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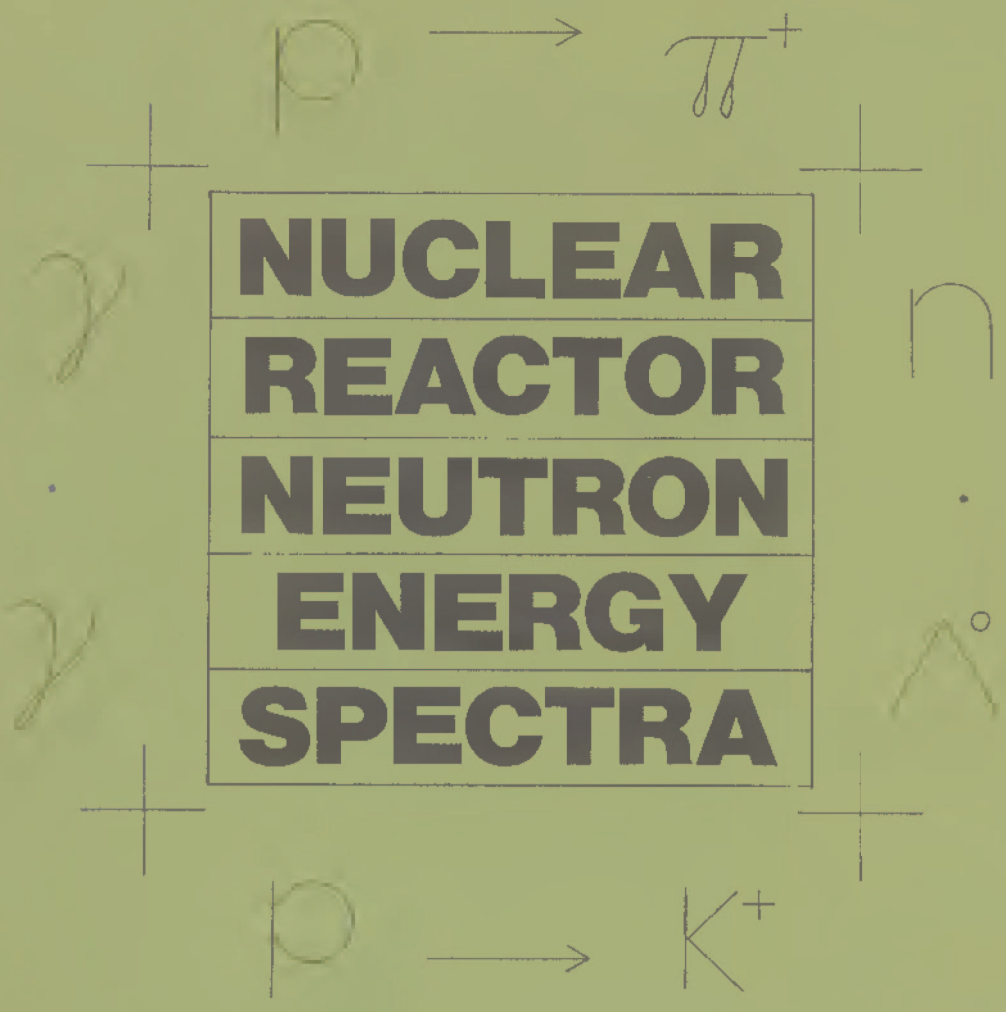

NUCLEAR REACTOR NEUTRON ENERGY SPECTRA

by

C. Z. Serpan, Jr. and B. H. Menke

AMERICAN SOCIETY FOR TESTING AND MATERIALS

NUCLEAR REACTOR NEUTRON ENERGY SPECTRA

by C. Z. Serpan, Jr. and B. H. Menke
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NUCLEAR REACTOR NEUTRON ENERGY SPECTRA

C. Z. Serpan, Jr.[a] and B. H. Menke[a]

INTRODUCTION

Studies of the effects resulting from exposure of materials to neutron bombardment in nuclear reactors can be made much more quantitative if the energy-level distribution of the neutrons is known. Such a distribution is commonly called a neutron spectrum. The neutron energies range from as low as 1×10^{-10} MeV in the thermal-neutron region, to over 18 MeV in the fast region. This extremely wide range can be conveniently handled, however, using a system of 25 or even fewer groups each defining a precise energy range, with the neutron population within those energy bounds being tabulated as the neutron spectrum.

A very common method in use for defining such a group structure is by quarter-lethargy units (0.25 u) where u is defined by

$$u = \ln \left(\frac{10 \text{ MeV}}{x \text{ MeV}} \right) , \qquad (1)$$

with 10 MeV typically taken as the highest energy boundary. For example, using 10 MeV as the highest energy level boundary (and noting that all neutrons ≥10 MeV are included in this group), the next lower energy level boundary would be

$$0.25 \text{ u} = \ln \left(\frac{10 \text{ MeV}}{7.79 \text{ MeV}} \right) . \qquad (2)$$

When all the neutrons in a spectrum having energies between any two such energy limits are summed and tabulated for that group, the neutrons are termed a group-integral flux and then the corresponding spectrum (all of the groups) is termed an integral spectrum. The integral spectra presented in this compilation are listed in the column Flux Fraction Per Group.

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Neutron spectra have been and continue to be calculated for specific reactor environments for specific requirements, and on an individual basis, their value is limited to that particular application. If, however, many neutron spectra can be assembled and reviewed simultaneously, it is possible to discern important similarities and differences between spectra and begin to relate them to the specific reactor environment. This is the first reason for this compilation of neutron spectra. The second reason is to document a large body of neutron spectra, which have been calculated at a number of different laboratories and subsequently used at the Naval Research Laboratory, thus making them generally available for reference and for additional research purposes. Such spectra are published herein in tabulated form (under the column Flux Fraction Per Group) and in corresponding graphical form.

REACTOR PHYSICS SPECTRUM CODES

As noted above, the neutron spectra in this compilation have been calculated at a number of different laboratories. Because each laboratory has typically used different reactor physics spectrum codes, the spectra in this compilation reflect these different computational methods. In addition to the "pure" spectrum calculation codes, however, another computer code is represented that will "unfold" neutron spectra from multiple activation foil results. The different codes represented in this compilation include "2DXY" [1] (two-dimensional transport theory), "Program S" [2] and "DTF-IV" [3] (one-dimensional transport theory), "2DB" [4] (two-dimensional diffusion theory), "SAND-II" [5] (multiple-foil unfolding), and "P1MG" [6] and "P3MG" [7] (one-dimensional, transport-modified diffusion).

The cross section libraries for the different codes are not necessarily the same, primarily because each laboratory uses a different library. Therefore, the results for the same reactor

facilities but from different codes (and/or laboratories) reveal variations beyond those resulting from the calculational method alone. No attempt is made to adjust or explain such variations in this compilation. In fact, an additional benefit of the compilation is the presentation of such variations for further inspection and consideration. References given for each spectrum show the source of the original calculation. It follows then, that reasonable consistency can be assumed for spectra calculated at the same laboratory because of consistency in the cross section library.

DESCRIPTION OF DATA IN MAIN COMPILATION

The information presented for each neutron spectrum in this compilation consists of:

1. A graphical representation of the integral neutron spectrum,
2. A description of the reactor and environment plus dosimetry data (including measured fluxes and cross sections, and
3. A computer listing of the lethargy and energy intervals plus the neutron spectrum normalized in two different ways.

The plotted neutron spectra in the main compilation correspond to the listing titled Flux Fraction Per Group. All of the neutron spectra in the compilation, except the last 12 for the EBR-II, are plotted with the right ordinate at a maximum of six percent; the area under all these curves is equivalent. Because the neutron-energy distribution in the EBR-II is so different from thermal reactors, those 12 reactor spectra are plotted with the right ordinate a maximum of 12 percent; the area under these curves are all equal. In those few cases when a group flux value exceeds the maximum percent of the plot, the graph terminates at the maximum and a digit is printed to indicate the excess. Pictorial representations of reactor facilities or experiments have been inset (where available) to aid the spectrum description.

The spectrum number identification assigned at NRL is shown in the graphical representation (e.g. SP24, meaning SPectrum 24) followed by the short title (e.g. Big Rock Point Accel Surv, meaning the accelerated surveillance location of the Big Rock Point Reactor). A total of six letters and/or numbers can be included in the spectrum identification number. In the compilation the first two letters are SP for thermal reactors, and the next two numbers are generally arbitrary except for several series which are apparent. The last two letters refer to a specific code (e.g. D = DTF-IV, PM = P1MG) or indicate that the reactor physics code spectrum has been adjusted by multiple foils and thus has been unfolded (e.g. U) or that the spectrum has been adjusted to conform to high temperature operations (e.g. H), or the use of shielding materials (e.g. C = Cadmium, B = Boron). A series of spectra from the EBR-II are included, and these are all identified as from the "31F dosimetry test", followed by an arbitrary two digit number, (e.g. 31F24).

A detailed description of each part of the tabulated information in the main compilation follows.

Reactor Description. This includes the name and physical location of the reactor, its type such as a PWR, BWR, test, etc., its full power level in thermal MW, the coolant and the moderator.

Spectrum Facility Description. This provides a brief description of the specific irradiation location within the reactor for which the spectrum was calculated. Special important features are also included, and a statement of the major environment considered which the spectrum represents.

Spectrum Code. The name of the specific code used for the spectrum calculation, the laboratory performing the calculation and a reference to the initial publication of the spectrum information.

Lower Energy Limit. Thresholds typically used for interpretation of results for materials studies. The thermal group is always the last energy group of the tabulated spectrum. The temperature

refers to the moderator temperature and is given as either (a) 20°C which is used when no meaningful activation foil measurement was available, and thus, the thermal value is directly from the calculation, or (b) some higher temperature value which means that a foil measurement was made and that the thermal flux measurement was corrected to the Maxwellian thermal flux at that temperature. In case (b), the tabulated, thermal flux group value is adjusted to conform to the measured Maxwellian thermal flux at the stated temperature. The technique for this calculation is described in a following section (titled Thermal Neutron Flux (at Maxwellian temperature)) page 10.

Neutron Flux. Fast and thermal neutron fluxes measured from irradiations in the spectra are listed. They correspond to full power levels unless indicated otherwise. They have beencalculated using the cross sections given in the adjacent column.

Fluxes in parenthesis at the threshold >0.5 MeV are taken directly from the reactor physics computer code calculation output; they have been included only for certain series of spectra wherein it is useful to observe the progressive changes in spectrum shape and intensity among the spectra in the series as calculated by the particular code, and not adjusted in any way by measurements. The values given represent the summation of all integral fluxes equal to and above 0.5 MeV in the spectrum (lethargy ≤3.00). Thus it is possible to normalize the entire spectrum using that sum for flux >0.5 MeV and accordingly all other spectra in the series to their corresponding sums >0.5 MeV. If no fluxes are given, no measurements are available.

Spectrum-Averaged Cross Sections. These are cross sections for activation in the spectrum of interest using the $^{54}Fe(n,p)^{54}Mn$ reaction determined with Helm's[8] model. The procedure is discussed in a following section (titled Spectrum-Averaged Cross Sections) page 9. Other cross section models could also be used,

of course, such as those of Simons and McElroy[9] or Shure[10]; the effect of the differences incurred using alternate models is discussed elsewhere.[11]

Lethargy. The lower lethargy limit of the group. One lethargy interval in this compilation is taken to be 0.25 u. Therefore, for example, 1.0 u equals 4 lethargy intervals.

Lower Energy Limit (MeV). The lower-energy limit of the group in MeV.

Flux Fraction Per Group. This listing is the integral spectrum, and is normalized to one neutron. Tabulated values are the relative, integral fluxes between the energy limits. Because of the normalization to one neutron, the tabulated values clearly do not correspond to the actual, absolute flux values in the reactor environment.

All the spectra in the main compilation are plotted directly from these values for all groups having a lethargy interval of 0.25 u; groups having more than one quarter-lethargy interval are plotted by dividing the listed group-integral flux value by the number of quarter-lethargy intervals in that group. For example, fluxes in the group u = 5.0 typically are bounded between u = 4.0 and u = 5.0, wherein there are four quarter-lethargy intervals. Thus, for plotting, the tabulated flux must be divided by 4 and that average value plotted between u = 4.0 and u = 5.0.

Normalized Flux Per Lethargy Interval. The integral spectrum above (Flux Fraction Per Group) has been renormalized in this column to equivalent activation by the $^{54}Fe(n,p)^{54}Mn$ reaction using the activation cross sections of Helm;[8] the procedure is described in the first two subsections of the following section titled Use of Neutron Spectrum Data. This is an integral spectrum for fluxes in groups having one quarter-lethargy interval; for groups having more than one quarter-lethargy interval, the tabulated values are already divided by the number of quarter-lethargy intervals, and may be plotted directly between the listed

energy or lethargy limits, as has been done in Fig. 1.

USE OF NEUTRON SPECTRUM DATA

A clearer understanding of the tabulated data of this compilation and its use may be gained from the following examples, which are keyed to Fig. 1. The figure shows the spectrum for the accelerated surveillance location of the Big Rock Point reactor (the histogram) plotted from "Normalized Flux Per Lethargy Interval" values. Superimposed on this histogram is a representation of the fission spectrum as the smooth curve. The overall intensity values of both the fission spectrum and the Big Rock Point reactor spectrum are normalized to equal activation by the $^{54}Fe(n,p)^{54}Mn$ reaction using Helm's cross section values.[8] The response functions, consisting of group flux values for both the fission spectrum and the Big Rock Point spectrum times the group activation cross section values of Helm, are plotted between 130 and 140 on the right ordinate as the smooth curve and the histogram respectively. It is pointed out that this is the only plot in this compilation made directly from values of the listing "Normalized Flux Per Lethargy Interval" and has been included to show how to use this particular spectrum listing. All other plots in this compilation are made directly from the "Flux Fraction Per Group" listing.

Additional detailed descriptions of the data listings in Fig. 1 follow.

Normalized Flux Per Lethargy Interval. This spectrum is renormalized in relative intensity to a specific level of activation with respect to the $^{54}Fe(n,p)^{54}Mn$ reaction using the activation cross section model of Helm.[8] These values σ_i^{act} are shown in the column Activation Cross-Fe and are in units of Barns, (B). The activation level or "Normalized Response," is 32.7876 $n/cm^2 \cdot sec^{-1}$ x B, and simply comes from multiplying each group flux ϕ_i times the corresponding cross section σ_i^{act} and summing the products, e.g. for group having lower lethargy 0.25 u in Fig. 1.

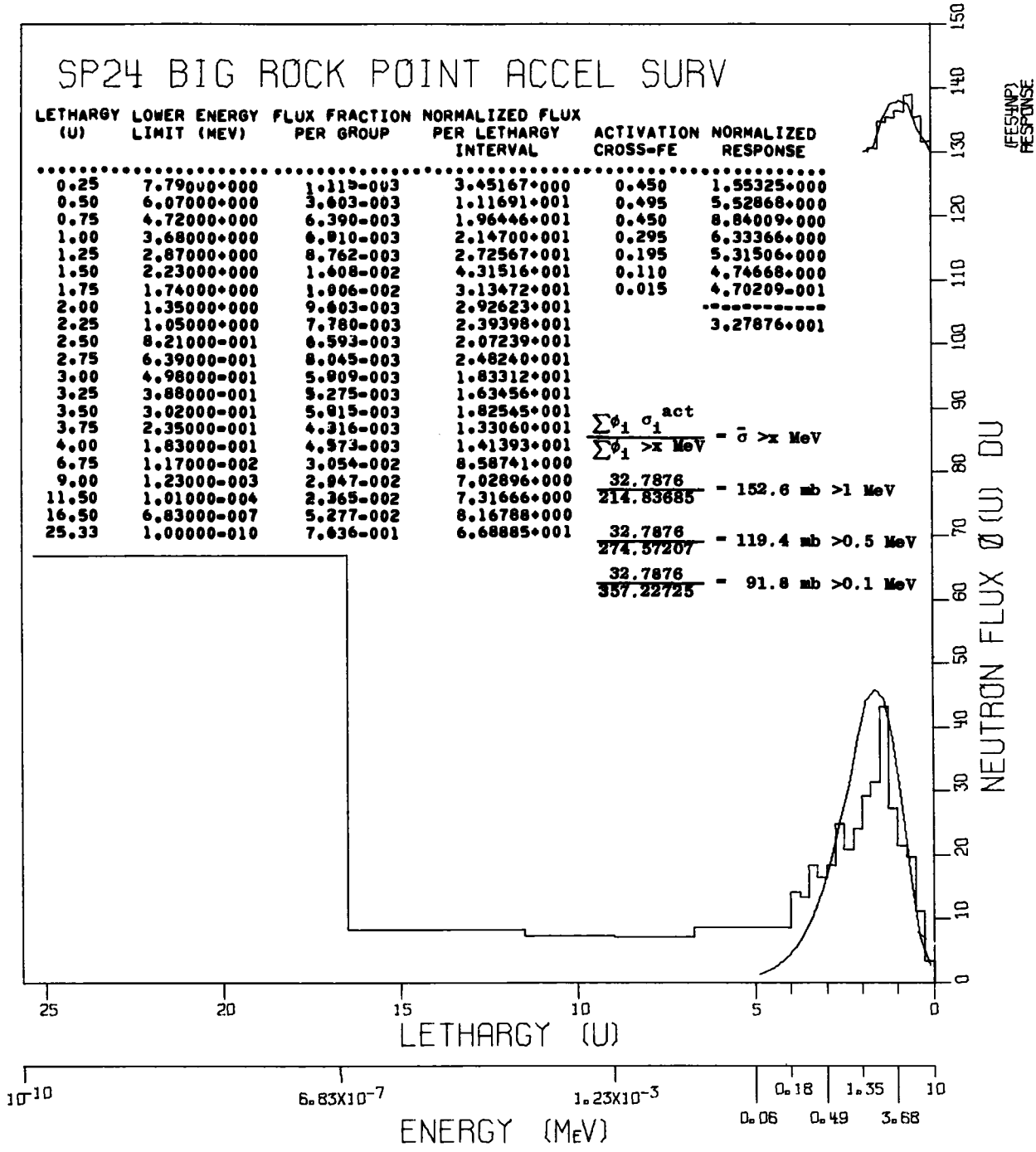

Fig. 1 - Graphical representation and tabulated neutron spectrum for the accelerated surveillance location, position 124, of the Big Rock Point Reactor.

$$3.45167\ n/cm^2 \cdot sec^{-1} \times 0.450\ B = 1.55325\ n/cm^2 \cdot sec^{-1} \times B \quad (3)$$

etc.

Normalized Response. The value of 32.7876 is the total activation from the $^{54}Fe(n,p)^{54}Mn$ reaction in this spectrum. In every spectrum in this compilation, the group fluxes listed under Normalized Flux Per Lethargy Interval are similarly normalized as shown above such that multiplication of the Normalized Flux Per Lethargy Interval values times the activation cross sections of Helm will result in the normalized response value of 32.812 ± 0.050.

The fluxes shown under Normalized Flux Per Lethargy Interval are integral values through lethargy 4.0 and are the average value for quarter-lethargy intervals for the subsequent groups. Thus, in the group having lower lethargy limit 6.75 u of Fig. 1, a total of 11 quarter-lethargy intervals exist. This follows from

$$6.75\ u - 4.00\ u = 2.75\ u\ /\ group \quad (4)$$

and

$$\frac{2.75\ u/group}{0.25\ u/interval} = 11\ interval/group \quad (5)$$

Accordingly, the flux in the group having lower lethargy 6.75 is

$$8.58741 \times 11 = 94.46151\ . \quad (6)$$

Spectrum-Averaged Cross Sections. Spectrum-averaged cross-sections can now be calculated for the various threshold energies of interest using the formula shown in the table. The spectrum-averaged cross-section is calculated by dividing the Normalized Response value (in this case 32.7876) by the sum of the fluxes greater than the desired threshold energy. For threshold >1 MeV, the Normalized Flux Per Lethargy Interval values are summed from lethargy 0.25 through 2.30, since 2.30 u = ln (10 MeV/1MeV). Because the group structure does not correspond to 2.30, it is necessary to add 20% of the group having lower lethargy 2.50 to the total, e.g.

$$20.7239 \times 0.20 = 4.14478 \quad (7)$$

The total sum of fluxes between 0.25 u and 2.30 u is then 214.83685, and when divided into the normalized response value, yields the cross section of 152.6 mb. Calculation of the cross section for threshold >0.5 MeV requires the sum of fluxes from 0.25 u through 3.00 u, and this sum again divided into the response value. Calculation of the cross section for threshold 0.1 MeV requires the sum of fluxes from 0.25 u through 4.60 u. Again, interpolation between lethargy groups is required for this total sum, e.g. in spectrum 24 of Fig. 1, recall that the flux for group 6.75 u is the average value for all 11 lethargy intervals, and from equation (6) that the integral flux in this group is 95.46151. To obtain the fraction representing lethargy 4.60 u the following procedure is used:

$$\frac{(4.60\ u - 4.00\ u)}{(6.75\ u - 4.00\ u)} \times 94.46151 = 20.60978 \qquad (8)$$

This value of 20.60978 is then added to the sum of fluxes from groups 0.25 u through 4.00 u to yield the total value of 357.22725.

Thermal Neutron Flux (at Maxwellian Temperature). Thermal neutron flux derived from the $^{59}Co(n,\gamma)^{60}Co$ reaction using both bare and cadmium-covered foils, is commonly reported as 2200m·sec^{-1} flux at 20°C represented herein as $\phi_{th}^{20°C}$. When the actual irradiation temperature exceeds 20°C, this flux value no longer correctly represents the true thermal neutron flux. To correct existing $\phi_{th}^{20°C}$ flux values, for some different temperature, x°C, the following relation is used:

$$\phi_{th}^{x°C} = \frac{\phi_{th}^{20°C}}{0.8862\left(\frac{T_o}{T}\right)\ 1/2} \qquad (9)$$

where T_o and T are both expressed in degrees absolute, (°K) so that

T_o is 293°K = (273 + 20°C) and
T represents x°C (expressed as (273 + X°C) = °K.

The 2200 $m \cdot sec^{-1}$ flux at 20°C for spectrum 24 is 9.52×10^{12} $n/cm^2 \cdot sec^{-1}$, and from the main data compilation for spectrum 24, the actual operating temperature was 302°C (equal to 575°K). Thus,

$$\phi_{th}^{302°C} = \frac{9.52 \times 10^{12} \ n/cm^2 \cdot sec^{-1}}{0.8862 \left(\frac{293}{575}\right) 1/2} \quad (10)$$

$$= 15.05 \times 10^{12} \ n/cm^2 \cdot sec^{-1} \quad (11)$$

This technique can also be used for 2200$m \cdot sec^{-1}$ flux at 20°C calculated by the Ag-Co technique.[11]

Calculation of Fluxes from Cross Sections. It is a very simple matter to calculate flux values for different threshold energies if the spectral-averaged cross-sections ($\bar{\sigma}$) are known for those threshold energies. For thresholds 1 and 2, for example, the relation is

$$\phi_1 \times \bar{\sigma}_1 = \phi_2 \times \bar{\sigma}_2 \ . \quad (12)$$

Using the values for spectrum 24 again as an example,

$$1.37 \times 10^{12} \ n/cm^2 \cdot sec^{-1} \ >1 \text{ MeV} \times 152.6 \text{mb} =$$

$$1.75 \times 10^{12} \ n/cm^2 \cdot sec^{-1} \ >0.5 \text{ MeV} \times 119.4 \text{mb} \quad (13)$$

Care must be taken to be sure that the correct cross section is being used. If one desires flux greater than some threshold energy, the cross section must also be calculated based on the flux greater than that same energy.

Frequently, the fission-spectrum-averaged cross sections are used for flux calculations. In this case, all the neutrons in the fission spectrum are being considered, not just those greater than some threshold, such as >1 MeV. For example, the fission-spectrum-averaged cross section may be given as 68mb for the $^{54}Fe(n,p)^{54}Mn$ reaction, but the corresponding flux values are quoted as >1 MeV. In this case, the cross section corresponding to these fluxes is not 68mb, but rather is

$$\frac{68 \text{mb}}{0.692} = 98.26 \text{mb} \ . \quad (14)$$

This results because flux >1 MeV represents 69.2% of the flux in the fission spectrum but the cross section of 68mb represents flux averaged over the entire fission spectrum. In order to determine the flux value corresponding to these conditions of a fission-spectrum-averaged cross section of 68mb, and fluxes >1 MeV, the cross section of 98.26 is used for $\bar{\sigma}_2$ in equation (12), and the values on the left side of equation (13) representing calculated-spectrum flux >1 MeV for threshold 1. Thus, the fission-spectrum flux >1 MeV of 2.12×10^{12} $n/cm^2 \cdot sec^{-1}$ >1 MeV is calculated:

$$1.37 \times 10^{12}\ n/cm^2 \cdot sec^{-1} > 1\ MeV \times 152.6mb = 2.12 \times 10^{12}\ n/cm^2 \cdot sec^{-1} > 1\ MeV \times 98.26mb \quad (14)$$

Flux Fraction Per Group. As was stated earlier, this is the tabulated integral spectrum. It is normalized to one neutron for consistency throughout this report. This has an advantage, because it is thus possible to easily determine the population fraction of any flux group or groups. For example, it can be seen that the value for the thermal group, (at lower energy 1×10^{-10} MeV) is 7.636-001, meaning that thermal neutrons occupy 76.36% of the entire spectrum. By contrast, the highest energy group (7.79 MeV, lower lethargy 0.25 u) has only 0.115% of the neutrons in the entire spectrum. The group flux values listed in this column are plotted as percentages directly in the accompanying figures in the main compilation for groups through lethargy 4.0. For group-fluxes at higher lethargies, the values plotted are those derived from division of the tabulated group fluxes by the number of quarter-lethargy intervals in the group as has been described above in the section titled "Flux Fraction Per Group", page 6.

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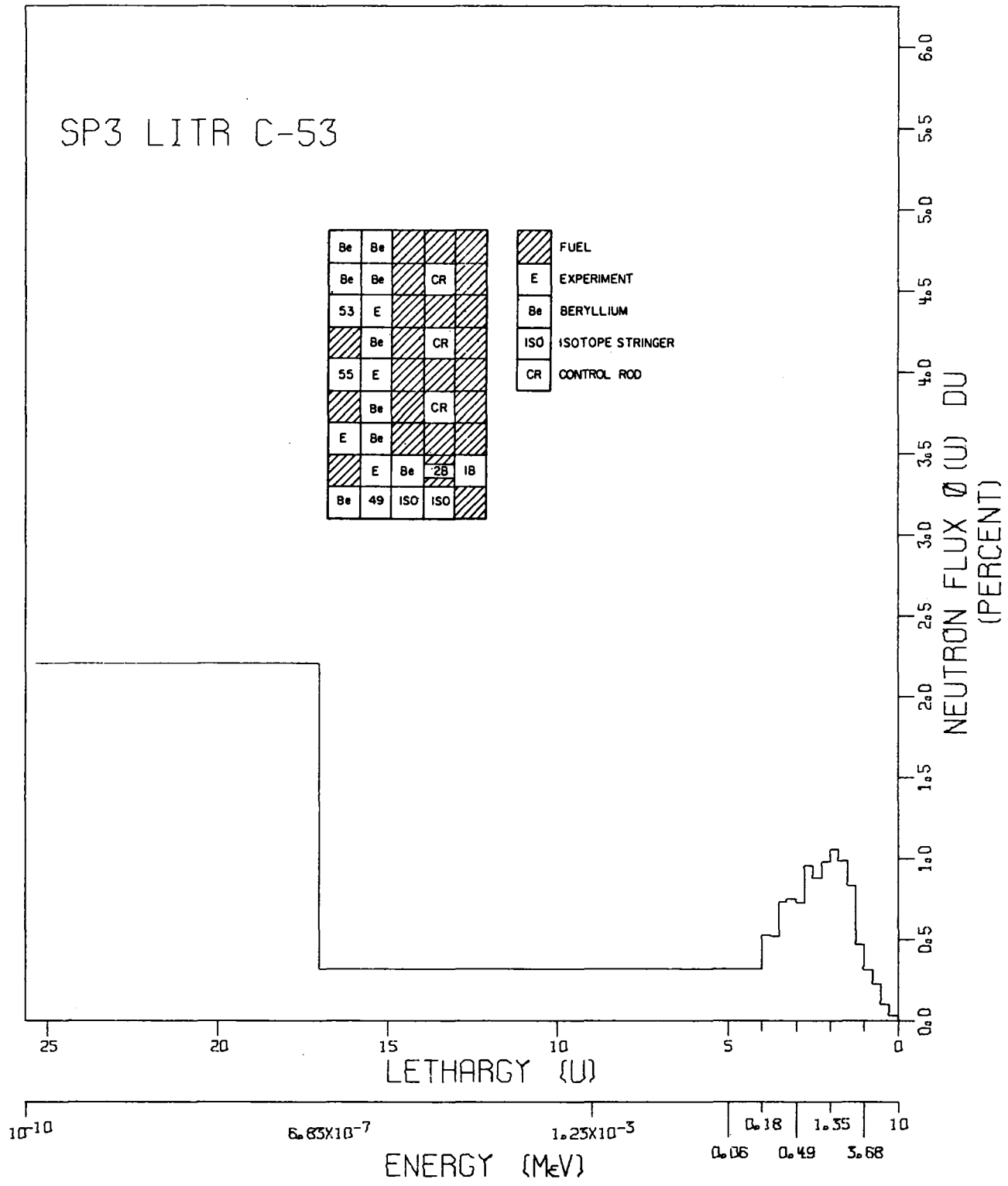
MAIN COMPILATION

LIGHT WATER MODERATED REACTORS

RESEARCH AND TEST REACTORS


SP3 LITR C-53
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be 2B IB
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0
25 20 15 10 5 0
LETHARGY (U)
10-10 6.83X10-7 1.25X10-3 0.18 1.35 10
0.06 0.49 3.68
ENERGY (MeV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Core lattice facility C-53; unfueled location; steel and water.

Spectrum Code

Code: 2 DXY Calculation: BNW[12-14]

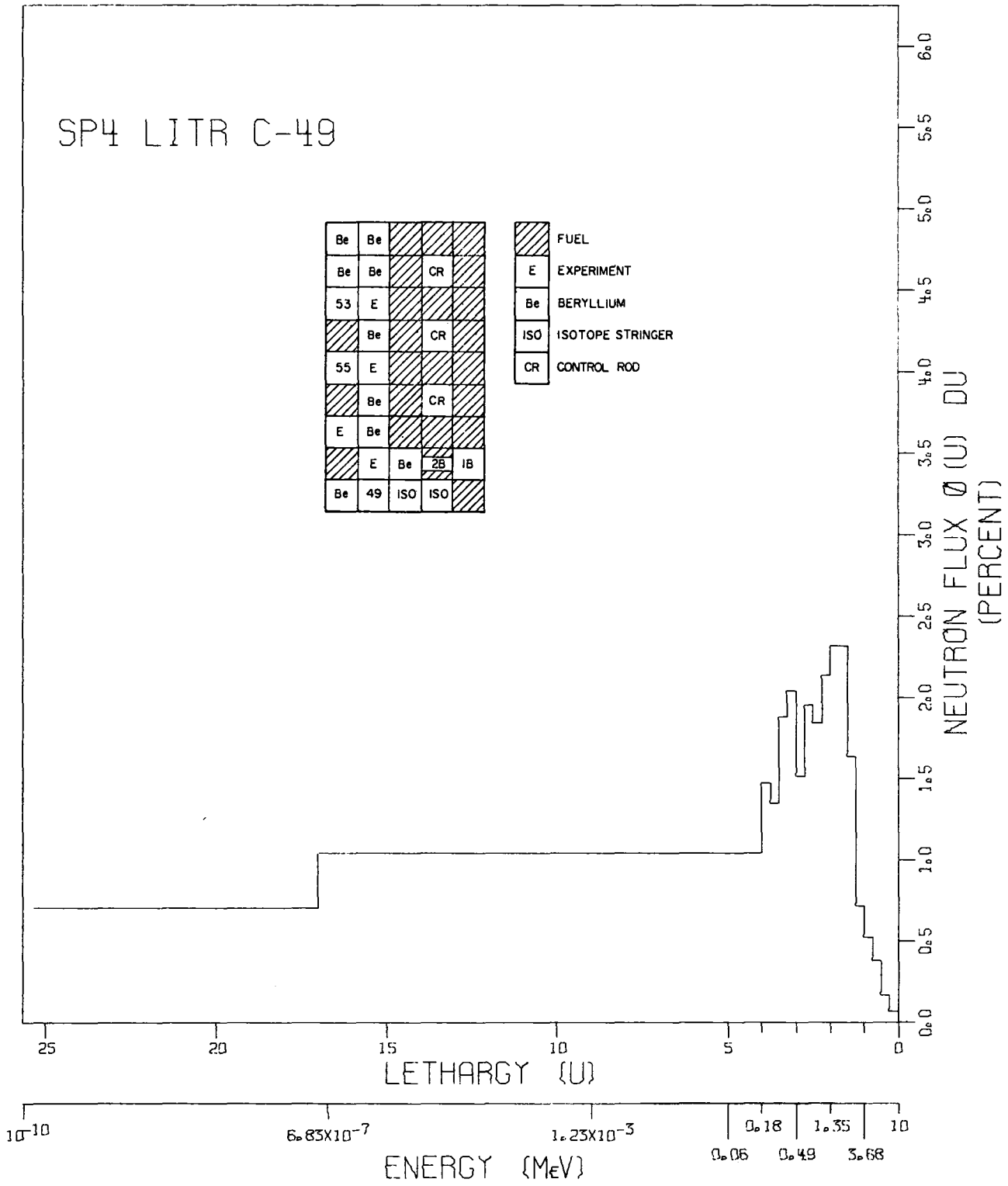
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.78×10^{12}	87.5
>0.5 MeV	4.05	60.1
>0.1 MeV	5.46	44.6
Thermal, 49 °C	4.00	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP3 LITR C-53

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.231-004	2.33958+000
0.50	6.07000+000	9.827-004	7.12354+000
0.75	4.72000+000	2.236-003	1.60733+001
1.00	3.68000+000	3.113-003	2.26180+001
1.25	2.87000+000	4.663-003	3.39235+001
1.50	2.23000+000	8.400-003	6.02092+001
1.75	1.74000+000	9.755-003	7.11011+001
2.00	1.35000+000	1.072-002	7.64117+001
2.25	1.05000+000	9.875-003	7.10618+001
2.50	8.21000-001	8.644-003	6.35374+001
2.75	6.39000-001	9.592-003	6.92132+001
3.00	4.98000-001	7.200-003	5.22278+001
3.25	3.88000-001	7.499-003	5.43377+001
3.50	3.02000-001	7.307-003	5.27380+001
3.75	2.35000-001	5.209-003	3.75568+001
4.00	1.83000-001	5.235-003	3.78509+001
17.00	4.14000-007	1.647-001	2.29090+001
25.33	1.00000-010	7.346-001	1.59509+002
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP4 LITR C-49
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be Be 2B IB
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Core lattice facility C-49; unfueled location; steel and water.

Spectrum Code

Code: 2 DXY Calculation: BNWL-14

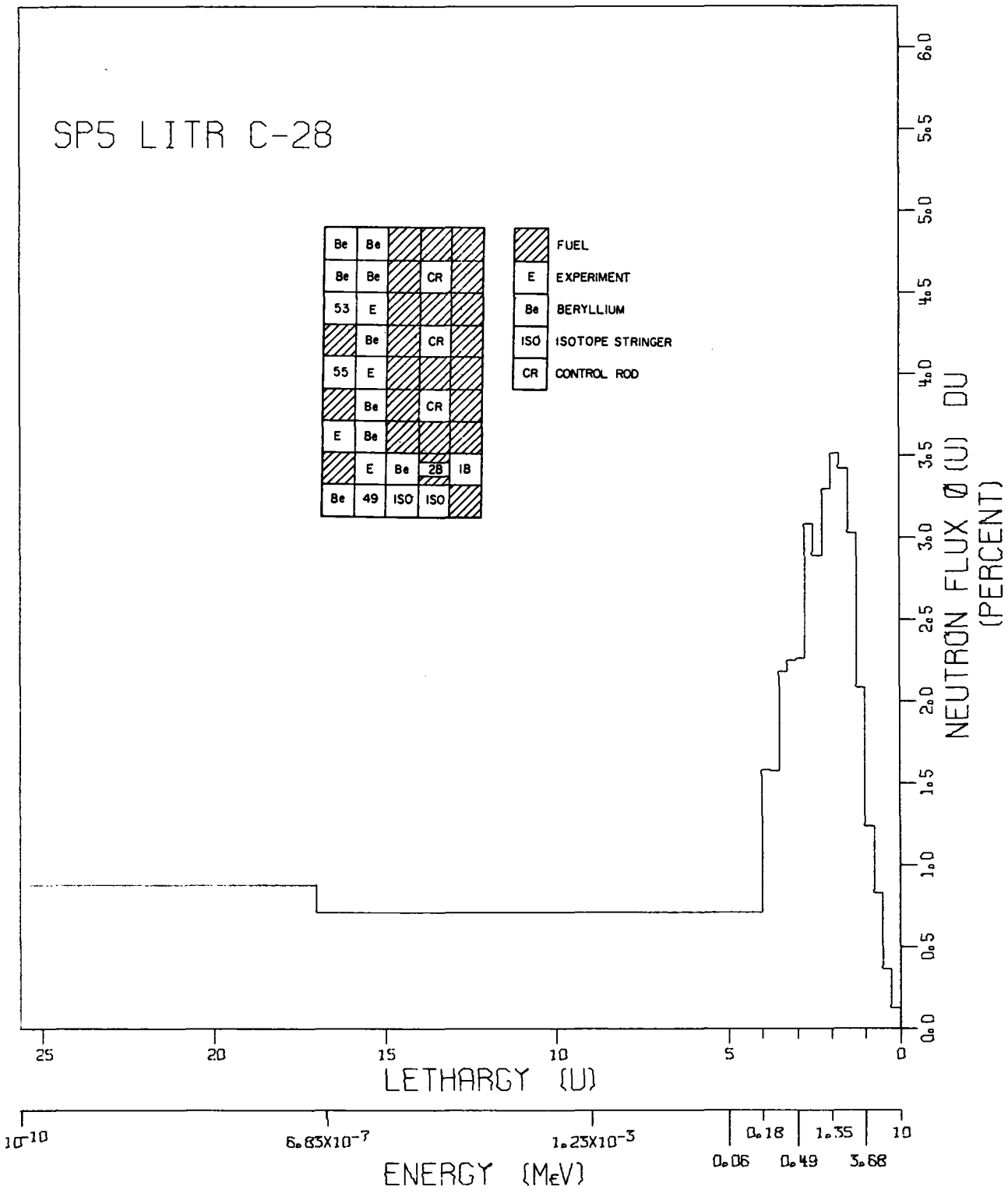
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.08×10^{12}	74.5
>0.5 MeV	3.04	51.0
>0.1 MeV	4.41	35.2
Thermal, 49°C	4.59	

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP4 LITR C-49

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	6.502-004	2.68646+000
0.50	6.07000+000	1.688-003	6.98228+000
0.75	4.72000+000	3.848-003	1.57864+001
1.00	3.68000+000	5.220-003	2.16401+001
1.25	2.87000+000	7.113-003	2.95239+001
1.50	2.23000+000	1.652-002	6.75815+001
1.75	1.74000+000	2.300-002	9.56603+001
2.00	1.35000+000	2.353-002	9.56653+001
2.25	1.05000+000	2.148-002	8.81792+001
2.50	8.21000-001	1.810-002	7.59152+001
2.75	6.39000-001	1.962-002	8.07643+001
3.00	4.98000-001	1.508-002	6.24120+001
3.25	3.88000-001	2.041-002	8.43640+001
3.50	3.02000-001	1.883-002	7.75316+001
3.75	2.35000-001	1.352-002	5.56100+001
4.00	1.83000-001	1.475-002	6.08561+001
17.00	4.14000-007	5.421-001	4.30330+001
25.33	1.00000-010	2.346-001	2.90633+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP5 LITR C-28
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be 2B 1B
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Partial fuel element, core lattice facility C-28; steel, water, aluminum and uranium.

Spectrum Code

Code: 2 DXY Calculation: BNW [12-14]

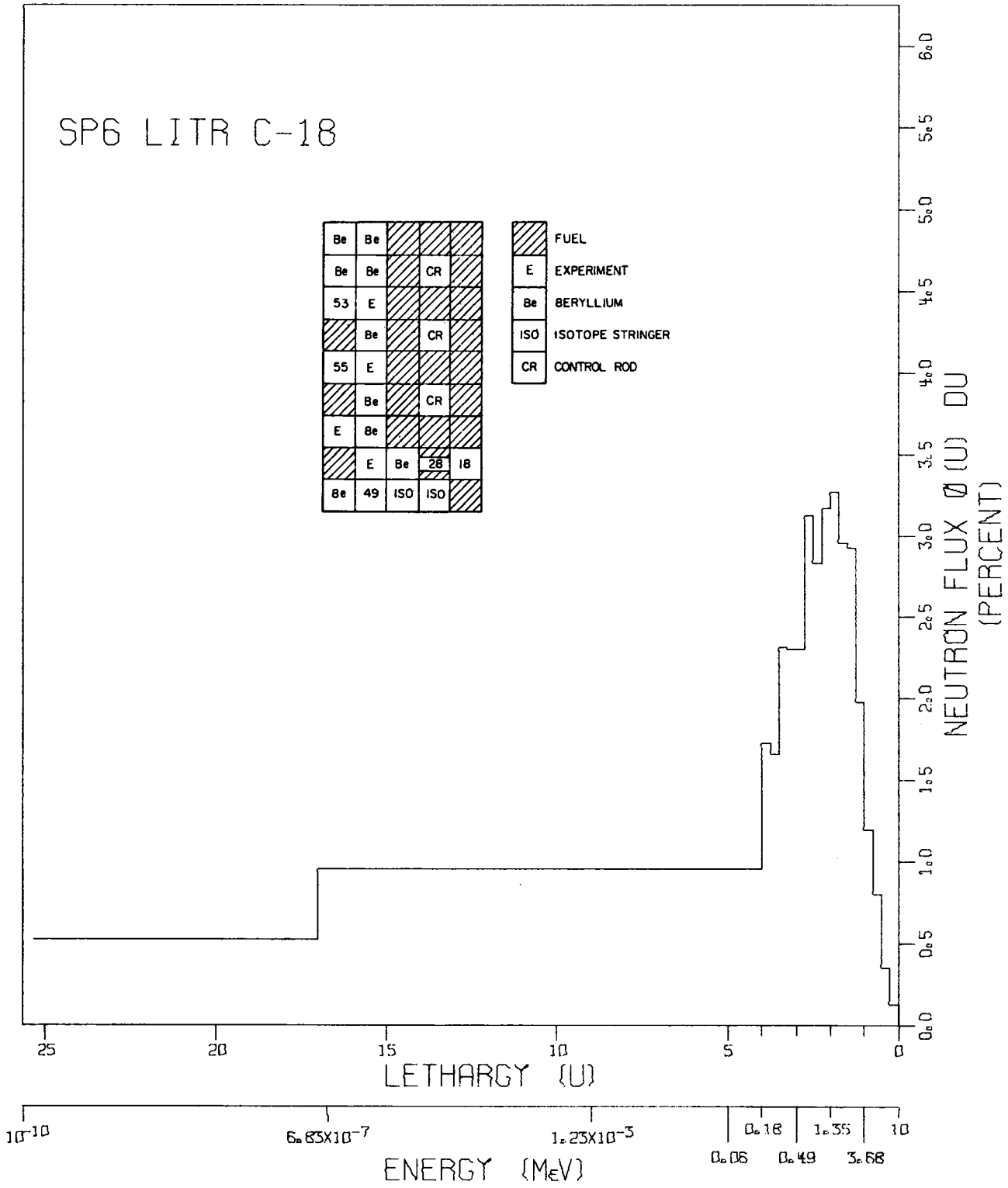
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	6.70×10^{12}	95.2
>0.5 MeV	9.46	67.4
>0.1 MeV	12.8	49.7
Thermal, 49°C	10.6	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP5 LITR C-28

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.244-003	2.31943+000
0.50	6.07000+000	3.592-003	6.70619+000
0.75	4.72000+000	8.342-003	1.54457+001
1.00	3.68000+000	1.228-002	2.29765+001
1.25	2.87000+000	2.068-002	3.87485+001
1.50	2.23000+000	3.052-002	5.63309+001
1.75	1.74000+000	3.391-002	6.36472+001
2.00	1.35000+000	3.562-002	6.53645+001
2.25	1.05000+000	3.307-002	6.12822+001
2.50	8.21000-001	2.839-002	5.37516+001
2.75	6.39000-001	3.089-002	5.74061+001
3.00	4.98000-001	2.257-002	4.21699+001
3.25	3.88000-001	2.247-002	4.19345+001
3.50	3.02000-001	2.187-002	4.06451+001
3.75	2.35000-001	1.577-002	2.92766+001
4.00	1.83000-001	1.580-002	2.94212+001
17.00	4.14000-007	3.699-001	1.32534+001
25.33	1.00000-010	2.931-001	1.63911+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP6 LITR C-18
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be 28 18
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Core lattice facility C-18; unfueled location; steel and water.

Spectrum Code

Code: 2 DXY Calculation: BNW [12-14]

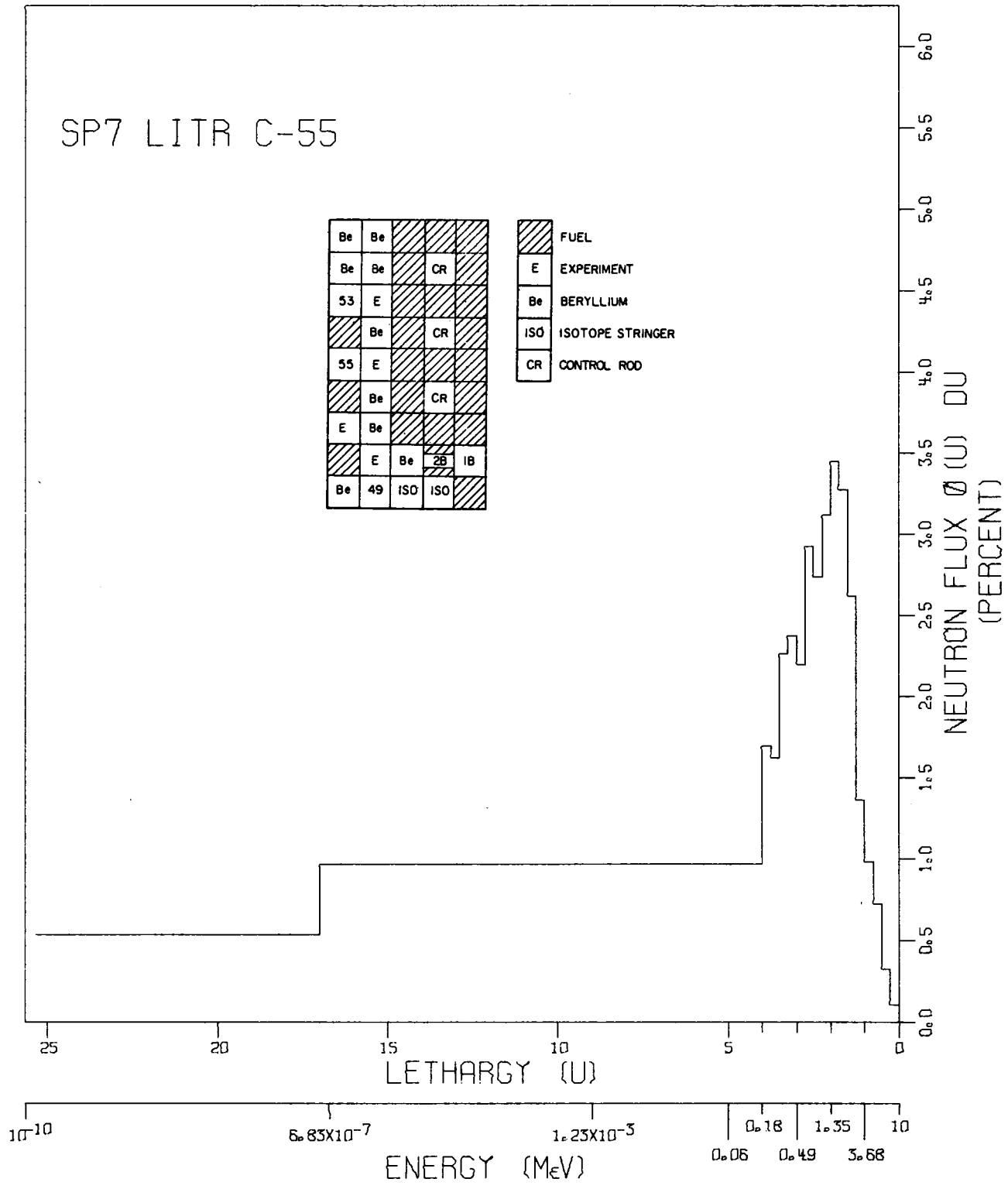
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	4.54×10^{12}	99.6
>0.5 MeV	6.64	68.1
>0.1 MeV	9.19	49.2
Thermal, 49 °C	4.63	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP6 LITR C-18

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,221-003	2,37560+000
0,50	6,07000+000	3,458-003	6,73659+000
0,75	4,72000+000	8,029-003	1,55128+001
1,00	3,68000+000	1,185-002	2,31329+001
1,25	2,87000+000	1,962-002	3,83571+001
1,50	2,23000+000	2,949-002	5,67997+001
1,75	1,74000+000	2,931-002	5,74197+001
2,00	1,35000+000	3,315-002	6,34845+001
2,25	1,05000+000	3,186-002	6,16158+001
2,50	8,21000-001	2,786-002	5,50412+001
2,75	6,39000-001	3,131-002	6,07233+001
3,00	4,98000-001	2,290-002	4,46479+001
3,25	3,88000-001	2,294-002	4,46774+001
3,50	3,02000-001	2,313-002	4,48714+001
3,75	2,35000-001	1,658-002	3,21183+001
4,00	1,83000-001	1,724-002	3,34956+001
17,00	4,14000-007	4,964-001	1,85597+001
25,33	1,00000-010	1,737-001	1,01365+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP7 LITR C-55
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be 2B IB
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Core lattice facility C-55; unfueled location; steel and water.

Spectrum Code

Code: 2 DXY Calculation: BNW [12-14]

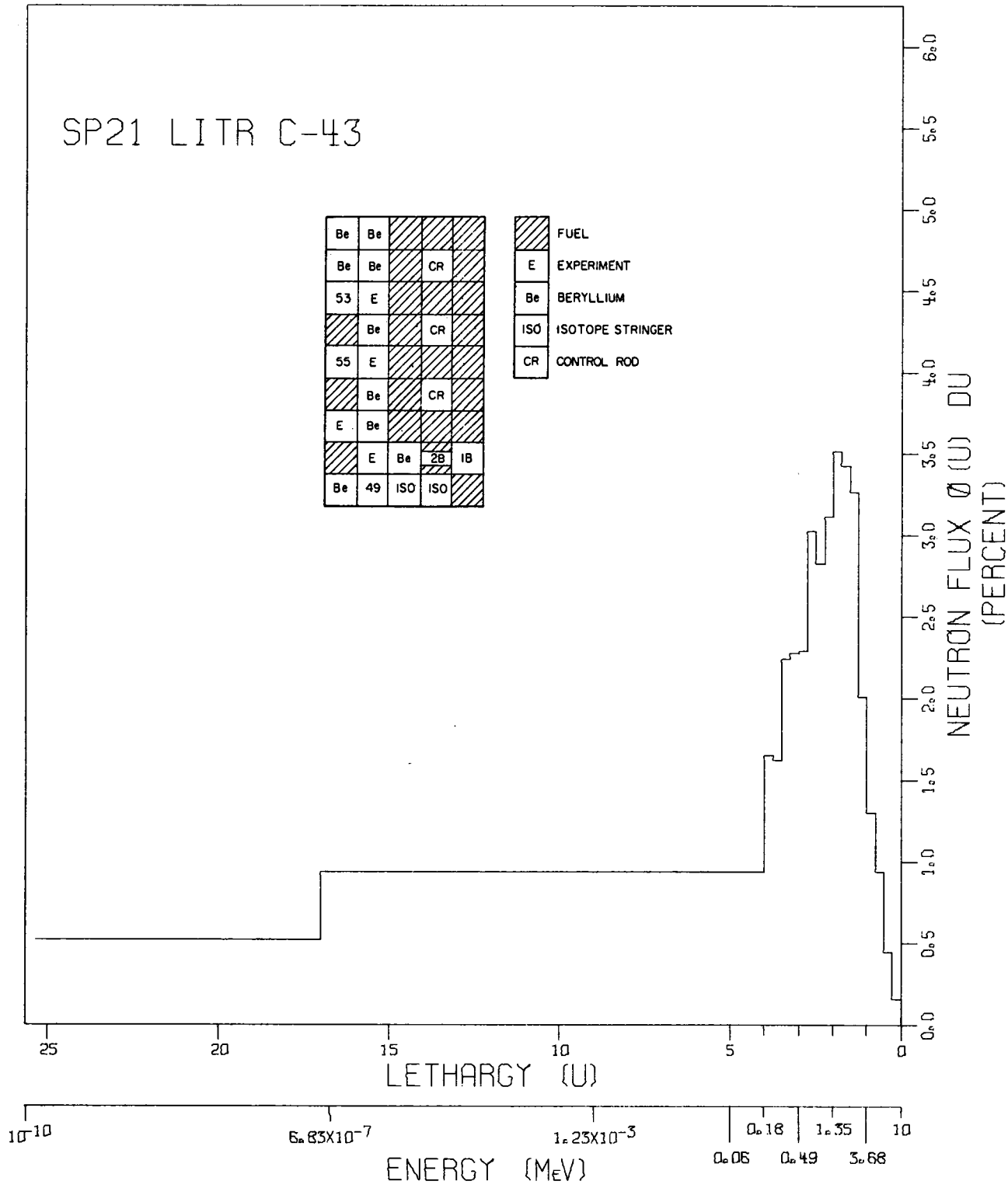
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	3.58×10^{12}	89.0
>0.5 MeV	5.24	60.8
>0.1 MeV	7.39	43.1
Thermal, 49°C	3.95	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP7 LITR C-55

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,043-003	2,40347+000
0,50	6,07000+000	3,220-003	7,42859+000
0,75	4,72000+000	7,262-003	1,66168+001
1,00	3,68000+000	9,776-003	2,26083+001
1,25	2,87000+000	1,354-002	3,13588+001
1,50	2,23000+000	2,644-002	6,03059+001
1,75	1,74000+000	3,250-002	7,53957+001
2,00	1,35000+000	3,501-002	7,93961+001
2,25	1,05000+000	3,133-002	7,17653+001
2,50	8,21000-001	2,693-002	6,29933+001
2,75	6,39000-001	2,930-002	6,72811+001
3,00	4,98000-001	2,185-002	5,04519+001
3,25	3,88000-001	2,369-002	5,46227+001
3,50	3,02000-001	2,264-002	5,19989+001
3,75	2,35000-001	1,620-002	3,71632+001
4,00	1,83000-001	1,696-002	3,90261+001
17,00	4,14000-007	5,039-001	2,23123+001
25,33	1,00000-010	1,764-001	1,23301+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP21 LITR C-43
Be Be
Be Be CR
53 E
Be CR
55 E
Be CR
E Be
E Be 28 IB
Be 49 ISO ISO
FUEL
E EXPERIMENT
Be BERYLLIUM
ISO ISOTOPE STRINGER
CR CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Low Intensity Test Reactor

Type: Test, tank Power Level: 3 MWt

Coolant: Light water Moderator: Light water

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee

Spectrum Facility Description

Core lattice facility C-43; unfueled location; steel and water.

Spectrum Code

Code: 2 DXY Calculation: BNW [12-14]

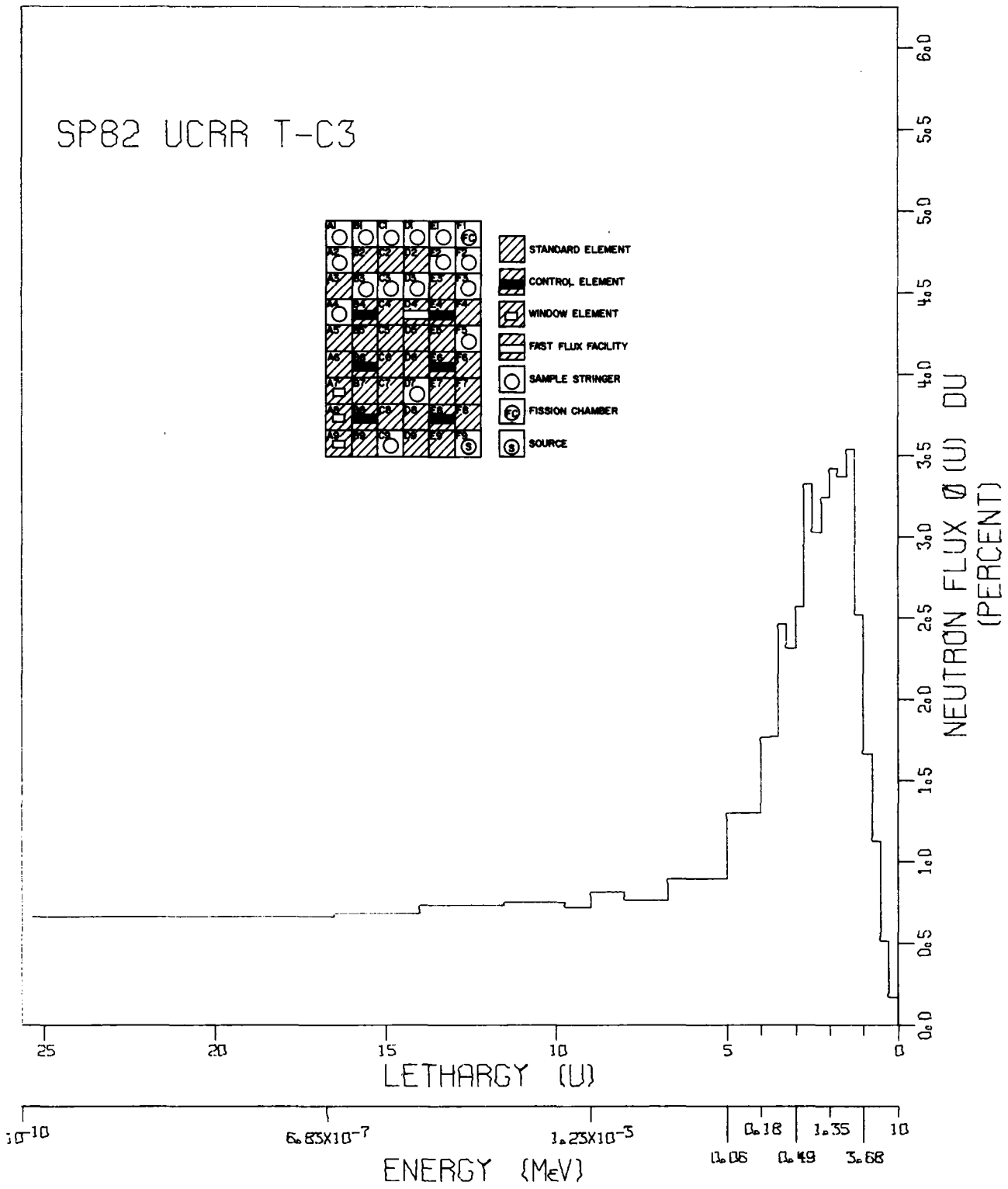
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	6.91×10^{13}	101.
>0.5 MeV	9.68	72.1
>0.1 MeV	13.4	52.2
Thermal, 49 °C	6.40	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP21 LITR C-43

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,559-003	2,70026+000
0,50	6,07000+000	4,435-003	7,69081+000
0,75	4,72000+000	9,414-003	1,61916+001
1,00	3,68000+000	1,290-002	2,24300+001
1,25	2,87000+000	1,996-002	3,47406+001
1,50	2,23000+000	3,289-002	5,63959+001
1,75	1,74000+000	3,400-002	5,92890+001
2,00	1,35000+000	3,562-002	6,07280+001
2,25	1,05000+000	3,125-002	5,38050+001
2,50	8,21000-001	2,777-002	4,88437+001
2,75	6,39000-001	3,032-002	5,23425+001
3,00	4,98000-001	2,278-002	3,95271+001
3,25	3,88000-001	2,272-002	3,93817+001
3,50	3,02000-001	2,242-002	3,87101+001
3,75	2,35000-001	1,620-002	2,79411+001
4,00	1,83000-001	1,651-002	2,85637+001
17,00	4,14000-007	4,863-001	1,61869+001
25,33	1,00000-010	1,729-001	8,98497+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP82 UCRR T-C3
STANDARD ELEMENT
CONTROL ELEMENT
WINDOW ELEMENT
FAST FLUX FACILITY
SAMPLE STRINGER
FISSION CHAMBER
SOURCE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-5
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Union Carbide Research Reactor

Type: Pool, test Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Tuxedo, New York

Spectrum Facility Description

Core facility C3; unfueled position; steel and water.

