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GCFR Radial Blanket and Shield Experiment

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GCFR RADIAL BLANKET AND SHIELD EXPERIMENT

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GCFR RADIAL BLANKET AND SHIELD EXPERIMENT
(DATA PLAN)

1. ThO₂ Blanket Configurations (Priority IA)
 - A. Spectrum Modifier (SM) (10.2-cm Fe + 8.9-cm Al + 2.54-cm Boral)
 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls at 305 cm and NE213 or hydrogen counter location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location. (If NE213 run not feasible do hydrogen counters as close as feasible.)
 - B. Spectrum Modifier + 1.27-cm void + 6.76-cm ThO₂ slab
 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls at on centerline at 305 cm.
 - C. Spectrum Modifier + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂
 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm.
 - D. Spectrum Modifier + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂
 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location.
 5. TLD measurements on centerline in each void.
 - E. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂
 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location.
 5. TLD measurements on centerline in each void.

- F. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 25.4-cm Fe
1. TLD measurements on centerline in each void.
- II. UO₂ Blanket Configuration (Priority 1A)
- A. Spectrum Modifier + 1.27-cm void + 10.2-cm (UO₂ + Na) + 1.27-cm void + 10.2-cm (UO₂ + Na) + 1.27-cm void + 10.2-cm (UO₂ + Na)
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location.
 5. TLD measurements on centerline in each void.
- B. Spectrum Modifier + 1.27-cm void + 10.2-cm (UO₂ + Na) + 1.27-cm void + 10.2-cm (UO₂ + Na) + [0.95-cm SS + 12.7-cm (B₄C + C) + 1.27-cm SS] container + 15.2-cm SS
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location.
- III. Inner Radial Shield Configuration (Priority 1B)
- A. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void, + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂ + [0.95-cm SS + 12.7-cm (B₄C + C) + 1.27-cm SS] container
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counters (1D) at NE213 location.
- B. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂ + [0.95-cm SS + 12.7-cm (B₄C + C) + 1.27-cm SS] container + 15.2-cm SS

1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
3. NE213 on centerline as close as feasible.
4. Hydrogen counters (1D) at NE213 location.

IV. Outer Radial Shield Configurations (Priority 1C)

A. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂ + [0.95-cm SS + 12.7-cm (B₄C + C) + 1.27-cm SS] container + 1.27-cm void + 15.2-cm SS + 1.27-cm void + 4.45-cm SS + [0.952-cm SS + 5.1-cm (B₄C + C) + 0.8-cm SS] container

1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm.

B. Spectrum Modifier + 1.27-cm void + 15.2-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 7.62-cm ThO₂ + 1.27-cm void + 15.2-cm ThO₂ + [0.95-cm SS + 12.7-cm (B₄C + C) + 1.27-cm SS] container + 1.27-cm void + 15.2-cm SS + 1.27-cm void + 4.45-cm SS + [0.952-cm SS + 5.1-cm (B₄C + C) + 0.8-cm SS] container + 22.9-cm graphite

1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm.

C. Repeat B + [0.8-cm SS + 5.1-cm (B₄C + C) + 0.8-cm SS] container + 4.45-cm SS

1. 3-, 6-, and 10-in. Bonner balls on centerline at 18 cm and 30.5 cm.
2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
3. NE213 on centerline as close as feasible.

D. Repeat C + 35.6-cm void + 2.54-cm Fe + 61-cm concrete

1. 3-, 6-, and 10-in. Bonner balls on centerline in 35.6-cm void at 18 cm behind the SS.
2. TLD in front of 15.2-cm SS.
3. TLD behind 15.2-cm SS.
4. TLD in front of 2.54-cm Fe.

- E. Spectrum Modifier + [0.95-cm SS + 12.7-cm (B_4C + C) + 1.27-cm SS] + 19.7-cm SS + [0.952-cm SS + 5.1-cm (B_4C + C) + 0.8-cm SS] + 22.9-cm graphite + [0.81-cm SS + 5.1-cm (B_4C + C) + 0.81-cm SS] + 4.45-cm SS
1. 3-, 6-, and 10-in. Bonner balls on centerline at 18 cm and 30.5 cm.
 2. 3-, 6-, and 10-in. Bonner balls on centerline at 305 cm and at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counter (1D) at NE213 location.
- V. Alternate Inner Radial Shield Configurations (Priority 1D)
- A. Spectrum Modifier + 1.27-cm void + 10.2-cm (UO_2 + Na) + 1.27-cm void + 10.2-cm (UO_2 + Na) + 1.27-cm void + 10.2-cm (UO_2 + Na)
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm.
- B. Repeat A + 1.27-cm void + 15.2-cm graphite
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm and at 305 cm.
 2. 3-, 6-, and 10-in. Bonner balls at NE123 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counter (1D) at NE213 location.
- C. Repeat B + 1.27-cm void + [0.95-cm SS + 12.7-cm (B_4C + C) + 1.27-cm SS] container + 1.27-cm void + 4.45-cm SS
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm and 305 cm.
 2. 3-, 6-, and 10-in. Bonner balls at NE213 location.
 3. NE213 on centerline as close as feasible.
 4. Hydrogen counter (1D) at NE213 location.
 5. TLD on centerline in all voids following UO_2 .
- D. Repeat B + 1.27-cm void + [0.95-cm SS + 12.7-cm (B_4C + C) + 1.27-cm SS] container + 1.27-cm void + 15.2-cm SS + 1.27-cm void + 4.45-cm SS
1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm and at 305 cm.
 2. TLD on centerline in all voids following UO_2 .

- E. Spectrum Modifier + 1.27-cm void + 10.2-cm (UO_2 + Na) + 1.27-cm void + 10.2-cm (UO_2 + Na) + 1.27-cm void + [0.95-cm SS + 12.7-cm (B_4C + C) + 1.27-cm SS] container + 1.27-cm void + 4.45-cm SS
 - 1. 3-, 6-, and 10-in. Bonner balls on centerline at 30.5 cm and at 305 cm.
 - 2. TLD on centerline in all voids beyond UO_2 blanket.

VI. Reactor Source Measurement

- A. 15.2-cm lead
 - 1. NE213 on centerline as close as feasible.
- B. 15.2-cm lead + spectrum modifier
 - 1. NE213 on centerline as close as feasible.
- C. 30.6-cm UO_2
 - 1. NE213 on centerline as close as feasible.
- D. 30.6-cm UO_2 + spectrum modifier
 - 1. 3-, 6-, and 10-in. Bonner balls at same location as NE213.
 - 2. NE213 on centerline as close as feasible.

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GCFR RADIAL BLANKET AND SHIELD EXPERIMENT*

F. J. Muckenthaler, J. L. Hull, and J. J. Manning

ABSTRACT

This report presents integral neutron flux, energy spectra, and gamma-ray heating measurements made for the Radial Blanket and Shield Experiment at the Oak Ridge National Laboratory Tower Shielding Facility as part of a continuing Gas Cooled Fast Breeder Reactor program. The experimental configurations were divided into four basic segments: a spectrum modifier inserted into the Tower Shielding Reactor II beam; blanket slabs consisting of either ThO₂ or UO₂ placed directly behind the spectrum modifier; an inner radial shield behind the blankets; and an outer radial shield to complete the mockup. The segments were added in sequence, with selected measurements made within and beyond each segment.

The integral experiment was performed to provide verification of calculational methods and nuclear data used in designing a radial shield for the GCFR and determining the effectiveness of the design. The ThO₂ blanket measurements were needed to bracket the uncertainties in the nuclear cross sections for calculating both the neutron transmission through the blanket and the gamma-ray heating rates within the blanket. Measurements with a UO₂ blanket were included both as a reference for the ThO₂ analysis, neutron transmission through UO₂ having been successfully calculated in previous experiments, and to provide comparison information for other breeder reactor designs.

*Work performed under DOE 189a No. 01351, GCFR Shielding Studies - Experimental.

INTRODUCTION

An integral experiment was conducted at the Tower Shielding Facility (TSF) to provide data for verification of the calculational methods and nuclear data used in design of the proposed radial shield for the 300 MW(e) Gas Cooled Fast Breeder Reactor (GCFR).¹ The neutron source from the Tower Shielding Reactor (TSR-11) was modified through the use of Fe, Al, and boral slabs to represent the neutron spectra predicted from the GCFR core. The scope of the experiment was chosen to include neutron penetration studies through both ThO₂ and UO₂ radial blankets, with emphasis primarily on the ThO₂ blanket, to establish the uncertainty in the relevant cross section data and hence provide bias factors for the calculated source term incident on the radial shield. Although there was a greater need for verification of thorium cross sections, the UO₂ blanket was included since it is a likely option for the GCFR, and it served as a guideline for the ThO₂ calculations since calculations involving UO₂ slabs in other experiments resulted in good agreement with the experiment. The inner and outer radial shield measurements were also needed to verify calculations of radiation damage to the prestressed concrete reactor vessel. Even though the experiment was designed specifically for the GCFR program, such measurements should also benefit other breeder reactor designers. A subsequent analysis of the experiment, to be published separately, will indicate the adequacy of the calculational methods and available nuclear data for determining the uncertainties in the shield design.

The configurations, consisting of 152-cm by 152-cm slabs were divided into basically four segments: a spectrum modifier (SM), radial blanket mockups, the inner radial shield, and the outer radial shield. Both integral and spectral measurements were made of the neutron and gamma-ray flux transmitted through the mockups as each of these segments was added to the configurations with the integral gamma-ray measurements being in the form of *in situ* heating measurements. The detectors included a series of Bonner balls, an NE213 spectrometer, a hydrogen-filled proton recoil spectrometer, and thermoluminescent dosimeters (TLDs).

The limited time span provided for this experiment was insufficient to perform the two lowest priority configurations which included the heterogeneous shield and PCRV mockups. Also, the original series of alternate shield configurations were replaced with material combinations which were more representative of the revised GCFR radial shield design.

2. INSTRUMENTATION

A Bonner ball detector measures an integral of the neutron energy flux weighted by the energy-dependent response function for that ball. The detection device of the Bonner ball consists of a 5.1-cm spherical proportional counter filled with approximately one-half atmosphere of $^{10}\text{BF}_3$. This proportional counter is used bare, cadmium covered, or enclosed in various thicknesses of polyethylene shells surrounded by cadmium. Bonner ball experimental results are predicted analytically by folding a calculated neutron spectrum with the Bonner ball response functions calculated by Maerker et al.² and C. E. Burgart et al.³

Neutron spectral measurements were obtained in the region from about 800 keV to 15 MeV using a NE213 liquid scintillator and from about 50 keV to 1 MeV using spherical proton recoil counters filled with hydrogen to pressures of 1, 3, and 10 atmospheres. Gamma-ray spectra above 1 MeV were obtained simultaneously with the neutron spectra using the same NE213 scintillator. The NE213 neutron and gamma-ray pulse-height data were unfolded using the FERD code to yield absolute neutron and gamma-ray energy spectra. Pulse-height data from the hydrogen-filled counters were unfolded using SPEC-4, with the unfolded NE213 neutron spectrum used for the high-energy input spectrum.

Measurement of the gamma-ray energy deposited within the configuration was obtained using a series of thermoluminescent detectors (TLDs). These detectors, $\text{CaF}_2:\text{Mn}$ chips purchased from Harshaw Chemical Company, were 0.3175 cm on a side and approximately 0.089-cm thick. The chips weighed approximately 28 mg and had a density of ~ 3.1 g/cc. For this experiment, the exposure dose was limited to between 10 millirad and several hundred rad, well within the linear region of the chip response.

The underlying mechanism of the TLD is the ejection of orbital electrons from ions in the crystal structure by absorption of sufficient energy from incident radiation. The TL material contains imperfections

called traps which can capture and hold temporarily these energetic electrons. Following this exposure to radiation, if these TLDs are then heated to about 400°C, the electrons will be released from the traps and under certain conditions their excess kinetic energy will be converted to light. If the application of this heat takes place under controlled conditions then a characteristic light output versus temperature curve can be obtained. Integration of the area under the curve gives a numerical value to the amount of light output. Using an established calibration procedure the amount of light associated with the "glow curve" can then be related to the intensity of the radiation field at the location of the TLD exposure.

The TLDs respond not only to gamma rays but also to neutrons and this may be an important factor when applying thermoluminescent dosimetry techniques to reactor shield measurements. The quantity of the light output generated within the TLD due to neutrons was not determinable from the experiment and must be calculated.

The readout instrumentation consists of a dual unit Harshaw TLD analyzer comprising a model 2000A TL detector and the 2000B automatic integrating picoammeter. The 2000A contains the planchet for heating the chip and a phototube for collection and conversion of the TL output. The resultant current flow is then integrated using the picoammeter. Nitrogen gas serves as a purge of the planchet chamber to provide stability to the conversion. A built-in radium activated sodium light source served as an effective means of checking the sensitivity of the phototube-picoammeter combination.

The response of the chips was calibrated by exposing them to a known dose rate using a ^{60}Co gamma-ray source. The chips were enclosed in Fe capsules both during the calibration and the experimental measurement. The Fe capsule thickness was greater than the maximum path length of an electron induced from a gamma ray generated within the configuration. Application of the calibration factor to the readout from exposure within the configuration provides the energy deposition value at the TLD location in terms of $\text{MeV}/(\text{g}\cdot\text{min}\cdot\text{kW})$.

The measurements for each detector used in the experiment are referenced to the reactor power during the run using two fission chambers that were previously normalized to an established reactor power. The fission chambers, through the use of iron inserts, are capable of providing a measurement of the reactor power over the range from 0.1 W to 1 MW.

3. EXPERIMENTAL CONFIGURATION COMPONENTS

3.1 Spectrum Modifier

The scope of the experiment was divided into measurements behind mockups of the blanket material surrounding the core to be followed by the inner and outer radial shields. An important aspect of the design of the experiment, however, was to provide a source term incident at the inner surface of the blankets that would be representative of the flux emanating radially from the 300 MW(e) GCFR core. As noted earlier, calculations⁴ indicated the use of two 5.1-cm Fe slabs, 9 cm of Al slabs (3), followed by 2.54 cm of Boral would satisfactorily modify the TSR-II spectrum. These slabs, 152.5 cm on a side, were stacked in the above order adjacent to the reactor shield collimator with the center of the slabs coinciding with the axis of the collimator. The slabs were surrounded with lithiated paraffin and concrete blocks to minimize the neutron scattering back into the slabs and to reduce the background at the detectors. Analyses of the Fe, Al, and Boral slabs are given in Tables 1, 2, and 3 respectively.

3.2 ThO₂ Radial Blanket

One mockup of the GCFR radial blanket was simulated using a series of vertically positioned ThO₂ slabs, one behind the other, adjacent to the spectrum modifier. These slabs, two each of nominally 7.62-cm and 15.2-cm thickness, consisted of ThO₂ powder packed in type 304L stainless steel containers. As shown in Fig. 1, the walls in the individual containers were interconnected at specified intervals with thin SS rods — 0.79-cm diam for the thin containers and 1.27-cm diam for the thicker ones. These ties were designed to discourage slumping of the powder within the can, thus preventing the slab from changing thickness as a function of time. Despite these precautions, the inherent lack of flatness in the SS pieces forming the walls of the containers produced some small variations

in the overall thicknesses for each slab. Welding the pieces together produced additional distortions leaving concave/convex relationships between the faces of the containers resulting in nonuniform thicknesses for the slabs. The thicknesses shown in Fig. 1 are an average value for the immediate area along the centerline. Some variations in the thickness of the slabs amounted to as much as 5 mm.

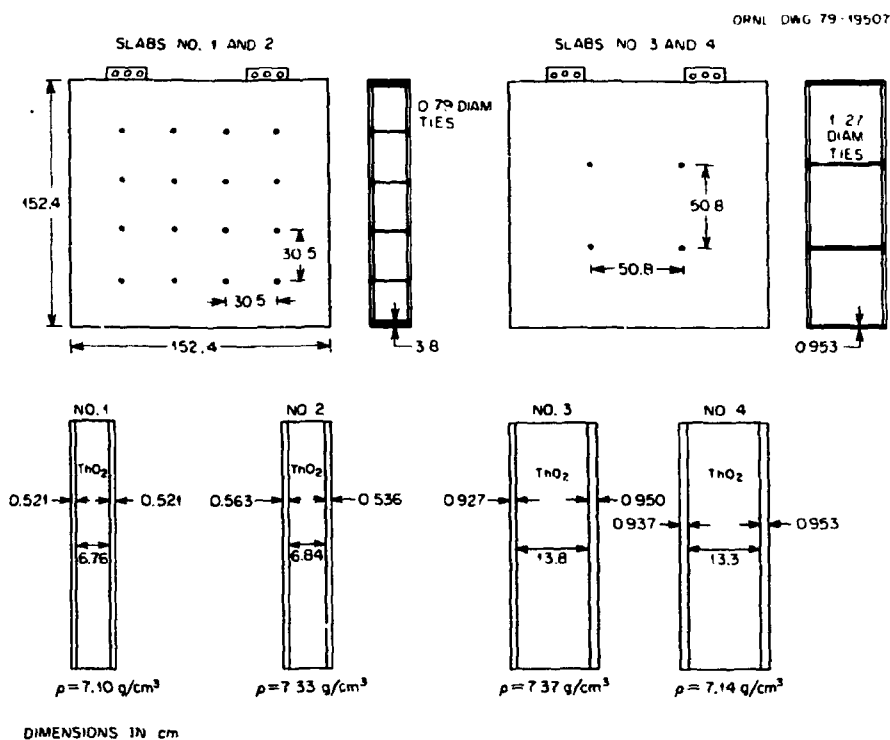


Fig. 1. Schematic of radial blanket slabs containing ThO_2 .

The containers were filled by jolting the container and vibrating it through a series of blows with a rubber mallet. Blows from the mallet were particularly concentrated near the pins to eliminate voids directly beneath the pins. The overall homogeneity of the powder density was checked using radiography, again paying particular attention to the pin areas. Results of the radiographs indicate negligible voids directly below the pins with those areas having reduced density by less than 10%.

The analyses of the ThO_2 with their corresponding batch numbers used to fill the four slabs are given in Table 4. Schematics

of the four ThO_2 containers, given in Fig. 1, include their thickness measurements obtained at the centerline of the slabs and the density of the ThO_2 powder in each container. Throughout the text the thickness of the slabs quoted will be that for the ThO_2 powder only and does not include SS thickness. Analysis of the SS slabs used to fabricate both the ThO_2 and the B_4C containers (see Sect. 3.4) used in this experiment is given in Table 5.

The ThO_2 slabs, as the data plan indicates, were placed in a series of four thicknesses behind the spectrum modifier with appropriate detector measurements made as listed. Each slab, as it was included in the mockup, was surrounded by 20.3 cm of lithiated paraffin and a minimum of 61-cm concrete. Compositions of the slabs are given in Tables 6 and 7 respectively.

3.3 UO_2 Radial Blanket

The UO_2 slabs used to represent the blanket were fabricated for previous experiments. They contained natural UO_2 pellets, 1.397-cm OD, enclosed in aluminum cylinders having an OD of 1.524 cm. Between the aluminum and the pellets there was 0.00508 to 0.01016-cm void filled with argon. The cylinders were stacked side-by-side vertically having a triangular pitch of 1.608 cm. The void between the cylinders was filled with sodium. These rods were enclosed in iron vessels having an overall thickness of 11.05 cm and a length of 152.4 cm on each side.

Each of the three slabs used in this experiment contained 522 rods amounting to 64.6% of the volume of the slab. There were seven rows of rods with 74 and 75 rods per alternate row. The UO_2 density was 10.28 g/cc, 94% of theoretical. The volume of the aluminum cladding was 11.2% and that for the sodium was 23.2%, leaving a void volume between the pellet and the aluminum cylinder of 1%. The pellet stack length in each of the rods was approximately 121.9 cm. These rods were built by Numes Corporation in 1962 to conform, in general, to the then AEC/RDT design standards for the FFTF. A schematic of the slab is shown in Fig. 2, with analyses of the UO_2 and aluminum given in Tables 8 and 9.

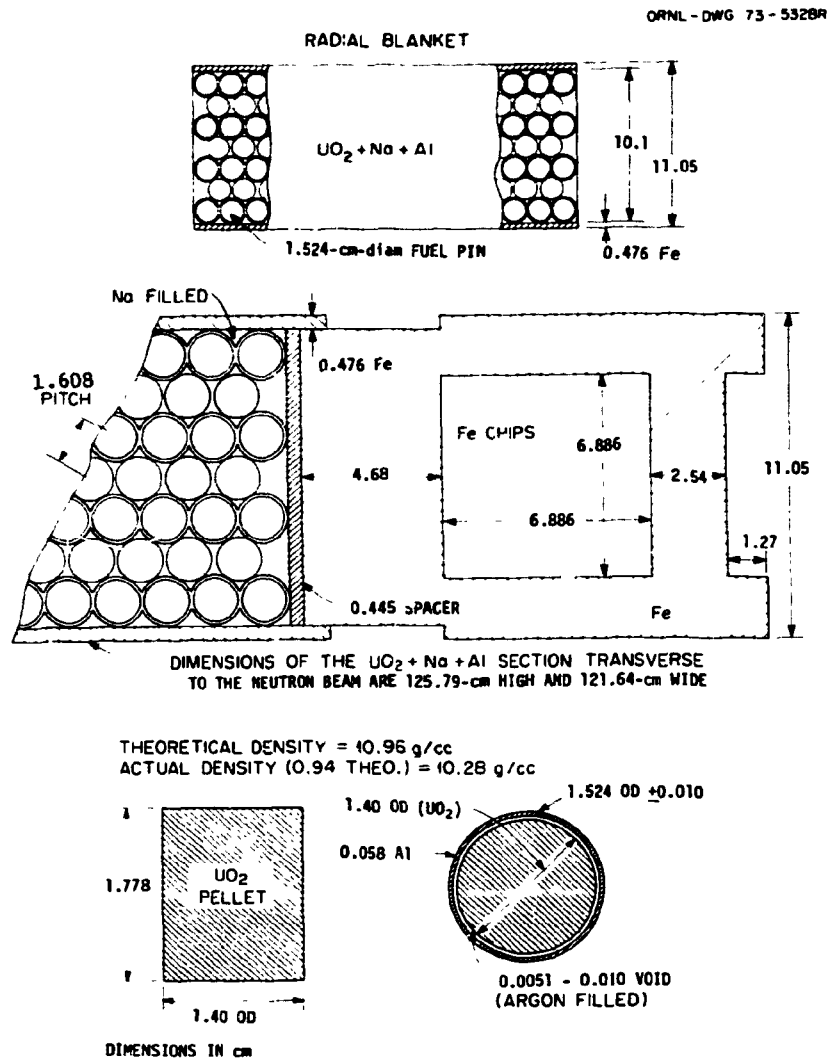


Fig. 2. Schematic of radial blanket slab containing UO_2 .

3.4 $(\text{B}_4\text{C} + \text{C})$ Slabs

The slabs containing the boronated graphite ($\text{B}_4\text{C} + \text{C}$) used in the radial shield mockups were fabricated at ORNL and filled with a powdered mixture at Carborundum. Three slabs, one thick and two thin ones, were fabricated using type 304L stainless steel, the thin ones maintaining constant slab thickness through the use of four tie rods spaced between the walls (see Fig. 3). The walls of the other slab were made of thicker SS and did not warrant the use of tie rods. As was mentioned for the ThO_2 slabs the ($\text{B}_4\text{C} + \text{C}$) slabs

also had inherent unevenness, resulting in concave/convex relationships while maintaining constant thicknesses within several mm. Again, the thicknesses indicated in Fig. 3 are for the immediate centerline area.

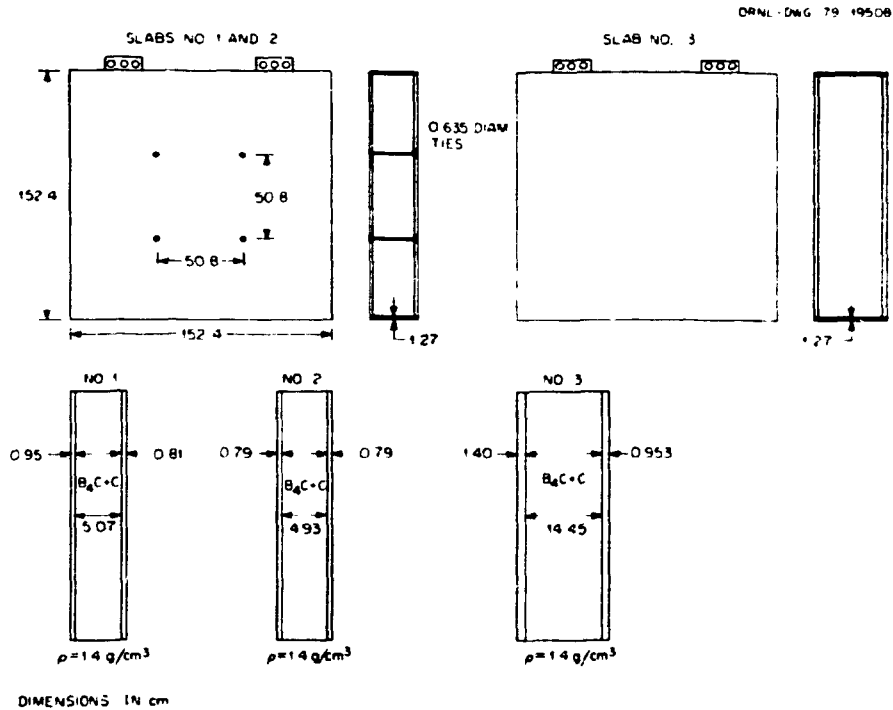


Fig. 3. Schematic of radial shield slabs containing ($B_4C + C$) mixture.

Two different grit sizes of B_4C powder were combined with powdered graphite to fill the containers. Analysis for the boron content gave a spread from 27.2 – 27.7% for the small cans and 26.18 – 27.15% for the large can. The ($B_4C + C$) density obtained for all three containers was 1.4 g/cc. An analysis of the B_4C -graphite mixture is given in Table 10.

3.5 Graphite Slabs

Two slab thicknesses of solid graphite were fabricated at Carborundum, one 7.62-cm thick and the other 15.2-cm thick. Each

slab consisted of two pieces of graphite, joined in the horizontal midplane using an inverted V overlap to minimize radiation leakage at the joint. The graphite was reactor grade, an analysis of which is given in Table 11.

3.6 Stainless Steel Slabs

All of the stainless steel slabs are type 304 whose chemical composition can be found in Table 12. Three nominal thicknesses were used, 1.905 cm, 2.54 cm, and 5.1 cm, with edge dimensions of approximately 152 cm.

3.7 Iron Slabs

The iron slabs used in one of the mockups were carbon steel and have been in use at the TSF for many years. These slabs were fabricated from the same material (see Table 1) as those used in the spectrum modifier.

4. MEASUREMENTS

4.1 ThO_2 Blanket Configurations (*Items I-A, I-B, I-C, I-D, I-E, I-F*)

As mentioned earlier one of the needs of this experiment was to provide a neutron source term similar to that expected radially from the core of the GCFR. To do this, a spectrum modifier previously described (see Sect. 3.1) was placed between the TSR-II and succeeding mockups (see Fig. 4). A series of measurements were made along the center at several

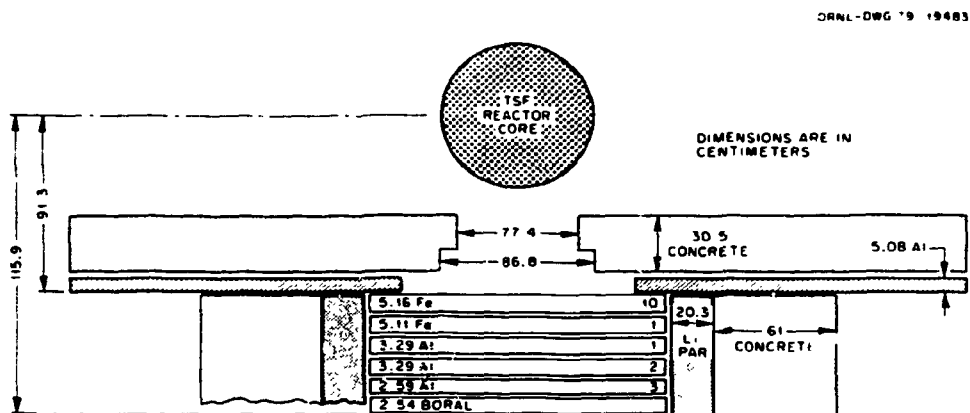


Fig. 4. The mockup of the spectrum modifier surrounded by lithiated paraffin and concrete (*Item I-A*).

locations behind the boron. Neutron spectra were obtained using both the NE213 and hydrogen-filled proton recoil detector located 396.9 cm behind the boron. These spectra are given in Figs. 5 and 6 and listed in Tables 13 and 14 respectively. Integral neutron measurements using the 3-, 6-, and 10-in. Bonner balls were made at 30.5 cm, 305 cm, and at the NE213 location (396.9 cm) behind the configuration. These results are listed in Table 15, I-A.

An attempt was made to measure the gamma-ray spectra simultaneously with the neutron spectra using the same NE213 scintillator. Use of a crossover pick-off technique permitted separations of the neutron and gamma-ray pulses. To obtain a neutron spectrum using the NE213 it had been standard procedure to make foreground and background runs where the background contribution was determined by placing a neutron "black"

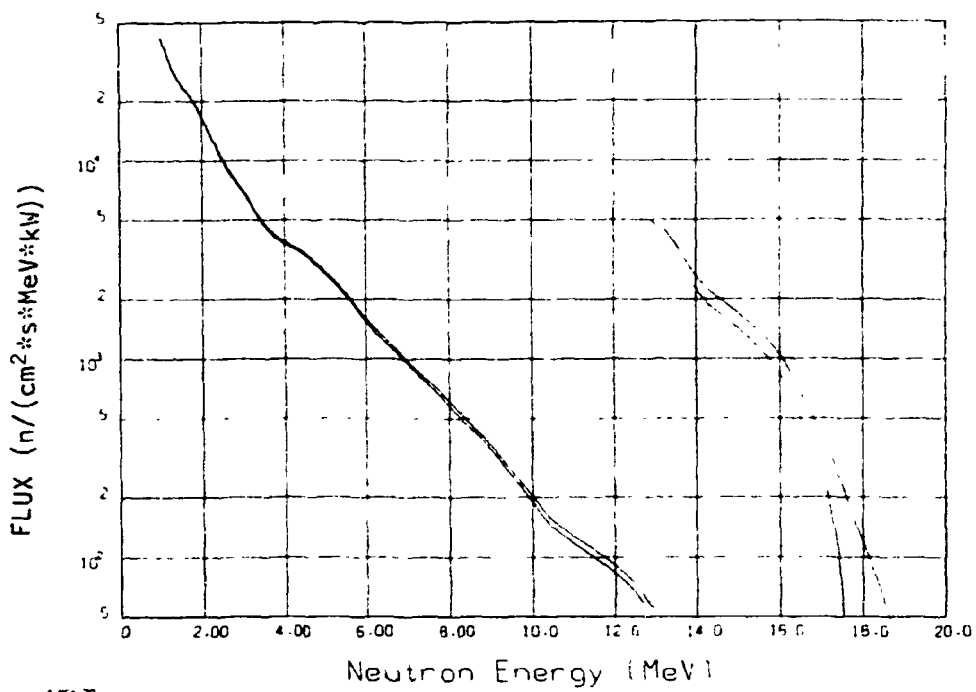


Fig. 5. High-energy neutron spectrum on centerline at 396.9 cm beyond the borai (Item I-A).

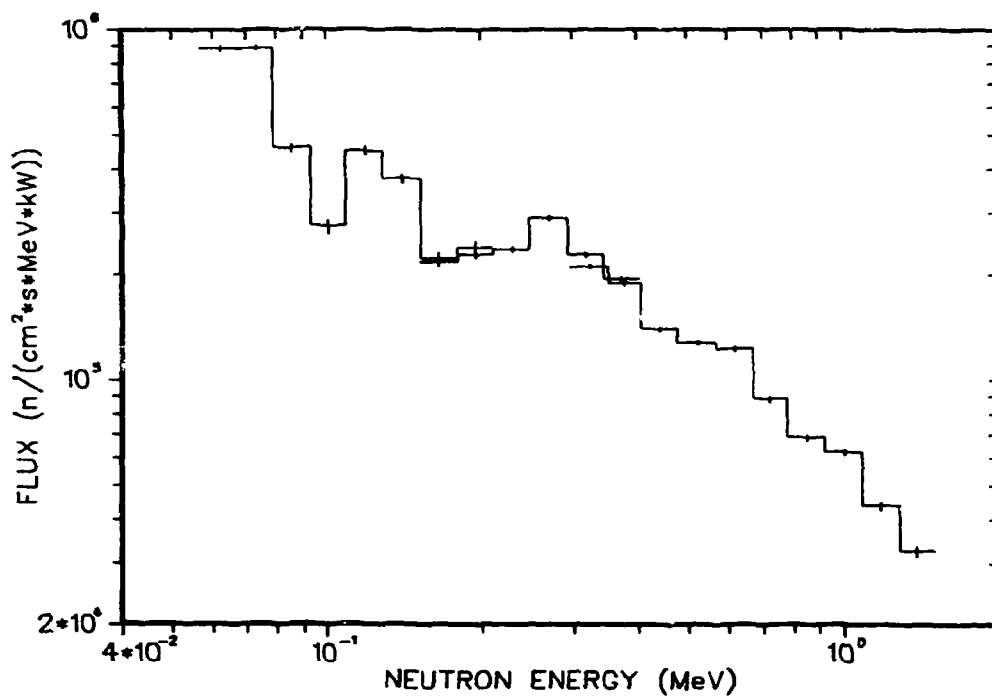


Fig. 6. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 396.9 cm beyond the borai (Item I-A).

absorber (shadow shield) between the configuration and detector. With the inclusion of the gamma-ray spectra it was necessary to include a gamma-ray absorber (Pb) between the neutron absorber and the detector when making background measurements. Unlike the neutron measurements, data obtained in the foreground and background gamma-ray measurements also include contributions from the ground surface near the detector, from fission fragments in the reactor, and induced radioactivity in the reactor vessel and reactor shield that are alias to the spectra initiated from within the configuration. These extraneous values could only be subtracted by making two additional measurements at zero power with and without the background shield in the beam. Thus, four separate measurements were made to unscramble a single spectrum. Using previously determined response functions in unscrambling the data, the resulting gamma-ray spectra is given in Fig. 7 and listed in Table 16.

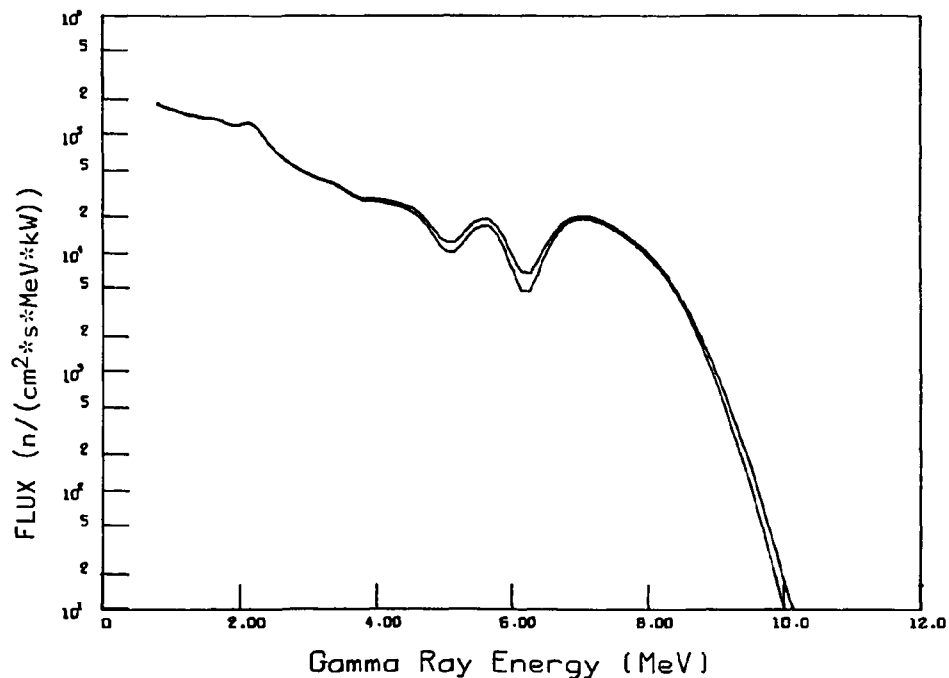


Fig. 7. Gamma-ray spectrum on centerline at 396.9 cm beyond the boral (*Item I-A*).

As described earlier (see Sect. 3.2) the ThO₂ blanket was divided into four slabs to permit neutron penetration studies as a function of ThO₂ thickness. The first of these slabs placed behind the spectrum modifier contained 6.76-cm ThO₂ (7.8 cm including SS sides) as shown

in Fig. 8, I-B. Bonner ball measurements were made at two locations behind the mockup, 30.5 cm and 305 cm. These values, given in Table 15, I-B, contain two columns of data marked foreground and background. As

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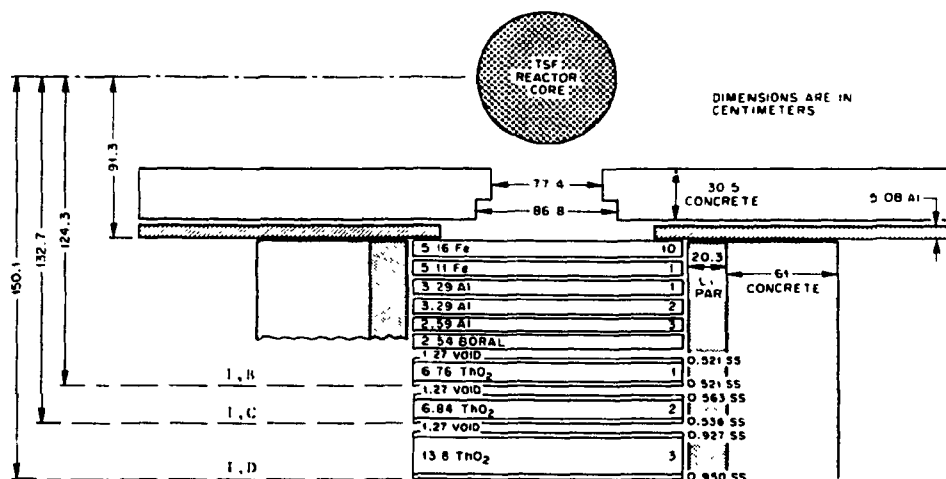


Fig. 8. Mockup of spectrum modifier and ThO₂ radial blanket slabs surrounded by lithiated paraffin and concrete (Items I-B, I-C, I-D).

the detector moves from directly behind the configuration contribution from neutrons reaching the detector after air and ground scattering can become quite significant. For this reason, a background measurement was also made with the detector at 305 cm by placing a 50-cm-thick lithiated paraffin shadow shield midway between the configuration and the detector. It should be noted in the tables that the Bonner ball foreground data (measurements without the shadow shield present) includes the background contribution.

These measurements were repeated following the addition of another thin slab (6.84 cm) of ThO₂ to the configuration (see Fig. 8, I-C). The Bonner ball data are given in the first part of Table 15, I-C. These measurements were repeated at the end of the program to also include measurements at the NE213 location (1332.5 cm). These results are listed in the second part of Table 15, I-C repeat.

