.0000E-01				
115-CD-48	YE25	5.1540E-01 +/- 6.0000E-02	5.3998E-01	2.5055E-02	5.3837E-02	9.94
	YE28	4.1000E-01 +/- 7.0000E-02				
	YE30	5.7000E-01 +/- 3.0000E-02				
121-SN-50	YE25	2.3500E-02 +/- 2.0000E-03	2.4135E-02	1.9728E-03	3.8108E-03	5.34
	YE28	4.7000E-02 +/- 1.2000E-02				

123-SN-50	YE28	5.4000E-02 +/- 1.2000E-02				
125-SN-50	YE25	2.3000E-01 +/- 2.0000E-02	1.2120E-01	1.2000E-02	8.1600E-02	0.00
	YE28	6.0000E-02 +/- 1.5000E-02				
125-SB-51	YE28	7.1000E-02 +/- 1.5000E-02				
127-SN-50	YE30	4.4000E-01 +/- 7.0000E-02				
127-SB-51	YE25	4.3120E-01 +/- 3.0000E-02	4.3722E-01	2.1824E-02	3.3282E-02	31.26
	YE28	5.7000E-01 +/- 9.0000E-02				
	YE30	4.2600E-01 +/- 3.4000E-02				
128-SN-50	YE30	4.4000E-01 +/- 5.0000E-02				
128-SB-51G	YE30	9.0000E-02 +/- 1.0000E-02				
128-SB-51M	YE30	5.9000E-01 +/- 4.0000E-02				
129-SB-51	YE30	1.0600E+00 +/- 1.2000E-01				
129-SB-51G	YE28	1.4200E+00 +/- 3.0000E-01				
129-TE-52	YE28	1.4800E+00 +/- 2.0000E-01				
130-SB-51G	YE30	7.9900E-01 +/- 4.2000E-02				
130-SB-51M	YE30	9.4000E-01 +/- 1.0000E-01				
131-SB-51	YE30	2.2400E+00 +/- 2.4000E-01				
131-TE-52M	YE30	9.3000E-01 +/- 7.0000E-02				
131-I -53	YE24	2.9000E+00 +/- 8.0000E-02	2.9524E+00	3.6434E-02	9.8545E-02	12.01
	YE25	3.0360E+00 +/- 5.0000E-02				
	YE28	3.1800E+00 +/- 4.0000E-01				
	YE30	2.8200E+00 +/- 8.0000E-02				
	YE26	2.7800E+00 +/- 1.7000E-01				
132-SB-51	YE30	1.8300E+00 +/- 1.5000E-01	1.8971E+00	9.3704E-02	5.3659E-02	56.69
	YE30	1.9400E+00 +/- 1.2000E-01				
132-TE-52	YE24	4.1000E+00 +/- 9.0000E-02	3.9286E+00	3.4268E-02	8.3809E-02	20.05
	YE25	3.8870E+00 +/- 4.0000E-02				
	YE28	4.4100E+00 +/- 8.0000E-01				
	YE30	4.0100E+00 +/- 1.1000E-01				
	YE26	3.7900E+00 +/- 2.3000E-01				
132-I -53	YE30	4.1600E+00 +/- 1.3000E-01				
133-TE-52G	YE30	2.0000E+00 +/- 1.6000E-01				
133-TE-52M	YE30	2.7200E+00 +/- 1.6000E-01				
133-I -53	YE24	5.5200E+00 +/- 8.0000E-02	5.4890E+00	6.9485E-02	8.5484E-02	67.91
	YE28	6.0100E+00 +/- 7.0000E-01				
	YE30	5.3900E+00 +/- 1.6000E-01				
	YE26	5.2800E+00 +/- 3.2000E-01				
133-XE-54	YE25	5.3210E+00 +/- 1.0000E-01				
134-TE-52	YE30	3.9200E+00 +/- 2.7000E-01				