Spectrum Code

Code: 2 DB Calculation: BNW [15]

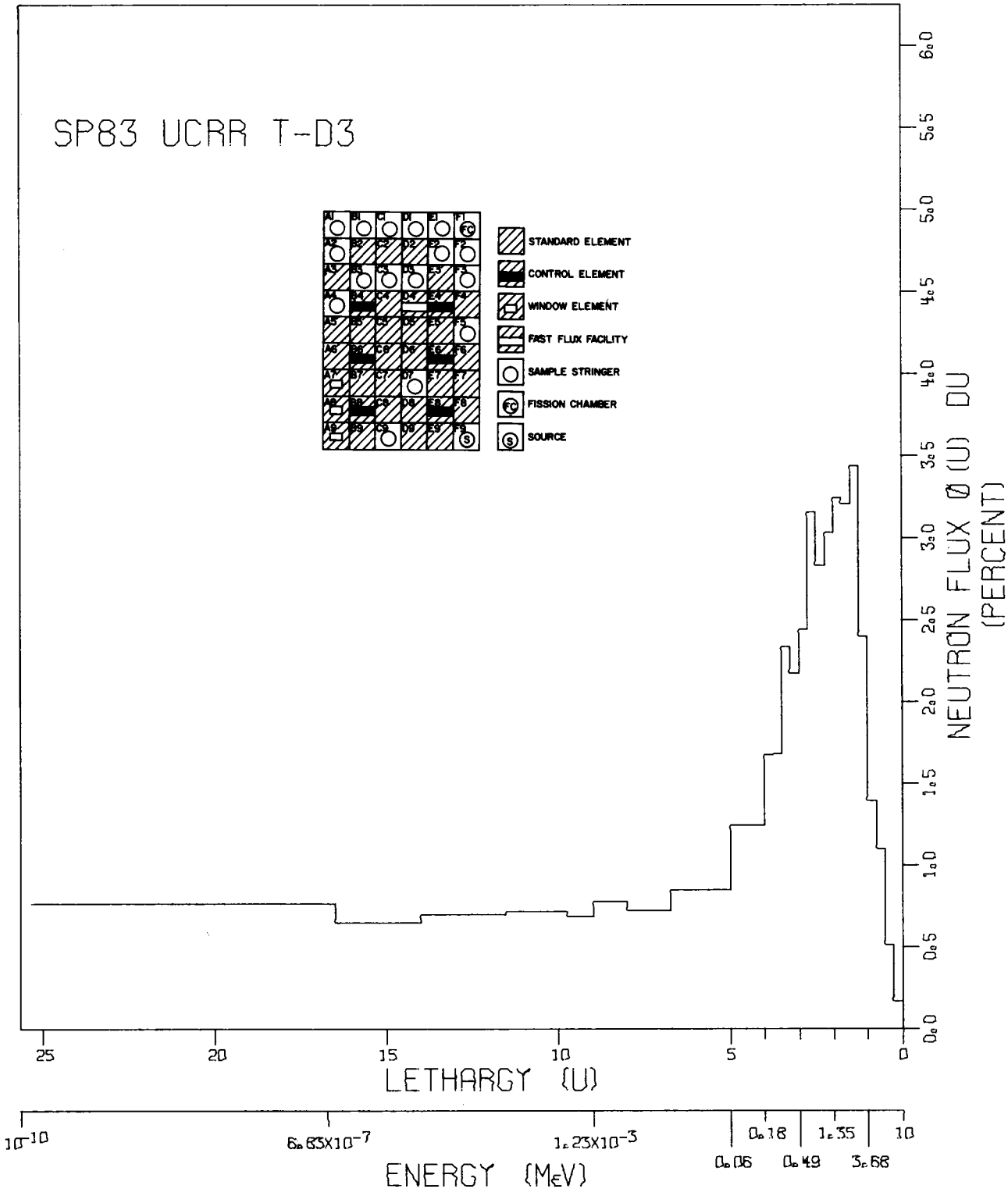
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	7.98×10^{12}	111.
>0.5 MeV	11.5	77.1
>0.1 MeV	16.1	55.0
Thermal, 49°C	9.43	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP82 UCRR T-C3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7,79000+000	1,646-003	2,39965+000
0.50	6,07000+000	5,070-003	7,39870+000
0.75	4,72000+000	1,132-002	1,63889+001
1.00	3,68000+000	1,653-002	2,41844+001
1.25	2,87000+000	2,505-002	3,66850+001
1.50	2,23000+000	3,566-002	5,14472+001
1.75	1,74000+000	3,341-002	4,90264+001
2.00	1,35000+000	3,472-002	4,98045+001
2.25	1,05000+000	3,256-002	4,71690+001
2.50	8,21000-001	2,972-002	4,39861+001
2.75	6,39000-001	3,332-002	4,83994+001
3.00	4,98000-001	2,559-002	3,73625+001
3.25	3,88000-001	2,306-002	3,36398+001
3.50	3,02000-001	2,469-002	3,58684+001
3.75	2,35000-001	1,775-002	2,57613+001
4.00	1,83000-001	1,764-002	2,56843+001
5.00	6,74000-002	5,196-002	1,89383+001
6.75	1,17000-002	6,229-002	1,29499+001
8.00	3,36000-003	3,783-002	1,10390+001
9.00	1,23000-003	3,265-002	1,18285+001
9.75	5,83000-004	2,150-002	1,04835+001
11.50	1,01000-004	5,259-002	1,09210+001
14.00	8,32000-006	7,287-002	1,06260+001
16.50	6,83000-007	6,779-002	9,87169+000
25.33	1,00000-010	2,328-001	9,59866+000
		1,000+000	

ONE LETHARGY INTERVAL = 0.25U


SP83 UCRR T-D3
STANDARD ELEMENT
CONTROL ELEMENT
WINDOW ELEMENT
FAST FLUX FACILITY
SAMPLE STRINGER
FISSION CHAMBER
SOURCE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Union Carbide Research Reactor

Type: Pool, research Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Tuxedo, New York

Spectrum Facility Description

Core facility D3; unfueled position; steel and water.

Spectrum Code

Code: 2 DB Calculation: BNW [15]

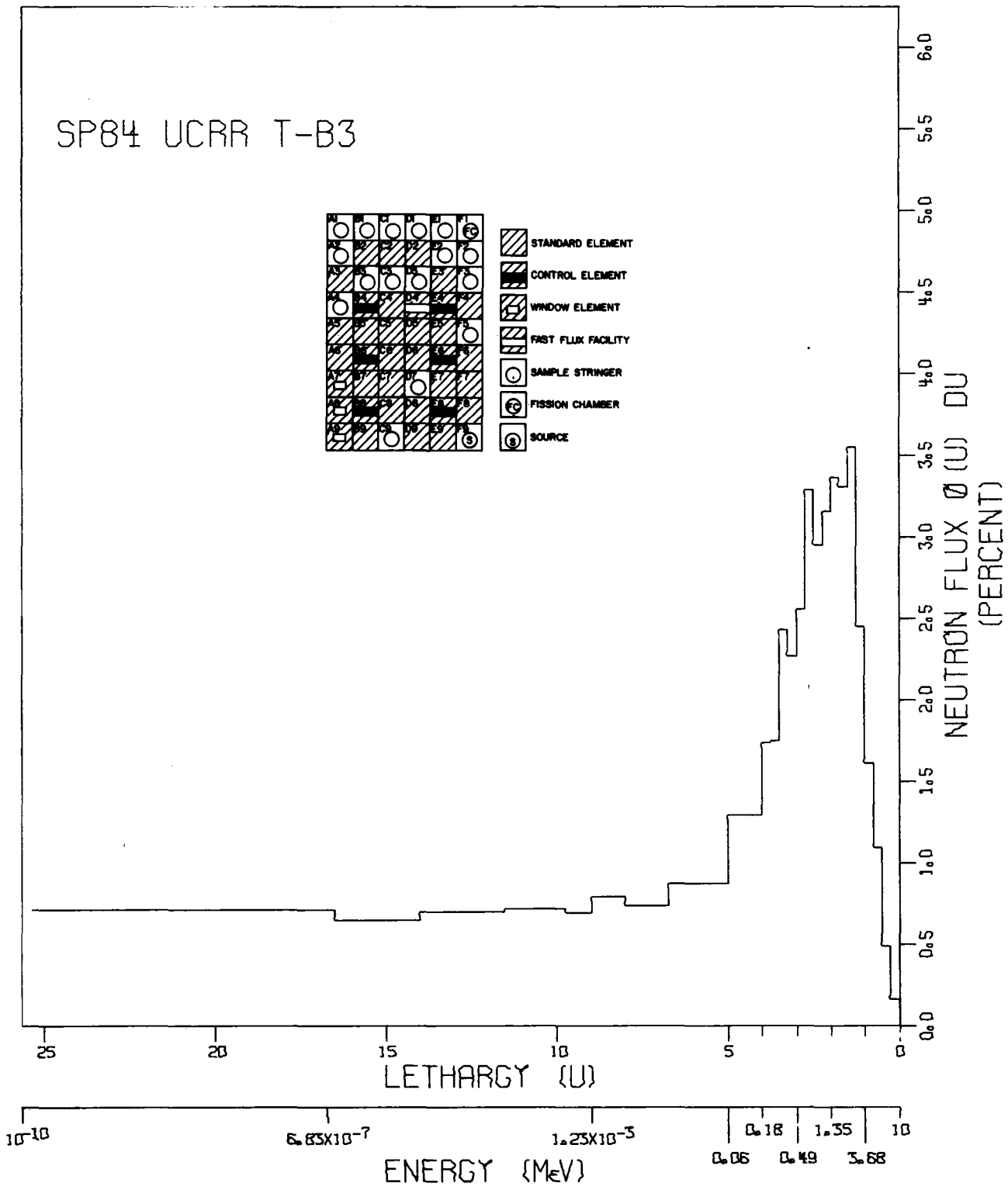
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	8.26×10^{12}	113.
>0.5 MeV	11.9	78.7
>0.1 MeV	16.6	56.3
Thermal, 49°C	9.76	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP83 UCRR T=D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,650-003	2,54836+000
0,50	6,07000+000	5,080-003	7,85518+000
0,75	4,72000+000	1,108-002	1,69903+001
1,00	3,68000+000	1,384-002	2,14529+001
1,25	2,87000+000	2,383-002	3,69763+001
1,50	2,23000+000	3,468-002	5,30266+001
1,75	1,74000+000	3,178-002	4,94141+001
2,00	1,35000+000	3,291-002	5,00367+001
2,25	1,05000+000	3,047-002	4,67737+001
2,50	8,21000-001	2,786-002	4,36940+001
2,75	6,39000-001	3,160-002	4,86428+001
3,00	4,98000-001	2,435-002	3,76770+001
3,25	3,88000-001	2,171-002	3,35620+001
3,50	3,02000-001	2,341-002	3,60487+001
3,75	2,35000-001	1,688-002	2,59606+001
4,00	1,83000-001	1,672-002	2,57966+001
5,00	6,74000-002	4,970-002	1,91978+001
6,75	1,17000-002	5,945-002	1,30993+001
8,00	3,36000-003	3,599-002	1,11286+001
9,00	1,23000-003	3,140-002	1,20547+001
9,75	5,83000-004	2,054-002	1,06120+001
11,50	1,01000-004	5,020-002	1,10482+001
14,00	8,32000-006	6,950-002	1,07401+001
16,50	6,83000-007	6,463-002	9,97390+000
25,33	1,00000-010	2,708-001	1,18313+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP84 UCRR T-B3
STANDARD ELEMENT
CONTROL ELEMENT
WINDOW ELEMENT
FAST FLUX FACILITY
SAMPLE STRINGER
FISSION CHAMBER
SOURCE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Union Carbide Research Reactor

Type: Pool, research Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Tuxedo, New York

Spectrum Facility Description

Core lattice facility D3; unfueled position; steel and water.

Spectrum Code

Code: 2 DB Calculation: BNW [15]

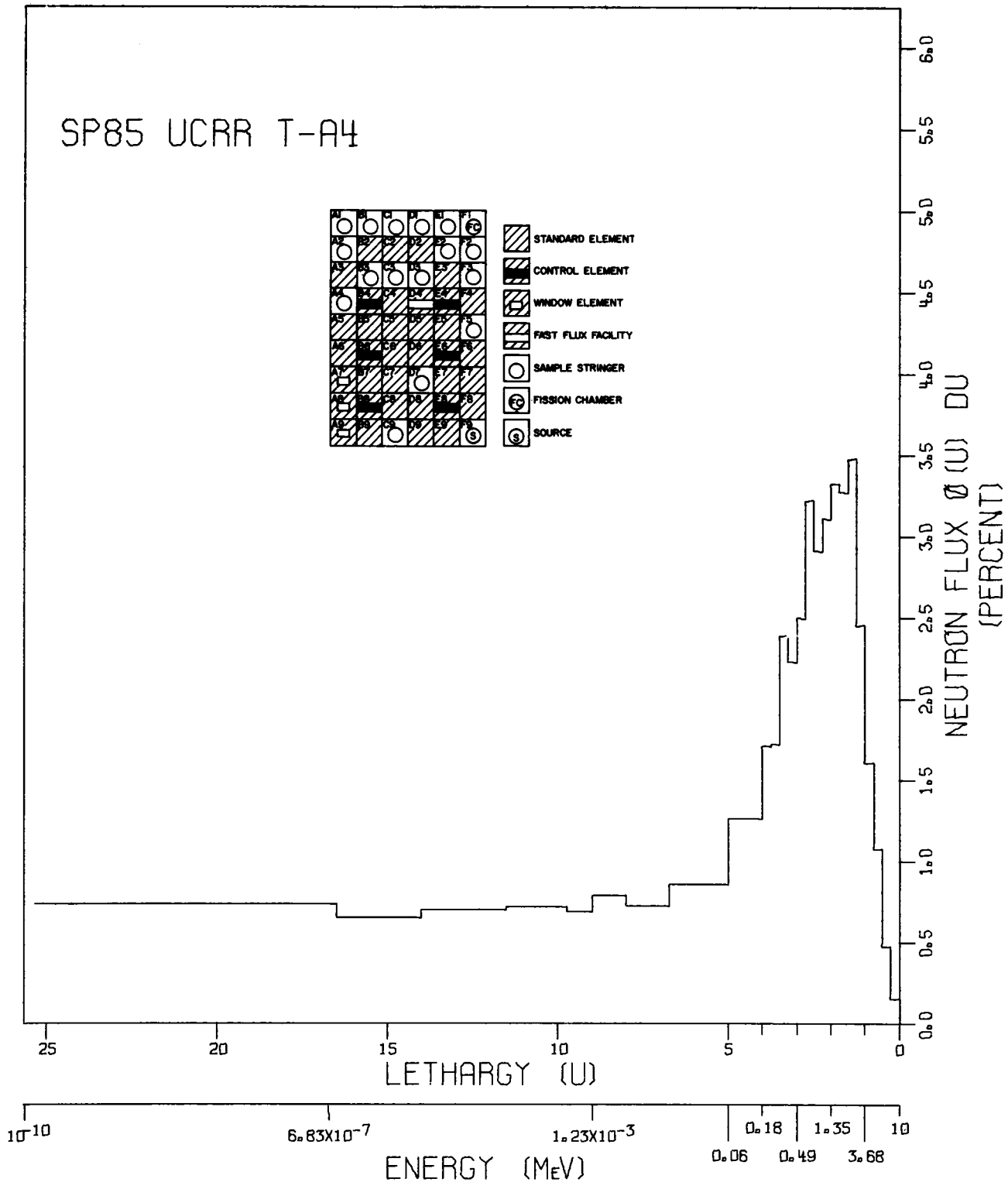
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section σ, mb
>1 MeV	7.52×10^{12}	111.
>0.5 MeV	10.9	76.3
>0.1 MeV	15.2	55.1
Thermal, 49 °C	9.81	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP84 UCRR T-83

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.585-003	2.36705+000
0.50	6.07000+000	4.873-003	7.28733+000
0.75	4.72000+000	1.101-002	1.63221+001
1.00	3.68000+000	1.605-002	2.40585+001
1.25	2.87000+000	2.432-002	3.65039+001
1.50	2.23000+000	3.582-002	5.29618+001
1.75	1.74000+000	3.278-002	4.92848+001
2.00	1.35000+000	3.412-002	5.01613+001
2.25	1.05000+000	3.169-002	4.70434+001
2.50	8.21000-001	2.905-002	4.40447+001
2.75	6.39000-001	3.292-002	4.90107+001
3.00	4.98000-001	2.549-002	3.81480+001
3.25	3.88000-001	2.263-002	3.38196+001
3.50	3.02000-001	2.437-002	3.62780+001
3.75	2.35000-001	1.756-002	2.61210+001
4.00	1.83000-001	1.737-002	2.59073+001
5.00	6.74000-002	5.155-002	1.92525+001
6.75	1.17000-002	6.117-002	1.30327+001
8.00	3.36000-003	3.665-002	1.09595+001
9.00	1.23000-003	3.180-002	1.18059+001
9.75	5.83000-004	2.068-002	1.03327+001
11.50	1.01000-004	5.038-002	1.07221+001
14.00	8.32000-006	6.964-002	1.04066+001
16.50	6.83000-007	6.460-002	9.64091+000
25.33	1.00000-010	2.519-001	1.06437+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP85 UCRR T-A4
STANDARD ELEMENT
CONTROL ELEMENT
WINDOW ELEMENT
FAST FLUX FACILITY
SAMPLE STRINGER
FISSION CHAMBER
SOURCE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Union Carbide Research Reactor

Type: Pool, research Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Tuxedo, New York

Spectrum Facility Description

Core lattice facility A4; unfueled position; steel and water.

Spectrum Code

Code: 2 DB Calculation: BNW [15]

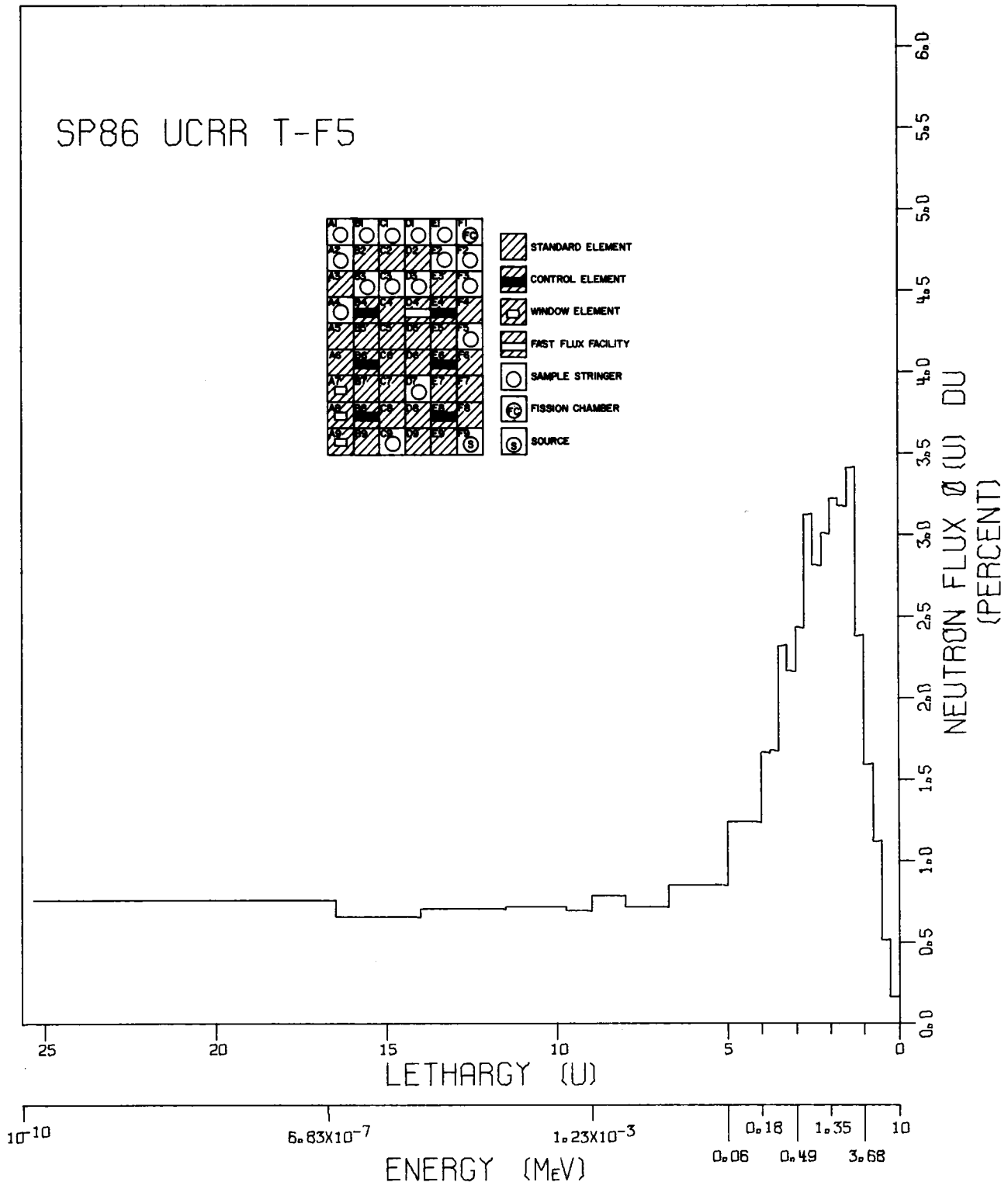
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	8.41×10^{12}	111.
>0.5 MeV	12.2	76.7
>0.1 MeV	17.0	54.9
Thermal, 49 °C	11.6	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP85 UCRR T-A4

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.545-003	2.33916+000
0.50	6.07000+000	4.728-003	7.16434+000
0.75	4.72000+000	1.080-002	1.62352+001
1.00	3.68000+000	1.599-002	2.42828+001
1.25	2.87000+000	2.433-002	3.69942+001
1.50	2.23000+000	3.505-002	5.25126+001
1.75	1.74000+000	3.242-002	4.93897+001
2.00	1.35000+000	3.368-002	5.01736+001
2.25	1.05000+000	3.122-002	4.69538+001
2.50	8.21000-001	2.856-002	4.38774+001
2.75	6.39000-001	3.225-002	4.86477+001
3.00	4.98000-001	2.486-002	3.76907+001
3.25	3.88000-001	2.218-002	3.35966+001
3.50	3.02000-001	2.389-002	3.60416+001
3.75	2.35000-001	1.723-002	2.59664+001
4.00	1.83000-001	1.707-002	2.58028+001
5.00	6.74000-002	5.048-002	1.91040+001
6.75	1.17000-002	6.007-002	1.29670+001
8.00	3.36000-003	3.618-002	1.09623+001
9.00	1.23000-003	3.148-002	1.18407+001
9.75	5.83000-004	2.053-002	1.03934+001
11.50	1.01000-004	5.017-002	1.08186+001
14.00	8.32000-006	6.974-002	1.05607+001
16.50	6.83000-007	6.508-002	9.84107+000
25.33	1.00000-010	2.605-001	1.11512+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP86 UCRR T-F5
STANDARD ELEMENT
CONTROL ELEMENT
WINDOW ELEMENT
FAST FLUX FACILITY
SAMPLE STRINGER
FISSION CHAMBER
SOURCE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Union Carbide Research Reactor

Type: Pool, research Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Tuxedo, New York

Spectrum Facility Description

Core lattice facility F5; unfueled position; steel and water.

Spectrum Code

Code: 2 DB Calculation: BNW [15]

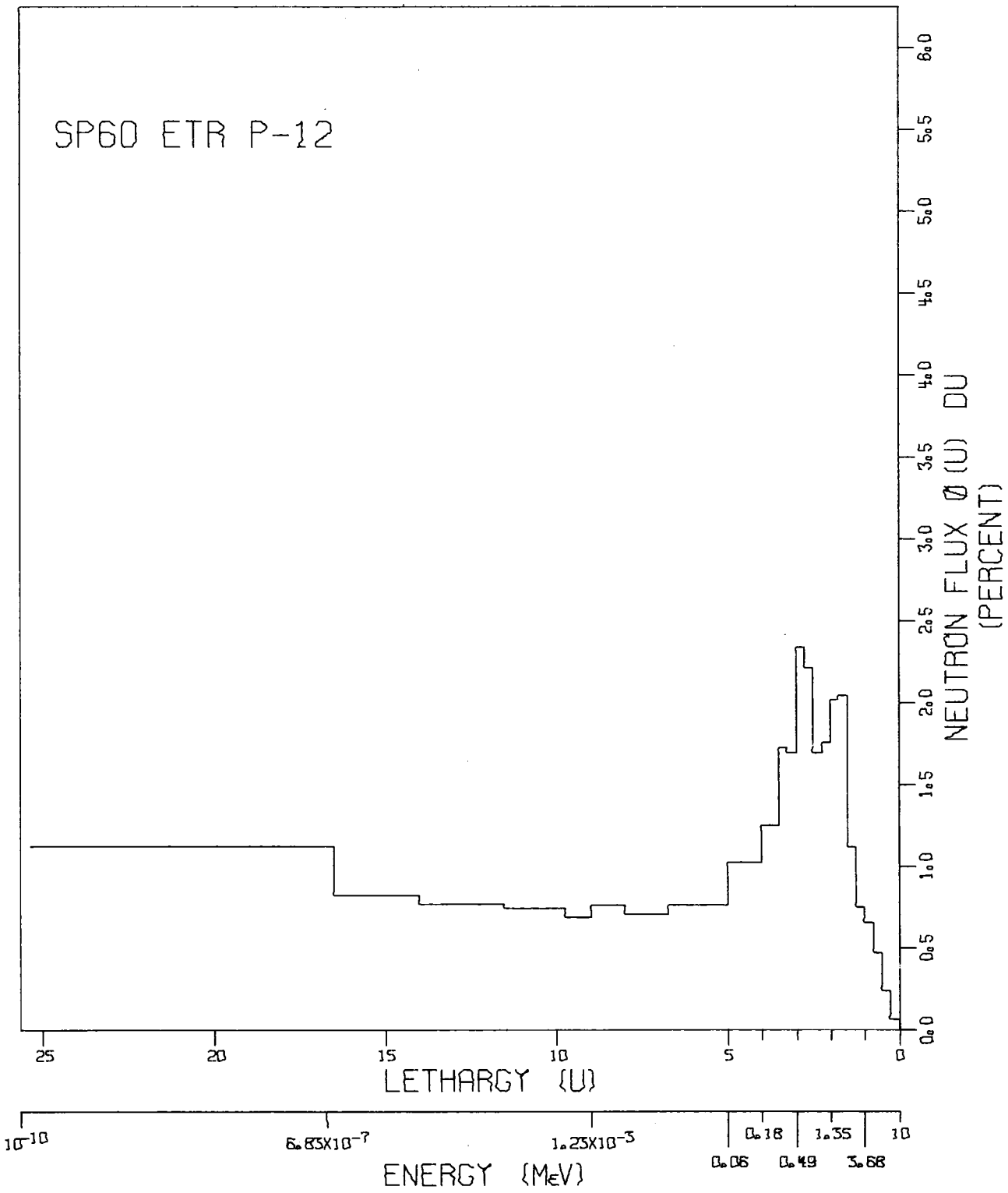
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	9.91×10^{12}	114.
>0.5 MeV	14.2	79.3
>0.1 MeV	19.9	56.8
Thermal, 49 °C	14.2	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP86 UCRR T-F5

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.679-003	2.51558+000
0.50	6.07000+000	5.164-003	7.74697+000
0.75	4.72000+000	1.124-002	1.67190+001
1.00	3.68000+000	1.584-002	2.38216+001
1.25	2.87000+000	2.367-002	3.56291+001
1.50	2.23000+000	3.445-002	5.10938+001
1.75	1.74000+000	3.147-002	4.74731+001
2.00	1.35000+000	3.263-002	4.81182+001
2.25	1.05000+000	3.022-002	4.50019+001
2.50	8.21000-001	2.769-002	4.21189+001
2.75	6.39000-001	3.132-002	4.67664+001
3.00	4.98000-001	2.423-002	3.63733+001
3.25	3.88000-001	2.158-002	3.23623+001
3.50	3.02000-001	2.323-002	3.46929+001
3.75	2.35000-001	1.676-002	2.50135+001
4.00	1.83000-001	1.660-002	2.48395+001
5.00	6.74000-002	4.934-002	1.84879+001
6.75	1.17000-002	5.924-002	1.26609+001
8.00	3.36000-003	3.594-002	1.07810+001
9.00	1.23000-003	3.148-002	1.17235+001
9.75	5.83000-004	2.060-002	1.03283+001
11.50	1.01000-004	5.048-002	1.07762+001
14.00	8.32000-006	7.040-002	1.05546+001
16.50	6.83000-007	6.577-002	9.84624+000
25.33	1.00000-010	2.690-001	1.14025+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP60 ETR P-12
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Engineering Test Reactor

Type: Test, tank Power Level: 175 MWt

Coolant: Light water Moderator: Light water

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Reflector position P-12; steel and water

Spectrum Code

Code: DTF-IV Calculation: BNW [18]

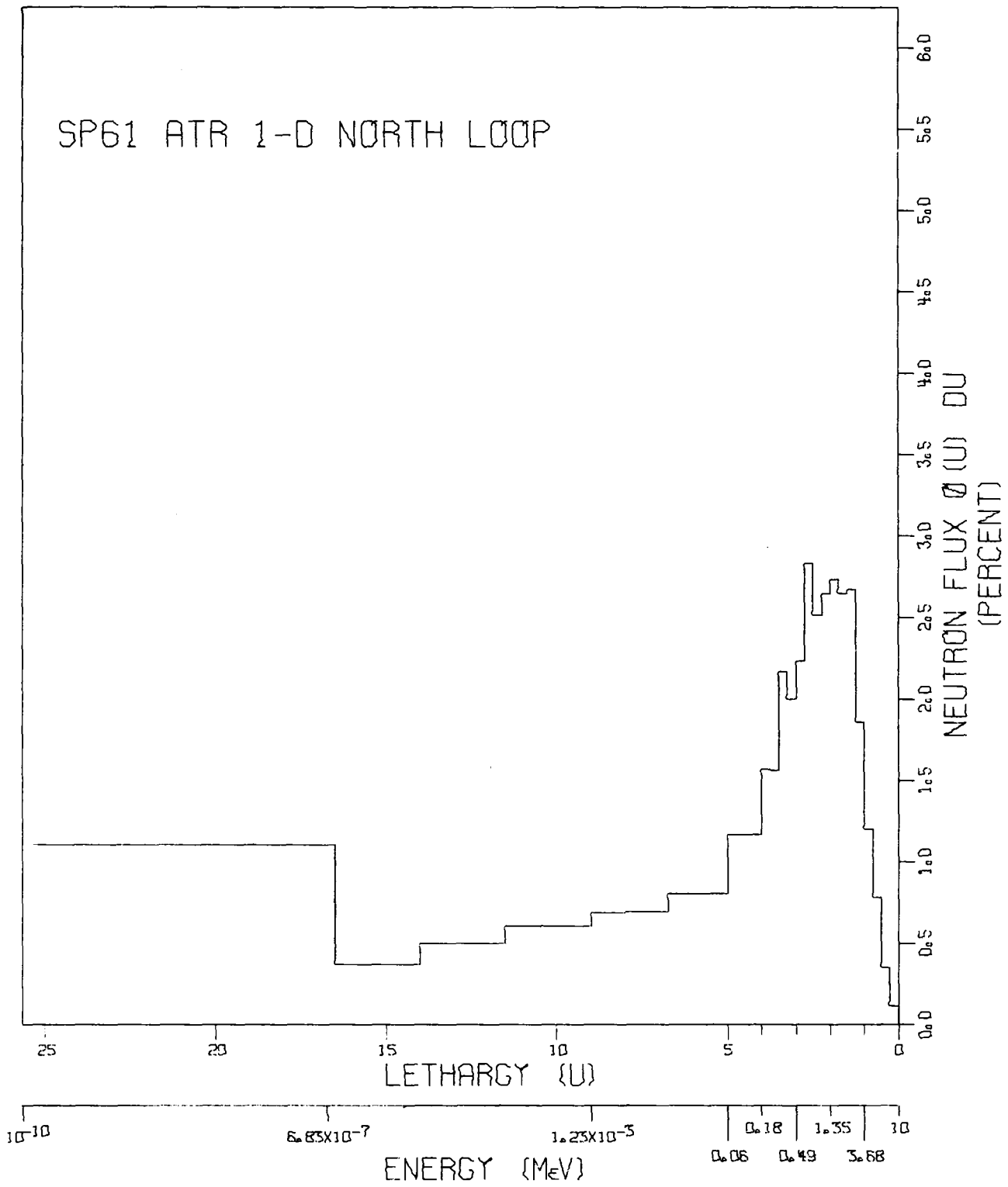
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	88.7
>0.5 MeV	-	53.2
>0.1 MeV	-	35.2
Thermal, 20°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP60 ETR P-12

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	6.383-004	2.47108+000
0.50	6.07000+000	2.334-003	9.04388+000
0.75	4.72000+000	4.731-003	1.81838+001
1.00	3.68000+000	6.495-003	2.52297+001
1.25	2.87000+000	7.439-003	2.89319+001
1.50	2.23000+000	1.129-002	4.32769+001
1.75	1.74000+000	2.027-002	7.89811+001
2.00	1.35000+000	2.045-002	7.79105+001
2.25	1.05000+000	1.767-002	6.79607+001
2.50	8.21000-001	1.663-002	6.53591+001
2.75	6.39000-001	2.216-002	8.54979+001
3.00	4.98000-001	2.331-002	9.04097+001
3.25	3.88000-001	1.691-002	6.54958+001
3.50	3.02000-001	1.731-002	6.67696+001
3.75	2.35000-001	1.253-002	4.82822+001
4.00	1.83000-001	1.246-002	4.81795+001
5.00	6.74000-002	4.097-002	3.96537+001
6.75	1.17000-002	5.318-002	2.93610+001
8.00	3.36000-003	3.516-002	2.72460+001
9.00	1.23000-003	3.069-002	2.95226+001
9.75	5.83000-004	2.045-002	2.64875+001
11.50	1.01000-004	5.185-002	2.85970+001
14.00	8.32000-006	7.687-002	2.97677+001
16.50	6.83000-007	8.214-002	3.17661+001
25.33	1.00000-010	3.961-001	4.33694+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP61 ATR 1-D NORTH LOOP
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.85X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Advanced Test Reactor

Type: Test, tank Power Level: 250 MWt

Coolant: Light water Moderator: Light water

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Mid plane of 1-D North loop.

Spectrum Code

Code: DTF-IV Calculation: BNW [16]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.50×10^{14}	103.6
>0.5 MeV	2.24	69.4
>0.1 MeV	3.23	48.1
Thermal, 260 °C	3.88	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

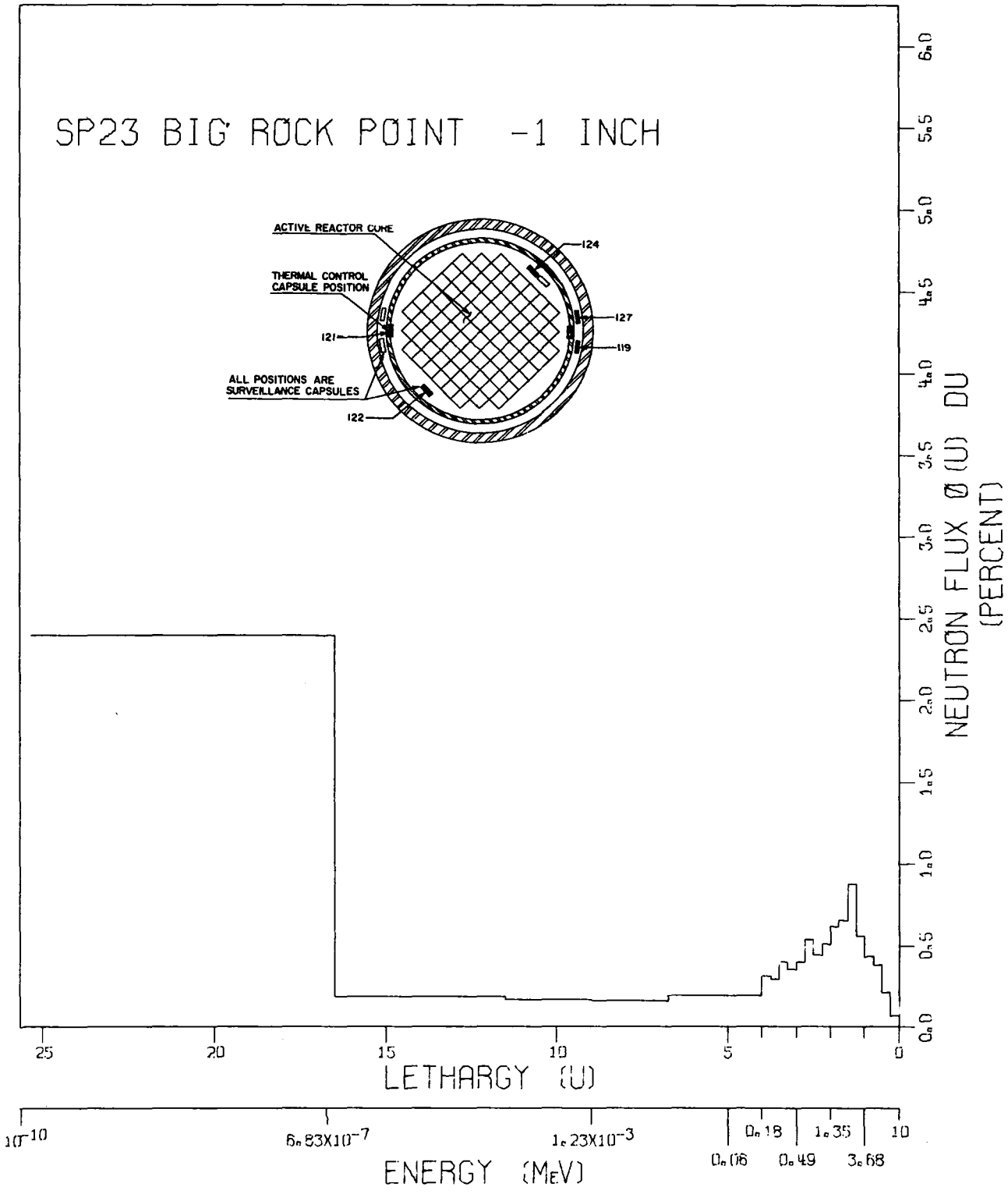
SP61 ATR 1-D NORTH LOOP

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.113-003	2.25529+000
0.50	6.07000+000	3.456-003	7.00663+000
0.75	4.72000+000	7.862-003	1.59089+001
1.00	3.68000+000	1.190-002	2.41888+001
1.25	2.87000+000	1.846-002	3.75536+001
1.50	2.23000+000	2.694-002	5.40116+001
1.75	1.74000+000	2.625-002	5.35125+001
2.00	1.35000+000	2.774-002	5.52923+001
2.25	1.05000+000	2.655-002	5.34380+001
2.50	8.21000-001	2.468-002	5.07430+001
2.75	6.39000-001	2.837-002	5.72612+001
3.00	4.98000-001	2.223-002	4.51062+001
3.25	3.88000-001	1.996-002	4.04518+001
3.50	3.02000-001	2.171-002	4.38317+001
3.75	2.35000-001	1.565-002	3.15585+001
4.00	1.83000-001	1.567-002	3.16925+001
5.00	6.74000-002	4.663-002	2.36130+001
6.75	1.17000-002	5.628-002	1.62589+001
8.00	3.36000-003	3.444-002	1.39633+001
9.00	1.23000-003	2.749-002	1.38361+001
9.75	5.83000-004	1.809-002	1.22593+001
11.50	1.01000-004	4.226-002	1.21951+001
14.00	8.32000-006	4.982-002	1.00941+001
16.50	6.83000-007	3.700-002	7.48704+000
25.33	1.00000-010	3.894-001	2.23120+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U

LIGHT WATER MODERATED REACTORS

POWER REACTORS


SP23 BIG ROCK POINT -1 INCH
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø (U) DU (PERCENT)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power, BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Spatial location: 1-in. closer to fuel than accelerated surveillance location: water.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	147.6
>0.5 MeV	(13.83†)	119.8
>0.1 MeV	-	81.1
Thermal, 20 °C	-	-

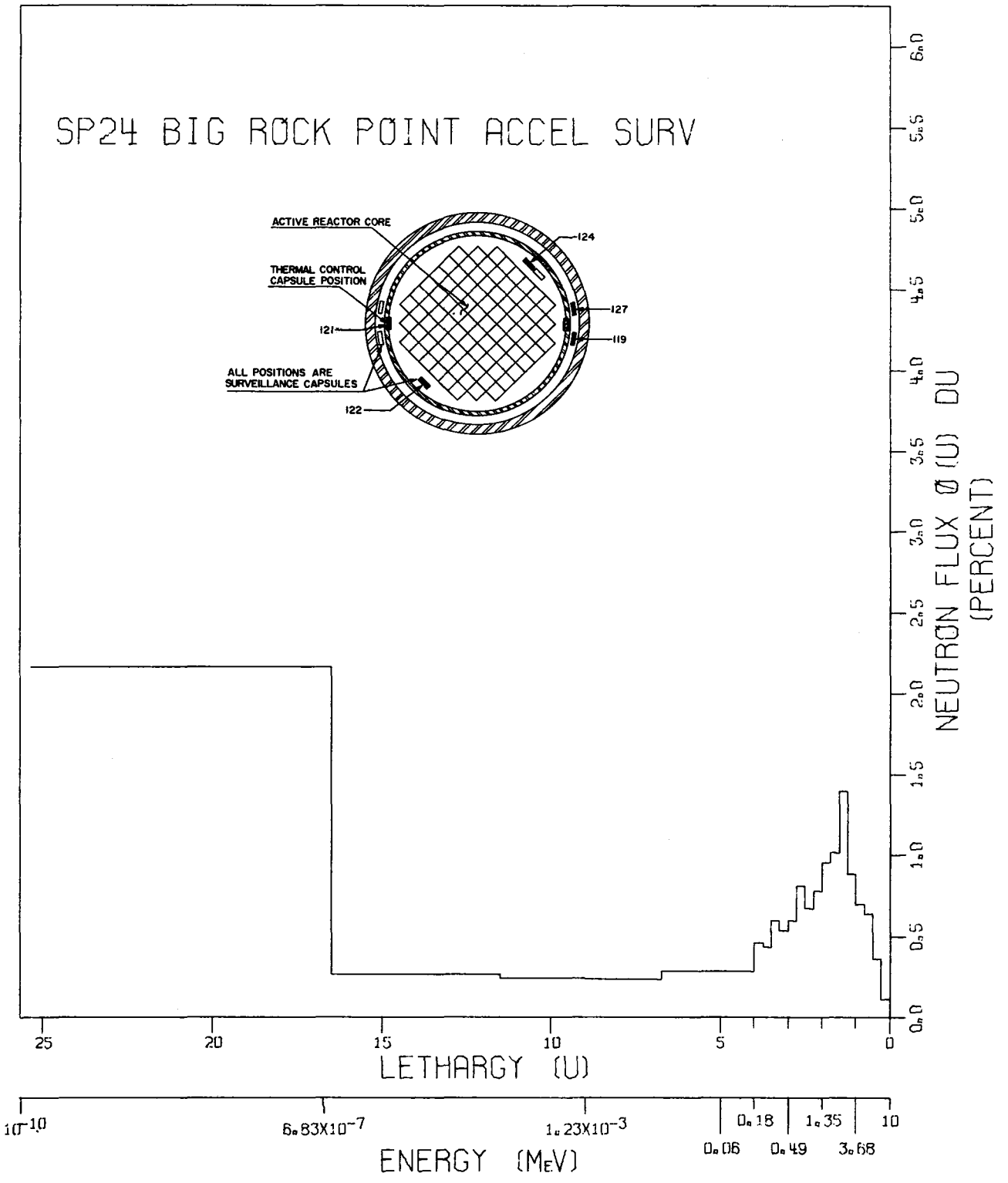
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP23 BIG ROCK POINT -1 INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7,79000+000	6,489-004	3,31755+000
0.50	6,07000+000	2,089-003	1,06918+001
0.75	4,72000+000	3,795-003	1,92644+001
1.00	3,68000+000	4,247-003	2,17888+001
1.25	2,87000+000	5,496-003	2,82303+001
1.50	2,23000+000	8,813-003	4,45996+001
1.75	1,74000+000	6,418-003	3,30310+001
2.00	1,35000+000	6,196-003	3,11729+001
2.25	1,05000+000	5,061-003	2,57156+001
2.50	8,21000-001	4,314-003	2,23915+001
2.75	6,39000-001	5,308-003	2,70453+001
3.00	4,98000-001	3,913-003	2,00391+001
3.25	3,88000-001	3,483-003	1,78193+001
3.50	3,02000-001	3,923-003	1,99908+001
3.75	2,35000-001	2,869-003	1,46058+001
4.00	1,83000-001	3,045-003	1,55456+001
6.75	1,17000-002	2,046-002	9,50154+000
9.00	1,23000-003	1,380-002	7,82455+000
11.50	1,01000-004	1,602-002	8,18335+000
16.50	6,83000-007	3,596-002	9,19047+000
25.33	1,00000-010	8,441-001	1,22080+002
		1,000+000	

ONE LETHARGY INTERVAL = 0.250


SP24 BIG ROCK POINT ACCEL SURV
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Accelerated-irradiation rate surveillance location; position 124; steel and water.

Spectrum Code

Code: Program S Calculation: BNW [17, 18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.37×10^{12}	152.6
>0.5 MeV	1.75 (9.924†)	119.4
>0.1 MeV	2.28	91.8
Thermal, 302°C	15.05	

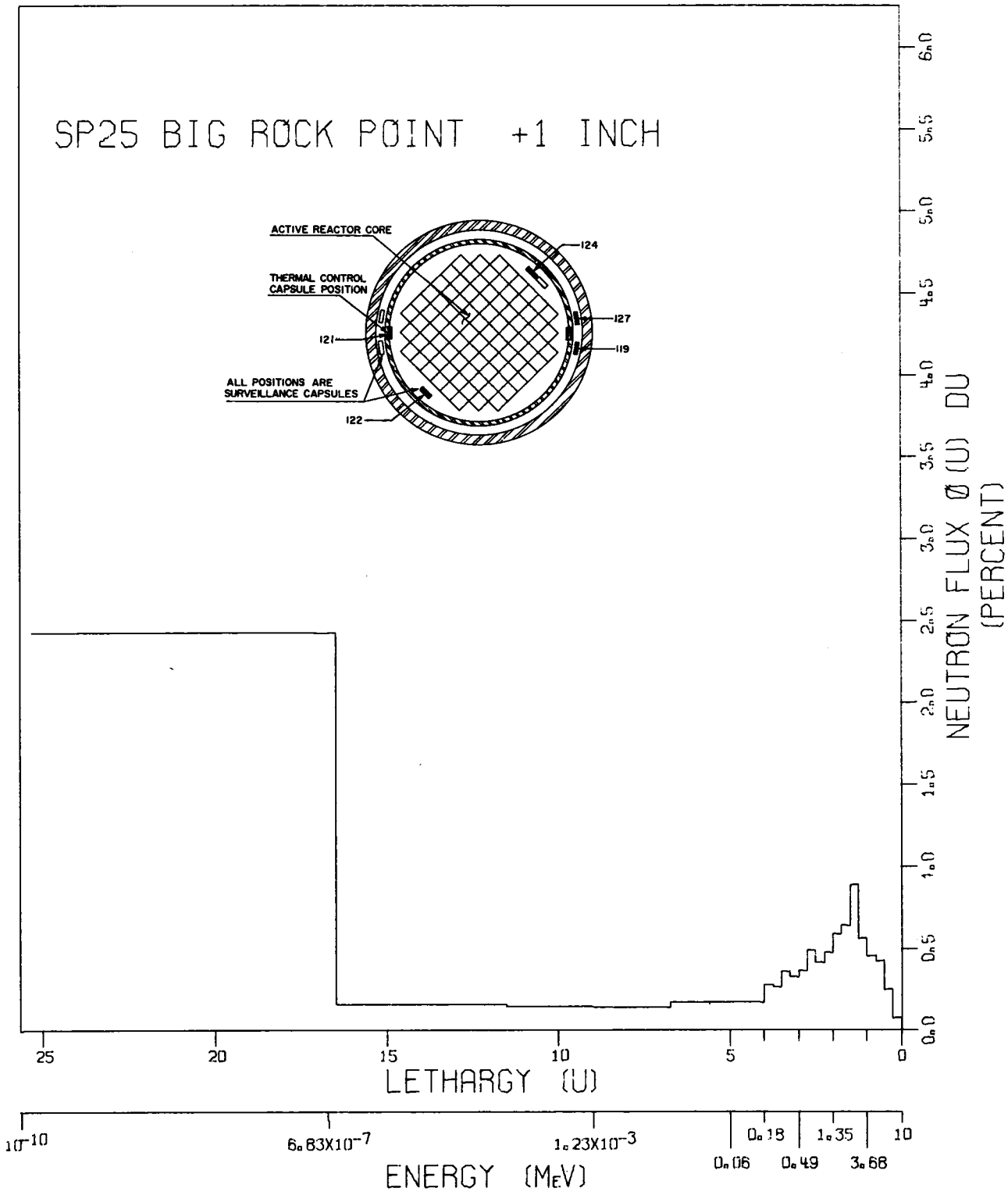
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP24 BIG ROCK POINT ACCEL SUHV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.115-003	3.45167+000
0.50	6.07000+000	3.603-003	1.11691+001
0.75	4.72000+000	6.390-003	1.96446+001
1.00	3.68000+000	6.910-003	2.14700+001
1.25	2.87000+000	8.762-003	2.72567+001
1.50	2.23000+000	1.408-002	4.31516+001
1.75	1.74000+000	1.006-002	3.13472+001
2.00	1.35000+000	9.603-003	2.92623+001
2.25	1.05000+000	7.780-003	2.39398+001
2.50	8.21000-001	6.593-003	2.07239+001
2.75	6.39000-001	8.045-003	2.48240+001
3.00	4.98000-001	5.909-003	1.83312+001
3.25	3.88000-001	5.275-003	1.63456+001
3.50	3.02000-001	5.915-003	1.82545+001
3.75	2.35000-001	4.316-003	1.33060+001
4.00	1.83000-001	4.573-003	1.41393+001
6.75	1.17000-002	3.054-002	8.58741+000
9.00	1.23000-003	2.047-002	7.02896+000
11.50	1.01000-004	2.365-002	7.31666+000
16.50	6.83000-007	5.277-002	8.16788+000
25.33	1.00000-010	7.636-001	6.68885+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP25 BIG ROCK POINT +1 INCH
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
121
119
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

One inch farther away from accelerated surveillance; water.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	157.5
≥0.5 MeV	(7.233†)	124.7
>0.1 MeV	-	88.1
Thermal, 20 °C	-	-

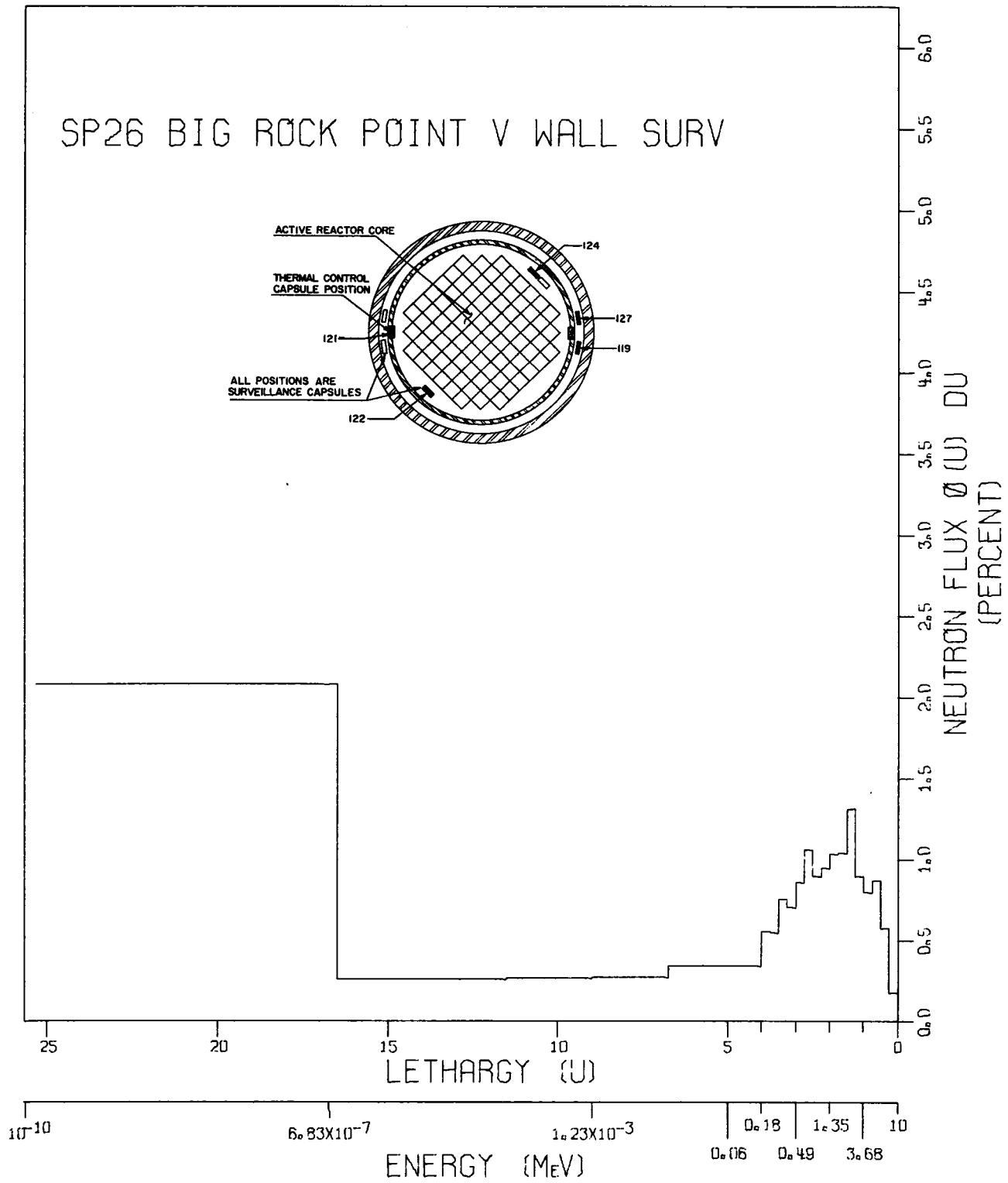
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP25 BIG ROCK POINT +1 INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	7.632-004	3.58913+000
0.50	6.07000+000	2.473-003	1.16441+001
0.75	4.72000+000	4.283-003	1.99966+001
1.00	3.68000+000	4.506-003	2.12616+001
1.25	2.87000+000	5.557-003	2.62567+001
1.50	2.23000+000	8.924-003	4.15451+001
1.75	1.74000+000	6.305-003	2.98470+001
2.00	1.35000+000	5.933-003	2.74595+001
2.25	1.05000+000	4.777-003	2.23244+001
2.50	8.21000-001	4.031-003	1.92431+001
2.75	6.39000-001	4.882-003	2.28776+001
3.00	4.98000-001	3.576-003	1.68484+001
3.25	3.88000-001	3.201-003	1.50649+001
3.50	3.02000-001	3.576-003	1.67596+001
3.75	2.35000-001	2.604-003	1.21929+001
4.00	1.83000-001	2.755-003	1.29387+001
6.75	1.17000-002	1.830-002	7.81714+000
9.00	1.23000-003	1.221-002	6.36542+000
11.50	1.01000-004	1.400-002	6.58031+000
16.50	6.83000-007	3.106-002	7.30087+000
25.33	1.00000-010	8.563-001	1.13913+002
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP26 BIG ROCK POINT V WALL SURV
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
121
119
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Vessel wall surveillance location: steel and water

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	6.95×10^{10}	170.9
>0.5 MeV	9.30 (1.017†)	127.7
>0.1 MeV	16.5	72.9
Thermal, 20°C	-	-