The third slab thickness added to the mockup was equal to the combined thickness of the first two slabs, giving a 27.4-cm thickness of ThO₂ powder (also Fig. 8, I-D). The radiation level at the outside

surface of the ThO_2 slabs was approximately 50 mR/h, necessitating movement of the NE213 to a greater distance behind the configuration than the 30.5 cm originally planned. The distance selected was 1464 cm from the center of the reactor core, which corresponded to a dose field of about 1 mR/h at zero power with the beam shutter open. At this location, however, there were nearly equal magnitudes of neutrons and gamma rays reaching the detector from background sources as from the configuration. This difficulty was resolved by selecting a single location for the NE213 for the remainder of the experiment and surrounding the detector with a 120-cm-thick concrete house containing a collimator focused on the configuration. Another collimator was placed between the detector housing and the configuration to provide better collimation of the detector. For this configuration spectral measurements were made at 1314.1 cm behind the mock-up and these results are listed in Tables 17 and 18 and plotted in Figs. 9 and 10 respectively. The low-energy neutron spectra measured with the hydrogen-filled proton recoil detector at the NE213 location are listed in Table 19 and plotted in Fig. 11. The Bonner ball data on centerline at 30.5 cm, 305 cm, and 1314.1 cm behind the ThO_2 are listed in Table 15, I-D. The TLD chips were placed on centerline in the void between the

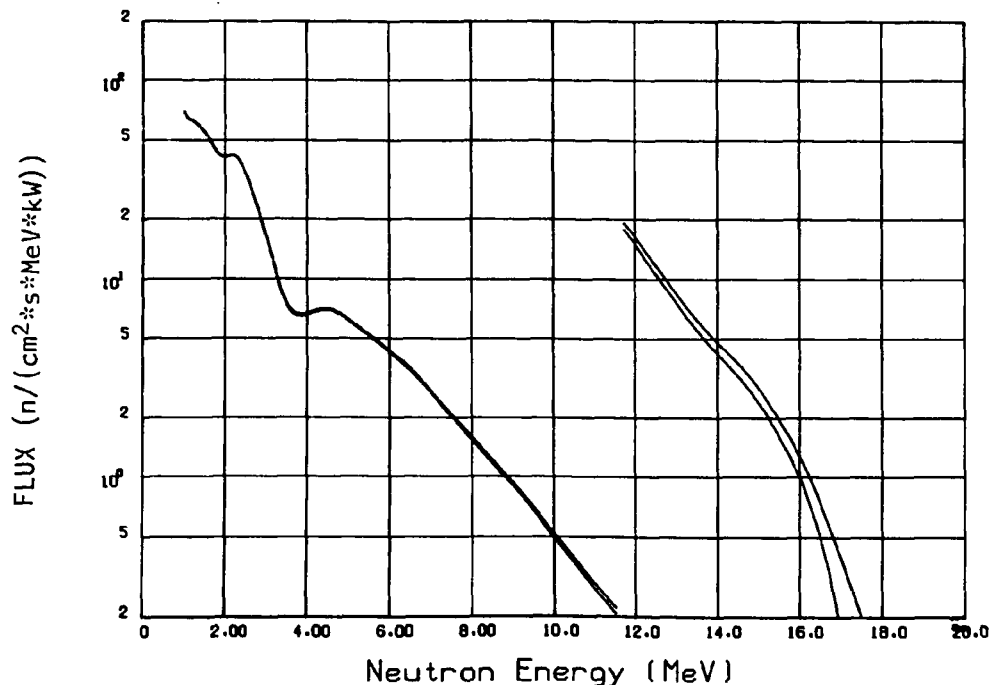


Fig. 9. High-energy neutron spectrum on centerline at 1314.1 cm beyond the radial blanket (Item I-D).

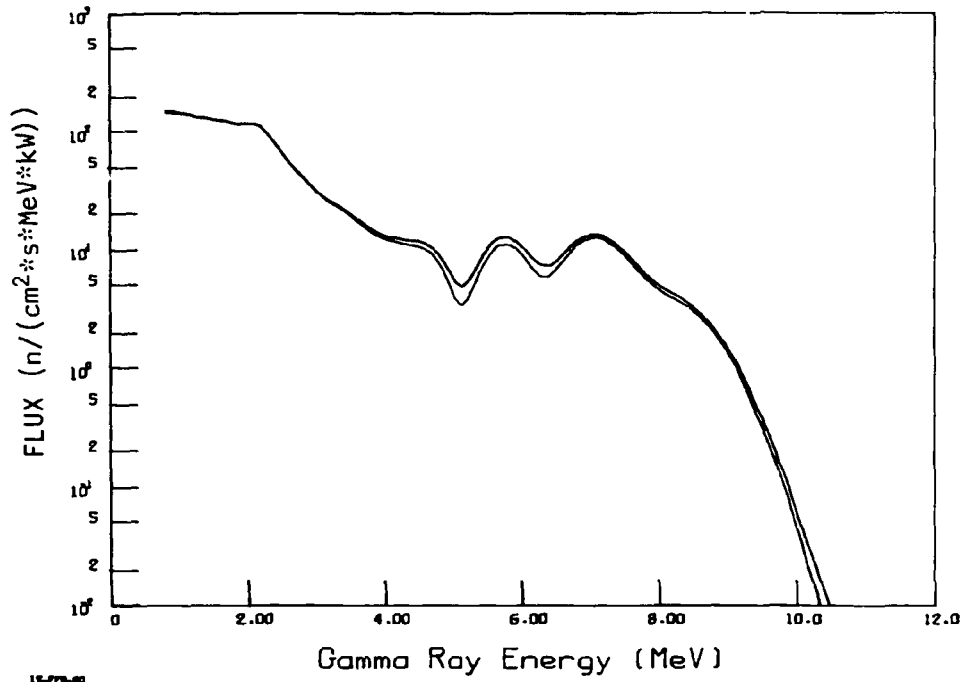


Fig. 10. Gamma-ray spectrum on centerline at 1314.1 cm beyond the radial blanket (Item I-D).

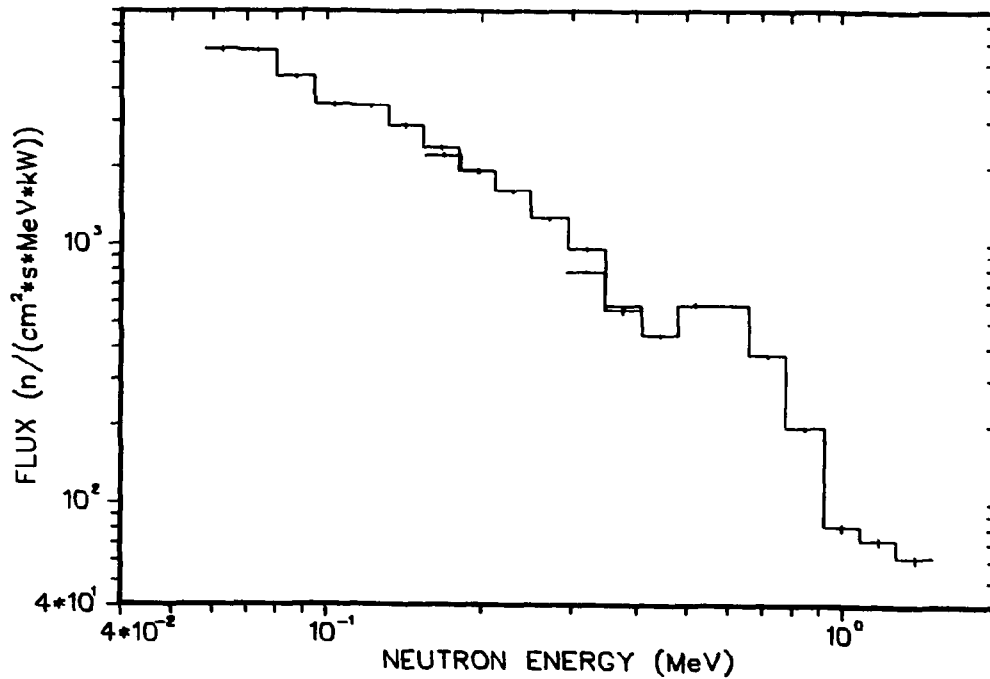


Fig. 11. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1314.1 cm beyond the radial blanket (Item I-D).

boral and the first ThO_2 slab and in the two voids between the three ThO_2 slabs (see Fig. 12). Since the TLD measurements were not done

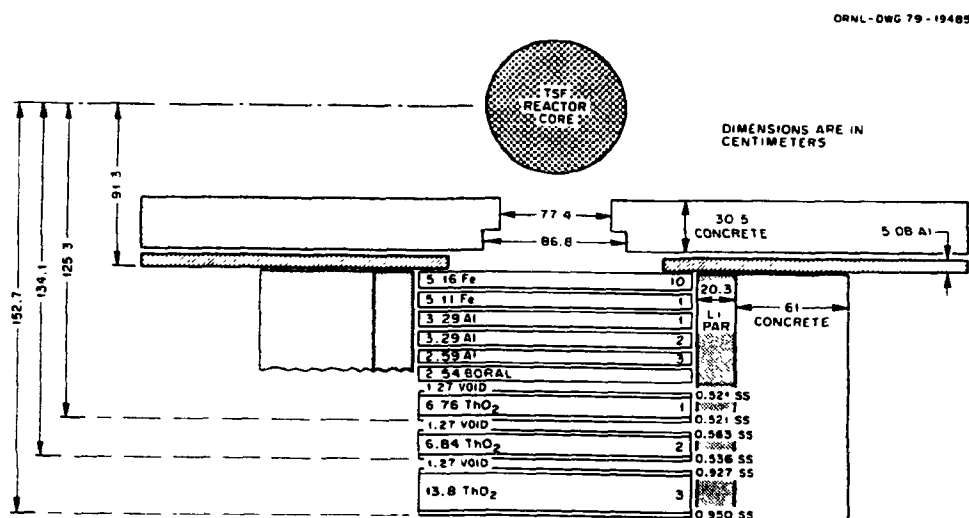


Fig. 12. Mockup of spectrum modifier and ThO_2 radial blanket slabs surrounded by lithiated paraffin and concrete (Item I-D, TLDs only).

until later in the experimental program it required redoing the mockup at that time. Hence, you will note that the distances between the slabs and the reactor are slightly different in Fig. 12 (TLD) than in Fig. 8 (neutron spectra). Three reactor runs were made, exposing a total of 20 chips at each location. For this series and all succeeding TLD runs a procedure was established to obtain the background component for each reactor power exposure. This consisted of exposing TLDs at each of the void locations immediately prior to and following the reactor run and averaging the resulting readouts. This average, when corrected for the time of the reactor power run, constitutes the background to be subtracted from the TLDs exposure during a reactor run. Where a series of reactor power runs were made on any given day, TLDs exposed after a previous reactor power run were used as the "before" exposure for the next reactor power run in establishing the background. The results given in Table 20, I-D, are the average values obtained in each of the voids, corrected for background, and presented in terms of energy deposition in iron $\text{MeV}/(\text{g}\cdot\text{min}\cdot\text{kW})$. TLD results presented throughout this report have not been corrected for the gamma-ray spectral effects

($\frac{1}{F}$ factor) and energy deposition due to neutron interaction within the configuration. There has, however, been a spectral correction applied to the calibration factor.

The fourth ThO₂ mockup consists of placing the thick slab first followed by the thin slabs, and then the last thick slab, giving a total of 40.7 cm of ThO₂ as shown in Fig. 13. A series of the same measurements were made behind the ThO₂ as in the previous configuration. Results

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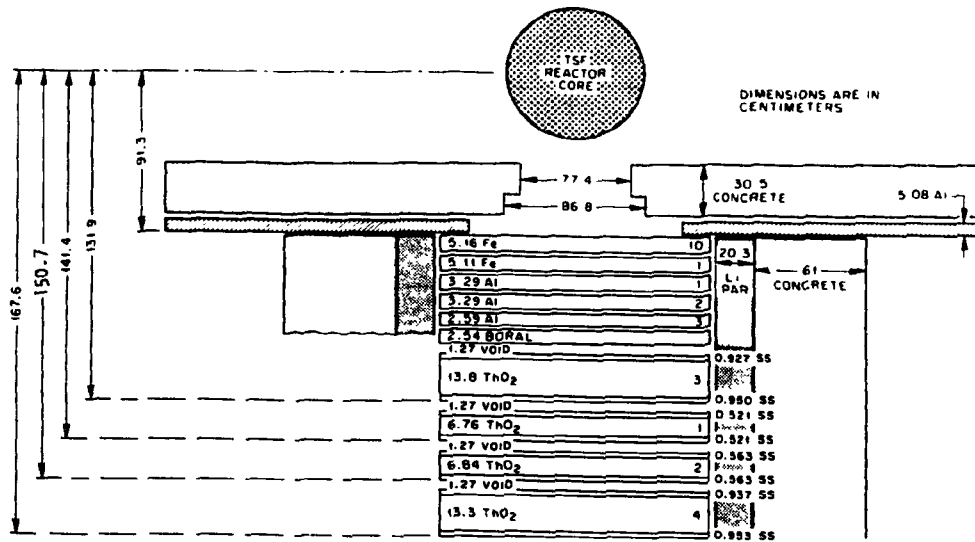


Fig. 13. Mockup of spectrum modifier and full thickness ThO₂ radial blanket slabs surrounded by lithiated paraffin and concrete (Item I-E).

of the neutron spectra at 1296.4 cm behind the ThO₂ are given in Tables 21 and 22 and plotted in Figs. 14 and 15. The gamma spectrum is found in Fig. 16 and Table 23. Bonner ball and TLD results are given in Tables 15, I-E and 20, I-E.

The last configuration in the ThO₂ blanket series consisted of adding 25.4 cm of Fe to a configuration containing 40.7 cm of ThO₂ (see Fig. 17). The slabs were rearranged from the previous mockup, putting the two thick slabs first followed by the thinner ones. This arrangement allowed us to complete measurements of the gamma-ray heating at nominal 6-cm intervals throughout the ThO₂ blanket. However, with this arrangement there was also concern that due to the thinness of the last slab (only 6.84 cm) the TLD reading in the last void might be affected by

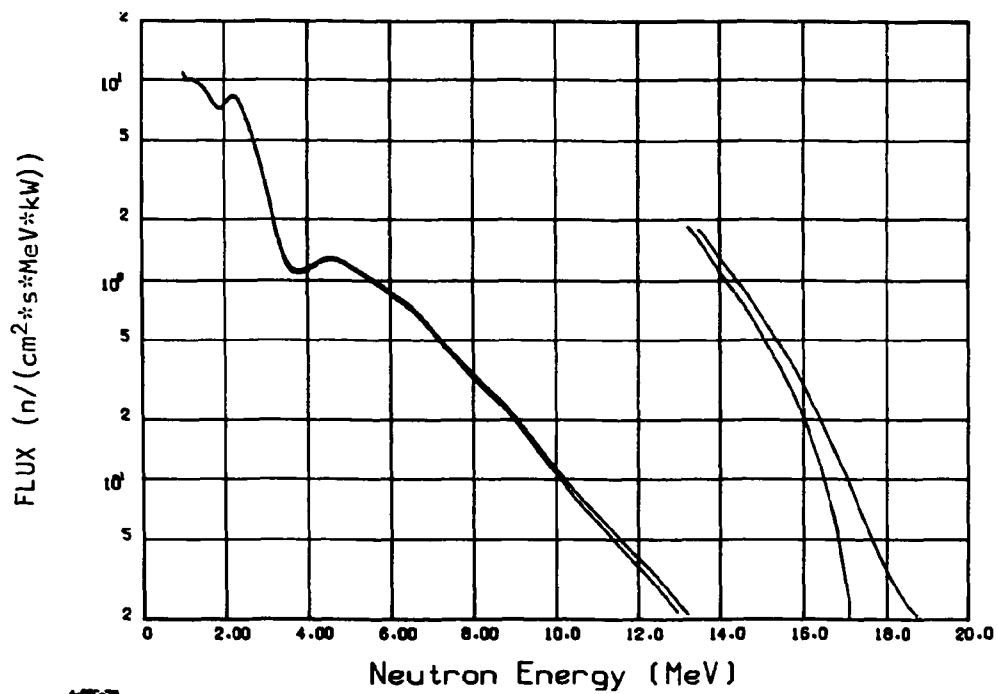


Fig. 14. High-energy neutron spectrum on centerline at 1296.4 cm beyond the radial blanket (*Item I-E*).

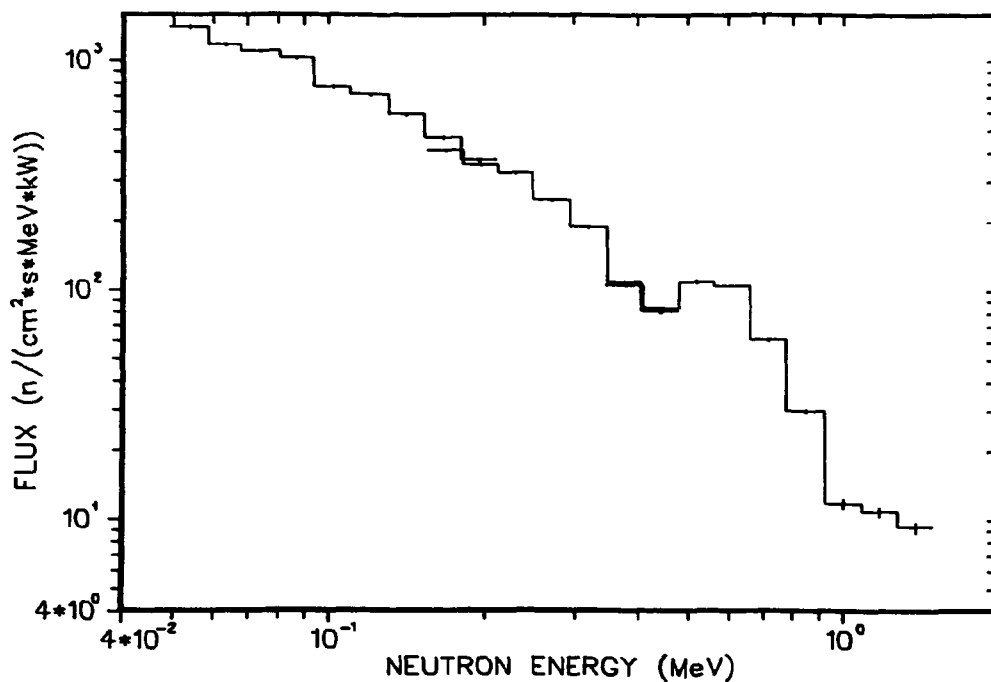


Fig. 15. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1296.4 cm beyond radial blanket (*Item I-E*).

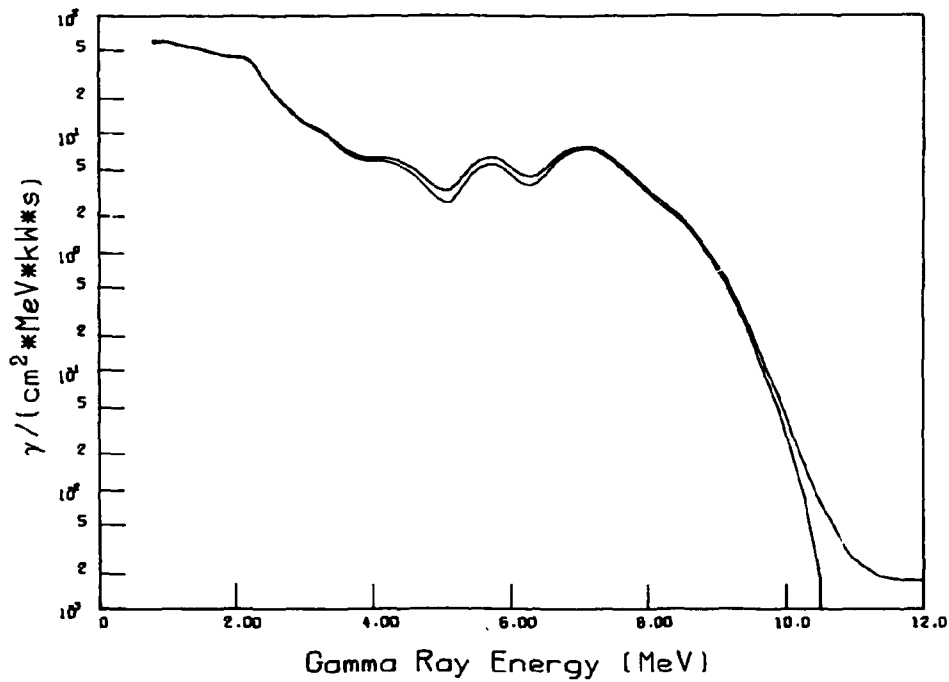


Fig. 16. Gamma-ray spectrum on centerline at 1296.4 cm beyond the radial blanket (Item I-E).

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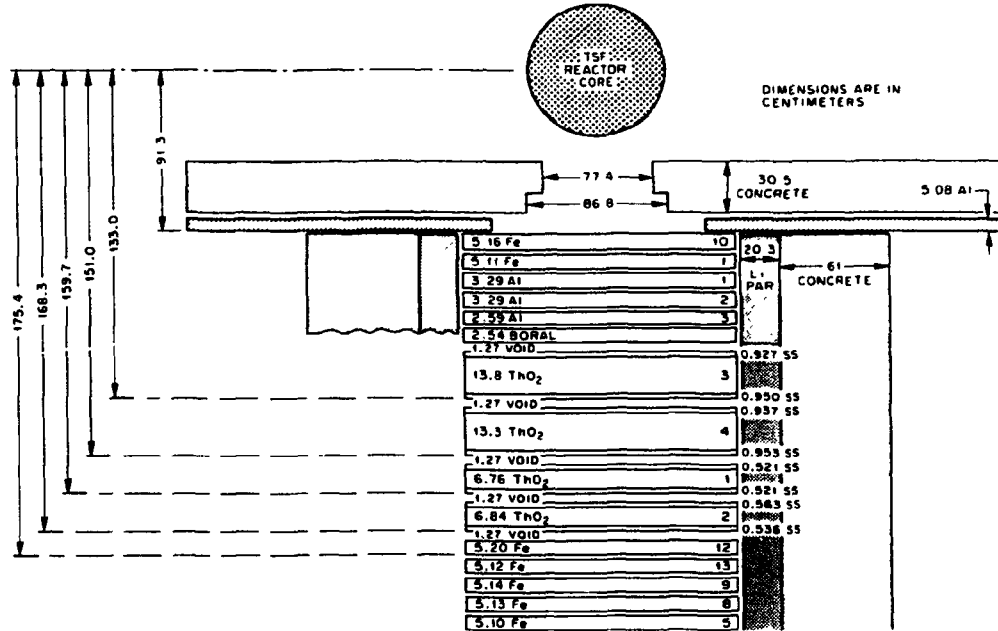


Fig. 17. Mockup of spectrum modifier, ThO_2 radial blanket, and 25 cm of Fe surrounded by lithiated paraffin and concrete (Item I-F).

contributions from sources outside the mockup. Thus, 25.4 cm of Fe was added and with it a new void was created following the last ThO₂ slab. Only TLD measurements were made for this configuration and the data are presented in Table 20, I-F.

A summary of the TLD measurements as a function of ThO₂ thickness is presented in the form of a curve in Fig. 18. No corrections for R^2 , changes in SS thicknesses as the slabs were rearranged, or ThO₂ density were applied to the data. Even so, it is possible to draw a smooth curve through the points which does indicate consistency in the measurements.

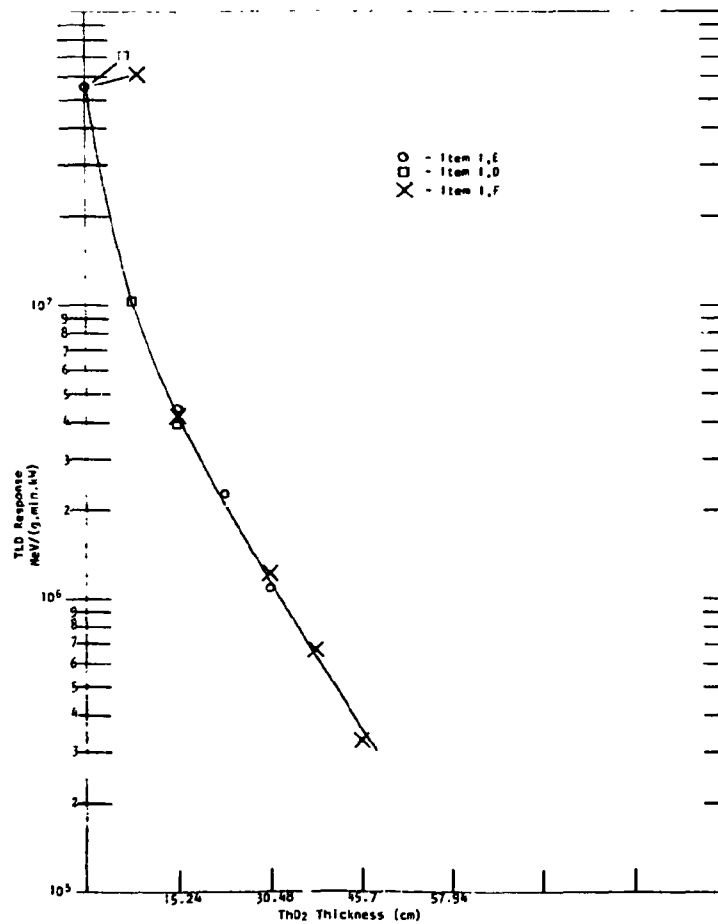


Fig. 18. Plot of raw data from TLD measurements in ThO₂ radial blanket.

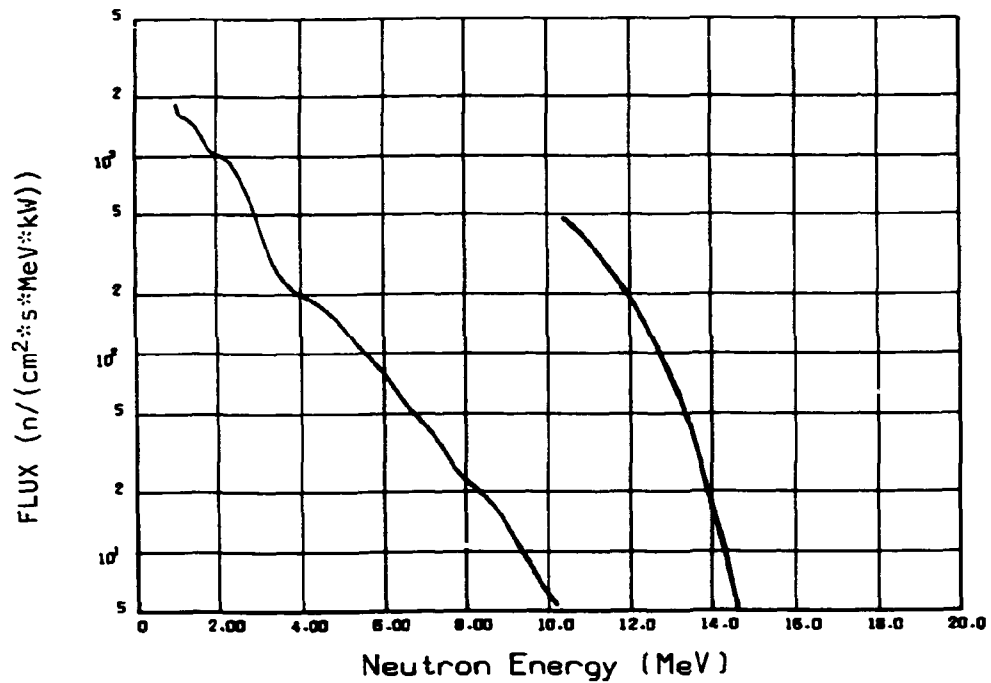


Fig. 20. High-energy neutron spectrum on centerline at 285.4 cm beyond the radial blanket (*Item II-A*).

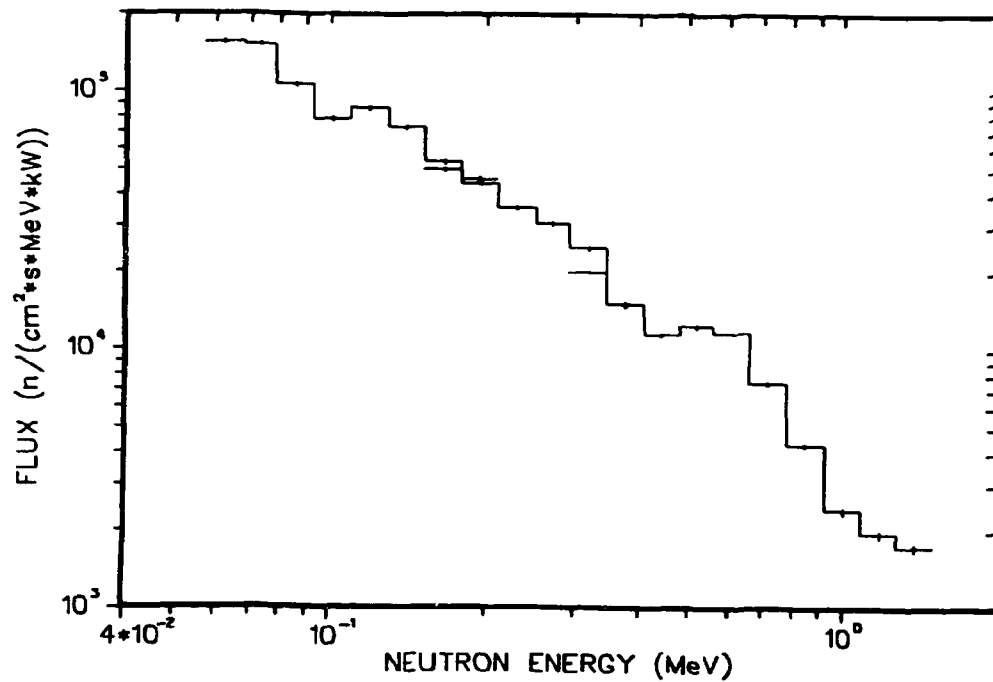


Fig. 21. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 285.4 cm beyond the radial blanket (*Item II-A*).

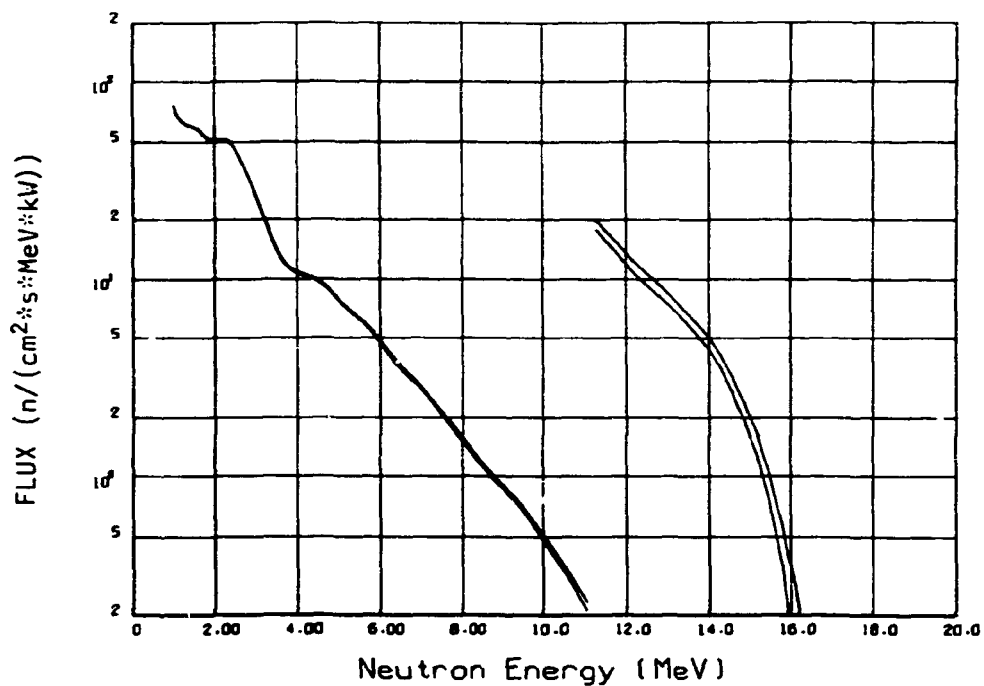


Fig. 22. High-energy neutron spectrum on centerline at 1311.3 cm beyond UO₂ blanket (Item II-A).

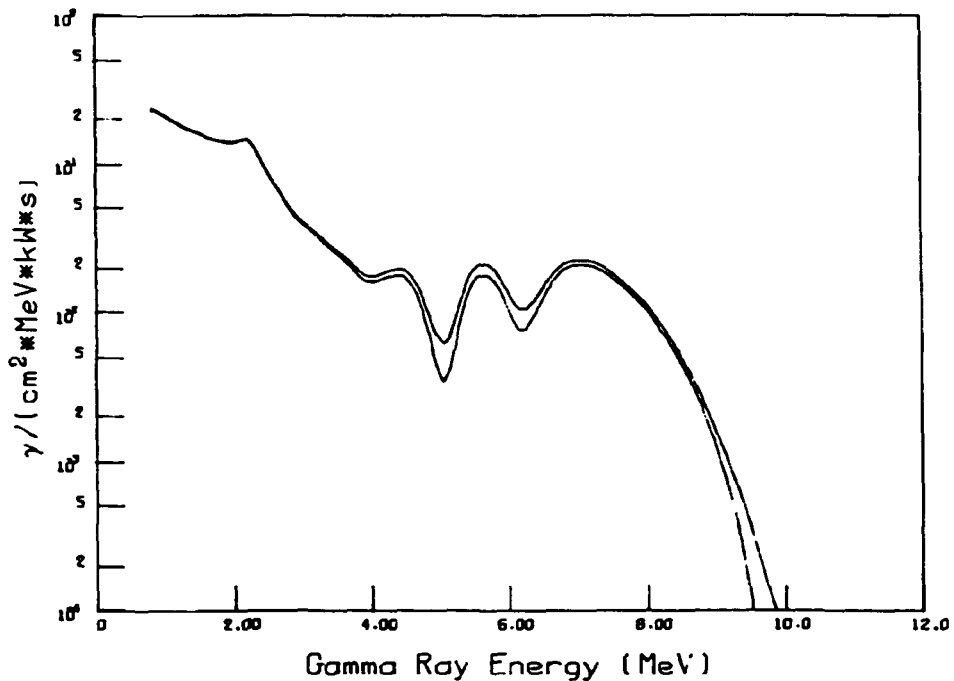


Fig. 23. Gamma-ray spectrum on centerline at 1311.3 cm beyond radial blanket (Item II-A).

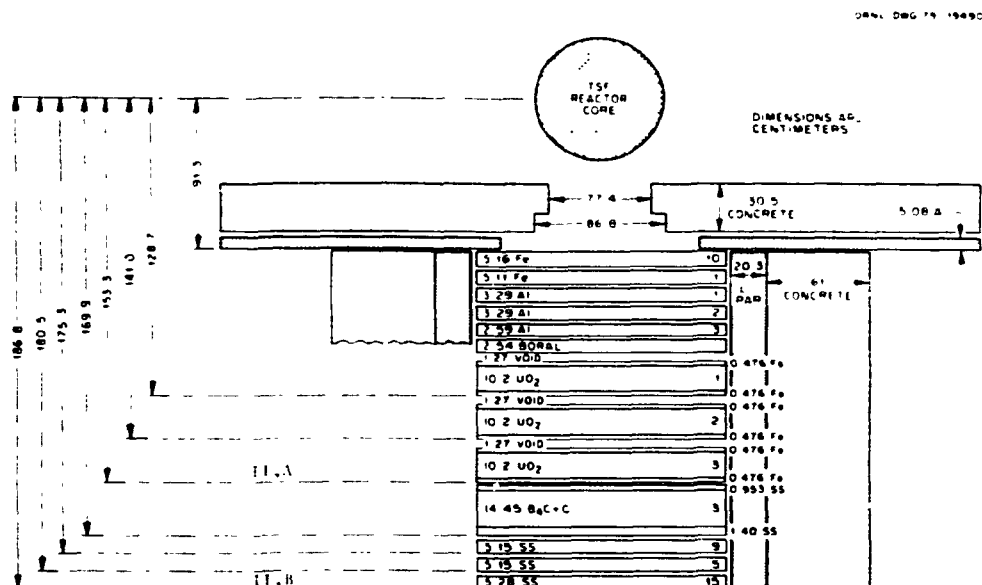


Fig. 24. Mockup of spectrum modifier, UO₂ radial blanket (*Item II-A*), and inner radial shield (*Item II-B*) surrounded by lithiated paraffin and concrete.

4.3 Inner Radial Shield Configurations (*Items II-B, III-A, III-B*)

An inner radial shield was added to the UO₂ mockup described in Section 4.2, consisting of a nominal 12.7-cm slab of (B₄C + C) mixture followed by 15.2-cm SS (Fig. 24, *II-B*). Bonner ball measurements behind the SS are given in Table 15, *II-B*. Neutron spectra at 1277.2 cm beyond the SS are shown in Figs. 25 and 26 and listed in Tables 28 and 29. The gamma spectrum is given in Fig. 27 and Table 30.

The UO₂ blanket was replaced by the 40.7-cm ThO₂ blanket behind the spectrum modifier. Measurements were made following the blanket plus the 12.7-cm (B₄C + C) slab and again with 15.2 cm of SS added to the (B₄C + C) (see Fig. 28, *III-A, III-B*). Neutron spectra at 1280.6 cm behind the (B₄C + C) slab are given in Figs. 29 and 30 and listed in Tables 31 and 32. Bonner ball data are given in Table 15, *III-A*. The gamma spectrum is shown in in Fig. 31 and listed in Table 33.

Similar measurements at 1263 cm behind the addition of the SS are given in Figs. 32 and 33 for neutrons and Fig. 34 for gammas with their respective listings in Tables 34, 35, and 36. Bonner ball measurements are in Table 15, *III-B*.

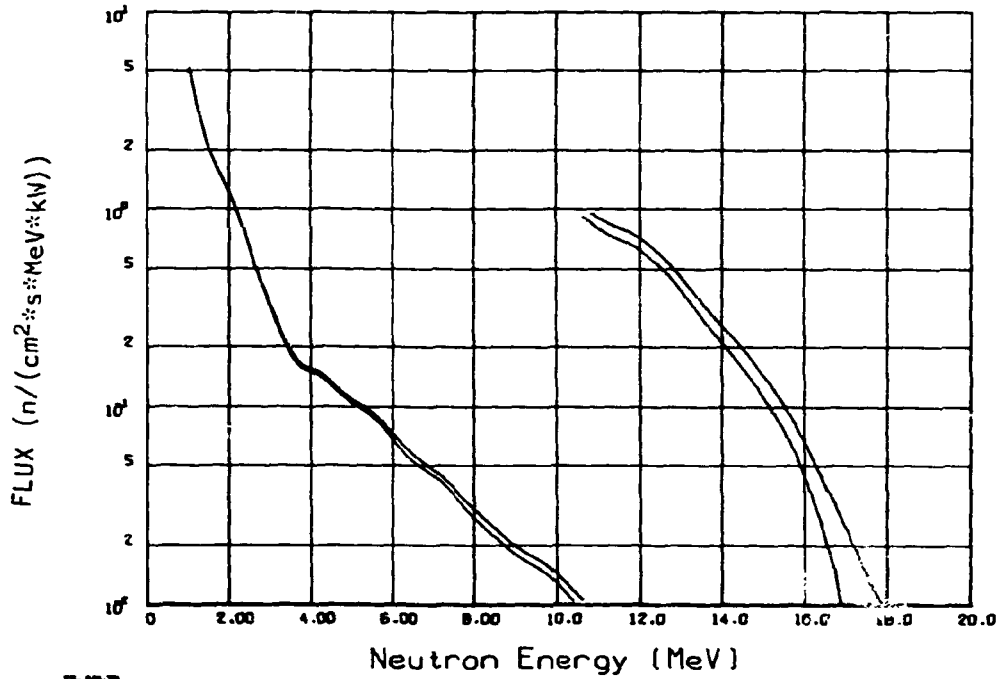


Fig. 25. High-energy neutron spectrum on centerline at 1277.2 cm beyond inner radial shield (Item II-B).