134-I -53	YE30	5.3100E+00 +/- 4.5000E-01	5.8333E+00	2.0480E-01	2.6746E-01	19.16
	YE30	5.9700E+00 +/- 2.3000E-01				
134-I -53M	YE30	1.1200E+00 +/- 1.0000E-01				
135-I -53	YE24	6.2700E+00 +/- 3.0000E-01	5.6835E+00	1.2967E-01	2.8618E-01	8.76
	YE30	5.4800E+00 +/- 2.2000E-01				
	YE30	5.6000E+00 +/- 1.9000E-01				
135-XE-54	YE25	6.9510E+00 +/- 3.0000E-01	6.7920E+00	2.4787E-01	2.3319E-01	34.68
	YE26	6.4500E+00 +/- 4.4000E-01				
135-XE-54G	YE30	6.0600E+00 +/- 2.4000E-01				
135-XE-54M	YE30	1.3800E+00 +/- 7.0000E-02				
136-I -53G	YE30	1.8000E+00 +/- 5.0000E-01				
136-I -53M	YE30	1.5300E+00 +/- 1.4000E-01				
137-I -53	YE30	1.2000E+00 +/- 7.0000E-01				
137-XE-54	YE30	4.9000E+00 +/- 9.0000E-01				
137-CS-55	YE24	6.1500E+00 +/- 1.7000E-01	6.1694E+00	1.6905E-01	1.8281E-01	27.95
	YE28	7.8900E+00 +/- 1.6000E+00				
138-XE-54	YE30	4.7800E+00 +/- 3.4000E-01	4.8065E+00	2.3302E-01	2.4954E-02	91.47
	YE30	4.8300E+00 +/- 3.2000E-01				
138-CS-55	YE24	6.0100E+00 +/- 2.2000E-01	5.9277E+00	1.7022E-01	1.1713E-01	78.92
	YE30	5.7100E+00 +/- 3.8000E-01				
	YE26	5.9000E+00 +/- 3.8000E-01				
139-XE-54	YE30	4.8000E+00 +/- 7.0000E-01				
139-CS-55	YE30	6.8000E+00 +/- 2.8000E+00				
139-BA-56	YE24	5.5200E+00 +/- 3.3000E-01	5.7549E+00	2.5455E-01	2.8472E-01	26.34
	YE30	6.1000E+00 +/- 4.0000E-01				
140-BA-56	YE24	5.3600E+00 +/- 8.0000E-02	5.3755E+00	6.7334E-02	3.8418E-02	98.81
	YE25	5.4380E+00 +/- 2.7000E-01				
	YE28	5.7000E+00 +/- 7.0000E-01				
	YE30	5.3900E+00 +/- 1.6000E-01				
	YE26	5.4100E+00 +/- 3.2460E-01				
140-LA-57	YE30	5.3200E+00 +/- 1.6000E-01	5.4421E+00	1.1651E-01	1.2976E-01	26.54
	YE30	5.5800E+00 +/- 1.7000E-01				
141-BA-56	YE30	4.0100E+00 +/- 4.5000E-01				
141-CE-58	YE24	5.1000E+00 +/- 1.3000E-01	5.1338E+00	7.0662E-02	1.2333E-01	38.45
	YE25	5.0562E+00 +/- 1.0000E-01				
	YE28	5.2000E+00 +/- 7.0000E-01				
	YE30	5.3800E+00 +/- 1.6000E-01				
142-BA-56	YE30	4.2400E+00 +/- 4.6000E-01				
142-LA-57	YE24	4.8400E+00 +/- 8.0000E-02	4.8178E+00	7.5393E-02	6.3751E-02	69.94
	YE30	4.6700E+00 +/- 2.8000E-01				
	YE26	4.5900E+00 +/- 3.8000E-01				
143-CE-58	YE24	4.3900E+00 +/- 7.0000E-02	4.4390E+00	4.4204E-02	6.8786E-02	65.88