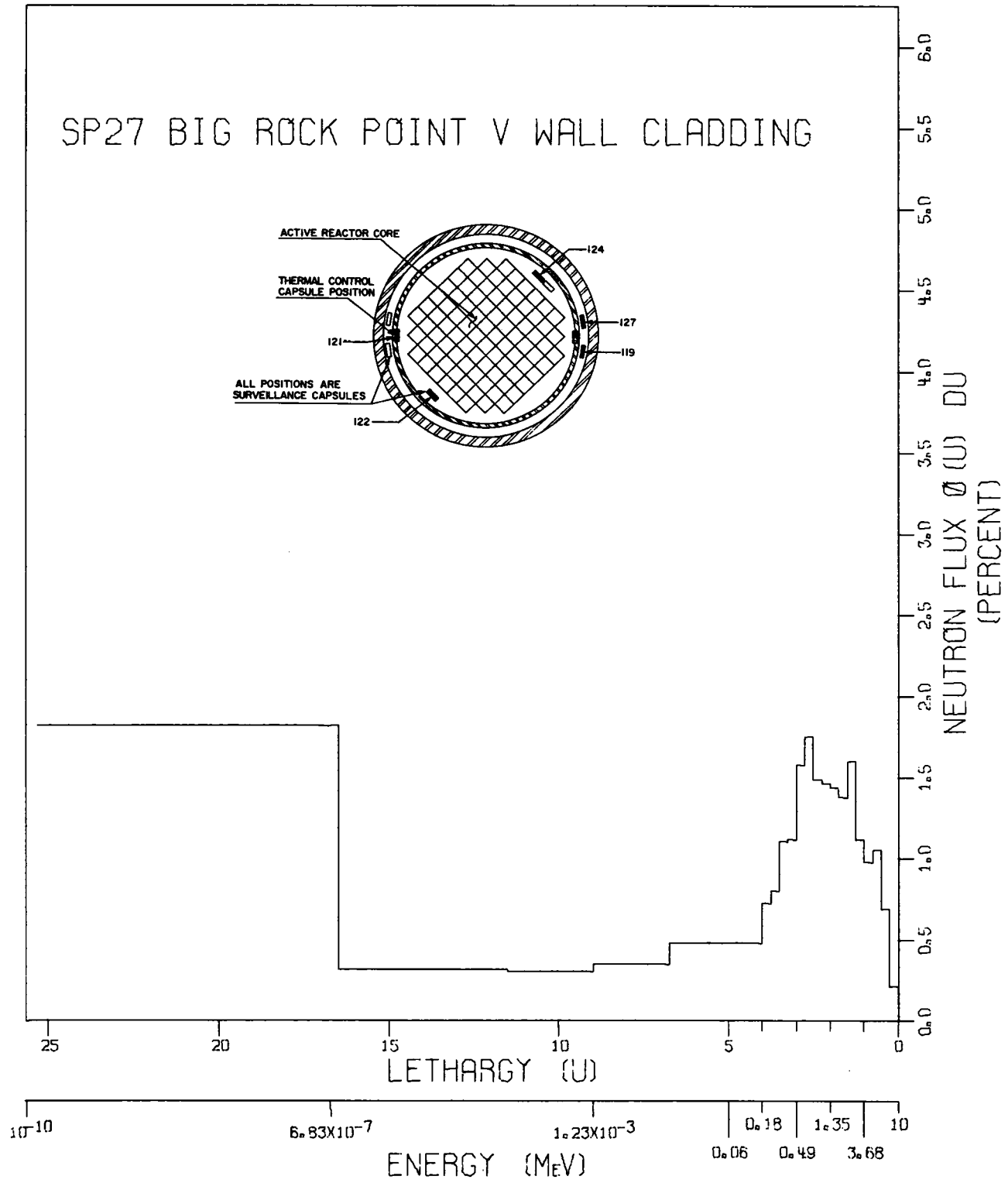
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP26 BIG ROCK POINT V WALL SURV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.758-003	4.36554+000
0.50	6.07000+000	5.725-003	1.42308+001
0.75	4.72000+000	8.732-003	2.15265+001
1.00	3.68000+000	7.890-003	1.96572+001
1.25	2.87000+000	8.903-003	2.22078+001
1.50	2.23000+000	1.323-002	3.25156+001
1.75	1.74000+000	1.031-002	2.57616+001
2.00	1.35000+000	1.044-002	2.55065+001
2.25	1.05000+000	9.483-003	2.34001+001
2.50	8.21000-001	8.807-003	2.21994+001
2.75	6.39000-001	1.060-002	2.62328+001
3.00	4.98000-001	8.522-003	2.11966+001
3.25	3.88000-001	6.953-003	1.72739+001
3.50	3.02000-001	7.526-003	1.86255+001
3.75	2.35000-001	5.435-003	1.34372+001
4.00	1.83000-001	5.498-003	1.36334+001
6.75	1.17000-002	3.706-002	8.35682+000
9.00	1.23000-003	2.402-002	6.61244+000
11.50	1.01000-004	2.579-002	6.39744+000
16.50	6.83000-007	5.070-002	6.29317+000
25.33	1.00000-010	7.326-001	5.14563+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP27 BIG ROCK POINT V WALL CLADDING
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding; steel.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	157.6
>0.5 MeV	(0.8963†)	109.5
>0.1 MeV	-	74.5
Thermal, 20 °C	-	-

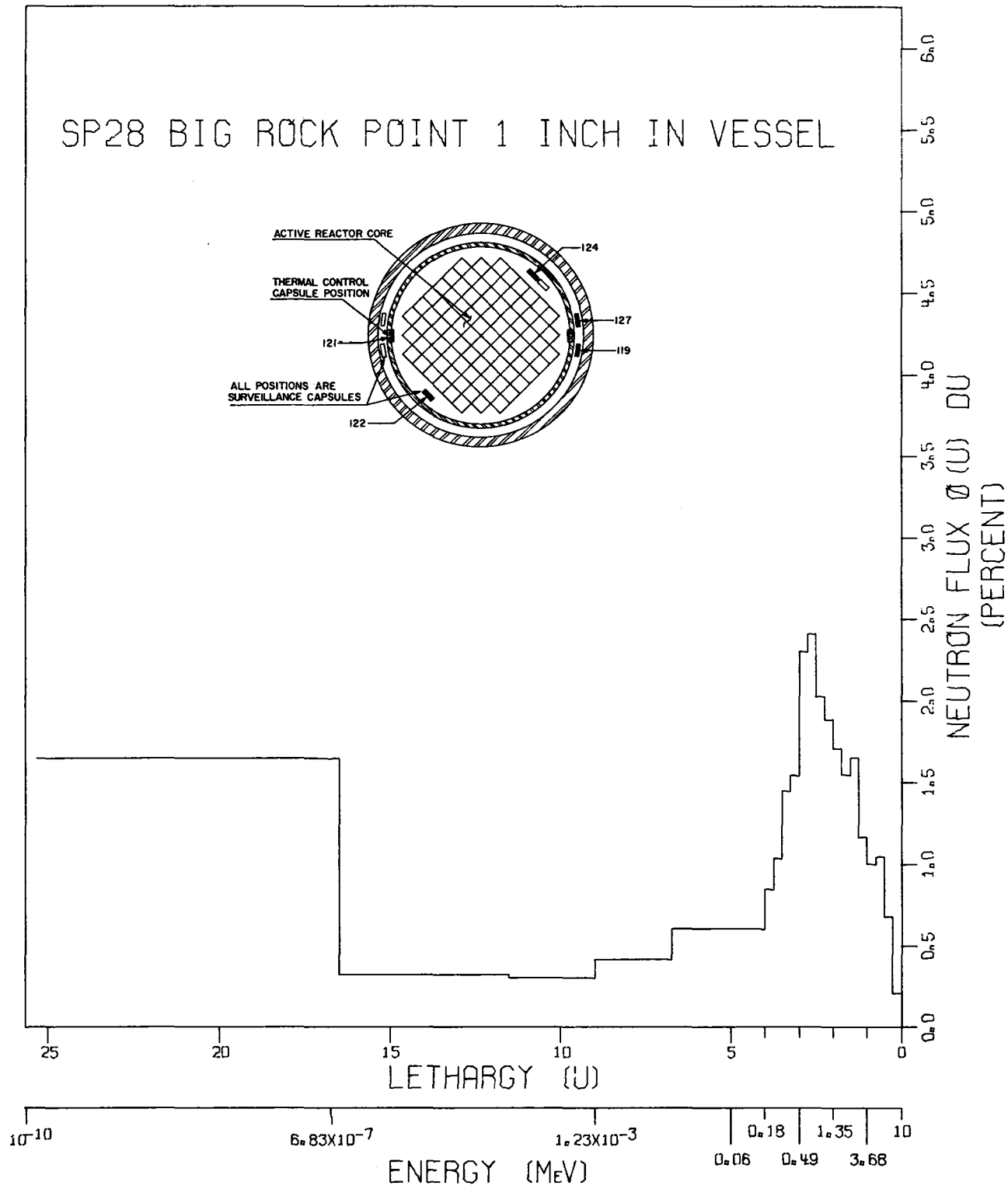
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP27 BIG ROCK POINT V WALL CLADDING

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7,79000+000	2,091-003	4,27134+000
0.50	6,07000+000	6,868-003	1,40427+001
0.75	4,72000+000	1,055-002	2,14045+001
1.00	3,68000+000	9,714-003	1,99092+001
1.25	2,87000+000	1,102-002	2,26101+001
1.50	2,23000+000	1,610-002	3,25532+001
1.75	1,74000+000	1,365-002	2,80679+001
2.00	1,35000+000	1,449-002	2,91323+001
2.25	1,05000+000	1,461-002	2,96558+001
2.50	8,21000-001	1,454-002	3,01567+001
2.75	6,39000-001	1,753-002	3,56857+001
3.00	4,98000-001	1,570-002	3,21291+001
3.25	3,88000-001	1,111-002	2,27087+001
3.50	3,02000-001	1,101-002	2,24157+001
3.75	2,35000-001	7,927-003	1,61211+001
4.00	1,83000-001	7,184-003	1,46535+001
6.75	1,17000-002	5,216-002	9,67681+000
9.00	1,23000-003	3,108-002	7,03755+000
11.50	1,01000-004	2,976-002	6,07305+000
16.50	6,83000-007	6,188-002	6,31760+000
25.33	1,00000-010	6,410-001	3,70359+001
		1,000+000	

ONE LETHARGY INTERVAL = 0.25U


SP28 BIG ROCK POINT 1 INCH IN VESSEL
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø(U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Location one inch into vessel wall; steel

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	143.5
>0.5 MeV	(0.7645†)	92.3
>0.1 MeV	-	61.3
Thermal, 20°C	-	-

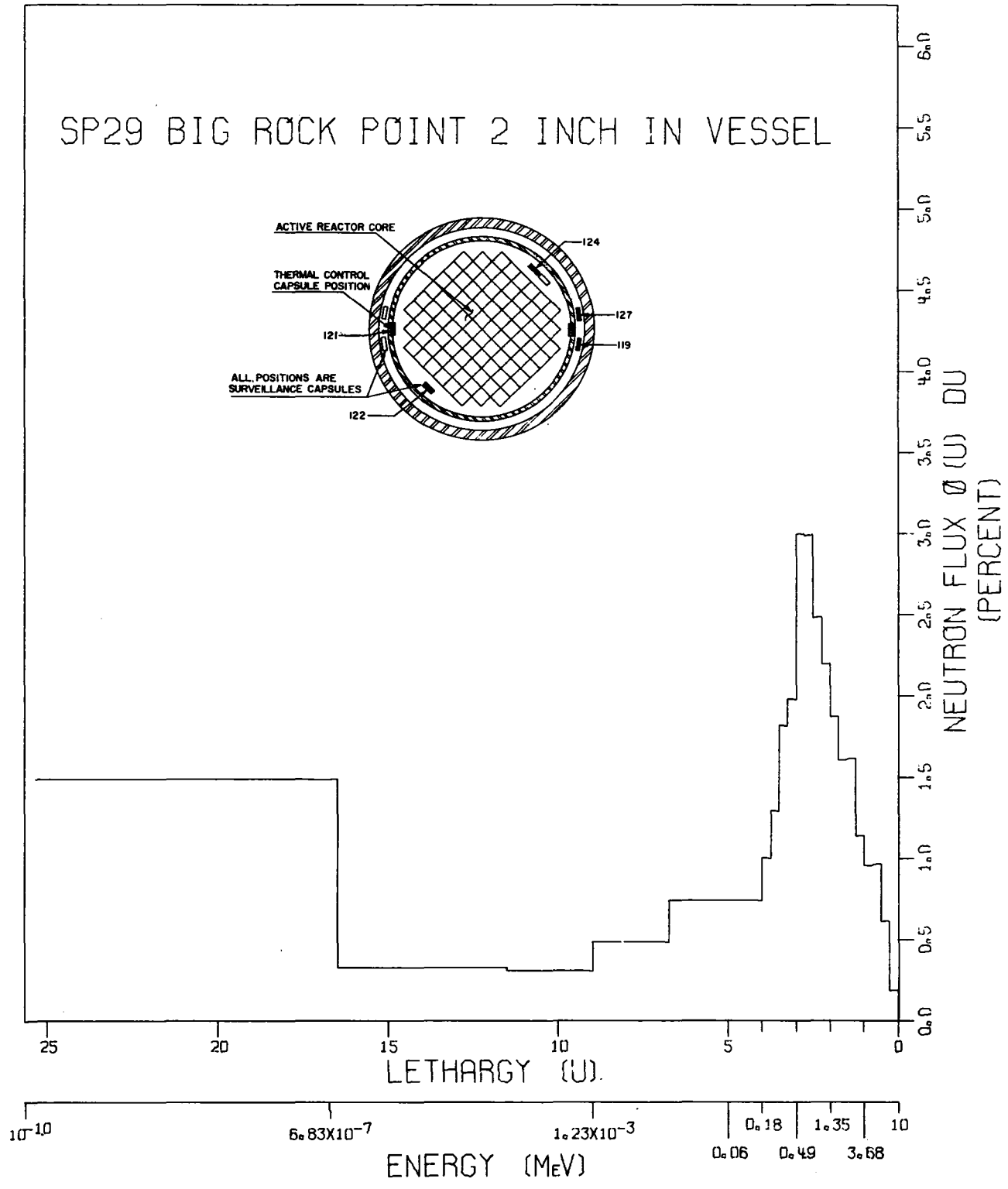
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP28 BIG ROCK POINT 1 INCH IN VESSEL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.039-003	4.13603+000
0.50	6.07000+000	6.695-003	1.35941+001
0.75	4.72000+000	1.047-002	2.10828+001
1.00	3.68000+000	9.956-003	2.02631+001
1.25	2.87000+000	1.155-002	2.35322+001
1.50	2.23000+000	1.665-002	3.34279+001
1.75	1.74000+000	1.534-002	3.13092+001
2.00	1.35000+000	1.729-002	3.45075+001
2.25	1.05000+000	1.888-002	3.80595+001
2.50	8.21000-001	1.989-002	4.09559+001
2.75	6.39000-001	2.410-002	4.87085+001
3.00	4.98000-001	2.289-002	4.65201+001
3.25	3.88000-001	1.533-002	3.11080+001
3.50	3.02000-001	1.445-002	2.92142+001
3.75	2.35000-001	1.033-002	2.08635+001
4.00	1.83000-001	8.442-003	1.70988+001
6.75	1.17000-002	6.610-002	1.21765+001
9.00	1.23000-003	3.707-002	8.33609+000
11.50	1.01000-004	2.982-002	6.04418+000
16.50	6.83000-007	6.310-002	6.39767+000
25.33	1.00000-010	5.796-001	3.32555+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP29 BIG ROCK POINT 2 INCH IN VESSEL
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Location two inches into vessel wall; steel.

Spectrum Code

Code: Program S Calculation: BNW [17, 18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	130.8
>0.5 MeV	(0.6111†)	77.8
>0.1 MeV	-	49.9
Thermal, 20 °C	-	-

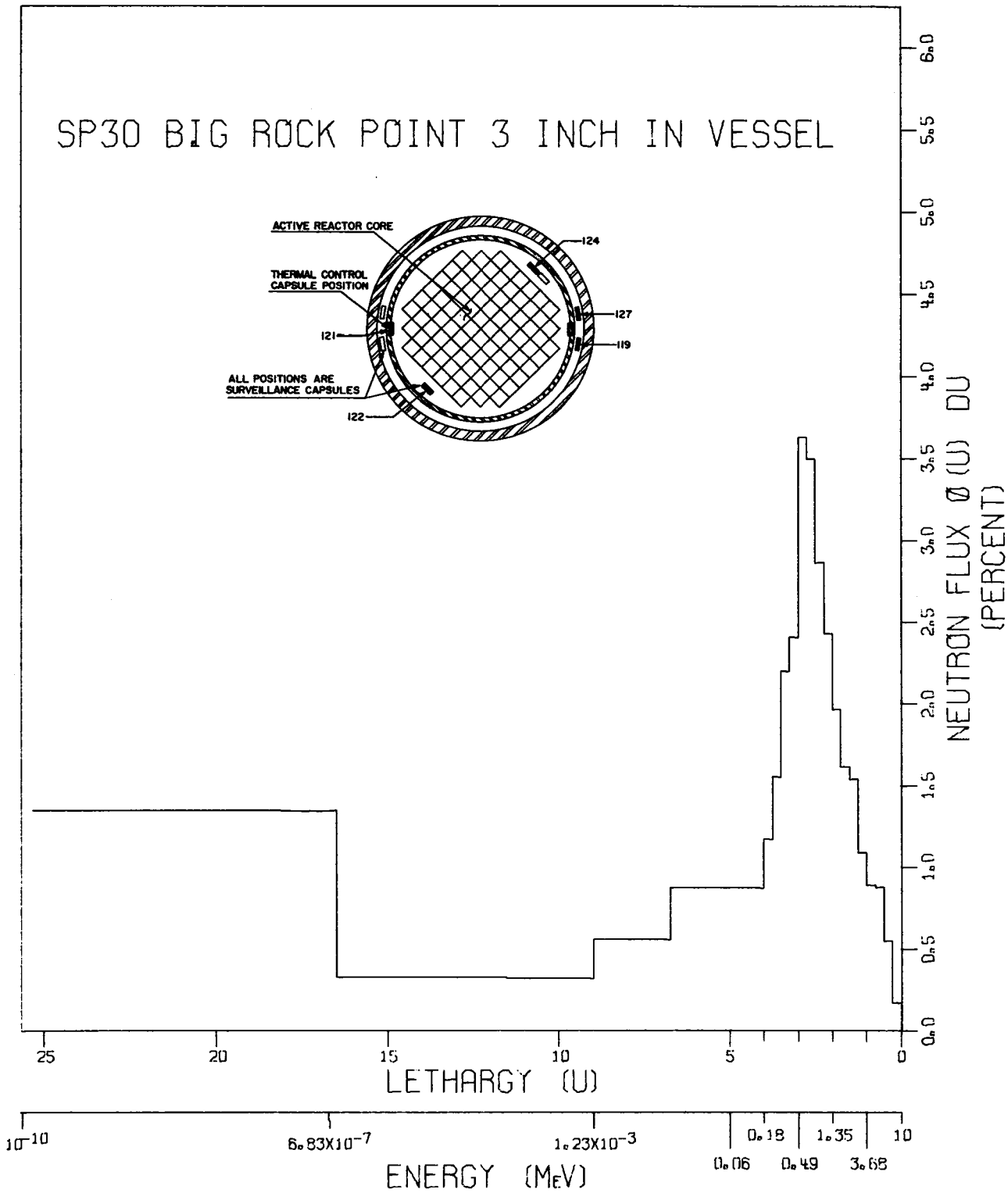
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP29 BIG ROCK POINT 2 INCH IN VESSEL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7,79000+000	1,853-003	3,99691+000
0.50	6,07000+000	6,092-003	1,31542+001
0.75	4,72000+000	9,661-003	2,06892+001
1.00	3,68000+000	9,492-003	2,05441+001
1.25	2,87000+000	1,131-002	2,44990+001
1.50	2,23000+000	1,624-002	3,46837+001
1.75	1,74000+000	1,593-002	3,45798+001
2.00	1,35000+000	1,896-002	4,02376+001
2.25	1,05000+000	2,204-002	4,72523+001
2.50	8,21000-001	2,442-002	5,34758+001
2.75	6,39000-001	2,991-002	6,42982+001
3.00	4,98000-001	2,981-002	6,44157+001
3.25	3,88000-001	1,972-002	4,25611+001
3.50	3,02000-001	1,816-002	3,90399+001
3.75	2,35000-001	1,290-002	2,77013+001
4.00	1,83000-001	9,992-003	2,15227+001
6.75	1,17000-002	8,068-002	1,58058+001
9.00	1,23000-003	4,345-002	1,03900+001
11.50	1,01000-004	3,053-002	6,58056+000
16.50	6,83000-007	6,411-002	6,91224+000
25.33	1,00000-010	5,247-001	3,20176+001
		1,000+000	

ONE LETHARGY INTERVAL = 0.25U


SP30 BIG ROCK POINT 3 INCH IN VESSEL
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
121
119
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Location three inches into vessel wall: steel.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	120.2
>0.5 MeV	(0.4729†)	66.7
>0.1 MeV	-	41.1
Thermal, 20°C	-	-

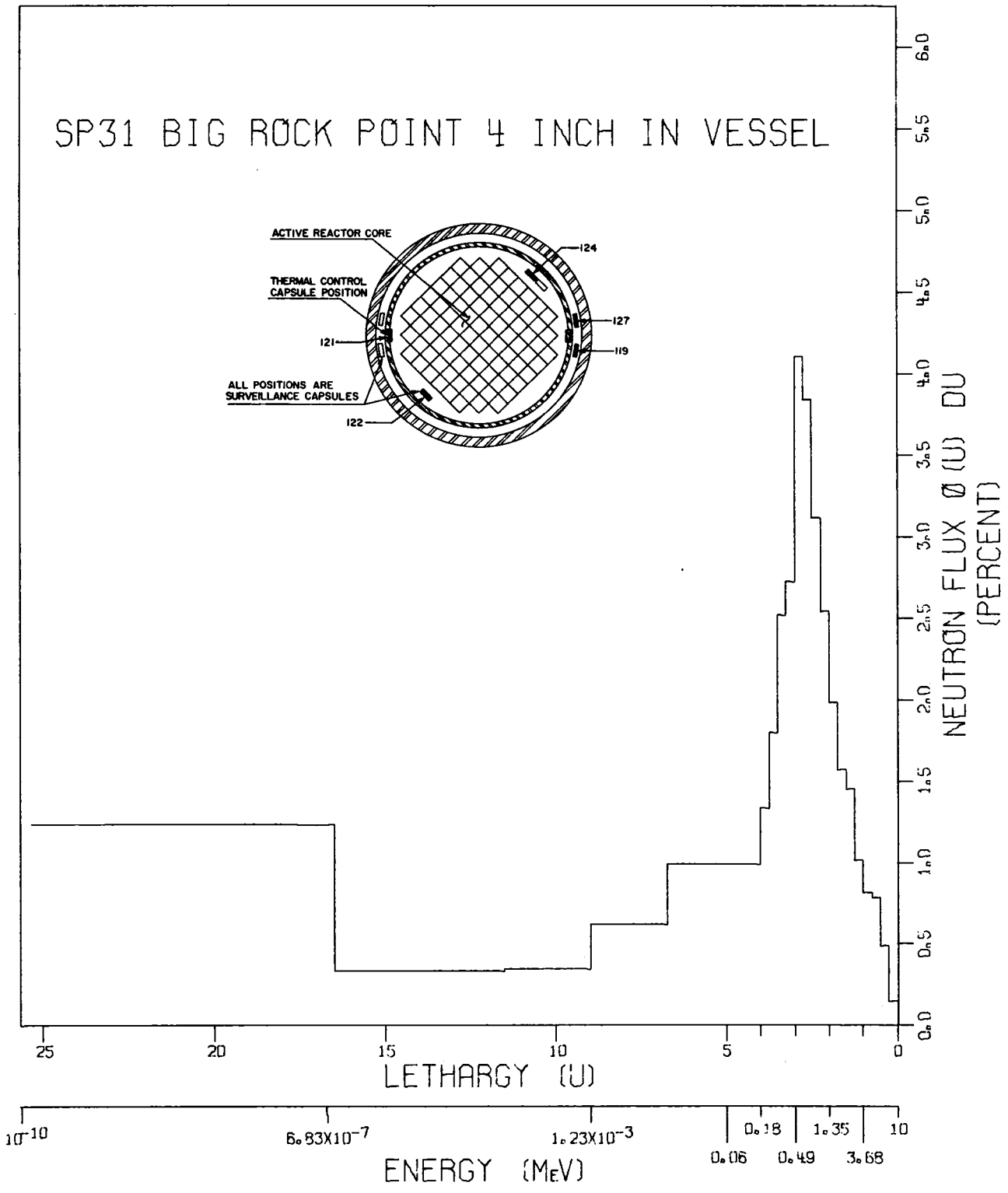
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP30 BIG ROCK POINT 3 INCH IN VESSEL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7,79000+000	1,652-003	3,86167+000
0.50	6,07000+000	5,457-003	1,27668+001
0.75	4,72000+000	8,765-003	2,03389+001
1.00	3,68000+000	8,851-003	2,07575+001
1.25	2,87000+000	1,080-002	2,53478+001
1.50	2,23000+000	1,553-002	3,59318+001
1.75	1,74000+000	1,598-002	3,75979+001
2.00	1,35000+000	1,992-002	4,58168+001
2.25	1,05000+000	2,434-002	5,65382+001
2.50	8,21000-001	2,818-002	6,68645+001
2.75	6,39000-001	3,498-002	8,14690+001
3.00	4,98000-001	3,615-002	8,46484+001
3.25	3,88000-001	2,396-002	5,60348+001
3.50	3,02000-001	2,194-002	5,11130+001
3.75	2,35000-001	1,556-002	3,62185+001
4.00	1,83000-001	1,169-002	2,72910+001
6.75	1,17000-002	9,548-002	2,02670+001
9.00	1,23000-003	5,000-002	1,29574+001
11.50	1,01000-004	3,176-002	7,41645+000
16.50	6,83000-007	6,497-002	7,59037+000
25,33	1,00000-010	4,740-001	3,13365+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP31 BIG ROCK POINT 4 INCH IN VESSEL
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
121
119
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Location four inches into vessel wall; steel.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	111.8
>0.5 MeV	(0.3525†)	58.5
>0.1 MeV	-	34.8
Thermal, 20°C	-	-

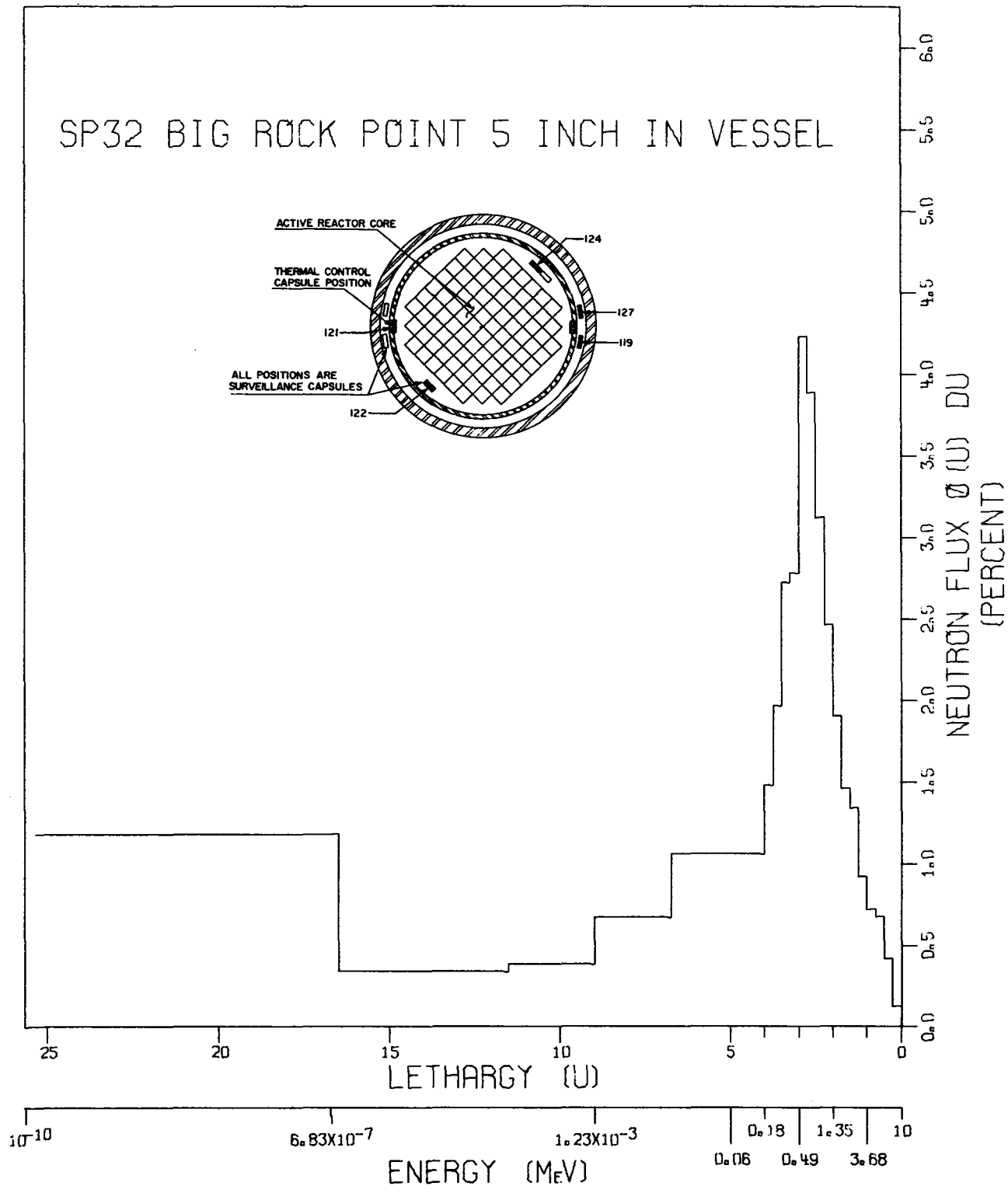
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SPJ1 BIG ROCK POINT 4 INCH IN VESSEL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.452-003	3.73855+000
0.50	6.07000+000	4.824-003	1.24336+001
0.75	4.72000+000	7.837-003	2.00317+001
1.00	3.68000+000	8.088-003	2.08937+001
1.25	2.87000+000	1.008-002	2.60672+001
1.50	2.23000+000	1.459-002	3.71929+001
1.75	1.74000+000	1.553-002	4.02528+001
2.00	1.35000+000	2.011-002	5.09602+001
2.25	1.05000+000	2.548-002	6.51776+001
2.50	8.21000-001	3.060-002	7.99798+001
2.75	6.39000-001	3.847-002	9.86981+001
3.00	4.98000-001	4.085-002	1.05366+002
3.25	3.88000-001	2.712-002	6.98614+001
3.50	3.02000-001	2.518-002	6.46209+001
3.75	2.35000-001	1.797-002	4.60695+001
4.00	1.83000-001	1.332-002	3.42487+001
6.75	1.17000-002	1.083-001	2.53304+001
9.00	1.23000-003	5.588-002	1.59501+001
11.50	1.01000-004	3.391-002	8.72317+000
16.50	6.83000-007	6.596-002	8.48781+000
25.33	1.00000-010	4.344-001	3.16348+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP32 BIG ROCK POINT 5 INCH IN VESSEL
ACTIVE REACTOR CORE
THERMAL CONTROL CAPSULE POSITION
ALL POSITIONS ARE SURVEILLANCE CAPSULES
124
127
119
121
122
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Big Rock Point Reactor

Type: Power BWR Power Level: 240 MWt

Coolant: Light water Moderator: Light water

Location: Charlevoix, Michigan

Spectrum Facility Description

Location five inches into vessel wall: steel.

Spectrum Code

Code: Program S Calculation: BNW [17,18]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	105.6
>0.5 MeV	(0.2416+)	53.0
>0.1 MeV	-	30.3
Thermal, 20 °C	-	-

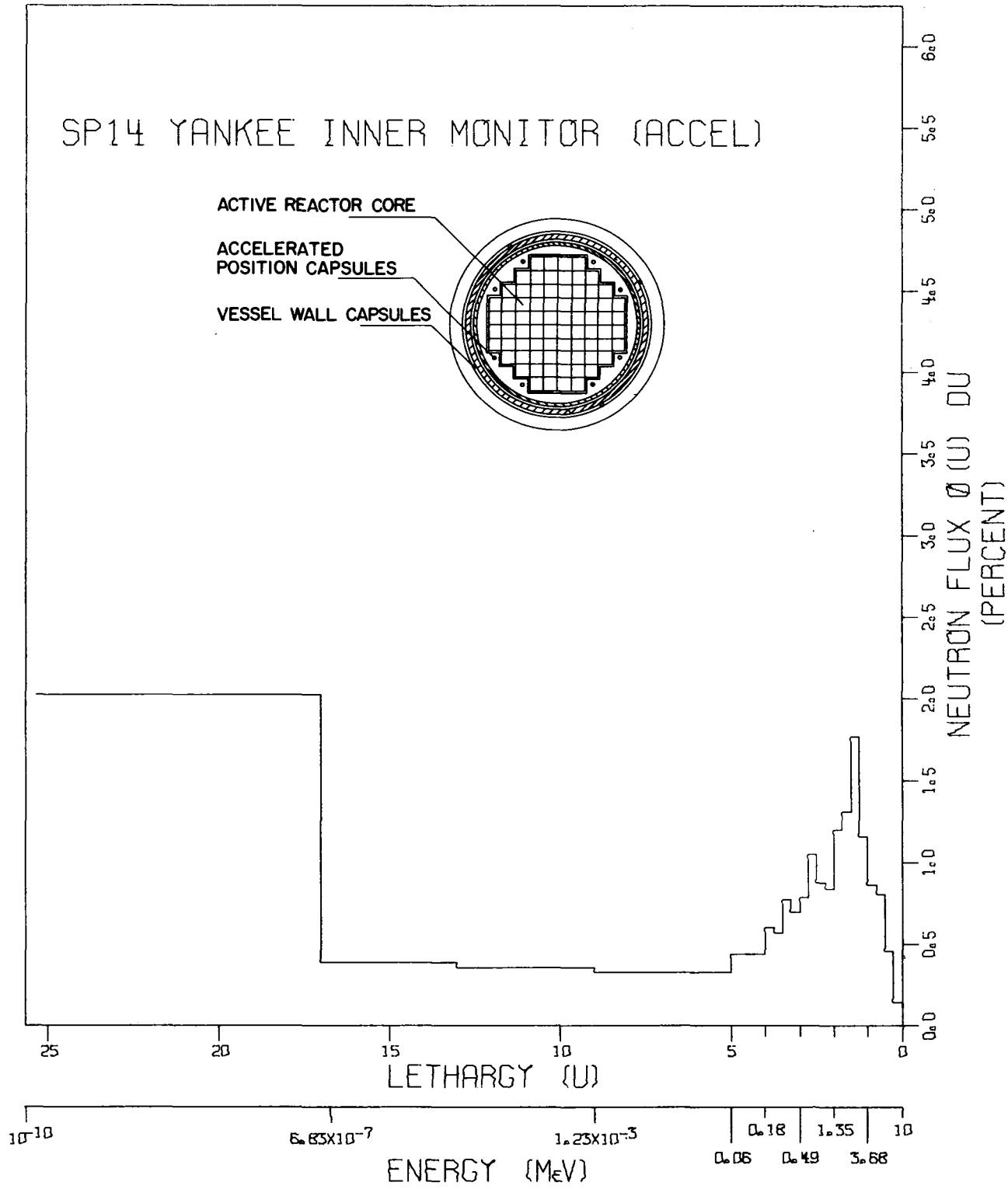
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 23 through 32

SP32 BIG ROCK POINT 5 INCH IN VESSEL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.245-003	3.63297+000
0.50	6.07000+000	4.155-003	1.21390+001
0.75	4.72000+000	6.801-003	1.97069+001
1.00	3.68000+000	7.123-003	2.08598+001
1.25	2.87000+000	9.099-003	2.66783+001
1.50	2.23000+000	1.350-002	3.89994+001
1.75	1.74000+000	1.441-002	4.23328+001
2.00	1.35000+000	1.928-002	5.53900+001
2.25	1.05000+000	2.476-002	7.18206+001
2.50	8.21000-001	3.068-002	9.09009+001
2.75	6.39000-001	3.894-002	1.13253+002
3.00	4.98000-001	4.220-002	1.23377+002
3.25	3.88000-001	2.767-002	8.08207+001
3.50	3.02000-001	2.722-002	7.91715+001
3.75	2.35000-001	1.969-002	5.72102+001
4.00	1.83000-001	1.473-002	4.29344+001
6.75	1.17000-002	1.162-001	3.08013+001
9.00	1.23000-003	6.029-002	1.95083+001
11.50	1.01000-004	3.812-002	1.11158+001
16.50	6.83000-007	6.723-002	9.80739+000
25.33	1.00000-010	4.167-001	3.43981+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.250


SP14 YANKEE INNER MONITOR (ACCEL)
ACTIVE REACTOR CORE
ACCELERATED POSITION CAPSULES
VESSEL WALL CAPSULES
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Yankee Atomic Power Plant

Type: Power PWR Power Level: 600 MWt

Coolant: Light water Moderator: Light water

Location: Rowe, Massachusetts

Spectrum Facility Description

Accelerated-irradiation rate surveillance location; steel and water.

Spectrum Code

Code: Program S Calculation: BNW [19,20]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.26×10^{12}	154.2
>0.5 MeV	2.91 (42.7†)	119.7
>0.1 MeV	3.87	90.1
Thermal, 20 °C	-	-

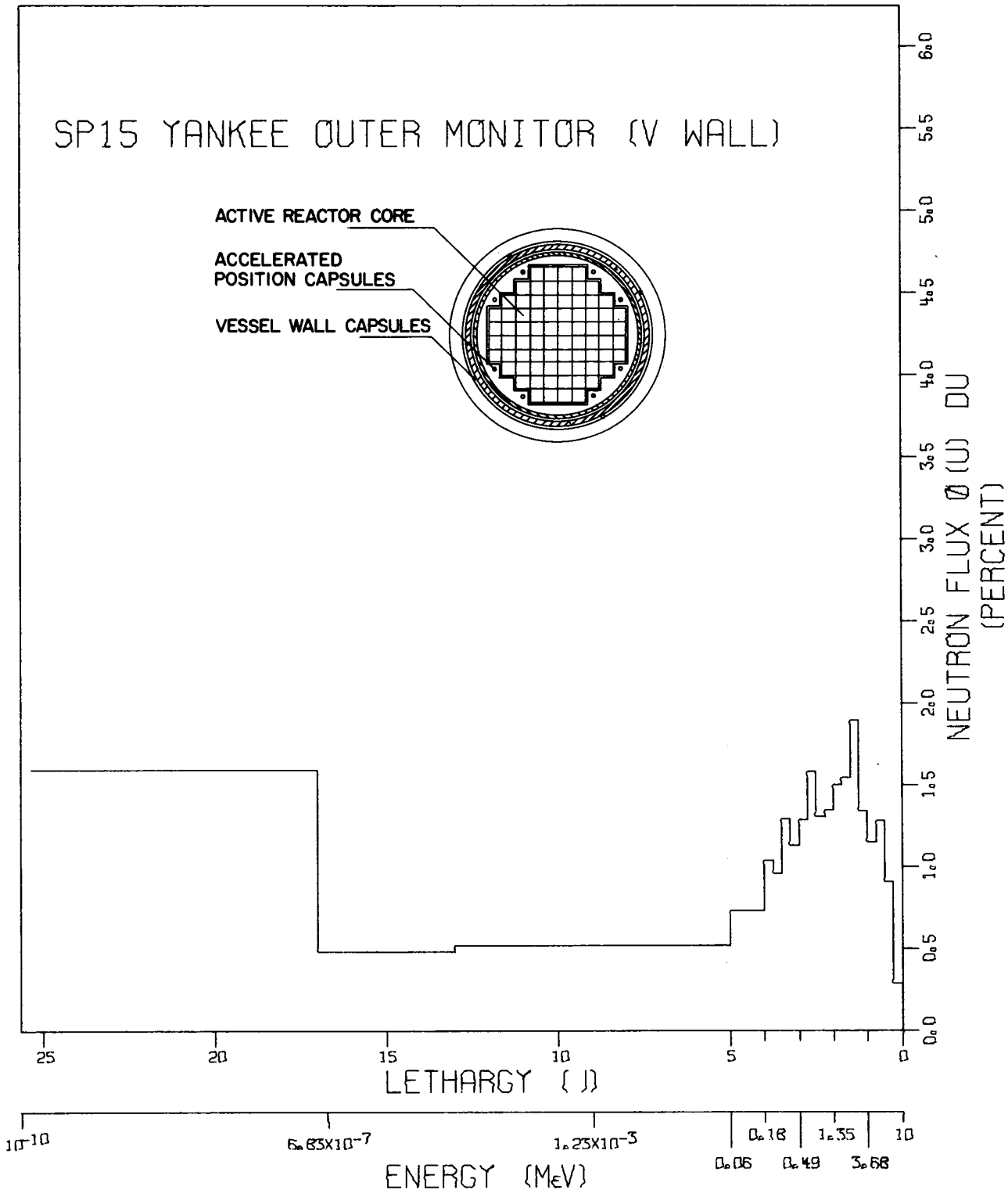
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 14, 15, 33

SP14 YANKEE INNER MONITOR (ACCEL)

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,437-003	3,50759+000
0,50	6,07000+000	4,538-003	1,10906+001
0,75	4,72000+000	8,067-003	1,95518+001
1,00	3,68000+000	8,588-003	2,10368+001
1,25	2,87000+000	1,148-002	2,81538+001
1,50	2,23000+000	1,786-002	4,31585+001
1,75	1,74000+000	1,298-002	3,18966+001
2,00	1,35000+000	1,214-002	2,91686+001
2,25	1,05000+000	8,418-003	2,04236+001
2,50	8,21000-001	8,598-003	2,13078+001
2,75	6,39000-001	1,050-002	2,55492+001
3,00	4,98000-001	7,830-003	1,91496+001
3,25	3,88000-001	6,934-003	1,69390+001
3,50	3,02000-001	7,774-003	1,89159+001
3,75	2,35000-001	5,682-003	1,38099+001
4,00	1,83000-001	5,978-003	1,45738+001
5,00	6,74000-002	1,751-002	1,06913+001
9,00	1,23000-003	5,190-002	7,90390+000
13,00	2,26000-005	5,707-002	8,70526+000
17,00	4,14000-007	6,145-002	9,36732+000
25,33	1,00000-010	6,733-001	4,92876+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP15 YANKEE OUTER MONITOR (V WALL)
ACTIVE REACTOR CORE
ACCELERATED POSITION CAPSULES
VESSEL WALL CAPSULES
NEUTRON FLUX Ø(U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Yankee Atomic Power Plant

Type: Power PWR Power Level: 600 MWt

Coolant: Light water Moderator: Light water

Location: Rowe, Massachusetts

Spectrum Facility Description

Vessel-wall-irradiation surveillance location: steel and water.

Spectrum Code

Code: Program S Calculation: BNW [19,20]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.45×10^{11}	172.5
>0.5 MeV	1.94 (0.542†)	128.9
>0.1 MeV	2.72	92.1
Thermal, 20 °C	-	-

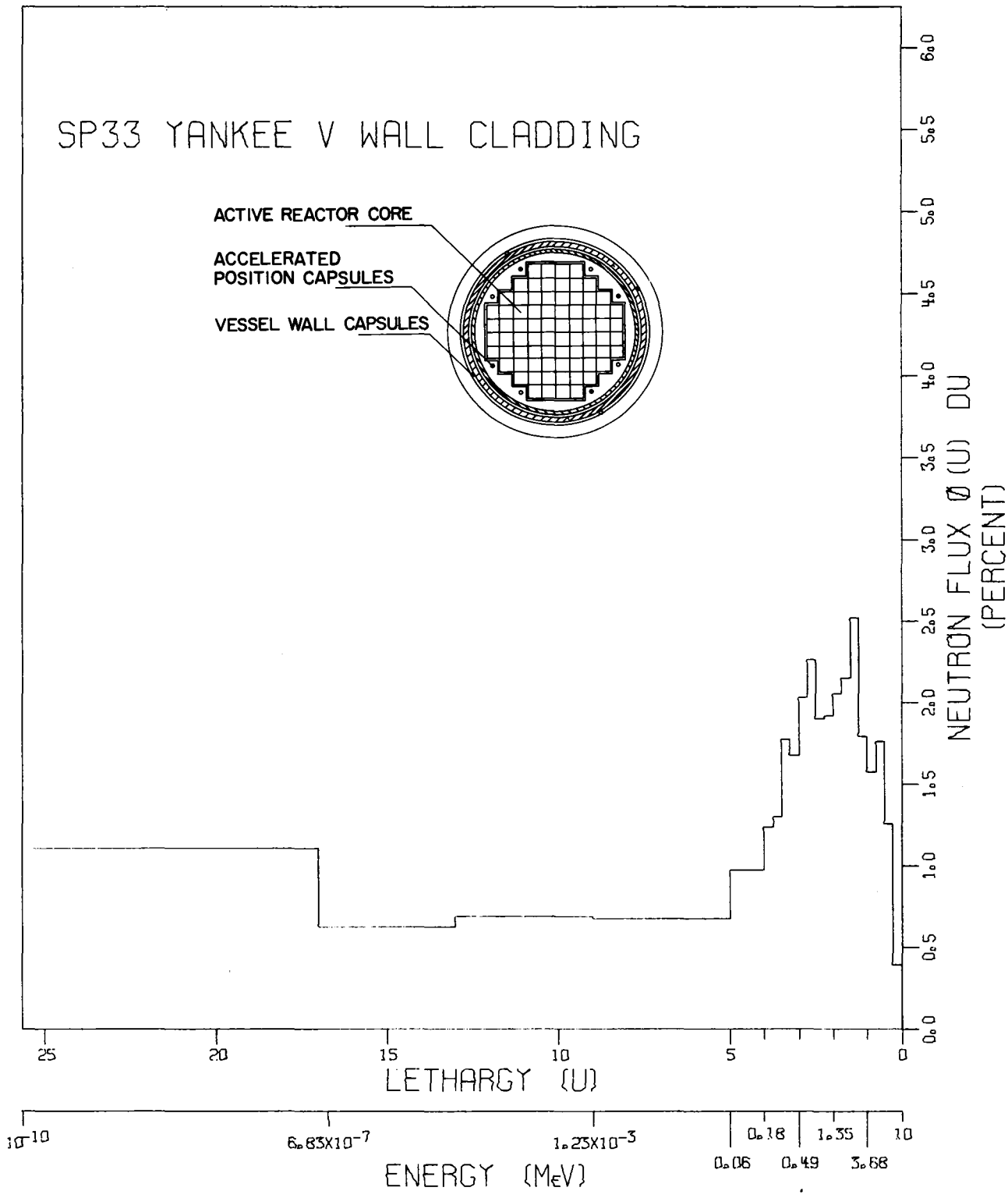
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 14, 15, 33

SP15 YANKEE OUTER MONITOR (V WALL)

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	2,885-003	4,76850+000
0,50	6,07000+000	9,059-003	1,49869+001
0,75	4,72000+000	1,289-002	2,11458+001
1,00	3,68000+000	1,145-002	1,89861+001
1,25	2,87000+000	1,327-002	2,20295+001
1,50	2,23000+000	1,907-002	3,11984+001
1,75	1,74000+000	1,531-002	2,54704+001
2,00	1,35000+000	1,518-002	2,46901+001
2,25	1,05000+000	1,350-002	2,21716+001
2,50	8,21000+001	1,287-002	2,15856+001
2,75	6,39000+001	1,585-002	2,61076+001
3,00	4,98000+001	1,280-002	2,11988+001
3,25	3,88000+001	1,129-002	1,86738+001
3,50	3,02000+001	1,297-002	2,13679+001
3,75	2,35000+001	9,567-003	1,57426+001
4,00	1,83000+001	1,038-002	1,71230+001
5,00	6,74000+002	2,914-002	1,20413+001
9,00	1,23000+003	8,250-002	8,50557+000
13,00	2,26000+005	8,266-002	8,53584+000
17,00	4,14000+007	7,707+002	7,95299+000
25,33	1,00000+010	5,303+001	2,62801+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP33 YANKEE V WALL CLADDING
ACTIVE REACTOR CORE
ACCELERATED POSITION CAPSULES
VESSEL WALL CAPSULES
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Yankee Atomic Power Plant

Type: Power PWR Power Level: 600 MWt

Coolant: Light water Moderator: Light water

Location: Rowe, Massachusetts

Spectrum Facility Description

Interface of water and stainless steel cladding; steel and water.

Spectrum Code

Code: Program S Calculation: BNW [19,20]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	168.3
>0.5 MeV	(0.418†)	125.6
>0.1 MeV	-	74.4
Thermal, 20 °C	-	-

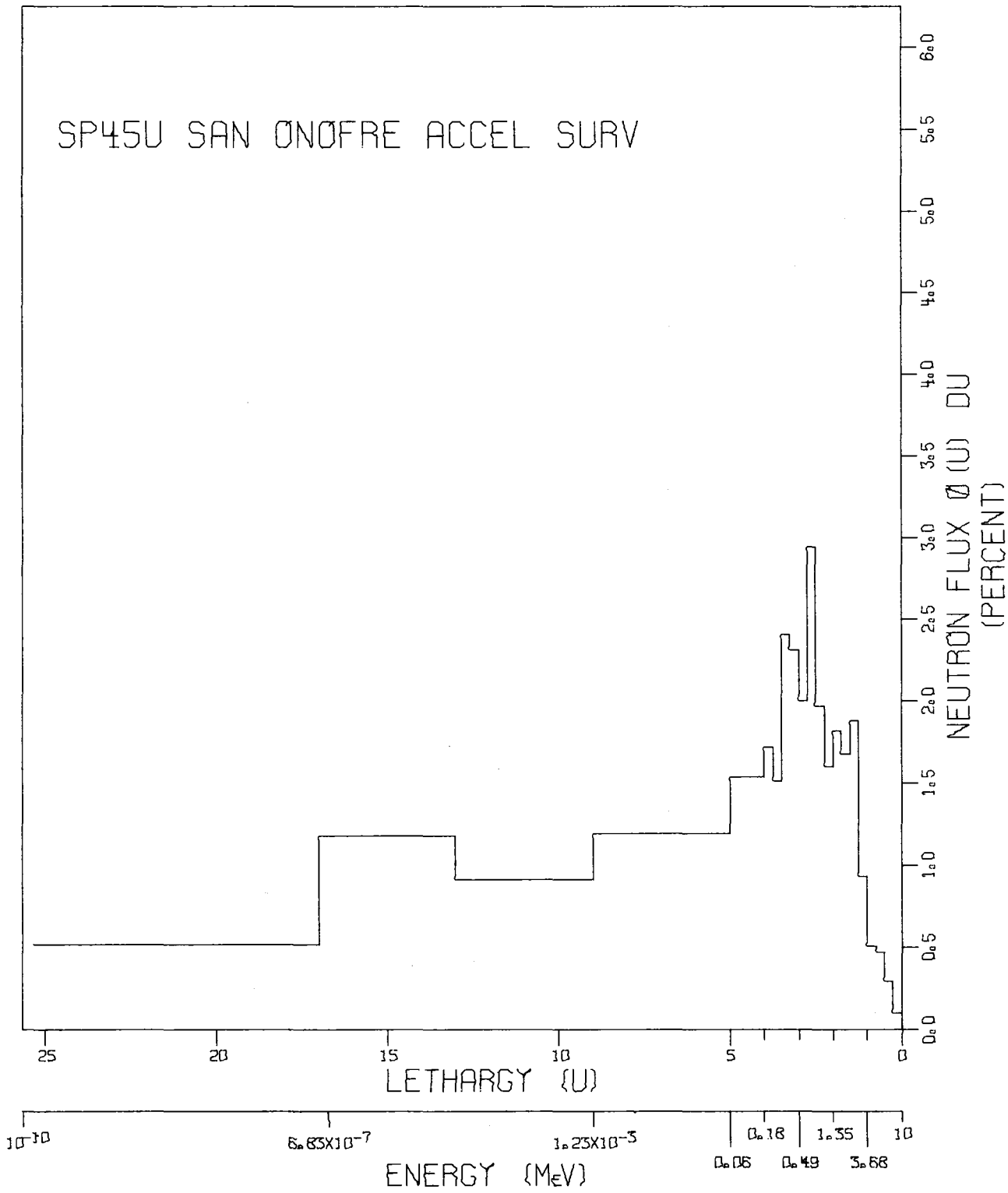
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 14, 15, 33

SP33 YANKEE V WALL CLADDING

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.933-003	4.75728+000
0.50	6.07000+000	1.252-002	1.51634+001
0.75	4.72000+000	1.773-002	2.12943+001
1.00	3.68000+000	1.565-002	1.89912+001
1.25	2.87000+000	1.783-002	2.16627+001
1.50	2.23000+000	2.540-002	3.04116+001
1.75	1.74000+000	2.134-002	2.59847+001
2.00	1.35000+000	2.086-002	2.48313+001
2.25	1.05000+000	1.925-002	2.31323+001
2.50	8.21000-001	1.866-002	2.29150+001
2.75	6.39000-001	2.269-002	2.73412+001
3.00	4.98000-001	2.024-002	2.45248+001
3.25	3.88000-001	1.672-002	2.02329+001
3.50	3.02000-001	1.777-002	2.14189+001
3.75	2.35000-001	1.300-002	1.56554+001
4.00	1.83000-001	1.238-002	1.49527+001
5.00	6.74000-002	3.894-002	1.17760+001
9.00	1.23000-003	1.082-001	8.15979+000
13.00	2.26000-005	1.095-001	8.27732+000
17.00	4.14000-007	9.933-002	7.50149+000
25.33	1.00000-010	3.681-001	1.33487+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP45U SAN ONOFRE ACCEL SURV
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: San Onofre Nuclear Generating Station, Unit 1

Type: Power PWR Power Level: 1347 MWt

Coolant: Light water Moderator: Light water

Location: San Onofre, California

Spectrum Facility Description

Accelerated irradiation rate surveillance location; steel and water; unfolded from activation foil data.