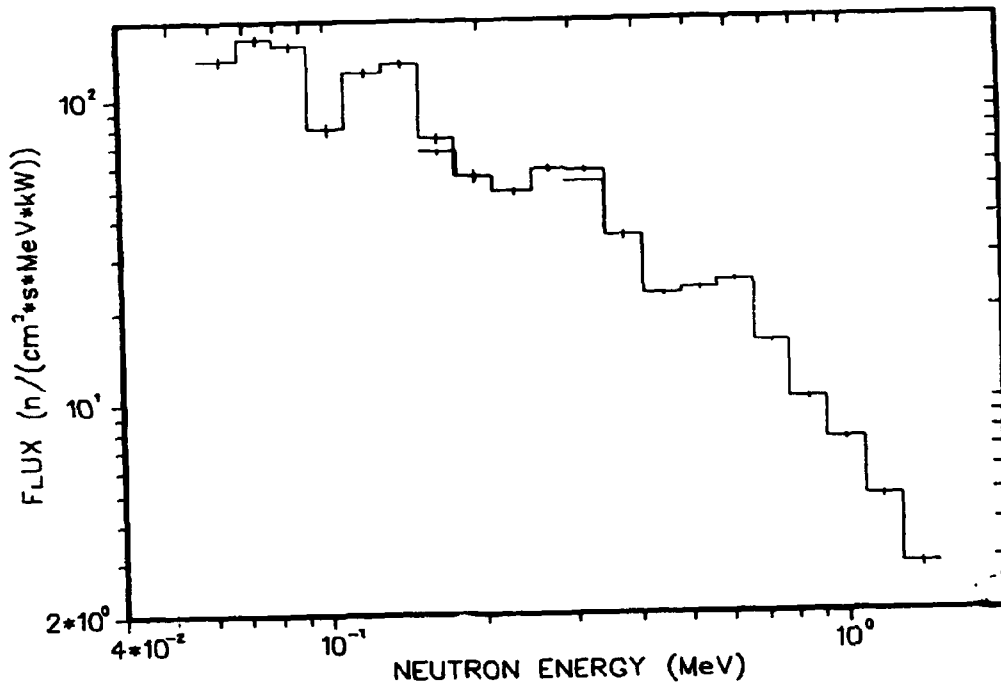


Fig. 26. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1277.2 cm beyond inner radial shield (Item II-B).

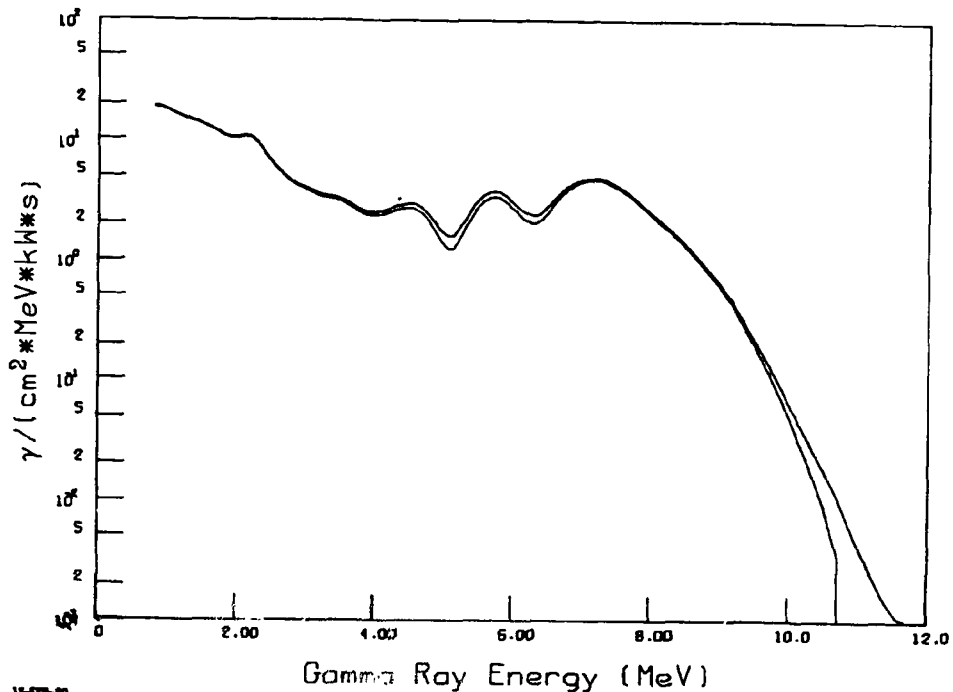


Fig. 27. Gamma-ray spectrum on centerline at 1277.2 cm beyond inner radial shield (Item II-B).

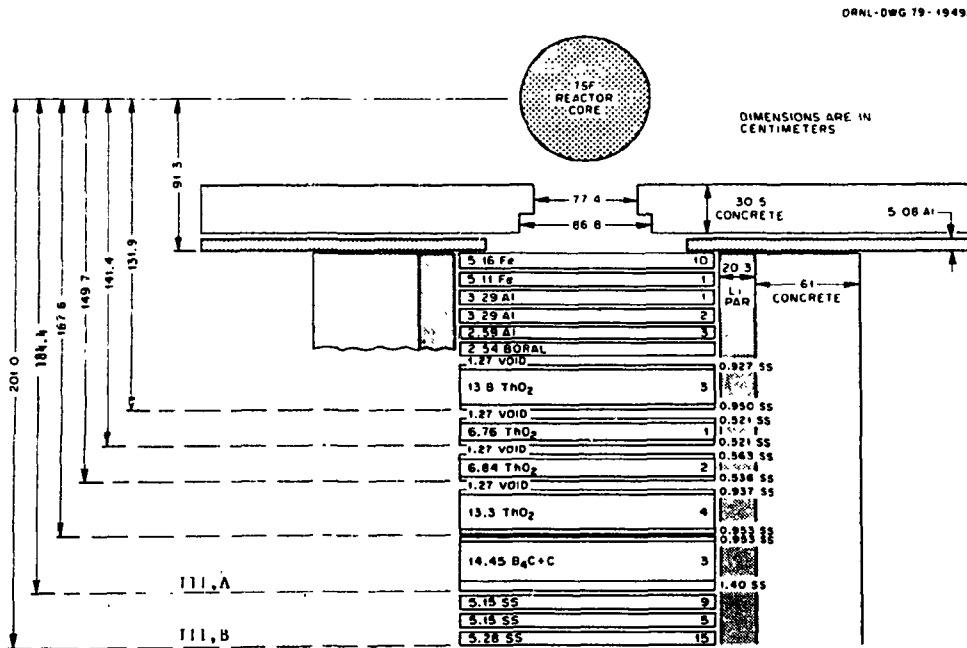


Fig. 28. Mockup of spectrum modifier, ThO₂ radial blanket, and inner radial shield surrounded by lithiated paraffin and concrete (Items III-A, III-B).

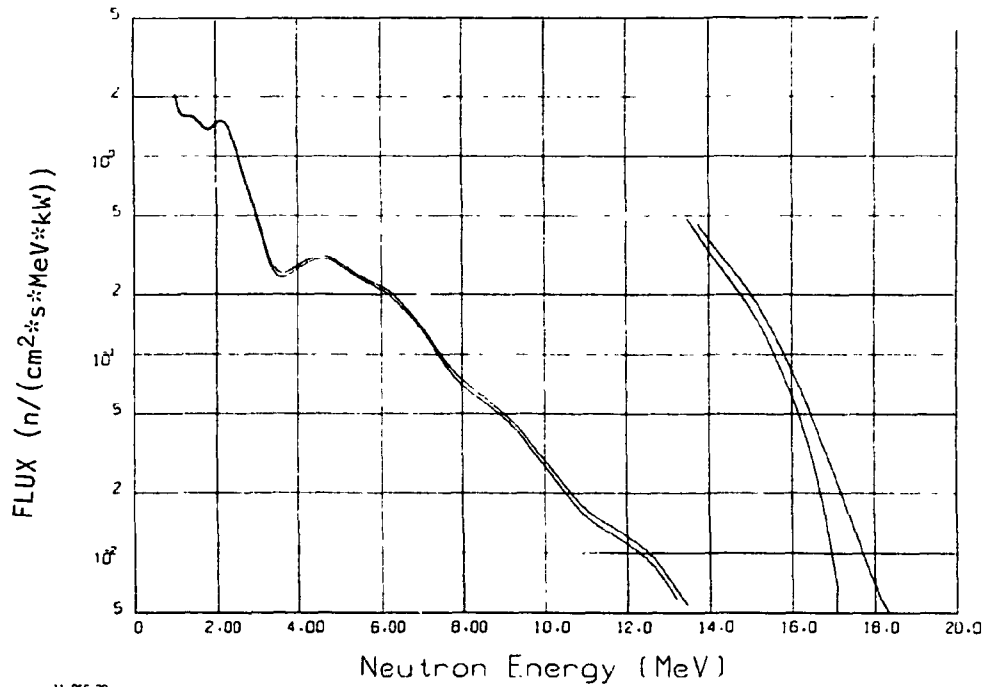


Fig. 29. High-energy neutron spectrum on centerline at 1280.6 cm beyond the ($B_4C + C$) slab (Item III-A).

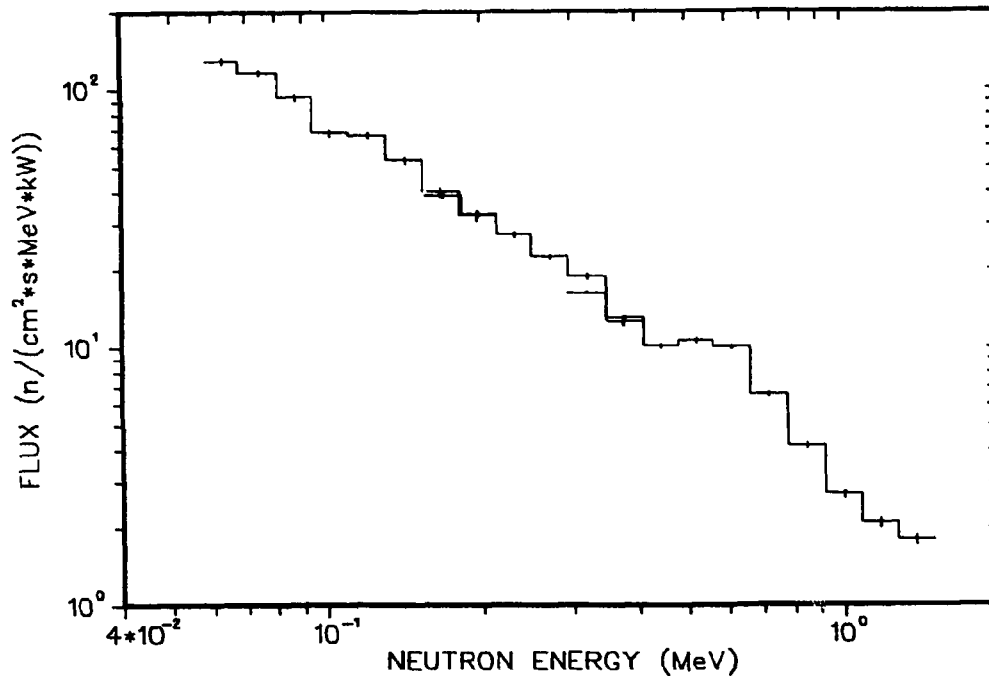


Fig. 30. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1280.6 cm beyond the ($B_4C + C$) slab (Item III-A).

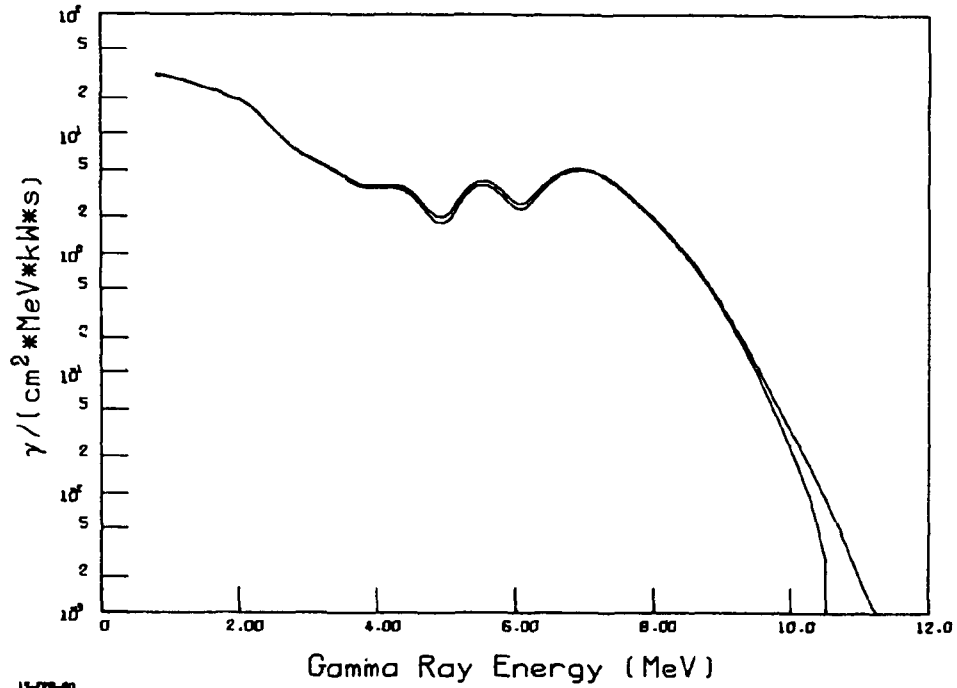


Fig. 31. Gamma-ray spectrum on centerline at 1280.6 cm beyond the ($B_4C + C$) slab (Item III-A).

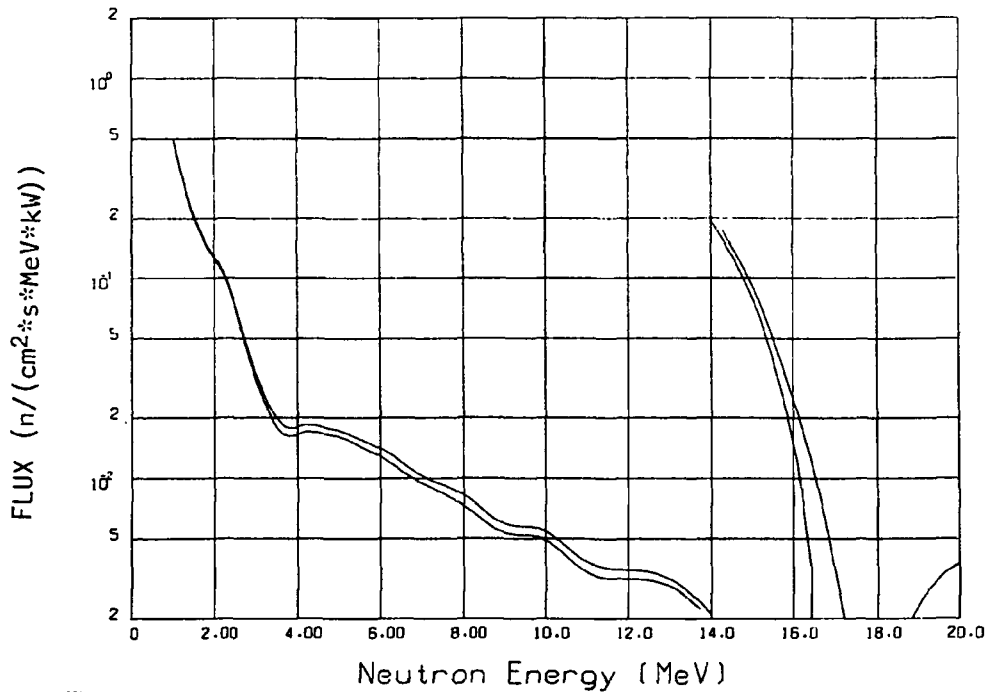


Fig. 32. High-energy neutron spectrum on centerline at 1263 cm beyond the inner radial shield (Item III-B).

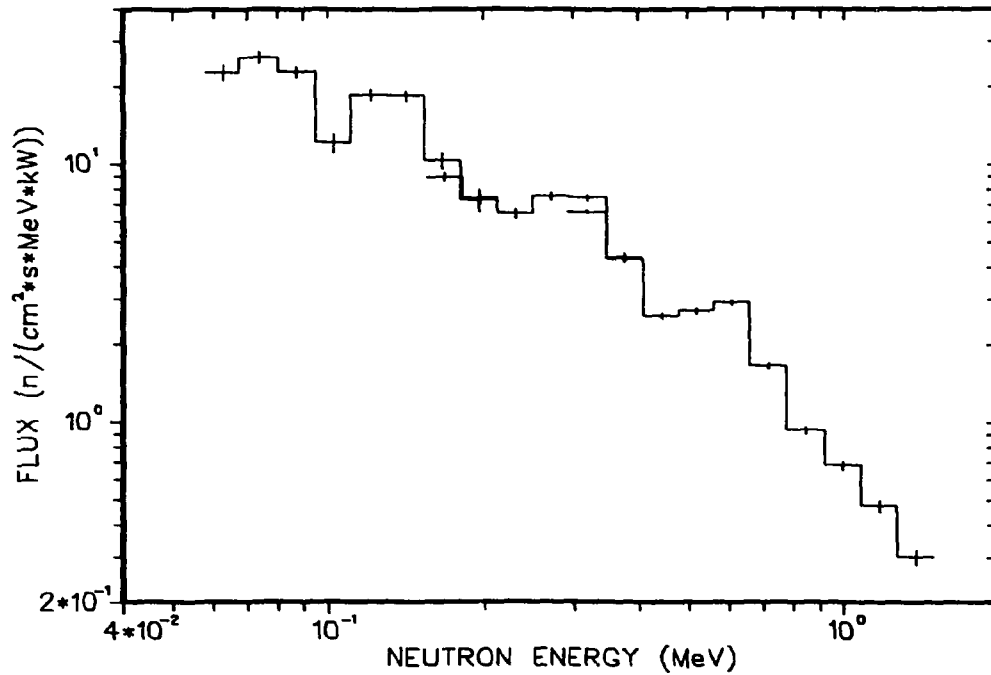


Fig. 33. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1263 cm beyond the inner radial shield (*Item III-B*).

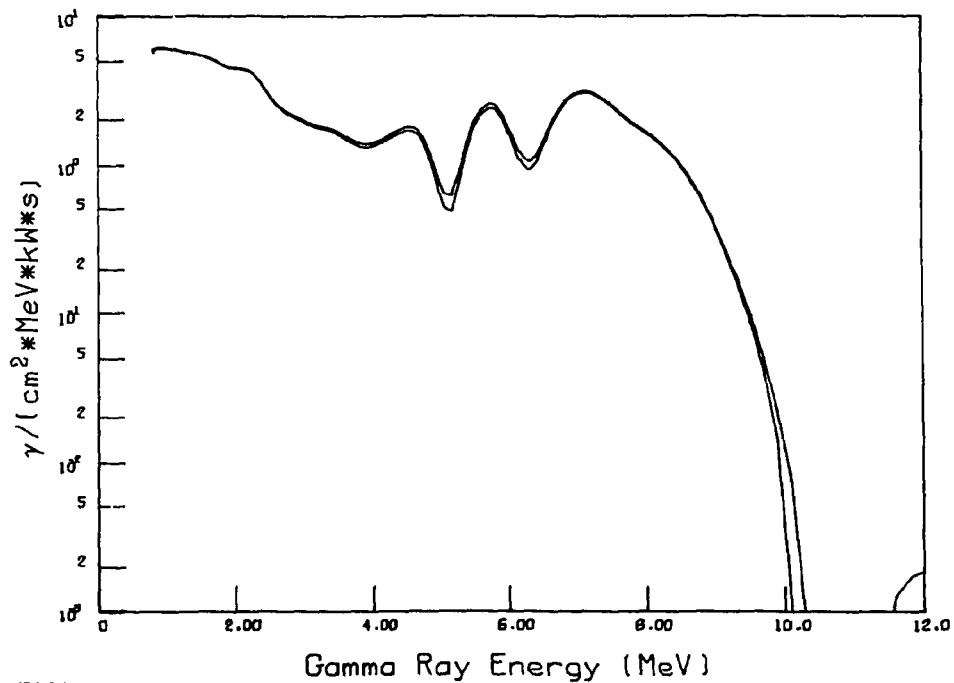


Fig. 34. Gamma-ray spectrum on centerline at 1263 cm beyond inner radial shield (*Item III-B*).

4.4 Outer Radial Shield Configuration (Items IV-A, IV-E)

The outer radial shield design consisted of 4.45-cm SS followed by nominal thicknesses of 5.1-cm ($B_4C + C$), 22.9-cm graphite, 5.1-cm ($B_4C + C$), and 4.45-cm SS. These slabs were added to the ThO_2 blanket and inner radial shield configuration. The outer radial shield was divided into three groups that were successively added to the mockup, with group one composed of 4.45-cm SS plus 5.1-cm ($B_4C + C$) (see Fig. 35), group two, 22.9-cm graphite, and the final group, 5.1-cm ($B_4C + C$) plus 4.45-cm SS (See Fig. 36, IV-B, IV-C).

Only Bonner ball measurements were made behind the first and second groups of the outer radial shield and these results are given in Table 15, IV-A, IV-B. NE213 and hydrogen-filled proton recoil spectra were requested behind the addition of the last ($B_4C + C$) and SS slabs (complete outer radial shield present) but the low neutron intensity observed in the NE213 run made the results questionable and negated the hydrogen counter run. The NE213 data was unscrambled, however, and the neutron

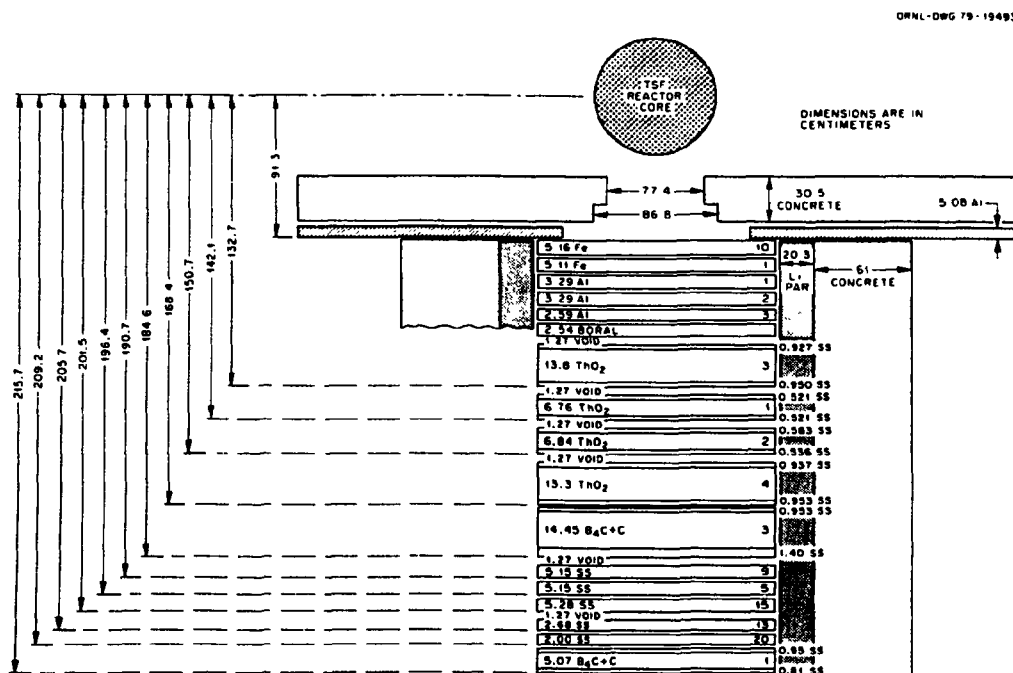
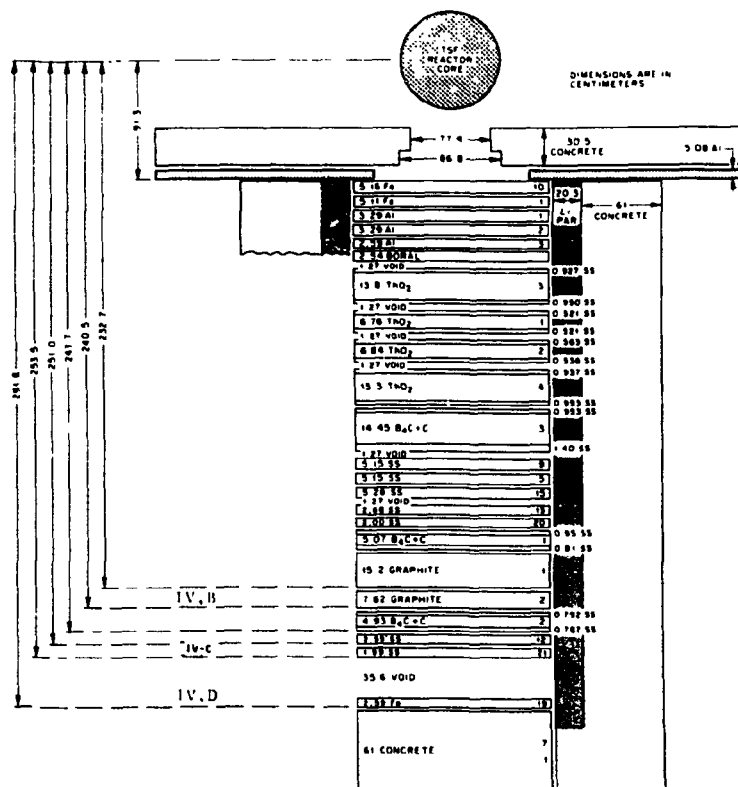


Fig. 35. Mockup of spectrum modifier, ThO_2 radial blanket, inner radial shield, and phase I of outer radial shield surrounded by lithiated paraffin and concrete (Item IV-A).



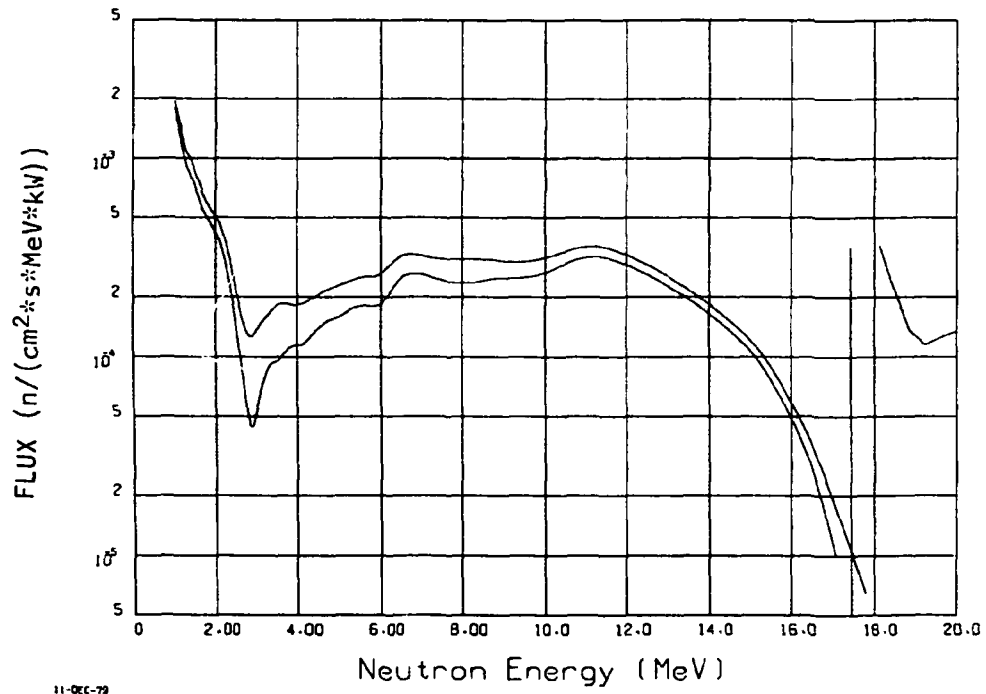


Fig. 37. High-energy neutron spectrum on centerline at 1210.5 cm beyond outer radial shield (Item IV-C).

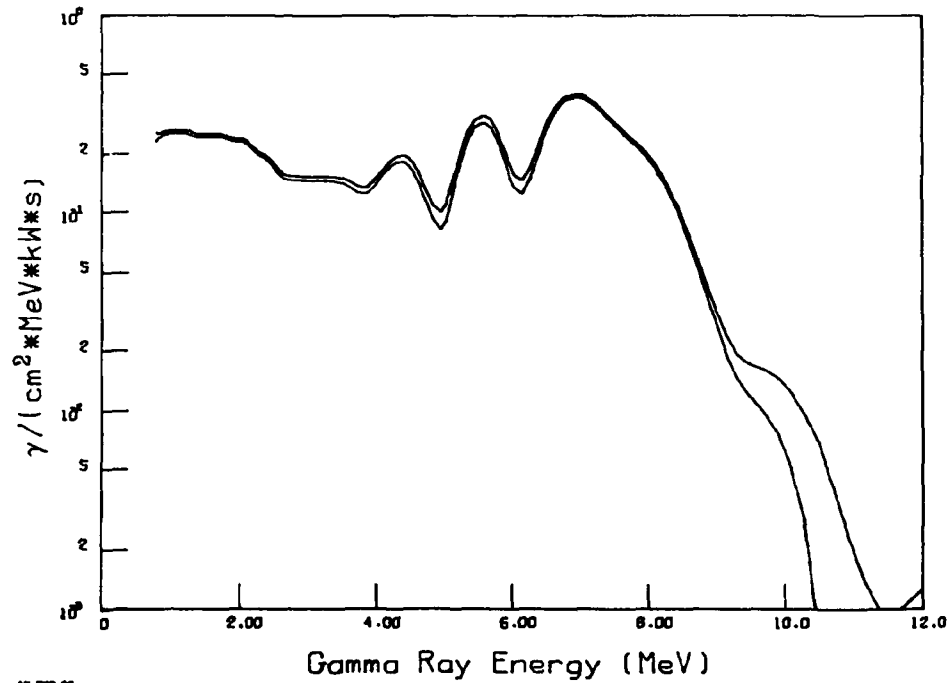


Fig. 38. Gamma-ray spectrum on centerline at 1210.5 cm beyond outer radial shield (Item IV-C).

The inadequate source strength for the NE213 measurement behind the outer radial shield discussed is aptly demonstrated by the large errors above in the neutron spectra (Fig. 37) as indicated by the spread between the two curves (68% confidence level). The importance of the neutron spectrum behind the radial shields suggested a substitute measurement, this time removing the ThO₂ blanket and placing the radial shield directly behind the spectrum modifier (Fig. 39). Spectral measurements

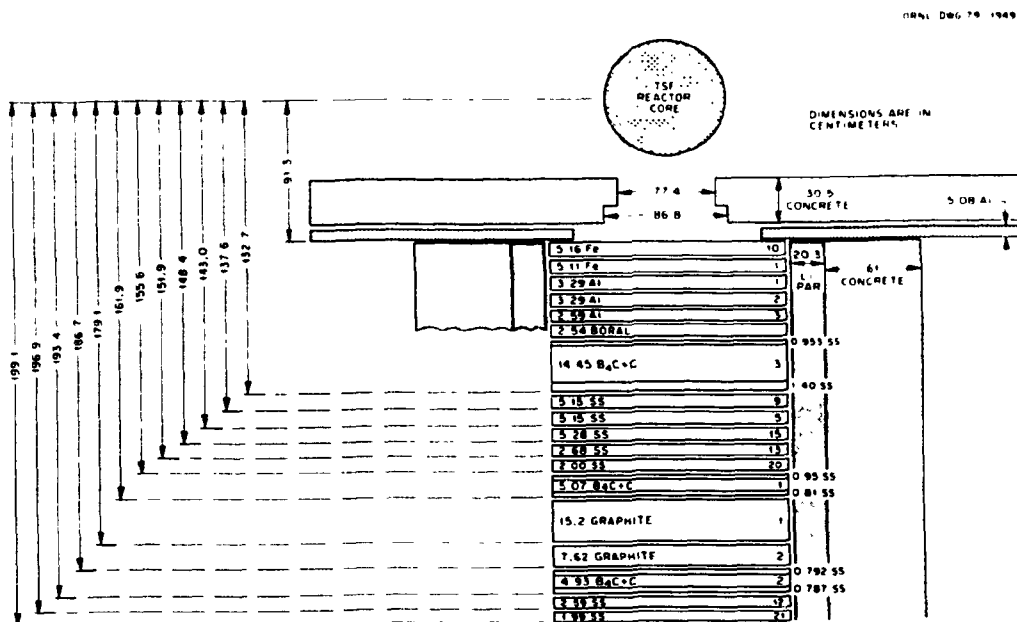


Fig. 39. Mockup of spectrum modifier, inner radial shield, and outer radial shield surrounded by lithiated paraffin and concrete (Item IV-E).

were obtained at 1264.9 cm behind the configuration and these spectra are presented in Figs. 40 and 41 (neutrons), Fig. 42 (gamma), and listed in Tables 39, 40, and 41 respectively. Bonner ball data in Table 15, IV-E were obtained at 30.5 cm, 305 cm, and 1264.9 cm.

4.5 Alternate Inner Radial Shield Configuration (Items V-A, V-E)

The program originally called for ThO₂ to be used as the blanket for the alternate inner radial shield studies. Calculations made during the first part of the experiment indicated large discrepancies with experimental results using ThO₂ as the blanket but good agreement using

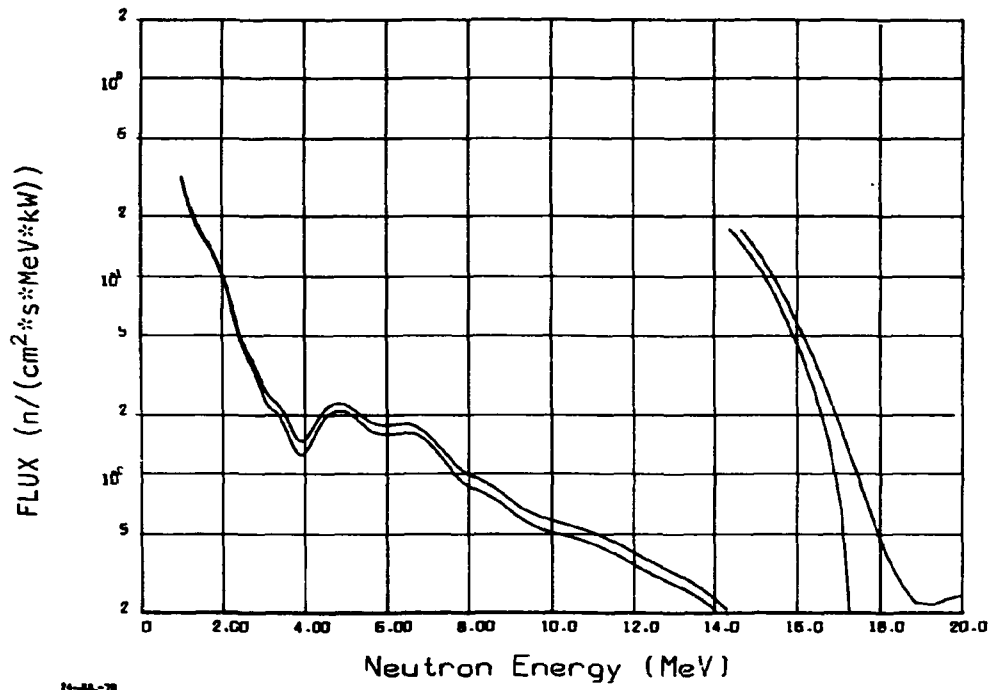


Fig. 40. High-energy neutron spectrum on centerline at 1264.9 cm beyond the outer radial shield (*Item IV-E*).

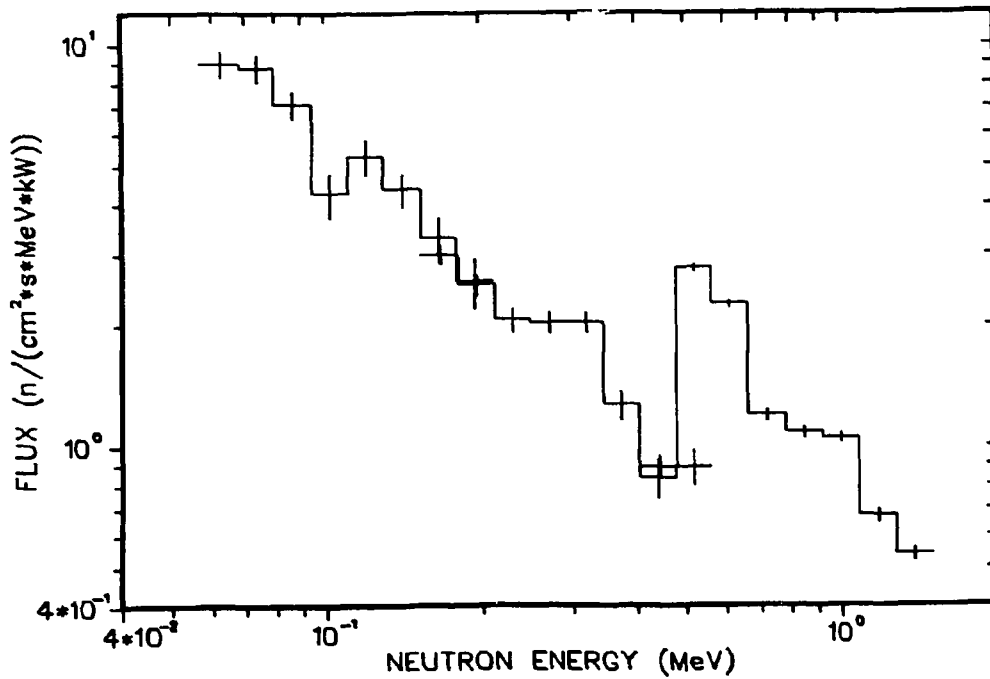


Fig. 41. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1264.9 cm beyond the outer radial shield (*Item IV-E*).

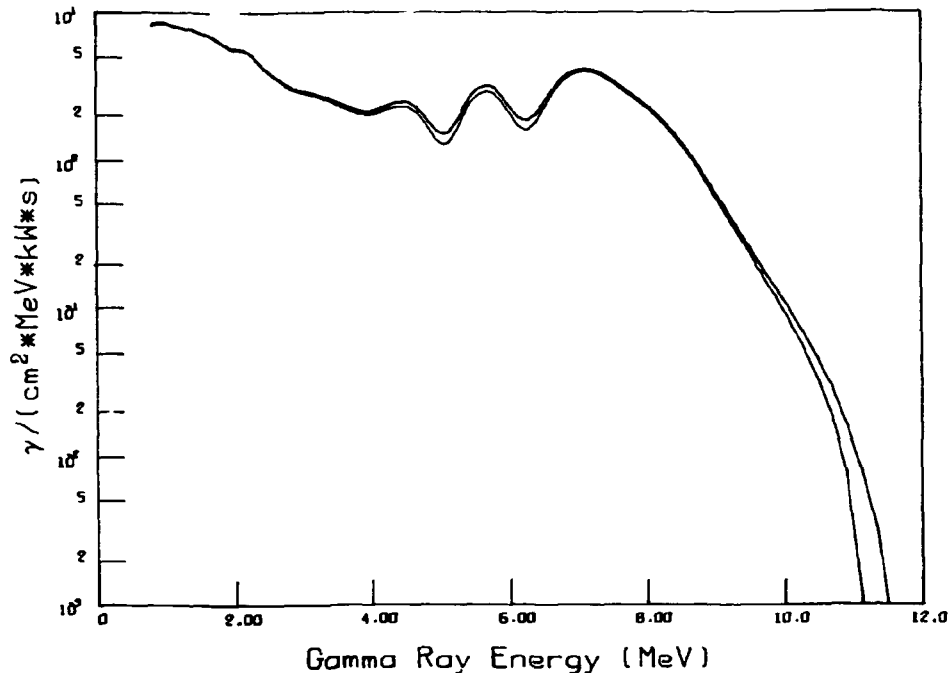


Fig. 42. Gamma-ray spectrum on centerline at 1264.9 cm beyond the outer radial shield (Item IV-E).

UO_2 . Since basically the experiment was a methods verification study it appeared reasonable to make changes in the program that would still permit verification but allow use of materials whose cross sections were well established. The three UO_2 slabs replaced the ThO_2 following the spectrum modifier with measurements behind the components of the alternate inner radial shield as they were placed in the configuration.