	YE25	4.4890E+00 +/- 6.0000E-02				
	YE28	3.8500E+00 +/- 6.0000E-01				
	YE30	4.4000E+00 +/- 2.4000E-01				
	YE26	4.2800E+00 +/- 3.2000E-01				
144-LA-57	YE30	4.3100E+00 +/- 3.1000E-01				
144-CE-58	YE28	3.3000E+00 +/- 7.0000E-01				
145-CE-58	YE30	3.0400E+00 +/- 2.7000E-01				
146-CE-58	YE30	2.6800E+00 +/- 4.9000E-01	2.8099E+00	2.9012E-01	9.5429E-02	74.22
	YE30	2.8800E+00 +/- 3.6000E-01				
146-PR-59	YE30	1.9700E+00 +/- 3.5000E-01	2.4269E+00	2.0343E-01	3.2635E-01	10.87
	YE30	2.6600E+00 +/- 2.5000E-01				
147-ND-60	YE24	2.1800E+00 +/- 5.0000E-02	2.3057E+00	4.0554E-02	1.8506E-01	0.03
	YE25	2.5340E+00 +/- 1.2000E-01				
	YE28	2.6000E+00 +/- 5.0000E-01				
	YE30	2.3300E+00 +/- 1.7000E-01				
	YE30	2.6300E+00 +/- 1.0000E-01				
147-PM-61	YE28	2.0300E+00 +/- 5.0000E-01				
149-ND-60	YE30	1.9400E+00 +/- 1.5000E-01				
149-PM-61	YE28	1.9700E+00 +/- 4.0000E-01				
151-ND-60	YE30	1.1500E+00 +/- 5.0000E-02	1.1040E+00	4.4721E-02	9.2000E-02	3.97
	YE30	9.2000E-01 +/- 1.0000E-01				
151-PM-61	YE28	1.3500E+00 +/- 3.5000E-01	1.1884E+00	7.7989E-02	3.6928E-02	63.59
	YE30	1.1800E+00 +/- 8.0000E-02				
152-PM-61	YE30	1.4000E+00 +/- 7.0000E-01				
153-PM-61	YE30	6.7000E-01 +/- 5.4000E-01				
153-SM-62	YE28	1.2000E+00 +/- 3.0000E-01				
156-EU-63	YE28	2.5000E-01 +/- 6.0000E-02	3.4500E-01	4.2426E-02	9.5000E-02	2.51
	YE30	4.4000E-01 +/- 6.0000E-02				

Fractional Cumulative Yield data table for Cm245 Thermal neutron fission.

Nuclide	Ref.	Fractional Cumulative Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
99-MO-42	YE80	9.6900E-01 +/- 8.0000E-03				
132-TE-52	YE23	9.4000E-01 +/- 1.0000E-02				
134-TE-52	YE23	5.6000E-01 +/- 8.0000E-02				
135-I -53	YE80	9.5100E-01 +/- 1.4000E-02				
140-BA-56	YE80	9.6900E-01 +/- 6.0000E-03				

A5.4 Cm245

Independent yield data table for Cm245 Thermal neutron fission.

Nuclide	Ref.	Independent Yield and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
86-RB-37	YE28	6.2000E-05 +/- 1.5000E-05				
135-XE-54	YE24	1.1540E+00 +/- 1.3580E-01				
136-CS-55G	YE28	1.6000E-01 +/- 3.0000E-02	1.2635E-01	5.8835E-03	6.7308E-03	25.26
	YE30	1.2500E-01 +/- 6.0000E-03				

A5.5 Cm245

Isomeric independent yield splitting ratio data table for Cm245 Thermal neutron fission.

Nuclide	Ref.	Splitting ratio and experimental error.	Weighted. Mean.	internal error	external error	Chi-test
132-I -53	YE31	4.8200E-01 +/- 4.4000E-02				

Splitting ratio = Independent yield of metastable state / (sum of metastable and ground state yields).