Spectrum Code

Code: SAND-II Calculation: NRL [31]

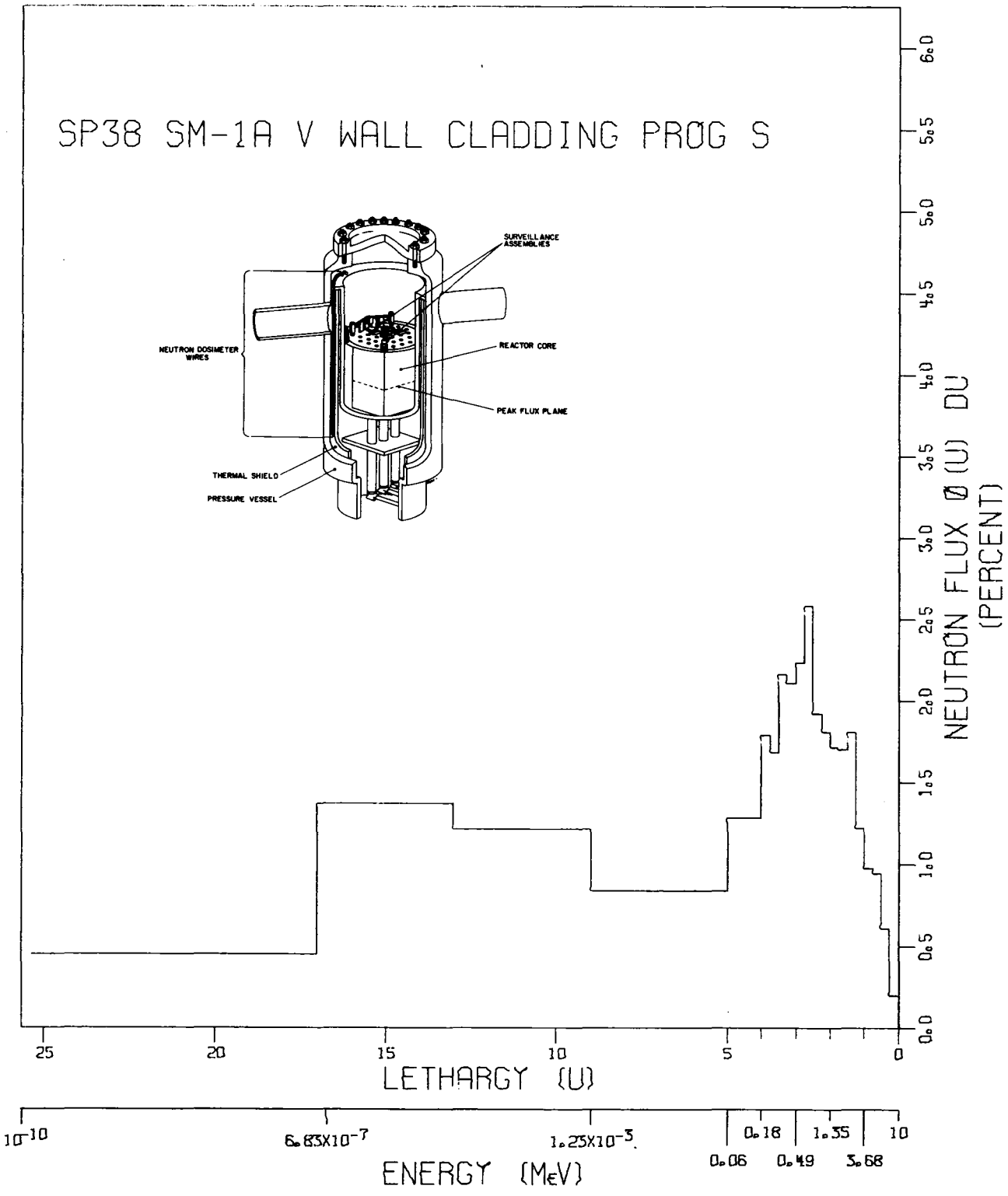
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.07×10^{11}	98.9
>0.5 MeV	3.58×10^{11}	57.4
>0.1 MeV	5.61×10^{11}	36.6
Thermal, 288°C	3.83×10^{11}	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP45U SAN ONOFRE ACCEL SURV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	9,799-004	3,34818+000
0,50	6,07000+000	2,893-003	9,89474+000
0,75	4,72000+000	4,706-003	1,59660+001
1,00	3,68000+000	5,025-003	1,72299+001
1,25	2,87000+000	9,235-003	3,16986+001
1,50	2,23000+000	1,900-002	6,42456+001
1,75	1,74000+000	1,661-002	5,71328+001
2,00	1,35000+000	1,846-002	6,20802+001
2,25	1,05000+000	1,608-002	5,46124+001
2,50	8,21000-001	1,937-002	6,71781+001
2,75	6,39000-001	2,948-002	1,00372+002
3,00	4,98000-001	1,992-002	6,81903+001
3,25	3,88000-001	2,309-002	7,89473+001
3,50	3,02000-001	2,412-002	8,21384+001
3,75	2,35000-001	1,519-002	5,16800+001
4,00	1,83000-001	1,716-002	5,85353+001
5,00	6,74000-002	6,128-002	5,23511+001
9,00	1,23000-003	1,911-001	4,07224+001
13,00	2,26000-005	1,458-001	3,11341+001
17,00	4,14000-007	1,887-001	4,02510+001
25,33	1,00000-010	1,719-001	1,76084+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP38 SM-1A V WALL CLADDING PROG S
SURVEILLANCE ASSEMBLIES
NEUTRON DOSIMETER WIRES
REACTOR CORE
PEAK FLUX PLANE
THERMAL SHIELD
PRESSURE VESSEL
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1A

Type: Power PWR Power Level: 20.2 MWt

Coolant: Light water Moderator: Light water

Location: Fort Greely, Alaska (decommissioned)

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding; steel

Spectrum Code

Code: Program S Calculation: BNW [19,23]

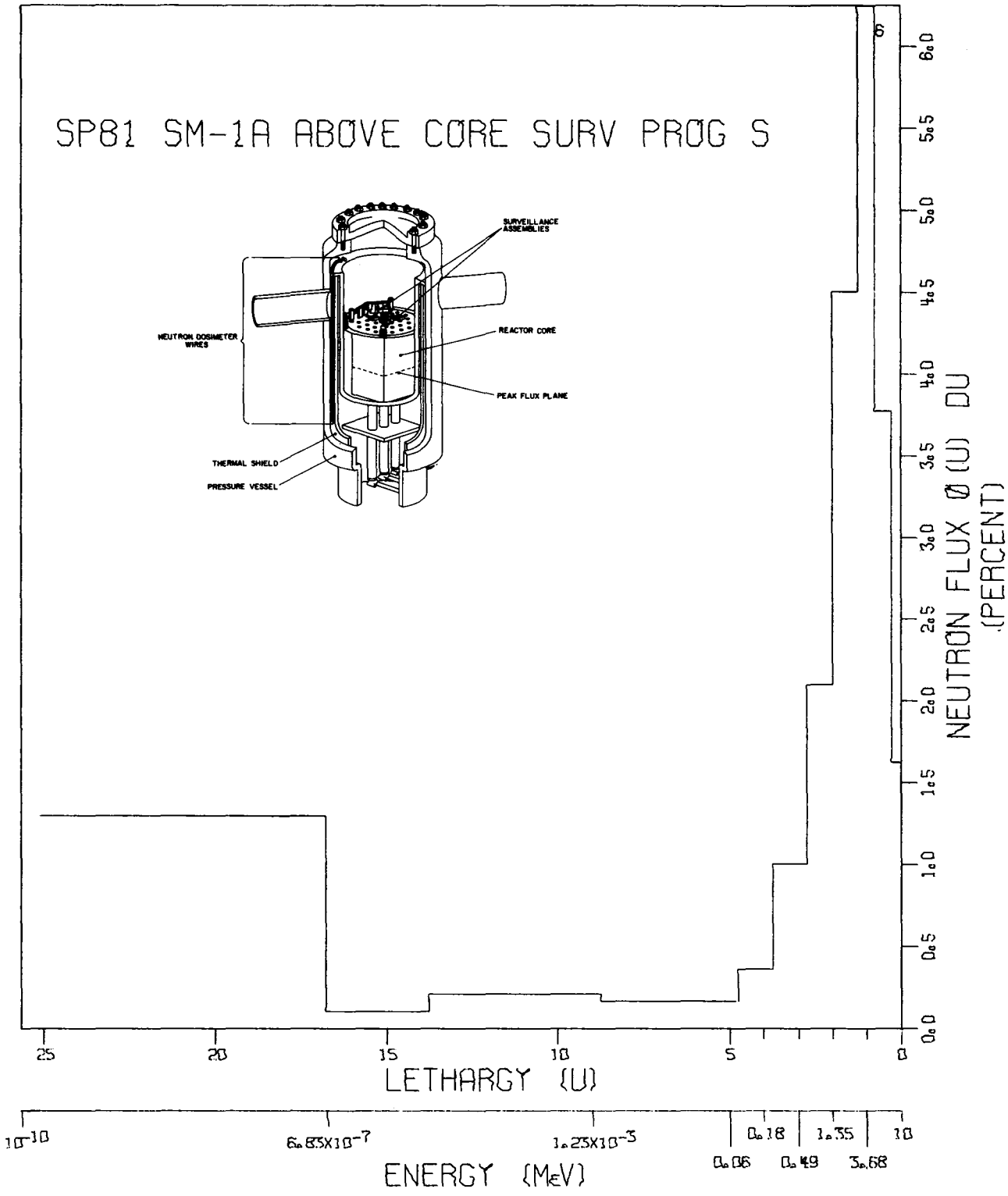
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.85×10^{11}	137.4
>0.5 MeV	2.88	88.3
>0.1 MeV	4.64	54.8
Thermal, 20°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP38 SM-1A V WALL CLADDING PR0G S

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.955-003	4.11423+000
0.50	6.07000+000	6.046-003	1.27354+001
0.75	4.72000+000	9.480-003	1.98055+001
1.00	3.68000+000	9.685-003	2.04491+001
1.25	2.87000+000	1.208-002	2.55389+001
1.50	2.23000+000	1.822-002	3.79540+001
1.75	1.74000+000	1.688-002	3.57531+001
2.00	1.35000+000	1.738-002	3.59807+001
2.25	1.05000+000	1.812-002	3.78852+001
2.50	8.21000-001	1.884-002	4.02511+001
2.75	6.39000-001	2.585-002	5.41962+001
3.00	4.98000-001	2.224-002	4.68766+001
3.25	3.88000-001	2.102-002	4.42665+001
3.50	3.02000-001	2.168-002	4.54726+001
3.75	2.35000-001	1.683-002	3.52594+001
4.00	1.83000-001	1.786-002	3.75220+001
5.00	6.74000-002	5.109-002	2.68830+001
9.00	1.23000-003	1.339-001	1.75721+001
13.00	2.26000-005	1.937-001	2.54745+001
17.00	4.14000-007	2.186-001	2.87227+001
25.33	1.00000-010	1.485-001	9.37188+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP81 SM-1A ABOVE CORE SURV PROG S
SURVEILLANCE ASSEMBLIES
REACTOR CORE
NEUTRON DOSIMETER WIRES
PEAK FLUX PLANE
THERMAL SHIELD
PRESSURE VESSEL
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.85X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1A

Type: Power PWR Power Level: 20.2 MWt

Coolant: Light water Moderator: Light water

Location: Fort Greely, Alaska (decommissioned)

Spectrum Facility Description

Surveillance location above fuel core; steel and water

Spectrum Code

Code: Program S Calculation: BNW [19,22]

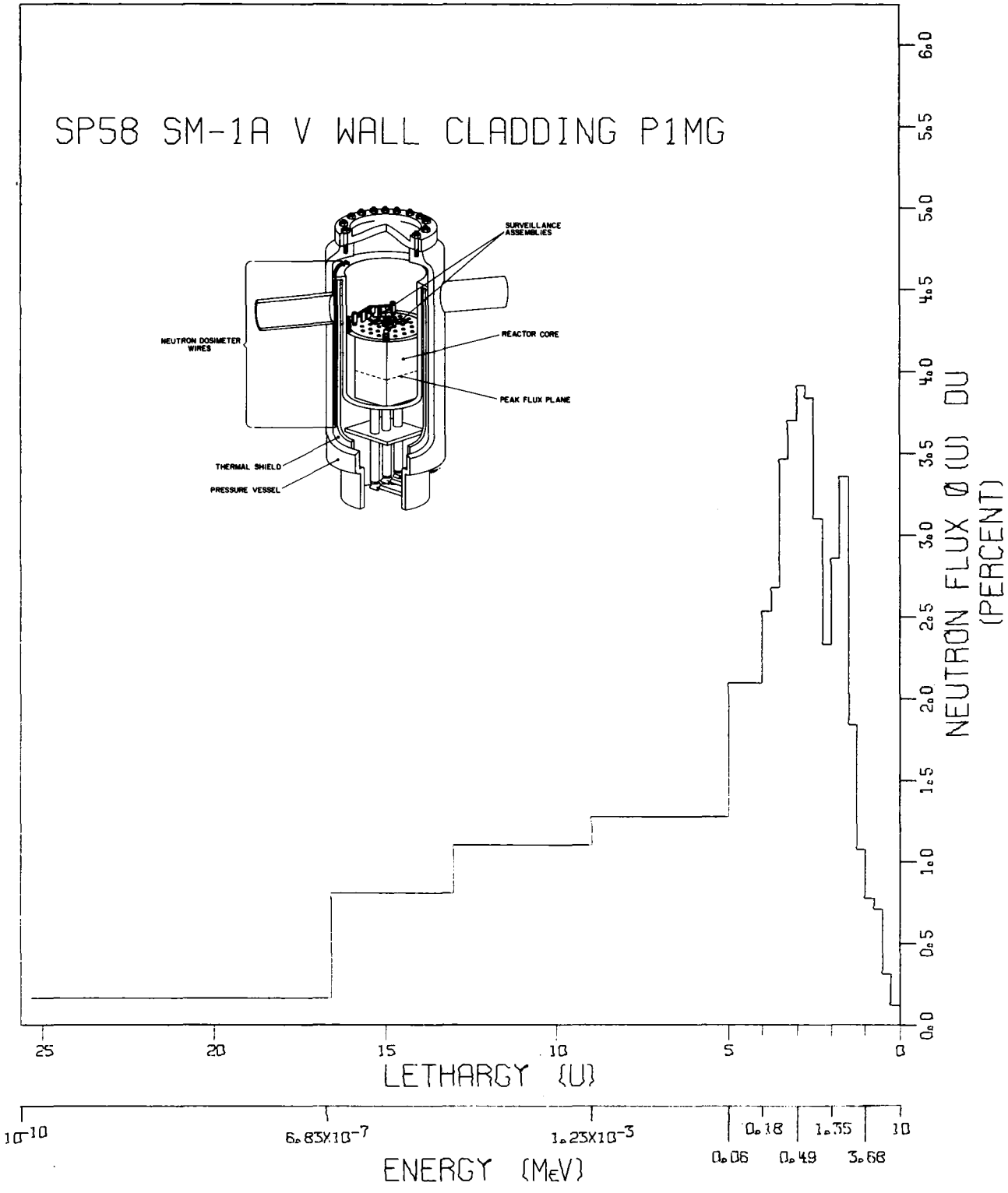
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	6.96×10^{10}	168
>0.5 MeV	8.10	144
>0.1 MeV	9.03	129.5
Thermal, 20 °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Compare with fluxes, spectrum 59

SP81 SM-1A ABOVE CORE SURV PROG S

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	6,07 00+000	3,246-002	3,22252+000
0.75	3,68000+000	7,553-002	7,48000+000
1.25	2,23000+000	1,259-001	1,24529+001
2.00	1,05000+000	1,357-001	8,92701+000
2.75	4,98000-001	6,264-002	4,16147+000
3.75	1,83000-001	4,025-002	1,99243+000
4.75	6,74000-002	1,453-002	7,20848-001
8.75	1,23000-003	2,644-002	3,27227-001
13.75	8,32000-006	4,263-002	4,22815-001
16.75	4,14000-007	1,223-002	2,02000-001
25.08	1,00000-010	4,318-001	2,56915+000
		1,000+000	

ONE LETHARGY INTERVAL = 0.25U


SP58 SM-1A V WALL CLADDING P1MG
SURVEILLANCE ASSEMBLIES
REACTOR CORE
PEAK FLUX PLANE
NEUTRON DOSIMETER WIRES
THERMAL SHIELD
PRESSURE VESSEL
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1A

Type: Power PWR Power Level: 20.2 MWt

Coolant: Light water Moderator: Light water

Location: Fort Greely, Alaska, (decommissioned)

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding.

Spectrum Code

Code: P1MG Calculation: Westinghouse [33,34]

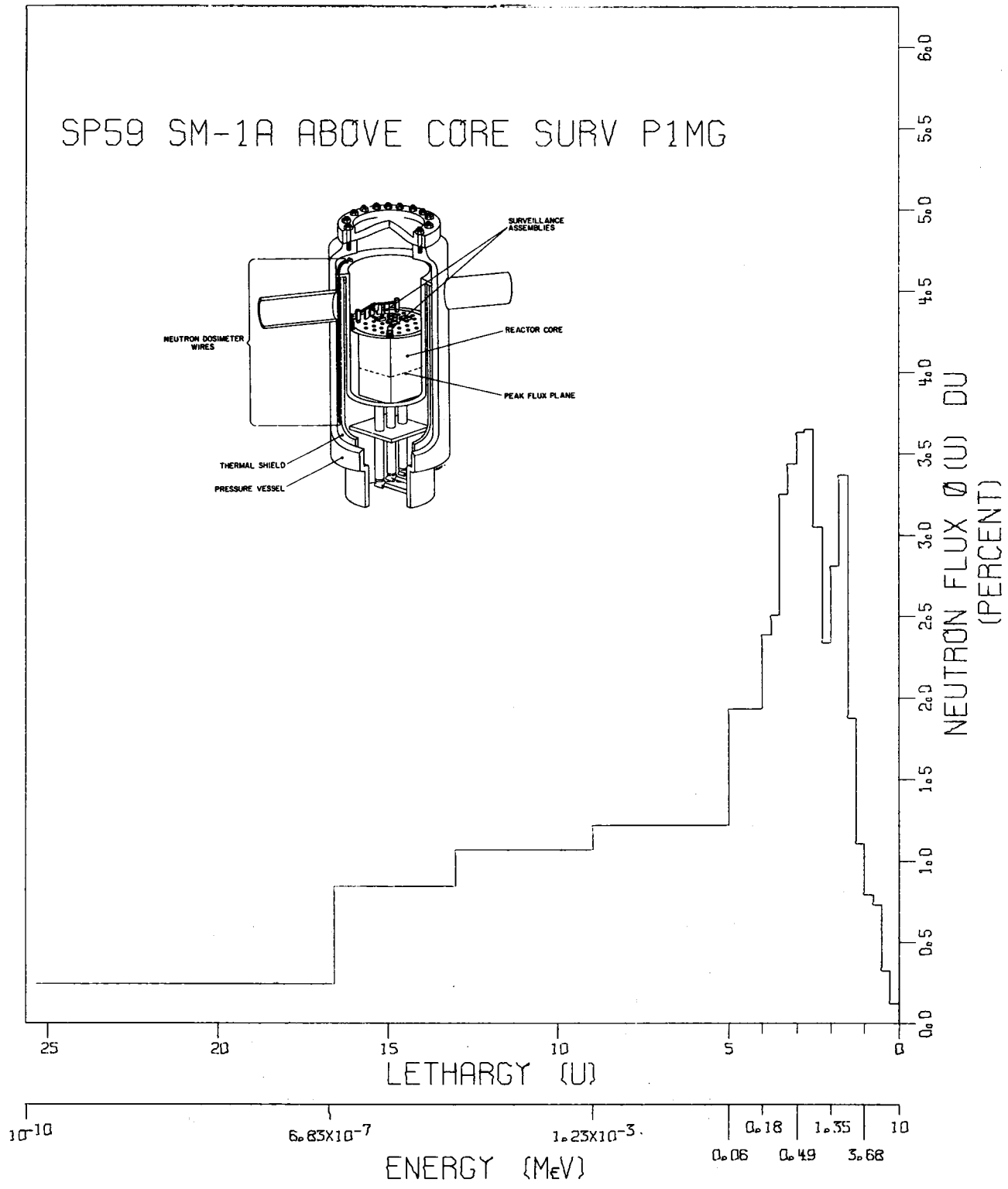
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	85.9
>0.5 MeV	-	48.1
>0.1 MeV	-	28.1
Thermal, 20 °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP58 SM-1A V WALL CLADDING P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.161-003	3.14130+000
0.50	6.07000+000	3.120-003	8.44825+000
0.75	4.72000+000	7.087-003	1.90306+001
1.00	3.68000+000	7.692-003	2.08755+001
1.25	2.87000+000	1.066-002	2.89533+001
1.50	2.23000+000	1.856-002	4.96779+001
1.75	1.74000+000	3.329-002	9.06370+001
2.00	1.35000+000	2.897-002	7.71217+001
2.25	1.05000+000	2.340-002	6.28894+001
2.50	8.21000-001	3.048-002	8.36754+001
2.75	6.39000-001	3.844-002	1.03620+002
3.00	4.98000-001	3.898-002	1.05628+002
3.25	3.88000-001	3.693-002	9.99522+001
3.50	3.02000-001	3.468-002	9.34890+001
3.75	2.35000-001	2.683-002	7.22509+001
4.00	1.83000-001	2.529-002	6.82935+001
5.00	6.74000-002	8.366-002	5.65787+001
9.00	1.23000-003	2.042-001	3.44485+001
13.00	2.26000-005	1.757-001	2.96864+001
16.59	6.25000-007	1.152-001	2.16976+001
25.33	1.00000-010	5.569-002	4.30407+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP59 SM-1A ABOVE CORE SURV P1MG
SURVEILLANCE ASSEMBLIES
REACTOR CORE
PEAK FLUX PLANE
NEUTRON DOSIMETER WIRES
THERMAL SHIELD
PRESSURE VESSEL
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1A

Type: Power PWR Power Level: 20.2 MWt

Coolant: Light water Moderator: Light water

Location: Fort Greely, Alaska (decommissioned)

Spectrum Facility Description

Surveillance location above fuel core; steel and water.

Spectrum Code

Code: P1MG Calculation: Westinghouse [23,24]

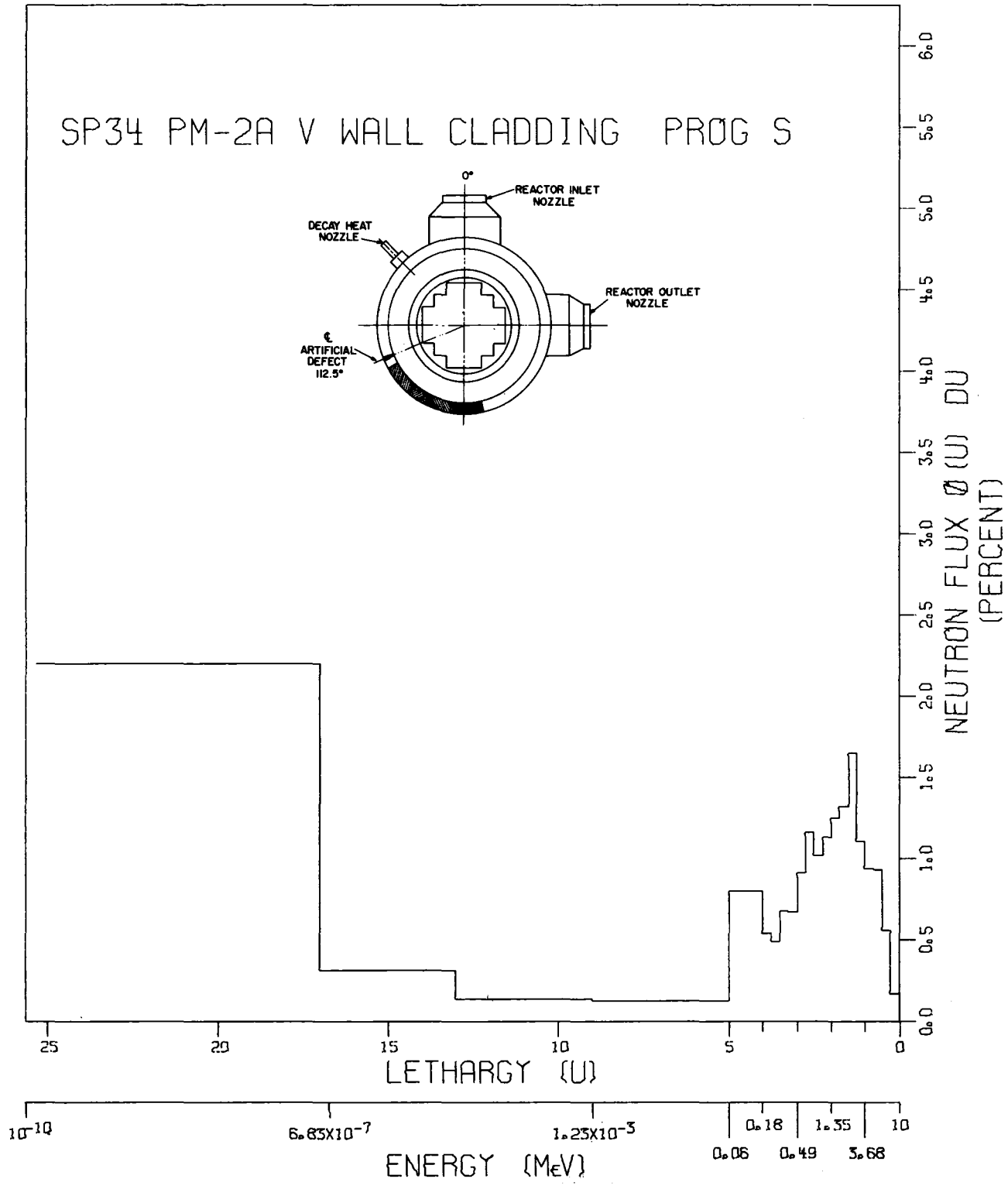
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.33×10^{11}	87.9
>0.5 MeV	2.32	50.4
>0.1 MeV	3.90	30.0
Thermal, 20°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Compare with fluxes spectrum 81

SP50 SM-1A ABOVE CORE SURV P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.204-003	3.16683+000
0.50	6.07000+000	3.237-003	8.52171+000
0.75	4.72000+000	7.324-003	1.91210+001
1.00	3.68000+000	7.892-003	2.08253+001
1.25	2.87000+000	1.096-002	2.89630+001
1.50	2.23000+000	1.893-002	4.92869+001
1.75	1.74000+000	3.342-002	8.84609+001
2.00	1.35000+000	2.852-002	7.37949+001
2.25	1.05000+000	2.346-002	6.13124+001
2.50	8.21000-001	3.001-002	8.01105+001
2.75	6.39000-001	3.660-002	9.59200+001
3.00	4.98000-001	3.617-002	9.52856+001
3.25	3.88000-001	3.428-002	9.02123+001
3.50	3.02000-001	3.258-002	8.53790+001
3.75	2.35000-001	2.513-002	6.57965+001
4.00	1.83000-001	2.385-002	6.26332+001
5.00	6.74000-002	7.715-002	5.07274+001
9.00	1.23000-003	1.945-001	3.19102+001
13.00	2.26000-005	1.703-001	2.79795+001
16.59	6.25000-007	1.209-001	2.21242+001
25.33	1.00000-010	8.361-002	6.28253+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP34 PM-2A V WALL CLADDING PROG S
0°
REACTOR INLET NOZZLE
DECAY HEAT NOZZLE
REACTOR OUTLET NOZZLE
℄ ARTIFICIAL DEFECT 112.5°
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.25X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: PM-2A

Type: Power PWR Power Level: 10 MWt

Coolant: Light water Moderator: Light water

Location: Camp Century, Greenland (decommissioned)

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding; steel.

Spectrum Code

Code: Program S Calculation: BNW [14,27]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	157.7
>0.5 MeV	(5.032†)	120.4
>0.1 MeV	-	89.0
Thermal, 20°C	-	-

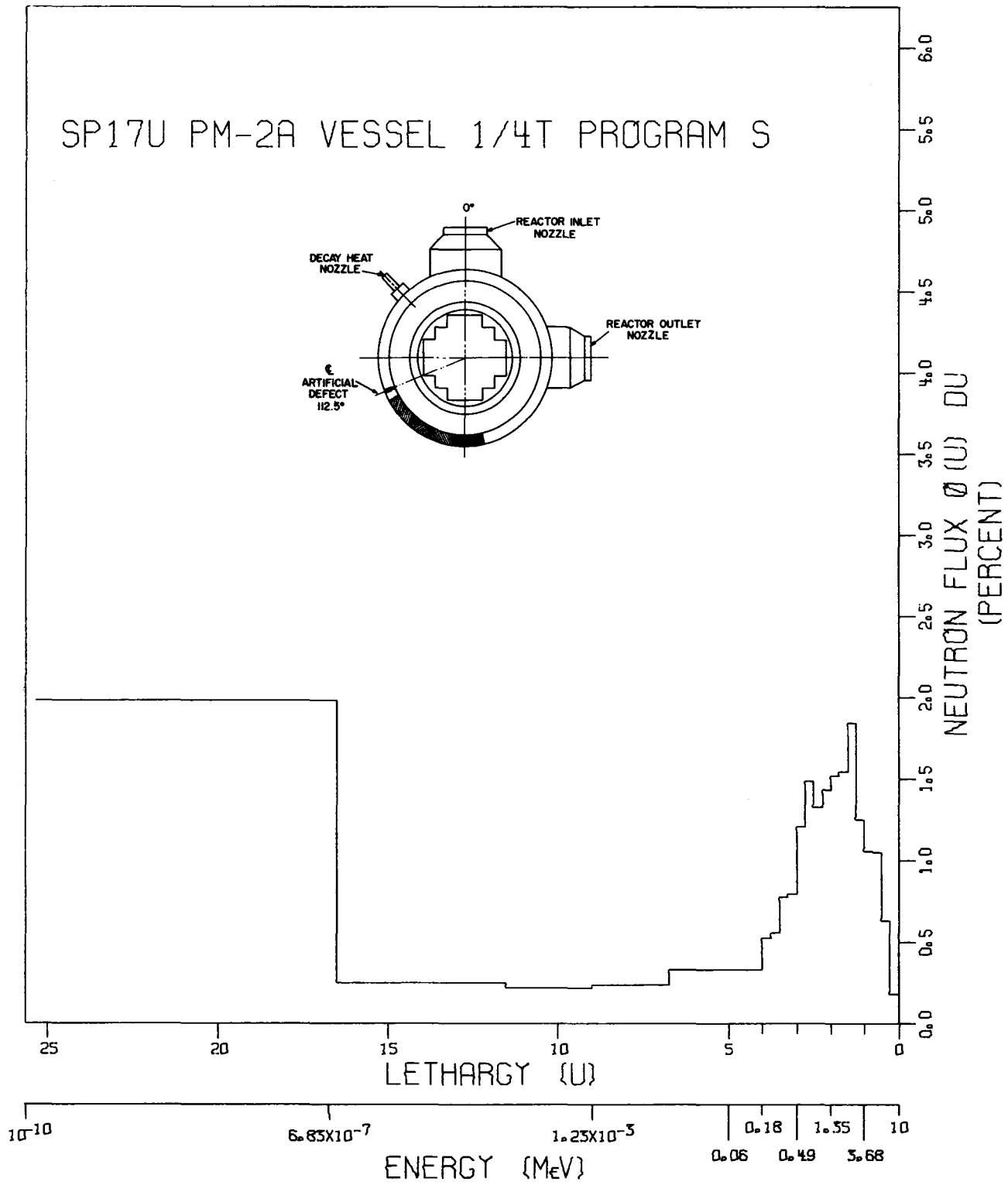
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 34, 17U, 16U

SP34 PM-2A V WALL CLADDING PROG S

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	1.693-003	3.80354+000
0.50	6.07000+000	5.527-003	1.24287+001
0.75	4.72000+000	9.338-003	2.08266+001
1.00	3.68000+000	9.321-003	2.10112+001
1.25	2.87000+000	1.100-002	2.48187+001
1.50	2.23000+000	1.664-002	3.70120+001
1.75	1.74000+000	1.308-002	2.95688+001
2.00	1.35000+000	1.270-002	2.80846+001
2.25	1.05000+000	1.136-002	2.53684+001
2.50	8.21000-001	1.003-002	2.28725+001
2.75	6.39000-001	1.163-002	2.60472+001
3.00	4.98000-001	9.112-003	2.05076+001
3.25	3.88000-001	6.663-003	1.49774+001
3.50	3.02000-001	6.731-003	1.50705+001
3.75	2.35000-001	4.864-003	1.08787+001
4.00	1.83000-001	5.337-003	1.19736+001
5.00	6.74000-002	3.198-002	1.79614+001
9.00	1.23000-003	1.954-002	2.73893+000
13.00	2.26000-005	2.160-002	3.03212+000
17.00	4.14000-007	4.939-002	6.92805+000
25.33	1.00000-010	7.325-001	4.93428+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP17U PM-2A VESSEL 1/4T PROGRAM S
0°
REACTOR INLET NOZZLE
DECAY HEAT NOZZLE
REACTOR OUTLET NOZZLE
ARTIFICIAL DEFECT 112.5°
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: PM-2A

Type: Power PWR Power Level: 10MWt

Coolant: Light water Moderator: Light water

Location: Camp Century, Greenland (decommissioned)

Spectrum Facility Description

Pressure vessel wall: 1/4 thickness from inside: steel.

Spectrum Code

Code: Program S Calculation: BNW [14,27]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.78×10^{11}	154
>0.5 MeV	1.07 (4.454†)	112
>0.1 MeV	1.29	93.2
Thermal, 20 °C	-	-

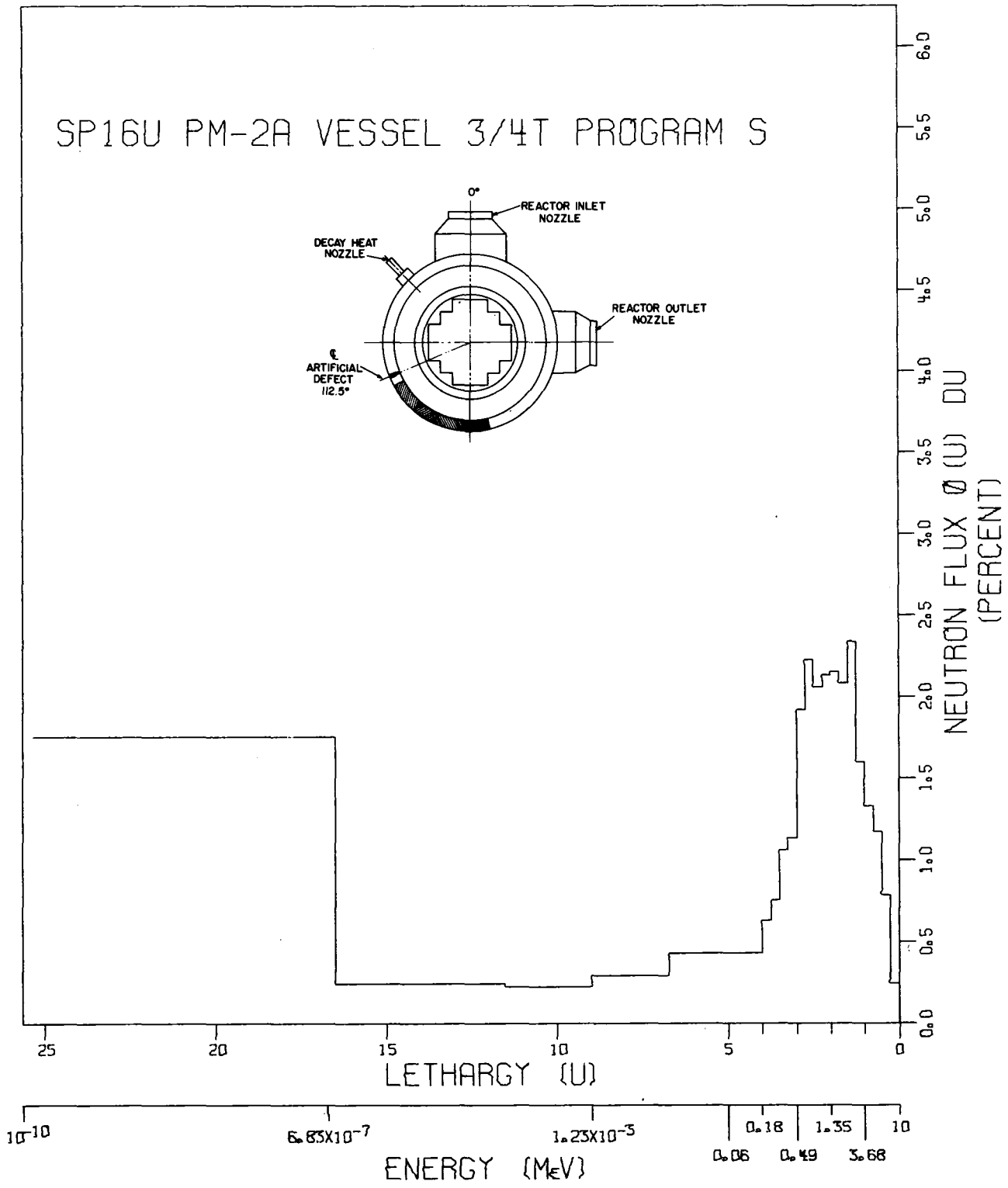
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 34, 17U, 16U

SP17U PM-2A VESSEL 1/4T PROGRAM S

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.806-003	3.60760+000
0.50	6.07000+000	6.253-003	1.25043+001
0.75	4.72000+000	1.053-002	2.08886+001
1.00	3.68000+000	1.049-002	2.10284+001
1.25	2.87000+000	1.242-002	2.49332+001
1.50	2.23000+000	1.861-002	3.68021+001
1.75	1.74000+000	1.533-002	3.08243+001
2.00	1.35000+000	1.538-002	3.02316+001
2.25	1.05000+000	1.439-002	2.85565+001
2.50	8.21000-001	1.305-002	2.64602+001
2.75	6.39000-001	1.487-002	2.96061+001
3.00	4.98000-001	1.204-002	2.40866+001
3.25	3.88000-001	7.937-003	1.58638+001
3.50	3.02000-001	7.730-003	1.53891+001
3.75	2.35000-001	5.571-003	1.10806+001
4.00	1.83000-001	5.251-003	1.04752+001
6.75	1.17000-002	3.641-002	6.60477+000
9.00	1.23000-003	2.152-002	4.76528+000
11.50	1.01000-004	2.156-002	4.30303+000
16.50	6.83000-007	4.907-002	4.89979+000
25.33	1.00000-010	6.998-001	3.95408+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP16U PM-2A VESSEL 3/4T PROGRAM S
0°
REACTOR INLET NOZZLE
DECAY HEAT NOZZLE
REACTOR OUTLET NOZZLE
℄ ARTIFICIAL DEFECT 112.5°
NEUTRON FLUX Ø (U) DU (PERCENT)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: PM-2A

Type: Power PWR Power Level: 10 MWt

Coolant: Light water Moderator: Light water

Location: Camp Century, Greenland (decommissioned)

Spectrum Facility Description

Pressure vessel wall; 3/4 thickness from inside; steel

Spectrum Code

Code: Program S Calculation: BNW [14,27]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.44×10^{11}	146
>0.5 MeV	0.64 (2.821†)	102
>0.1 MeV	0.76	85.2
Thermal, 20 °C	-	-

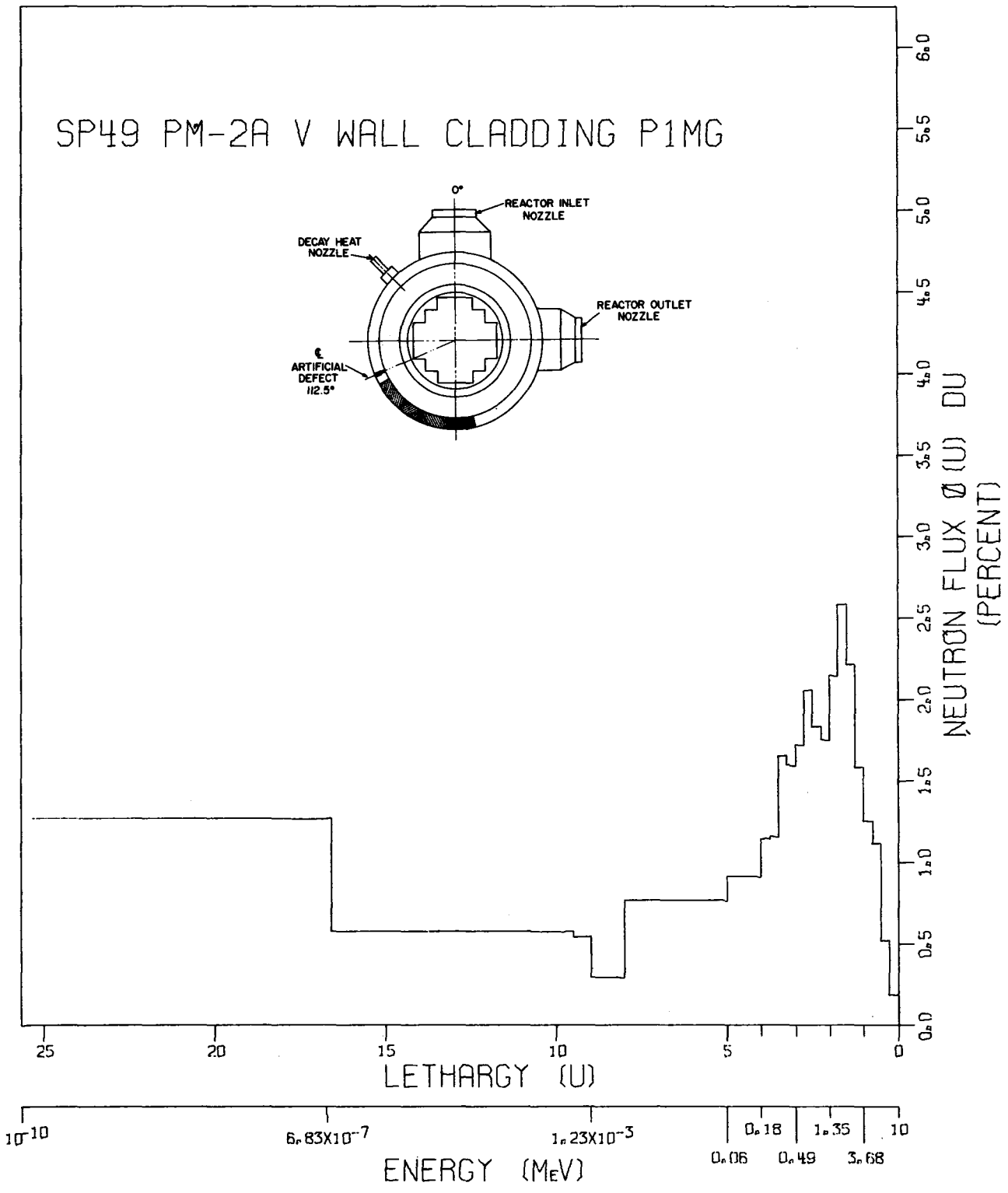
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†Inseries of spectra 34, 17U, 16U

SP16U PM-2A VESSEL 3/4T PROGRAM S

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.428-003	3.95024+000
0.50	6.07000+000	7.813-003	1.27255+001
0.75	4.72000+000	1.183-002	1.91067+001
1.00	3.68000+000	1.323-002	2.15920+001
1.25	2.87000+000	1.588-002	2.59629+001
1.50	2.23000+000	2.360-002	3.80151+001
1.75	1.74000+000	2.061-002	3.37588+001
2.00	1.35000+000	2.179-002	3.48889+001
2.25	1.05000+000	2.143-002	3.46553+001
2.50	8.21000-001	2.023-002	3.34147+001
2.75	6.39000-001	2.232-002	3.61842+001
3.00	4.98000-001	1.910-002	3.11391+001
3.25	3.88000-001	1.134-002	1.84689+001
3.50	3.02000-001	1.065-002	1.72633+001
3.75	2.35000-001	7.582-003	1.22834+001
4.00	1.83000-001	6.297-003	1.02319+001
6.75	1.17000-002	4.737-002	6.99967+000
9.00	1.23000-003	2.658-002	4.79558+000
11.50	1.01000-004	2.221-002	3.61123+000
16.50	6.83000-007	4.799-002	3.90306+000
25.33	1.00000-010	6.197-001	2.85225+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP49 PM-2A V WALL CLADDING P1MG
0°
REACTOR INLET NOZZLE
DECAY HEAT NOZZLE
REACTOR OUTLET NOZZLE
℄ ARTIFICIAL DEFECT 112.5°
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: PM-2A

Type: Power PWR Power Level: 10 MWt

Coolant: Light water Moderator: Light water

Location: Camp Century, Greenland (decommissioned)

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding; steel.

Spectrum Code

Code: P1MG-4 Calculation: Westinghouse [23,25]

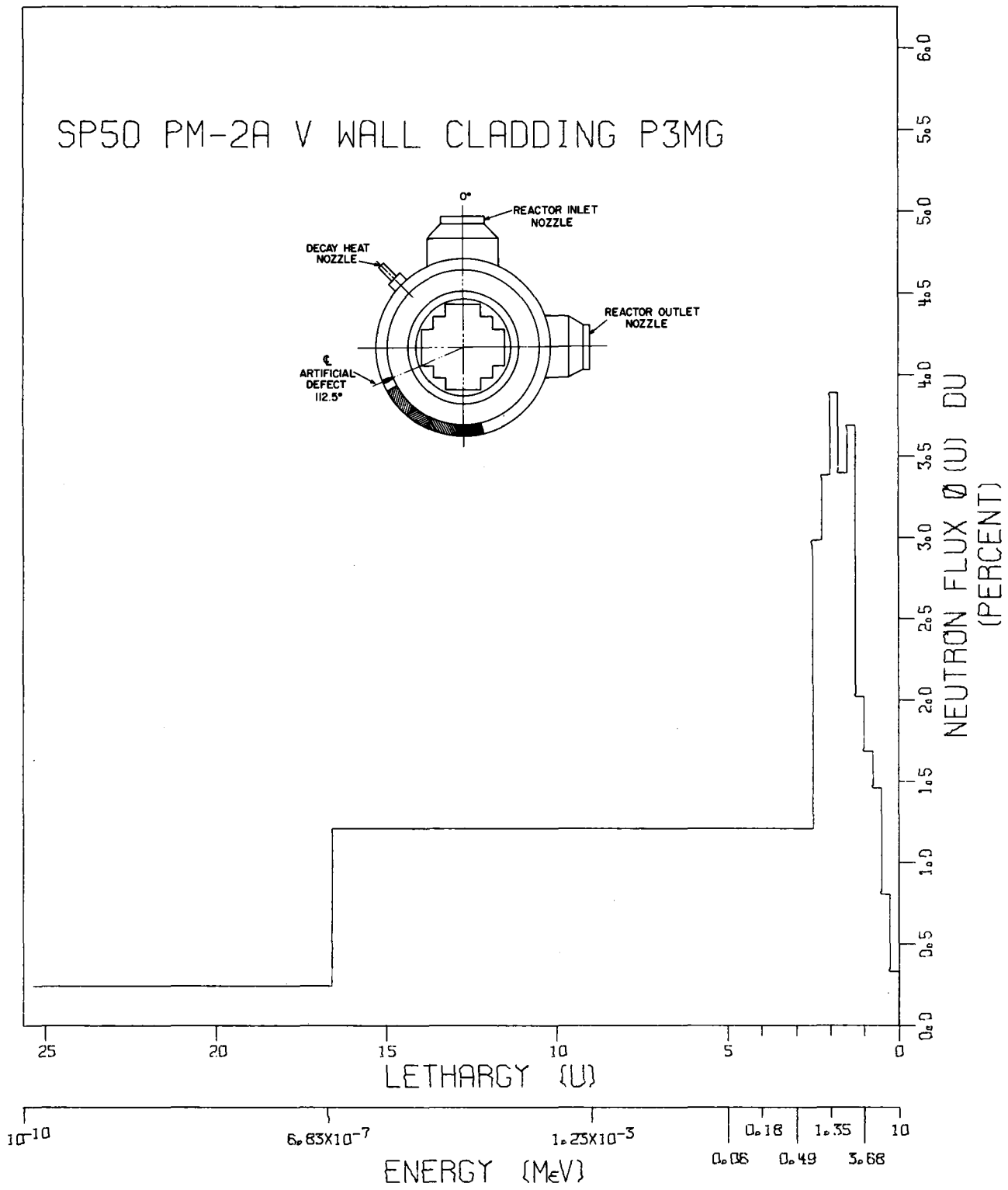
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	129.9
>0.5 MeV	-	92.1
>0.1 MeV	-	66.6
Thermal, 20 °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP49 PM-2A V WALL CLADDING P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.869-003	3.41464+000
0.50	6.07000+000	5.162-003	9.44149+000
0.75	4.72000+000	1.116-002	2.02486+001
1.00	3.68000+000	1.241-002	2.27518+001
1.25	2.87000+000	1.568-002	2.87807+001
1.50	2.23000+000	2.232-002	4.03598+001
1.75	1.74000+000	2.561-002	4.71016+001
2.00	1.35000+000	2.173-002	3.90709+001
2.25	1.05000+000	1.760-002	3.19610+001
2.50	8.21000-001	1.802-002	3.34310+001
2.75	6.39000-001	2.058-002	3.74642+001
3.00	4.98000-001	1.711-002	3.13175+001
3.25	3.88000-001	1.592-002	2.91002+001
3.50	3.02000-001	1.654-002	3.01163+001
3.75	2.35000-001	1.157-002	2.10491+001
4.00	1.83000-001	1.143-002	2.08468+001
5.00	6.74000-002	3.629-002	1.65813+001
8.00	3.35000-003	9.133-002	1.38838+001
9.00	1.23000-003	1.172-002	5.33581+000
9.50	7.50000-004	1.071-002	9.87533+000
16.59	6.25000-007	1.630-001	1.04888+001
25.33	1.00000-010	4.423-001	2.30911+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP50 PM-2A V WALL CLADDING P3MG
0°
REACTOR INLET NOZZLE
DECAY HEAT NOZZLE
REACTOR OUTLET NOZZLE
℄ ARTIFICIAL DEFECT 112.5°
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: PM-2A

Type: Power PWR Power Level: 10 MWt

Coolant: Light water Moderator: Light water

Location: Camp Century, Greenland (decommissioned)

Spectrum Facility Description

Interface of carbon steel vessel wall and stainless steel cladding ; steel

Spectrum Code

Code: P3MG Calculation: Westinghouse, BAPL [23,28]

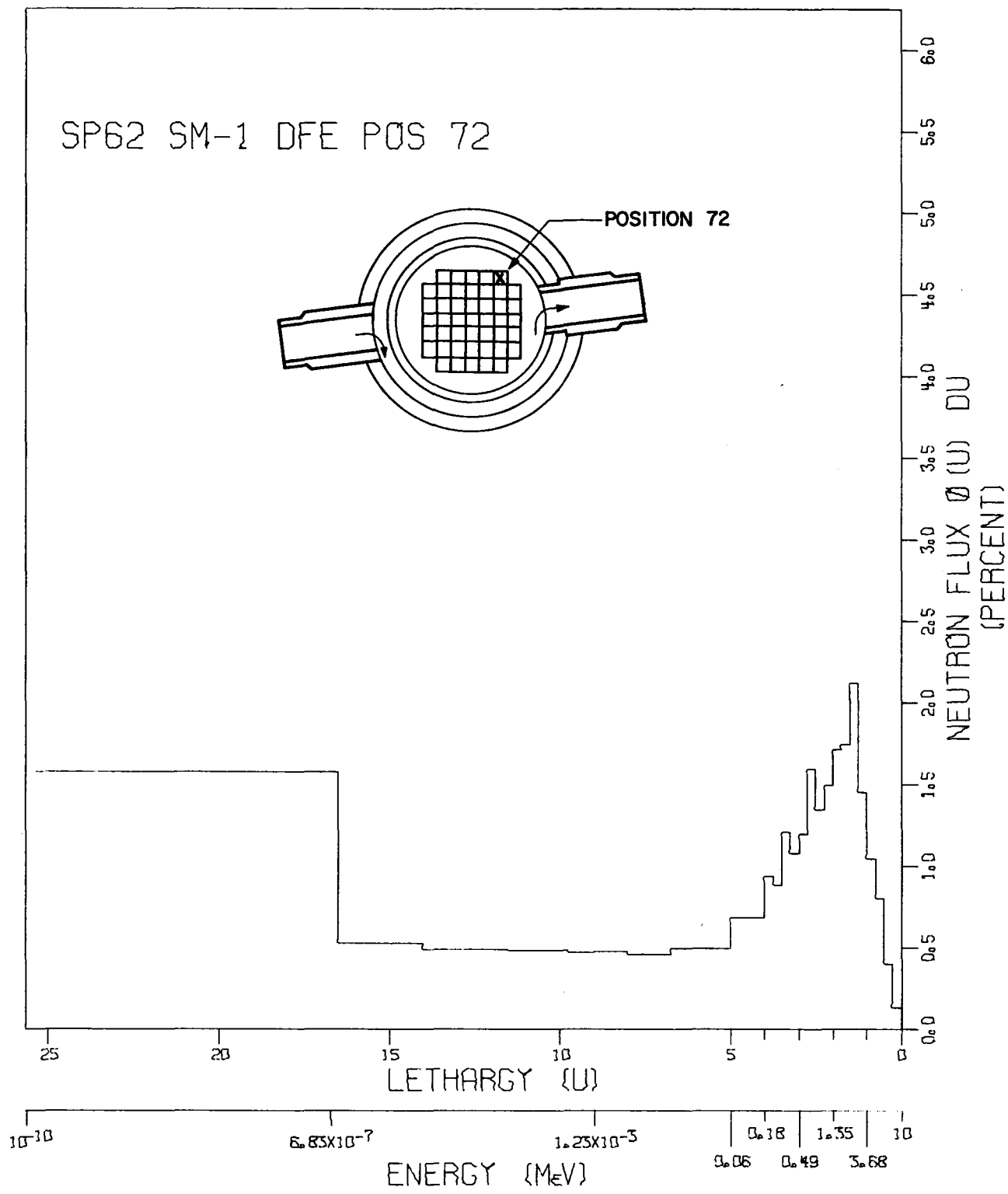
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	118.9
>0.5 MeV	-	-
>0.1 MeV	-	-
Thermal, 20 °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP50 PM-2A V WALL CLADDING P3MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.291-003	4.24091+000
0.50	6.07000+000	8.046-003	1.03786+001
0.75	4.72000+000	1.463-002	1.87226+001
1.00	3.68000+000	1.672-002	2.16232+001
1.25	2.87000+000	2.006-002	2.59719+001
1.50	2.23000+000	3.718-002	4.74200+001
1.75	1.74000+000	3.367-002	4.36699+001
2.00	1.35000+000	3.944-002	5.00101+001
2.25	1.05000+000	3.396-002	4.34846+001
2.50	8.21000-001	2.930-002	3.83219+001
16.59	6.25000-007	6.800-001	1.55331+001
25.33	1.00000-010	8.374-002	3.08329+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP62 SM-1 DFE POS 72
POSITION 72
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1

Type: Power PWR Power Level: 10.66 MWt

Coolant: Light water Moderator: Light water

Location: Fort Belvoir, Virginia (decommissioned)

Spectrum Facility Description

Unfueled core lattice position No. 72; steel and water.

Spectrum Code

Code: DTF-IV Calculation: BNW [28]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section σ, mb
>1 MeV	1.94×10^{13}	129.6
>0.5 MeV	2.66 (109.4†)	94.5
>0.1 MeV	3.66	68.7
Thermal, 227°C	9.88	-

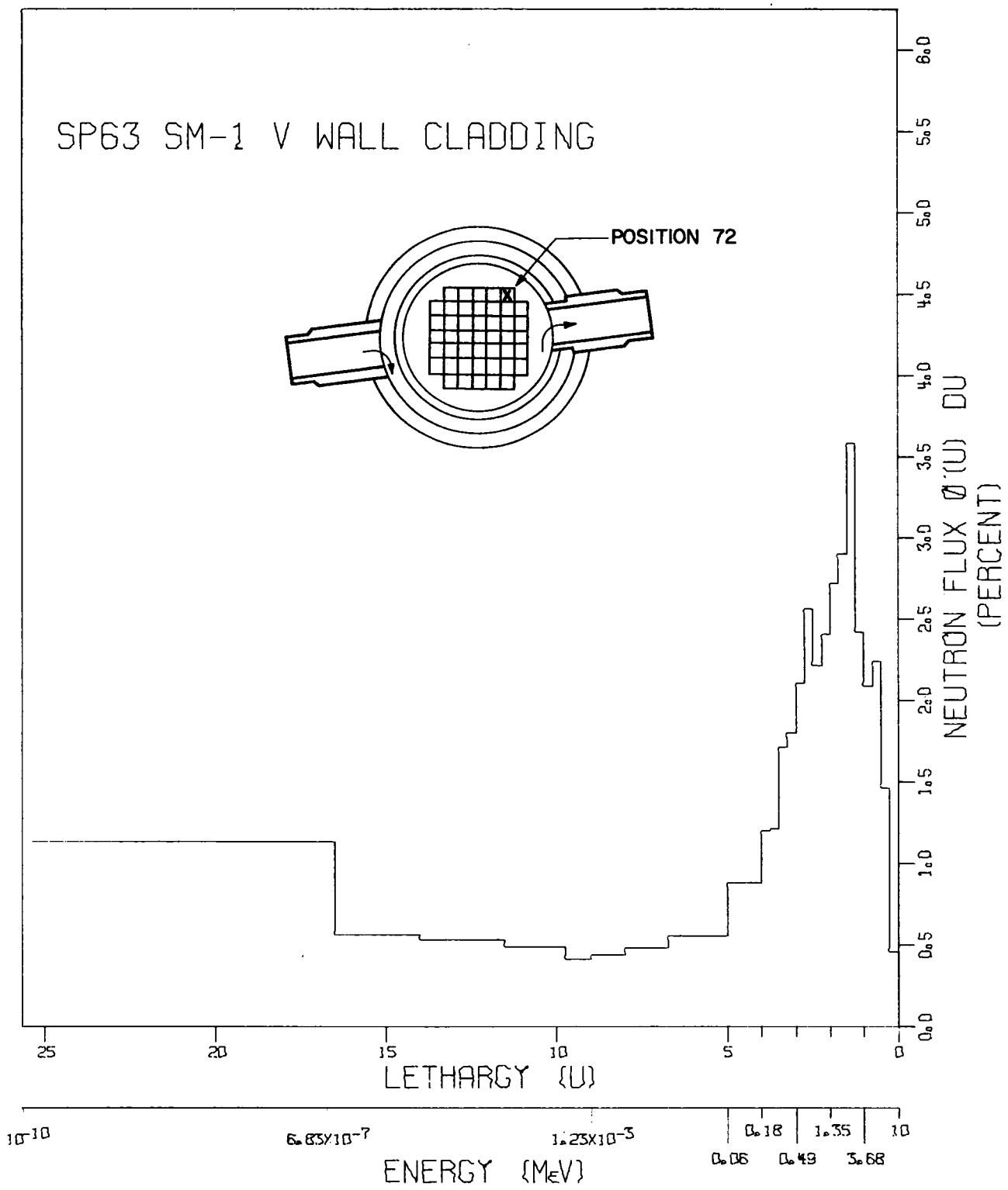
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 62, 63

SP62 SM-1 DFE P0$ 72

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.280-003	2.87266+000
0.50	6.07000+000	3.973-003	8.92745+000
0.75	4.72000+000	8.024-003	1.78816+001
1.00	3.68000+000	1.037-002	2.33490+001
1.25	2.87000+000	1.441-002	3.25015+001
1.50	2.23000+000	2.138-002	4.74975+001
1.75	1.74000+000	1.728-002	3.90417+001
2.00	1.35000+000	1.735-002	3.83173+001
2.25	1.05000+000	1.503-002	3.35202+001
2.50	8.21000-001	1.320-002	3.00822+001
2.75	6.39000-001	1.599-002	3.57670+001
3.00	4.98000-001	1.189-002	2.67363+001
3.25	3.88000-001	1.069-002	2.40025+001
3.50	3.02000-001	1.205-002	2.69549+001
3.75	2.35000-001	8.810-003	1.96895+001
4.00	1.83000-001	9.332-003	2.09185+001
5.00	6.74000-002	2.720-002	1.52672+001
6.75	1.17000-002	3.460-002	1.10766+001
8.00	3.36000-003	2.277-002	1.02332+001
9.00	1.23000-003	1.904-002	1.06229+001
9.75	5.83000-004	1.394-002	1.04663+001
11.50	1.01000-004	3.382-002	1.08163+001
14.00	8.32000-006	4.837-002	1.08617+001
16.50	6.83000-007	5.261-002	1.17969+001
25.33	1.00000-010	5.566-001	3.53430+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP63 SM-1 V WALL CLADDING
POSITION 72
X
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: SM-1

Type: Power PWR Power Level: 10.66 MWt

Coolant: Light water Moderator: Light water

Location: Fort Belvoir, Virginia (decommissioned)

Spectrum Facility Description

Interfaced of carbon steel vessel wall and stainless steel cladding.