Previous Bonner ball measurements at 30.5 cm behind the spectrum modifier and UO_2 slabs (Table 15, II-A) were repeated (Fig. 43, V-A) to verify the repeatability of the source term and these data, listed in Table 15, V-A, are within a few percent of the original data. Graphite (15.2 cm) was then added to the mockup (Fig. 43, V-B) and both neutron and gamma spectra were obtained. These results are shown in Figs. 44 and 45 (neutron), and Fig. 46 (gammas) with listings in Tables 42, 43, and 44 respectively. Bonner ball results made at 30.5 cm, 305 cm, and 1294.4 cm (NE213 location) behind the graphite are given in Table 15, V-B.

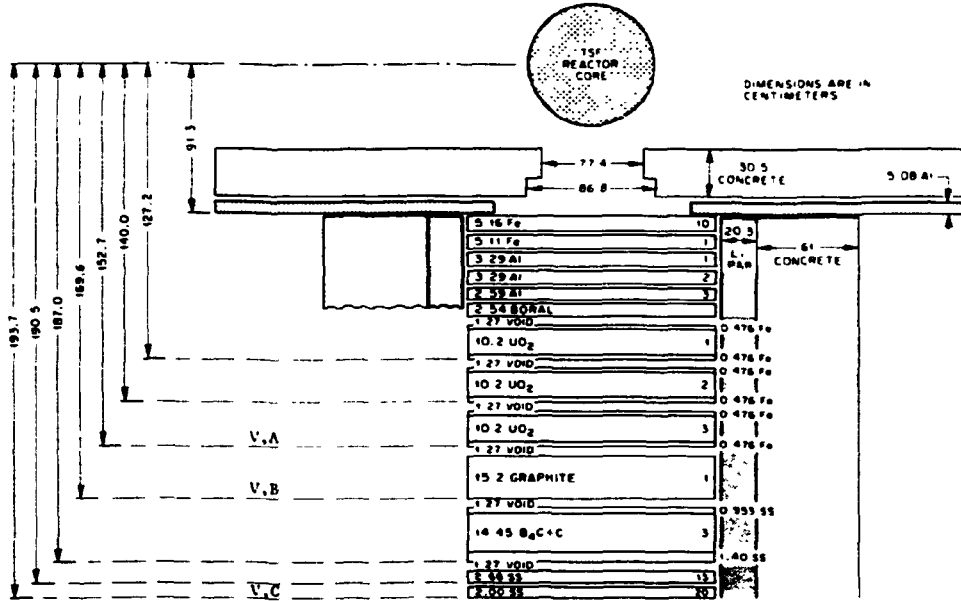


Fig. 43. Mockup of spectrum modifier, UO₂ radial blanket, and phases I and II of the alternate inner radial shield surrounded by lithiated paraffin and concrete (Items V-A, V-B, V-C).

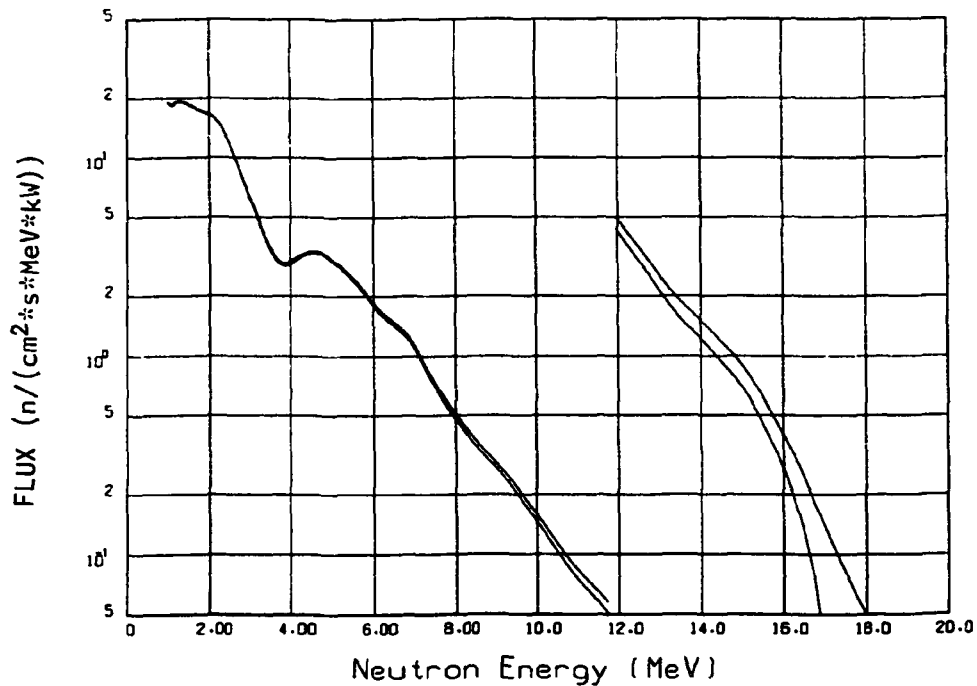


Fig. 44. High-energy neutron spectrum on centerline at 1294.4 cm beyond the graphite (Item V-B).

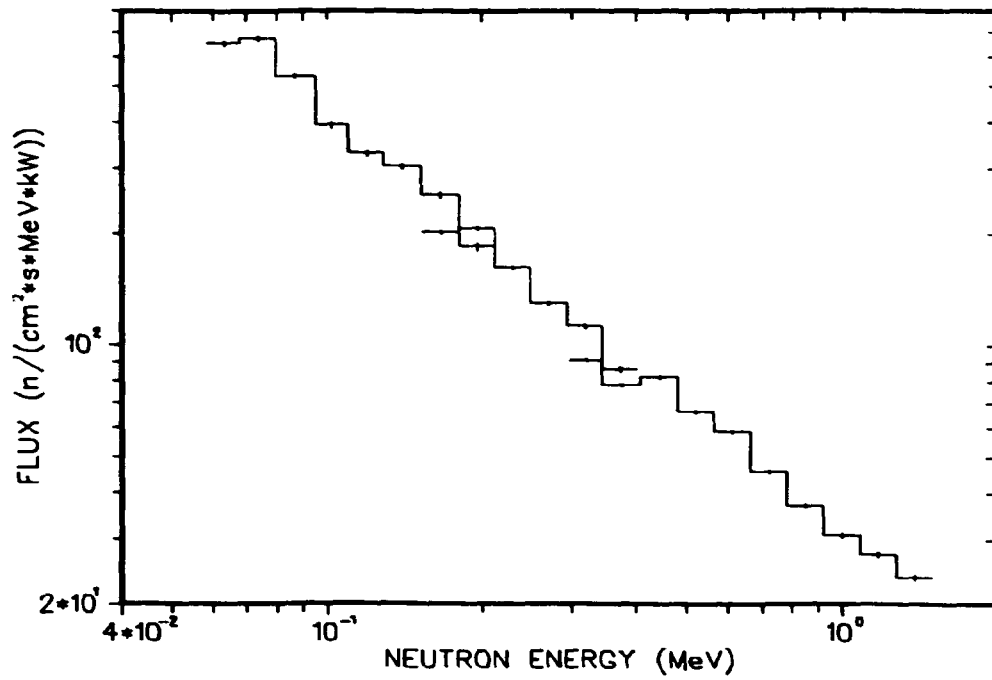


Fig. 45. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1294.4 cm beyond the graphite (*Item V-B*).

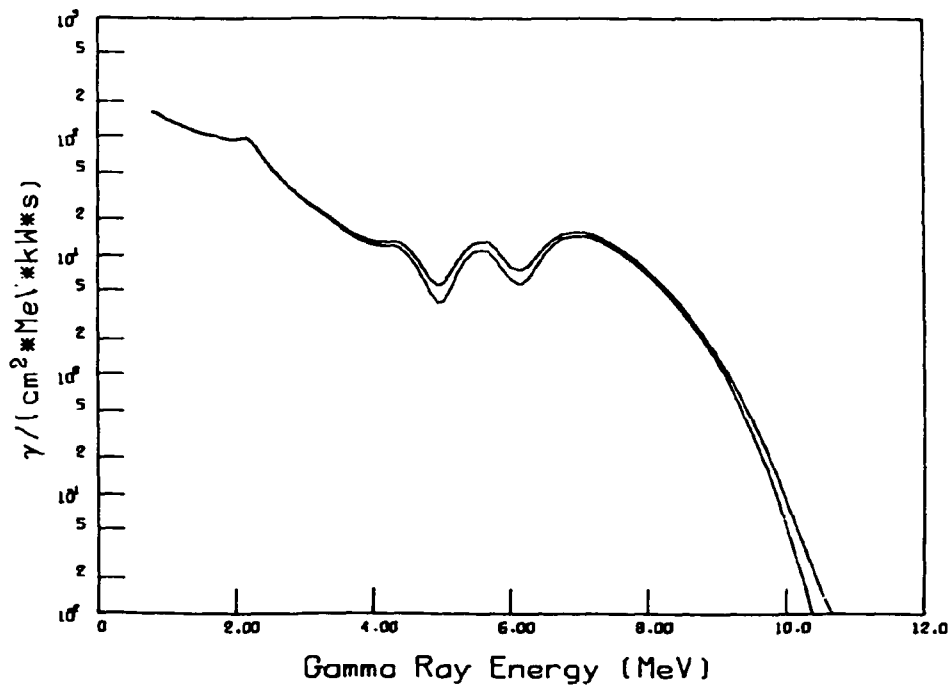


Fig. 46. Gamma-ray spectrum on centerline at 1294.4 cm beyond the graphite (*Item V-B*).

The 12.7-cm ($B_4C + C$) slab and the 4.45-cm SS slab were added to the mockup with 1.27-cm voids in front of and behind the ($B_4C + C$) as shown in Fig. 43, V-C. The neutron spectra at 1270 cm behind the SS are given in Figs. 47 and 48, the gamma spectra in Fig. 49 with the spectra values listed in Tables 45, 46, and 47 respectively. Bonner ball results from measurements at 30.5 cm, 305 cm, and 1270 cm behind the SS are listed in Table 15, V-C. TLDs were exposed in the voids between the UO_2 - graphite slabs and before and after the 12.7-cm ($B_4C + C$) and these results are in Table 20, V-C. In the next configuration 15.2 cm of SS was inserted between the ($B_4C + C$) and the 4.45-cm SS, leaving a 1.27-cm void each side of the SS insert, see Fig. 50. Bonner ball measurements at 30.5 cm and 305 cm behind the mockup are listed in Table 15, V-D. Results from TLD exposures in the voids following the UO_2 are given in Table 20, V-D.

The final configuration for the alternate outer radial shield concept consisted of 12.7-cm ($B_4C + C$) and 4.45-cm SS following the UO_2 with voids before and after the ($B_4C + C$) as shown in Fig. 51. Again Bonner balls were run at 30.5 cm and 305 cm behind the SS and results presented in Table 15, V-E. Results of the TLDs exposed in the two voids are given in Table 20, V-E.

4.6 Reactor Source Measurements (Items VI-A, VI-B, VI-C, VI-D)

Discrepancies between the initial calculations and the measurements of the neutron spectra behind several of the configurations suggested that maybe the TSR-II source term used in the calculations might be in error. The source spectrum had been previously calculated and had been normalized to Hornyak button mappings of the TSR-II beam. Some concern was also expressed about calculating the penetration of the spectrum modifier correctly. This concern added several measurements to the program behind configurations with and without the spectrum modifier in the beam. Since calculations of both the source term and the flux transmission through the spectrum modifier were considered as possible sources of error the first measurement requested was that of the flux coming from the bare TSR-II. This was not possible since the residual gamma-ray flux from the core completely saturated the detector. A lead shield, 15.2-cm thick, was placed in the beam (Fig. 52, VI-A) and a

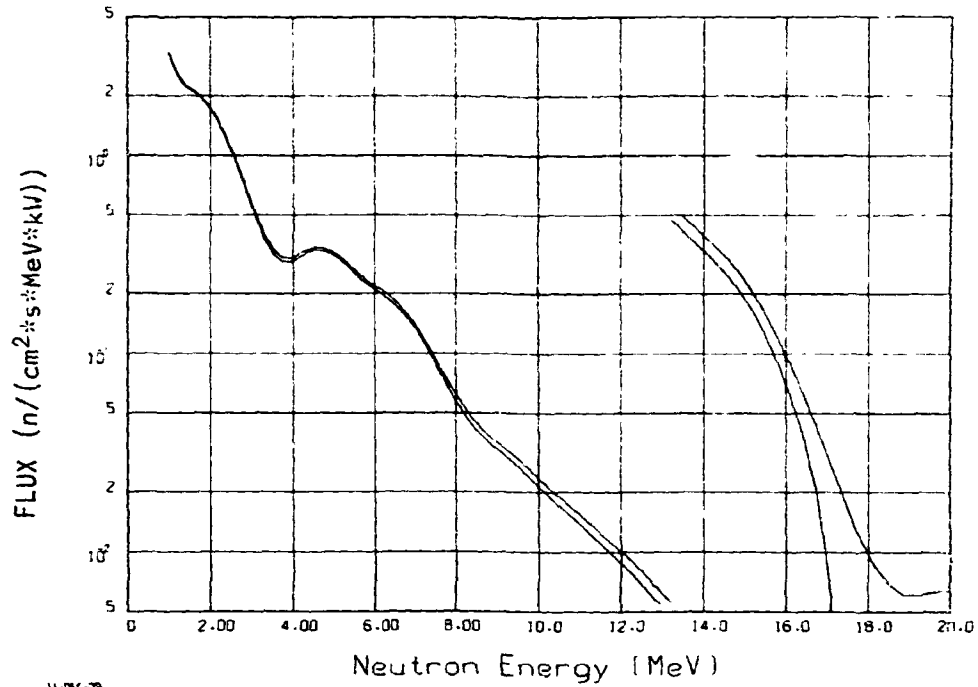


Fig. 47. High-energy neutron spectrum on centerline at 1270 cm beyond the 4.45-cm stainless steel (*Item V-C*).

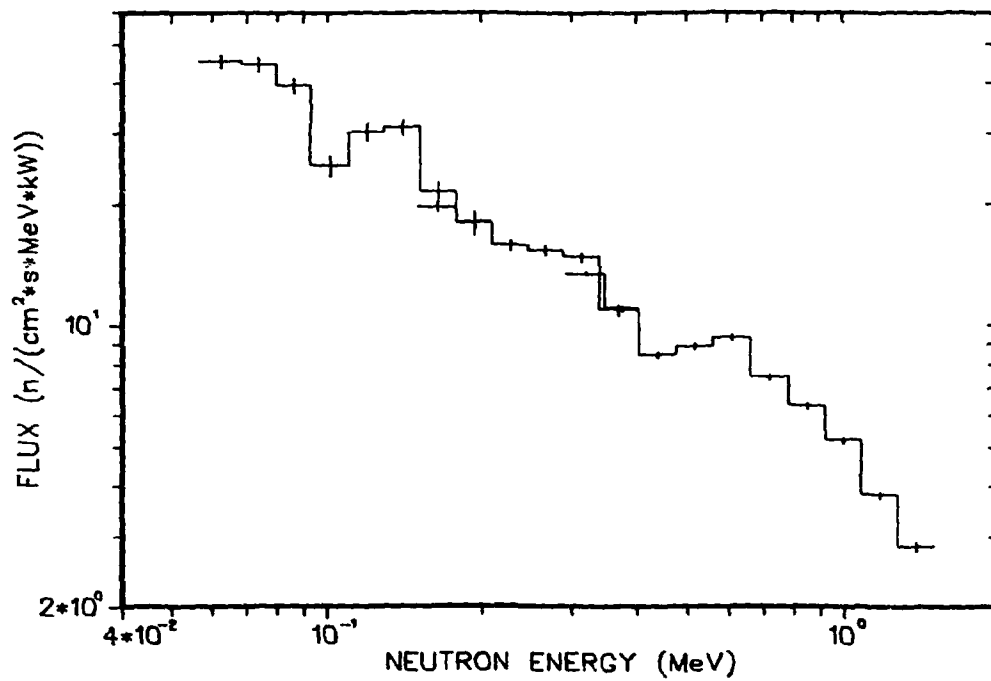
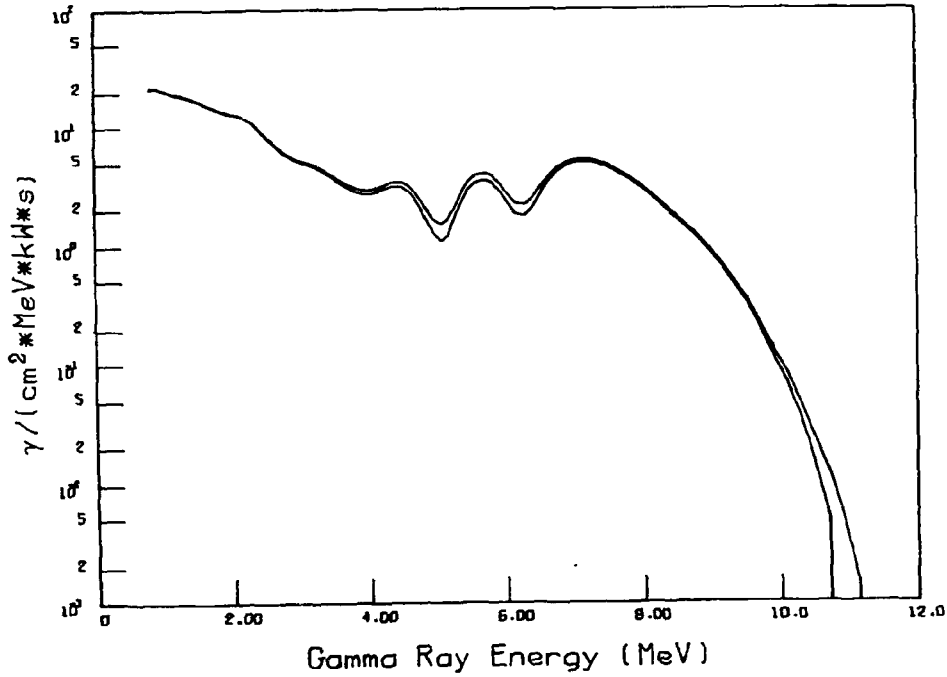


Fig. 48. Spectrum of neutrons from 100 keV to 1.4 MeV on centerline at 1270 cm beyond the 4.45-cm stainless steel (*Item V-C*).



13-723-80
 Fig. 49. Gamma-ray spectrum on centerline at 1270 cm beyond the 4.45-cm stainless steel (Item V-C).

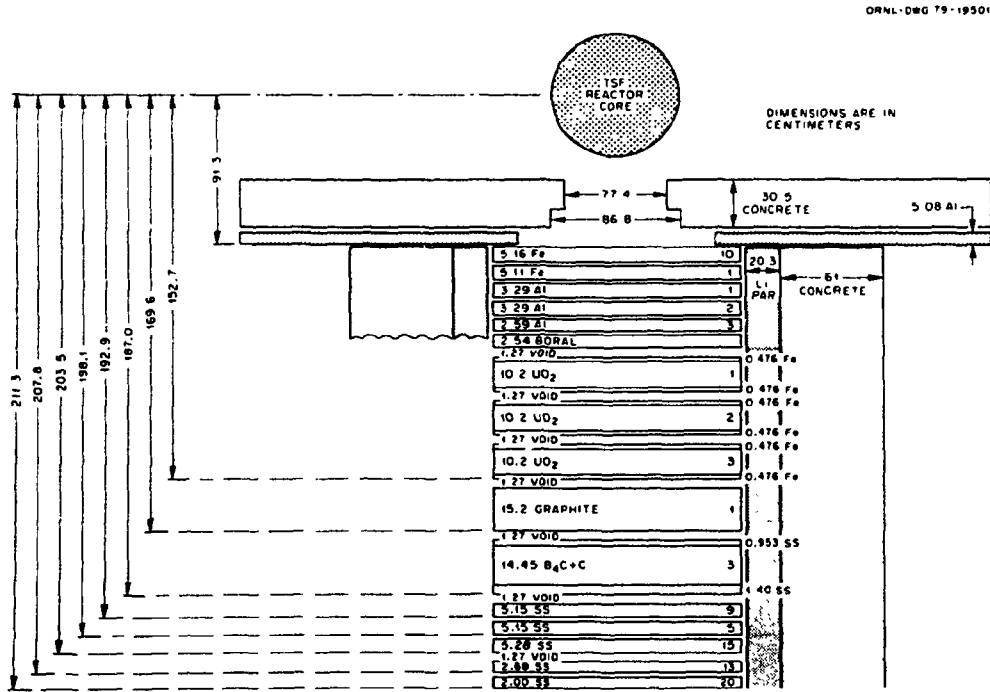


Fig. 50. Mockup of spectrum modifier, UO₂ radial blanket, and phase III of the alternate inner radial shield surrounded by lithiated paraffin and concrete (Item V-D).

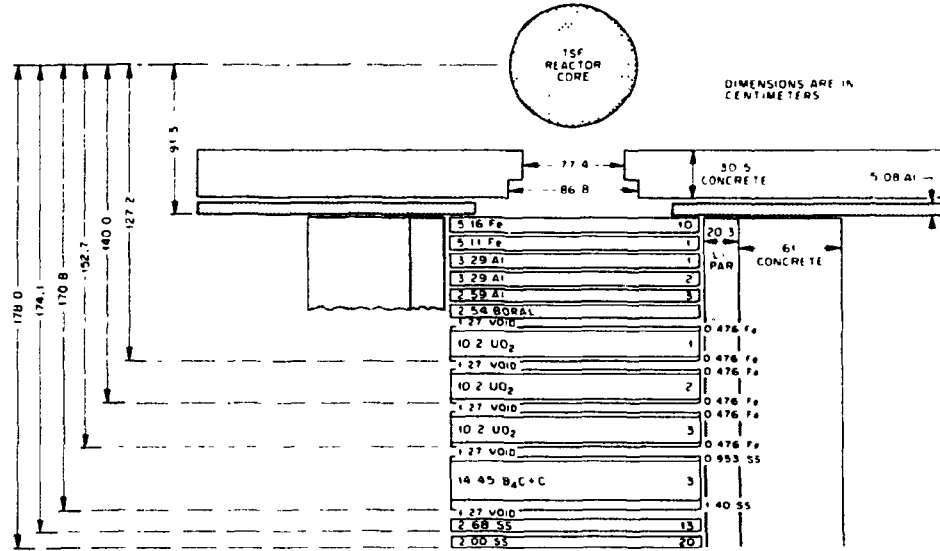


Fig. 51. Mockup of spectrum modifier, UO₂ radial blanket, and final phase of alternate inner radial shield (Item V-E).

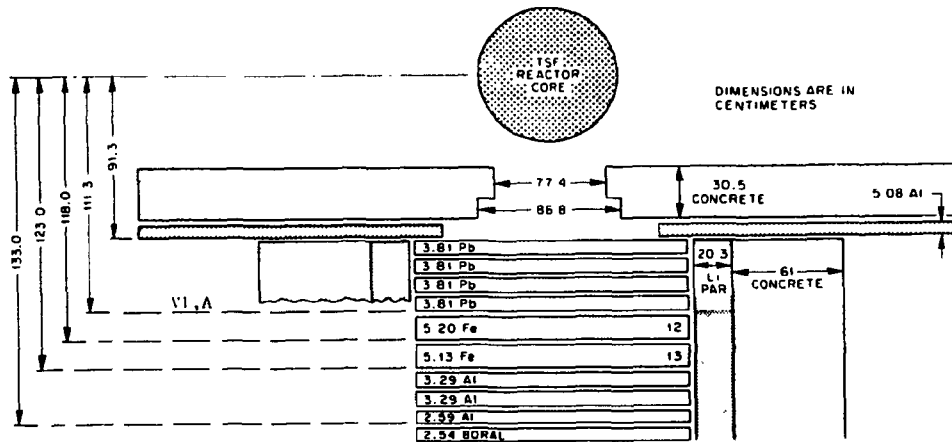


Fig. 52. Mockup of Pb and spectrum modifier (Items VI-A, VI-B).

neutron spectrum was obtained behind the lead with the NE213 scintillator. The spectrum modifier was then placed behind the Pb (Fig. 52) and the NE213 measurements repeated at the same location, but adding the spectrum modifier reduced the detector distance behind it to 1328.5 cm. The second approach was to provide a different source term for the spectrum modifier and again obtain spectra with and without the spectrum modifier in the beam. This would provide not only another check on the source term but also a second independent check on the calculations through the spectrum modifier. The lead was replaced with the UO_2 radial blanket and measurements made 1338.3 cm behind it and then 1313.3 cm behind the UO_2 plus the spectrum modifier (Fig. 53). These spectra,

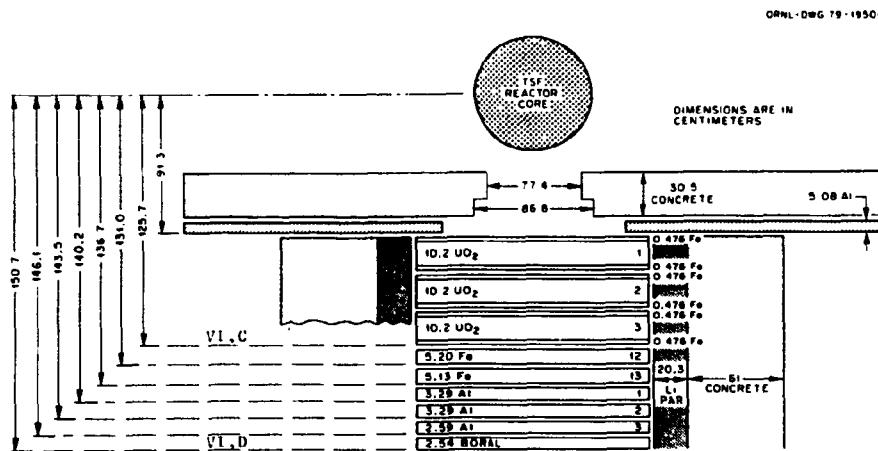
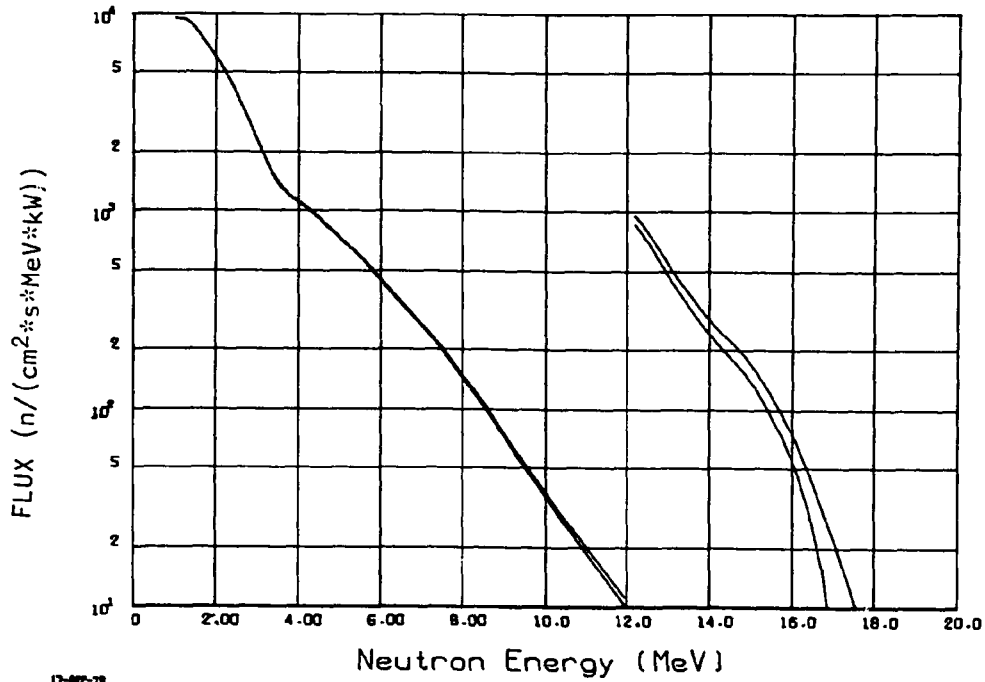


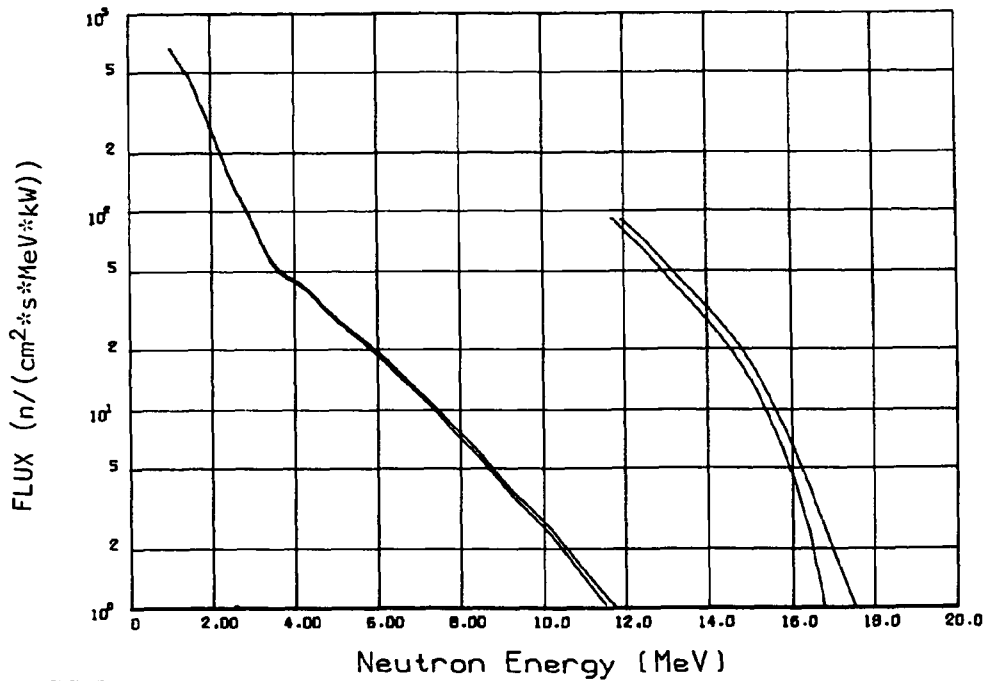
Fig. 53. Mockup of UO_2 radial blanket and spectrum modifier (Items VI-C, VI-D).

taken on the beam centerline behind the configurations in that order, are given in Figs. 54, 55, 56, and 57 respectively and the tabular values are listed in Tables 48 through 51. Bonner ball measurements were made behind UO_2 plus the spectrum modifier only and these are contained in Table 15, VI-D.



17-807-78

Fig. 54. High-energy neutron spectrum on centerline at 1352.7 cm beyond the Pb (Item VI-A).



21-807-78

Fig. 55. High-energy neutron spectrum on centerline at 1328.5 cm beyond the boral (Item VI-B).

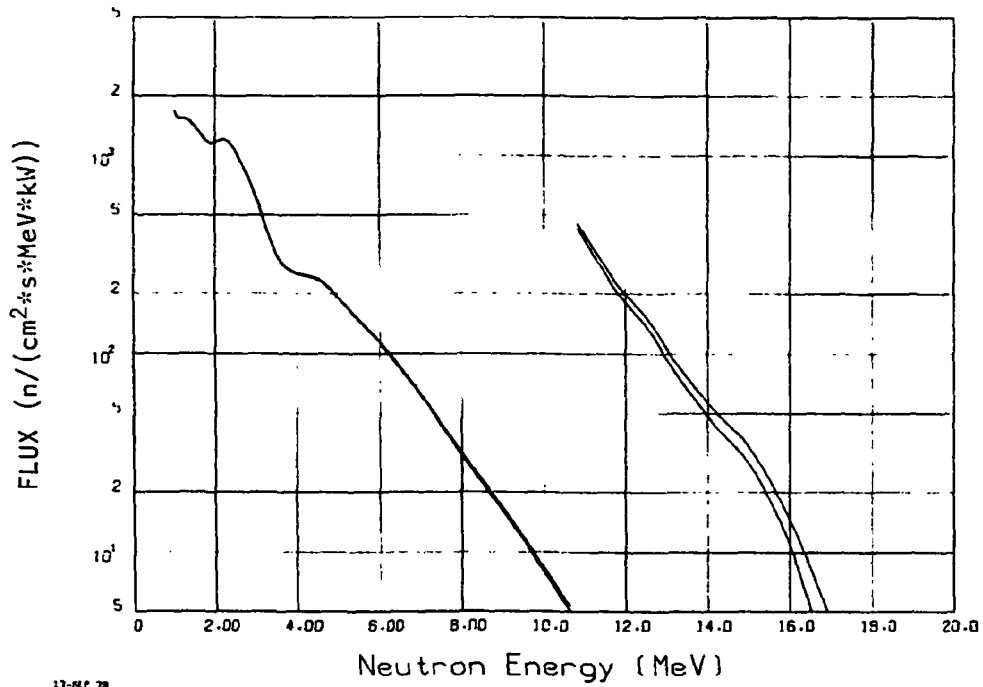


Fig. 56. High-energy neutron spectrum on centerline at 1338.3 cm beyond the UO_2 (Item VI-C).

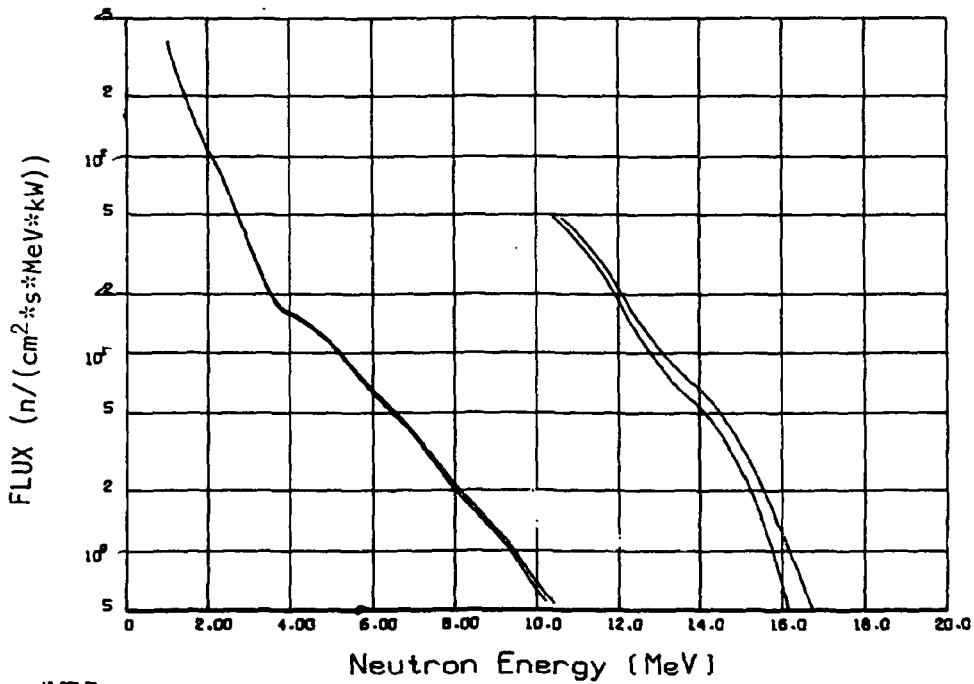


Fig. 57. High-energy neutron spectrum on centerline at 1313.3 cm beyond the spectrum modifier (Item VI-D).

ANALYSIS OF EXPERIMENTAL ERRORS

The error in measurements results mainly from a combination of the uncertainties in the reactor power determination, detector calibrations, count-rate statistics, detector positioning, configuration geometry, and exposure of the experimental configurations to the weather. Of these, the effects due to changes in the weather are least understood and basically indeterminable since the experiment contained so many configuration changes. The configurations are exposed to the weather and the uncertainty in the measurements lies in the variable amounts of moisture between the slabs forming the configurations and absorbed within the material placed around the slabs to inhibit background contributions. This is very difficult to estimate, probably more so for gamma rays than neutrons. For metal slabs or metal containers the effect on neutron transport is thought to be minimal, but for slabs like concrete or graphite this is not negligible.

The configurations usually consist of metal slabs that are not flat and filled containers that may be thicker or thinner in the middle than at the ends. Since our geometry is quoted as being along the reactor beam centerline the thicknesses given introduce an unknown error. For this experiment, the ThO_2 and B_4C containers were measured and these measurements were discussed previously under the section on Experimental Configuration Components.

Positioning of the detector with respect to the configuration would require close tolerances only for a measurements adjacent to the configuration, that is, within several centimeters. It has been estimated from prior experiments that an error of several millimeters in positioning at a distance of 30.5 cm behind the configuration, which was normally the closest measurement in this experiment, would result in an error of only 1-2%. Positioning accuracy at distances further from the mockup is less stringent since flux changes over an error in positioning, say 1 cm, would fall well within statistics of the measurement. Errors in positioning for this experiment were within the 1-2%.

Count-rate statistics are expressed in a manner exclusive to each detector. For the NE213, counting statistics and unfolding errors are included in the unscrambling of the pulse-height spectra using the FERD code, with the resultant flux expressed in terms of lower and upper limits that represent a 68% confidence interval. Similar errors are expressed in the tabular data for the hydrogen counter measurements unfolded using SPEC 4. Neither of the spectra, NE213 or Hydrogen counter, reflects the error in determining the reactor power since this is not fed into the unscrambling. This, as will be discussed later, could be as much as 5%.

For the Bonner balls the statistical error in the detector count rates was kept at a minimal of 1-2% by maintaining an adequate count rate. Calibrations over the experimental period indicated about a 3-4% variation. If one now includes the error in reactor power determination for each run, the error in the Bonner ball data would be about $\pm 5\%$.

The largest source of error in the experiment was believed to lie in determination of the reactor power. The power level for each measurement was determined from the output from two fission chambers located in the reactor shield on reactor centerline. These detectors were calibrated daily and at one point during the experiment they were compared to gold foils placed at the detector locations. During any one detector traverse in a given day the variation in reactor power as indicated by the monitors might only be several percent. However, over a span of several months the monitors have indicated variations in the power levels of about $\pm 5\%$ from a mean value. These variations may be real and could be indicative of actual drifts in the reactor flux output. Rather than calculate probable errors for each one of a series of measurements in a traverse or for any one traverse we prefer, in general, to quote a value for the error in the measurements for a given experiment.

In the case of the TLD measurements we have made an exception to the normal procedure and attempted to calculate the probable error for measurements made at individual voids in the configurations. From experience we have found there are many things that can affect the

reliability of the measurements using TLDs. Of these, the most recognized ones are found in determination of chip weights, their relative sensitivities to radiation exposure, calibration of the TLD reader, change in chip sensitivity with use, determination of the reactor power, orientation of the chips in the configuration voids, weather conditions during the run, abuse of the chips during handling, changes in background exposure, and TLD calibration. Of these, the effect of the variations in weather, orientation of the TLDs in the voids and abuse to the chips in handling on the results of the measurements are indeterminable and were not estimated. Established procedures were used throughout the experiment to minimize the magnitude of the errors. Calculation of the most probable error value for the remaining contributors stated above, using our best estimates, gave values of about 3% or less for all the TLD measurements. Combining these estimates with the standard deviation values for the chip readouts (square root of the sum of the two squares) gives the error values listed in Table 20.

TABLES

Table 1. Analysis of iron slabs (ρ 7.86 g/cc) used in spectrum modifier

Element	wt %
Fe	98.4
C	.25
Cr	.15
Cu	.03
Mn	1.0
Mo	.02
Ni	.05
Si	.25

Table 2. Analysis of aluminum slabs (ρ 2.70 g/cc) used in spectrum modifier

Element	wt %
Al	98
Mg, Fe, Si	2

Table 3. Composition of boron slabs used in spectrum modifier

(B ₄ C - 40-43 vol % in B ₄ C-Al mixture)			
Element	Density (g/cc)	Elemental Composition (wt %)	With Al Cladding (wt %)
B ₄ C	2.3		
Al	2.70	65	~75
B		27.5	~19.6
C		7.5	~5.4

Table 4. Analysis of ThO₂ powder used in radial blanket

Element	Batch (ppm)				
	0318	0320	0322	0330	0332
Al	3.	<1.	<1.	<1.	30.
B	<0.1	<0.1	0.2	M	1.
Ba	<1.	<1.	<1.	<1.	<1.
Ca	1.	20.	1.	1.	1.
Co	<0.5	<0.5	<0.5	<0.5	<0.5
Cr	10.	100.	100.	30.	3
Cu	20.	20.	20.	5.	5.
Fe	100.	300.	100.	300.	100.
K	1.	1.	2.	10.	10.
Mg	<5.	<5.	<5.	<5.	<5.
Mn	5.	1.	5.	2.	3.
Na	<1.	<1.	1.	10.	1.
Ni	10.	10.	10.	5.	5.
P	50.	200.	50.	300.	100.
Si	<10.	<10.	<10.	<10.	<10.
²³⁰ Th	<1.	<1.	<1.	<1.	<1.
²³⁸ U	<2.	2.	≤5.	4.	12.
²³³ U	<1.	<1.	<1.	<1.	<1.
Zn	10.	2.	5.	1.	2.