Spectrum Code

Code: DTF-IV Calculation: BNW [28]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	166.0
>0.5 MeV	(60.82†)	124.6
>0.1 MeV	-	96.3
Thermal, 227 °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 62, 63

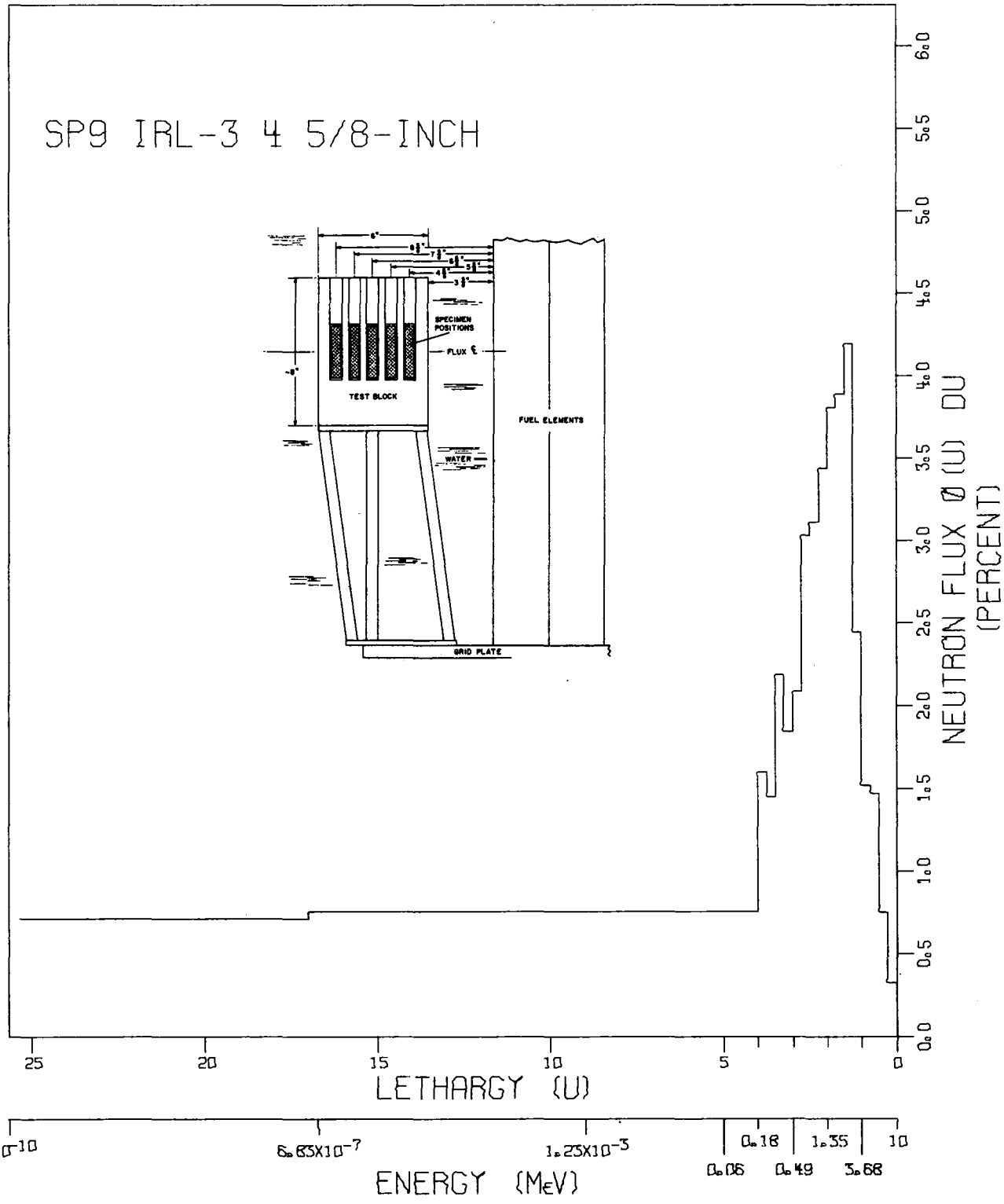
SP63 SM-1 V WALL CLADDING

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	4.532-003	4.29996+000
0.50	6.07000+000	1.458-002	1.38527+001
0.75	4.72000+000	2.253-002	2.12192+001
1.00	3.68000+000	2.078-002	1.97879+001
1.25	2.87000+000	2.402-002	2.28994+001
1.50	2.23000+000	3.613-002	3.39333+001
1.75	1.74000+000	2.877-002	2.74774+001
2.00	1.35000+000	2.761-002	2.57755+001
2.25	1.05000+000	2.415-002	2.27669+001
2.50	8.21000-001	2.174-002	2.09360+001
2.75	6.39000-001	2.567-002	2.42747+001
3.00	4.98000-001	2.100-002	1.99639+001
3.25	3.88000-001	1.799-002	1.70752+001
3.50	3.02000-001	1.717-002	1.62364+001
3.75	2.35000-001	1.213-002	1.14622+001
4.00	1.83000-001	1.201-002	1.13837+001
5.00	6.74000-002	3.503-002	8.30916+000
6.75	1.17000-002	3.866-002	5.23193+000
8.00	3.36000-003	2.383-002	4.52561+000
9.00	1.23000-003	1.749-002	4.12360+000
9.75	5.83000-004	1.220-002	3.87159+000
11.50	1.01000-004	3.409-002	4.60748+000
14.00	8.32000-006	5.274-002	5.00554+000
16.50	6.83000-007	5.599-002	5.30729+000
25.33	1.00000-010	3.992-001	1.07127+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U

LIGHT WATER MODERATED REACTORS

SPECIAL EXPERIMENTAL FACILITIES


SP9 IRL-3 4 5/8-INCH
SPECIMEN POSITIONS
FLUX ℄
TEST BLOCK
FUEL ELEMENTS
WATER
GRID PLATE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Research, pool Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; 4 5/8-inch from fuel core (one inch inside exp.); steel.

Spectrum Code

Code: 2 DXY Calculation: BNW [12,13]

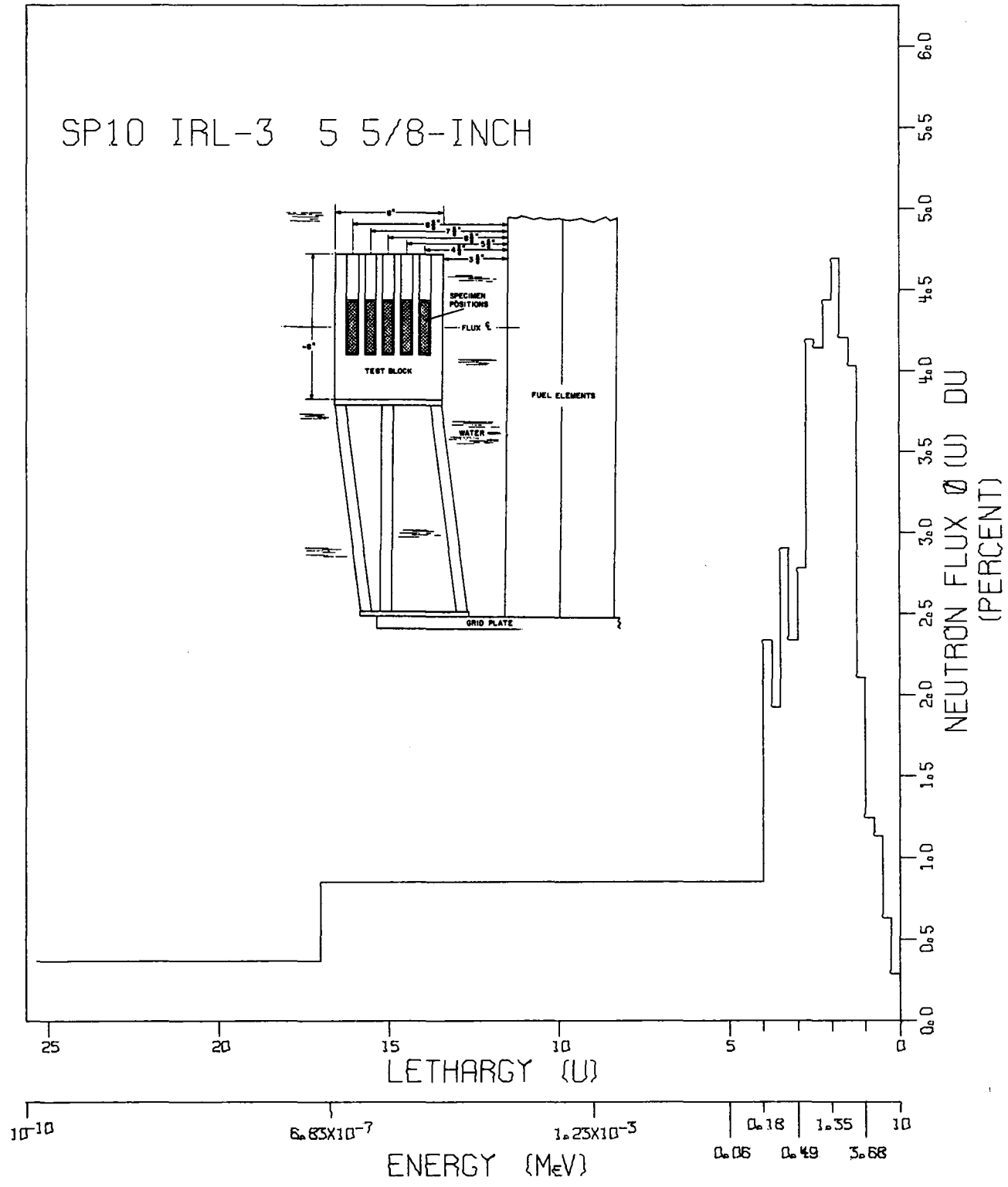
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.70×10^{12}	116.5
>0.5 MeV	2.26	87.2
>0.1 MeV	3.03	65.1
Thermal, 49°C	0.82	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP9 IRL•3 4 5/8•INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000•000	3,224•003	4,03817•000
0,50	6,07000•000	7,470•003	9,36726•000
0,75	4,72000•000	1,477•002	1,83735•001
1,00	3,68000•000	1,512•002	1,90006•001
1,25	2,87000•000	2,428•002	3,05578•001
1,50	2,23000•000	4,228•002	5,24252•001
1,75	1,74000•000	3,858•002	4,86500•001
2,00	1,35000•000	3,862•002	4,76104•001
2,25	1,05000•000	3,453•002	4,29834•001
2,50	8,21000•001	3,059•002	3,88953•001
2,75	6,39000•001	3,036•002	3,78962•001
3,00	4,98000•001	2,078•002	2,60766•001
3,25	3,88000•001	1,839•002	2,30506•001
3,50	3,02000•001	2,190•002	2,73422•001
3,75	2,35000•001	1,454•002	1,81284•001
4,00	1,83000•001	1,599•002	1,99963•001
17,00	4,14000•007	3,919•001	9,43142•000
25,33	1,00000•010	2,367•001	8,89173•000
		1,000•000	

ONE LETHARGY INTERVAL = 0,25U


SP10 IRL-3 5 5/8-INCH
SPECIMEN POSITIONS
FLUX ℄
TEST BLOCK
FUEL ELEMENTS
WATER
GRID PLATE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Research, pool Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment: 5 3/8-inch from fuel core (two inches inside exp.): steel

Spectrum Code

Code: 2 DXY Calculation: BNW [12, 13]

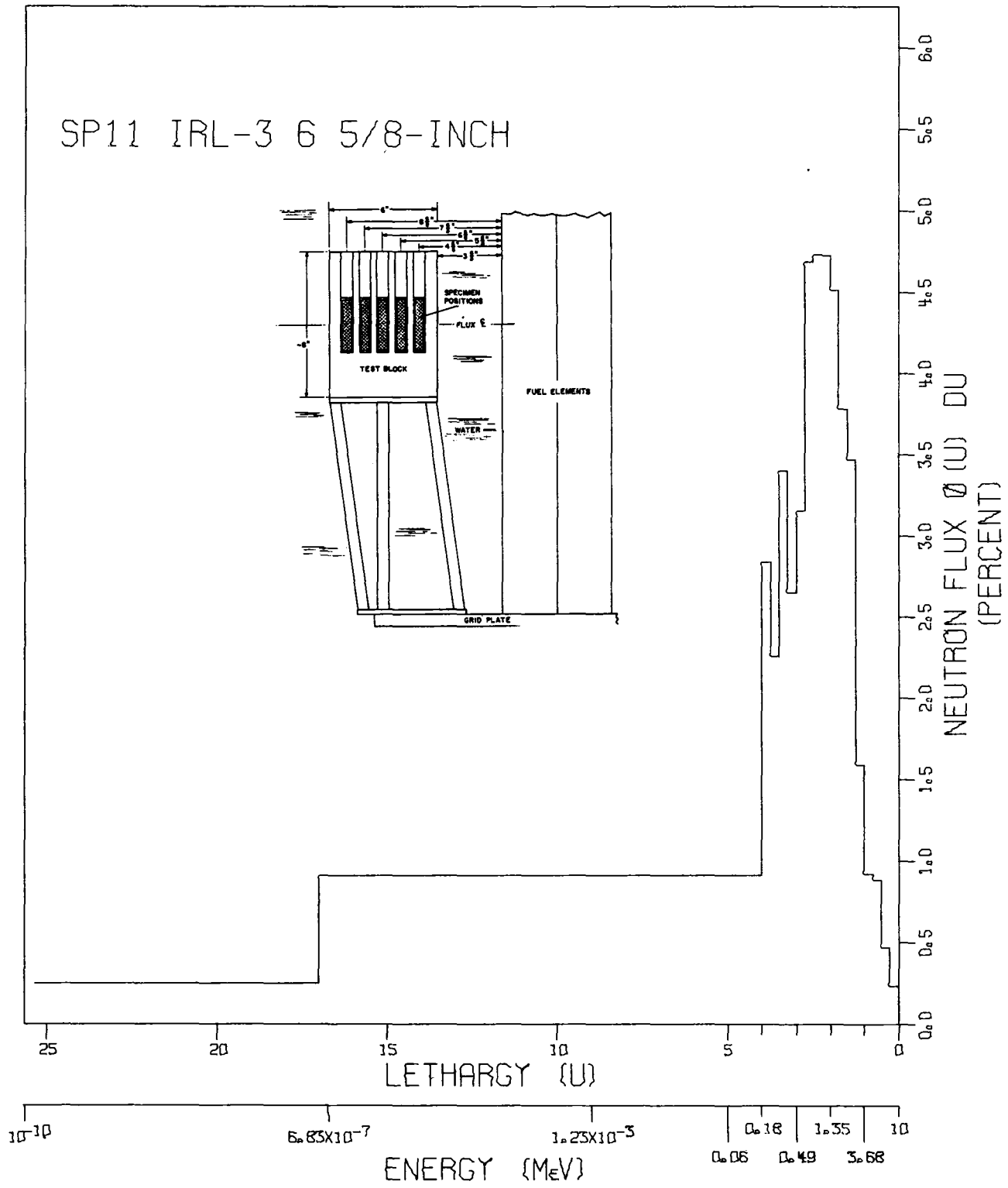
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.30×10^{12}	94.5
>0.5 MeV	1.86	65.9
>0.1 MeV	2.50	49.2
Thermal, 49 °C	0.18	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP10 IRL-3 5 5/8-INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	2,875-003	4,22354+000
0,50	6,07000+000	6,274-003	9,22779+000
0,75	4,72000+000	1,138-002	1,66076+001
1,00	3,68000+000	1,239-002	1,82678+001
1,25	2,87000+000	2,091-002	3,08708+001
1,50	2,23000+000	4,066-002	5,91356+001
1,75	1,74000+000	4,174-002	6,17290+001
2,00	1,35000+000	4,763-002	6,88734+001
2,25	1,05000+000	4,456-002	6,50652+001
2,50	8,21000-001	4,076-002	6,07971+001
2,75	6,39000-001	4,200-002	6,15008+001
3,00	4,98000-001	2,774-002	4,08290+001
3,25	3,88000-001	2,332-002	3,42845+001
3,50	3,02000-001	2,908-002	4,25889+001
3,75	2,35000-001	1,928-002	2,82000+001
4,00	1,83000-001	2,337-002	3,42898+001
17,00	4,14000-007	4,447-001	1,25532+001
25,33	1,00000-010	1,213-001	5,34453+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP11 IRL-3 6 5/8-INCH
SPECIMEN POSITIONS
FLUX Ø
TEST BLOCK
FUEL ELEMENTS
WATER
GRID PLATE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Research, pool Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; 6 5/8-inch from fuel core (three inches inside exp.); steel

Spectrum Code

Code: 2 DXY Calculation: BNW [12,13]

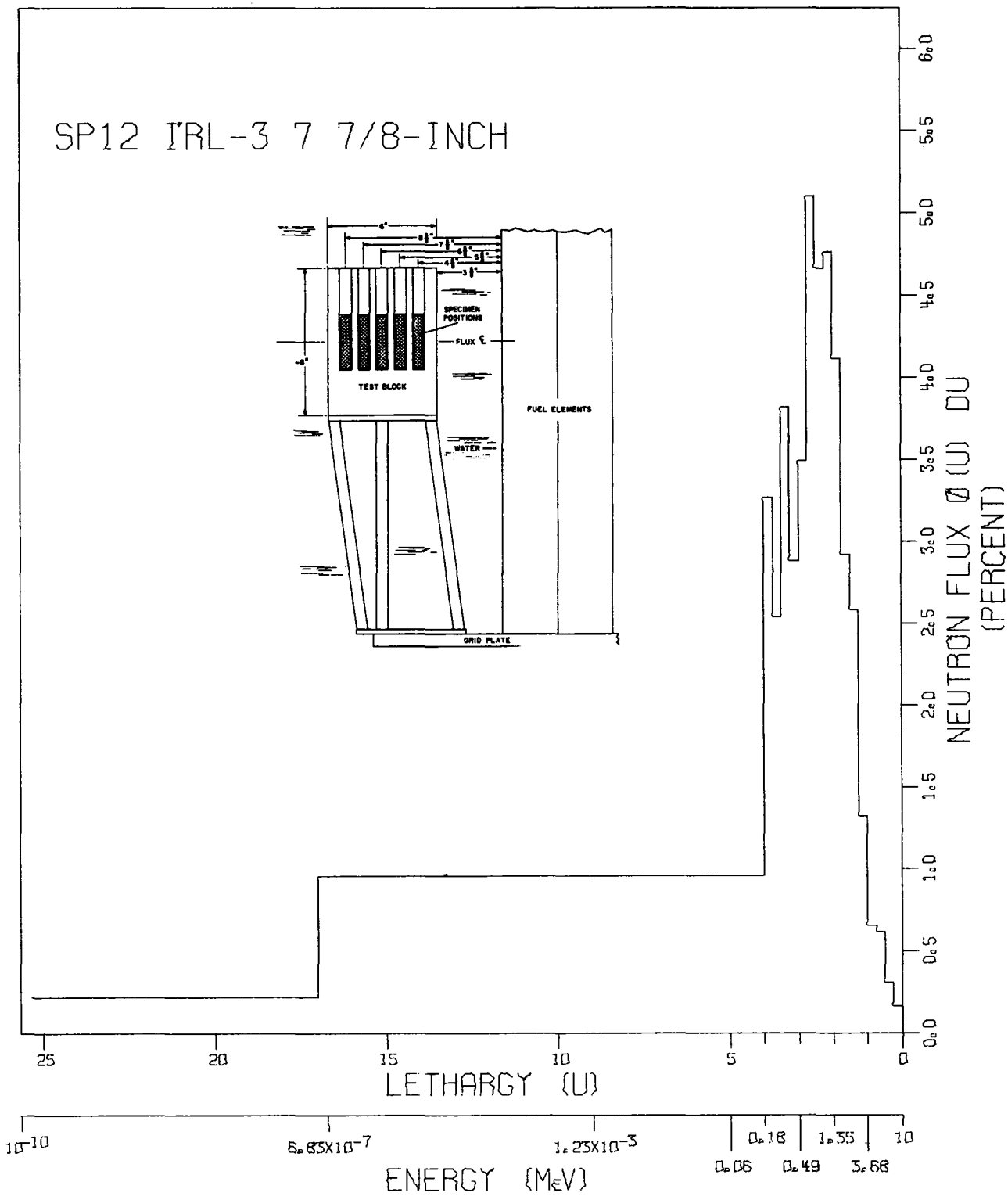
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	9.05×10^{11}	81.1
>0.5 MeV	13.9	52.8
>0.1 MeV	19.5	37.6
Thermal, 49°C	0.657	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP11 IRL-3 6 5/8-INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000-000	2,307-003	4,33308+000
0,50	6,07000+000	4,641-003	8,72813+000
0,75	4,72000+000	8,828-003	1,64650+001
1,00	3,68000+000	9,126-003	1,72026+001
1,25	2,87000+000	1,577-002	2,97584+001
1,50	2,23000+000	3,497-002	6,50316+001
1,75	1,74000+000	3,748-002	7,08734+001
2,00	1,35000+000	4,578-002	8,46228+001
2,25	1,05000+000	4,749-002	8,86488+001
2,50	8,21000-001	4,652-002	8,87158+001
2,75	6,39000-001	4,701-002	8,79930+001
3,00	4,98000-001	3,146-002	5,91986+001
3,25	3,88000-001	2,645-002	4,97075+001
3,50	3,02000-001	3,407-002	6,37874+001
3,75	2,35000-001	2,263-002	4,23236+001
4,00	1,83000-001	2,834-002	5,31706+001
17,00	4,14000-007	4,747-001	1,71341+001
25,33	1,00000-010	8,239-002	4,64099+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,250


SP12 IRL-3 7 7/8-INCH
SPECIMEN POSITIONS
FLUX ℄
TEST BLOCK
FUEL ELEMENTS
WATER
GRID PLATE
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Research, pool Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; 12 5/8-inches inside experiment (four inches inside exp.); steel

Spectrum Code

Code: 2 DXY Calculation: BNW [12,13]

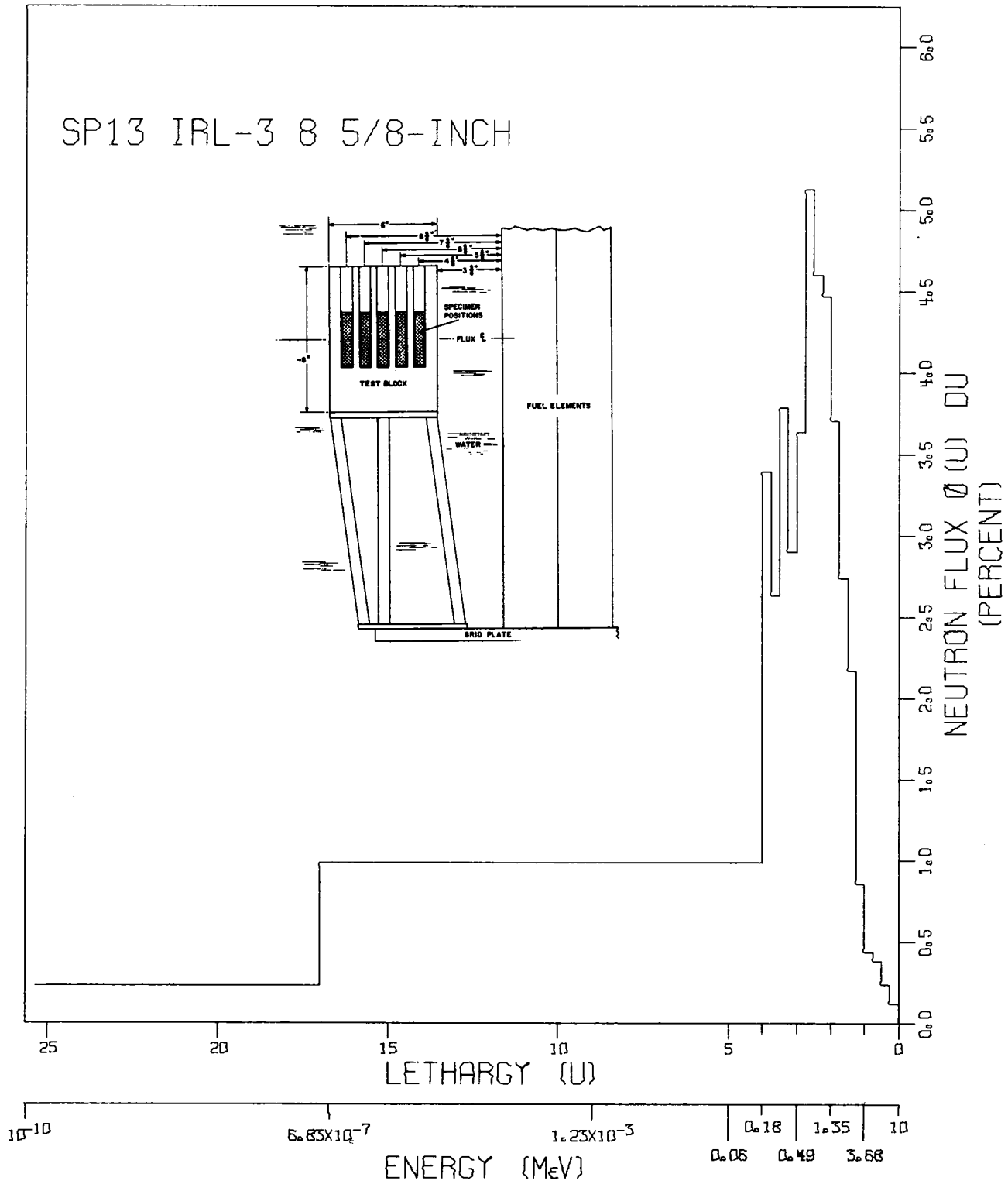
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	6.50×10^{11}	69.2
>0.5 MeV	10.8	41.5
>0.1 MeV	16.1	28.0
Thermal, 49°C	0.41	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP12 IRL-3 7 7/8-INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,624-003	4,18636+000
0,50	6,07000+000	3,043-003	7,85340+000
0,75	4,72000+000	6,133-003	1,56970+001
1,00	3,68000+000	6,429-003	1,66297+001
1,25	2,87000+000	1,307-002	3,38473+001
1,50	2,23000+000	2,604-002	6,64567+001
1,75	1,74000+000	2,894-002	7,51030+001
2,00	1,35000+000	4,172-002	1,05838+002
2,25	1,05000+000	4,786-002	1,22608+002
2,50	8,21000-001	4,585-002	1,19975+002
2,75	6,39000-001	5,113-002	1,31348+002
3,00	4,98000-001	3,483-002	8,99447+001
3,25	3,88000-001	2,874-002	7,41240+001
3,50	3,02000-001	3,826-002	9,83095+001
3,75	2,35000-001	2,546-002	6,53492+001
4,00	1,83000-001	3,272-002	8,42176+001
17,00	4,14000-007	4,951-001	2,45184+001
25,33	1,00000-010	7,309-002	5,65024+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP13 IRL-3 8 5/8-INCH
SPECIMEN POSITIONS
FLUX ℄
TEST BLOCK
FUEL ELEMENTS
WATER
GRID PLATE
NEUTRON FLUX Ø (U) DU
(PERCENT)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.23X10-3
0.18
1.35
10
0.08
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Research, pool Power Level: 5 MWt

Coolant: Light water Moderator: Light water

Location: plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; 8 5/8-inches inside experiment (five inches inside exp.); steel.

Spectrum Code

Code: 2 DXY Calculation: BNW [12,13]

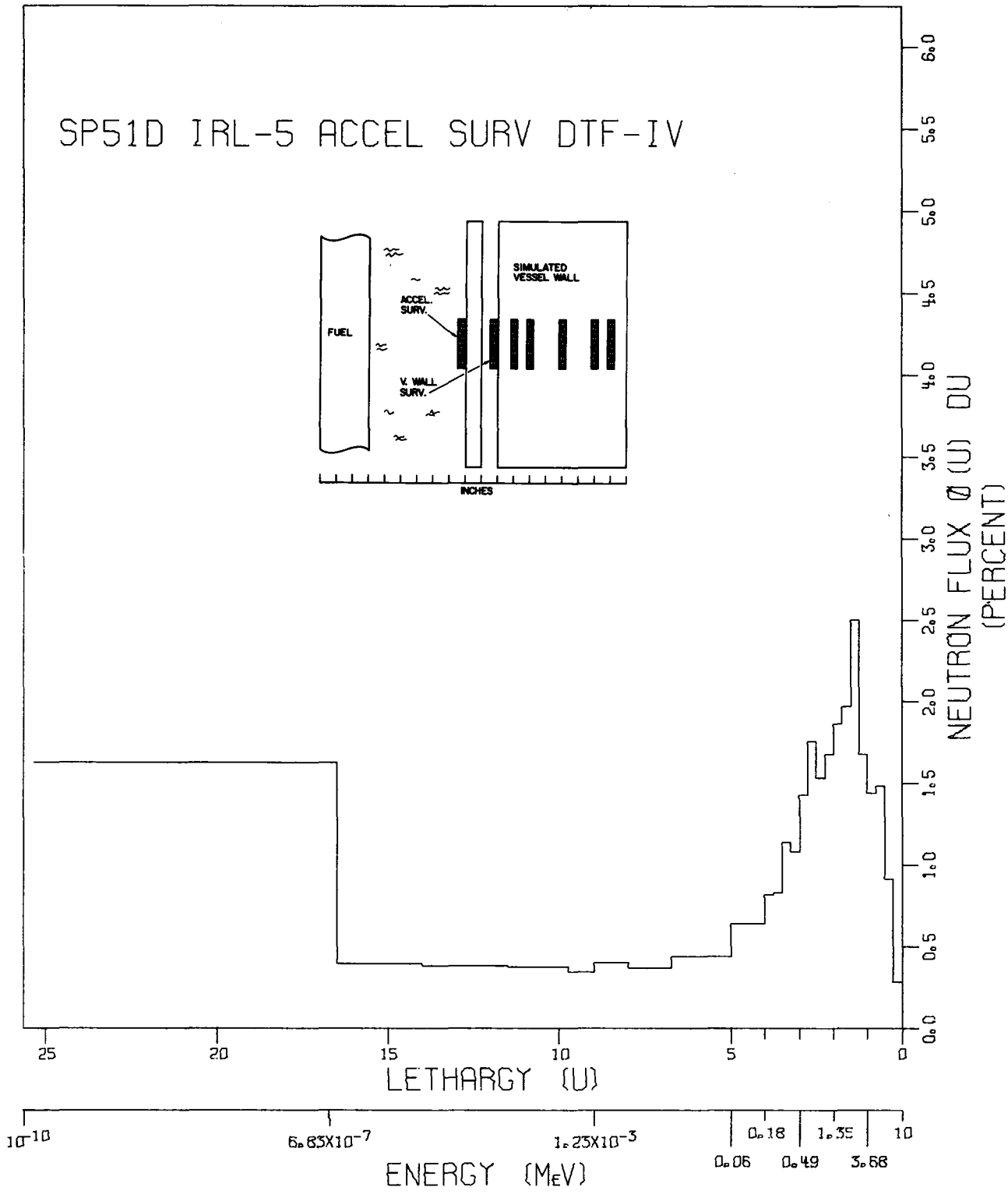
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	4.75×10^{11}	57.1
>0.5 MeV	8.40	32.3
>0.1 MeV	12.9	21.1
Thermal, 49 °C	0.54	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP13 IRL-3 8 5/8-INCH

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,195-003	4,27176+000
0,50	6,07000+000	2,383-003	8,52775+000
0,75	4,72000+000	3,814-003	1,35346+001
1,00	3,68000+000	4,346-003	1,55866+001
1,25	2,87000+000	8,498-003	3,05145+001
1,50	2,23000+000	2,190-002	7,74735+001
1,75	1,74000+000	2,717-002	9,77509+001
2,00	1,35000+000	3,758-002	1,32189+002
2,25	1,05000+000	4,491-002	1,59536+002
2,50	8,21000-001	4,525-002	1,64180+002
2,75	6,39000-001	5,139-002	1,83041+002
3,00	4,98000-001	3,626-002	1,29827+002
3,25	3,88000-001	2,894-002	1,03511+002
3,50	3,02000-001	3,796-002	1,35242+002
3,75	2,35000-001	2,636-002	9,37984+001
4,00	1,83000-001	3,395-002	1,21173+002
17,00	4,14000-007	5,118-001	3,51478+001
25,33	1,00000-010	7,629-002	8,17672+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP51D IRL-5 ACCEL SURV DTF-IV
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; accelerated irradiation-rate location; steel and water

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.45×10^{11}	160.0
>0.5 MeV	3.23 (79.95†)	121.3
>0.1 MeV	4.16	94.2
Thermal, 49°C	10.03	-

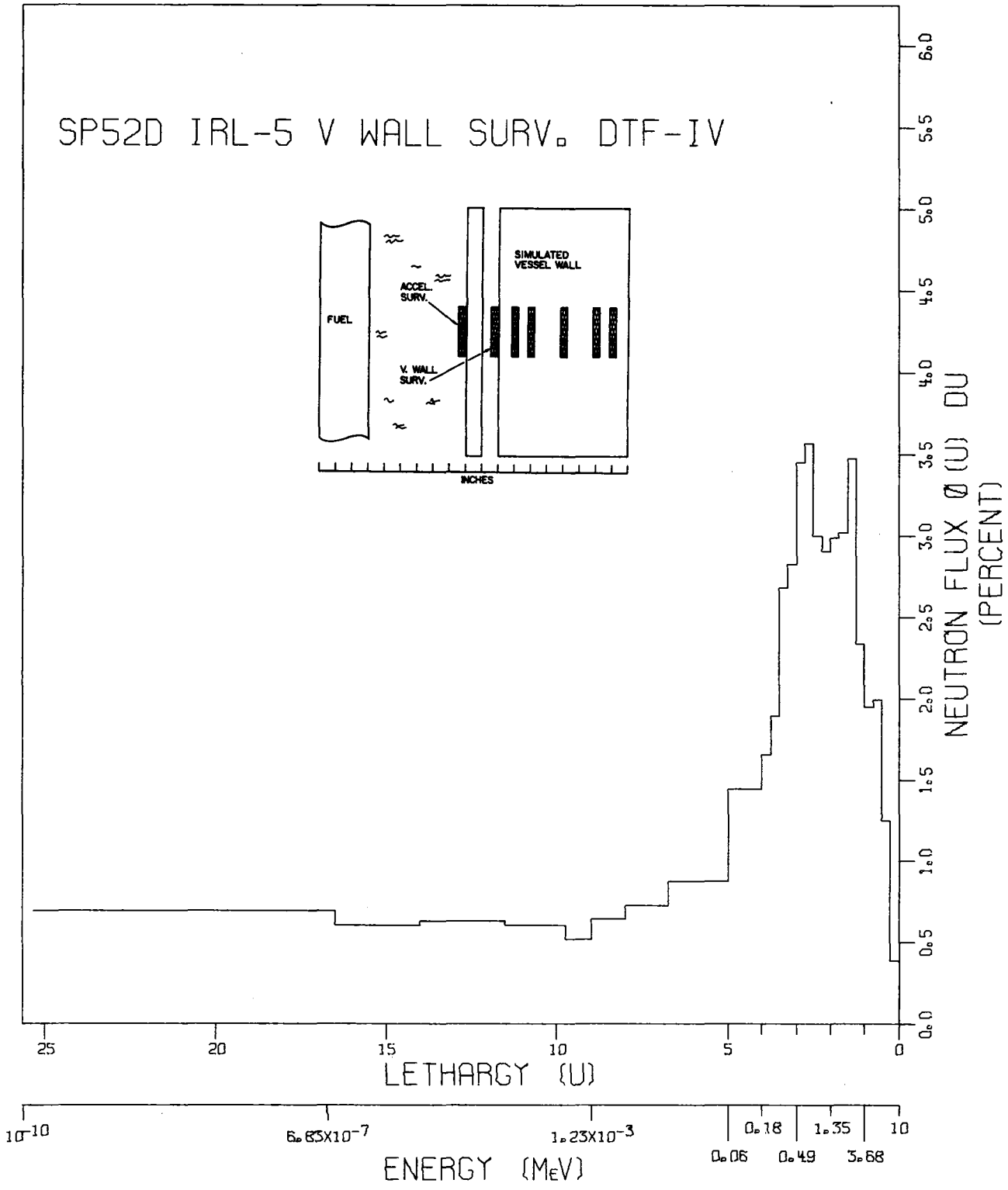
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP51D IRL-5 ACCEL SURV DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	2,793-003	3,99083+000
0,50	6,07000+000	9,101-003	1,30191+001
0,75	4,72000+000	1,487-002	2,10914+001
1,00	3,68000+000	1,432-002	2,05387+001
1,25	2,87000+000	1,663-002	2,38761+001
1,50	2,23000+000	2,520-002	3,56440+001
1,75	1,74000+000	1,952-002	2,80703+001
2,00	1,35000+000	1,888-002	2,65567+001
2,25	1,05000+000	1,681-002	2,38787+001
2,50	8,21000-001	1,508-002	2,18702+001
2,75	6,39000-001	1,761-002	2,50735+001
3,00	4,98000-001	1,417-002	2,02840+001
3,25	3,88000-001	1,077-002	1,53991+001
3,50	3,02000-001	1,137-002	1,61934+001
3,75	2,35000-001	8,295-003	1,18016+001
4,00	1,83000-001	8,183-003	1,16772+001
5,00	6,74000-002	2,530-002	9,04085+000
6,75	1,17000-002	3,042-002	6,20052+000
8,00	3,36000-003	1,845-002	5,27843+000
9,00	1,23000-003	1,599-002	5,67764+000
9,75	5,83000-004	1,019-002	4,87087+000
11,50	1,01000-004	2,600-002	5,29248+000
14,00	8,32000-006	3,819-002	5,45931+000
16,50	6,83000-007	3,921-002	5,59691+000
25,33	1,00000-010	5,727-001	2,31479+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP52D IRL-5 V WALL SURV. DTF-IV
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10^-10
6.83X10^-7
1.23X10^-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; vessel wall surveillance location; steel and water.

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.07×10^{11}	147.8
>0.5 MeV	1.56 (47.24†)	101.4
>0.1 MeV	2.20	71.9
Thermal, 49 °C	1.25	-

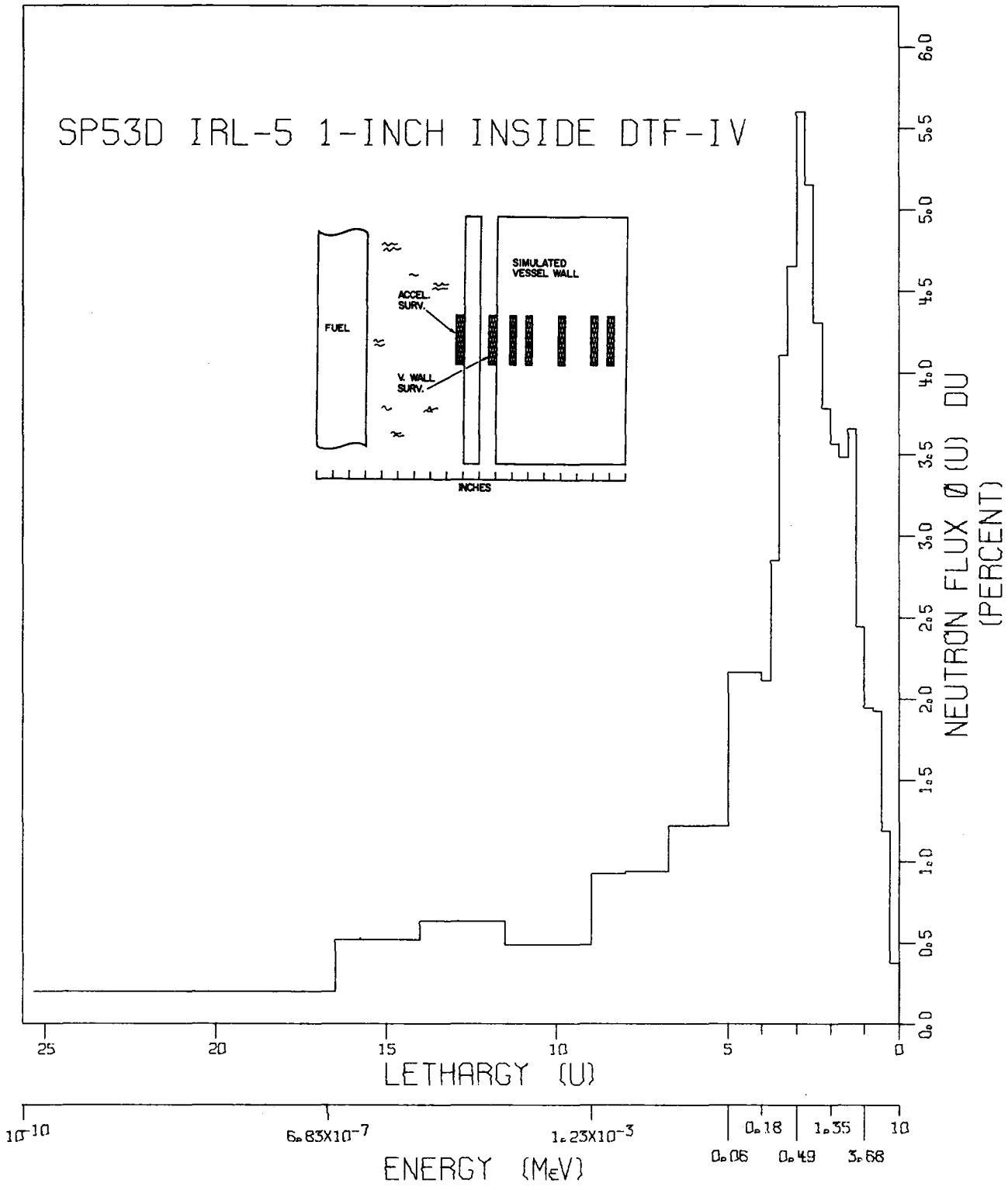
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP52D IRL-5 V WALL SURV, DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	3,876-003	4,04329+000
0,50	6,07000+000	1,244-002	1,29863+001
0,75	4,72000+000	2,005-002	2,07646+001
1,00	3,68000+000	1,941-002	2,03149+001
1,25	2,87000+000	2,326-002	2,43691+001
1,50	2,23000+000	3,505-002	3,61871+001
1,75	1,74000+000	2,996-002	3,14574+001
2,00	1,35000+000	3,033-002	3,11380+001
2,25	1,05000+000	2,920-002	3,02667+001
2,50	8,21000-001	2,950-002	3,12403+001
2,75	6,39000-001	3,573-002	3,71415+001
3,00	4,98000-001	3,438-002	3,59193+001
3,25	3,88000-001	2,821-002	2,94455+001
3,50	3,02000-001	2,686-002	2,79198+001
3,75	2,35000-001	1,901-002	1,97409+001
4,00	1,83000-001	1,654-002	1,72242+001
5,00	6,74000-002	5,763-002	1,50303+001
6,75	1,17000-002	6,137-002	9,12987+000
8,00	3,36000-003	3,595-002	7,50680+000
9,00	1,23000-003	2,577-002	6,68038+000
9,75	5,83000-004	1,542-002	5,38097+000
11,50	1,01000-004	4,237-002	6,29593+000
14,00	8,32000-006	6,314-002	6,58879+000
16,50	6,83000-007	6,055-002	6,30951+000
25,33	1,00000-010	2,440-001	7,19880+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP53D IRL-5 1-INCH INSIDE DTF-IV
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location one inch inside vessel; steel

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.66×10^{11}	132.2
>0.5 MeV	1.08 (38.78†)	81.5
>0.1 MeV	1.62	54.2
Thermal, 49 °C	0.202	-

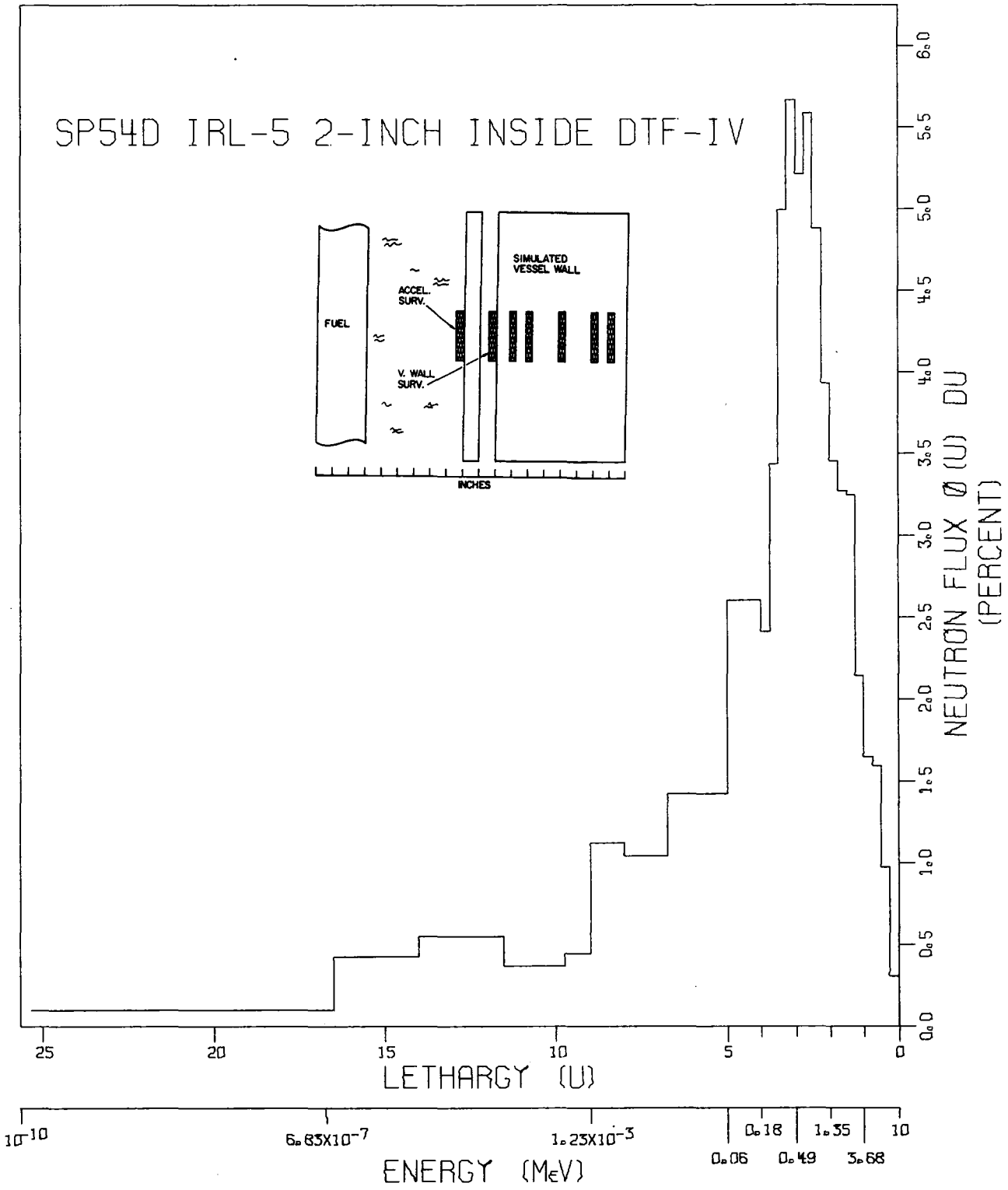
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP53D IRL-5 1-INCH INSIDE DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.716-003	3.90412+000
0.50	6.07000+000	1.184-002	1.24559+001
0.75	4.72000+000	1.936-002	2.01888+001
1.00	3.68000+000	1.937-002	2.04137+001
1.25	2.87000+000	2.428-002	2.56188+001
1.50	2.23000+000	3.687-002	3.83404+001
1.75	1.74000+000	3.451-002	3.64889+001
2.00	1.35000+000	3.613-002	3.73502+001
2.25	1.05000+000	3.800-002	3.96722+001
2.50	8.21000-001	4.234-002	4.51478+001
2.75	6.39000-001	5.159-002	5.40049+001
3.00	4.98000-001	5.584-002	5.87667+001
3.25	3.88000-001	4.638-002	4.87536+001
3.50	3.02000-001	4.116-002	4.30937+001
3.75	2.35000-001	2.857-002	2.98782+001
4.00	1.83000-001	2.114-002	2.21756+001
5.00	6.74000-002	8.628-002	2.26619+001
6.75	1.17000-002	8.543-002	1.28005+001
8.00	3.36000-003	4.660-002	9.79950+000
9.00	1.23000-003	3.713-002	9.69489+000
9.75	5.83000-004	1.456-002	5.11719+000
11.50	1.01000-004	3.406-002	5.09713+000
14.00	8.32000-006	6.276-002	6.59579+000
16.50	6.83000-007	5.198-002	5.45546+000
25.33	1.00000-010	7.011-002	2.08328+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP54D IRL-5 2-INCH INSIDE DTF-IV
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment: location two inches inside vessel; steel

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.46×10^{11}	120.8
>0.5 MeV	0.79 (29.78†)	71.4
>0.1 MeV	1.28	43.9
Thermal, 49°C	0.077	-

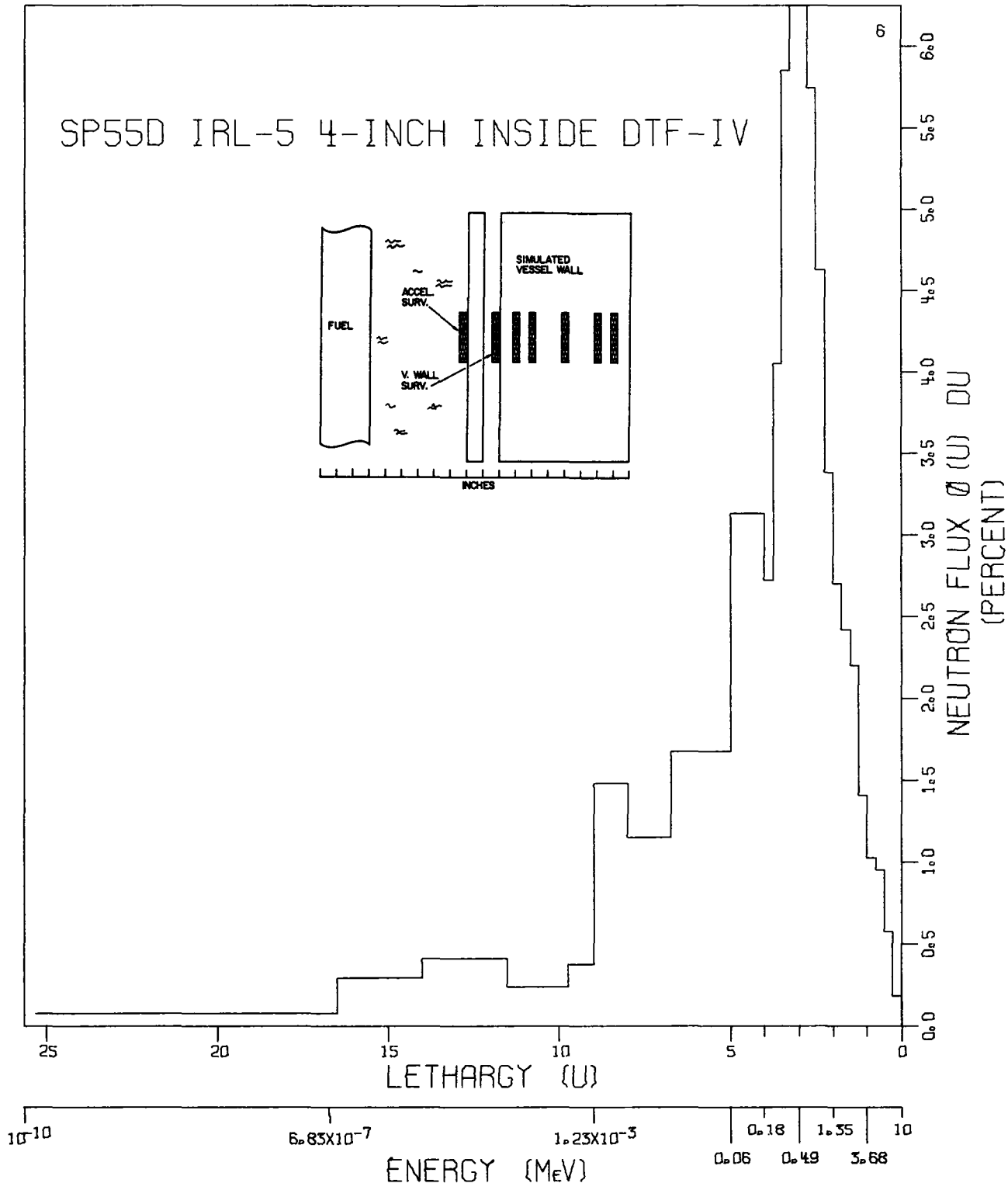
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP54C IRL-5 2-INCH INSIDE DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	3,054-003	3,78609+000
0,50	6,07000+000	9,715-003	1,20576+001
0,75	4,72000+000	1,601-002	1,97104+001
1,00	3,68000+000	1,644-002	2,04578+001
1,25	2,87000+000	2,131-002	2,65436+001
1,50	2,23000+000	3,280-002	4,02576+001
1,75	1,74000+000	3,254-002	4,06060+001
2,00	1,35000+000	3,513-002	4,28672+001
2,25	1,05000+000	3,934-002	4,84694+001
2,50	8,21000-001	4,702-002	5,91787+001
2,75	6,39000-001	5,608-002	6,92859+001
3,00	4,98000-001	5,204-002	6,46317+001
3,25	3,88000-001	5,668-002	7,03156+001
3,50	3,02000-001	5,007-002	6,18692+001
3,75	2,35000-001	3,452-002	4,26128+001
4,00	1,83000-001	2,412-002	2,98592+001
5,00	6,74000-002	1,043-001	3,23257+001
6,75	1,17000-002	9,987-002	1,76597+001
8,00	3,36000-003	5,200-002	1,29048+001
9,00	1,23000-003	4,514-002	1,39072+001
9,75	5,83000-004	1,315-002	5,45548+000
11,50	1,01000-004	2,607-002	4,60402+000
14,00	8,32000-006	5,506-002	6,82874+000
16,50	6,83000-007	4,239-002	5,25078+000
25,33	1,00000-010	3,517-002	1,23341+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP55D IRL-5 4-INCH INSIDE DTF-IV
6
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Sinulated vessel wall experiment; location four inches inside vessel; steel

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.22×10^{11}	102.6
>0.5 MeV	0.45 (18.95†)	49.0
>0.1 MeV	0.82	27.1
Thermal, 49°C	0.035	-

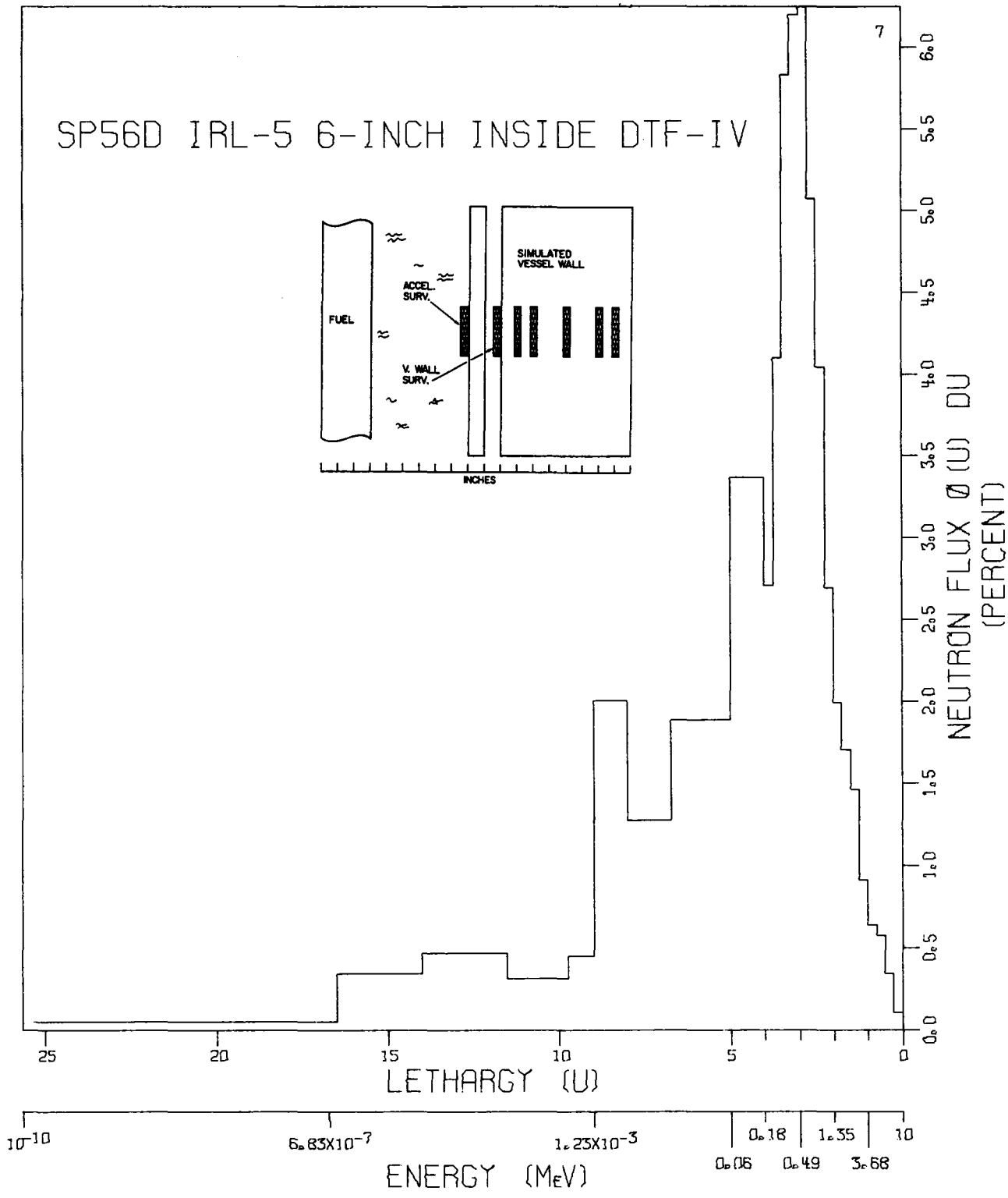
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP55D IRL-5 4-INCH INSIDE DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,791-003	3,57226+000
0,50	6,07000+000	5,703-003	1,13859+001
0,75	4,72000+000	9,554-003	1,89175+001
1,00	3,68000+000	1,022-002	2,04418+001
1,25	2,87000+000	1,398-002	2,80142+001
1,50	2,23000+000	2,219-002	4,38009+001
1,75	1,74000+000	2,401-002	4,82036+001
2,00	1,35000+000	2,740-002	5,37841+001
2,25	1,05000+000	3,398-002	6,73348+001
2,50	8,21000-001	4,548-002	9,20739+001
2,75	6,39000-001	5,755-002	1,14369+002
3,00	4,98000-001	7,483-002	1,49504+002
3,25	3,88000-001	6,446-002	1,28636+002
3,50	3,02000-001	5,860-002	1,16479+002
3,75	2,35000-001	4,063-002	8,06664+001
4,00	1,83000-001	2,720-002	5,41601+001
5,00	6,74000-002	1,249-001	6,22931+001
6,75	1,17000-002	1,173-001	3,33693+001
8,00	3,36000-003	5,742-002	2,29244+001
9,00	1,23000-003	5,943-002	2,94553+001
9,75	5,83000-004	1,118-002	7,46002+000
11,50	1,01000-004	1,674-002	4,75648+000
14,00	8,32000-006	4,098-002	8,17632+000
16,50	6,83000-007	2,939-002	5,85647+000
25,33	1,00000-010	2,504-002	1,41282+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP56D IRL-5 6-INCH INSIDE DTF-IV
7
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location six inches inside vessel; steel

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.096×10^{11}	89.9
>0.5 MeV	0.23 (10.52†)	37.3
>0.1 MeV	0.46	18.6
Thermal, 49°C	0.016	-

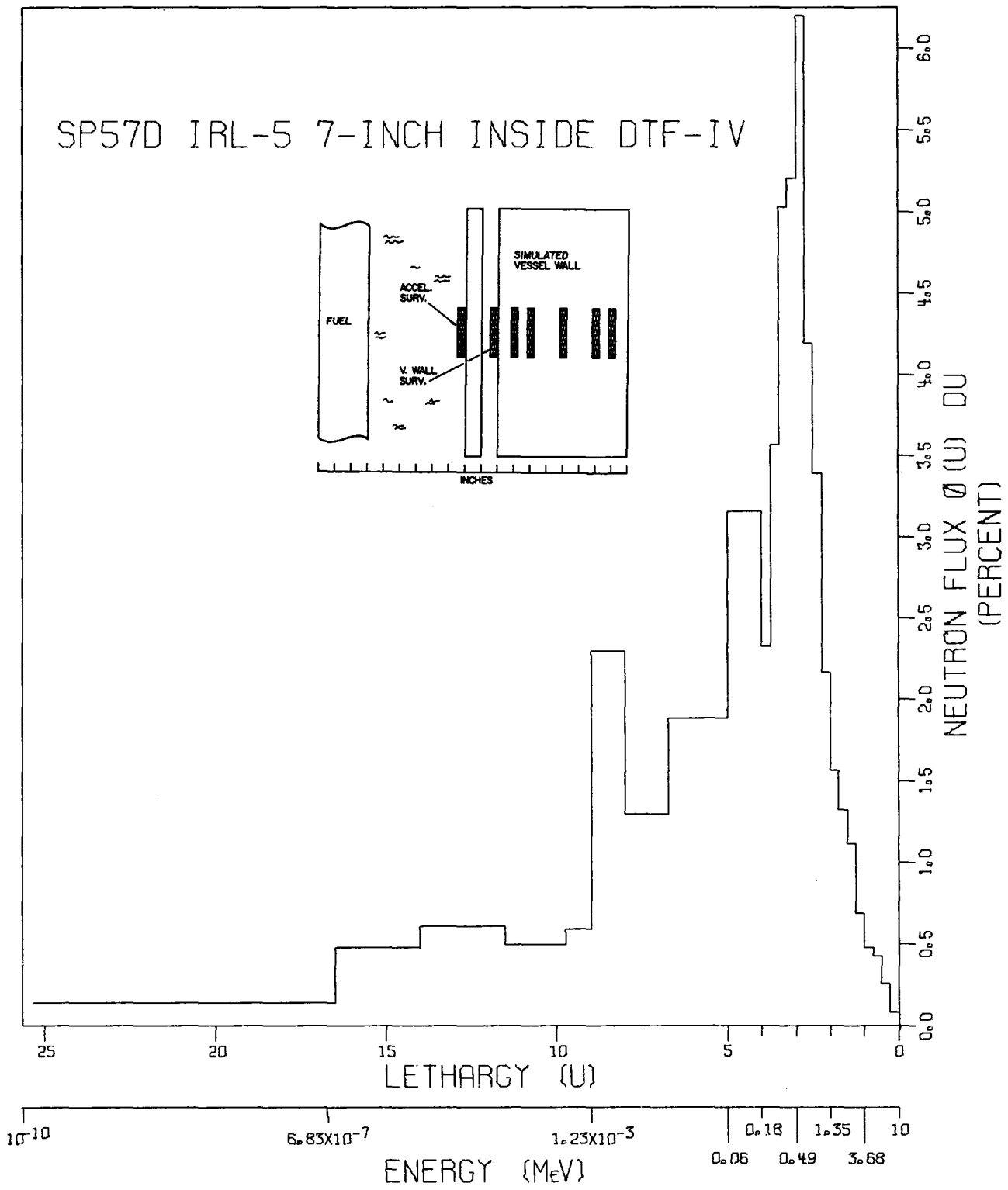
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP56D IRL-5 6-INCH INSIDE DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,071-003	3,42299+000
0,50	6,07000+000	3,409-003	1,09110+001
0,75	4,72000+000	5,772-003	1,83205+001
1,00	3,68000+000	6,335-003	2,03222+001
1,25	2,87000+000	9,033-003	2,90114+001
1,50	2,23000+000	1,475-002	4,66812+001
1,75	1,74000+000	1,694-002	5,45201+001
2,00	1,35000+000	2,021-002	6,35811+001
2,25	1,05000+000	2,704-002	8,59115+001
2,50	8,21000-001	3,977-002	1,29081+002
2,75	6,39000-001	5,084-002	1,61968+002
3,00	4,98000-001	7,195-002	2,30421+002
3,25	3,88000-001	6,186-002	1,97886+002
3,50	3,02000-001	5,841-002	1,86117+002
3,75	2,35000-001	4,111-002	1,30845+002
4,00	1,83000-001	2,707-002	8,64086+001
5,00	6,74000-002	1,346-001	1,07590+002
6,75	1,17000-002	1,320-001	6,02099+001
8,00	3,36000-003	6,358-002	4,06880+001
9,00	1,23000-003	8,058-002	6,40190+001
9,75	5,83000-004	1,336-002	1,42907+001
11,50	1,01000-004	2,188-002	9,96336+000
14,00	8,32000-006	4,655-002	1,48872+001
16,50	6,83000-007	3,395-002	1,08429+001
25,33	1,00000-010	1,790-002	1,61919+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP57D IRL-5 7-INCH INSIDE DTF-IV
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment: location seven inches inside vessel; steel

Spectrum Code

Code: DTF-IV Calculation: BNW [29,30]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.063	86.1
>0.5 MeV	0.16 (7.19+)	34.1
>0.1 MeV	0.33	16.4
Thermal, 49°C	0.035	-

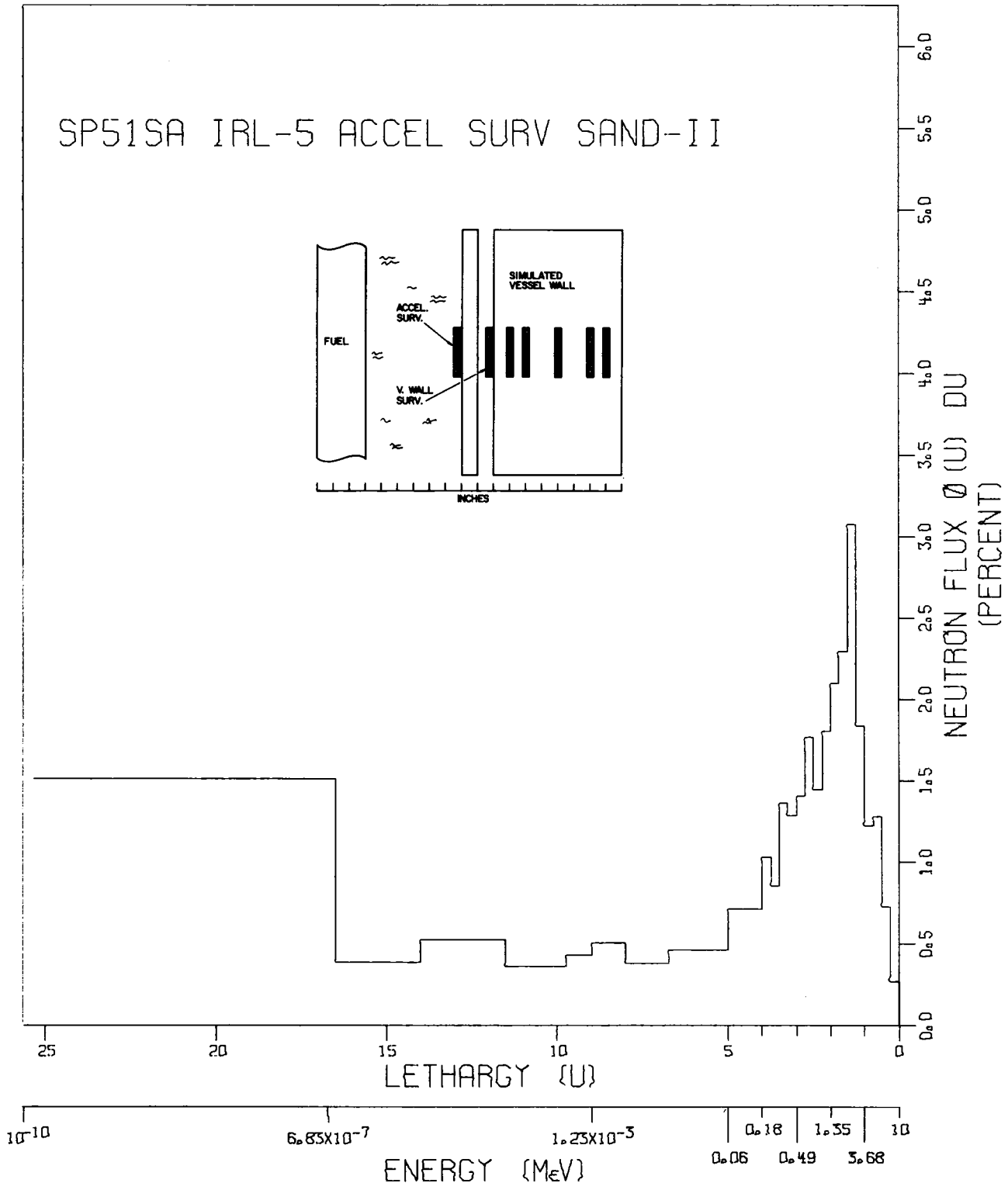
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51D through 57D

SP57D IRL-5 7-INCH INSIDE DTF-IV

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	7,932-004	3,40083+000
0,50	6,07000+000	2,519-003	1,08136+001
0,75	4,72000+000	4,259-003	1,81301+001
1,00	3,68000+000	4,698-003	2,02105+001
1,25	2,87000+000	6,798-003	2,92807+001
1,50	2,23000+000	1,121-002	4,75638+001
1,75	1,74000+000	1,305-002	5,63250+001
2,00	1,35000+000	1,585-002	6,68885+001
2,25	1,05000+000	2,175-002	9,26556+001
2,50	8,21000-001	3,332-002	1,45027+002
2,75	6,39000-001	4,194-002	1,79178+002
3,00	4,98000-001	6,179-002	2,65397+002
3,25	3,88000-001	5,187-002	2,22537+002
3,50	3,02000-001	5,032-002	2,15041+002
3,75	2,35000-001	3,574-002	1,52576+002
4,00	1,83000-001	2,323-002	9,94827+001
5,00	6,74000-002	1,260-001	1,35048+002
6,75	1,17000-002	1,315-001	8,04312+001
8,00	3,36000-003	6,457-002	5,54178+001
9,00	1,23000-003	9,213-002	9,81704+001
9,75	5,83000-004	1,753-002	2,51381+001
11,50	1,01000-004	3,435-002	2,09795+001
14,00	8,32000-006	6,011-002	2,57845+001
16,50	6,83000-007	4,725-002	2,02406+001
25,33	1,00000-010	4,743-002	5,75300+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP51SA IRL-5 ACCEL SURV SAND-II
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; accelerated-irradiation rate surveillance location; steel and water.

Spectrum Code

Code: SAND-II Calculation: BNW [30,31]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.78×10^{11}	140.8
≥0.5 MeV	3.61 (48.85†)	108.6
>0.1 MeV	4.77	82.2
Thermal, 49°C	10.03	-

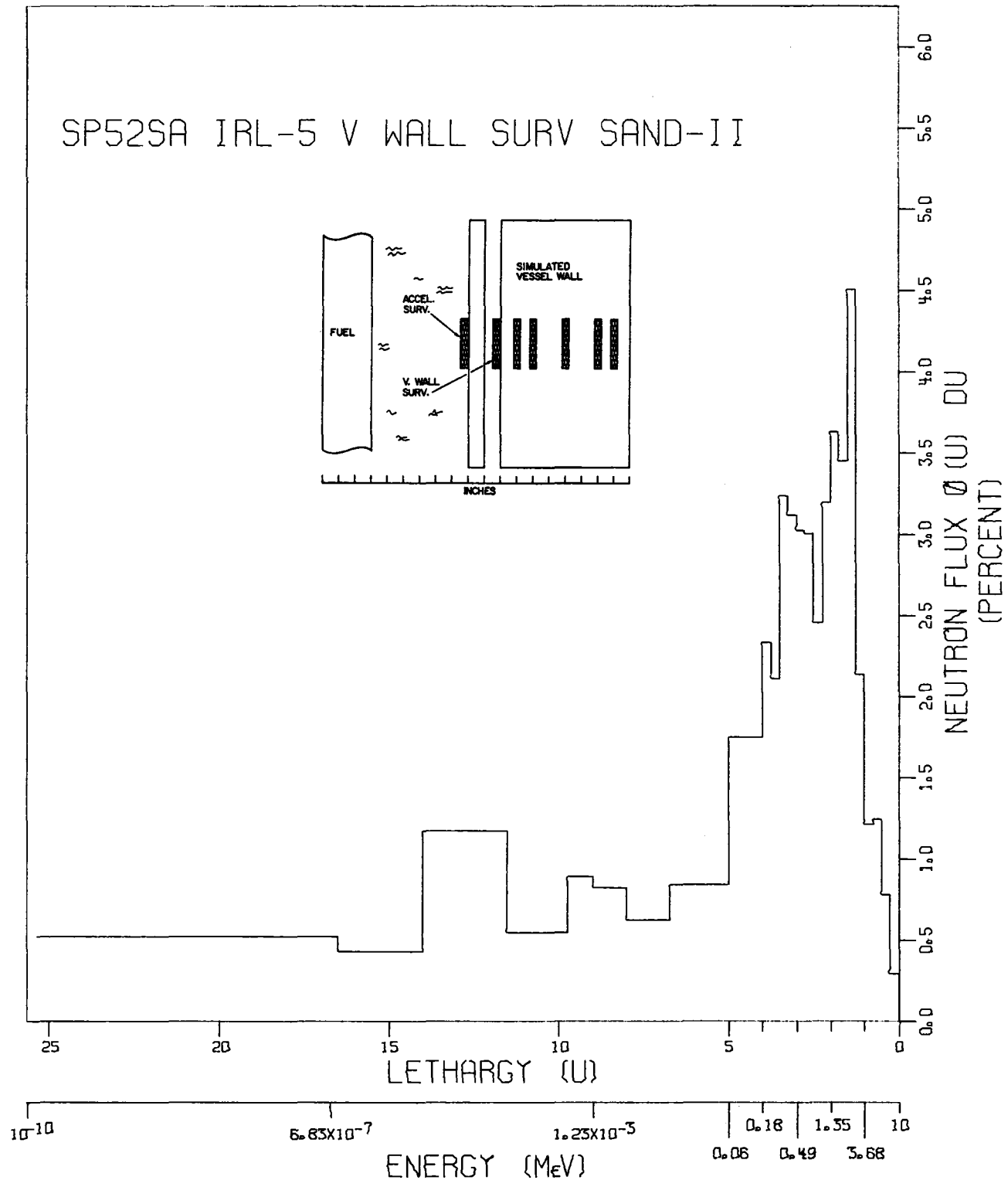
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51SA through 57SA

SP51SA IRL-5 ACCEL SURV SAND-II

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.662-003	4.07292+000
0.50	6.07000+000	7.223-003	1.10620+001
0.75	4.72000+000	1.288-002	1.95684+001
1.00	3.68000+000	1.217-002	1.86862+001
1.25	2.87000+000	1.823-002	2.80108+001
1.50	2.23000+000	3.102-002	4.69799+001
1.75	1.74000+000	2.274-002	3.50092+001
2.00	1.35000+000	2.129-002	3.20554+001
2.25	1.05000+000	1.812-002	2.75424+001
2.50	8.21000-001	1.421-002	2.20722+001
2.75	6.39000-001	1.773-002	2.70282+001
3.00	4.98000-001	1.404-002	2.15128+001
3.25	3.88000-001	1.287-002	1.96993+001
3.50	3.02000-001	1.363-002	2.07891+001
3.75	2.35000-001	8.598-003	1.30959+001
4.00	1.83000-001	1.031-002	1.57435+001
5.00	6.74000-002	2.851-002	1.09054+001
6.75	1.17000-002	3.224-002	7.03532+000
8.00	3.36000-003	1.883-002	5.76479+000
9.00	1.23000-003	2.018-002	7.67113+000
9.75	5.83000-004	1.280-002	6.55009+000
11.50	1.01000-004	2.550-002	5.55648+000
14.00	8.32000-006	5.239-002	8.01749+000
16.50	6.83000-007	3.876-002	5.92298+000
25.33	1.00000-010	5.331-001	2.30684+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP52SA IRL-5 V WALL SURV SAND-II
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; vessel wall surveillance location; steel and water.

Spectrum Code

Code: SAND-II Calculation: BNW [30, 31]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.42×10^{11}	111.3
>0.5 MeV	1.97 (30.69+)	80.2
>0.1 MeV	2.98	53.0
Thermal, 49°C	1.25	-

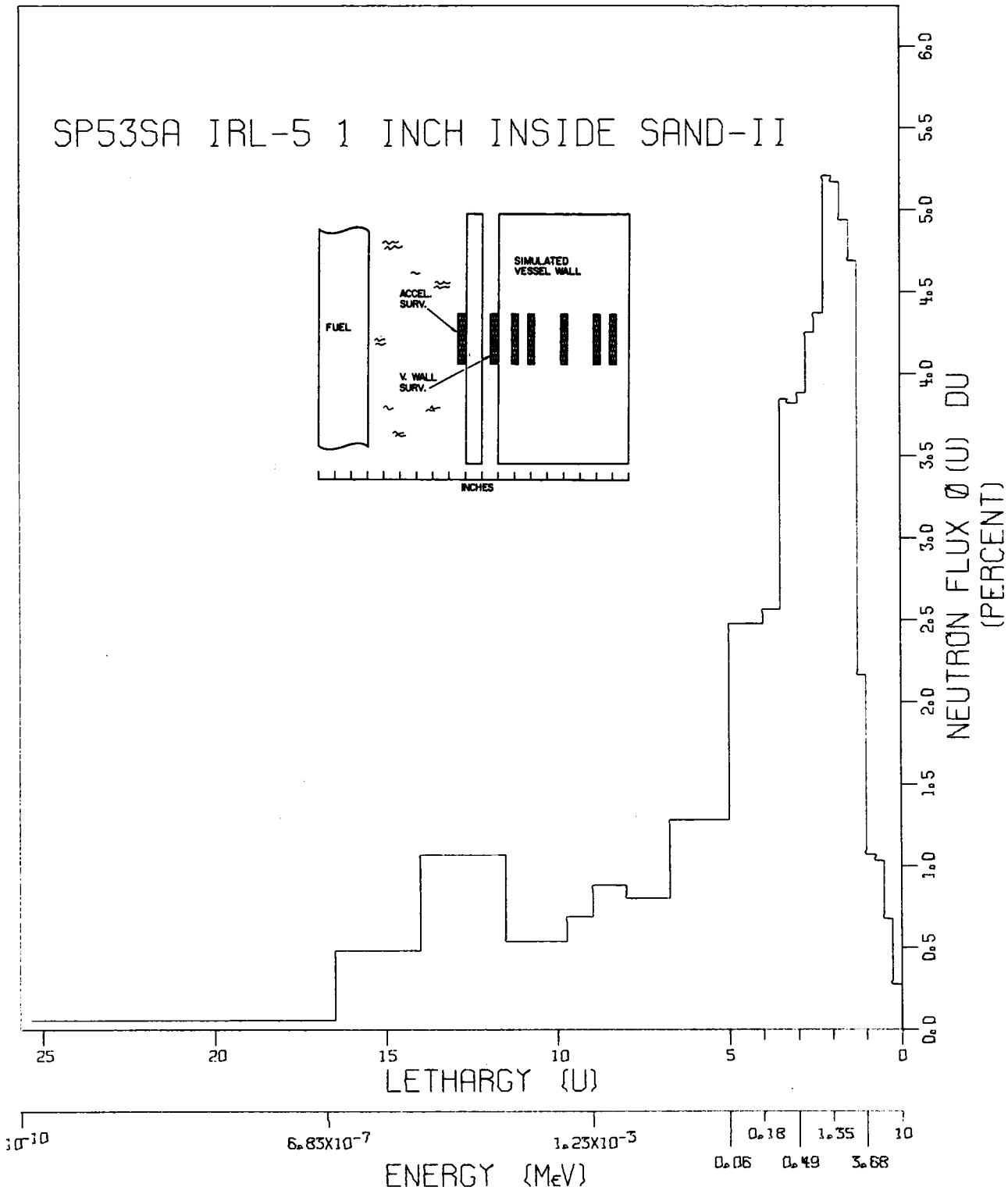
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51SA through 57 SA

SP52SA IRL-5 V WALL SURV SAND-II

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.897-003	3.96756+000
0.50	6.07000+000	7.790-003	1.06784+001
0.75	4.72000+000	1.250-002	1.69967+001
1.00	3.68000+000	1.203-002	1.65262+001
1.25	2.87000+000	2.122-002	2.91871+001
1.50	2.23000+000	4.547-002	6.16343+001
1.75	1.74000+000	3.420-002	4.71454+001
2.00	1.35000+000	3.685-002	4.96646+001
2.25	1.05000+000	3.207-002	4.36430+001
2.50	8.21000-001	2.414-002	3.35635+001
2.75	6.39000-001	3.015-002	4.11412+001
3.00	4.98000-001	3.013-002	4.13353+001
3.25	3.88000-001	3.114-002	4.26643+001
3.50	3.02000-001	3.246-002	4.43003+001
3.75	2.35000-001	2.121-002	2.89130+001
4.00	1.83000-001	2.335-002	3.19227+001
5.00	6.74000-002	6.978-002	2.38903+001
6.75	1.17000-002	5.892-002	1.15075+001
8.00	3.36000-003	3.113-002	8.53217+000
9.00	1.23000-003	3.317-002	1.12872+001
9.75	5.83000-004	2.663-002	1.21994+001
11.50	1.01000-004	3.849-002	7.50928+000
14.00	8.32000-006	1.174-001	1.60761+001
16.50	6.83000-007	4.274-002	5.84667+000
25.33	1.00000-010	1.842-001	7.13448+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP53SA IRL-5 1 INCH INSIDE SAND-II
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10
1.35
0.18
0.49
0.06
3.68
6.83X10-7
1.23X10-3
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location one inch inside vessel; steel.

Spectrum Code

Code: SAND-II Calculation: BNW [30,31]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.13×10^{11}	77.5
>0.5 MeV	1.61 (23.07†)	54.4
>0.1 MeV	2.36	37.1
Thermal, 49°C	0.202	-

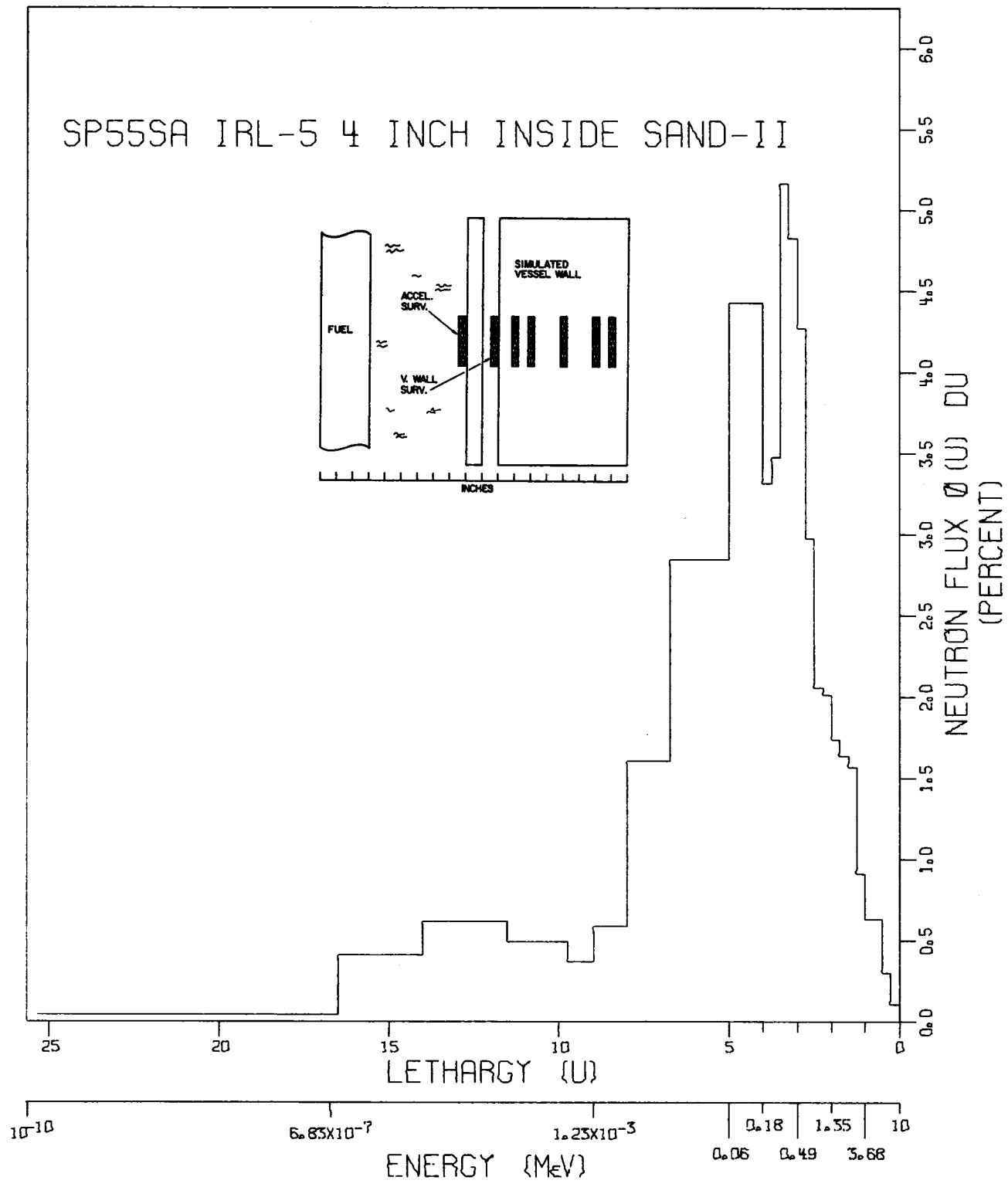
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51SA through 57SA

SP53SA IRL-5 1 INCH INSIDE SAND-II

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.733-003	3.99306+000
0.50	6.07000+000	6.719-003	9.82805+000
0.75	4.72000+000	1.036-002	1.50283+001
1.00	3.68000+000	1.063-002	1.55843+001
1.25	2.87000+000	2.147-002	3.15146+001
1.50	2.23000+000	4.731-002	6.84319+001
1.75	1.74000+000	4.898-002	7.20343+001
2.00	1.35000+000	5.245-002	7.54145+001
2.25	1.05000+000	5.229-002	7.59295+001
2.50	8.21000-001	4.295-002	6.37046+001
2.75	6.39000-001	4.257-002	6.19891+001
3.00	4.98000-001	3.866-002	5.65935+001
3.25	3.88000-001	3.814-002	5.57589+001
3.50	3.02000-001	3.852-002	5.60944+001
3.75	2.35000-001	2.569-002	3.73763+001
4.00	1.83000-001	2.561-002	3.73663+001
5.00	6.74000-002	9.883-002	3.61064+001
6.75	1.17000-002	8.956-002	1.86646+001
8.00	3.36000-003	3.996-002	1.16877+001
9.00	1.23000-003	3.531-002	1.28224+001
9.75	5.83000-004	2.048-002	1.00114+001
11.50	1.01000-004	3.740-002	7.78596+000
14.00	8.32000-006	1.064-001	1.55560+001
16.50	6.83000-007	4.815-002	7.02897+000
25.33	1.00000-010	1.879-002	7.76803-001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP55SA IRL-5 4 INCH INSIDE SAND-II
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location four inches inside vessel; steel

Spectrum Code

Code: SAND-II Calculation: BNW [30,31]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.41×10^{11}	53.6
>0.5 MeV	0.61 (8.72†)	36.4
>0.1 MeV	1.20	18.4
Thermal, 49°C	0.035	-

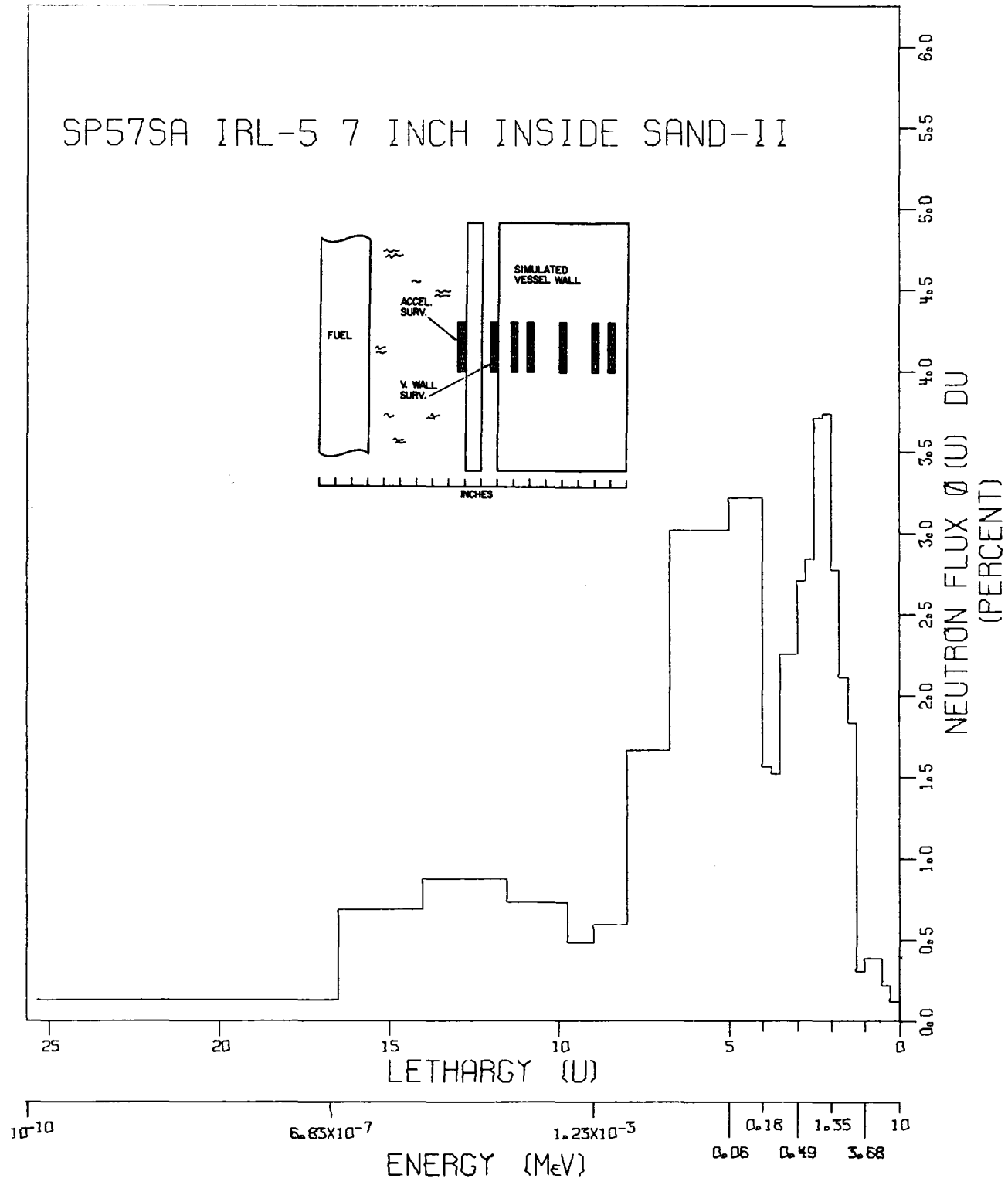
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51SA through 57SA

SP55SA IRL-5 4 INCH INSIDE SAND-II

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.024-003	3.23286+000
0.50	6.07000+000	3.003-003	9.49197+000
0.75	4.72000+000	6.326-003	1.98300+001
1.00	3.68000+000	6.270-003	1.98643+001
1.25	2.87000+000	9.087-003	2.88254+001
1.50	2.23000+000	1.585-002	4.95270+001
1.75	1.74000+000	1.626-002	5.16674+001
2.00	1.35000+000	1.765-002	5.48513+001
2.25	1.05000+000	2.020-002	6.33894+001
2.50	8.21000-001	2.019-002	6.47245+001
2.75	6.39000-001	2.980-002	9.37561+001
3.00	4.98000-001	4.257-002	1.34661+002
3.25	3.88000-001	4.818-002	1.52213+002
3.50	3.02000-001	5.170-002	1.62708+002
3.75	2.35000-001	3.485-002	1.09573+002
4.00	1.83000-001	3.315-002	1.04512+002
5.00	6.74000-002	1.767-001	1.39506+002
6.75	1.17000-002	1.993-001	8.97479+001
8.00	3.36000-003	8.001-002	5.05715+001
9.00	1.23000-003	2.366-002	1.85651+001
9.75	5.83000-004	1.099-002	1.16064+001
11.50	1.01000-004	3.468-002	1.55997+001
14.00	8.32000-006	6.141-002	1.93990+001
16.50	6.83000-007	4.139-002	1.30546+001
25.33	1.00000-010	1.576-002	1.40763+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP57SA IRL-5 7 INCH INSIDE SAND-II
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location seven inches inside vessel; steel

Spectrum Code

Code: SAND-II Calculation: BNW [30, 31]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.095×10^{11}	56.6
>0.5 MeV	0.16 (2.19†)	33.4
>0.1 MeV	0.28	19.5
Thermal, 4gC	0.035	-

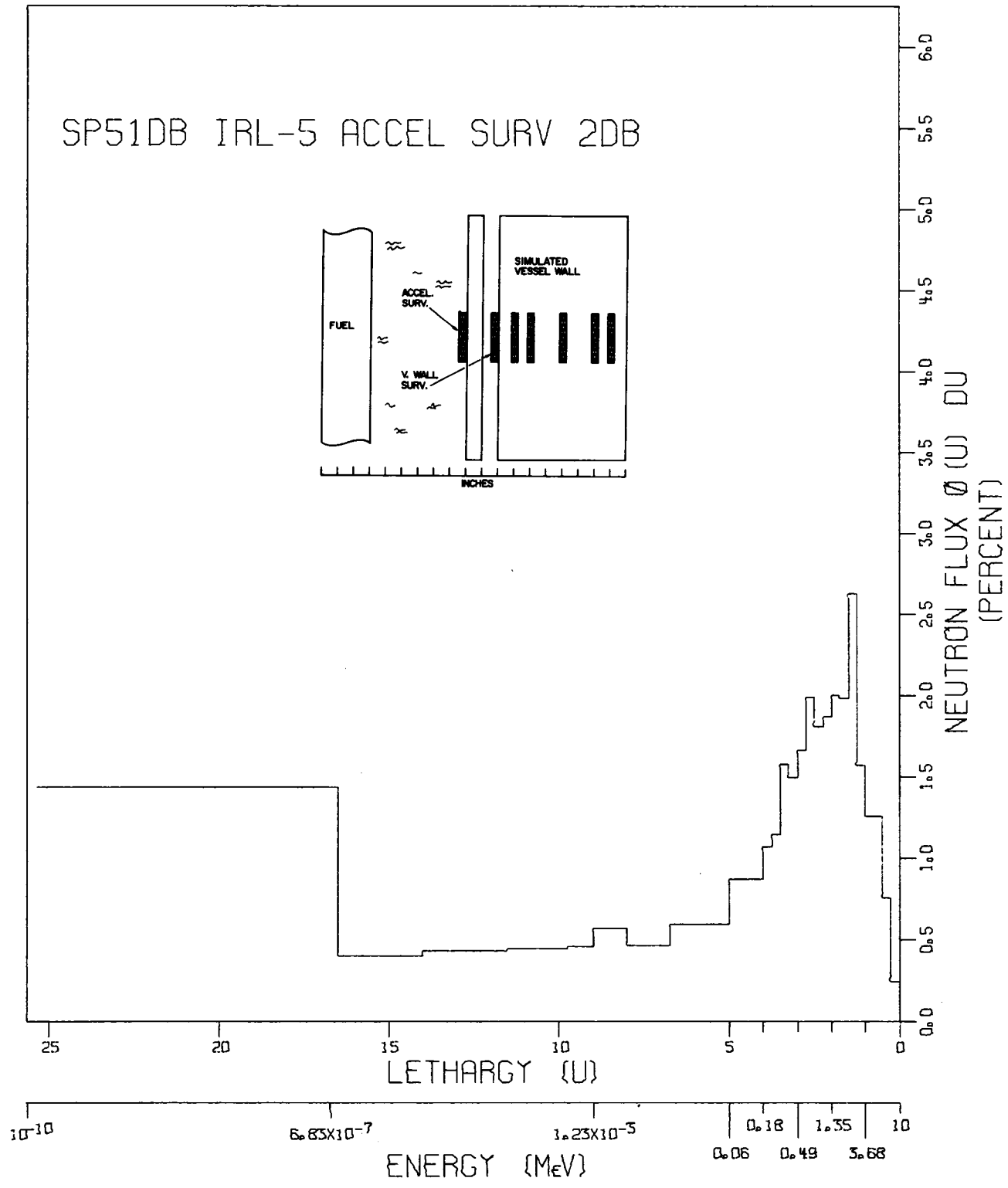
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51SA through 57SA

SP57SA IRL-5 7 INCH INSIDE SAND-II

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.166-003	5.16687+000
0.50	6.07000+000	2.176-003	9.65361+000
0.75	4.72000+000	3.868-003	1.70213+001
1.00	3.68000+000	3.839-003	1.70736+001
1.25	2.87000+000	3.014-003	1.34219+001
1.50	2.23000+000	1.849-002	8.11033+001
1.75	1.74000+000	2.097-002	9.35494+001
2.00	1.35000+000	2.813-002	1.22680+002
2.25	1.05000+000	3.756-002	1.65424+002
2.50	8.21000-001	3.653-002	1.64343+002
2.75	6.39000-001	2.847-002	1.25753+002
3.00	4.98000-001	2.695-002	1.19655+002
3.25	3.88000-001	2.251-002	9.98326+001
3.50	3.02000-001	2.261-002	9.98993+001
3.75	2.35000-001	1.524-002	6.72632+001
4.00	1.83000-001	1.561-002	6.90896+001
5.00	6.74000-002	1.285-001	1.42371+002
6.75	1.17000-002	2.113-001	1.33548+002
8.00	3.36000-003	8.280-002	7.34631+001
9.00	1.23000-003	2.377-002	2.61777+001
9.75	5.83000-004	1.434-002	2.12560+001
11.50	1.01000-004	5.138-002	3.24418+001
14.00	8.32000-006	8.735-002	3.87294+001
16.50	6.83000-007	6.849-002	3.03273+001
25.33	1.00000-010	4.501-002	5.64330+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP51DB IRL-5 ACCEL SURV 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-5
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; accelerated irradiation-rate surveillance location: steel and water.

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.73×10^{11}	143.8
>0.5 MeV	3.74 (17.24†)	104.7
>0.1 MeV	5.18	75.7
Thermal, 49°C	10.03	-

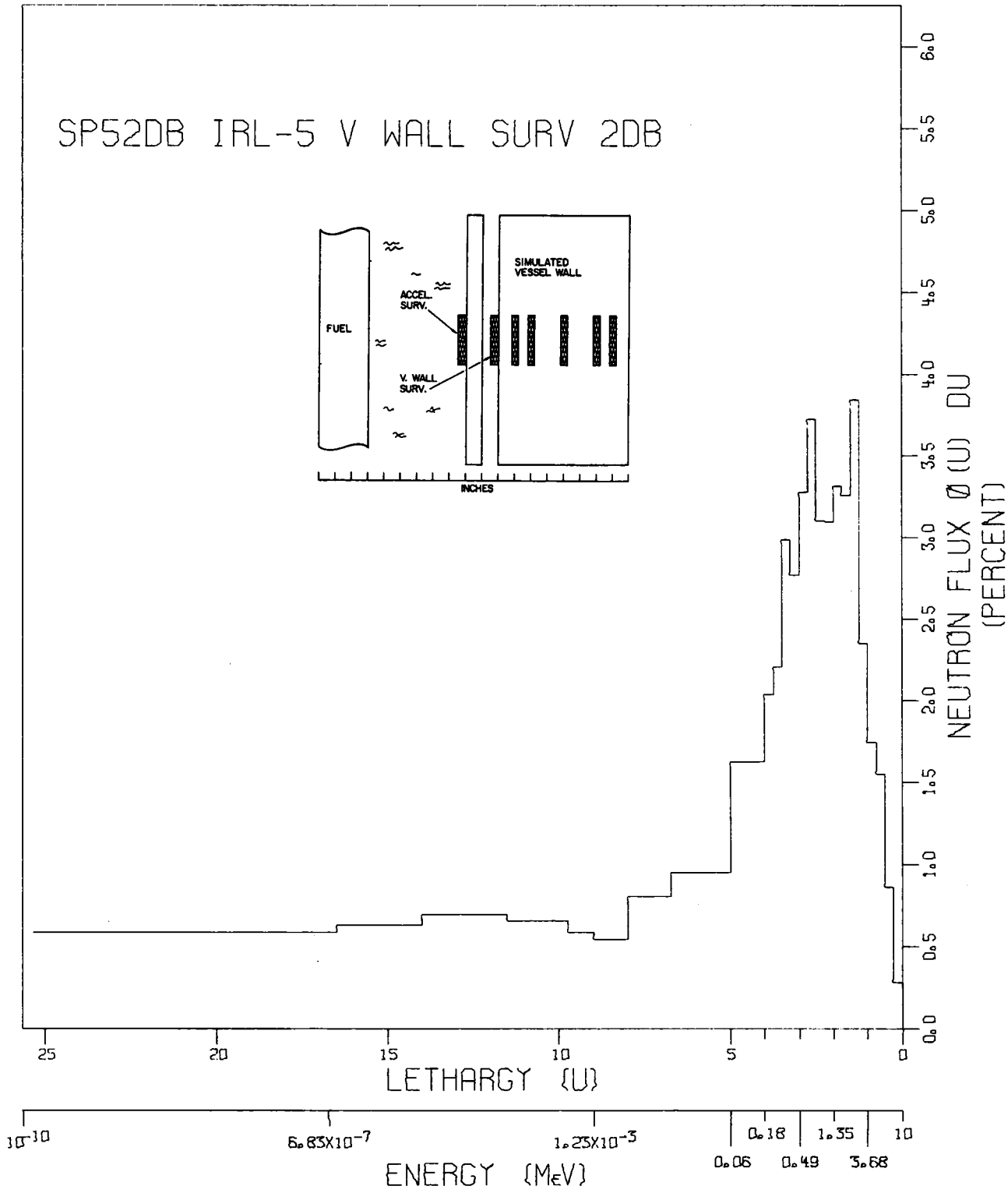
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP51DB IRL-5 ACCEL SURV 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	2.401-003	3.86344+000
0.50	6.07000+000	7.546-003	1.21550+001
0.75	4.72000+000	1.260-002	2.01251+001
1.00	3.68000+000	1.248-002	2.01518+001
1.25	2.87000+000	1.557-002	2.51655+001
1.50	2.23000+000	2.651-002	4.22157+001
1.75	1.74000+000	1.964-002	3.18097+001
2.00	1.35000+000	2.030-002	3.21518+001
2.25	1.05000+000	1.880-002	3.00599+001
2.50	8.21000-001	1.778-002	2.90490+001
2.75	6.39000-001	1.989-002	3.18857+001
3.00	4.98000-001	1.655-002	2.66708+001
3.25	3.88000-001	1.491-002	2.40048+001
3.50	3.02000-001	1.578-002	2.53107+001
3.75	2.35000-001	1.144-002	1.83266+001
4.00	1.83000-001	1.065-002	1.71061+001
5.00	6.74000-002	3.455-002	1.39002+001
6.75	1.17000-002	4.162-002	9.55206+000
8.00	3.36000-003	2.310-002	7.44101+000
9.00	1.23000-003	2.289-002	9.15503+000
9.75	5.83000-004	1.358-002	7.31064+000
11.50	1.01000-004	3.121-002	7.15337+000
14.00	8.32000-006	4.292-002	6.90905+000
16.50	6.83000-007	3.955-002	6.35732+000
25.33	1.00000-010	5.077-001	2.31107+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP52DB IRL-5 V WALL SURV 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.25X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; vessel wall surveillance location; steel and water.

Spectrum Code

Code: 2DB Calculation: BNW [30] [32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.26×10^{11}	125.9
>0.5 MeV	1.84 (14.39+)	86.1
>0.1 MeV	2.67	59.2
Thermal, 49°C	1.25	-

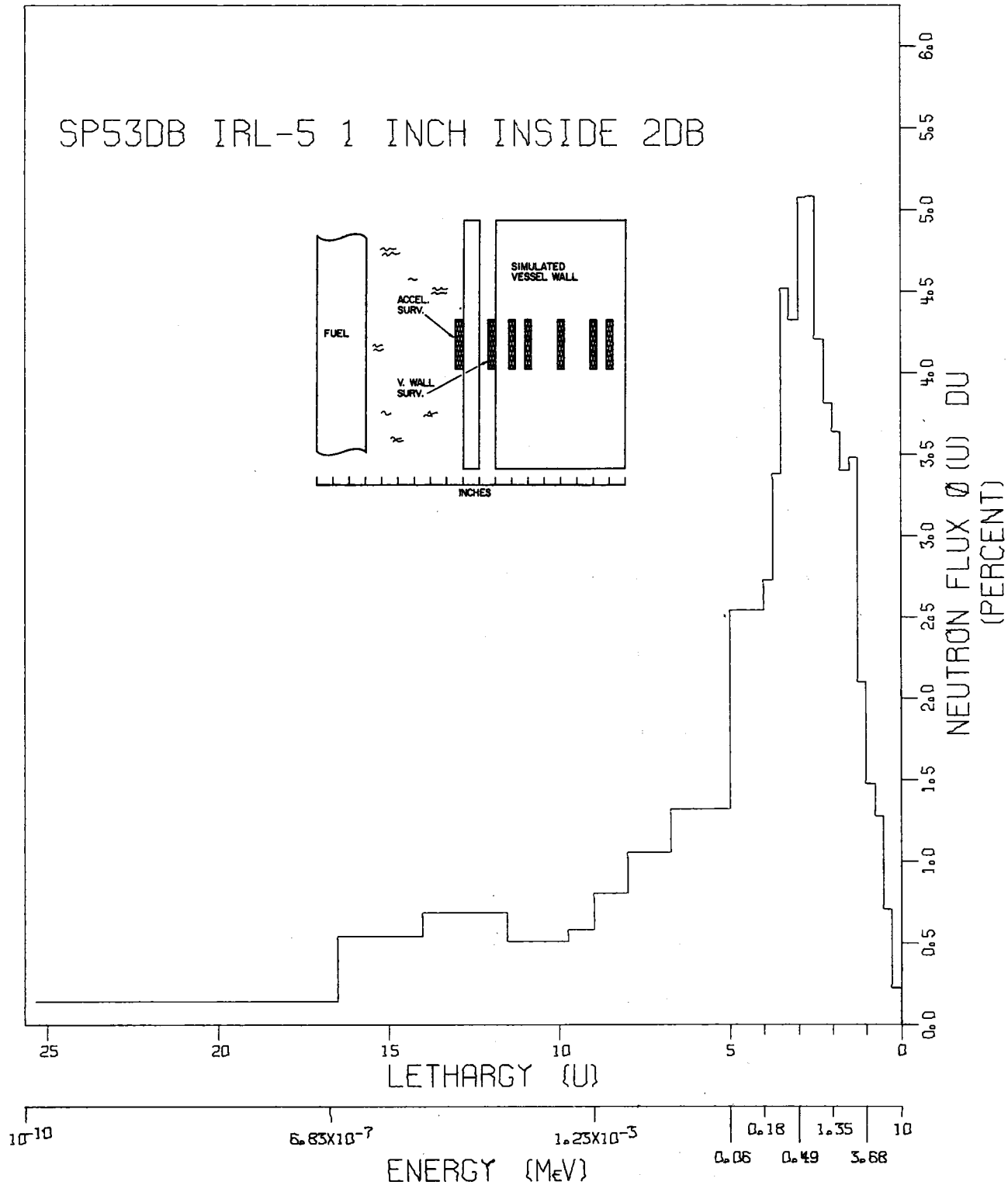
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

+In series of spectra 51DB through 57DB

SP52DB IRL-5 V WALL SURV 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.768-003	3.37476+000
0.50	6.07000+000	8.589-003	1.04829+001
0.75	4.72000+000	1.560-002	1.88837+001
1.00	3.68000+000	1.734-002	2.12194+001
1.25	2.87000+000	2.337-002	2.86209+001
1.50	2.23000+000	3.877-002	4.67903+001
1.75	1.74000+000	3.229-002	3.96219+001
2.00	1.35000+000	3.361-002	4.03294+001
2.25	1.05000+000	3.111-002	3.76962+001
2.50	8.21000-001	3.049-002	3.77343+001
2.75	6.39000-001	3.730-002	4.53241+001
3.00	4.98000-001	3.266-002	3.98882+001
3.25	3.88000-001	2.765-002	3.37371+001
3.50	3.02000-001	2.990-002	3.63387+001
3.75	2.35000-001	2.212-002	2.68466+001
4.00	1.83000-001	2.036-002	2.47933+001
5.00	6.74000-002	6.496-002	1.98044+001
6.75	1.17000-002	6.636-002	1.15391+001
8.00	3.36000-003	4.007-002	9.78017+000
9.00	1.23000-003	2.184-002	6.61759+000
9.75	5.83000-004	1.752-002	7.14616+000
11.50	1.01000-004	4.590-002	7.97346+000
14.00	8.32000-006	6.896-002	8.41146+000
16.50	6.83000-007	6.279-002	7.64854+000
25.33	1.00000-010	2.077-001	7.16150+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP53DB IRL-5 1 INCH INSIDE 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location one inch inside vessel; steel.

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.82×10^{11}	107.2
>0.5 MeV	1.35 (9.853†)	64.7
>0.1 MeV	2.17	40.3
Thermal, 49°C	0.202	-

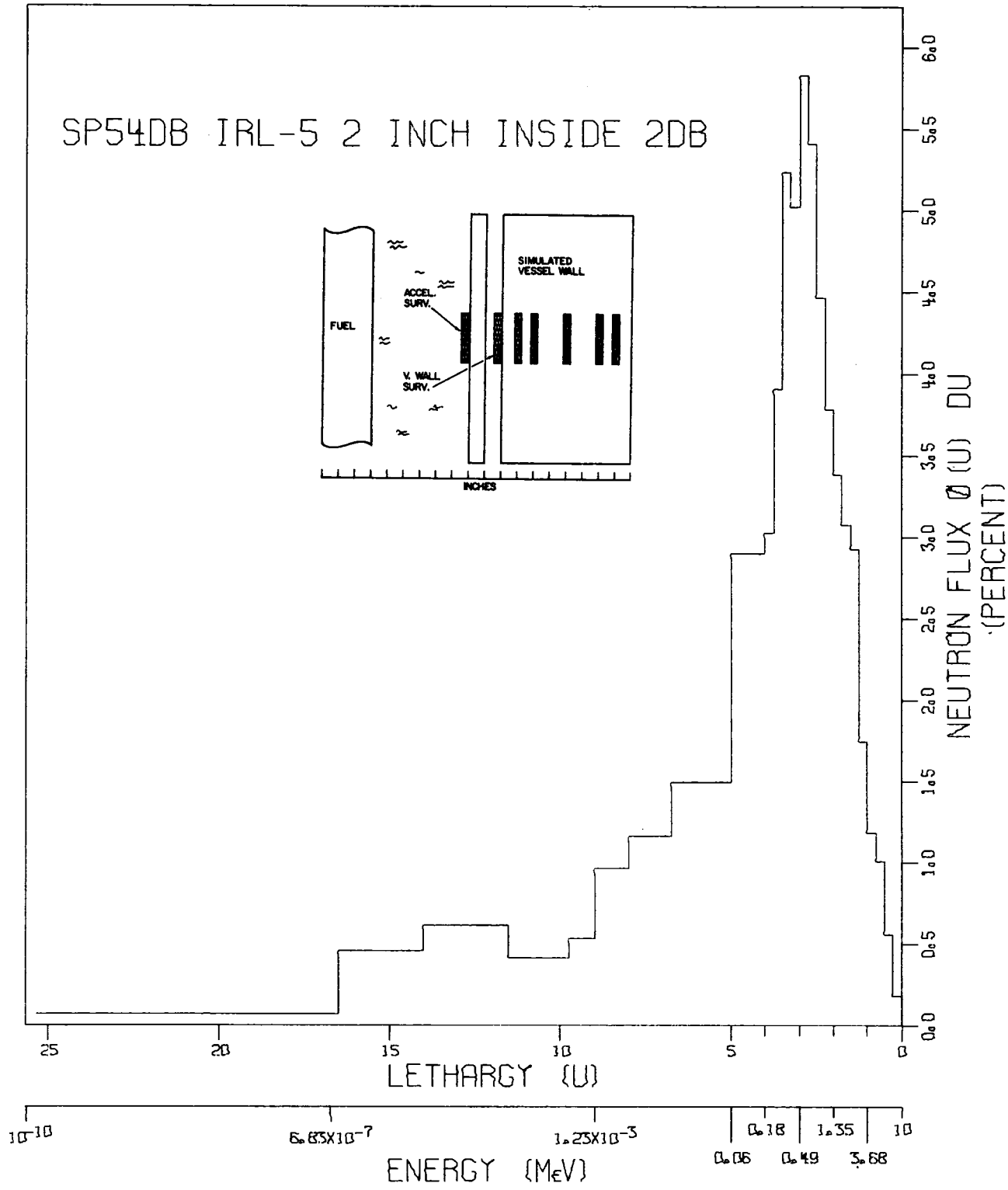
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP53DB IRL-5 1 INCH INSIDE 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	2.256-003	3.21946+000
0.50	6.07000+000	7.018-003	1.00284+001
0.75	4.72000+000	1.279-002	1.81297+001
1.00	3.68000+000	1.465-002	2.09887+001
1.25	2.87000+000	2.090-002	2.99627+001
1.50	2.23000+000	3.510-002	4.95936+001
1.75	1.74000+000	3.375-002	4.84956+001
2.00	1.35000+000	3.690-002	5.18332+001
2.25	1.05000+000	3.833-002	5.43715+001
2.50	8.21000-001	4.138-002	5.99627+001
2.75	6.39000-001	5.093-002	7.24396+001
3.00	4.98000-001	5.060-002	7.23597+001
3.25	3.88000-001	4.317-002	6.16568+001
3.50	3.02000-001	4.525-002	6.43805+001
3.75	2.35000-001	3.389-002	4.81592+001
4.00	1.83000-001	2.733-002	3.89511+001
5.00	6.74000-002	1.016-001	3.62671+001
6.75	1.17000-002	9.229-002	1.87891+001
8.00	3.36000-003	5.264-002	1.50397+001
9.00	1.23000-003	3.233-002	1.14676+001
9.75	5.83000-004	1.728-002	8.24934+000
11.50	1.01000-004	3.596-002	7.31272+000
14.00	8.32000-006	6.836-002	9.76142+000
16.50	6.83000-007	5.397-002	7.69623+000
25.33	1.00000-010	5.129-002	2.07085+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP54DB IRL-5 2 INCH INSIDE 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location two inches inside vessel; steel

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.58×10^{11}	97.3
>0.5 MeV	1.04 (7.391+)	53.9
>0.1 MeV	1.79	31.3
Thermal, 49°C	0.077	-

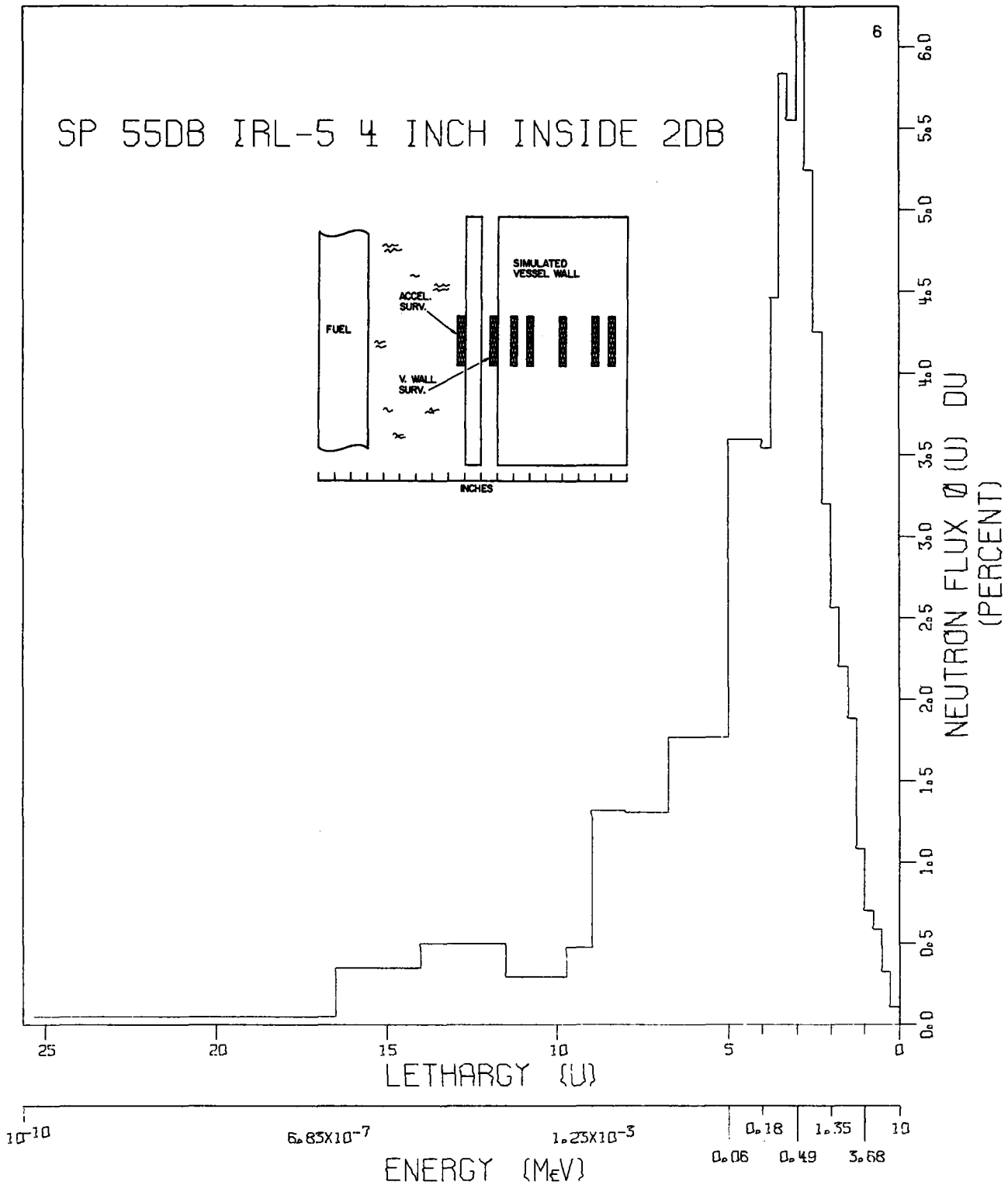
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP54DB IRL-5 2 INCH INSIDE 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.780-003	3.13386+000
0.50	6.07000+000	5.566-003	9.80676+000
0.75	4.72000+000	1.013-002	1.76965+001
1.00	3.68000+000	1.174-002	2.07262+001
1.25	2.87000+000	1.734-002	3.06569+001
1.50	2.23000+000	2.952-002	5.14312+001
1.75	1.74000+000	3.051-002	5.40449+001
2.00	1.35000+000	3.431-002	5.94298+001
2.25	1.05000+000	3.797-002	6.64072+001
2.50	8.21000-001	4.393-002	7.84884+001
2.75	6.39000-001	5.417-002	9.50083+001
3.00	4.98000-001	5.806-002	1.02366+002
3.25	3.88000-001	5.010-002	8.82401+001
3.50	3.02000-001	5.241-002	9.19370+001
3.75	2.35000-001	3.915-002	6.86080+001
4.00	1.83000-001	3.022-002	5.31135+001
5.00	6.74000-002	1.158-001	5.09666+001
6.75	1.17000-002	1.047-001	2.62761+001
8.00	3.36000-003	5.799-002	2.04298+001
9.00	1.23000-003	3.870-002	1.69264+001
9.75	5.83000-004	1.587-002	9.34267+000
11.50	1.01000-004	2.867-002	7.18769+000
14.00	8.32000-006	6.131-002	1.07948+001
16.50	6.83000-007	4.553-002	8.00499+000
25.33	1.00000-010	2.459-002	1.22417+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


6
SP 55DB IRL-5 4 INCH INSIDE 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location four inches inside vessel; steel.