Table 5. Analysis of type 304L stainless steel used in ThO₂ radial blanket and (B₄C + C) containers

Element	Semi-quantitative (wt %)	Photoelectric (wt %)	Analytical
B	~.0015	--	--
C	--	--	202 ppm
Cr	M	--	18.0 wt %
Co	.2	--	--
Cu	.3	--	--
Fe	M	M	--
Mn	2	--	1.82 wt %
Mo	.3	--	--
Nb	<.05	--	--
Ni	M	M	8.53 wt %
Si	.8	0.6	0.6 wt %
Ta	<.05	--	--
Ti	<.01	0.03	0.03 wt %
V	.08	--	--

Table 6. Composition of lithium-paraffin bricks

Element	wt %
CH ₄	60
LiCO ₃	40
ρ = 1.15 g/cc	

Table 7. Analysis of 61-cm X 61-cm X 30.5-cm concrete blocks used to surround configuration

Element	wt %	Element	wt %
CO ₃	41.9	Al ₂ O ₃	2.2
Ca	27.4	Fe ₂ O ₃	.60
SiO ₂	18.1	SO ₃	.32
H ₂ O	4.0	P ₂ O ₅	.035
Mg	3.66	K	.30
O ₂	1.4		

Table 8. Composition of UO₂ radial blanket

Element	vol %	Density			
UO ₂ (pellets)	64.6	10.28			
Al (8001)	11.2	2.8			
Na	23.2	0.92			
Void	1.0	--			
UO ₂ content 88.18 wt %					
Isotope %					
²³⁴ U	.0053	²³⁶ U --			
²³⁵ U	.713	²³⁸ U 99.28			
Metallic impurities in UO ₂ (ppm)					
Al	<20	Cu	1	Na	<20
B	<1	F	<2	Ni	<10
Be	<2	Fe	<20	Pb	<4
Bi	<2	H ₂ O	2.1	Si	<20
C	<10	Li	<1	Sn	<2
Ca	<20	Mg	<10	Ta	<25
Cd	<.5	Mn	<4	Tu	<4
Cl	<3.3	Mo	<10	W	<25
Co	<2	N	54	Zr	<25
Cr	<10				

Table 9. Analysis of aluminum used in UO₂ cladding

Element	wt %	ppm
Fe	.59	
Ni	1.13	
B		<6
Be		<20
Cd		<20
Co		<20
Cr		<6
Cu		52.9
Li		6
Ng		3.04
Mn		11.2
Mo		<6
Pb		<20
Si		27.5
Sn		<60
Ta		<2000
Ti		65.5
V		44.2
W		<60
Zr		<20

Table 10. Analysis of (B₄C + C) in 5.1-cm and 12.7-cm containers

Element	Container		Element	Container	
	5.07 cm	14.45 cm		5.07 cm	14.45 cm
Ag	<1	<1	Li	≤1	≤1
Al	80	100	Hg	50	20
B	27.2-27.75%	26.18-27.15%	Mn	40	20
Ba	15	20	Mo	<5	<5
Be	<1	<1	Na	60	5
Bi	<5	<5	Nb	<20	<20
C	66.4%	66.4%	Ni	10	10
Ca	600	400	Pb	<5	<5
Cd	<25	<25	Rb	<5	<5
Co	<5	<5	Sb	<10	<10
Cr	15	10	Si	2000	1000
Cs	<20	<20	Sn	<5	<5
Cu	5	3	Sr	10	10
Fe	1000	700	Ta	<120	<120
Ga	<5	<5	Ti	80	60
Ge	15	10	V	<5	<5
Hg	<10	<10	W	<30	<30
K	<5	<5	Zn	<100	<100
			Zr	<10	<10

Table 11. Analysis of graphite slabs (ρ 1.73 g/cc) used in radial shield

Element	wt %	Element	wt %
Ag	<.005	Mn	<.001
Al	.007	Mo	<.001
Au	<.005	Na	.002
B	<.001	Nb	<.005
Ba	.007	Ni	<.001
Be	<.0001	Pb	<.002
Bi	<.002	Pt	<.005
Ca	.07	Rb	<.002
Cd	<.005	Sb	<.005
Co	<.002	Si	.01
Cr	<.002	Sn	<.002
Cs	<.005	Sr	<.001
Cu	<.001	Ta	<.005
Fe	.02	Te	<.01
Ga	<.002	Ti	.005
Ge	<.002	V	<.002
Hg	<.005	W	<.005
K	.002	Zn	<.005
Li	.002	Zr	<.005
Mg	.001		

Table 12. Analysis of type 304 stainless steel slabs used in radial shield

Element	2.54-cm Thick (wt %)	5.08-cm Thick (wt %)
Fe	71.2	68.1 - 69.3
Cr	18.3	18.7 - 19.1
Ni	8.8	9.6 - 9.8
Mn	1.3	1.04 - 1.65
Si	.35	.33 - .65
C	.039	.024 - .085
O ₂	.015	.013 - .021
P	.028	.028
S	.022	.022
Mo	.30	.30
Cu	.26	.26
Co	.10	.10

Table 13. Runs 7776B, 7773C. NE213 on centerline at 396.9 cm beyond boral (Item I-A)

NEUTRON ENERGY (MEV)	FLUX (N/(CM2*S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM2*S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
8.1135E-01	3.3933E 04	3.4973E 04	5.9380E 00	1.6075E 03	1.6585E 03
9.0694E-01	4.2994E 04	4.3535E 04	6.2542E 00	1.3262E 03	1.3932E 03
1.0066E 00	4.2294E 04	4.2713E 04	6.5557E 00	1.1484E 03	1.2034E 03
1.1069E 00	3.7025E 04	3.7425E 04	6.8390E 00	1.0146E 03	1.0522E 03
1.2047E 00	3.2563E 04	3.2914E 04	7.2352E 00	8.4515E 02	8.7422E 02
1.3096E 00	2.8882E 04	2.9215E 04	7.7365E 00	6.6047E 02	6.9390E 02
1.4121E 00	2.6027E 04	2.6353E 04	8.2364E 00	5.1600E 02	5.4475E 02
1.5107E 00	2.4097E 04	2.4394E 04	8.7578E 00	3.9710E 02	4.1619E 02
1.6100E 00	2.2578E 04	2.2844E 04	9.2613E 00	3.0175E 02	3.1761E 02
1.7095E 00	2.1053E 04	2.1307E 04	9.7411E 00	2.2262E 02	2.3718E 02
1.8125E 00	1.9398E 04	1.9640E 04	1.0259E 01	1.5956E 02	1.7208E 02
1.9323E 00	1.7529E 04	1.7760E 04	1.0777E 01	1.2588E 02	1.3649E 02
2.1000E 00	1.5103E 04	1.5320E 04	1.1247E 01	1.0800E 02	1.1758E 02
2.2961E 00	1.2527E 04	1.2725E 04	1.1751E 01	9.1814E 01	9.9983E 01
2.4988E 00	1.0323E 04	1.0485E 04	1.2393E 01	6.9672E 01	7.6422E 01
2.7026E 00	8.5599E 03	8.7201E 03	1.3201E 01	4.0980E 01	4.5837E 01
2.8984E 00	7.3825E 03	7.5348E 03	1.4021E 01	2.2098E 01	2.5838E 01
3.0975E 00	6.3885E 03	6.5481E 03	1.4792E 01	1.5541E 01	1.8480E 01
3.2965E 00	5.5036E 03	5.6248E 03	1.5629E 01	1.0742E 01	1.3086E 01
3.5009E 00	4.7898E 03	4.9302E 03	1.6539E 01	4.9532E 00	6.6371E 00
3.7074E 00	4.2694E 03	4.3779E 03	1.7533E 01	7.4483E-01	2.2333E 00
3.9061E 00	3.9097E 03	4.0027E 03	1.8521E 01	-9.8890E-01	5.7909E-01
4.1528E 00	3.6422E 03	3.7314E 03	1.9498E 01	-1.2564E 00	2.3763E-01
4.4540E 00	3.3916E 03	3.4642E 03	2.0556E 01	-1.1962E 00	2.9177E-01
4.7521E 00	3.0510E 03	3.1187E 03	2.1580E 01	-7.8869E-01	6.4863E-01
5.0422E 00	2.6280E 03	2.6860E 03	2.2560E 01	-6.8168E-01	7.8890E-01
5.3459E 00	2.2295E 03	2.2841E 03	2.3471E 01	-6.3220E-01	9.5554E-01
5.6453E 00	1.9125E 03	1.9711E 03			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM2*S*MEV*KW))	EFBS (N/(CM2*S*MEV*KW))
0.811	1.000	7.8653E 03	5.7148E 01
1.000	1.200	7.5411E 03	3.9583E 01
1.200	1.600	1.0793E 04	6.3725E 01
1.600	2.000	7.8939E 03	4.8905E 01
2.000	3.000	1.0871E 04	8.5118E 01
3.000	4.000	5.0400E 03	6.1873E 01
4.000	6.000	5.4502E 03	6.5242E 01
6.000	8.000	1.9905E 03	4.2050E 01
8.000	10.000	7.3973E 02	1.5425E 01
10.000	12.000	2.5505E 02	1.0254E 01
12.000	16.000	1.3594E 02	8.2602E 00
16.000	20.000	7.1495E 01	3.1519E 00
1.500	15.000	3.4728E 04	3.5652E 02

Table 14. Runs 1459A, 1460A, 1461NB. Hydrogen counter on centerline beyond the boral (*Item I-A*)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0570	0.0678	8.8339E 05	1.76
2	0.0678	0.0786	8.8067E 05	1.94
3	0.0786	0.0930	4.5768E 05	2.96
4	0.0930	0.1092	2.7269E 05	4.97
5	0.1092	0.1290	4.4959E 05	2.71
6	0.1290	0.1524	3.7236E 05	3.01
7	0.1524	0.1794	2.1996E 05	4.90
9	0.1794	0.2100	2.3805E 05	4.45
1	0.1525	0.1797	2.1724E 05	2.24
2	0.1797	0.2114	2.2900E 05	2.08
3	0.2114	0.2476	2.3612E 05	1.98
4	0.2476	0.2929	2.9024E 05	1.39
5	0.2929	0.3427	2.2640E 05	1.78
6	0.3427	0.4015	1.9239E 05	1.90
1	0.2964	0.3508	2.1036E 05	1.19
2	0.3508	0.4051	1.8747E 05	1.48
3	0.4051	0.4776	1.3880E 05	1.59
4	0.4776	0.5683	1.2676E 05	1.50
5	0.5683	0.6680	1.2210E 05	1.54
6	0.6680	0.7767	8.7699E 04	2.11
7	0.7767	0.9218	6.8215E 04	2.09
8	0.9218	1.0849	6.1931E 04	2.18
9	1.0849	1.2752	4.3660E 04	2.74
10	1.2752	1.4927	3.2381E 04	3.34

Table 15. Bonner ball measurements

Item	Shield configuration	Distance on centerline behind configuration (cm)	Bonner ball count rate ($s^{-1}W^{-1}$)					
			3-in.-diam		6-in.-diam		10-in.-diam	
			Fore-ground ^a	Back-ground ^b	Fore-ground	Back-ground	Fore-ground	Back-ground
I-A	SM (10.2-cm Fe + 8.9-cm Al + 2.54-cm Boral)	30.5	2.08(3) ^c	--	1.37(4)	--	6.53(3)	--
		305	1.22(2)	2.29(1)	7.14(2)	6.55(1)	3.18(2)	2.22(1)
		396.9	7.85(1)	2.19(1)	4.50(2)	6.40(1)	2.02(2)	2.17(1)
I-B	SM + 6.76-cm ThO ₂	30.5	1.39(3)	--	8.78(3)	--	3.61(3)	--
		305	7.20(1)	1.21(1)	3.81(2)	3.63(1)	1.67(2)	1.19(1)
I-C	SM + 13.6-cm ThO ₂	30.5	8.02(2)	--	4.51(3)	--	1.75(3)	--
		305	4.10(1)	7.46(0)	2.13(2)	2.13(1)	8.03(1)	6.43(0)
	Repeat I-C	30.5	8.46(2)	--	4.58(3)	--	1.75(3)	--
		305	4.49(1)	--	2.17(2)	3.03(1)	8.17(1)	8.50(0)
1332.5	1.57(0)	7.23(-2)	8.66(0)	1.37(-1)	3.62(0)	3.46(-2)		
I-D	SM + 27.4-cm ThO ₂	30.5	2.36(2)	--	1.20(3)	--	3.89(2)	--
		305	1.24(1)	2.50(0)	5.41(1)	6.45(0)	1.83(1)	1.80(0)
		1314.1	4.76(-1)	1.94(-2)	2.31(0)	3.41(-2)	8.26(-1)	8.60(-3)
I-E	SM + 40.7-cm ThO ₂	30.5	6.30(1)	--	2.70(2)	--	8.07(1)	--
		305	3.52(0)	7.00(-1)	1.30(1)	1.62(0)	4.55(0)	4.10(-1)
		1296.4	1.37(-1)	6.55(-3)	5.46(-1)	1.10(-2)	1.83(-1)	2.70(-3)
II-A	SM + 30.6-cm UO ₂	30.5	2.66(2)	--	1.24(3)	--	4.07(2)	--
		285.4	1.63(1)	2.86(0)	6.73(1)	7.27(0)	2.26(1)	2.03(0)
		305	1.48(1)	2.88(0)	6.08(1)	7.24(0)	2.02(1)	2.01(0)
II-B	SM + 30.6-cm UO ₂ + 14.45-cm (B ₄ C + C) + 15.2-cm SS	30.5	7.55(0)	--	3.27(1)	--	1.17(1)	--
		305	4.71(-1)	1.27(-1)	1.82(0)	2.78(-1)	6.42(-1)	7.56(-2)
		1277.2	1.87(-2)	1.28(-3)	8.33(-2)	1.91(-3)	3.11(-2)	5.76(-4)
III-A	SM + 40.7-cm ThO ₂ + 14.45-cm (B ₄ C ² + C)	30.5	5.38(0)	--	2.43(1)	--	7.89(0)	--
		305	3.39(-1)	8.81(-2)	1.36(0)	2.01(-1)	4.50(-1)	5.27(-2)
		1280.6	1.33(-2)	6.22(-4)	5.89(-2)	9.86(-4)	2.06(-2)	2.60(-4)
III-B	SM + 40.7-cm ThO ₂ + 14.45-cm (B ₄ C + C) + 15.2-cm SS	30.5	6.83(-1)	--	5.20(0)	--	1.67(0)	--
		305	8.63(-2)	2.73(-2)	2.98(-1)	5.37(-2)	9.17(-2)	1.37(-2)
		1263	3.28(-3)	1.62(-4)	1.27(-2)	2.48(-4)	4.23(-3)	6.02(-5)
IV-A	SM + 40.7-cm ThO ₂ + 14.45-cm (B ₄ C + C) + 19.65-cm SS + 5.1-cm (B ₄ C + C)	30.5	2.97(-1)	--	1.45(0)	--	4.69(-1)	--
		305	2.32(-2)	9.60(-3)	8.68(-2)	1.88(-2)	2.75(-2)	4.85(-3)

Table 15. (Continued)

Item	Shield configuration	Distance on centerline behind configuration (cm)	Bonner ball count rate ($s^{-1}W^{-1}$)					
			3-in.-diam		6-in.-diam		10-in.-diam	
			Fore-ground	Back-ground	Fore-ground	Back-ground	Fore-ground	Back-ground
IV-B	SM + 40.7-cm ThO_2 + 14.45-cm (B_4C + C) + 19.65-cm SS + 5.1-cm (B_4C + C) + 22.9-cm graphite	30.5	1.36(-1)	--	1.89(-1)	--	3.93(-2)	--
		305	8.06(-3)	2.32(-3)	1.16(-2)	3.38(-3)	2.65(-3)	7.84(-4)
IV-C	SM + 40.7-cm ThO_2 + 14.45-cm (B_4C + C) + 19.65-cm SS + 5.1-cm (B_4C + C) + 22.9-cm graphite + 4.93-cm (B_4C + C) + 4.45-cm SS	18	4.75(-3)	--	1.38(-2)	--	3.98(-3)	--
		30.5	3.87(-3)	--	1.09(-2)	--	3.10(-3)	--
		305	1.63(-3)	1.45(-3)	2.94(-3)	2.46(-3)	7.79(-4)	6.33(-4)
		1210.5	1.75(-5)	8.23(-6)	4.07(-5)	1.08(-5)	1.30(-5)	2.77(-6)
IV-D	SM + 40.7-cm ThO_2 + 14.45-cm (B_4C + C) + 19.65-cm SS + 5.1-cm (B_4C + C) + 22.9-cm graphite + 4.93-cm (B_4C + C) + 2.54-cm Fe + 61-cm concrete	17.8	9.09(-3)	--	2.13(-2)	--	5.55(-3)	--
IV-E	SM + 14.45-cm (B_4C + C) + 19.7-cm SS + 5.1-cm (B_4C + C) + 22.9-cm graphite + 4.93-cm (B_4C + C) + 4.45-cm SS	30.5	7.76(-1)	--	2.64(0)	--	7.81(-1)	--
		305	4.40(-2)	1.13(-2)	1.35(-1)	2.23(-2)	4.04(-2)	5.61(-3)
		1264.9	1.73(-3)	9.27(-5)	5.82(-3)	1.05(-4)	1.97(-3)	2.81(-5)
V-A	SM + 30.6-cm UO_2	30.5	2.67(2)	--	1.16(3)	--	4.05(2)	--
V-B	SM + 30.6-cm UO_2 + 15.2-cm graphite	30.5	2.04(2)	--	3.93(2)	--	1.06(2)	--
		305	1.05(1)	1.88(0)	1.98(1)	2.77(0)	5.34(0)	6.55(-1)
		1294.4	3.76(-1)	1.07(-2)	7.43(-1)	1.40(-2)	2.15(-1)	3.25(-3)
V-C	SM + 30.6-cm UO_2 + 15.2-cm graphite + 14.45-cm (B_4C + C) + 4.45-cm SS	30.5	2.05(0)	--	1.15(1)	--	5.28(0)	--
		305	1.38(-1)	4.04(-2)	6.50(-1)	9.99(-2)	2.99(-1)	3.54(-2)
		1270	5.64(-3)	2.42(-4)	3.09(-2)	4.40(-4)	1.57(-2)	1.50(-4)
V-D	SM + 30.6-cm UO_2 + 15.2-cm graphite + 14.45-cm (B_4C + C) + 19.7-cm SS	30.5	7.56(-1)	--	3.98(0)	--	9.70(-2)	--
		305	4.91(-2)	1.40(-2)	2.19(-1)	3.41(-2)	3.81(-3)	4.92(-4)
V-E	SM + 30.6-cm UO_2 + 14.45-cm (B_4C + C) + 4.45-cm SS	30.5	1.50(1)	--	7.37(1)	--	2.82(1)	--
		305	9.26(-1)	2.43(-1)	4.14(0)	5.94(-1)	1.58(0)	1.68(-1)
VI-D	30.6-cm UO_2 + SM	1313.3	2.30(0)	1.14(-1)	9.87(0)	2.06(-1)	3.22(0)	4.94(-2)

^aNeutron flux without shadow shield between configuration and detector.

^bNeutron flux with shadow shield between configuration and detector.

^cRead: 2.08×10^3 .

Table 16. Runs 7776B, 7773C, 7772C, 7776C. Gamma-ray spectrum on centerline beyond spectrum modifier (Item I-A)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2000E-01	1.2279E 05	2.1815E 05	3.9250E 00	2.6315E 04	2.7361E 04
7.6000E-01	1.6244E 05	2.0122E 05	4.0550E 00	2.6130E 04	2.7170E 04
8.0000E-01	1.7315E 05	1.8424E 05	4.1850E 00	2.5383E 04	2.6520E 04
8.4000E-01	1.7059E 05	1.7485E 05	4.3150E 00	2.4257E 04	2.5559E 04
8.8000E-01	1.6637E 05	1.6959E 05	4.4450E 00	2.2900E 04	2.4394E 04
9.2000E-01	1.6342E 05	1.6668E 05	4.5750E 00	2.0856E 04	2.2430E 04
9.6000E-01	1.6113E 05	1.6426E 05	4.7050E 00	1.7718E 04	1.9320E 04
1.0000E 00	1.5876E 05	1.6172E 05	4.8350E 00	1.3887E 04	1.5595E 04
1.0400E 00	1.5639E 05	1.5907E 05	4.9850E 00	1.0409E 04	1.2362E 04
1.0800E 00	1.5385E 05	1.5647E 05	5.1550E 00	9.9945E 03	1.2052E 04
1.1250E 00	1.5065E 05	1.5326E 05	5.3250E 00	1.3086E 04	1.5274E 04
1.1750E 00	1.4705E 05	1.4965E 05	5.4950E 00	1.6378E 04	1.8735E 04
1.2250E 00	1.4376E 05	1.4681E 05	5.6650E 00	1.6501E 04	1.8931E 04
1.2750E 00	1.4134E 05	1.4455E 05	5.8350E 00	1.2754E 04	1.5007E 04
1.3250E 00	1.4001E 05	1.4254E 05	6.0050E 00	7.5238E 03	9.6617E 03
1.3750E 00	1.3837E 05	1.4062E 05	6.1750E 00	4.4224E 03	6.4734E 03
1.4250E 00	1.3602E 05	1.3837E 05	6.3450E 00	5.4374E 03	7.2647E 03
1.4750E 00	1.3378E 05	1.3590E 05	6.5150E 00	9.6514E 03	1.1328E 04
1.5250E 00	1.3222E 05	1.3425E 05	6.7000E 00	1.5020E 04	1.6451E 04
1.5750E 00	1.3129E 05	1.3322E 05	6.9000E 00	1.8753E 04	1.9921E 04
1.6400E 00	1.3020E 05	1.3203E 05	7.1000E 00	1.9230E 04	2.0322E 04
1.7200E 00	1.2725E 05	1.2894E 05	7.3000E 00	1.7614E 04	1.8674E 04
1.8000E 00	1.2130E 05	1.2296E 05	7.5000E 00	1.5256E 04	1.6084E 04
1.8900E 00	1.1581E 05	1.1749E 05	7.7000E 00	1.2791E 04	1.3502E 04
1.9600E 00	1.1591E 05	1.1770E 05	7.9000E 00	1.0312E 04	1.1006E 04
2.0400E 00	1.2054E 05	1.2234E 05	8.1000E 00	7.9059E 03	8.4476E 03
2.1200E 00	1.2248E 05	1.2427E 05	8.3000E 00	5.6501E 03	6.0061E 03
2.2000E 00	1.1643E 05	1.1812E 05	8.5000E 00	3.6778E 03	3.9358E 03
2.2800E 00	1.0399E 05	1.0552E 05	8.7250E 00	1.9995E 03	2.2391E 03
2.3600E 00	9.0507E 04	9.1843E 04	8.9750E 00	9.8910E 02	1.0723E 03
2.4500E 00	7.8238E 04	7.9408E 04	9.2250E 00	3.4872E 02	4.5829E 02
2.5500E 00	6.8037E 04	6.9122E 04	9.4750E 00	1.2334E 02	1.7689E 02
2.6500E 00	6.0057E 04	6.1107E 04	9.7250E 00	3.9981E 01	6.2633E 01
2.7500E 00	5.4075E 04	5.5105E 04	9.9750E 00	1.2020E 01	2.0588E 01
2.8500E 00	4.9568E 04	5.0573E 04	1.0300E 01	2.2637E 00	4.4008E 00
2.9500E 00	4.5872E 04	4.6863E 04	1.0700E 01	2.8196E-01	6.0061E-01
3.0500E 00	4.2916E 04	4.3899E 04	1.1100E 01	-2.2306E-02	5.4640E-02
3.1500E 00	4.0674E 04	4.1665E 04	1.1500E 01	-1.8385E-03	2.1707E-03
3.2500E 00	3.8887E 04	3.9896E 04	1.1900E 01	-1.8973E-03	2.0050E-03
3.3500E 00	3.7227E 04	3.8190E 04	1.2300E 01	-1.7680E-03	1.9016E-03
3.4500E 00	3.5179E 04	3.6075E 04	1.2700E 01	-1.4286E-03	1.7560E-03
3.5500E 00	3.2445E 04	3.3435E 04	1.3100E 01	-1.2845E-03	1.5511E-03
3.6650E 00	2.9195E 04	3.0276E 04	1.3500E 01	-1.0665E-03	1.3308E-03
3.7950E 00	2.6895E 04	2.7976E 04	1.3900E 01	-7.9345E-04	1.1592E-03

Table 17. Runs 7814B, 7815B. NE213 on centerline at 1314.1 cm beyond spectrum modifier plus 27.4-cm ThO₂ (Item I-D)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
8.1135E-01	1.0408E 02	1.0505E 02	5.9380E 00	4.3539E 00	4.4504E 00
9.0694E-01	8.9121E 01	8.9679E 01	6.2542E 00	3.7975E 00	3.9215E 00
1.0066E 00	6.9638E 01	7.0075E 01	6.5557E 00	3.3118E 00	3.4147E 00
1.1069E 00	6.3108E 01	6.3557E 01	6.8390E 00	2.8814E 00	2.9526E 00
1.2047E 00	6.2062E 01	6.2463E 01	7.2352E 00	2.3346E 00	2.3899E 00
1.3096E 00	5.9864E 01	6.0260E 01	7.7365E 00	1.7619E 00	1.8274E 00
1.4121E 00	5.6994E 01	5.7404E 01	8.2364E 00	1.3413E 00	1.3997E 00
1.5107E 00	5.4198E 01	5.4578E 01	8.7578E 00	1.0164E 00	1.0528E 00
1.6100E 00	5.0615E 01	5.0953E 01	9.2613E 00	7.6606E-01	7.9552E-01
1.7095E 00	4.6451E 01	4.6787E 01	9.7411E 00	5.7741E-01	6.0369E-01
1.8125E 00	4.2791E 01	4.3114E 01	1.0259E 01	4.1967E-01	4.4218E-01
1.9323E 00	4.0794E 01	4.1105E 01	1.0777E 01	3.1012E-01	3.2842E-01
2.1000E 00	4.1563E 01	4.1858E 01	1.1247E 01	2.3819E-01	2.5424E-01
2.2961E 00	4.0958E 01	4.1230E 01	1.1751E 01	1.7603E-01	1.8971E-01
2.4988E 00	3.4543E 01	3.4759E 01	1.2393E 01	1.1391E-01	1.2534E-01
2.7026E 00	2.6226E 01	2.6443E 01	1.3201E 01	6.6368E-02	7.4187E-02
2.8944E 00	1.9487E 01	1.9697E 01	1.4021E 01	4.1774E-02	4.7699E-02
3.0975E 00	1.3922E 01	1.4145E 01	1.4792E 01	2.7550E-02	3.2266E-02
3.2965E 00	9.7271E 00	9.9011E 00	1.5629E 01	1.4656E-02	1.7911E-02
3.5009E 00	7.3438E 00	7.5523E 00	1.6539E 01	4.7810E-03	7.1761E-03
3.7074E 00	6.5374E 00	6.7040E 00	1.7533E 01	-2.1643E-04	1.8877E-03
3.9061E 00	6.4819E 00	6.6276E 00	1.8521E 01	-1.7843E-03	4.2659E-04
4.1528E 00	6.7922E 00	6.9359E 00	1.9498E 01	-1.7616E-03	3.5034E-04
4.4540E 00	6.9898E 00	7.1129E 00	2.0556E 01	-1.5675E-03	5.3534E-04
4.7521E 00	6.6550E 00	6.7727E 00	2.1580E 01	-1.0536E-03	9.7745E-04
5.0422E 00	6.0352E 00	6.1392E 00	2.2560E 01	-9.8654E-04	1.0899E-03
5.3459E 00	5.3984E 00	5.4983E 00	2.3471E 01	-9.5716E-04	1.2834E-03
5.6453E 00	4.8634E 00	4.9748E 00			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	1.6800E 01	5.7405E-02
1.000	1.200	1.2950E 01	4.3741E-02
1.200	1.600	2.2948E 01	7.8297E-02
1.600	2.000	1.7716E 01	6.4880E-02
2.000	3.000	3.2641E 01	1.2124E-01
3.000	4.000	8.9135E 00	9.1240E-02
4.000	6.000	1.2002E 01	1.1474E-01
6.000	8.000	5.5320E 00	7.9613E-02
8.000	10.000	1.8925E 00	3.7269E-02
10.000	12.000	5.9551E-01	1.7695E-02
12.000	16.000	2.2764E-01	1.3276E-02
16.000	20.000	6.4268E-02	4.4555E-03
1.500	15.000	9.4766E 01	5.5690E-01
3.000	12.000	2.8932E 01	3.4094E-01

Table 18. Runs 7814B, 7814C, 7815C, 7815C. Gamma-ray spectrum on center-line beyond spectrum modifier plus 27.4-cm ThO₂ (Item I-D)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2600E-01	8.2539E 01	1.5817E 02	3.9250E 00	1.2577E 01	1.3331E 01
7.6000E-01	1.2501E 02	1.5560E 02	4.0550E 00	1.1747E 01	1.2511E 01
8.0000E-01	1.4124E 02	1.4976E 02	4.1950E 00	1.1229E 01	1.2052E 01
8.4000E-01	1.4392E 02	1.4708E 02	4.3150E 00	1.0861E 01	1.1795E 01
8.9000E-01	1.4380E 02	1.4608E 02	4.4450E 00	1.0533E 01	1.1596E 01
9.2000E-01	1.4356E 02	1.4568E 02	4.5750E 00	9.9784E 00	1.1109E 01
9.6000E-01	1.4273E 02	1.4455E 02	4.7050E 00	9.8083E 00	9.9739E 00
1.0000E 00	1.4117E 02	1.4288E 02	4.8350E 00	6.8904E 00	8.1334E 00
1.0400E 00	1.3921E 02	1.4092E 02	4.9850E 00	4.5076E 00	5.9002E 00
1.0900E 00	1.3738E 02	1.3907E 02	5.1550E 00	3.3378E 00	4.8449E 00
1.1250E 00	1.3565E 02	1.3728E 02	5.3250E 00	4.9839E 00	6.5503E 00
1.1750E 00	1.3320E 02	1.3500E 02	5.4950E 00	8.2760E 00	9.9956E 00
1.2250E 00	1.3031E 02	1.3252E 02	5.6650E 00	1.0842E 01	1.2605E 01
1.2750E 00	1.2822E 02	1.3061E 02	5.8350E 00	1.0993E 01	1.2612E 01
1.3250E 00	1.2753E 02	1.2947E 02	6.0050E 00	3.9874E 00	1.0487E 01
1.3750E 00	1.2693E 02	1.2848E 02	6.1750E 00	6.5537E 00	8.0638E 00
1.4250E 00	1.2549E 02	1.2695E 02	6.3450E 00	5.6652E 00	7.0317E 00
1.4750E 00	1.2361E 02	1.2506E 02	6.5150E 00	6.9142E 00	8.0557E 00
1.5250E 00	1.2188E 02	1.2340E 02	6.7000E 00	9.5875E 00	1.0610E 01
1.5750E 00	1.2074E 02	1.2239E 02	6.9000E 00	1.2094E 01	1.2957E 01
1.6400E 00	1.1979E 02	1.2136E 02	7.1000E 00	1.2604E 01	1.3363E 01
1.7200E 00	1.1799E 02	1.1936E 02	7.3000E 00	1.1194E 01	1.1869E 01
1.8000E 00	1.1490E 02	1.1619E 02	7.5000E 00	8.7930E 00	9.4174E 00
1.8900E 00	1.1243E 02	1.1370E 02	7.7000E 00	6.5527E 00	7.0693E 00
1.9600E 00	1.1248E 02	1.1382E 02	7.9000E 00	5.0223E 00	5.4314E 00
2.0400E 00	1.1373E 02	1.1510E 02	8.1000E 00	4.1152E 00	4.4937E 00
2.1200E 00	1.1237E 02	1.1374E 02	8.3000E 00	3.5520E 00	3.8696E 00
2.2000E 00	1.0589E 02	1.0718E 02	8.5000E 00	3.0044E 00	3.2205E 00
2.2900E 00	9.5146E 01	9.6326E 01	8.7250E 00	2.2589E 00	2.3963E 00
2.3600E 00	8.7037E 01	9.4102E 01	8.9750E 00	1.4011E 00	1.5274E 00
2.4500E 00	7.0394E 01	7.1325E 01	9.2250E 00	7.4404E-01	8.4470E-01
2.5500E 00	5.8535E 01	5.9392E 01	9.4750E 00	3.4685E-01	4.0946E-01
2.6500E 00	4.9265E 01	5.0107E 01	9.7250E 00	1.4393E-01	1.7568E-01
2.7500E 00	4.2502E 01	4.3304E 01	9.9750E 00	5.3486E-02	6.9916E-02
2.8500E 00	3.7243E 01	3.7998E 01	1.0300E 01	1.1313E-02	1.9926E-02
2.9500E 00	3.2636E 01	3.3349E 01	1.0700E 01	-1.0592E-04	5.0163E-03
3.0500E 00	2.9600E 01	2.9353E 01	1.1100E 01	-1.9134E-03	2.3813E-03
3.1500E 00	2.5608E 01	2.6316E 01	1.1500E 01	-2.0836E-03	1.9869E-03
3.2500E 00	2.3449E 01	2.4157E 01	1.1900E 01	-2.0178E-03	1.9206E-03
3.3500E 00	2.1728E 01	2.2412E 01	1.2300E 01	-1.8233E-03	1.8659E-03
3.4500E 00	1.9992E 01	2.0647E 01	1.2700E 01	-1.4840E-03	1.7106E-03
3.5500E 00	1.8096E 01	1.8912E 01	1.3100E 01	-1.3598E-03	1.4854E-03
3.6500E 00	1.5960E 01	1.6729E 01	1.3500E 01	-1.1509E-03	1.2562E-03
3.7500E 00	1.3962E 01	1.4723E 01	1.3900E 01	-8.6941E-04	1.0920E-03

Table 19. Runs 1465B, 1467A, 1466A. Hydrogen counter on centerline beyond spectrum modifier plus 27.4-cm ThO₂ (Item I-D)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0581	0.0672	5.6770E 03	1.57
2	0.0672	0.0800	5.6015E 03	1.20
3	0.0800	0.0947	4.4282E 03	1.42
4	0.0947	0.1112	3.4474E 03	1.76
5	0.1112	0.1313	3.4200E 03	1.53
6	0.1313	0.1533	2.8583E 03	1.81
7	0.1533	0.1809	2.3603E 03	1.80
8	0.1809	0.2119	1.9176E 03	2.06
1	0.1552	0.1820	2.2255E 03	1.16
2	0.1820	0.2133	1.9149E 03	1.23
3	0.2133	0.2491	1.6031E 03	1.36
4	0.2491	0.2939	1.2566E 03	1.44
5	0.2939	0.3475	9.5322E 02	1.65
6	0.3475	0.4057	5.5246E 02	2.85
1	0.2928	0.3466	7.8204E 02	0.82
2	0.3466	0.4093	5.7339E 02	1.05
3	0.4093	0.4809	4.4235E 02	1.32
4	0.4809	0.5615	5.8263E 02	0.95
5	0.5615	0.6600	5.8290E 02	0.77
6	0.6600	0.7764	3.6944E 02	0.99
7	0.7764	0.9197	1.9436E 02	1.48
8	0.9197	1.0809	8.0749E 01	3.37
9	1.0809	1.2690	7.1593E 01	3.51
10	1.2690	1.4928	6.1350E 01	3.62

Table 20. *In situ* TLD measurements on centerline in voids beyond spectrum modifier

Item	Shield Configuration	TLD Pos	Detector response (uncorrected) MeV/(g.min.kW)	%SD ^a	Error ^b
I-D	SM + V ₁ + 6.76-cm ThO ₂ + V ₂ + 6.84-cm ThO ₂ + V ₃ + 13.8-cm ThO ₂	V ₁	5.87 X 10(7) ^c	1.04	±3.17
		V ₂	1.08 X 10(7)	1.95	±3.58
		V ₃	4.12 X 10(6)	1.37	±3.21
I-E	SM + V ₁ + 13.8-cm ThO ₂ + V ₂ + 6.76-cm ThO ₂ + V ₃ + 6.84-cm ThO ₂ + V ₄ + 13.3-cm ThO ₂	V ₁	5.83 X 10(7)	1.25	±2.36
		V ₂	4.66 X 10(6)	1.87	±2.74
		V ₃	2.40 X 10(6)	2.51	±3.15
		V ₄	1.13 X 10(6)	1.52	±2.43
I-F	SM + V ₁ + 13.8-cm ThO ₂ + V ₂ + 13.3-cm ThO ₂ + V ₃ + 6.76-cm ThO ₂ + V ₄ + 6.84-cm ThO ₂ + V ₅ + 25.4-cm Fe	V ₁	5.89 X 10(7)	1.40	±2.61
		V ₂	4.37 X 10(6)	0.91	±2.20
		V ₃	1.28 X 10(6)	1.06	±2.44
		V ₄	6.90 X 10(5)	1.59	±2.63
		V ₅	3.41 X 10(5)	1.40	±2.61
II-A	SM + V ₁ + 10.2-cm UO ₂ + V ₂ + 10.2-cm UO ₂ + V ₃ + 10.2-cm UO ₂	V ₁	5.76 X 10(7)	1.92	±3.23
		V ₂	7.58 X 10(6)	0.95	±2.77
		V ₃	2.71 X 10(6)	1.63	±2.98
IV-D	SM + ThO ₂ blanket + 12.7-cm (B ₄ C + C) + V ₁ + 15.2-cm SS + V ₂ + 4.45-cm SS + 5.1-cm (B ₄ C + C) + 22.9-cm graphite + 5.1-cm (B ₄ C + C) + 4.45-cm SS + V ₃ + 2.54-cm Fe + 61-cm concrete	V ₁	5.60 X 10(4)	2.95	±4.14
		V ₂	8.00 X 10(3)	2.15	±3.69
		V ₃	8.50 X 10(3)	2.42	±3.78
V-C	SM + UO ₂ blanket + V ₁ + 15.2-cm graphite + V ₂ + 12.7-cm (B ₄ C + C) + V ₃ + 4.45-cm SS	V ₁	1.98 X 10(6)	1.80	±3.16
		V ₂	1.02 X 10(6)	1.51	±3.09
		V ₃	1.35 X 10(5)	2.04	±3.23
V-D	SM + UO ₂ blanket + V ₁ + 15.2-cm graphite + V ₂ + 12.7-cm (B ₄ C + C) + V ₃ + 15.2-cm SS + V ₄ + 4.45-cm SS	V ₁	2.06 X 10(6)	1.61	±3.14
		V ₂	1.03 X 10(6)	1.94	±3.16
		V ₃	1.44 X 10(5)	2.03	±3.30
		V ₄	5.96 X 10(3)	3.35	±4.24
V-E	SM + UO ₂ blanket + V ₁ + 12.7-cm (B ₄ C + C) + V ₂ + 4.45-cm SS	V ₁	1.03 X 10(6)	2.95	±3.93
		V ₂	2.08 X 10(5)	1.97	±3.18

^aPercent standard deviation for TLD readouts^bError includes standard deviation^cRead: 5.87 X 10⁷