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.27×10^{11}	82.9
>0.5 MeV	0.57 (3.991†)	38.5
>0.1 MeV	1.14	19.4
Thermal, 49°C	0.035	-

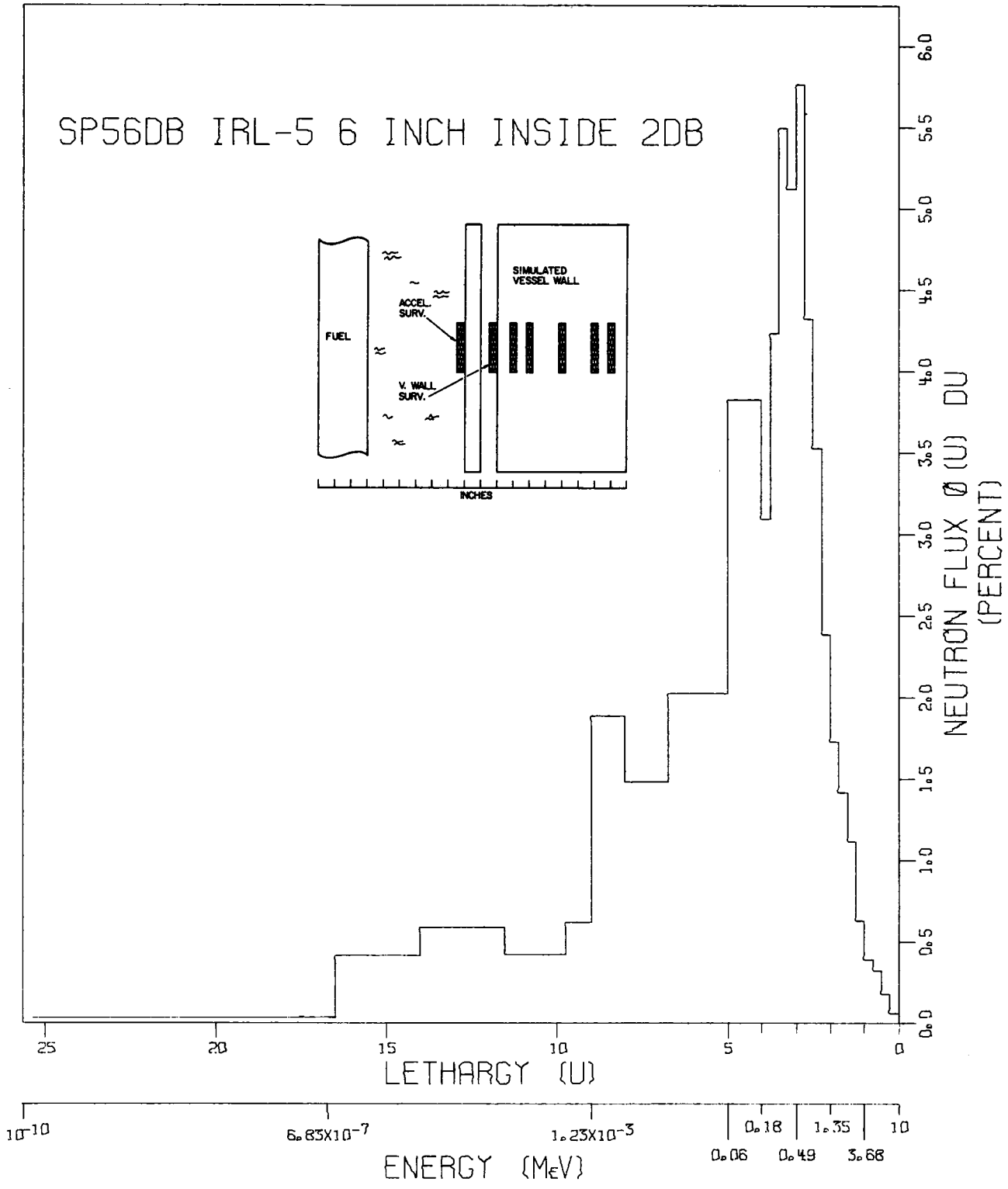
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP 55DB IRL-5 4 INCH INSIDE 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.025-003	2.98680+000
0.50	6.07000+000	3.224-003	9.40757+000
0.75	4.72000+000	5.878-003	1.70119+001
1.00	3.68000+000	6.972-003	2.03921+001
1.25	2.87000+000	1.076-002	3.15032+001
1.50	2.23000+000	1.895-002	5.46734+001
1.75	1.74000+000	2.179-002	6.39412+001
2.00	1.35000+000	2.598-002	7.45218+001
2.25	1.05000+000	3.218-002	9.32093+001
2.50	8.21000-001	4.181-002	1.23723+002
2.75	6.39000-001	5.254-002	1.52626+002
3.00	4.98000-001	6.308-002	1.84193+002
3.25	3.88000-001	5.541-002	1.61622+002
3.50	3.02000-001	5.851-002	1.69991+002
3.75	2.35000-001	4.477-002	1.29934+002
4.00	1.83000-001	3.542-002	1.03115+002
5.00	6.74000-002	1.434-001	1.04521+002
6.75	1.17000-002	1.238-001	5.14591+001
8.00	3.36000-003	6.521-002	3.80506+001
9.00	1.23000-003	5.307-002	3.84452+001
9.75	5.83000-004	1.419-002	1.38388+001
11.50	1.01000-004	2.060-002	8.55391+000
14.00	8.32000-006	4.954-002	1.44472+001
16.50	6.83000-007	3.491-002	1.01654+001
25.33	1.00000-010	1.698-002	1.40012+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP56DB IRL-5 6 INCH INSIDE 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø(U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment: location six inches inside vessel wall; steel.

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.12×10^{11}	69.7
>0.5 MeV	0.31 (1.912†)	28.1
>0.1 MeV	0.68	12.6
Thermal, 49°C	0.016	-

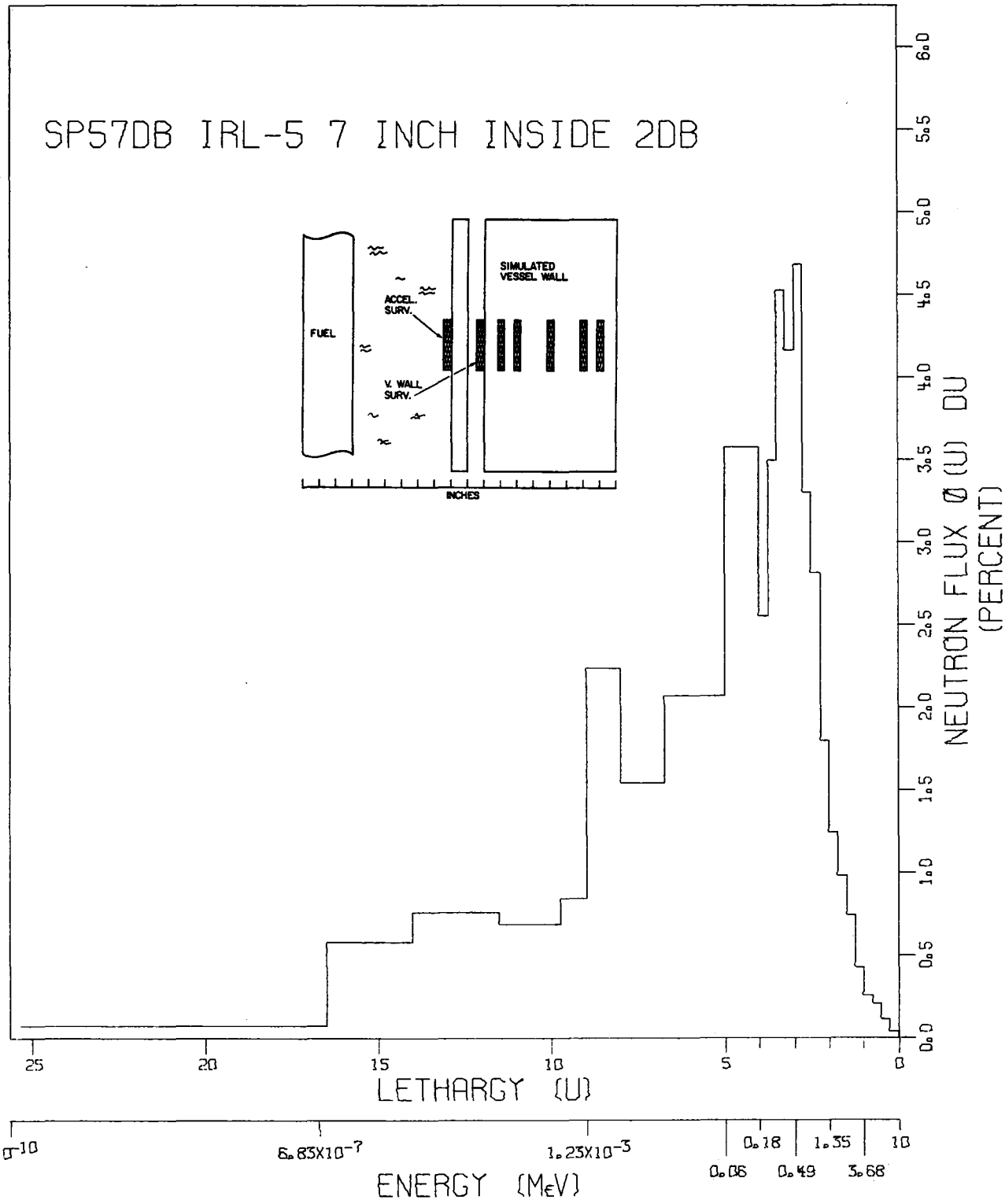
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP56DB IRL-5 6 INCH INSIDE 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	5.612-004	2.90034+000
0.50	6.07000+000	1.746-003	9.03112+000
0.75	4.72000+000	3.214-003	1.64945+001
1.00	3.68000+000	3.856-003	1.99954+001
1.25	2.87000+000	6.207-003	3.22266+001
1.50	2.23000+000	1.122-002	5.74088+001
1.75	1.74000+000	1.399-002	7.27857+001
2.00	1.35000+000	1.752-002	8.91008+001
2.25	1.05000+000	2.392-002	1.22879+002
2.50	8.21000-001	3.468-002	1.81976+002
2.75	6.39000-001	4.330-002	2.23017+002
3.00	4.98000-001	5.745-002	2.97432+002
3.25	3.88000-001	5.106-002	2.64083+002
3.50	3.02000-001	5.505-002	2.83591+002
3.75	2.35000-001	4.246-002	2.18484+002
4.00	1.83000-001	3.095-002	1.59721+002
5.00	6.74000-002	1.528-001	1.97480+002
6.75	1.17000-002	1.418-001	1.04561+002
8.00	3.36000-003	7.399-002	7.65516+001
9.00	1.23000-003	7.581-002	9.73734+001
9.75	5.83000-004	1.849-002	3.19607+001
11.50	1.01000-004	2.917-002	2.14812+001
14.00	8.32000-006	5.835-002	3.01673+001
16.50	6.83000-007	4.135-002	2.13526+001
25.33	1.00000-010	1.099-002	1.60612+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP57DB IRL-5 7 INCH INSIDE 2DB
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location seven inches inside vessel; steel.

Spectrum Code

Code: 2DB Calculation: BNW [30,32]

Lower Energy Limit	Neutron Flux* $n/cm^2/sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.084×10^{11}	63.9
>0.5 MeV	0.22 (1.174†)	24.1
>0.1 MeV	0.53	10.1
Thermal, 49°C	0.035	-

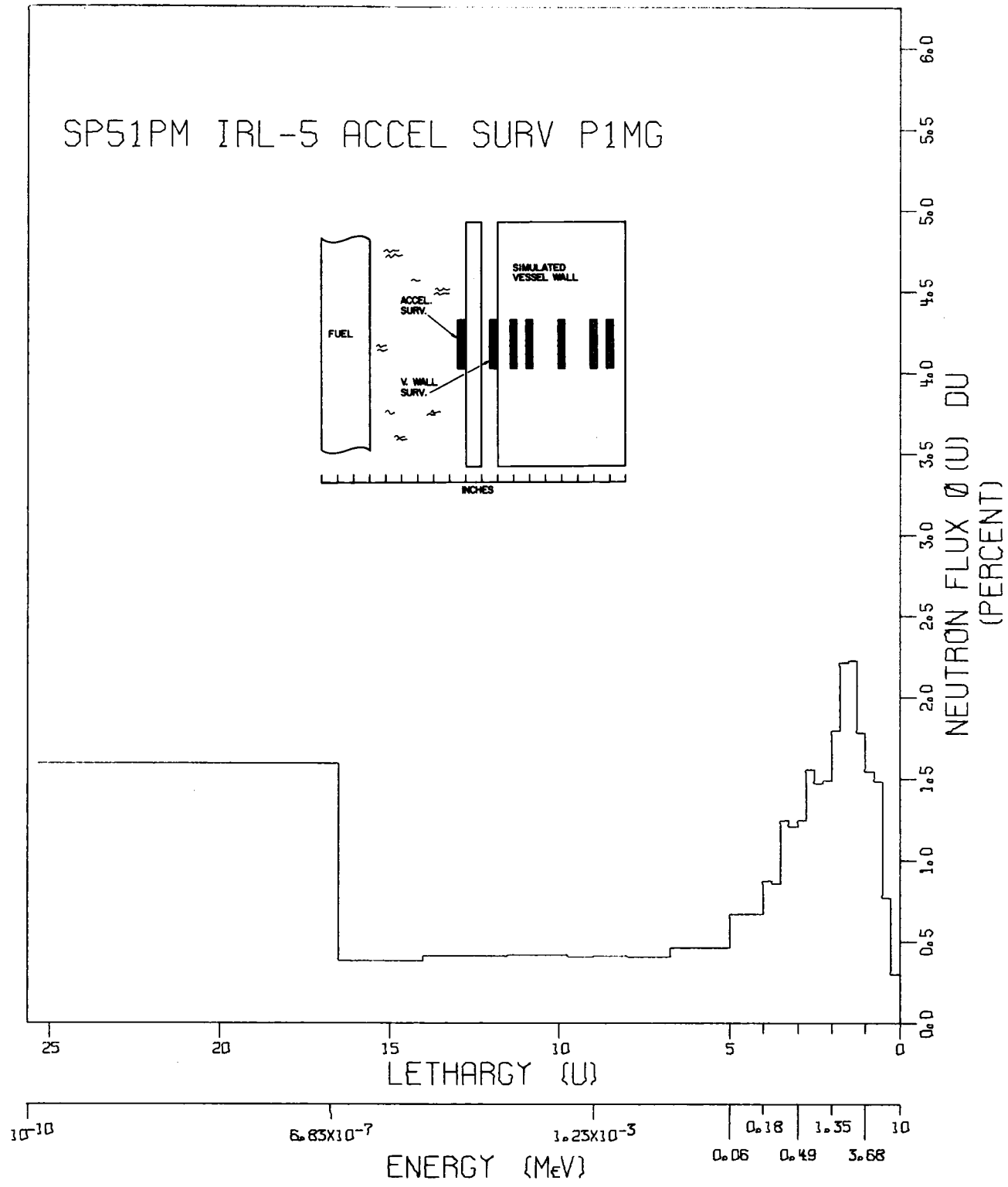
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51DB through 57DB

SP57DB IRL-5 7 INCH INSIDE 2DB

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	3.543-004	2.80301+000
0.50	6.07000+000	1.095-003	8.66998+000
0.75	4.72000+000	2.051-003	1.61068+001
1.00	3.68000+000	2.526-003	2.00492+001
1.25	2.87000+000	4.182-003	3.32350+001
1.50	2.23000+000	7.467-003	5.84666+001
1.75	1.74000+000	9.722-003	7.74126+001
2.00	1.35000+000	1.261-002	9.81750+001
2.25	1.05000+000	1.810-002	1.42263+002
2.50	8.21000-001	2.767-002	2.22232+002
2.75	6.39000-001	3.309-002	2.60875+002
3.00	4.98000-001	4.666-002	3.69742+002
3.25	3.88000-001	4.155-002	3.28881+002
3.50	3.02000-001	4.532-002	3.57336+002
3.75	2.35000-001	3.505-002	2.76087+002
4.00	1.83000-001	2.550-002	2.01481+002
5.00	6.74000-002	1.427-001	2.82262+002
6.75	1.17000-002	1.450-001	1.63598+002
8.00	3.36000-003	7.681-002	1.21629+002
9.00	1.23000-003	8.993-002	1.76805+002
9.75	5.83000-004	2.509-002	6.63934+001
11.50	1.01000-004	4.803-002	5.41313+001
14.00	8.32000-006	7.628-002	6.03661+001
16.50	6.83000-007	5.779-002	4.56699+001
25.33	1.00000-010	2.543-002	5.69009+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP51PM IRL-5 ACCEL SURV P1MG
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; accelerated irradiation-rate surveillance location; steel and water.

Spectrum Code

Code: P1MG Calculation: Westinghouse [30,33]

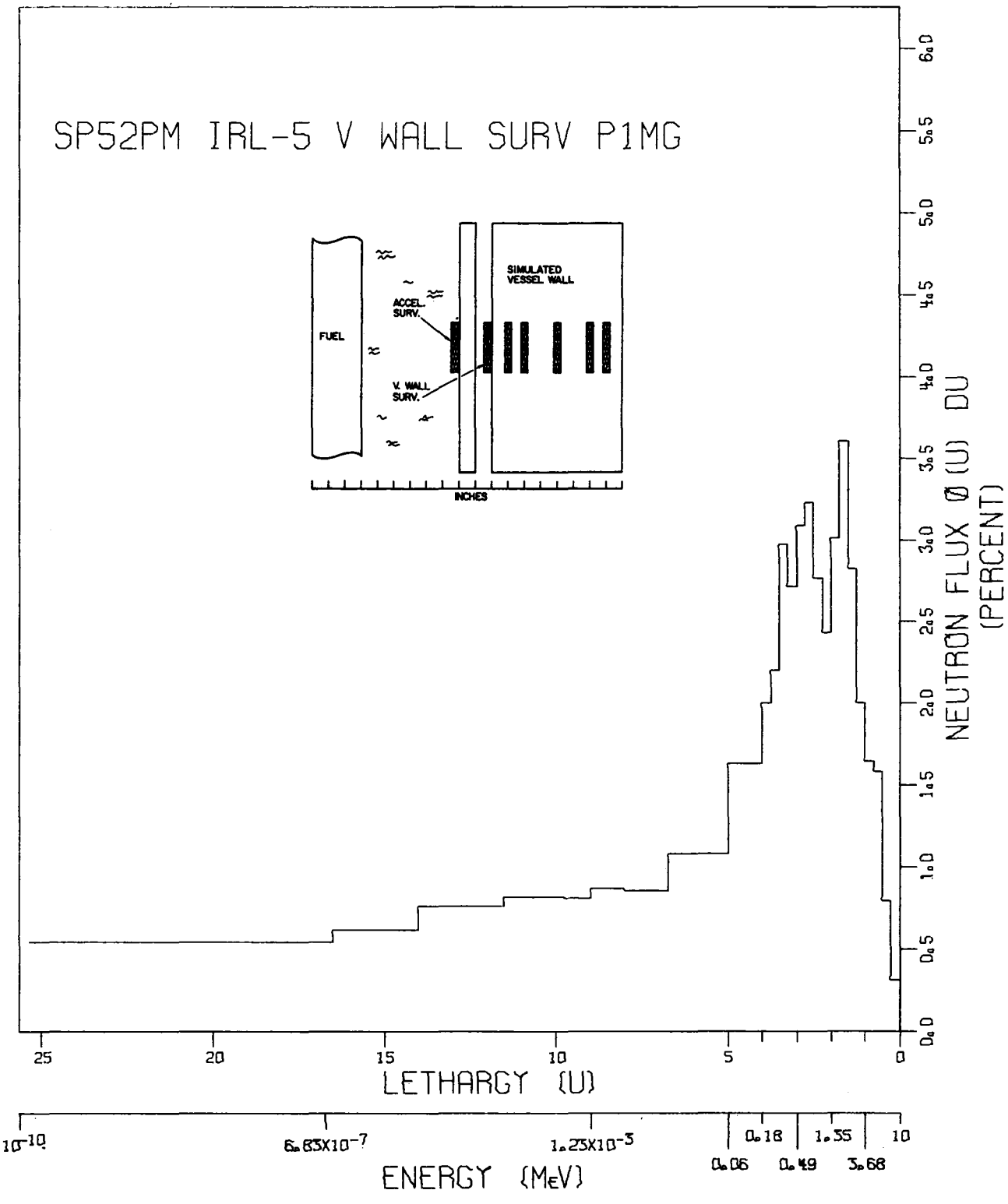
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.45×10^{11}	159.7
>0.5 MeV	3.17 (43.439†)	123.7
>0.1 MeV	4.19	93.6
Thermal, 49°C	10.03×10^{11}	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
†In series of spectra 51PM through 57PM

SP51PM IRL-5 ACCEL SURV P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.001-003	4.35611+000
0.50	6.07000+000	7.675-003	1.11520+001
0.75	4.72000+000	1.491-002	2.14920+001
1.00	3.68000+000	1.535-002	2.23531+001
1.25	2.87000+000	1.767-002	2.57661+001
1.50	2.23000+000	2.241-002	3.21980+001
1.75	1.74000+000	2.197-002	3.20932+001
2.00	1.35000+000	1.819-002	2.59896+001
2.25	1.05000+000	1.491-002	2.15045+001
2.50	8.21000-001	1.444-002	2.12711+001
2.75	6.39000-001	1.557-002	2.25256+001
3.00	4.98000-001	1.237-002	1.79941+001
3.25	3.88000-001	1.200-002	1.74346+001
3.50	3.02000-001	1.246-002	1.80320+001
3.75	2.35000-001	8.555-003	1.23637+001
4.00	1.83000-001	8.718-003	1.26363+001
5.00	6.74000-002	2.677-002	9.71508+000
6.75	1.17000-002	3.240-002	6.70837+000
8.00	3.36000-003	2.033-002	5.90602+000
9.00	1.23000-003	1.660-002	5.98979+000
9.75	5.83000-004	1.204-002	5.84607+000
11.50	1.01000-004	2.915-002	6.02863+000
14.00	8.32000-006	4.093-002	5.94362+000
16.50	6.83000-007	3.825-002	5.54680+000
25.33	1.00000-010	5.633-001	2.31292+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP52PM IRL-5 V WALL SURV P1MG
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; vessel wall surveillance location; steel and water.

Spectrum Code

Code: P1MG Calculation: Westinghouse [30,33]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	1.23×10^{11}	128.8
>0.5 MeV	1.79 (23.262†)	88.4
>0.1 MeV	2.69	58.9
Thermal, 49°C	1.25	-

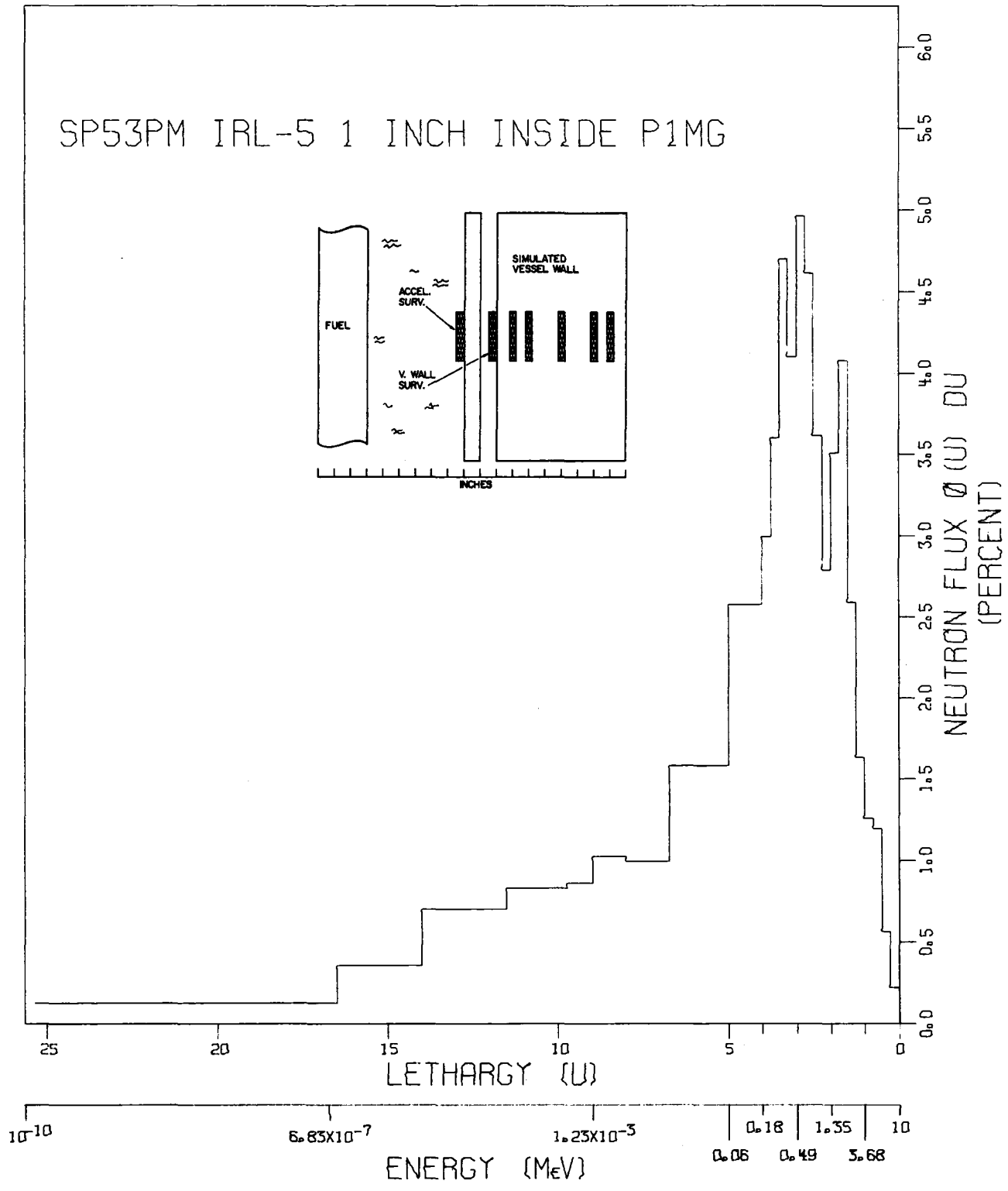
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51PM through 57PM

SP52PM IRL-5 V WALL SURV P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	3.106-003	4.11140+000
0.50	6.07000+000	7.876-003	1.04357+001
0.75	4.72000+000	1.591-002	2.09044+001
1.00	3.68000+000	1.634-002	2.17000+001
1.25	2.87000+000	1.984-002	2.63879+001
1.50	2.23000+000	2.849-002	3.73298+001
1.75	1.74000+000	3.576-002	4.76371+001
2.00	1.35000+000	3.054-002	3.97808+001
2.25	1.05000+000	2.442-002	3.21253+001
2.50	8.21000-001	2.725-002	3.66190+001
2.75	6.39000-001	3.240-002	4.27356+001
3.00	4.98000-001	3.077-002	4.08019+001
3.25	3.88000-001	2.704-002	3.58155+001
3.50	3.02000-001	2.977-002	3.92781+001
3.75	2.35000-001	2.203-002	2.90306+001
4.00	1.83000-001	2.000-002	2.64396+001
5.00	6.74000-002	6.502-002	2.15169+001
6.75	1.17000-002	7.566-002	1.42828+001
8.00	3.36000-003	4.269-002	1.13116+001
9.00	1.23000-003	3.487-002	1.14693+001
9.75	5.83000-004	2.424-002	1.07307+001
11.50	1.01000-004	5.722-002	1.07905+001
14.00	8.32000-006	7.569-002	1.00229+001
16.50	6.83000-007	6.166-002	8.15341+000
25.33	1.00000-010	1.914-001	7.16589+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP53PM IRL-5 1 INCH INSIDE P1MG
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU (PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location one inch inside vessel; steel.

Spectrum Code

Code: P1MG Calculation: Westinghouse [30, 33]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.84×10^{11}	104.2
>0.5 MeV	1.45 (17.62†)	60.6
>0.1 MeV	2.44	35.9
Thermal, 49°C	0.202	-

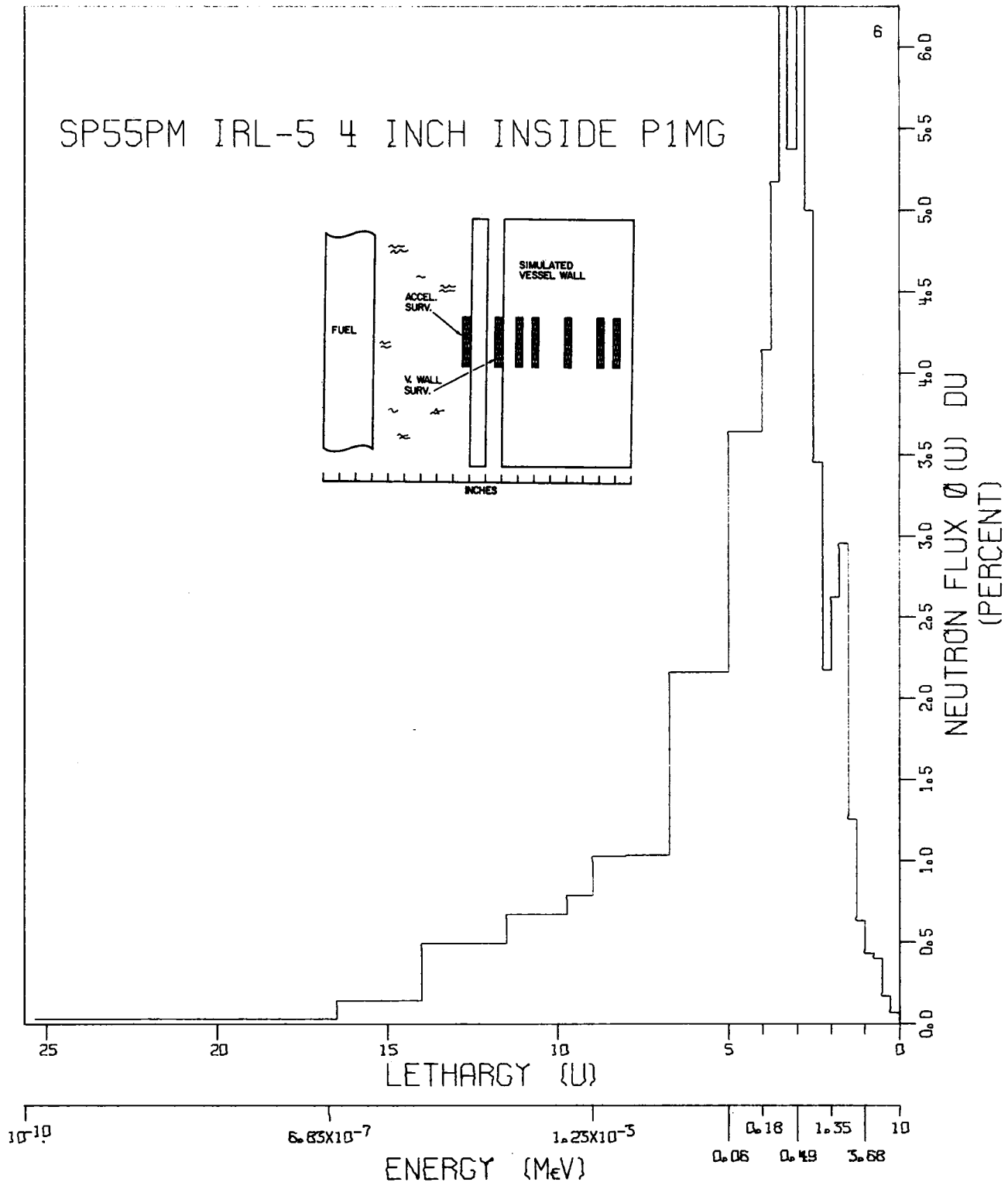
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51PM through 57PM

SP53PM IRL-5 1 INCH INSIDE P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.197-003	3.70351+000
0.50	6.07000+000	5.625-003	9.49236+000
0.75	4.72000+000	1.201-002	2.00983+001
1.00	3.68000+000	1.246-002	2.10768+001
1.25	2.87000+000	1.619-002	2.74131+001
1.50	2.23000+000	2.608-002	4.35089+001
1.75	1.74000+000	4.045-002	6.86379+001
2.00	1.35000+000	3.559-002	5.90354+001
2.25	1.05000+000	2.803-002	4.69603+001
2.50	8.21000-001	3.556-002	6.08420+001
2.75	6.39000-001	4.624-002	7.76709+001
3.00	4.98000-001	4.947-002	8.35415+001
3.25	3.88000-001	4.094-002	6.90477+001
3.50	3.02000-001	4.711-002	7.91515+001
3.75	2.35000-001	3.608-002	6.05470+001
4.00	1.83000-001	2.990-002	5.03362+001
5.00	6.74000-002	1.029-001	4.33855+001
6.75	1.17000-002	1.106-001	2.65790+001
8.00	3.36000-003	4.958-002	1.67295+001
9.00	1.23000-003	4.106-002	1.71989+001
9.75	5.83000-004	2.569-002	1.44875+001
11.50	1.01000-004	5.807-002	1.39458+001
14.00	8.32000-006	6.953-002	1.17249+001
16.50	6.83000-007	3.539-002	5.95943+000
25.33	1.00000-010	4.324-002	2.06195+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP55PM IRL-5 4 INCH INSIDE P1MG
6
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-5
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location four inches inside vessel; steel

Spectrum Code

Code: P1MG Calculation: Westinghouse [30,33]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.36×10^{11}	61.1
≥0.5 MeV	0.82 (9.31+)	27.0
>0.1 MeV	1.77	12.5
Thermal, 49 °C	0.035	-

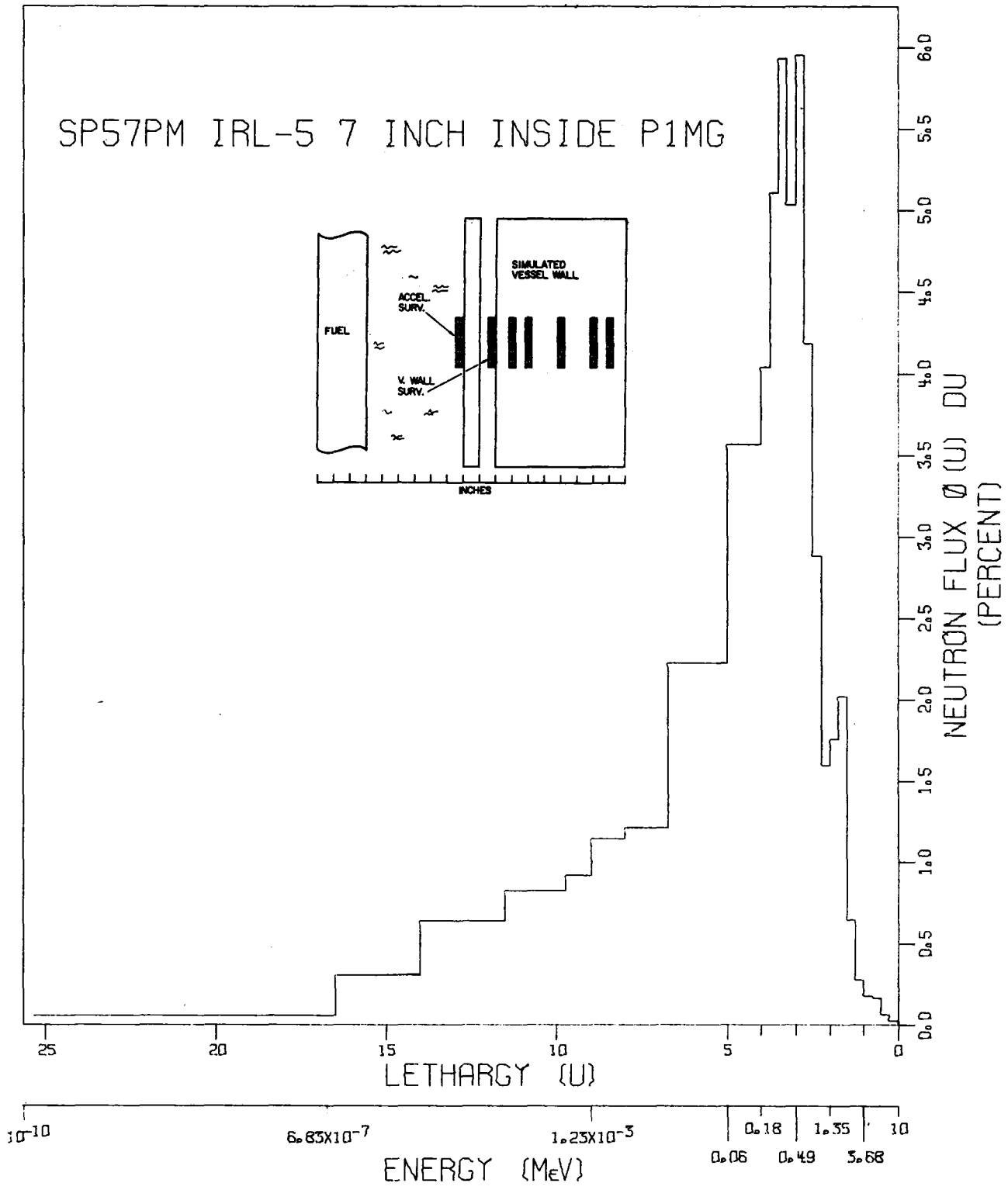
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 51PM through 57PM

SP55PM IRL-5 4 INCH INSIDE P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	6.509-004	2.94023+000
0.50	6.07000+000	1.680-003	7.59561+000
0.75	4.72000+000	4.037-003	1.81049+001
1.00	3.68000+000	4.308-003	1.95285+001
1.25	2.87000+000	6.272-003	2.84620+001
1.50	2.23000+000	1.269-002	5.67459+001
1.75	1.74000+000	2.934-002	1.33425+002
2.00	1.35000+000	2.664-002	1.18449+002
2.25	1.05000+000	2.186-002	9.81189+001
2.50	8.21000-001	3.403-002	1.56033+002
2.75	6.39000-001	5.011-002	2.25564+002
3.00	4.98000-001	6.400-002	2.89624+002
3.25	3.88000-001	5.364-002	2.42472+002
3.50	3.02000-001	6.278-002	2.82647+002
3.75	2.35000-001	5.190-002	2.33430+002
4.00	1.83000-001	4.142-002	1.86849+002
5.00	6.74000-002	1.456-001	1.64484+002
6.75	1.17000-002	1.513-001	9.75080+001
8.00	3.36000-003	5.170-002	4.67543+001
9.00	1.23000-003	4.148-002	4.65722+001
9.75	5.83000-004	2.340-002	3.53590+001
11.50	1.01000-004	4.717-002	3.03539+001
14.00	8.32000-006	4.886-002	2.20810+001
16.50	6.83000-007	1.429-002	6.45079+000
25.33	1.00000-010	1.079-002	1.37820+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP57PM IRL-5 7 INCH INSIDE P1MG
FUEL
ACCEL. SURV.
V. WALL SURV.
SIMULATED VESSEL WALL
INCHES
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10
0.18
1.35
0.06
0.49
3.68
6.83X10-7
1.23X10-3
ENERGY (MeV)

Reactor Description

Name: Industrial Reactor Laboratories, Inc.

Type: Pool, research Power Level: 4.84 MWt

Coolant: Light water Moderator: Light water

Location: Plainsboro, New Jersey

Spectrum Facility Description

Simulated vessel wall experiment; location seven inches inside vessel; steel

Spectrum Code

Code: P1MG Calculation: Westinghouse [30,33]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	0.098×10^{11}	54.9
>0.5 MeV	0.35 (3.91†)	15.3
>0.1 MeV	0.87	6.2
Thermal, 49°C	0.035	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

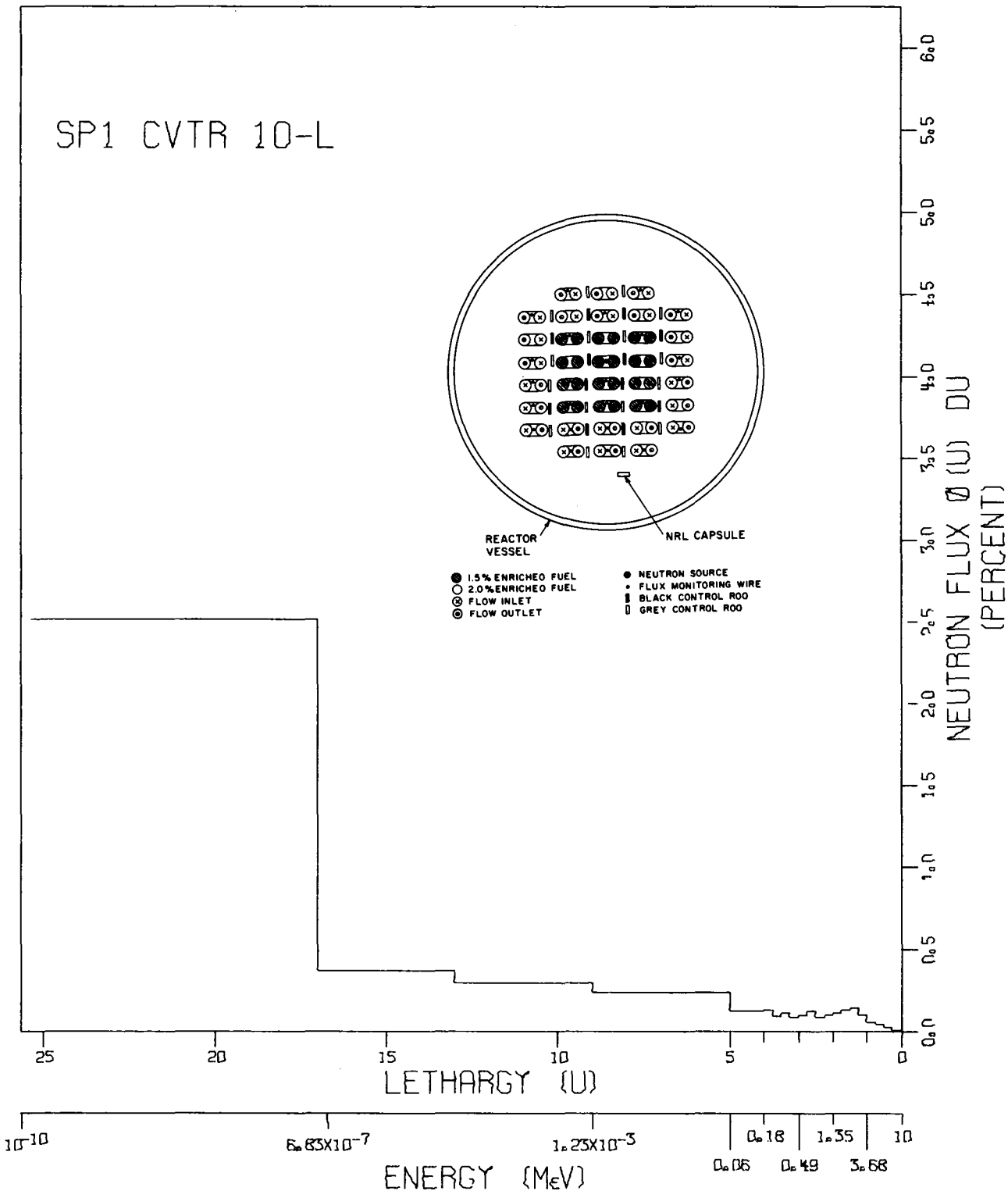
†In series of spectra 51PM through 57PM

SP57PM IRL-5 7 INCH INSIDE P1MG

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	2.348-004	2.41766+000
0.50	6.07000+000	6.153-004	6.34094+000
0.75	4.72000+000	1.634-003	1.67019+001
1.00	3.68000+000	1.721-003	1.77806+001
1.25	2.87000+000	2.700-003	2.79263+001
1.50	2.23000+000	6.460-003	6.58259+001
1.75	1.74000+000	2.000-002	2.07257+002
2.00	1.35000+000	1.784-002	1.80686+002
2.25	1.05000+000	1.602-002	1.63863+002
2.50	8.21000-001	2.836-002	2.96364+002
2.75	6.39000-001	4.190-002	4.29821+002
3.00	4.98000-001	5.935-002	6.12054+002
3.25	3.88000-001	5.019-002	5.17004+002
3.50	3.02000-001	5.945-002	6.09942+002
3.75	2.35000-001	5.119-002	5.24689+002
4.00	1.83000-001	4.036-002	4.14922+002
5.00	6.74000-002	1.422-001	3.65989+002
6.75	1.17000-002	1.557-001	2.28678+002
8.00	3.36000-003	6.052-002	1.24713+002
9.00	1.23000-003	4.581-002	1.17197+002
9.75	5.83000-004	2.746-002	9.45732+001
11.50	1.01000-004	5.765-002	8.45499+001
14.00	8.32000-006	6.337-002	6.52600+001
16.50	6.83000-007	3.027-002	3.11267+001
25.33	1.00000-010	1.898-002	5.52568+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U

HEAVY WATER MODERATED REACTORS


SP1 CVTR 10-L
REACTOR VESSEL
NRL CAPSULE
1.5% ENRICHED FUEL
2.0% ENRICHED FUEL
FLOW INLET
FLOW OUTLET
NEUTRON SOURCE
FLUX MONITORING WIRE
BLACK CONTROL ROD
GREY CONTROL ROD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Carolinas-Virginia Tube Reactor

Type: Power, pressure tube Power Level: 56 MWt

Coolant: Heavy water Moderator: Heavy water

Location: Parr, South Carolina

Spectrum Facility Description

Position 10-L; unfueled pressure tube location in heavy water coolant; steel and heavy water.

Spectrum Code

Code: 2DXY Calculation: BNW [11,13]

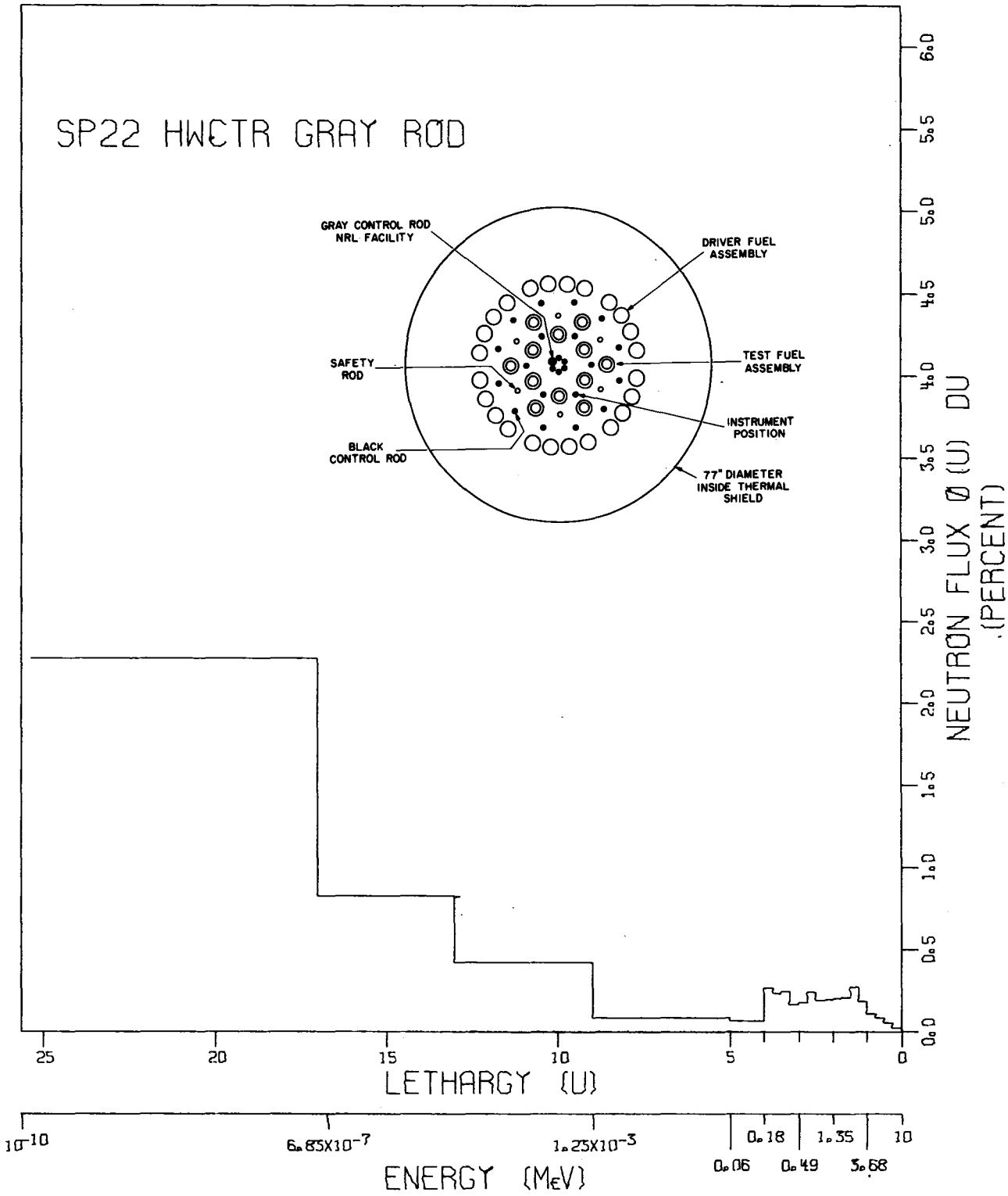
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	3.11×10^{11}	116.7
>0.5 MeV	4.43	81.8
>0.1 MeV	7.48	48.5
Thermal, 49 °C	6.82×10^{13}	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Fluxes calculated @ 53.2 MWt

SP1 CVTR 10-L

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	7,576-005	2,89123+000
0,50	6,07000+000	2,198-004	8,39763+000
0,75	4,72000+000	3,997-004	1,51451+001
1,00	3,68000+000	5,663-004	2,16863+001
1,25	2,87000+000	1,001-003	3,83966+001
1,50	2,23000+000	1,420-003	5,36363+001
1,75	1,74000+000	1,289-003	4,95300+001
2,00	1,35000+000	1,103-003	4,14297+001
2,25	1,05000+000	1,010-003	3,82900+001
2,50	8,21000-001	8,675-004	3,36069+001
2,75	6,39000-001	1,245-003	4,73559+001
3,00	4,98000-001	9,594-004	3,66777+001
3,25	3,88000-001	8,499-004	3,24567+001
3,50	3,02000-001	1,090-003	4,14755+001
3,75	2,35000-001	9,067-004	3,44514+001
4,00	1,83000-001	1,287-003	4,90457+001
5,00	6,74000-002	4,985-003	4,75725+001
9,00	1,23000-003	3,752-002	8,93241+001
13,00	2,26000-005	4,689-002	1,11813+002
17,00	4,14000-007	5,913-002	1,40893+002
25,33	1,00000-010	8,372-001	9,58097+002
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP22 HWCTR GRAY ROD
GRAY CONTROL ROD
NRL FACILITY
DRIVER FUEL
ASSEMBLY
SAFETY
ROD
TEST FUEL
ASSEMBLY
INSTRUMENT
POSITION
BLACK
CONTROL ROD
77" DIAMETER
INSIDE THERMAL
SHIELD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.85X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Heavy Water Components Test Reactor

Type: Test Power Level: 45 MWt

Coolant: Heavy water Moderator: Heavy water

Location: Savannah River Laboratories, Aiken, S. Carolina

Spectrum Facility Description

Gray control rod location; above mid-plane; steel and heavy water

Spectrum Code

Code: Program S Calculation: BNW [12,13]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	3.34×10^{12}	124.8
>0.5 MeV	4.73	88.1
>0.1 MeV	7.35	56.7
Thermal, 232°C	1.90×10^{14}	-

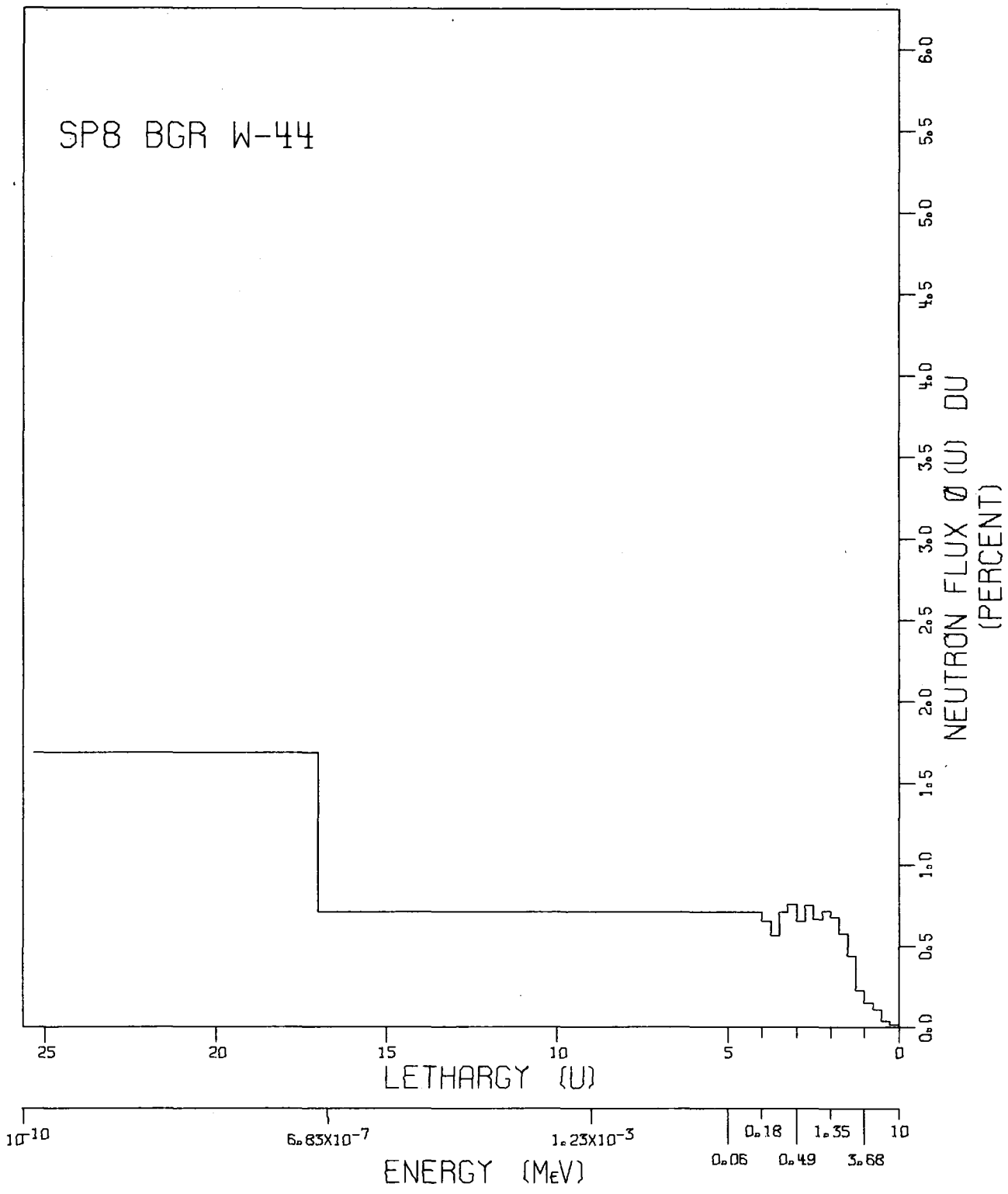
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Flux calculated at 43 MWt

SP22 HWCTR GRAY ROD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.714-004	3.37899+000
0.50	6.07000+000	4.690-004	9.25758+000
0.75	4.72000+000	8.216-004	1.60858+001
1.00	3.68000+000	1.063-003	2.10279+001
1.25	2.87000+000	1.777-003	3.51934+001
1.50	2.23000+000	2.696-003	5.26287+001
1.75	1.74000+000	2.009-003	3.98825+001
2.00	1.35000+000	2.041-003	3.96127+001
2.25	1.05000+000	1.934-003	3.79007+001
2.50	8.21000-001	1.848-003	3.69852+001
2.75	6.39000-001	2.356-003	4.62968+001
3.00	4.98000-001	1.729-003	3.41645+001
3.25	3.88000-001	1.628-003	3.21131+001
3.50	3.02000-001	2.440-003	4.79631+001
3.75	2.35000-001	2.300-003	4.51538+001
4.00	1.83000-001	2.587-003	5.09519+001
5.00	6.74000-002	2.493-003	1.22935+001
9.00	1.23000-003	1.283-002	1.57796+001
13.00	2.26000-005	6.650-002	8.19417+001
17.00	4.14000-007	1.322-001	1.62789+002
25.33	1.00000-010	7.581-001	4.48286+002
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U

GRAPHITE MODERATED REACTORS


SP8 BGR W-44
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Brookhaven Graphite Reactor

Type: Research, pile Power Level: 20 MWt

Coolant: Air Moderator: Graphite

Location: Brookhaven National Laboratory, Upton, L. I., New York

Spectrum Facility Description

Horizontal experiment hole, W-44; unfueled; steel, air and aluminum.