Table 21. Runs 7813B, 7813D. NE213 on centerline beyond spectrum modifier plus 40.7-cm ThO₂ (Item I-E)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
3.1125E-01	1.6972E 01	1.7218E 01	5.9380E 00	3.6867E-01	8.9493E-01
9.0694E-01	1.4296E 01	1.4436E 01	6.2542E 00	7.7376E-01	8.0803E-01
1.0066E 00	1.0974E 01	1.1086E 01	6.5557E 00	6.8761E-01	7.1609E-01
1.1069E 00	1.0007E 01	1.0123E 01	6.8390E 00	5.9754E-01	6.1734E-01
1.2047E 00	1.0072E 01	1.0177E 01	7.2352E 00	4.9085E-01	4.9669E-01
1.3096E 00	9.8710E 00	9.9728E 00	7.7365E 00	3.6621E-01	3.8429E-01
1.4121E 00	9.4774E 00	9.5792E 00	8.2364E 00	2.8752E-01	3.0305E-01
1.5177E 00	9.0724E 00	9.1711E 00	8.7578E 00	2.2756E-01	2.3790E-01
1.6100E 00	8.4227E 00	8.5121E 00	9.2613E 00	1.6912E-01	1.7764E-01
1.7095E 00	7.7719E 00	7.8599E 00	9.7411E 00	1.2462E-01	1.3221E-01
1.8125E 00	7.2746E 00	7.3603E 00	1.0259E 01	9.1332E-02	9.7869E-02
1.9227E 00	7.2092E 00	7.2925E 00	1.0777E 01	6.8502E-02	7.3919E-02
2.1000E 00	7.7521E 00	8.0307E 00	1.1247E 01	5.3574E-02	5.8341E-02
2.2961E 00	8.2779E 00	8.3501E 00	1.1751E 01	4.1547E-02	4.5692E-02
2.4989E 00	6.7254E 00	6.9922E 00	1.2393E 01	2.9675E-02	3.3145E-02
2.7026E 00	5.0696E 00	5.1275E 00	1.3201E 01	1.8650E-02	2.1084E-02
2.8984E 00	3.5940E 00	3.6491E 00	1.4021E 01	1.0931E-02	1.2694E-02
3.0975E 00	2.4139E 00	2.4732E 00	1.4792E 01	6.2857E-03	7.6035E-03
3.2965E 00	1.6237E 00	1.6696E 00	1.5629E 01	3.0914E-03	4.1123E-03
3.5009E 00	1.2079E 00	1.2637E 00	1.6539E 01	9.6263E-04	1.7506E-03
3.7074E 00	1.0840E 00	1.1287E 00	1.7533E 01	-1.1778E-04	5.8312E-04
3.9061E 00	1.0977E 00	1.1365E 00	1.8521E 01	-5.0390E-04	2.3229E-04
4.1529E 00	1.1746E 00	1.2137E 00	1.9498E 01	-5.0624E-04	1.9652E-04
4.4540E 00	1.2632E 00	1.2969E 00	2.0556E 01	-4.7964E-04	2.2057E-04
4.7521E 00	1.2462E 00	1.2786E 00	2.1580E 01	-3.3596E-04	3.4049E-04
5.0420E 00	1.1524E 00	1.1809E 00	2.2560E 01	-3.2737E-04	3.6466E-04
5.3459E 00	1.0524E 00	1.0799E 00	2.3471E 01	-3.2188E-04	4.2536E-04
5.6453E 00	9.613E-01	9.9172E-01			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.911	1.000	2.7034E 00	1.4476E-02
1.000	1.200	2.0629E 00	1.1285E-02
1.200	1.600	3.8032E 00	2.0259E-02
1.600	2.000	3.0338E 00	1.7190E-02
2.000	3.000	6.7850E 00	3.2145E-02
3.000	4.000	1.5151E 00	2.4303E-02
4.000	6.000	2.2596E 00	3.1359E-02
6.000	8.000	1.1451E 00	2.2140E-02
8.000	10.000	4.1614E-01	1.0426E-02
10.000	12.000	1.3394E-01	5.2327E-03
12.000	16.000	5.9405E-02	4.0447E-03
16.000	20.000	1.5162E-02	1.4765E-03
1.500	15.000	1.5816E 01	1.5119E-01
3.000	12.000	5.4692E 00	9.3520E-02

Table 22. Runs 1468A, 1470A, 1469C. Hydrogen counter on centerline beyond the spectrum modifier plus 40.7-cm ThO₂ (Item I-E)

N	ENERGY BOUNDARY (eV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0493	0.0596	1.4103E 03	1.03
2	0.0586	0.0678	1.1712E 03	1.36
3	0.0678	0.0807	1.1007E 03	1.09
4	0.0807	0.0937	1.0258E 03	1.27
5	0.0937	0.1103	7.6563E 02	1.37
6	0.1103	0.1306	7.1254E 02	1.27
7	0.1306	0.1528	5.8503E 02	1.50
8	0.1528	0.1805	4.6304E 02	1.55
9	0.1805	0.2115	3.6881E 02	1.79
1	0.1552	0.1821	4.1005E 02	0.66
2	0.1821	0.2134	3.5315E 02	0.71
3	0.2134	0.2492	3.2438E 02	0.71
4	0.2492	0.2939	2.4718E 02	0.76
5	0.2939	0.3476	1.8952E 02	0.86
6	0.3476	0.4057	1.0782E 02	1.50
7	0.4057	0.4773	8.1068E 01	1.71
1	0.3466	0.4093	1.0660E 02	1.25
2	0.4093	0.4809	8.3492E 01	1.52
3	0.4809	0.5615	1.0977E 02	1.09
4	0.5615	0.6600	1.0515E 02	0.91
5	0.6600	0.7764	6.0690E 01	1.26
6	0.7764	0.9197	2.9606E 01	2.02
7	0.9197	1.0809	1.1719E 01	4.86
8	1.0809	1.2690	1.0794E 01	4.92
9	1.2690	1.4928	9.2727E 00	5.10

Table 23. Runs 7813B, 7813C, 7813D, 7813E. Gamma-ray spectrum on center-line beyond the spectrum modifier plus 40.7-cm ThO₂ (Item I-E)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KV)) LOWER LIMIT	UPPER LIMIT	PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KV)) LOWER LIMIT	UPPER LIMIT
7.2000E-01	3.5792E 01	6.6974E 01	7.9250E 00	5.9184E 00	6.1669E 00
7.6000E-01	5.1266E 01	6.3871E 01	4.0550E 00	5.7966E 00	6.1527E 00
8.0000E-01	5.7593E 01	6.1095E 01	4.1350E 00	5.7249E 00	6.1084E 00
8.4000E-01	5.9212E 01	6.0318E 01	4.3150E 00	5.4925E 00	5.9275E 00
8.8000E-01	5.9420E 01	6.0295E 01	4.4450E 00	5.0949E 00	5.6028E 00
9.2000E-01	5.9183E 01	5.9997E 01	4.5750E 00	4.5630E 00	5.1071E 00
9.6000E-01	5.9851E 01	5.9652E 01	4.7050E 00	3.9110E 00	4.4594E 00
1.0000E 00	5.8568E 01	5.9302E 01	4.8350E 00	3.1947E 00	3.7808E 00
1.0400E 00	5.8104E 01	5.8839E 01	4.9850E 00	2.6211E 00	3.2711E 00
1.0800E 00	5.7772E 01	5.8090E 01	5.1550E 00	2.6783E 00	3.3930E 00
1.1250E 00	5.6352E 01	5.7062E 01	5.3250E 00	3.5999E 00	4.3452E 00
1.1750E 00	5.5116E 01	5.5863E 01	5.4950E 00	4.8147E 00	5.6118E 00
1.2250E 00	5.3954E 01	5.4874E 01	5.6650E 00	5.5350E 00	6.3757E 00
1.2750E 00	5.3250E 01	5.4226E 01	5.8350E 00	5.3982E 00	6.1513E 00
1.3250E 00	5.2979E 01	5.3786E 01	6.0050E 00	4.5563E 00	5.2593E 00
1.3750E 00	5.2593E 01	5.3263E 01	6.1750E 00	3.7489E 00	4.4468E 00
1.4250E 00	5.1914E 01	5.2529E 01	6.3450E 00	3.7171E 00	4.3648E 00
1.4750E 00	5.1097E 01	5.1669E 01	6.5150E 00	4.5729E 00	5.1124E 00
1.5250E 00	5.0185E 01	5.0788E 01	6.7000E 00	5.9591E 00	6.4347E 00
1.5750E 00	4.9260E 01	4.9987E 01	6.9000E 00	7.1895E 00	7.5959E 00
1.6400E 00	4.8149E 01	4.9784E 01	7.1000E 00	7.5364E 00	7.8922E 00
1.7200E 00	4.7012E 01	4.7574E 01	7.3000E 00	7.0029E 00	7.3234E 00
1.8000E 00	4.5753E 01	4.6257E 01	7.5000E 00	5.8990E 00	6.1868E 00
1.8800E 00	4.4344E 01	4.4810E 01	7.7000E 00	4.6635E 00	4.9088E 00
1.9600E 00	4.3551E 01	4.4017E 01	7.9000E 00	3.6116E 00	3.8027E 00
2.0400E 00	4.3569E 01	4.4019E 01	8.1000E 00	2.8222E 00	2.9961E 00
2.1200E 00	4.3176E 01	4.3620E 01	8.3000E 00	2.2540E 00	2.4018E 00
2.2000E 00	4.0991E 01	4.1428E 01	8.5000E 00	1.7884E 00	1.8900E 00
2.2800E 00	3.6950E 01	3.7370E 01	8.7250E 00	1.2933E 00	1.3593E 00
2.3600E 00	3.2136E 01	3.2531E 01	8.9750E 00	7.9778E-01	8.5385E-01
2.4500E 00	2.7069E 01	2.7445E 01	9.2250E 00	4.3014E-01	4.7529E-01
2.5500E 00	2.2573E 01	2.2937E 01	9.4750E 00	2.0567E-01	2.3557E-01
2.6500E 00	1.9230E 01	1.9589E 01	9.7250E 00	8.8239E-02	1.0690E-01
2.7500E 00	1.6620E 01	1.6966E 01	9.9750E 00	3.4205E-02	4.6108E-02
2.8500E 00	1.4427E 01	1.4755E 01	1.0300E 01	7.9767E-03	1.5306E-02
2.9500E 00	1.2720E 01	1.3035E 01	1.0700E 01	-3.0207E-04	4.8270E-03
3.0500E 00	1.1632E 01	1.1948E 01	1.1100E 01	-2.0338E-03	2.3086E-03
3.1500E 00	1.0948E 01	1.1272E 01	1.1500E 01	-2.3212E-03	1.7653E-03
3.2500E 00	1.0255E 01	1.0595E 01	1.1900E 01	-2.2463E-03	1.6961E-03
3.3500E 00	9.3508E 00	9.6688E 00	1.2300E 01	-1.9722E-03	1.7194E-03
3.4500E 00	8.3332E 00	8.6356E 00	1.2700E 01	-1.5602E-03	1.6387E-03
3.5500E 00	7.3912E 00	7.7216E 00	1.3100E 01	-1.3946E-03	1.4560E-03
3.6500E 00	6.5738E 00	6.9344E 00	1.3500E 01	-1.1694E-03	1.2437E-03
3.7500E 00	6.0265E 00	6.3850E 00	1.3900E 01	-8.8318E-04	1.0836E-03

Table 24. Runs 7778C, 7778D. NE213 on centerline beyond spectrum modifier plus 30.6-cm CO₂ (Item II-A - 285.4 cm)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
8.1135E-01	2.4236E 03	2.4414E 03	5.9380E 00	8.0850E 01	8.2003E 01
9.0694E-01	2.2522E 03	2.2815E 03	6.2542E 00	6.5295E 01	6.6964E 01
1.0066E 00	1.8231E 03	1.8310E 03	6.5557E 00	5.4306E 01	5.5673E 01
1.1069E 00	1.6111E 03	1.6186E 03	6.8390E 00	4.6835E 01	4.7722E 01
1.2047E 00	1.5654E 03	1.5724E 03	7.2352E 00	3.7022E 01	3.7719E 01
1.3096E 00	1.5164E 03	1.5231E 03	7.7365E 00	2.5890E 01	2.6502E 01
1.4121E 00	1.4401E 03	1.4466E 03	8.2364E 00	2.0464E 01	2.0975E 01
1.5107E 00	1.3533E 03	1.3595E 03	8.7578E 00	1.5953E 01	1.6294E 01
1.6100E 00	1.2524E 03	1.2582E 03	9.2613E 00	1.0696E 01	1.0980E 01
1.7095E 00	1.1512E 03	1.1568E 03	9.7411E 00	7.0969E 00	7.2977E 00
1.8125E 00	1.0676E 03	1.0731E 03	1.0259E 01	5.1272E 00	5.2808E 00
1.9323E 00	1.0139E 03	1.0193E 03	1.0777E 01	3.9717E 00	4.0983E 00
2.1000E 00	9.8991E 02	9.9497E 02	1.1247E 01	3.0779E 00	3.1775E 00
2.2961E 00	9.3379E 02	9.3843E 02	1.1751E 01	2.2438E 00	2.3188E 00
2.4988E 00	8.0414E 02	8.0800E 02	1.2393E 01	1.3685E 00	1.4268E 00
2.7026E 00	6.4991E 02	6.5368E 02	1.3201E 01	5.7349E-01	6.0960E-01
2.8984E 00	5.1489E 02	5.1843E 02	1.4021E 01	1.6148E-01	1.7572E-01
3.0975E 00	3.9541E 02	3.9909E 02	1.4792E 01	2.8358E-02	3.2963E-02
3.2965E 00	3.0467E 02	3.0760E 02	1.5629E 01	-4.8729E-03	-3.5905E-03
3.5009E 00	2.4818E 02	2.5151E 02	1.6539E 01	-8.5933E-03	-8.0739E-03
3.7074E 00	2.1805E 02	2.2072E 02	1.7533E 01	-7.4423E-03	-7.0126E-03
3.9061E 00	2.0181E 02	2.0413E 02	1.8521E 01	-5.9564E-03	-5.4614E-03
4.1528E 00	1.8966E 02	1.9189E 02	1.9498E 01	-4.3305E-03	-3.8611E-03
4.4540E 00	1.7521E 02	1.7705E 02	2.0556E 01	-2.7546E-03	-2.2910E-03
4.7521E 00	1.5463E 02	1.5635E 02	2.1580E 01	-1.5645E-03	-1.1233E-03
5.0422E 00	1.3155E 02	1.3303E 02	2.2560E 01	-9.0354E-04	-4.5326E-04
5.3459E 00	1.1110E 02	1.1249E 02	2.3471E 01	-5.5425E-04	-6.9515E-05
5.6453E 00	9.5715E 01	9.7143E 01			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*MEV*KW))	ERROR (N/(CM ² *S*MEV*KW))
0.811	1.000	4.1939E 02	9.9080E-01
1.000	1.200	3.3176E 02	7.5081E-01
1.200	1.600	5.7699E 02	1.2963E 00
1.600	2.000	4.3935E 02	1.1051E 00
2.000	3.000	7.7982E 02	2.0911E 00
3.000	4.000	2.7566E 02	1.4856E 00
4.000	6.000	2.7546E 02	1.6304E 00
6.000	8.000	8.9917E 01	9.7559E-01
8.000	10.000	2.7565E 01	3.3301E-01
10.000	12.000	7.4016E 00	1.1481E-01
12.000	16.000	1.7792E 00	4.6132E-02
16.000	20.000	-2.4914E-02	9.9788E-04
1.500	15.000	2.0281E 03	8.0818E 00

Table 25. Runs 1464A, 1463A, 1462B. Hydrogen counter on centerline
beyond spectrum modifier plus 30.6-cm UO₂ (Item II-A - 285.4 cm)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0570	0.0678	1.5500E 05	1.26
2	0.0678	0.0785	1.5124E 05	1.41
3	0.0785	0.0929	1.0567E 05	1.56
4	0.0929	0.1091	7.7814E 04	2.05
5	0.1091	0.1289	8.6451E 04	1.60
6	0.1289	0.1522	7.2501E 04	1.69
7	0.1522	0.1792	5.3224E 04	2.10
8	0.1792	0.2097	4.5373E 04	2.30
1	0.1524	0.1795	5.0212E 04	1.32
2	0.1795	0.2112	4.3859E 04	1.38
3	0.2112	0.2519	3.5272E 04	1.40
4	0.2519	0.2926	3.0615E 04	1.76
5	0.2926	0.3468	2.4639E 04	1.65
6	0.3468	0.4056	1.4937E 04	2.70
1	0.2928	0.3466	2.0051E 04	0.84
2	0.3466	0.4093	1.4961E 04	1.04
3	0.4093	0.4809	1.1417E 04	1.29
4	0.4809	0.5615	1.2455E 04	1.12
5	0.5615	0.6600	1.1577E 04	0.99
6	0.6600	0.7764	7.3968E 03	1.30
7	0.7764	0.9197	4.2645E 03	1.84
8	0.9197	1.0809	2.3949E 03	3.12
9	1.0809	1.2690	1.9445E 03	3.50
10	1.2690	1.4928	1.7230E 03	3.45

Table 26. Runs 7802B, 7802D. NE213 on centerline beyond spectrum modifier plus 30.6-cm UO₂ (Item II-A - 285.4 cm)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
9.1135E-01	1.1049E 02	1.1193E 02	5.9380E 00	4.9033E 00	5.0296E 00
9.0694E-01	9.7175E 01	9.7964E 01	6.2542E 00	4.0108E 00	4.1841E 00
1.0066E 00	7.5680E 01	7.6333E 01	6.5557E 00	3.3781E 00	3.5216E 00
1.1069E 00	6.5818E 01	6.6490E 01	6.8390E 00	2.9299E 00	3.0246E 00
1.2047E 00	6.2469E 01	6.3071E 01	7.2352E 00	2.4060E 00	2.4801E 00
1.3096E 00	6.0262E 01	6.0852E 01	7.7365E 00	1.7733E 00	1.8548E 00
1.4121E 00	5.9030E 01	5.9617E 01	8.2364E 00	1.2904E 00	1.3571E 00
1.5107E 00	5.8256E 01	5.8822E 01	8.7578E 00	9.7844E-01	1.0249E 00
1.6100E 00	5.6743E 01	5.7269E 01	9.2613E 00	7.5418E-01	7.9288E-01
1.7095E 00	5.4264E 01	5.4781E 01	9.7411E 00	5.6527E-01	5.9914E-01
1.8125E 00	5.1680E 01	5.2186E 01	1.0259E 01	3.8953E-01	4.1787E-01
1.9323E 00	5.0094E 01	5.0589E 01	1.0777E 01	2.5771E-01	2.8057E-01
2.1000E 00	5.0632E 01	5.1104E 01	1.1247E 01	1.8272E-01	2.0289E-01
2.2961E 00	5.0523E 01	5.0962E 01	1.1751E 01	1.3643E-01	1.5341E-01
2.4988E 00	4.5054E 01	4.5412E 01	1.2393E 01	9.7985E-02	1.1286E-01
2.7026E 00	3.6960E 01	3.7320E 01	1.3201E 01	6.8280E-02	7.7322E-02
2.8984E 00	2.9863E 01	3.0203E 01	1.4021E 01	4.3357E-02	4.9974E-02
3.0975E 00	2.3170E 01	2.3526E 01	1.4792E 01	2.1000E-02	2.5610E-02
3.2965E 00	1.7453E 01	1.7732E 01	1.5629E 01	5.2848E-03	7.6808E-03
3.5009E 00	1.3632E 01	1.3955E 01	1.6539E 01	-5.9950E-04	6.2661E-04
3.7074E 00	1.1738E 01	1.1997E 01	1.7533E 01	-1.3416E-03	-2.6774E-04
3.9061E 00	1.0880E 01	1.1102E 01	1.8521E 01	-1.0774E-03	3.5553E-05
4.1528E 00	1.0352E 01	1.0569E 01	1.9498E 01	-7.7340E-04	2.8578E-04
4.4540E 00	9.7278E 00	9.9113E 00	2.0556E 01	-6.8420E-04	3.7324E-04
4.7521E 00	8.6847E 00	8.8575E 00	2.1580E 01	-5.2463E-04	5.0025E-04
5.0422E 00	7.5369E 00	7.6844E 00	2.2560E 01	-5.7205E-04	4.7211E-04
5.3459E 00	6.5861E 00	6.7266E 00	2.3471E 01	-5.8002E-04	5.4721E-04
5.6453E 00	5.7739E 00	5.9252E 00			

F1 (MEV)	F2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	1.8238E 01	8.2724E-02
1.000	1.200	1.3594E 01	6.5471E-02
1.200	1.600	2.3873E 01	1.1586E-01
1.600	2.000	2.1108E 01	1.0152E-01
2.000	3.000	4.2766E 01	1.9732E-01
3.000	4.000	1.5540E 01	1.4316E-01
4.000	6.000	1.5762E 01	1.6471E-01
6.000	8.000	5.7442E 00	1.0682E-01
8.000	10.000	1.8468E 00	4.6254E-02
10.000	12.000	5.1163E-01	2.2191E-02
12.000	16.000	2.0611E-01	1.4960E-02
16.000	20.000	-8.8495E-04	2.3006E-03
1.500	15.000	1.0924E 02	8.2337E-01
3.000	12.000	3.9395E 01	4.8305E-01

Table 27. Runs 7802B, 7802C, 7802D, 7802E. Gamma-ray spectrum on center-line beyond spectrum modifier plus 30.6-cm UO₂ (Item II-A - 1311.3 cm)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
7.2000E-01	1.3697E-01	2.4794E-01	3.9250E 00	1.5841E-02	1.7198E-02
7.6000E-01	2.0034E-01	2.4533E-01	4.0550E 00	1.5913E-02	1.7312E-02
8.0000E-01	2.2505E-01	2.3774E-01	4.1850E 00	1.6966E-02	1.8484E-02
8.4000E-01	2.2757E-01	2.3234E-01	4.3150E 00	1.7732E-02	1.9453E-02
8.8000E-01	2.2250E-01	2.2627E-01	4.4450E 00	1.7311E-02	1.9280E-02
9.2000E-01	2.1621E-01	2.2004E-01	4.5750E 00	1.5313E-02	1.7421E-02
9.6000E-01	2.1093E-01	2.1463E-01	4.7050E 00	1.1767E-02	1.3932E-02
1.0000E 00	2.0611E-01	2.0934E-01	4.8350E 00	7.3425E-03	9.6643E-03
1.0400E 00	2.0103E-01	2.0396E-01	4.9850E 00	3.6310E-03	6.3052E-03
1.0800E 00	1.9600E-01	1.9985E-01	5.1550E 00	4.4381E-03	7.3007E-03
1.1250E 00	1.9084E-01	1.9383E-01	5.3250E 00	1.0171E-02	1.3101E-02
1.1750E 00	1.8555E-01	1.8865E-01	5.4950E 00	1.6122E-02	1.9378E-02
1.2250E 00	1.7981E-01	1.8313E-01	5.6650E 00	1.7934E-02	2.1258E-02
1.2750E 00	1.7430E-01	1.7784E-01	5.8250E 00	1.4871E-02	1.7954E-02
1.3250E 00	1.7054E-01	1.7329E-01	6.0050E 00	1.0043E-02	1.2884E-02
1.3750E 00	1.6730E-01	1.6968E-01	6.1750E 00	7.3764E-03	1.0213E-02
1.4250E 00	1.6350E-01	1.6607E-01	6.3450E 00	9.7946E-03	1.1370E-02
1.4750E 00	1.5911E-01	1.6155E-01	6.5150E 00	1.3009E-02	1.5202E-02
1.5250E 00	1.5450E-01	1.5697E-01	6.7000E 00	1.7670E-02	1.9594E-02
1.5750E 00	1.5025E-01	1.5260E-01	6.9000E 00	2.0561E-02	2.2294E-02
1.6400E 00	1.4534E-01	1.4764E-01	7.1000E 00	2.0772E-02	2.2236E-02
1.7200E 00	1.4112E-01	1.4324E-01	7.3000E 00	1.9289E-02	2.0608E-02
1.8000E 00	1.3904E-01	1.4113E-01	7.5000E 00	1.6864E-02	1.8057E-02
1.8900E 00	1.3699E-01	1.3908E-01	7.7000E 00	1.4117E-02	1.5130E-02
1.9500E 00	1.3571E-01	1.3789E-01	7.9000E 00	1.1333E-02	1.2155E-02
2.0400E 00	1.3310E-01	1.4119E-01	8.1000E 00	8.7275E-03	9.4323E-03
2.1200E 00	1.4421E-01	1.4624E-01	8.3000E 00	6.4053E-03	7.0223E-03
2.2000E 00	1.4196E-01	1.4388E-01	8.5000E 00	4.4415E-03	4.9054E-03
2.2900E 00	1.2865E-01	1.3039E-01	8.7250E 00	2.6956E-03	3.0704E-03
2.3600E 00	1.1004E-01	1.1161E-01	8.9750E 00	1.3315E-03	1.6717E-03
2.4500E 00	9.1806E-02	9.3197E-02	9.2250E 00	5.3377E-04	8.3463E-04
2.5500E 00	7.7553E-02	7.8841E-02	9.4750E 00	1.4570E-04	3.8113E-04
2.6500E 00	6.5994E-02	6.7271E-02	9.7250E 00	-6.4891E-06	1.6192E-04
2.7500E 00	5.5233E-02	5.6481E-02	9.9750E 00	-4.0655E-05	6.9096E-05
2.8500E 00	4.6229E-02	4.7454E-02	1.0300E 01	-2.6466E-05	3.7383E-05
2.9500E 00	4.0122E-02	4.1215E-02	1.0700E 01	-1.3445E-05	4.5176E-05
3.0500E 00	3.6514E-02	3.7702E-02	1.1100E 01	-8.4659E-06	5.7715E-05
3.1500E 00	3.3729E-02	3.4964E-02	1.1500E 01	-5.5998E-06	5.9389E-05
3.2500E 00	3.0692E-02	3.1950E-02	1.1900E 01	-4.7039E-06	5.3527E-05
3.3500E 00	2.7640E-02	2.8858E-02	1.2300E 01	-4.6986E-06	4.5488E-05
3.4500E 00	2.5131E-02	2.6313E-02	1.2700E 01	-5.3956E-06	3.8189E-05
3.5500E 00	2.3035E-02	2.4318E-02	1.3100E 01	-5.4952E-06	3.2272E-05
3.6500E 00	2.0526E-02	2.1894E-02	1.3500E 01	-4.7731E-06	2.7372E-05
3.7500E 00	1.7597E-02	1.8963E-02	1.3900E 01	-3.5929E-06	2.3062E-05

Table 28. Runs 7793A, 7792B. NE213 on centerline beyond spectrum modifier plus UO₂ radial blanket plus inner radial shield
(Item II-B)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
9.1135E-01	5.5827E 00	5.6534E 00	5.9380E 00	7.0345E-02	7.4472E-02
9.0694E-01	5.9766E 00	6.0132E 00	6.2542E 00	5.8216E-02	6.3397E-02
1.0066E 00	5.2199E 00	5.2481E 00	6.5557E 00	5.1418E-02	5.5764E-02
1.1069E 00	4.2653E 00	4.2924E 00	6.8390E 00	4.7092E-02	5.0205E-02
1.2047E 00	3.4994E 00	3.5229E 00	7.2352E 00	4.0318E-02	4.3073E-02
1.3096E 00	2.8453E 00	2.8671E 00	7.7365E 00	3.1006E-02	3.4001E-02
1.4121E 00	2.3596E 00	2.3810E 00	8.2364E 00	2.4243E-02	2.6906E-02
1.5107E 00	2.0355E 00	2.0551E 00	8.7578E 00	1.9439E-02	2.1347E-02
1.6100E 00	1.8096E 00	1.8270E 00	9.2613E 00	1.6363E-02	1.8000E-02
1.7095E 00	1.6271E 00	1.6436E 00	9.7411E 00	1.4131E-02	1.5698E-02
1.8125E 00	1.4585E 00	1.4741E 00	1.0259E 01	1.1157E-02	1.2529E-02
1.9323E 00	1.2834E 00	1.2983E 00	1.0777E 01	8.5668E-03	9.7439E-03
2.1000E 00	1.0630E 00	1.0767E 00	1.1247E 01	7.3590E-03	8.4332E-03
2.2961E 00	8.2711E-01	8.3956E-01	1.1751E 01	6.6512E-03	7.6073E-03
2.4988E 00	6.2318E-01	6.3308E-01	1.2393E 01	5.3391E-03	6.1636E-03
2.7026E 00	4.6808E-01	4.7825E-01	1.3201E 01	3.3847E-03	3.9745E-03
2.8984E 00	3.6436E-01	3.7412E-01	1.4021E 01	2.0592E-03	2.5290E-03
3.0975E 00	2.8264E-01	2.9304E-01	1.4792E 01	1.3028E-03	1.6628E-03
3.2965E 00	2.2272E-01	2.3074E-01	1.5629E 01	6.7487E-04	9.1944E-04
3.5009E 00	1.7953E-01	1.8911E-01	1.6539E 01	2.1410E-04	3.9612E-04
3.7074E 00	1.5785E-01	1.6538E-01	1.7533E 01	-2.1155E-05	1.4033E-04
3.9061E 00	1.5083E-01	1.5732E-01	1.8521E 01	-1.0581E-04	6.3797E-05
4.1528E 00	1.4420E-01	1.5060E-01	1.9498E 01	-1.0786E-04	5.4073E-05
4.4540E 00	1.2830E-01	1.3374E-01	2.0556E 01	-1.0464E-04	5.6523E-05
4.7521E 00	1.1198E-01	1.1711E-01	2.1580E 01	-7.4340E-05	8.1342E-05
5.0422E 00	1.0131E-01	1.0587E-01	2.2560E 01	-7.4589E-05	8.4859E-05
5.3459E 00	9.3796E-02	9.8109E-02	2.3471E 01	-7.4551E-05	9.7698E-05
5.6453E 00	8.3328E-02	8.7919E-02			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	1.0982E 00	3.8695E-03
1.000	1.200	8.7483E-01	2.6721E-03
1.200	1.600	1.0050E 00	4.1941E-03
1.600	2.000	5.9867E-01	3.1648E-03
2.000	3.000	6.7509E-01	5.6142E-03
3.000	4.000	2.0326E-01	4.1764E-03
4.000	6.000	2.1809E-01	4.9786E-03
6.000	8.000	9.2753E-02	3.5364E-03
8.000	10.000	3.9048E-02	1.9310E-03
10.000	12.000	1.8090E-02	1.1479E-03
12.000	16.000	1.1230E-02	9.9603E-04
16.000	20.000	3.6458E-04	3.4078E-04
1.500	15.000	2.0509E 00	2.6372E-02
3.000	12.000	5.7133E-01	1.5781E-02

Table 29. Runs 1478A, 1477B, 1479A. Hydrogen counter on centerline beyond spectrum modifier plus UO₂ blanket plus inner radial shield (Item II-B)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0572	0.0684	1.3469E 02	3.31
2	0.0684	0.0796	1.5906E 02	3.19
3	0.0796	0.0927	1.4899E 02	3.13
4	0.0927	0.1094	7.9199E 01	4.92
5	0.1094	0.1300	1.2178E 02	2.86
6	0.1300	0.1523	1.2984E 02	2.65
7	0.1523	0.1784	7.3473E 01	4.24
8	0.1784	0.2101	5.5178E 01	4.94
1	0.1527	0.1799	6.7090E 01	2.59
2	0.1799	0.2116	5.4929E 01	2.98
3	0.2116	0.2524	4.8921E 01	2.83
4	0.2524	0.2932	5.8340E 01	2.66
5	0.2932	0.3476	5.7316E 01	2.04
6	0.3476	0.4065	3.4753E 01	3.27
1	0.2908	0.3459	5.2998E 01	0.64
2	0.3459	0.4101	3.4771E 01	0.88
3	0.4101	0.4835	2.2274E 01	1.29
4	0.4835	0.5661	2.3253E 01	1.17
5	0.5661	0.6670	2.4669E 01	0.91
6	0.6670	0.7771	1.5448E 01	1.32
7	0.7771	0.9147	1.0022E 01	1.58
8	0.9147	1.0798	7.4007E 00	1.75
9	1.0798	1.2725	4.7838E 00	2.24
10	1.2725	1.4927	2.8539E 00	3.20

Table 30. Runs 7792A, 7792B, 7792C, 7792D. Gamma-ray spectrum on center-line beyond spectrum modifier plus UO₂ blanket plus inner radial shield (Item II-B)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2000E-01	1.1653E 01	2.1058E 01	3.9250E 00	2.2969E 00	2.4441E 00
7.6000E-01	1.6319E 01	2.0113E 01	4.0550E 00	2.3421E 00	2.5074E 00
8.0000E-01	1.8126E 01	1.9168E 01	4.1850E 00	2.4915E 00	2.6468E 00
8.4000E-01	1.8390E 01	1.8687E 01	4.3150E 00	2.6217E 00	2.8221E 00
8.8000E-01	1.8197E 01	1.8415E 01	4.4450E 00	2.7114E 00	2.9473E 00
9.2000E-01	1.7921E 01	1.8176E 01	4.5750E 00	2.6355E 00	2.8942E 00
9.6000E-01	1.7590E 01	1.7840E 01	4.7050E 00	2.3225E 00	2.5768E 00
1.0000E 00	1.7184E 01	1.7418E 01	4.8350E 00	1.8364E 00	2.0962E 00
1.0400E 00	1.6775E 01	1.6993E 01	4.9850E 00	1.3197E 00	1.6246E 00
1.0800E 00	1.6382E 01	1.6595E 01	5.1550E 00	1.2612E 00	1.6023E 00
1.1250E 00	1.5962E 01	1.6166E 01	5.3250E 00	1.9033E 00	2.2385E 00
1.1750E 00	1.5511E 01	1.5725E 01	5.4950E 00	2.8155E 00	3.1736E 00
1.2250E 00	1.5041E 01	1.5310E 01	5.6650E 00	3.3549E 00	3.7604E 00
1.2750E 00	1.4583E 01	1.4871E 01	5.8350E 00	3.2299E 00	3.6100E 00
1.3250E 00	1.4225E 01	1.4462E 01	6.0050E 00	2.6499E 00	2.9653E 00
1.3750E 00	1.3945E 01	1.4138E 01	6.1750E 00	2.0915E 00	2.4239E 00
1.4250E 00	1.3651E 01	1.3833E 01	6.3450E 00	2.0502E 00	2.3777E 00
1.4750E 00	1.3301E 01	1.3478E 01	6.5150E 00	2.5870E 00	2.8786E 00
1.5250E 00	1.2912E 01	1.3096E 01	6.7000E 00	3.5273E 00	3.7435E 00
1.5750E 00	1.2560E 01	1.2748E 01	6.9000E 00	4.3838E 00	4.5844E 00
1.6400E 00	1.2147E 01	1.2333E 01	7.1000E 00	4.7471E 00	4.9368E 00
1.7200E 00	1.1532E 01	1.1702E 01	7.3000E 00	4.5794E 00	4.7377E 00
1.8000E 00	1.0835E 01	1.0986E 01	7.5000E 00	4.0250E 00	4.1669E 00
1.8800E 00	1.0319E 01	1.0463E 01	7.7000E 00	3.3228E 00	3.4517E 00
1.9600E 00	1.0202E 01	1.0350E 01	7.9000E 00	2.6578E 00	2.7611E 00
2.0400E 00	1.0485E 01	1.0634E 01	8.1000E 00	2.0980E 00	2.1838E 00
2.1200E 00	1.0751E 01	1.0900E 01	8.3000E 00	1.6490E 00	1.7230E 00
2.2000E 00	1.0451E 01	1.0604E 01	8.5000E 00	1.2787E 00	1.3418E 00
2.2800E 00	9.4691E 00	9.6237E 00	8.7250E 00	9.2884E-01	9.7731E-01
2.3600E 00	8.1807E 00	8.3310E 00	8.9750E 00	6.0983E-01	6.4568E-01
2.4500E 00	6.8923E 00	7.0299E 00	9.2250E 00	3.6769E-01	3.9615E-01
2.5500E 00	5.8601E 00	5.9849E 00	9.4750E 00	2.0575E-01	2.2861E-01
2.6500E 00	5.0894E 00	5.2121E 00	9.7250E 00	1.0767E-01	1.2624E-01
2.7500E 00	4.4998E 00	4.6225E 00	9.9750E 00	5.3492E-02	6.8328E-02
2.8500E 00	4.1207E 00	4.2401E 00	1.0300E 01	1.9520E-02	3.0462E-02
2.9500E 00	3.8841E 00	4.0042E 00	1.0700E 01	3.5623E-03	1.0758E-02
3.0500E 00	3.6572E 00	3.7813E 00	1.1100E 01	-1.8803E-03	3.3686E-03
3.1500E 00	3.4177E 00	3.5414E 00	1.1500E 01	-3.6066E-03	1.2095E-03
3.2500E 00	3.2327E 00	3.3692E 00	1.1900E 01	-3.7316E-03	9.9826E-04
3.3500E 00	3.1470E 00	3.2768E 00	1.2300E 01	-3.2232E-03	1.2673E-03
3.4500E 00	3.0746E 00	3.2003E 00	1.2700E 01	-2.5227E-03	1.4444E-03
3.5500E 00	2.9190E 00	3.0554E 00	1.3100E 01	-2.1294E-03	1.3968E-03
3.6650E 00	2.6504E 00	2.8016E 00	1.3500E 01	-1.7699E-03	1.2305E-03
3.7950E 00	2.3873E 00	2.5401E 00	1.3900E 01	-1.3203E-03	1.0994E-03

Table 31. Runs 7788A, 7788B. NE213 on centerline beyond spectrum modifier plus ThO₂ blanket plus 12.7-cm (B₄C + C) (Item III-A)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
9.1135E-01	2.5238E 00	2.5746E 00	5.9380E 00	2.1639E-01	2.2284E-01
9.0694E-01	2.4730E 00	2.5029E 00	6.2542E 00	1.9646E-01	2.0481E-01
1.0056E 00	2.0595E 00	2.0929E 00	6.5557E 00	1.7199E-01	1.7893E-01
1.1069E 00	1.7175E 00	1.7426E 00	6.8790E 00	1.4703E-01	1.5186E-01
1.2047E 00	1.5980E 00	1.6207E 00	7.2252E 00	1.1378E-01	1.1765E-01
1.3096E 00	1.5891E 00	1.6109E 00	7.7365E 00	9.0621E-02	8.5028E-02
1.4121E 00	1.5849E 00	1.6081E 00	8.2364E 00	6.3957E-02	6.7817E-02
1.5107E 00	1.5560E 00	1.5775E 00	8.7578E 00	5.3714E-02	5.6317E-02
1.6100E 00	1.4873E 00	1.5065E 00	9.2613E 00	4.2866E-02	4.5013E-02
1.7095E 00	1.4065E 00	1.4255E 00	9.7411E 00	3.2360E-02	3.4307E-02
1.8125E 00	1.3639E 00	1.3822E 00	1.0259E 01	2.3228E-02	2.4910E-02
1.9323E 00	1.4003E 00	1.4180E 00	1.0777E 01	1.7134E-02	1.8558E-02
2.1000E 00	1.5052E 00	1.5220E 00	1.1247E 01	1.3828E-02	1.5090E-02
2.2961E 00	1.4301E 00	1.4459E 00	1.1751E 01	1.1987E-02	1.3079E-02
2.4988E 00	1.4165E 00	1.4288E 00	1.2393E 01	9.7227E-03	1.0671E-02
2.7026E 00	7.8856E-01	8.0175E-01	1.3201E 01	5.8833E-03	6.5373E-03
2.8984E 00	5.6711E-01	5.7999E-01	1.4021E 01	3.2945E-03	3.7676E-03
3.0975E 00	4.0600E-01	4.1994E-01	1.4792E 01	1.9860E-03	2.3587E-03
3.2965E 00	2.9675E-01	3.0777E-01	1.5629E 01	9.5908E-04	1.2039E-03
3.5009E 00	2.4933E-01	2.6279E-01	1.6539E 01	2.7674E-04	4.5561E-04
3.7074E 00	2.4880E-01	2.5967E-01	1.7533E 01	-2.7356E-05	1.2972E-04
3.9061E 00	2.6313E-01	2.7251E-01	1.8521E 01	-1.2202E-04	4.3224E-05
4.1528E 00	2.8561E-01	2.9506E-01	1.9498E 01	-1.2223E-04	3.5300E-05
4.4540E 00	3.0387E-01	3.1204E-01	2.0556E 01	-1.1451E-04	4.2322E-05
4.7521E 00	3.0203E-01	3.0992E-01	2.1580E 01	-8.0790E-05	7.0650E-05
5.0422E 00	2.8114E-01	2.8807E-01	2.2560E 01	-7.7682E-05	7.7171E-05
5.3459E 00	2.5298E-01	2.5972E-01	2.3471E 01	-7.5079E-05	9.2042E-05
5.6453E 00	2.3155E-01	2.3900E-01			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	4.5977E-01	3.0573E-03
1.000	1.200	3.5842E-01	2.4142E-03
1.200	1.600	6.3337E-01	4.3824E-03
1.600	2.000	5.6501E-01	3.6799E-03
2.000	2.000	1.0851E 00	7.1195E-03
3.000	4.000	2.9917E-01	5.8341E-03
4.000	6.000	5.4750E-01	7.6446E-03
6.000	8.000	2.7788E-01	5.4024E-03
8.000	10.000	9.9392E-02	2.6208E-03
10.000	12.000	3.4764E-02	1.3699E-03
12.000	15.000	1.8576E-02	1.0779E-03
16.000	20.000	4.0493E-04	3.3279E-04
1.500	15.000	3.0802E 00	3.5664E-02
3.000	12.000	1.2584E 00	2.2885E-02

Table 32. Runs 1473B, 1472A, 1473A. Hydrogen counter on centerline beyond spectrum modifier plus ThO₂ blanket plus 12.7-cm (B₄C + C) (Item III-A)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0586	0.0678	1.2912E 02	2.68
2	0.0678	0.0807	1.1543E 02	2.23
3	0.0807	0.0937	9.2904E 01	3.01
4	0.0937	0.1103	6.7609E 01	3.36
5	0.1103	0.1306	6.6208E 01	2.96
6	0.1306	0.1528	5.2979E 01	3.65
7	0.1528	0.1805	3.9765E 01	4.02
8	0.1805	0.2119	3.2214E 01	4.66
1	0.1552	0.1820	3.8899E 01	1.79
2	0.1820	0.2133	3.2592E 01	1.97
3	0.2133	0.2491	2.7102E 01	2.22
4	0.2491	0.2939	2.2294E 01	2.27
5	0.2939	0.3475	1.8671E 01	2.40
6	0.3475	0.4057	1.2480E 01	3.60
1	0.2928	0.3466	1.6250E 01	1.15
2	0.3466	0.4093	1.2930E 01	1.35
3	0.4093	0.4809	1.0040E 01	1.67
4	0.4809	0.5615	1.0572E 01	1.52
5	0.5615	0.6600	9.9678E 00	1.35
6	0.6600	0.7764	6.5165E 00	1.79
7	0.7764	0.9197	4.1227E 00	2.36
8	0.9197	1.0809	2.6845E 00	3.50
9	1.0809	1.2690	2.0800E 00	4.15
10	1.2690	1.4928	1.7816E 00	4.29

Table 33. Runs 7788A, 7788B, 7788C, 7788D. Gamma-ray spectrum on centerline beyond spectrum modifier plus ThO₂ blanket plus 12.7-cm (B₄C + C) (Item III-A)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
7.2000E-01	1.9338E 01	3.3612E 01	3.9250E 00	3.4707E 00	3.6024E 00
7.6000E-01	2.6847E 01	3.2571E 01	4.0550E 00	3.5060E 00	3.6441E 00
8.0000E-01	2.9864E 01	3.1390E 01	4.1850E 00	3.5310E 00	3.6733E 00
8.4000E-01	3.0267E 01	3.0742E 01	4.3150E 00	3.4510E 00	3.6148E 00
8.8000E-01	3.0161E 01	3.0379E 01	4.4450E 00	3.1952E 00	3.3806E 00
9.2000E-01	2.9873E 01	3.0101E 01	4.5750E 00	2.7338E 00	2.9527E 00
9.6000E-01	2.9502E 01	2.9768E 01	4.7050E 00	2.2200E 00	2.4348E 00
1.0000E 00	2.9061E 01	2.9327E 01	4.8350E 00	1.8257E 00	2.0421E 00
1.0400E 00	2.8589E 01	2.8378E 01	4.9850E 00	1.7966E 00	2.0268E 00
1.0800E 00	2.8193E 01	2.8485E 01	5.1550E 00	2.4104E 00	2.6832E 00
1.1250E 00	2.7844E 01	2.8133E 01	5.3250E 00	3.3021E 00	3.5824E 00
1.1750E 00	2.7424E 01	2.7710E 01	5.4950E 00	3.7729E 00	4.0591E 00
1.2250E 00	2.6841E 01	2.7161E 01	5.6650E 00	3.5109E 00	3.8297E 00
1.2750E 00	2.6210E 01	2.6568E 01	5.8350E 00	2.8397E 00	3.1422E 00
1.3250E 00	2.5717E 01	2.6011E 01	6.0050E 00	2.3581E 00	2.6117E 00
1.3750E 00	2.5236E 01	2.5481E 01	6.1750E 00	2.4641E 00	2.7155E 00
1.4250E 00	2.4636E 01	2.4889E 01	6.3450E 00	3.1439E 00	3.3844E 00
1.4750E 00	2.4017E 01	2.4241E 01	6.5150E 00	4.0300E 00	4.2365E 00
1.5250E 00	2.3494E 01	2.3695E 01	6.7000E 00	4.7832E 00	4.9512E 00
1.5750E 00	2.3099E 01	2.3291E 01	6.9000E 00	5.0785E 00	5.2221E 00
1.6400E 00	2.2596E 01	2.2789E 01	7.1000E 00	4.8385E 00	4.9722E 00
1.7200E 00	2.1688E 01	2.1860E 01	7.3000E 00	4.2390E 00	4.3565E 00
1.8000E 00	2.0561E 01	2.0712E 01	7.5000E 00	3.4927E 00	3.5904E 00
1.8800E 00	1.9605E 01	1.9754E 01	7.7000E 00	2.7619E 00	2.8432E 00
1.9600E 00	1.9010E 01	1.9154E 01	7.9000E 00	2.1291E 00	2.1972E 00
2.0400E 00	1.8533E 01	1.8672E 01	8.1000E 00	1.6235E 00	1.6779E 00
2.1200E 00	1.7680E 01	1.7813E 01	8.3000E 00	1.2212E 00	1.2652E 00
2.2000E 00	1.6251E 01	1.6377E 01	8.5000E 00	8.9844E-01	9.3385E-01
2.2800E 00	1.4507E 01	1.4632E 01	8.7250E 00	6.0659E-01	6.3576E-01
2.3600E 00	1.2846E 01	1.2967E 01	8.9750E 00	3.6531E-01	3.8667E-01
2.4500E 00	1.1305E 01	1.1421E 01	9.2250E 00	2.0448E-01	2.2101E-01
2.5500E 00	9.9275E 00	1.0038E 01	9.4750E 00	1.0722E-01	1.2148E-01
2.6500E 00	8.7590E 00	8.8698E 00	9.7750E 00	5.3759E-02	6.5786E-02
2.7500E 00	7.7720E 00	7.8849E 00	9.9750E 00	2.5806E-02	3.5691E-02
2.8500E 00	6.9952E 00	7.1040E 00	1.0300E 01	8.3417E-03	1.5598E-02
2.9500E 00	6.4171E 00	6.5244E 00	1.0700E 01	-1.9194E-04	5.0056E-03
3.0500E 00	5.9691E 00	6.0756E 00	1.1100E 01	-3.0327E-03	1.3684E-03
3.1500E 00	5.5781E 00	5.6915E 00	1.1500E 01	-3.5142E-03	6.5156E-04
3.2500E 00	5.2234E 00	5.3436E 00	1.1900E 01	-3.0983E-03	9.2316E-04
3.3500E 00	4.8931E 00	5.0072E 00	1.2300E 01	-2.4510E-03	1.2797E-03
3.4500E 00	4.5464E 00	4.6531E 00	1.2700E 01	-1.8444E-03	1.3800E-03
3.5500E 00	4.1690E 00	4.2894E 00	1.3100E 01	-1.6196E-03	1.2433E-03
3.6500E 00	3.7804E 00	3.9175E 00	1.3500E 01	-1.3851E-03	1.0337E-03
3.7500E 00	3.5270E 00	3.6610E 00	1.3900E 01	-1.0798E-03	8.9312E-04

Table 34. Runs 7790A, 7791B. NE213 on centerline beyond spectrum
modifier plus ThO₂ blanket plus inner radial shield (Item III-B)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
9.1135E-01	5.4738E-01	5.5919E-01	5.9380E 00	1.3166E-02	1.4295E-02
9.0694E-01	5.6680E-01	5.7330E-01	6.2542E 00	1.1951E-02	1.3276E-02
1.0066E 00	4.8844E-01	4.9333E-01	6.5557E 00	1.0713E-02	1.1863E-02
1.1069E 00	4.1048E-01	4.1549E-01	6.8390E 00	9.8647E-03	1.0764E-02
1.2047E 00	3.4237E-01	3.4658E-01	7.2352E 00	9.0080E-03	9.8118E-03
1.3096E 00	2.7896E-01	2.8300E-01	7.7365E 00	7.9019E-03	8.8619E-03
1.4121E 00	2.3448E-01	2.3876E-01	8.2364E 00	6.7790E-03	7.6557E-03
1.5107E 00	2.0449E-01	2.0825E-01	8.7578E 00	5.5891E-03	6.2469E-03
1.6100E 00	1.8239E-01	1.8566E-01	9.2613E 00	5.2123E-03	5.7624E-03
1.7095E 00	1.6411E-01	1.6727E-01	9.7411E 00	5.1651E-03	5.7097E-03
1.8125E 00	1.4778E-01	1.5070E-01	1.0259E 01	4.5100E-03	5.0154E-03
1.9323E 00	1.3294E-01	1.3570E-01	1.0777E 01	3.6481E-03	4.0931E-03
2.1000E 00	1.1744E-01	1.2007E-01	1.1247E 01	3.2312E-03	3.6449E-03
2.2961E 00	9.6902E-02	9.9317E-02	1.1751E 01	3.1624E-03	3.5092E-03
2.4988E 00	7.3409E-02	7.5267E-02	1.2393E 01	3.1233E-03	3.4459E-03
2.7026E 00	5.2133E-02	5.4124E-02	1.3201E 01	2.7625E-03	2.9848E-03
2.8984E 00	3.7315E-02	3.9303E-02	1.4021E 01	1.9181E-03	2.0858E-03
3.0975E 00	2.7590E-02	2.9725E-02	1.4792E 01	1.0150E-03	1.1423E-03
3.2965E 00	2.1594E-02	2.3256E-02	1.5629E 01	3.2705E-04	4.3269E-04
3.5009E 00	1.7891E-02	1.9938E-02	1.6539E 01	1.3061E-05	1.0032E-04
3.7074E 00	1.6438E-02	1.8104E-02	1.7533E 01	-7.3525E-05	9.8612E-06
3.9061E 00	1.6383E-02	1.7798E-02	1.8521E 01	-9.1605E-05	1.4664E-05
4.1528E 00	1.7039E-02	1.8497E-02	1.9498E 01	-6.0870E-05	3.2422E-05
4.4540E 00	1.6977E-02	1.8245E-02	2.0556E 01	-5.1404E-05	4.1978E-05
4.7521E 00	1.6492E-02	1.7733E-02	2.1580E 01	-3.8952E-05	5.0325E-05
5.0422E 00	1.6101E-02	1.7259E-02	2.2560E 01	-4.7092E-05	4.4581E-05
5.3459E 00	1.5108E-02	1.6214E-02	2.3471E 01	-4.9937E-05	4.9178E-05
5.6453E 00	1.3980E-02	1.5195E-02			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.911	1.000	1.0483E-01	6.7391E-04
1.000	1.200	8.3939E-02	4.8362E-04
1.200	1.600	9.9873E-02	7.9762E-04
1.600	2.000	6.1212E-02	5.9524E-04
2.000	3.000	7.6508E-02	1.0905E-03
3.000	4.000	2.0926E-02	8.8789E-04
4.000	6.000	3.2547E-02	1.2290E-03
6.000	8.000	2.0459E-02	1.0010E-03
8.000	10.000	1.1990E-02	6.5369E-04
10.000	12.000	7.7211E-03	4.2894E-04
12.000	16.000	7.7166E-03	3.7631E-04
16.000	20.000	8.9070E-06	1.8100E-04
1.500	15.000	2.5839E-01	6.3957E-03
3.000	12.000	9.3721E-02	4.2069E-03

Table 35. Runs 1474A, 1475C, 1476B. Hydrogen counter on centerline beyond spectrum modifier plus ThO₂ blanket plus inner radial shield (Item III-B)

N	ENERGY BOUNDARY		PLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
	(MEV)			
1	0.0581	0.0672	2.2781E 01	6.72
2	0.0672	0.0800	2.5951E 01	4.49
3	0.0800	0.0947	2.2712E 01	4.85
4	0.0947	0.1112	1.2067E 01	8.88
5	0.1112	0.1313	1.8596E 01	5.07
6	0.1313	0.1533	1.8398E 01	4.98
7	0.1533	0.1808	1.0279E 01	7.29
8	0.1808	0.2119	7.2105E 00	9.90
1	0.1552	0.1820	8.9163E 00	3.48
2	0.1820	0.2133	7.3011E 00	3.99
3	0.2133	0.2491	6.4066E 00	4.35
4	0.2491	0.2939	7.5437E 00	3.12
5	0.2939	0.3475	7.3971E 00	2.70
6	0.3475	0.4057	4.3388E 00	4.39
1	0.2928	0.3466	6.5556E 00	1.23
2	0.3466	0.4093	4.2699E 00	1.67
3	0.4093	0.4809	2.5636E 00	2.58
4	0.4809	0.5615	2.7137E 00	2.30
5	0.5615	0.6600	2.9319E 00	1.71
6	0.6600	0.7764	1.6467E 00	2.45
7	0.7764	0.9197	9.2886E-01	3.43
8	0.9197	1.0809	6.7824E-01	4.22
9	1.0809	1.2690	4.7326E-01	5.08
10	1.2690	1.492E	2.9979E-01	6.49

Table 36. Runs 7790A, 7790B, 7791B, 7791C. Gamma-ray spectrum on centerline beyond spectrum modifier plus ThO₂ blanket plus inner radial shield (Item III-B)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2000E-01	2.2861E 00	5.7082E 00	3.9250E 00	1.3017E 00	1.3613E 00
7.6000E-01	4.4825E 00	5.8571E 00	4.0550E 00	1.3571E 00	1.4215E 00
8.0000E-01	5.5700E 00	5.9379E 00	4.1850E 00	1.4508E 00	1.5190E 00
8.4000E-01	5.9171E 00	6.0711E 00	4.3150E 00	1.5683E 00	1.6503E 00
8.8000E-01	6.0195E 00	6.1418E 00	4.4450E 00	1.6780E 00	1.7722E 00
9.2000E-01	6.0092E 00	6.1275E 00	4.5750E 00	1.6863E 00	1.7873E 00
9.6000E-01	5.9734E 00	6.0718E 00	4.7050E 00	1.4903E 00	1.5912E 00
1.0000E 00	5.9275E 00	6.0095E 00	4.8350E 00	1.0885E 00	1.1985E 00
1.0400E 00	5.8899E 00	5.9614E 00	4.9850E 00	6.1494E-01	7.2612E-01
1.0800E 00	5.8647E 00	5.9323E 00	5.1550E 00	4.8621E-01	6.2102E-01
1.1250E 00	5.8217E 00	5.8926E 00	5.3250E 00	1.0436E 00	1.1801E 00
1.1750E 00	5.7379E 00	5.8139E 00	5.4950E 00	1.9065E 00	2.0552E 00
1.2250E 00	5.6521E 00	5.7428E 00	5.6650E 00	2.4119E 00	2.5766E 00
1.2750E 00	5.5833E 00	5.6879E 00	5.8350E 00	2.2320E 00	2.3754E 00
1.3250E 00	5.5351E 00	5.6155E 00	6.0050E 00	1.5821E 00	1.7100E 00
1.3750E 00	5.4716E 00	5.5424E 00	6.1750E 00	1.0047E 00	1.1394E 00
1.4250E 00	5.3958E 00	5.4719E 00	6.3450E 00	9.5425E-01	1.0713E 00
1.4750E 00	5.3154E 00	5.3864E 00	6.5150E 00	1.4535E 00	1.5512E 00
1.5250E 00	5.2346E 00	5.3018E 00	6.7000E 00	2.2485E 00	2.3368E 00
1.5750E 00	5.1627E 00	5.2281E 00	6.9000E 00	2.9017E 00	2.9747E 00
1.6400E 00	5.0659E 00	5.1345E 00	7.1000E 00	3.0625E 00	3.1284E 00
1.7200E 00	4.8933E 00	4.9570E 00	7.3000E 00	2.8120E 00	2.8766E 00
1.8000E 00	4.6721E 00	4.7293E 00	7.5000E 00	2.3952E 00	2.4500E 00
1.8800E 00	4.4853E 00	4.5407E 00	7.7000E 00	2.0102E 00	2.0549E 00
1.9600E 00	4.3694E 00	4.4264E 00	7.9000E 00	1.7184E 00	1.7571E 00
2.0400E 00	4.3267E 00	4.3830E 00	8.1000E 00	1.4835E 00	1.5167E 00
2.1200E 00	4.3005E 00	4.3553E 00	8.3000E 00	1.2432E 00	1.2695E 00
2.2000E 00	4.1795E 00	4.2312E 00	8.5000E 00	9.7677E-01	9.9703E-01
2.2900E 00	3.9030E 00	3.9561E 00	8.7250E 00	6.7650E-01	6.9282E-01
2.3600E 00	3.5253E 00	3.5769E 00	8.9750E 00	3.9888E-01	4.1213E-01
2.4500E 00	3.0929E 00	3.1430E 00	9.2250E 00	2.0815E-01	2.1945E-01
2.5500E 00	2.7038E 00	2.7520E 00	9.4750E 00	9.5331E-02	1.0546E-01
2.6500E 00	2.4137E 00	2.4643E 00	9.7250E 00	3.6076E-02	4.4815E-02
2.7500E 00	2.2066E 00	2.2557E 00	9.9750E 00	8.1322E-03	1.5333E-02
2.8500E 00	2.0664E 00	2.1160E 00	1.0300E 01	-4.9638E-03	5.6998E-04
2.9500E 00	1.9602E 00	2.0098E 00	1.0700E 01	-6.7556E-03	-2.4846E-03
3.0500E 00	1.8525E 00	1.9027E 00	1.1100E 01	-4.5990E-03	-8.1446E-04
3.1500E 00	1.7605E 00	1.8158E 00	1.1500E 01	-2.5775E-03	9.8735E-04
3.2500E 00	1.7147E 00	1.7698E 00	1.1900E 01	-1.5618E-03	1.8273E-03
3.3500E 00	1.6942E 00	1.7467E 00	1.2300E 01	-1.3267E-03	1.7624E-03
3.4500E 00	1.6459E 00	1.6948E 00	1.2700E 01	-1.3878E-03	1.2613E-03
3.5500E 00	1.5462E 00	1.6024E 00	1.3100E 01	-1.6034E-03	7.5167E-04
3.6650E 00	1.4093E 00	1.4750E 00	1.3500E 01	-1.5286E-03	4.5707E-04
3.7950E 00	1.3092E 00	1.3750E 00	1.3900E 01	-1.2428E-03	4.0343E-04

Table 37. Runs 7794B, 7795A. NE213 on centerline beyond spectrum modifier plus ThO₂ blanket plus inner radial shield plus radial shield (Item IV-C)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	FLUX (N/(CM ² *S*MEV*KW)) UPPER LIMIT	NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	FLUX (N/(CM ² *S*MEV*KW)) UPPER LIMIT
9.7175E-01	1.8294E-03	2.1300E-03	5.9380E 00	1.8063E-04	2.5500E-04
9.0694E-01	1.9959E-03	2.2073E-03	6.2542E 00	2.1255E-04	2.9784E-04
1.0066E 00	1.7967E-03	1.9378E-03	6.5557E 00	2.5354E-04	3.2438E-04
1.1069E 00	1.4089E-03	1.6116E-03	6.8390E 00	2.6201E-04	3.2692E-04
1.2047E 00	1.1211E-03	1.2770E-03	7.2352E 00	2.5119E-04	3.1463E-04
1.3096E 00	9.2947E-04	1.0774E-03	7.7365E 00	2.3686E-04	3.0980E-04
1.4121E 00	8.2106E-04	9.9957E-04	8.2364E 00	2.3630E-04	3.1002E-04
1.5107E 00	7.3858E-04	8.8750E-04	8.7578E 00	2.4890E-04	3.0724E-04
1.6100E 00	6.4659E-04	7.7185E-04	9.2613E 00	2.4399E-04	2.9890E-04
1.7095E 00	5.6021E-04	6.7356E-04	9.7411E 00	2.5604E-04	3.0799E-04
1.8125E 00	5.0696E-04	5.9778E-04	1.0259E 01	2.7969E-04	3.2721E-04
1.9223E 00	4.5471E-04	5.4059E-04	1.0777E 01	3.1173E-04	3.5249E-04
2.0000E 00	3.7979E-04	4.6968E-04	1.1247E 01	3.2050E-04	3.6156E-04
2.2961E 00	2.6245E-04	3.4401E-04	1.1751E 01	3.0409E-04	3.4069E-04
2.4988E 00	1.5938E-04	2.2113E-04	1.2393E 01	2.6616E-04	2.9825E-04
2.7026E 00	7.5684E-05	1.4783E-04	1.3201E 01	2.1369E-04	2.3876E-04
2.8984E 00	4.3132E-05	1.2540E-04	1.4021E 01	1.6344E-04	1.8203E-04
3.0975E 00	6.4857E-05	1.4498E-04	1.4792E 01	1.1937E-04	1.3442E-04
3.2365E 00	9.0300E-05	1.6505E-04	1.5629E 01	6.8753E-05	8.0253E-05
3.5009E 00	9.5809E-05	1.8307E-04	1.6539E 01	2.5444E-05	3.3393E-05
3.7074E 00	1.0694E-04	1.8612E-04	1.7533E 01	2.0924E-06	9.4623E-06
3.9061E 00	1.1425E-04	1.8184E-04	1.8521E 01	-5.6344E-06	2.1361E-06
4.1528E 00	1.1502E-04	1.8743E-04	1.9498E 01	-6.1532E-06	1.2559E-06
4.4540E 00	1.3687E-04	2.0458E-04	2.0556E 01	-5.5600E-06	1.7955E-06
4.7521E 00	1.5298E-04	2.2023E-04	2.1580E 01	-3.7258E-06	3.3850E-06
5.0422E 00	1.5924E-04	2.2904E-04	2.2560E 01	-3.4315E-06	3.8434E-06
5.3459E 00	1.7623E-04	2.4369E-04	2.3471E 01	-3.2978E-06	4.5558E-06
5.6453E 00	1.9123E-04	2.5379E-04			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	3.8619E-04	2.0365E-05
1.000	1.200	3.0829E-04	1.7913E-05
1.200	1.600	3.7150E-04	3.1038E-05
1.600	2.000	2.2823E-04	1.9930E-05
2.000	3.000	2.2199E-04	3.9462E-05
3.000	4.000	1.3340E-04	3.8961E-05
4.000	6.000	3.8306E-04	6.9905E-05
6.000	8.000	5.5166E-04	7.0007E-05
8.000	10.000	5.5451E-04	5.8028E-05
10.000	12.000	6.4885E-04	4.1786E-05
12.000	16.000	7.0818E-04	4.1002E-05
16.000	20.000	3.5576E-05	1.5655E-05
1.500	15.000	3.4214E-03	3.8077E-04
3.000	12.000	2.2690E-03	2.7934E-04

Table 38. Runs 7794B, 7794C, 7795A, 7795B. Gamma-ray spectrum on center-line beyond spectrum modifier plus ThO₂ blanket plus inner radial shield plus outer radial shield (Item IV-C)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
7.2000E-01	8.5838E-02	3.2039E-01	3.9250E 00	1.2905E-01	1.3826E-01
7.6000E-01	1.8293E-01	2.7828E-01	4.0550E 00	1.4788E-01	1.5738E-01
8.0000E-01	2.2622E-01	2.5375E-01	4.1850E 00	1.6986E-01	1.7991E-01
8.4000E-01	2.3745E-01	2.4867E-01	4.3150E 00	1.9222E-01	1.9465E-01
8.8000E-01	2.4270E-01	2.5282E-01	4.4450E 00	1.7805E-01	1.9319E-01
9.2000E-01	2.4794E-01	2.5787E-01	4.5750E 00	1.5708E-01	1.7334E-01
9.6000E-01	2.5069E-01	2.6021E-01	4.7050E 00	1.2465E-01	1.4002E-01
1.0000E 00	2.5161E-01	2.5935E-01	4.8350E 00	9.3047E-02	1.0888E-01
1.0400E 00	2.5242E-01	2.6002E-01	4.9850E 00	8.2355E-02	1.0170E-01
1.0800E 00	2.5363E-01	2.6100E-01	5.1550E 00	1.2723E-01	1.4850E-01
1.1250E 00	2.5240E-01	2.6117E-01	5.3250E 00	2.1640E-01	2.3662E-01
1.1750E 00	2.5183E-01	2.6117E-01	5.4950E 00	2.8190E-01	3.0512E-01
1.2250E 00	2.5078E-01	2.6187E-01	5.6650E 00	2.7447E-01	3.0082E-01
1.2750E 00	2.4747E-01	2.5972E-01	5.8350E 00	2.0839E-01	2.3160E-01
1.3250E 00	2.4272E-01	2.5344E-01	6.0050E 00	1.3979E-01	1.6022E-01
1.3750E 00	2.3920E-01	2.4864E-01	6.1750E 00	1.2446E-01	1.4634E-01
1.4250E 00	2.3952E-01	2.4811E-01	6.3450E 00	1.7938E-01	2.0087E-01
1.4750E 00	2.4167E-01	2.4961E-01	6.5150E 00	2.6938E-01	2.8794E-01
1.5250E 00	2.4230E-01	2.5015E-01	6.7000E 00	3.5296E-01	3.6751E-01
1.5750E 00	2.4116E-01	2.4947E-01	6.9000E 00	3.8719E-01	4.0058E-01
1.6400E 00	2.4118E-01	2.4981E-01	7.1000E 00	3.6846E-01	3.8129E-01
1.7200E 00	2.4188E-01	2.5009E-01	7.3000E 00	3.2303E-01	3.3482E-01
1.8000E 00	2.3690E-01	2.4408E-01	7.5000E 00	2.7609E-01	2.8633E-01
1.8900E 00	2.2949E-01	2.3652E-01	7.7000E 00	2.3715E-01	2.4645E-01
1.9600E 00	2.2775E-01	2.3505E-01	7.9000E 00	2.0310E-01	2.1139E-01
2.0400E 00	2.2908E-01	2.3647E-01	8.1000E 00	1.6744E-01	1.7469E-01
2.1200E 00	2.2325E-01	2.3114E-01	8.3000E 00	1.2813E-01	1.3436E-01
2.2000E 00	2.0946E-01	2.1733E-01	8.5000E 00	8.9432E-02	9.4804E-02
2.2300E 00	1.9709E-01	2.0522E-01	8.7250E 00	5.3424E-02	5.8293E-02
2.3600E 00	1.8959E-01	1.9758E-01	8.9750E 00	2.8161E-02	3.2529E-02
2.4500E 00	1.7930E-01	1.8672E-01	9.2250E 00	1.6379E-02	2.0824E-02
2.5500E 00	1.6156E-01	1.6835E-01	9.4750E 00	1.1801E-02	1.7025E-02
2.6500E 00	1.4833E-01	1.5505E-01	9.7250E 00	9.3091E-03	1.5707E-02
2.7500E 00	1.4558E-01	1.5242E-01	9.9750E 00	6.5569E-03	1.3633E-02
2.8500E 00	1.4581E-01	1.5246E-01	1.0200E 01	2.6462E-03	9.3217E-03
2.9500E 00	1.4398E-01	1.5073E-01	1.0700E 01	-1.0693E-03	4.1320E-03
3.0500E 00	1.4348E-01	1.5031E-01	1.1100E 01	-3.0473E-03	1.5622E-03
3.1500E 00	1.4458E-01	1.5214E-01	1.1500E 01	-3.5288E-03	9.0858E-04
3.2500E 00	1.4475E-01	1.5264E-01	1.1900E 01	-3.3987E-03	1.1791E-03
3.3500E 00	1.4347E-01	1.5107E-01	1.2300E 01	-2.8515E-03	1.4374E-03
3.4500E 00	1.4193E-01	1.4933E-01	1.2700E 01	-2.1473E-03	1.5510E-03
3.5500E 00	1.3938E-01	1.4704E-01	1.3100E 01	-1.8314E-03	1.3971E-03
3.6650E 00	1.3146E-01	1.4081E-01	1.3500E 01	-1.4673E-03	1.1420E-03
3.7950E 00	1.2439E-01	1.3339E-01	1.3900E 01	-1.0962E-03	9.5009E-04

Table 39. Runs 7796B, 7797B. NE213 on centerline beyond spectrum modifier plus inner radial shield and outer radial shield
(Item IV-E)

NEUTRON ENERGY (MEV)	FLUX (N/(CM2*S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM2*S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
8.1135E-01	3.2450E-01	3.3793E-01	5.9390E 00	1.5863E-02	1.7530E-02
9.0594E-01	3.5864E-01	3.6619E-01	6.2542E 00	1.6149E-02	1.8088E-02
1.0066E 00	3.1575E-01	3.2156E-01	6.5557E 00	1.6209E-02	1.7863E-02
1.1069E 00	2.5838E-01	2.6449E-01	6.8390E 00	1.5391E-02	1.6688E-02
1.2047E 00	2.1864E-01	2.2384E-01	7.2352E 00	1.2736E-02	1.3952E-02
1.3096E 00	1.9873E-01	1.9368E-01	7.7365E 00	9.4527E-03	1.0781E-02
1.4121E 00	1.6750E-01	1.7273E-01	9.2364E 00	8.1875E-03	9.4146E-03
1.5107E 00	1.5426E-01	1.5889E-01	9.7578E 00	7.1390E-03	8.0729E-03
1.6100E 00	1.4438E-01	1.4844E-01	9.2613E 00	5.9296E-03	6.7247E-03
1.7095E 00	1.3356E-01	1.3743E-01	9.7411E 00	5.2472E-03	6.0503E-03
1.8125E 00	1.2088E-01	1.2446E-01	1.0259E 01	4.8952E-03	5.6176E-03
1.9123E 00	1.0615E-01	1.0957E-01	1.0777E 01	4.5813E-03	5.2160E-03
2.1100E 00	8.5439E-02	8.9627E-02	1.1247E 01	4.2064E-03	4.8093E-03
2.2961E 00	6.0384E-02	6.3470E-02	1.1751E 01	3.7155E-03	4.2715E-03
2.4988E 00	4.3589E-02	4.6024E-02	1.2393E 01	3.1378E-03	3.6121E-03
2.7026E 00	3.5077E-02	3.7746E-02	1.3201E 01	2.6458E-03	3.0142E-03
2.8984E 00	2.7715E-02	3.0466E-02	1.4021E 01	2.0515E-03	2.3336E-03
3.0975E 00	2.2123E-02	2.5041E-02	1.4792E 01	1.3592E-03	1.5766E-03
3.2965E 00	2.0607E-02	2.2971E-02	1.5629E 01	6.8175E-04	8.3224E-04
3.5099E 00	1.7451E-02	2.0326E-02	1.6539E 01	2.1352E-04	3.2335E-04
3.7074E 00	1.3799E-02	1.6188E-02	1.7533E 01	-5.2417E-06	9.0797E-05
3.9061E 00	1.2510E-02	1.4582E-02	1.8521E 01	-7.2990E-05	2.8094E-05
4.1528E 00	1.4580E-02	1.6739E-02	1.9498E 01	-7.3002E-05	2.3494E-05
4.4540E 00	1.9010E-02	2.0900E-02	2.0556E 01	-6.7038E-05	2.8901E-05
4.7521E 00	2.1067E-02	2.2927E-02	2.1580E 01	-4.6554E-05	4.6061E-05
5.0422E 00	2.0469E-02	2.2206E-02	2.2560E 01	-4.5314E-05	4.9539E-05
5.3459E 00	1.8330E-02	1.9987E-02	2.3471E 01	-4.4439E-05	5.8006E-05
5.6453E 00	1.6346E-02	1.8150E-02			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM2*S*MEV*KW))	ERROR (N/(CM2*S*MEV*KW))
0.811	1.000	6.6186E-02	7.7942E-04
1.000	1.200	5.3639E-02	5.8721E-04
1.200	1.600	7.0651E-02	9.7949E-04
1.600	2.000	4.9634E-02	7.3267E-04
2.000	3.000	5.1857E-02	1.4174E-03
3.000	4.000	1.8671E-02	1.2567E-03
4.000	6.000	3.7910E-02	1.8311E-03
6.000	8.000	2.8446E-02	1.4525E-03
8.000	10.000	1.4213E-02	9.3379E-04
10.000	12.000	9.3432E-03	6.2963E-04
12.000	16.000	8.5488E-03	5.9965E-04
16.000	20.000	3.1175E-04	2.0382E-04
1.500	15.000	2.3290E-01	9.0001E-03

Table 40. Runs 1485A, 1484B, 1483A. Hydrogen counter on centerline beyond spectrum modifier plus inner radial shield plus outer radial shield (Item IV-E)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0570	0.0682	8.9761E 00	7.12
2	0.0682	0.0793	8.7458E 00	8.06
3	0.0793	0.0942	7.0736E 00	7.81
4	0.0942	0.1109	4.2411E 00	12.67
5	0.1109	0.1295	5.2795E 00	10.04
6	0.1295	0.1537	4.3490E 00	9.68
7	0.1537	0.1797	3.2838E 00	13.04
8	0.1797	0.2113	2.5619E 00	14.42
1	0.1535	0.1809	3.0009E 00	5.26
2	0.1809	0.2127	2.5124E 00	5.90
3	0.2127	0.2492	2.0566E 00	6.92
4	0.2492	0.2947	2.0279E 00	6.02
5	0.2947	0.3449	2.0311E 00	5.91
6	0.3449	0.4041	1.2642E 00	8.49
7	0.4041	0.4770	8.3169E-01	11.17
8	0.4770	0.5590	8.8926E-01	10.13
1	0.4076	0.4805	8.9057E-01	6.22
2	0.4805	0.5626	2.7911E 00	1.95
3	0.5626	0.6629	2.2559E 00	1.99
4	0.6629	0.7815	1.1902E 00	3.28
5	0.7815	0.9182	1.0793E 00	3.30
6	0.9182	1.0824	1.0464E 00	2.83
7	1.0824	1.2739	6.7065E-01	3.66
8	1.2739	1.4927	5.3692E-01	3.80

Table 41. Runs 7796B, 7796C, 7797B, 7797C. Gamma-ray spectrum on center-line beyond spectrum modifier plus inner radial shield plus outer radial shield (Item IV-E)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2000E-01	4.2595E 00	9.0250E 00	3.9250E 00	1.9870E 00	2.0872E 00
7.6000E-01	6.8538E 00	9.7725E 00	4.0550E 00	2.0295E 00	2.1352E 00
8.0000E-01	8.0238E 00	9.5357E 00	4.1850E 00	2.1418E 00	2.2478E 00
8.4000E-01	8.2731E 00	9.4932E 00	4.3150E 00	2.2490E 00	2.3871E 00
8.8000E-01	8.2598E 00	9.5363E 00	4.4450E 00	2.3009E 00	2.4678E 00
9.2000E-01	8.4072E 00	9.5786E 00	4.5750E 00	2.2289E 00	2.4099E 00
9.6000E-01	8.4054E 00	9.5499E 00	4.7050E 00	1.9987E 00	2.1624E 00
1.0000E 00	8.3427E 00	9.4587E 00	4.8350E 00	1.6439E 00	1.8168E 00
1.0400E 00	8.2319E 00	9.3334E 00	4.9850E 00	1.2997E 00	1.5154E 00
1.0800E 00	8.0954E 00	9.1881E 00	5.1550E 00	1.3216E 00	1.5550E 00
1.1250E 00	7.9552E 00	9.0537E 00	5.3250E 00	1.8670E 00	2.0817E 00
1.1750E 00	7.8533E 00	7.9607E 00	5.4950E 00	2.5526E 00	2.8096E 00
1.2250E 00	7.7249E 00	7.8630E 00	5.6650E 00	2.9000E 00	3.1932E 00
1.2750E 00	7.5914E 00	7.7408E 00	5.8350E 00	2.6945E 00	2.9435E 00
1.3250E 00	7.5371E 00	7.6544E 00	6.0050E 00	2.1151E 00	2.3251E 00
1.3750E 00	7.5057E 00	7.6020E 00	6.1750E 00	1.6184E 00	1.8623E 00
1.4250E 00	7.3943E 00	7.4923E 00	6.3450E 00	1.6357E 00	1.8847E 00
1.4750E 00	7.2265E 00	7.3249E 00	6.5150E 00	2.2005E 00	2.3872E 00
1.5250E 00	7.0867E 00	7.1852E 00	6.7000E 00	3.0598E 00	3.2051E 00
1.5750E 00	7.0019E 00	7.0996E 00	6.9000E 00	3.7543E 00	3.9052E 00
1.6400E 00	6.8649E 00	6.9629E 00	7.1000E 00	3.9918E 00	4.1115E 00
1.7200E 00	6.5710E 00	6.6622E 00	7.3000E 00	3.7788E 00	3.8939E 00
1.8000E 00	6.2216E 00	6.3022E 00	7.5000E 00	3.3527E 00	3.4737E 00
1.8900E 00	5.8719E 00	5.9486E 00	7.7000E 00	2.9000E 00	2.9976E 00
1.9600E 00	5.5958E 00	5.6747E 00	7.9000E 00	2.4801E 00	2.5527E 00
2.0400E 00	5.4878E 00	5.5662E 00	8.1000E 00	2.0750E 00	2.1500E 00
2.1200E 00	5.4570E 00	5.5345E 00	8.3000E 00	1.6806E 00	1.7479E 00
2.2000E 00	5.2999E 00	5.3734E 00	8.5000E 00	1.3098E 00	1.3583E 00
2.2800E 00	4.9380E 00	5.0125E 00	8.7250E 00	9.3222E-01	9.7377E-01
2.3600E 00	4.4915E 00	4.5661E 00	8.9750E 00	6.0534E-01	6.4540E-01
2.4500E 00	4.0729E 00	4.1452E 00	9.2250E 00	3.8576E-01	4.1567E-01
2.5500E 00	3.7549E 00	3.8240E 00	9.4750E 00	2.4672E-01	2.6842E-01
2.6500E 00	3.4757E 00	3.5466E 00	9.7250E 00	1.5837E-01	1.7707E-01
2.7500E 00	3.2007E 00	3.2734E 00	9.9750E 00	1.0060E-01	1.1737E-01
2.8500E 00	2.9921E 00	3.0633E 00	1.0300E 01	5.2221E-02	6.6318E-02
2.9500E 00	2.3703E 00	2.9417E 00	1.0700E 01	1.8367E-02	2.8501E-02
3.0500E 00	2.7979E 00	2.8709E 00	1.1100E 01	2.0939E-03	9.1921E-03
3.1500E 00	2.7285E 00	2.8061E 00	1.1500E 01	-4.2902E-03	1.2696E-03
3.2500E 00	2.6431E 00	2.7273E 00	1.1900E 01	-5.9504E-03	-4.0055E-04
3.3500E 00	2.5430E 00	2.6231E 00	1.2300E 01	-5.5115E-03	-6.7044E-06
3.4500E 00	2.4335E 00	2.5099E 00	1.2700E 01	-4.4085E-03	5.5871E-04
3.5500E 00	2.3129E 00	2.3995E 00	1.3100E 01	-3.6035E-03	8.0543E-04
3.6500E 00	2.1722E 00	2.2708E 00	1.3500E 01	-2.9124E-03	8.1611E-04
3.7500E 00	2.0445E 00	2.1409E 00	1.3900E 01	-2.1943E-03	8.3365E-04

Table 42. Runs 7799D, 7799B. NE213 on centerline beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite (Item V-B)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
8.1135E-01	1.7981E 01	1.8462E 01	5.9380E 00	1.8492E 00	1.8991E 00
9.0694E-01	2.0056E 01	2.0328E 01	6.2542E 00	1.5838E 00	1.6506E 00
1.0066E 00	1.8923E 01	1.9152E 01	6.5557E 00	1.4044E 00	1.4592E 00
1.1069E 00	1.8257E 01	1.8496E 01	6.8390E 00	1.2021E 00	1.2385E 00
1.2047E 00	1.8876E 01	1.9091E 01	7.2352E 00	8.8505E-01	9.1287E-01
1.3096E 00	1.9169E 01	1.9376E 01	7.7365E 00	5.8324E-01	6.1395E-01
1.4121E 00	1.8853E 01	1.9065E 01	8.2364E 00	4.1106E-01	4.3681E-01
1.5107E 00	1.8479E 01	1.8681E 01	8.7578E 00	3.0739E-01	3.2420E-01
1.6100E 00	1.8030E 01	1.8213E 01	9.2613E 00	2.3453E-01	2.4873E-01
1.7095E 00	1.7522E 01	1.7700E 01	9.7411E 00	1.7584E-01	1.8841E-01
1.8125E 00	1.7061E 01	1.7236E 01	1.0259E 01	1.2135E-01	1.3187E-01
1.9323E 00	1.6661E 01	1.6830E 01	1.0777E 01	8.5015E-02	9.3633E-02
2.1000E 00	1.5976E 01	1.6135E 01	1.1247E 01	6.5263E-02	7.2926E-02
2.2961E 00	1.4471E 01	1.4622E 01	1.1751E 01	4.9762E-02	5.6365E-02
2.4988E 00	1.2080E 01	1.2200E 01	1.2393E 01	3.2769E-02	3.8131E-02
2.7026E 00	9.3841E 00	9.5100E 00	1.3201E 01	1.8741E-02	2.2618E-02
2.8984E 00	7.2269E 00	7.3474E 00	1.4021E 01	1.2136E-02	1.5010E-02
3.0975E 00	5.4684E 00	5.5975E 00	1.4792E 01	8.0488E-03	1.0277E-02
3.2965E 00	4.2103E 00	4.3115E 00	1.5629E 01	4.1032E-03	5.6266E-03
3.5009E 00	3.3690E 00	3.4903E 00	1.6539E 01	1.1807E-03	2.3077E-03
3.7074E 00	2.9304E 00	3.0290E 00	1.7533E 01	-2.2198E-04	7.7679E-04
3.9061E 00	2.8482E 00	2.9340E 00	1.8521E 01	-6.8287E-04	3.6364E-04
4.1528E 00	3.0521E 00	3.1368E 00	1.9498E 01	-6.6471E-04	3.3452E-04
4.4540E 00	3.3039E 00	3.3755E 00	2.0556E 01	-6.3861E-04	3.5765E-04
4.7521E 00	3.2463E 00	3.3143E 00	2.1580E 01	-4.5773E-04	5.0520E-04
5.0422E 00	2.9808E 00	3.0396E 00	2.2560E 01	-4.6446E-04	5.2131E-04
5.3459E 00	2.6006E 00	2.6563E 00	2.3471E 01	-4.6384E-04	6.0081E-04
5.6453E 00	2.2001E 00	2.2592E 00			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	3.7157E 00	2.8330E-02
1.000	1.200	3.7299E 00	2.3222E-02
1.200	1.600	7.5560E 00	4.1197E-02
1.600	2.000	6.9018E 00	3.4952E-02
2.000	3.000	1.1880E 01	6.7878E-02
3.000	4.000	3.8287E 00	5.3294E-02
4.000	6.000	5.6481E 00	6.4715E-02
6.000	8.000	2.2051E 00	4.0781E-02
8.000	10.000	5.8416E-01	1.7216E-02
10.000	12.000	1.7096E-01	8.3817E-03
12.000	16.000	6.7749E-02	6.3730E-03
16.000	20.000	1.9996E-03	2.1065E-03
1.500	15.000	3.3113E 01	3.0261E-01
3.000	12.000	1.2429E 01	1.8444E-01

Table 43. Runs 1486A, 1487B, 1488A. Hydrogen counters on centerline beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite (Item V-B)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0586	0.0681	6.5436E 02	1.55
2	0.0681	0.0795	6.7339E 02	1.35
3	0.0795	0.0948	5.2885E 02	1.35
4	0.0948	0.1101	3.9052E 02	2.03
5	0.1101	0.1291	3.2836E 02	2.05
6	0.1291	0.1520	3.0285E 02	1.97
7	0.1520	0.1806	2.5305E 02	1.98
8	0.1806	0.2112	1.8404E 02	2.81
1	0.1535	0.1808	2.0243E 02	0.99
2	0.1808	0.2127	2.0667E 02	0.91
3	0.2127	0.2491	1.6155E 02	1.11
4	0.2491	0.2947	1.2913E 02	1.20
5	0.2947	0.3448	1.1209E 02	1.40
6	0.3448	0.4040	8.5685E 01	1.67
1	0.2982	0.3438	9.1203E 01	0.94
2	0.3438	0.4076	7.7701E 01	0.87
3	0.4076	0.4805	8.2324E 01	0.80
4	0.4805	0.5626	6.6029E 01	0.98
5	0.5626	0.6629	5.8317E 01	0.98
6	0.6629	0.7815	4.5439E 01	1.17
7	0.7815	0.9182	3.6792E 01	1.37
8	0.9182	1.0824	3.0559E 01	1.50
9	1.0524	1.2739	2.7146E 01	1.57
10	1.2739	1.4927	2.3590E 01	1.69

Table 44. Runs 7799D, 7799E, 7799B, 7799C. Gamma-ray spectrum on center-line beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite (Item V-B)

PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MPV*KW))		PHOTON ENERGY (MEV)	FLUX (G/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
7.2000E-01	1.0135E 02	1.7225E 02	3.9250E 00	1.2440E 01	1.3265E 01
7.6000E-01	1.4099E 02	1.6953E 02	4.0550E 00	1.1892E 01	1.2768E 01
8.0000E-01	1.5547E 02	1.6320E 02	4.1850E 00	1.1786E 01	1.2708E 01
8.4000E-01	1.5550E 02	1.5835E 02	4.3150E 00	1.1723E 01	1.2751E 01
8.8000E-01	1.5174E 02	1.5425E 02	4.4450E 00	1.0983E 01	1.2214E 01
9.2000E-01	1.4699E 02	1.4950E 02	4.5750E 00	9.2636E 00	1.0616E 01
9.6000E-01	1.4212E 02	1.4447E 02	4.7050E 00	6.8972E 00	8.2869E 00
1.0000E 00	1.3780E 02	1.3978E 02	4.8350E 00	4.8254E 00	6.2093E 00
1.0400E 00	1.3410E 02	1.3581E 02	4.9850E 00	3.9182E 00	5.5989E 00
1.0800E 00	1.3117E 02	1.3264E 02	5.1550E 00	5.5436E 00	7.4263E 00
1.1250E 00	1.2852E 02	1.2988E 02	5.3250E 00	8.7636E 00	1.0617E 01
1.1750E 00	1.2548E 02	1.2699E 02	5.4950E 00	1.1030E 01	1.2969E 01
1.2250E 00	1.2186E 02	1.2381E 02	5.6650E 00	1.0763E 01	1.2941E 01
1.2750E 00	1.1818E 02	1.2042E 02	5.8350E 00	8.6216E 00	1.0656E 01
1.3250E 00	1.1513E 02	1.1710E 02	6.0050E 00	6.3854E 00	8.1198E 00
1.3750E 00	1.1242E 02	1.1406E 02	6.1750E 00	5.7241E 00	7.4832E 00
1.4250E 00	1.0935E 02	1.1086E 02	6.3450E 00	7.3138E 00	9.0658E 00
1.4750E 00	1.0622E 02	1.0750E 02	6.5150E 00	1.0266E 01	1.1795E 01
1.5250E 00	1.0385E 02	1.0504E 02	6.7000E 00	1.3218E 01	1.4391E 01
1.5750E 00	1.0260E 02	1.0378E 02	6.9000E 00	1.4652E 01	1.5759E 01
1.6400E 00	1.0167E 02	1.0279E 02	7.1000E 00	1.4430E 01	1.5460E 01
1.7200E 00	9.9325E 01	1.0036E 02	7.3000E 00	1.3276E 01	1.4111E 01
1.8000E 00	9.5762E 01	9.6742E 01	7.5000E 00	1.1572E 01	1.2336E 01
1.8800E 00	9.3001E 01	9.3952E 01	7.7000E 00	9.7068E 00	1.0414E 01
1.9600E 00	9.2938E 01	9.3910E 01	7.9000E 00	7.8502E 00	8.4283E 00
2.0400E 00	9.5419E 01	9.6351E 01	8.1000E 00	6.1467E 00	6.5901E 00
2.1200E 00	9.6817E 01	9.7757E 01	8.3000E 00	4.5965E 00	5.0104E 00
2.2000E 00	9.7263E 01	9.4208E 01	8.5000E 00	3.3463E 00	3.6895E 00
2.2800E 00	8.4450E 01	8.5373E 01	8.7250E 00	2.2673E 00	2.4891E 00
2.3600E 00	7.3273E 01	7.4164E 01	8.9750E 00	1.3629E 00	1.5068E 00
2.4500E 00	6.1672E 01	6.2488E 01	9.2250E 00	7.3264E-01	8.6540E-01
2.5500E 00	5.1787E 01	5.2524E 01	9.4750E 00	3.5288E-01	4.5572E-01
2.6500E 00	4.4421E 01	4.5149E 01	9.7250E 00	1.5421E-01	2.1795E-01
2.7500E 00	3.8738E 01	3.9454E 01	9.9750E 00	6.1205E-02	9.6943E-02
2.8500E 00	3.4278E 01	3.4967E 01	1.0300E 01	1.5449E-02	3.2066E-02
2.9500E 00	3.0646E 01	3.1325E 01	1.0700E 01	1.1930E-03	8.9302E-03
3.0500E 00	2.7552E 01	2.8226E 01	1.1100E 01	-1.5576E-03	3.6868E-03
3.1500E 00	2.4931E 01	2.5537E 01	1.1500E 01	-2.2067E-03	2.5429E-03
3.2500E 00	2.2450E 01	2.3174E 01	1.1900E 01	-2.3948E-03	2.2533E-03
3.3500E 00	2.0338E 01	2.1049E 01	1.2300E 01	-2.2724E-03	2.1670E-03
3.4500E 00	1.8381E 01	1.9090E 01	1.2700E 01	-1.8764E-03	2.0557E-03
3.5500E 00	1.6538E 01	1.7352E 01	1.3100E 01	-1.6519E-03	1.8503E-03
3.6500E 00	1.4887E 01	1.5689E 01	1.3500E 01	-1.3910E-03	1.5895E-03
3.7500E 00	1.3451E 01	1.4263E 01	1.3900E 01	-1.0293E-03	1.3754E-03

Table 45. Runs 7800B, 7801C. NE213 on centerline beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite plus 12.7-cm (B₄C + C) plus 4.45-cm SS (Item V-C)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
9.7135E-01	3.1846E 00	3.2625E 00	5.9380E 00	2.1441E-01	2.2216E-01
9.0694E-01	3.6426E 00	3.6956E 00	6.2542E 00	1.9385E-01	2.0413E-01
1.0086E 00	3.3306E 00	3.2655E 00	6.5557E 00	1.7216E-01	1.8064E-01
1.1069E 00	2.8955E 00	2.9211E 00	6.8390E 00	1.4764E-01	1.5339E-01
1.2047E 00	2.5977E 00	2.6291E 00	7.2352E 00	1.1119E-01	1.1575E-01
1.3096E 00	2.3764E 00	2.4067E 00	7.7365E 00	7.1982E-02	7.6974E-02
1.4121E 00	2.2204E 00	2.2516E 00	8.2364E 00	4.8127E-02	5.2406E-02
1.5107E 00	2.1436E 00	2.1728E 00	8.7578E 00	3.6325E-02	3.9253E-02
1.6100E 00	2.0962E 00	2.1223E 00	9.2613E 00	3.0044E-02	3.2575E-02
1.7095E 00	2.0236E 00	2.0488E 00	9.7411E 00	2.4309E-02	2.6672E-02
1.8125E 00	1.9161E 00	1.9406E 00	1.0259E 01	1.9081E-02	2.1109E-02
1.9223E 00	1.7904E 00	1.8139E 00	1.0777E 01	1.5237E-02	1.7001E-02
2.0000E 00	1.6104E 00	1.6325E 00	1.1247E 01	1.2368E-02	1.3941E-02
2.0961E 00	1.3361E 00	1.3572E 00	1.1751E 01	9.8515E-03	1.1228E-02
2.4988E 00	1.0676E 00	1.0942E 00	1.2393E 01	7.2613E-03	8.4147E-03
2.7026E 00	8.1881E-01	8.3679E-01	1.3201E 01	4.7730E-03	5.6167E-03
2.8994E 00	6.2242E-01	6.3984E-01	1.4021E 01	3.2888E-03	3.9254E-03
3.0975E 00	4.7935E-01	4.9809E-01	1.4792E 01	2.1810E-03	2.6761E-03
3.2765E 00	3.8927E-01	4.0401E-01	1.5629E 01	1.0738E-03	1.4010E-03
3.5009E 00	3.2746E-01	3.4531E-01	1.6539E 01	2.9859E-04	5.3561E-04
3.7074E 00	2.9466E-01	3.0900E-01	1.7533E 01	-4.5347E-05	1.6316E-04
3.9061E 00	2.8986E-01	3.0229E-01	1.8521E 01	-1.4992E-04	6.9011E-05
4.1528E 00	3.0751E-01	3.1995E-01	1.9498E 01	-1.4552E-04	6.3453E-05
4.4540E 00	3.2958E-01	3.4028E-01	2.0556E 01	-1.3838E-04	6.9652E-05
4.7521E 00	3.2996E-01	3.4016E-01	2.1580E 01	-9.3404E-05	1.0158E-04
5.0422E 00	3.1069E-01	3.1956E-01	2.2560E 01	-9.9559E-05	1.0621E-04
5.3459E 00	2.7530E-01	2.8380E-01	2.3471E 01	-9.9337E-05	1.2390E-04
5.6453E 00	2.3889E-01	2.4799E-01			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	6.6974E-01	4.4898E-03
1.000	1.200	5.9198E-01	3.4761E-03
1.200	1.600	9.1741E-01	6.0186E-03
1.600	2.000	7.7496E-01	4.9103E-03
2.000	2.000	1.0995E 00	9.5553E-03
2.000	4.000	3.6490E-01	7.7660E-03
4.000	6.000	5.8982E-01	9.7525E-03
6.000	8.000	2.7232E-01	6.4463E-03
8.000	10.000	7.2824E-02	3.0049E-03
10.000	12.000	3.0169E-02	1.6779E-03
12.000	16.000	1.6365E-02	1.3870E-03
16.000	20.000	4.7480E-04	4.4142E-04
1.500	15.000	3.4331E 00	4.5735E-02
3.000	12.000	1.3093E 00	2.8656E-02

Table 46. Runs 1490A, 1490B, 1489A. Hydrogen counters on centerline beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite plus 12.7-cm (B₄C + C) plus 4.45-cm SS (*Item V-C*)

N	ENERGY BOUNDARY (MEV)		FLUX (N/(CM ² *S*MEV*KW))	ERROR (PERCENT)
1	0.0566	0.0681	4.5489E 01	3.79
2	0.0681	0.0795	4.4432E 01	4.41
3	0.0795	0.0929	3.9263E 01	4.69
4	0.0929	0.1100	2.4876E 01	6.25
5	0.1100	0.1291	3.0317E 01	5.20
6	0.1291	0.1520	3.1059E 01	4.58
7	0.1520	0.1787	2.1382E 01	6.21
8	0.1787	0.2092	1.7969E 01	7.09
1	0.1508	0.1784	1.9677E 01	2.57
2	0.1784	0.2107	1.7888E 01	2.73
3	0.2107	0.2476	1.5765E 01	3.05
4	0.2476	0.2891	1.5322E 01	3.12
5	0.2891	0.3398	1.4761E 01	2.88
6	0.3398	0.3997	1.0886E 01	3.60
1	0.2926	0.3480	1.3450E 01	1.18
2	0.3480	0.4034	1.0983E 01	1.65
3	0.4034	0.4772	8.4113E 00	1.76
4	0.4772	0.5603	8.8716E 00	1.67
5	0.5603	0.6618	9.3285E 00	1.40
6	0.6618	0.7818	7.4027E 00	1.59
7	0.7818	0.9203	6.2847E 00	1.74
8	0.9203	1.0772	5.1761E 00	1.98
9	1.0772	1.2711	3.7942E 00	2.22
10	1.2711	1.4926	2.8171E 00	2.72

Table 47. Runs 7800B, 7800C, 7801C, 7801D. Gamma-ray spectrum on centerline beyond spectrum modifier plus UO₂ blanket plus 15.2-cm graphite plus 12.7-cm (B₄C + C) plus 4.45-cm SS (Item V-C)

PHOTON ENERGY (MEV)	FLUX (G/(CM2*S*MEV*KW)) LOWER LIMIT	UPPER LIMIT	PHOTON ENERGY (MEV)	FLUX (G/(CM2*S*MEV*KW)) LOWER LIMIT	UPPER LIMIT
7.2600E-01	1.1811E 01	2.2431E 01	3.9250E 00	2.7016E 00	2.8973E 00
7.5000E-01	1.9136E 01	2.2439E 01	4.0550E 00	2.7609E 00	2.9673E 00
9.0000E-01	2.0997E 01	2.2203E 01	4.1850E 00	2.9689E 00	3.1851E 00
8.4000E-01	2.1716E 01	2.2164E 01	4.3150E 00	3.1652E 00	3.4110E 00
8.8000E-01	2.1617E 01	2.1955E 01	4.4450E 00	3.1631E 00	3.4581E 00
9.2000E-01	2.1262E 01	2.1592E 01	4.5750E 00	2.9731E 00	3.2003E 00
9.6000E-01	2.0882E 01	2.1156E 01	4.7050E 00	2.3237E 00	2.6524E 00
1.0000E 00	2.0571E 01	2.0325E 01	4.8350E 00	1.6819E 00	2.0187E 00
1.0400E 00	2.0308E 01	2.0553E 01	4.9850E 00	1.1341E 00	1.5300E 00
1.0300E 00	1.9984E 01	2.0217E 01	5.1550E 00	1.2298E 00	1.6661E 00
1.1250E 00	1.9502E 01	1.9760E 01	5.3250E 00	2.1134E 00	2.5468E 00
1.1750E 00	1.8989E 01	1.9308E 01	5.4950E 00	3.1461E 00	3.6156E 00
1.2250E 00	1.8586E 01	1.8991E 01	5.6650E 00	3.5866E 00	4.1087E 00
1.2750E 00	1.8228E 01	1.8670E 01	5.8350E 00	3.1944E 00	3.6835E 00
1.3250E 00	1.7904E 01	1.8265E 01	6.0050E 00	2.3740E 00	2.7828E 00
1.3750E 00	1.7549E 01	1.7849E 01	6.1750E 00	1.7716E 00	2.1992E 00
1.4250E 00	1.7162E 01	1.7435E 01	6.3450E 00	1.9021E 00	2.3370E 00
1.4750E 00	1.6767E 01	1.6992E 01	6.5150E 00	2.7306E 00	3.0982E 00
1.5250E 00	1.6370E 01	1.6584E 01	6.7000E 00	3.8811E 00	4.1624E 00
1.5750E 00	1.5972E 01	1.6200E 01	6.9000E 00	4.7954E 00	5.0582E 00
1.6400E 00	1.5437E 01	1.5671E 01	7.1000E 00	5.1257E 00	5.3697E 00
1.7200E 00	1.4732E 01	1.4949E 01	7.3000E 00	4.9755E 00	5.1784E 00
1.8000E 00	1.4068E 01	1.4277E 01	7.5000E 00	4.5218E 00	4.7065E 00
1.8800E 00	1.3444E 01	1.3634E 01	7.7000E 00	3.9280E 00	4.0915E 00
1.9600E 00	1.2946E 01	1.3136E 01	7.9000E 00	3.2694E 00	3.4020E 00
2.0400E 00	1.2662E 01	1.2853E 01	8.1000E 00	2.6216E 00	2.7309E 00
2.1200E 00	1.2376E 01	1.2562E 01	8.3000E 00	2.0587E 00	2.1512E 00
2.2000E 00	1.1807E 01	1.1989E 01	8.5000E 00	1.6082E 00	1.6866E 00
2.2900E 00	1.0925E 01	1.1109E 01	8.7250E 00	1.2145E 00	1.2723E 00
2.3600E 00	9.9160E 00	1.0093E 01	8.9750E 00	8.5820E-01	9.0099E-01
2.4500E 00	8.8240E 00	8.9890E 00	9.2250E 00	5.6362E-01	5.9702E-01
2.5500E 00	7.7626E 00	7.9174E 00	9.4750E 00	3.4020E-01	3.6618E-01
2.6500E 00	6.8451E 00	7.0014E 00	9.7250E 00	1.9790E-01	2.0839E-01
2.7500E 00	6.0884E 00	6.2453E 00	9.9750E 00	9.5531E-02	1.1121E-01
2.8500E 00	5.5180E 00	5.6728E 00	1.0300E 01	3.4042E-02	4.5179E-02
2.9500E 00	5.1404E 00	5.2986E 00	1.0700E 01	5.1727E-03	1.2354E-02
3.0500E 00	4.9094E 00	5.0709E 00	1.1100E 01	-3.3522E-03	1.9070E-03
3.1500E 00	4.7180E 00	4.8829E 00	1.1500E 01	-5.0106E-03	-1.6550E-04
3.2500E 00	4.4669E 00	4.6418E 00	1.1900E 01	-4.5188E-03	2.0996E-04
3.3500E 00	4.1429E 00	4.3094E 00	1.2300E 01	-3.6390E-03	8.5439E-04
3.4500E 00	3.7941E 00	3.9552E 00	1.2700E 01	-2.8514E-03	1.1181E-03
3.5500E 00	3.4615E 00	3.6375E 00	1.3100E 01	-2.4913E-03	1.0438E-03
3.6500E 00	3.1307E 00	3.3247E 00	1.3500E 01	-2.1422E-03	8.5958E-04
3.7500E 00	2.8448E 00	3.0386E 00	1.3900E 01	-1.6486E-03	7.7493E-04

Table 48. Runs 7807B, 7807C. NE213 on centerline beyond 15.2-cm lead
(Item VI-A)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
8.1135E-01	8.8162E 02	8.9262E 03	5.9380E 00	4.5939E 02	4.6828E 02
9.0694E-01	9.6999E 03	9.7610E 03	6.2542E 00	3.9142E 02	3.9335E 02
1.0066E 00	9.4664E 03	9.5171E 03	6.5557E 00	3.2737E 02	3.3720E 02
1.1069E 00	9.3464E 03	9.3974E 03	6.8390E 00	2.8535E 02	2.9190E 02
1.2047E 00	9.3299E 03	9.3760E 03	7.2352E 00	2.3016E 02	2.3516E 02
1.3096E 00	9.1217E 03	9.1667E 03	7.7365E 00	1.6850E 02	1.7415E 02
1.4121E 00	8.7144E 03	8.7791E 03	8.2364E 00	1.2322E 02	1.2796E 02
1.5107E 00	8.2973E 03	8.3392E 03	8.7578E 00	8.6944E 01	8.9958E 01
1.6100E 00	7.8205E 03	7.8580E 03	9.2613E 00	6.0203E 01	6.2618E 01
1.7095E 00	7.3169E 03	7.3536E 03	9.7411E 00	4.2801E 01	4.4899E 01
1.8125E 00	6.8179E 03	6.8533E 03	1.0259E 01	3.0029E 01	3.1813E 01
1.9323E 00	6.3004E 03	6.3342E 03	1.0777E 01	2.1478E 01	2.2939E 01
2.1000E 00	5.5878E 03	5.6197E 03	1.1247E 01	1.5884E 01	1.7144E 01
2.2961E 00	4.7553E 03	4.7849E 03	1.1751E 01	1.1573E 01	1.2622E 01
2.4988E 00	3.9434E 03	3.9676E 03	1.2393E 01	7.6249E 00	8.5280E 00
2.7026E 00	3.1734E 03	3.1976E 03	1.3201E 01	4.1507E 00	4.7541E 00
2.9984E 00	2.5776E 03	2.6008E 03	1.4021E 01	2.3883E 00	2.8296E 00
3.0975E 00	2.0744E 03	2.0988E 03	1.4792E 01	1.5848E 00	1.9344E 00
3.2965E 00	1.6678E 03	1.6869E 03	1.5629E 01	8.3317E-01	1.0631E 00
3.5009E 00	1.3868E 03	1.4090E 03	1.6539E 01	2.3908E-01	4.0590E-01
3.7074E 00	1.2269E 03	1.2446E 03	1.7533E 01	-4.3875E-02	1.0316E-01
3.9061E 00	1.1328E 03	1.1481E 03	1.8521E 01	-1.2374E-01	3.0374E-02
4.1528E 00	1.0417E 03	1.0564E 03	1.9498E 01	-1.1422E-01	3.3013E-02
4.4540E 00	9.2566E 02	9.3807E 02	2.0556E 01	-1.0166E-01	4.5082E-02
4.7521E 00	8.0956E 02	8.2118E 02	2.1580E 01	-6.9957E-02	7.1855E-02
5.0422E 00	7.0848E 02	7.1858E 02	2.2560E 01	-6.8944E-02	7.6106E-02
5.3459E 00	6.2041E 02	6.2999E 02	2.3471E 01	-6.8559E-02	8.7976E-02
5.6453E 00	5.4070E 02	5.5117E 02			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.911	1.000	1.8022E 03	6.3843E 00
1.000	1.200	1.8796E 03	5.0042E 00
1.200	1.600	3.5005E 03	8.7306E 00
1.600	2.000	2.7679E 03	7.0785E 00
2.000	3.000	4.0197E 03	1.3339E 01
3.000	4.000	1.5097E 03	9.8148E 00
4.000	6.000	1.4991E 03	1.1239E 01
6.000	8.000	5.4742E 02	7.3436E 00
8.000	10.000	1.6013E 02	3.0460E 00
10.000	12.000	4.1356E 01	1.3947E 00
12.000	16.000	1.4437E 01	1.0110E 00
16.000	20.000	3.2519E-01	3.1090E-01
1.500	15.000	1.1373E 04	5.6176E 01
3.000	12.000	3.7577E 03	3.2949E 01

Table 49. Runs 7806B, 7806C. NE213 on centerline beyond 15.2-cm lead and spectrum modifier (Item VI-B)

NEUTRON ENERGY (MEV)	PLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	PLUX (N/(CM ² *S*MEV*KW)) UPPER LIMIT	NEUTRON ENERGY (MEV)	PLUX (N/(CM ² *S*MEV*KW)) LOWER LIMIT	PLUX (N/(CM ² *S*MEV*KW)) UPPER LIMIT
8.1135E-01	5.9761E 02	6.0611E 02	5.9280E 00	1.9230E 01	1.9863E 01
9.0694E-01	6.7915E 02	6.9274E 02	6.2542E 00	1.6511E 01	1.7337E 01
1.0066E 00	6.6366E 02	6.6740E 02	6.5557E 00	1.4342E 01	1.5028E 01
1.1069E 00	6.1895E 02	6.2254E 02	6.9390E 00	1.2701E 01	1.3179E 01
1.2047E 00	5.7104E 02	5.7431E 02	7.2352E 00	1.0593E 01	1.0978E 01
1.3096E 00	5.2994E 02	5.3206E 02	7.7365E 00	9.1053E 00	8.5430E 00
1.4121E 00	4.9461E 02	4.9771E 02	8.2364E 00	6.3802E 00	6.7550E 00
1.5107E 00	4.5722E 02	4.6005E 02	9.7578E 00	4.8105E 00	5.0581E 00
1.6100E 00	4.1263E 02	4.1512E 02	9.2613E 00	3.6160E 00	3.8200E 00
1.7095E 00	3.6586E 02	3.6825E 02	9.7411E 00	2.8604E 00	3.0434E 00
1.8125E 00	3.2215E 02	3.2443E 02	1.0259E 01	2.1735E 00	2.3308E 00
1.9323E 00	2.8067E 02	2.8285E 02	1.0777E 01	1.5824E 00	1.7122E 00
2.1000E 00	2.3106E 02	2.3310E 02	1.1247E 01	1.1822E 00	1.2974E 00
2.2961E 00	1.8074E 02	1.8264E 02	1.1751E 01	9.0578E-01	1.0051E 00
2.4988E 00	1.4267E 02	1.4420E 02	1.2393E 01	6.6239E-01	7.4703E-01
2.7026E 00	1.1522E 02	1.1680E 02	1.3201E 01	4.2832E-01	4.8766E-01
2.8984E 00	9.5780E 01	9.7302E 01	1.4021E 01	2.7647E-01	3.2051E-01
3.0975E 00	7.8370E 01	7.9993E 01	1.4792E 01	1.6864E-01	2.0337E-01
3.2965E 00	6.3639E 01	6.4897E 01	1.5629E 01	7.5618E-02	9.7837E-02
3.5009E 00	5.3489E 01	5.4977E 01	1.6539E 01	1.8714E-02	3.4779E-02
3.7074E 00	4.7952E 01	4.9120E 01	1.7533E 01	-4.0867E-03	1.0034E-02
3.9061E 00	4.4864E 01	4.5872E 01	1.8521E 01	-1.0672E-02	4.1613E-03
4.1528E 00	4.1928E 01	4.2817E 01	1.9498E 01	-1.0254E-02	3.9849E-03
4.4540E 00	3.6840E 01	3.7672E 01	2.0556E 01	-9.6846E-03	4.3957E-03
4.7521E 00	3.1536E 01	3.2326E 01	2.1580E 01	-6.9198E-03	6.6812E-03
5.0422E 00	2.7622E 01	2.8310E 01	2.2560E 01	-6.8596E-03	7.0527E-03
5.3459E 00	2.4434E 01	2.5100E 01	2.3471E 01	-6.7469E-03	8.2723E-03
5.6453E 00	2.1723E 01	2.2456E 01			

E1 (MEV)	E2 (MEV)	INTGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	1.2550E 02	4.8236E-01
1.000	1.200	1.2460E 02	3.6264E-01
1.200	1.600	1.9943E 02	6.0137E-01
1.600	2.000	1.3297E 02	4.6041E-01
2.000	3.000	1.5405E 02	8.5969E-01
3.000	4.000	5.8374E 01	6.5054E-01
4.000	6.000	5.9865E 01	7.6913E-01
6.000	8.000	2.4750E 01	5.3495E-01
8.000	10.000	9.0920E 00	3.5064E-01
10.000	12.000	3.0728E 00	1.2583E-01
12.000	16.000	1.3985E 00	9.8186E-02
16.000	20.000	2.9224E-02	2.9901E-02
1.500	15.000	4.8774E 02	3.8745E 00
3.000	12.000	1.5518E 02	2.3327E 00

Table 50. Runs 7808B, 7808C. NE213 on centerline beyond UO₂ blanket
(Item VI-C)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
0.1135E-01	2.3361E 03	2.3564E 03	5.9380E 00	1.1675E 02	1.1857E 02
9.0694E-01	2.7070E 02	2.71E3E 02	6.2542E 00	9.7938E 01	1.0037E 02
1.0066E 00	1.6856E 03	1.6948E 03	6.5557E 00	8.1864E 01	8.3844E 01
1.1069E 00	1.5502E 03	1.5597E 03	6.8390E 00	5.8321E 01	6.9639E 01
1.2047E 00	1.5400E 03	1.5576E 03	7.2352E 00	5.2523E 01	5.3499E 01
1.3096E 00	1.5308E 03	1.5392E 03	7.7365E 00	3.7022E 01	3.8120E 01
1.4121E 00	1.4794E 03	1.4882E 03	8.2364E 00	2.6131E 01	2.7083E 01
1.5107E 00	1.4095E 02	1.4177E 03	8.7578E 00	1.8792E 01	1.9376E 01
1.6100E 00	1.3268E 02	1.3343E 02	9.2613E 00	1.3533E 01	1.4003E 01
1.7095E 00	1.2440E 02	1.2515E 03	9.7411E 00	9.5412E 00	9.9421E 00
1.8125E 00	1.1912E 02	1.1885E 02	1.0259E 01	6.5638E 00	6.9011E 00
1.9323E 00	1.1580E 02	1.1650E 03	1.0777E 01	4.4809E 00	4.7542E 00
2.0600E 00	1.1197E 02	1.1194E 02	1.1247E 01	3.0536E 00	3.2875E 00
2.2061E 00	1.2004E 03	1.2067E 02	1.1751E 01	2.1326E 00	2.3236E 00
2.4989E 00	1.0886E 02	1.0938E 03	1.2393E 01	1.4736E 00	1.6354E 00
2.7076E 00	8.9564E 01	9.0170E 02	1.3201E 01	8.2094E-01	9.3081E-01
2.9934E 00	7.1664E 02	7.2146E 02	1.4021E 01	4.7812E-01	5.5933E-01
3.0975E 00	5.4795E 02	5.5292E 02	1.4792E 01	3.2258E-01	3.8875E-01
3.2965E 00	4.0938E 02	4.1237E 02	1.5629E 01	1.6619E-01	2.0931E-01
3.5009E 00	3.1768E 02	3.2230E 02	1.6539E 01	4.7378E-02	7.9198E-02
3.7074E 00	2.7464E 02	2.7831E 02	1.7533E 01	-6.2448E-03	2.1744E-02
3.9061E 00	2.5671E 02	2.5990E 02	1.8521E 01	-2.2253E-02	7.0951E-03
4.1528E 00	2.4741E 02	2.5051E 02	1.9498E 01	-2.1361E-02	6.1826E-03
4.4540E 00	2.3964E 02	2.4122E 02	2.0556E 01	-2.0275E-02	7.6748E-03
4.7521E 00	2.1638E 02	2.1880E 02	2.1580E 01	-1.4291E-02	1.2713E-02
5.0422E 00	1.8660E 01	1.8878E 02	2.2560E 01	-1.3368E-02	1.3758E-02
5.3459E 00	1.5876E 01	1.6074E 02	2.3471E 01	-1.3494E-02	1.6326E-02
5.6453E 00	1.3602E 02	1.3819E 02			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.811	1.000	3.9420E 02	1.1776E 00
1.000	1.200	3.1761E 02	9.2641E-01
1.200	1.600	5.9054E 02	1.6806E 00
1.600	2.000	4.8513E 02	1.4567E 00
2.000	3.000	1.0198E 03	2.8215E 00
3.000	4.000	3.6368E 02	2.0427E 00
4.000	6.000	3.8114E 02	2.3357E 00
6.000	8.000	1.3149E 02	1.4677E 00
8.000	10.000	3.4759E 01	5.9638E-01
10.000	12.000	8.4917E 00	2.6015E-01
12.000	16.000	2.3184E 00	1.9517E-01
16.000	20.000	6.7809E-02	5.9186E-02
1.500	15.000	2.5643E 03	1.1546E 01
3.000	12.000	9.1939E 02	6.7062E 00

Table 51. Runs 7809B, 7809C. NE213 on centerline beyond UO₂ blanket plus spectrum modifier (Item VI-D)

NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))		NEUTRON ENERGY (MEV)	FLUX (N/(CM ² *S*MEV*KW))	
	LOWER LIMIT	UPPER LIMIT		LOWER LIMIT	UPPER LIMIT
9.1135E-01	3.8605E 02	3.8966E 02	5.9380E 00	6.4902E 00	6.6982E 00
9.3694E-01	4.1896E 02	4.2094E 02	6.2542E 00	5.4919E 00	5.7699E 00
1.0066E 00	3.7469E 02	3.7618E 02	6.5557E 00	4.7816E 00	5.0103E 00
1.1069E 00	3.1644E 02	3.1788E 02	6.9390E 00	4.1753E 00	4.3299E 00
1.2047E 00	2.7125E 02	2.7252E 02	7.2352E 00	3.3063E 00	3.4301E 00
1.3096E 00	2.3623E 02	2.3743E 02	7.7365E 00	2.3828E 00	2.5195E 00
1.4121E 00	2.0870E 02	2.0987E 02	8.2364E 00	1.7691E 00	1.8814E 00
1.5107E 00	1.8530E 02	1.8638E 02	8.7578E 00	1.3765E 00	1.4528E 00
1.6100E 00	1.6423E 02	1.6520E 02	9.2613E 00	1.0477E 00	1.1125E 00
1.7095E 00	1.4531E 02	1.4623E 02	9.7411E 00	7.4386E-01	8.0201E-01
1.8125E 00	1.2850E 02	1.2938E 02	1.0259E 01	5.3420E-01	5.8270E-01
1.9323E 00	1.1314E 02	1.1399E 02	1.0777E 01	4.1407E-01	4.5416E-01
2.1000E 00	9.7634E 01	9.8423E 01	1.1247E 01	3.2015E-01	3.5610E-01
2.2961E 00	8.1956E 01	8.2679E 01	1.1751E 01	2.2723E-01	2.5795E-01
2.4988E 00	6.5547E 01	6.6130E 01	1.2393E 01	1.3451E-01	1.5849E-01
2.7026E 00	5.1412E 01	5.2001E 01	1.3201E 01	7.7199E-02	9.4331E-02
2.8984E 00	4.1150E 01	4.1709E 01	1.4021E 01	5.2867E-02	6.5389E-02
3.0975E 00	3.2542E 01	3.3130E 01	1.4792E 01	3.1357E-02	4.0854E-02
3.2965E 00	2.5208E 01	2.5666E 01	1.5629E 01	1.2250E-02	1.8595E-02
3.5009E 00	1.9891E 01	2.0427E 01	1.6539E 01	1.8572E-03	6.5249E-03
3.7074E 00	1.7152E 01	1.7575E 01	1.7533E 01	-1.8056E-03	2.3345E-03
3.9061E 00	1.6006E 01	1.6368E 01	1.8521E 01	-2.8843E-03	1.4540E-03
4.1528E 00	1.5070E 01	1.5426E 01	1.9498E 01	-2.6534E-03	1.4852E-03
4.4540E 00	1.3712E 01	1.4008E 01	2.0556E 01	-2.5772E-03	1.5486E-03
4.7521E 00	1.2167E 01	1.2447E 01	2.1580E 01	-1.8786E-03	2.1088E-03
5.0422E 00	1.0658E 01	1.0897E 01	2.2560E 01	-1.9525E-03	2.1295E-03
5.3459E 00	9.1123E 00	9.3399E 00	2.3471E 01	-1.9802E-03	2.4281E-03
5.6453E 00	7.6543E 00	7.8995E 00			

E1 (MEV)	E2 (MEV)	INTEGRAL (N/(CM ² *S*KW))	ERROR (N/(CM ² *S*KW))
0.311	1.000	7.6985E 01	1.9999E-01
1.000	1.200	6.4652E 01	1.4215E-01
1.200	1.600	8.5907E 01	2.3018E-01
1.600	2.000	5.3125E 01	1.7827E-01
2.000	3.000	6.7896E 01	3.2515E-01
3.000	4.000	2.2423E 01	2.3541E-01
4.000	6.000	2.2093E 01	2.6752E-01
6.000	8.000	7.9592E 00	1.7447E-01
8.000	10.000	2.5581E 00	7.7482E-02
10.000	12.000	7.9512E-01	3.8955E-02
12.000	16.000	2.7961E-01	2.7960E-02
16.000	20.000	4.2749E-03	9.7306E-03
1.500	15.000	1.9483E 02	1.3744E 00
3.000	12.000	5.5823E 01	7.9403E-01

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