Spectrum Code

Code: 2 DXY Calculation: BNW [12,13]

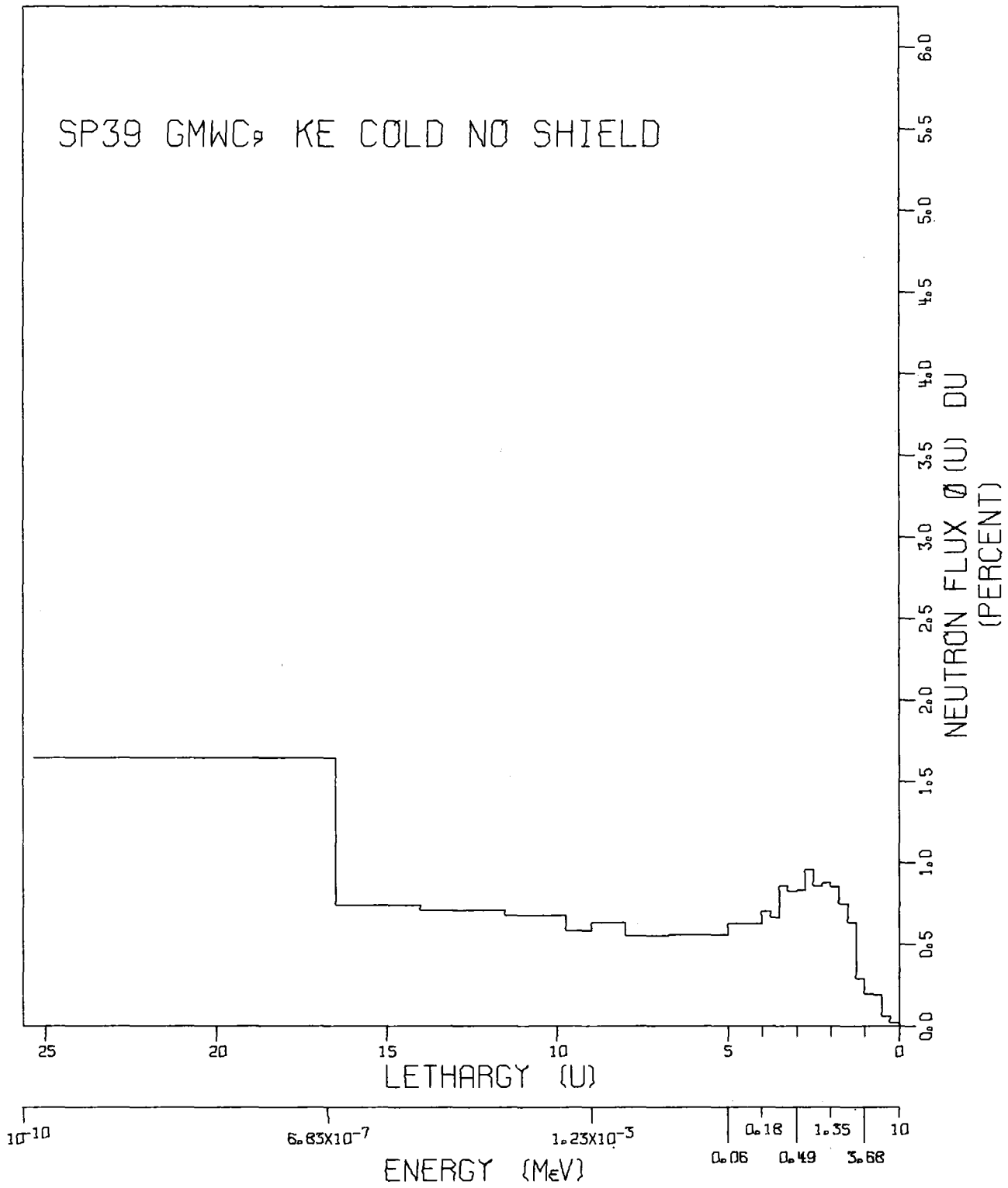
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	3.10×10^{11}	69.7
>0.5 MeV	5.22	41.4
>0.1 MeV	9.74	22.2
Thermal, 49°C	5.85×10^{13}	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP8 BGR W-44

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	9,811-005	1,49186+000
0,50	6,07000+000	3,780-004	5,75386+000
0,75	4,72000+000	1,077-003	1,62595+001
1,00	3,68000+000	1,475-003	2,25024+001
1,25	2,87000+000	2,244-003	3,42792+001
1,50	2,23000+000	4,417-003	6,64770+001
1,75	1,74000+000	5,710-003	8,73904+001
2,00	1,35000+000	6,806-003	1,01845+002
2,25	1,05000+000	7,124-003	1,07647+002
2,50	8,21000-001	6,525-003	1,00715+002
2,75	6,39000-001	7,503-003	1,13689+002
3,00	4,98000-001	6,454-003	9,83066+001
3,25	3,88000-001	7,547-003	1,14819+002
3,50	3,02000-001	7,075-003	1,07226+002
3,75	2,35000-001	5,611-003	8,49438+001
4,00	1,83000-001	6,465-003	9,81599+001
17,00	4,14000-007	3,649-001	1,06610+002
25,33	1,00000-010	5,586-001	2,54683+002
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP39 GMWC9 KE COLD NO SHIELD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: K-East

Type: Production Power Level: Not available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility; no thermal neutron shield; flux ratio Thermal (49°C): Fast >0.5 MeV = 9:1

Spectrum Code

Code: DTF-IV Calculation: BNW [28, 34]

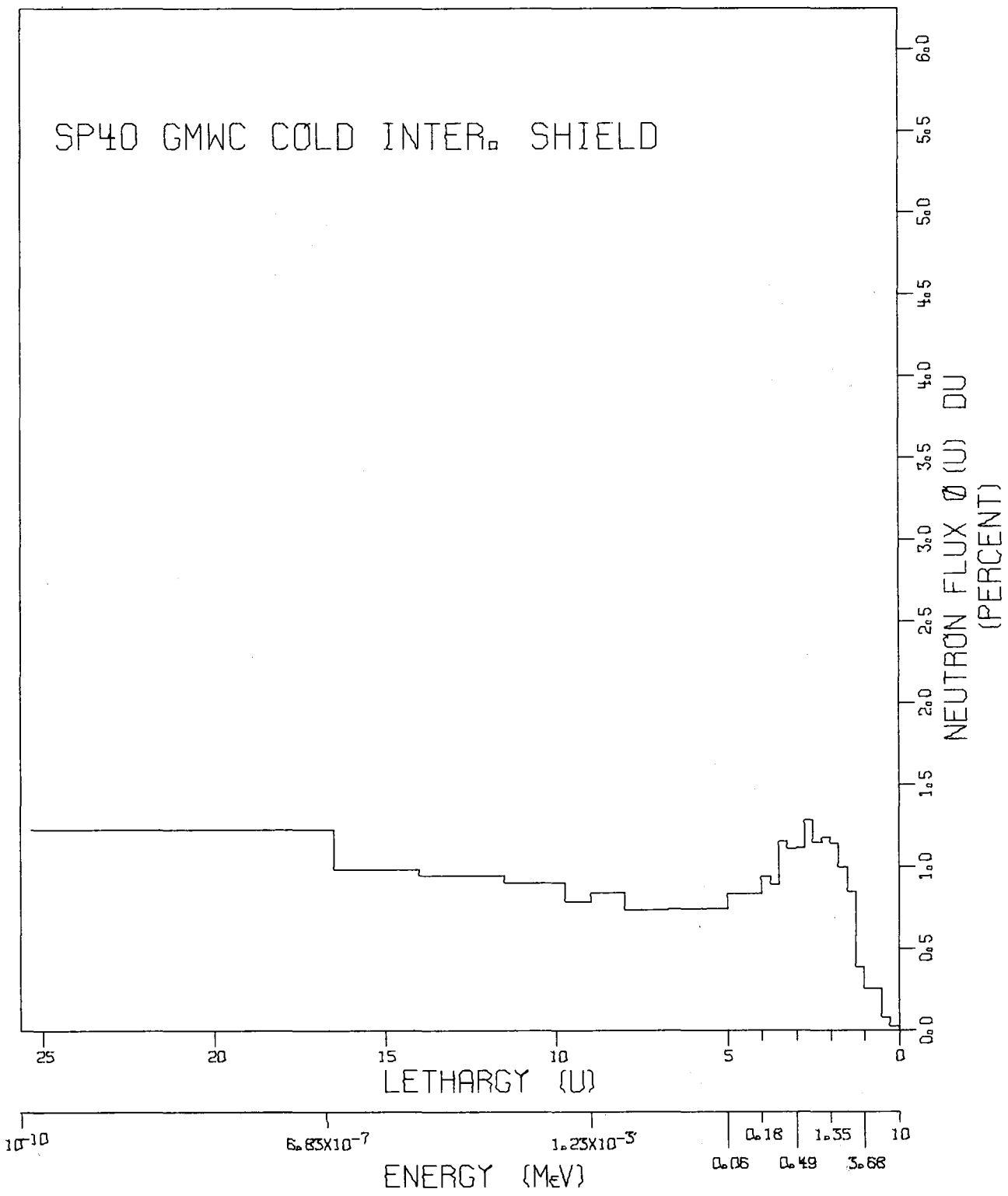
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 49°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP39 GMWC, KE COLD NO SHIELD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,524-004	1,59899+000
0,50	6,07000+000	5,743-004	6,03269+000
0,75	4,72000+000	1,894-003	1,97310+001
1,00	3,68000+000	1,893-003	1,99329+001
1,25	2,87000+000	2,857-003	3,01214+001
1,50	2,23000+000	6,357-003	6,60285+001
1,75	1,74000+000	7,339-003	7,75118+001
2,00	1,35000+000	8,608-003	8,88852+001
2,25	1,05000+000	8,812-003	9,18833+001
2,50	8,21000-001	8,387-003	8,93342+001
2,75	6,39000-001	9,577-003	1,00144+002
3,00	4,98000-001	8,244-003	8,66563+001
3,25	3,88000-001	8,212-003	8,62165+001
3,50	3,02000-001	8,595-003	8,98871+001
3,75	2,35000-001	6,636-003	6,93277+001
4,00	1,83000-001	7,010-003	7,34545+001
5,00	6,74000-002	2,481-002	6,50956+001
6,75	1,17000-002	3,872-002	5,79479+001
8,00	3,36000-003	2,726-002	5,72633+001
9,00	1,23000-003	2,521-002	6,57282+001
9,75	5,83000-004	1,735-002	6,09172+001
11,50	1,01000-004	4,710-002	7,04035+001
14,00	8,32000-006	7,031-002	7,38025+001
16,50	6,83000-007	7,340-002	7,69399+001
25,33	1,00000-010	5,807-001	1,72358+002
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP40 GMWC COLD INTER. SHIELD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: K-East

Type: Production Power Level: Not available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility; "intermediate" thermal neutron shield; flux ratio Thermal (49°C): Fast >0.5 MeV = 5:1

Spectrum Code

Code: DTF-IV Calculation: BNW [34]

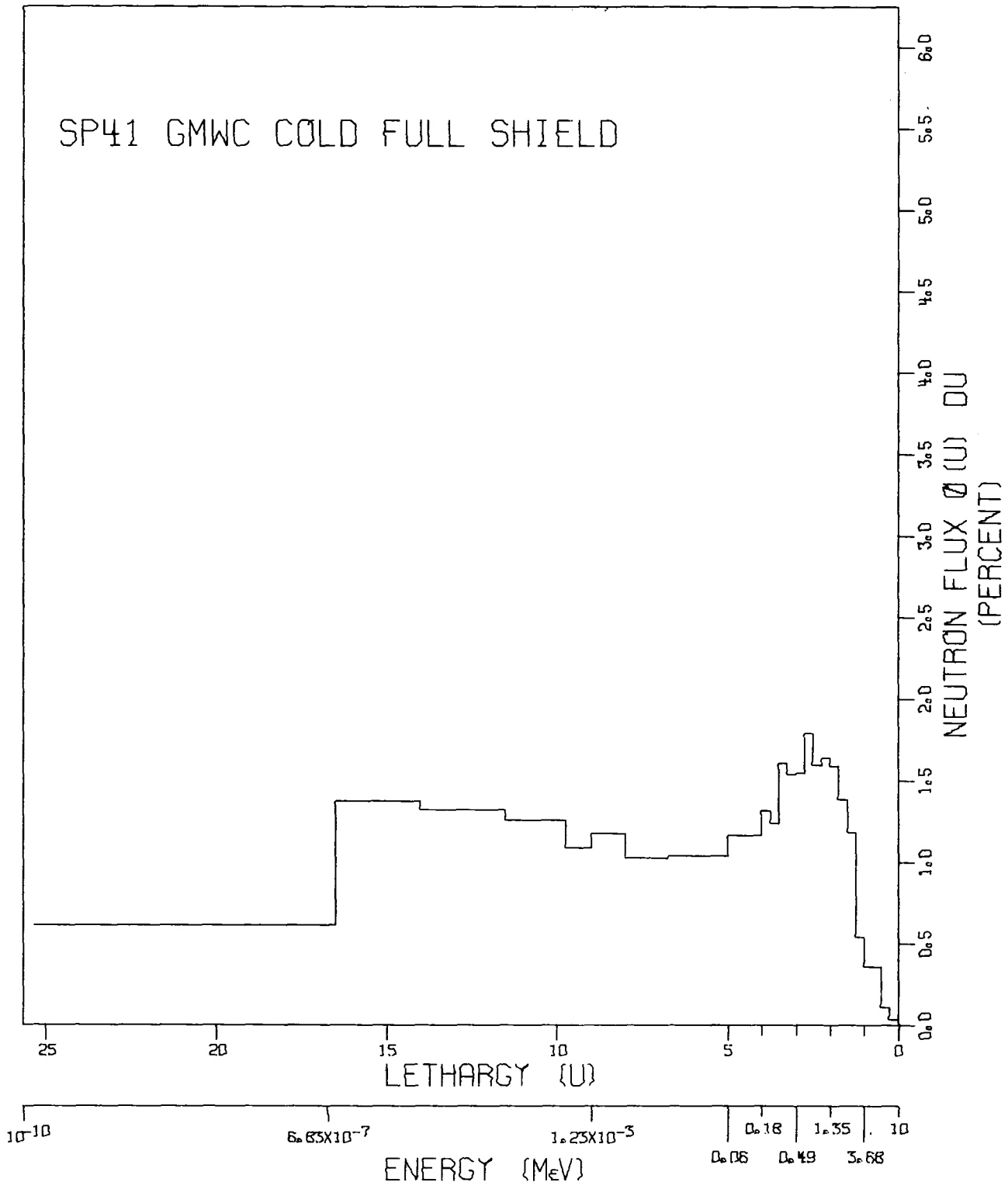
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 49°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP40 GMWC COLD INTER, SHIELD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	2,054-004	1,59899+000
0,50	6,07000+000	7,742-004	6,03269+000
0,75	4,72000+000	2,553-003	1,97310+001
1,00	3,68000+000	2,552-003	1,99329+001
1,25	2,87000+000	3,852-003	3,01214+001
1,50	2,23000+000	8,570-003	6,60285+001
1,75	1,74000+000	9,893-003	7,75118+001
2,00	1,35000+000	1,160-002	8,88852+001
2,25	1,05000+000	1,188-002	9,18833+001
2,50	8,21000-001	1,131-002	8,93342+001
2,75	6,39000-001	1,291-002	1,00144+002
3,00	4,98000-001	1,111-002	8,66563+001
3,25	3,88000-001	1,107-002	8,62165+001
3,50	3,02000-001	1,159-002	8,98871+001
3,75	2,35000-001	8,946-003	6,93277+001
4,00	1,83000-001	9,450-003	7,34545+001
5,00	6,74000-002	3,345-002	6,50956+001
6,75	1,17000-002	5,220-002	5,79479+001
8,00	3,36000-003	3,675-002	5,72633+001
9,00	1,23000-003	3,398-002	6,57282+001
9,75	5,83000-004	2,340-002	6,09172+001
11,50	1,01000-004	6,349-002	7,04035+001
14,00	8,32000-006	9,479-002	7,38118+001
16,50	6,83000-007	9,888-002	7,68884+001
25,33	1,00000-010	4,348-001	9,57331+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP41 GMWC COLD FULL SHIELD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: K-East

Type: Production Power Level: Not Available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility, "full" thermal neutron shield; flux ratio Thermal (49°C): Fast >0.5 MeV = 1.8:1

Spectrum Code

Code: DTF-IV Calculation: BNW [34]

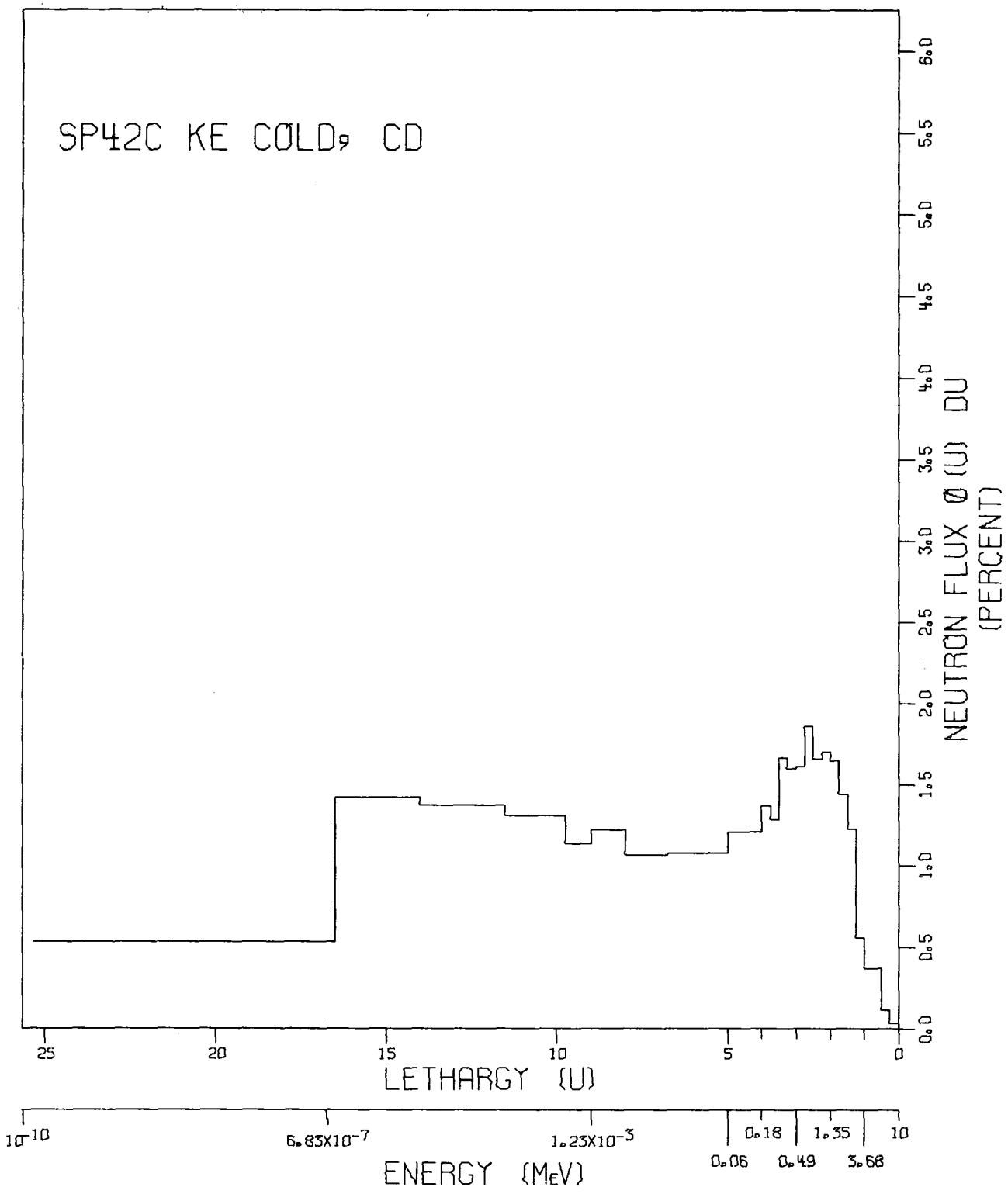
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 49°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP41 GMWC COLD FULL SHIELD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	2,847-004	1,59899+000
0,50	6,07000+000	1,073-003	6,03269+000
0,75	4,72000+000	3,539-003	1,97310+001
1,00	3,68000+000	3,537-003	1,99329+001
1,25	2,87000+000	5,339-003	3,01214+001
1,50	2,23000+000	1,188-002	6,60285+001
1,75	1,74000+000	1,371-002	7,75118+001
2,00	1,35000+000	1,608-002	8,88852+001
2,25	1,05000+000	1,646-002	9,18833+001
2,50	8,21000-001	1,567-002	8,93342+001
2,75	6,39000-001	1,789-002	1,00144+002
3,00	4,98000-001	1,540-002	8,66563+001
3,25	3,88000-001	1,534-002	8,62165+001
3,50	3,02000-001	1,606-002	8,98871+001
3,75	2,35000-001	1,240-002	6,93277+001
4,00	1,83000-001	1,310-002	7,34545+001
5,00	6,74000-002	4,636-002	6,50956+001
6,75	1,17000-002	7,235-002	5,79479+001
8,00	3,36000-003	5,094-002	5,72633+001
9,00	1,23000-003	4,710-002	6,57282+001
9,75	5,83000-004	3,243-002	6,09172+001
11,50	1,01000-004	8,800-002	7,04035+001
14,00	8,32000-006	1,314-001	7,38274+001
16,50	6,83000-007	1,369-001	7,67989+001
25,33	1,00000-010	2,167-001	3,44305+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP42C KE COLD, CD
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: K-East

Type: Production Power Level: Not available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility, 0.040-inch Cd shield; flux ratio Thermal (49°C): Fast >0.5 MeV = 1.5:1.

Spectrum Code

Code: DTF-IV Calculation: BNW [28]

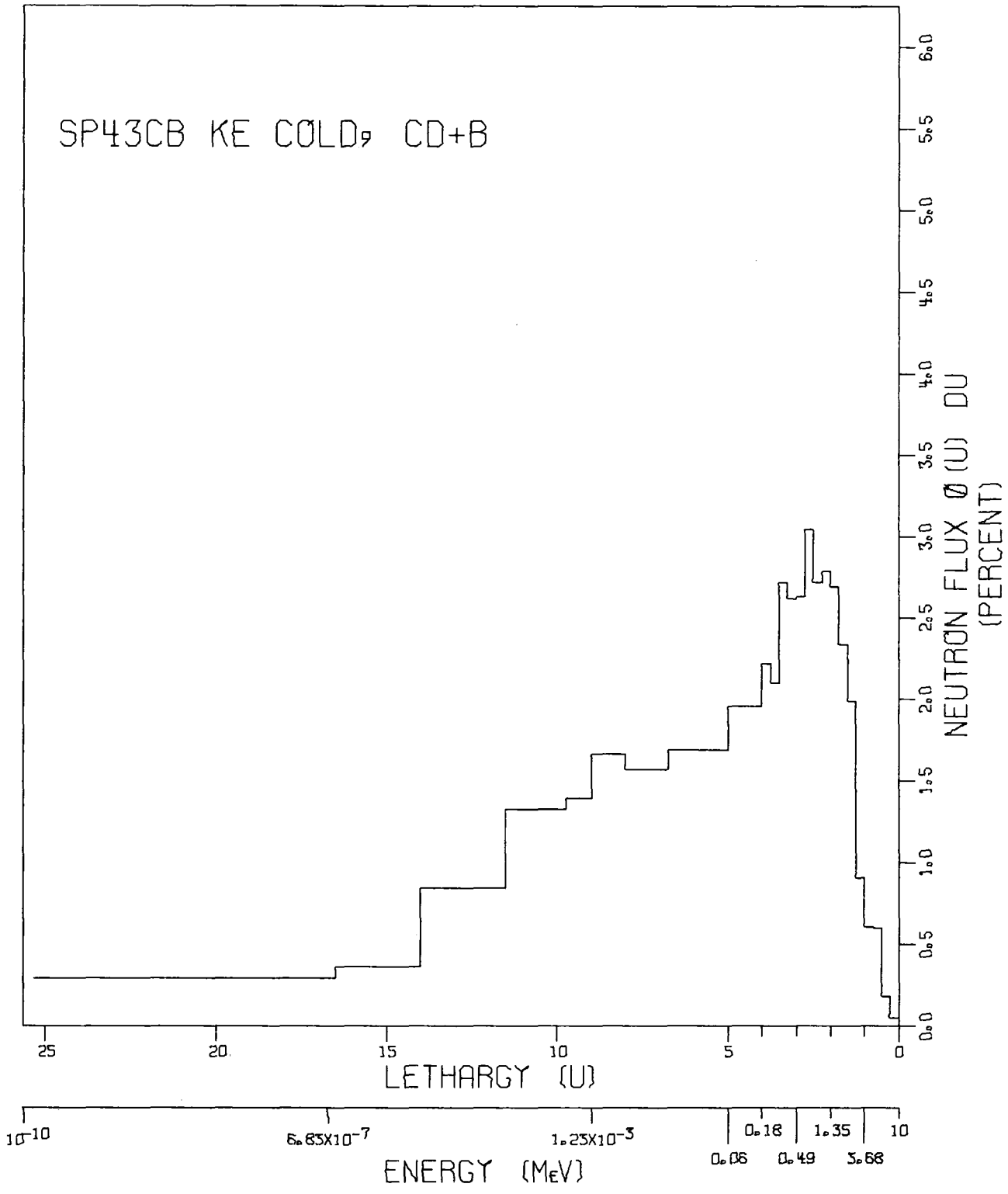
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 49°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP42C KE COLD, CD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000*000	2,954*004	1,59899*000
0,50	6,07000*000	1,113*003	6,03269*000
0,75	4,72000*000	3,672*003	1,97310*001
1,00	3,68000*000	3,670*003	1,99329*001
1,25	2,87000*000	5,540*003	3,01214*001
1,50	2,23000*000	1,232*002	6,60285*001
1,75	1,74000*000	1,423*002	7,75118*001
2,00	1,35000*000	1,669*002	8,88852*001
2,25	1,05000*000	1,708*002	9,18833*001
2,50	8,21000*001	1,626*002	8,93342*001
2,75	6,39000*001	1,857*002	1,00144*002
3,00	4,98000*001	1,598*002	8,66563*001
3,25	3,88000*001	1,592*002	8,62165*001
3,50	3,02000*001	1,666*002	8,98871*001
3,75	2,35000*001	1,286*002	6,93277*001
4,00	1,83000*001	1,359*002	7,34545*001
5,00	6,74000*002	4,810*002	6,50956*001
6,75	1,17000*002	7,507*002	5,79479*001
8,00	3,36000*003	5,285*002	5,72633*001
9,00	1,23000*003	4,886*002	6,57282*001
9,75	5,83000*004	3,364*002	6,09172*001
11,50	1,01000*004	9,130*002	7,04035*001
14,00	8,32000*006	1,364*001	7,38302*001
16,50	6,83000*007	1,420*001	7,67831*001
25,33	1,00000*010	1,874*001	2,86847*001
		1,000*000	

ONE LETHARGY INTERVAL = 0,25U


SP43CB KE COLD, CD+B
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.85X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: K-East

Type: Production Power Level: Not Available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility: 1-1/8 inch ^{10}B plus 0.040-inch Cd; flux ratio Thermal (49°C): Fast >0.5 MeV = 0.5:1.

Spectrum Code

Code: DTF-IV Calculation: BNW [28]

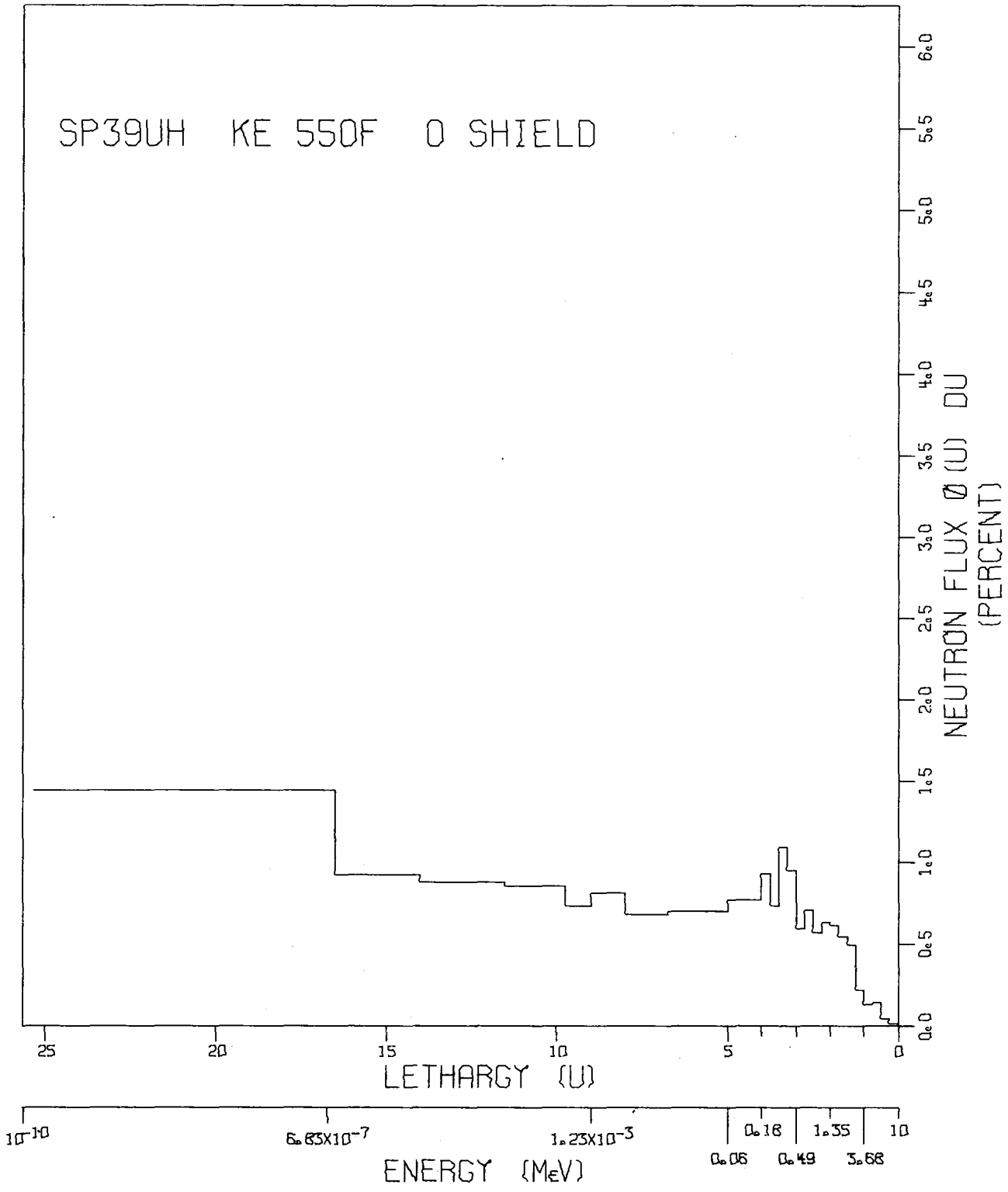
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 49°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP43CB KE COLD, CD-8

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	4,810-004	1,59498+000
0,50	6,07000+000	1,822-003	6,04836+000
0,75	4,72000+000	6,027-003	1,98421+001
1,00	3,68000+000	5,996-003	1,99502+001
1,25	2,87000+000	9,001-003	2,99826+001
1,50	2,23000+000	2,003-002	6,57359+001
1,75	1,74000+000	2,319-002	7,73811+001
2,00	1,35000+000	2,730-002	8,90943+001
2,25	1,05000+000	2,802-002	9,23408+001
2,50	8,21000-001	2,672-002	8,99485+001
2,75	6,39000-001	3,050-002	1,00778+002
3,00	4,98000-001	2,624-002	8,71690+001
3,25	3,88000-001	2,611-002	8,66428+001
3,50	3,02000-001	2,724-002	9,00303+001
3,75	2,35000-001	2,104-002	6,94665+001
4,00	1,83000-001	2,219-002	7,34651+001
5,00	6,74000-002	7,810-002	6,47468+001
6,75	1,17000-002	1,183-001	5,59235+001
8,00	3,36000-003	7,812-002	5,18520+001
9,00	1,23000-003	6,679-002	5,50355+001
9,75	5,83000-004	4,157-002	4,61135+001
11,50	1,01000-004	9,297-002	4,39162+001
14,00	8,32000-006	8,387-002	2,78217+001
16,50	6,83000-007	3,607-002	1,19475+001
25,33	1,00000-010	1,023-001	9,59768+000
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP39UH KE 550F 0 SHIELD
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: K-East

Type: Production Power Level: Not available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility; no thermal neutron shield; flux ratio Thermal (288°C): Fast >0.5 MeV = 10.9:1.

Spectrum Code

Code: DTF-IV Calculation: BNW [34]

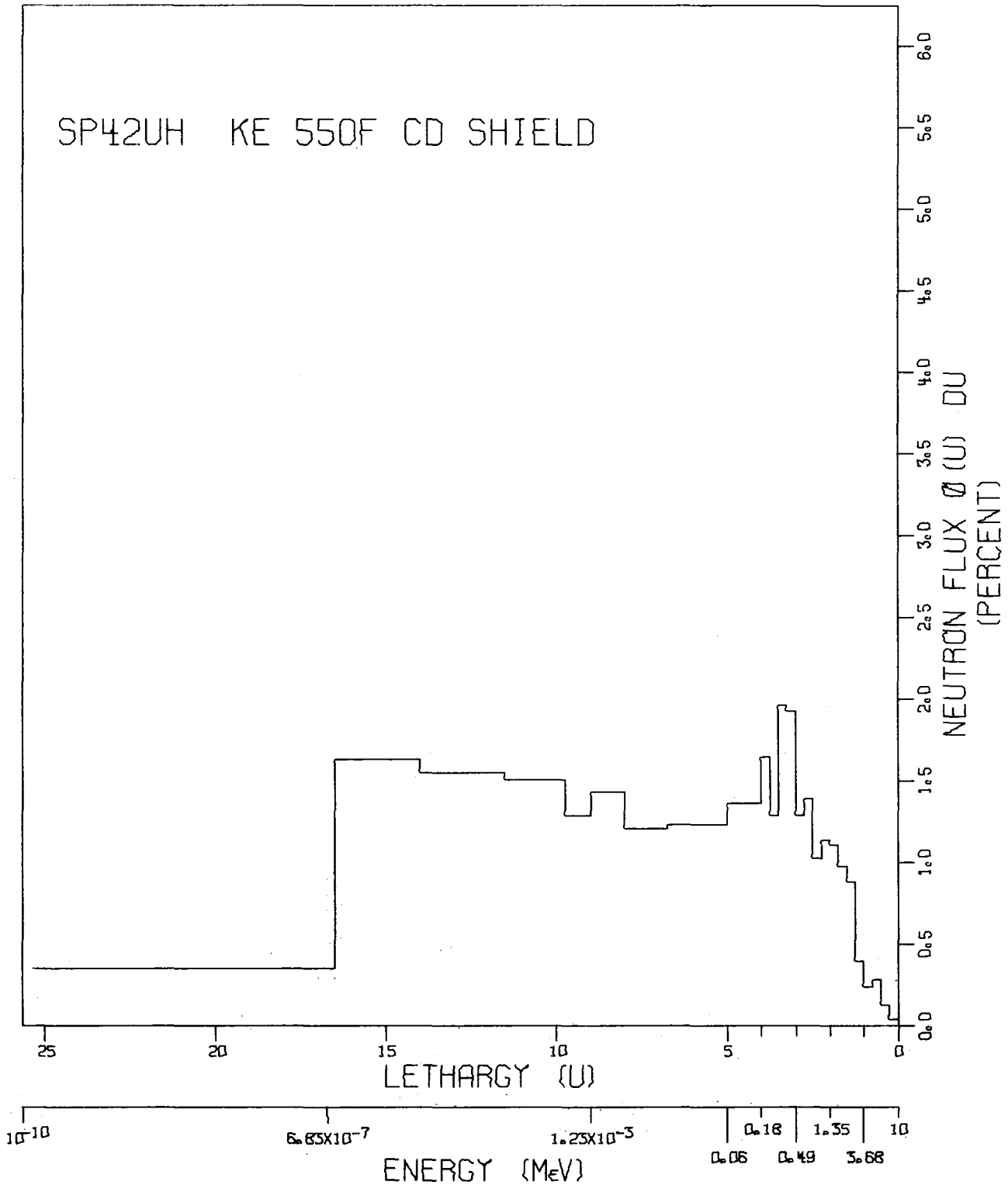
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 288°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP39UH KE 550F 0 SHIELD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	1,089-004	1,54371+000
0,50	6,07000+000	4,233-004	6,00689+000
0,75	4,72000+000	1,404-003	1,97689+001
1,00	3,68000+000	1,293-003	1,83877+001
1,25	2,87000+000	2,148-003	3,05871+001
1,50	2,23000+000	4,960-003	6,95970+001
1,75	1,74000+000	5,374-003	7,66908+001
2,00	1,35000+000	6,218-003	8,67485+001
2,25	1,05000+000	6,329-003	8,91622+001
2,50	8,21000-001	5,571-003	8,01754+001
2,75	6,39000-001	7,089-003	1,00145+002
3,00	4,98000-001	5,894-003	8,37125+001
3,25	3,88000-001	9,460-003	1,34193+002
3,50	3,02000-001	1,092-002	1,54296+002
3,75	2,35000-001	7,329-003	1,03447+002
4,00	1,83000-001	9,317-003	1,31897+002
5,00	6,74000-002	3,072-002	1,08905+002
6,75	1,17000-002	4,881-002	9,86958+001
8,00	3,36000-003	3,406-002	9,66713+001
9,00	1,23000-003	3,249-002	1,14456+002
9,75	5,83000-004	2,173-002	1,03053+002
11,50	1,01000-004	5,983-002	1,20843+002
14,00	8,32000-006	8,763-002	1,24290+002
16,50	6,83000-007	9,256-002	1,31090+002
25,33	1,00000-010	5,083-001	2,03853+002
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U


SP42UH KE 550F CD SHIELD
NEUTRON FLUX Ø(U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.65X10-7
1.25X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: K-East

Type: Production Power Level: Not available

Coolant: Light water Moderator: Graphite

Location: Hanford, Washington

Spectrum Facility Description

Tailored spectrum facility; 0.040-inch Cd shield:flux ratio Thermal (288°C): Fast >0.5 MeV = 1.4:1.

Spectrum Code

Code: DTF-IV Calculation: BNW [28]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.2
>0.5 MeV	-	46.3
>0.1 MeV	-	30.5
Thermal, 288°C	-	-

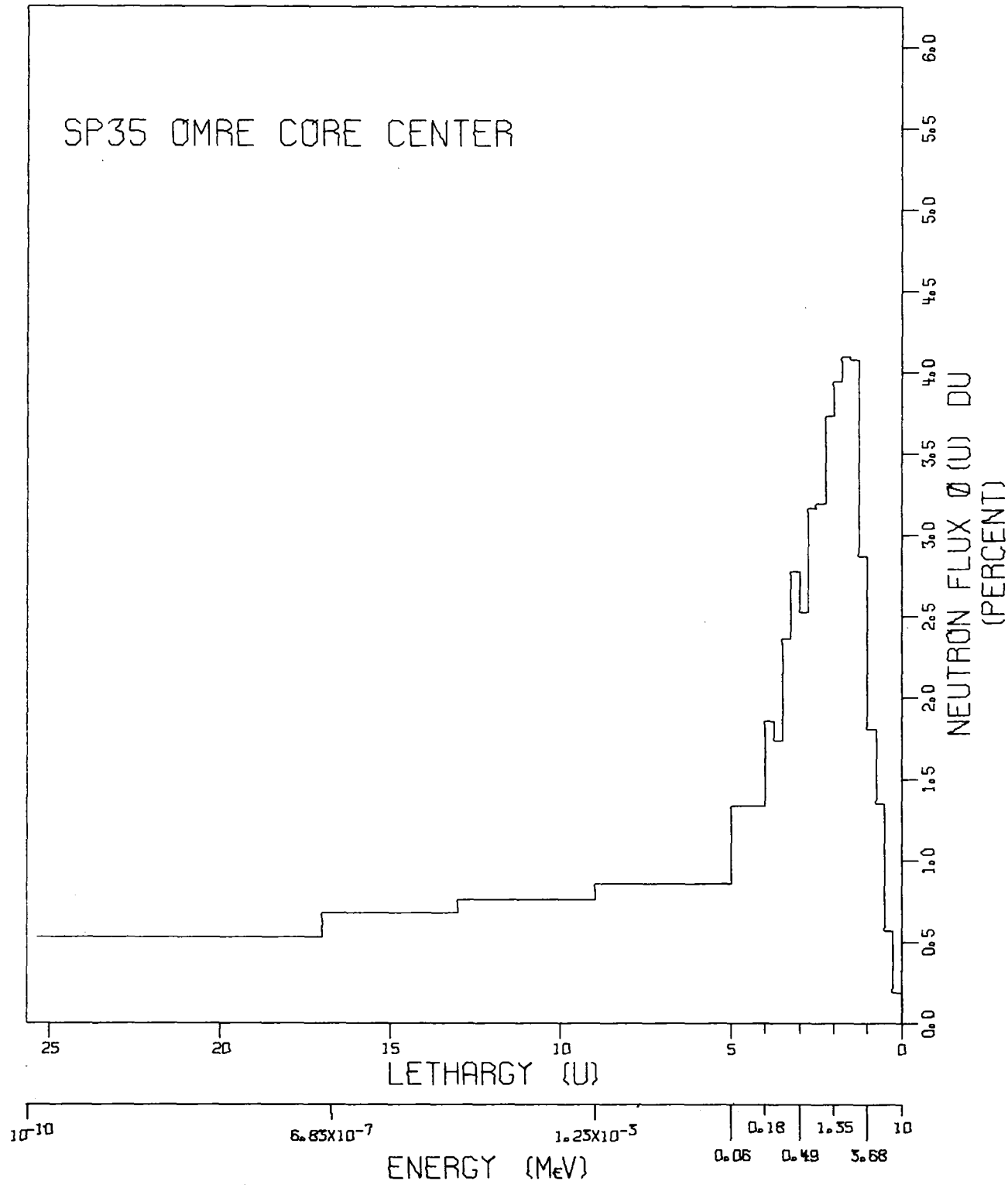
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

SP42UH KE 550F CD SHIELD

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0,25	7,79000+000	3,790-004	2,69517+000
0,50	6,07000+000	1,201-003	8,55308+000
0,75	4,72000+000	2,839-003	2,00482+001
1,00	3,68000+000	2,357-003	1,68198+001
1,25	2,87000+000	3,878-003	2,77061+001
1,50	2,23000+000	8,900-003	6,26554+001
1,75	1,74000+000	9,661-003	6,91605+001
2,00	1,35000+000	1,121-002	7,84876+001
2,25	1,05000+000	1,144-002	8,08460+001
2,50	8,21000-001	1,009-002	7,28695+001
2,75	6,39000-001	1,388-002	9,83876+001
3,00	4,98000-001	1,284-002	9,14740+001
3,25	3,88000-001	1,923-002	1,36839+002
3,50	3,02000-001	1,963-002	1,39164+002
3,75	2,35000-001	1,292-002	9,15122+001
4,00	1,83000-001	1,646-002	1,16867+002
5,00	6,74000-002	5,426-002	9,64978+001
6,75	1,17000-002	8,621-002	8,74501+001
8,00	3,36000-003	6,017-002	8,56584+001
9,00	1,23000-003	5,738-002	1,01417+002
9,75	5,83000-004	3,838-002	9,13128+001
11,50	1,01000-004	1,057-001	1,07079+002
14,00	8,32000-006	1,549-001	1,10227+002
16,50	6,83000-007	1,627-001	1,15611+002
25,33	1,00000-010	1,234-001	2,48174+001
		1,000+000	

ONE LETHARGY INTERVAL = 0,25U

ORGANIC MODERATED REACTORS


SP35 OMRE CORE CENTER
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.85X10-7
1.25X10-5
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Organic Moderated Reactor Experiment

Type: Power, experimental Power Level: .8 MWt

Coolant: Organic Moderator: Organic

Location: National Reactor Testing Station, Idaho Falls, Idaho (decommissioned)

Spectrum Facility Description

Location in core center, mid plane: organic, steel, uranium.

Spectrum Code

Code: Program S Calculation: BNW 19

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	110.4
≥0.5 MeV	(31.47†)	64.0
>0.1 MeV	-	49.3
Thermal, 20°C	-	-

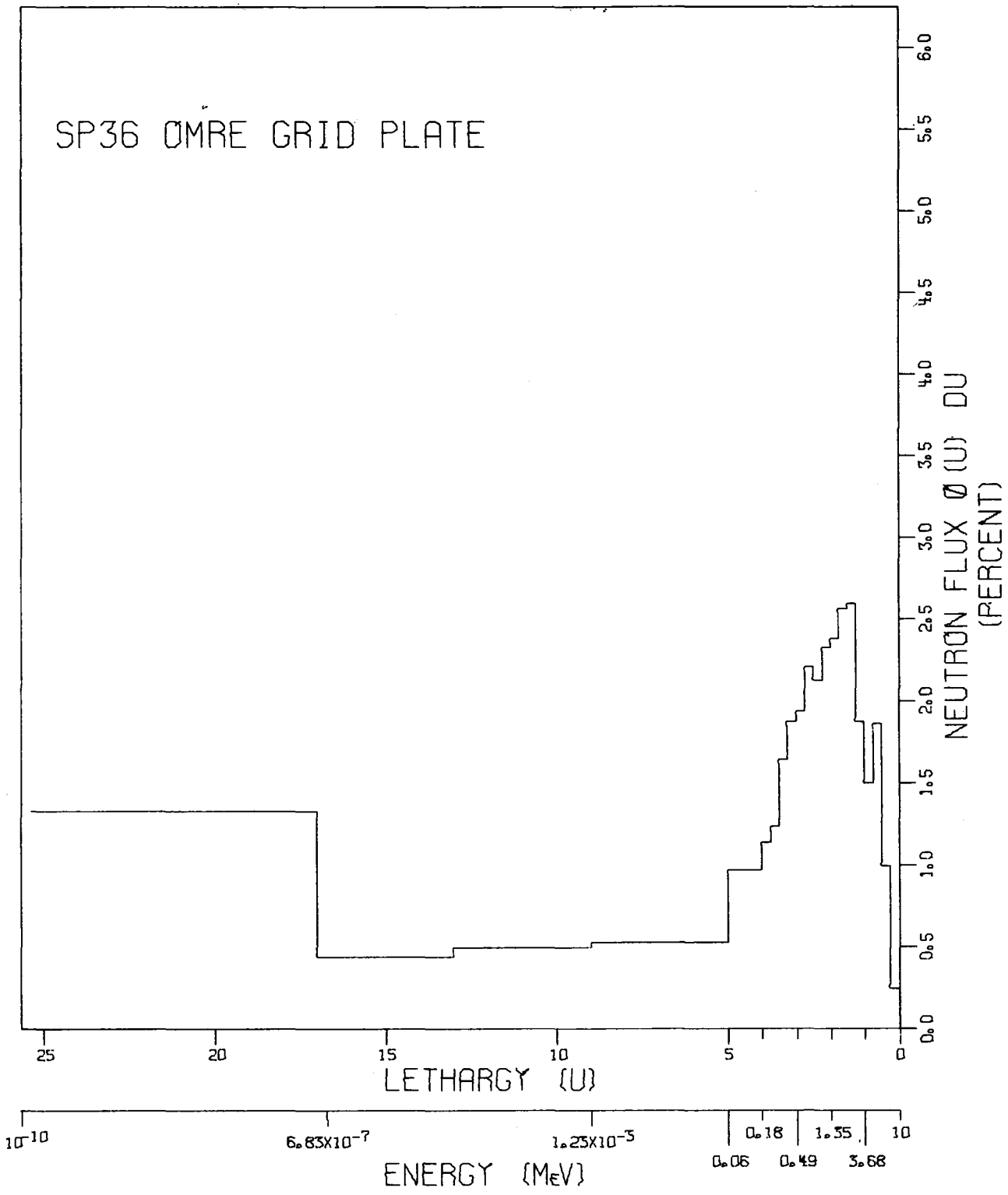
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 35, 36 and 35, 37

SP35 OMRE CORE CENTER

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.837-003	2.34400+000
0.50	6.07000+000	5.651-003	7.21867+000
0.75	4.72000+000	1.359-002	1.72158+001
1.00	3.68000+000	1.798-002	2.30170+001
1.25	2.87000+000	2.854-002	3.65835+001
1.50	2.23000+000	4.112-002	5.19438+001
1.75	1.74000+000	4.062-002	5.21814+001
2.00	1.35000+000	4.005-002	5.02918+001
2.25	1.05000+000	3.749-002	4.75359+001
2.50	8.21000-001	3.141-002	4.06869+001
2.75	6.39000-001	3.171-002	4.03287+001
3.00	4.98000-001	2.516-002	3.21580+001
3.25	3.88000-001	2.766-002	3.53172+001
3.50	3.02000-001	2.368-002	3.01116+001
3.75	2.35000-001	1.743-002	2.21451+001
4.00	1.83000-001	1.853-002	2.36094+001
5.00	6.74000-002	5.329-002	1.70020+001
9.00	1.23000-003	1.380-001	1.09856+001
13.00	2.26000-005	1.220-001	9.72911+000
17.00	4.14000-007	1.083-001	8.63251+000
25.33	1.00000-010	1.759-001	6.73152+000
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP36 ØMRE GRID PLATE
NEUTRØN FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.25X10-5
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Organic Moderated Reactor Experiment

Type: Power, experimental Power Level: ~8 MWt

Coolant: Organic Moderator: Organic

Location: National Reactor Testing Station, Idaho Falls, Idaho (decommissioned)

Spectrum Facility Description

Location 3/4-inch into the 1-1/2-inch thick grid plate; steel.

Spectrum Code

Code: Program S Calculation: BNW [19]

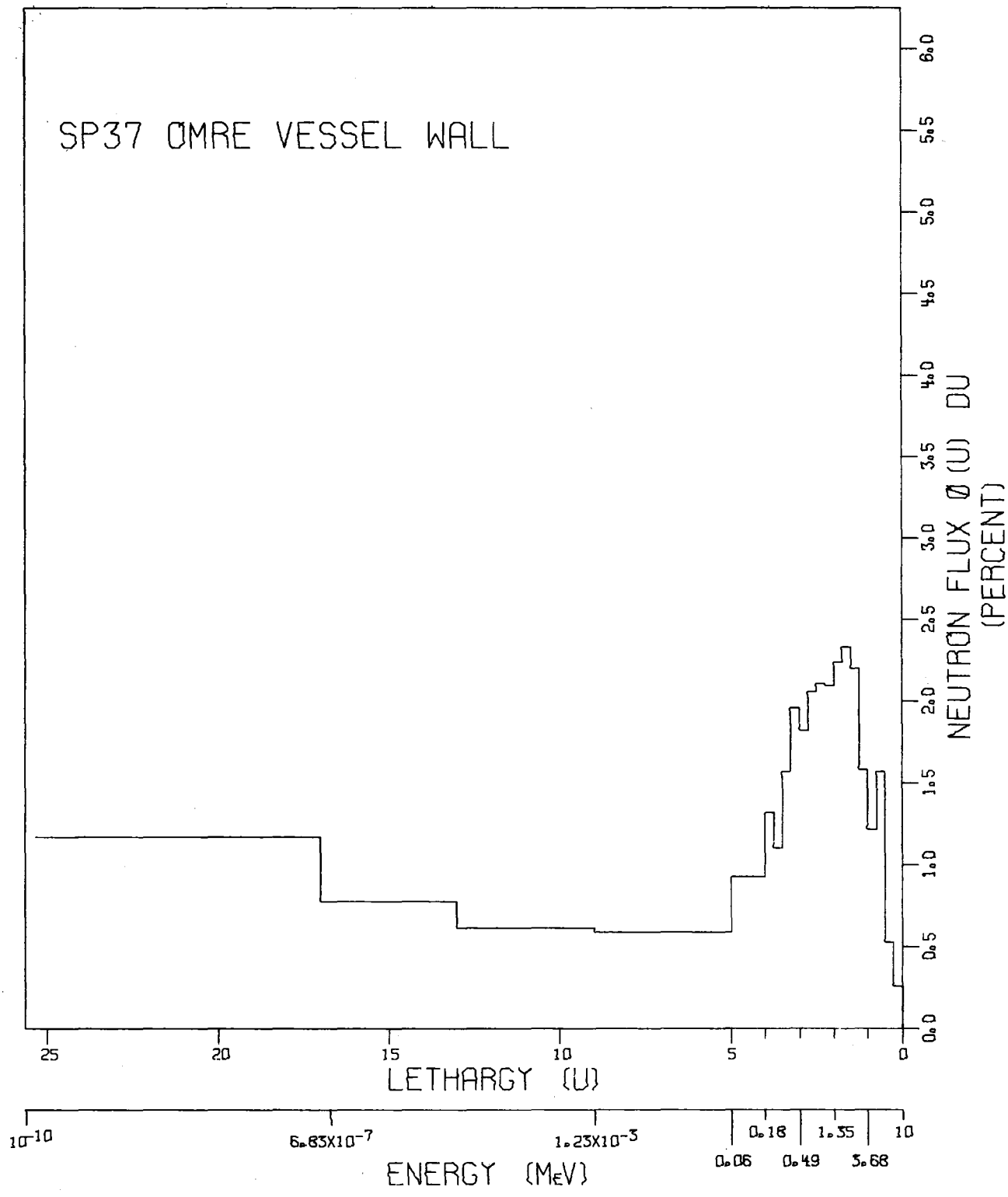
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.30×10^{11}	153.2
>0.5 MeV	3.09 (0.1862†)	113.8
>0.1 MeV	4.21	83.6
Thermal, 20°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Flux calculated @ 2.76 MWt
†In series of spectra 35, 36

SP36 @MRE GRID PLATE

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79 00+000	2.428-003	3.10104+000
0.50	6.07000+000	9.878-003	1.26275+001
0.75	4.72000+000	1.875-002	2.37722+001
1.00	3.68000+000	1.494-002	1.91379+001
1.25	2.87000+000	1.864-002	2.39131+001
1.50	2.23000+000	2.617-002	3.30826+001
1.75	1.74000+000	2.540-002	3.26512+001
2.00	1.35000+000	2.417-002	3.03732+001
2.25	1.05000+000	2.334-002	2.96171+001
2.50	8.21000-001	2.089-002	2.70752+001
2.75	6.39000-001	2.211-002	2.81325+001
3.00	4.98000-001	1.931-002	2.46993+001
3.25	3.88000-001	1.871-002	2.39032+001
3.50	3.02000-001	1.647-002	2.09584+001
3.75	2.35000-001	1.239-002	1.57523+001
4.00	1.83000-001	1.135-002	1.44782+001
5.00	6.74000-002	3.872-002	1.23642+001
9.00	1.23000-003	8.407-002	6.69703+000
13.00	2.26000-005	7.877-002	6.28573+000
17.00	4.14000-007	6.988-002	5.57201+000
25.33	1.00000-010	4.436-001	1.69874+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


SP37 ØMRE VESSEL WALL
NEUTRON FLUX Ø (U) DU
(PERCENT)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Organic Moderated Reactor Experiment

Type: Power, experiment Power Level: ~8 MWt

Coolant: Organic Moderator: Organic

Location: National Reactor Testing Station, Idaho Falls, Idaho (decommissioned)

Spectrum Facility Description

Location 1/4 inch into pressure vessel wall.

Spectrum Code

Code: Program S Calculation: BNW [19]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	2.08×10^{11}	140.2
>0.5 MeV	2.88 (0.0783†)	101.4
>0.1 MeV	4.05	72.0
Thermal, 20°C	-	-

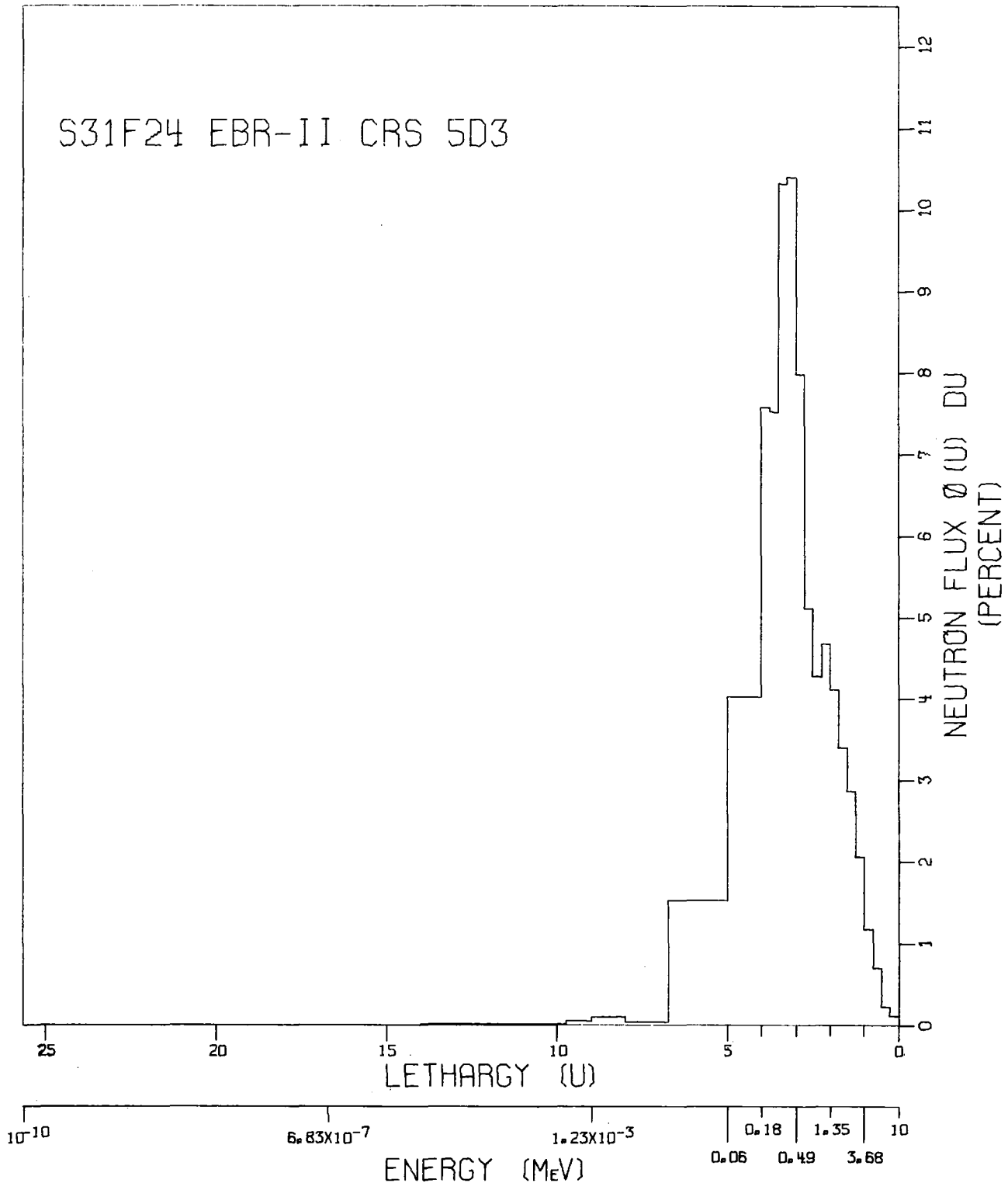
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
Flux calculated @ 2.76 MWt
†In series of spectra 35, 37

SP37 OMRE VESSEL WALL

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.543-003	4.12390+000
0.50	6.07000+000	5.250-003	8.52316+000
0.75	4.72000+000	1.579-002	2.54175+001
1.00	3.68000+000	1.208-002	1.96647+001
1.25	2.87000+000	1.568-002	2.55481+001
1.50	2.23000+000	2.216-002	3.55661+001
1.75	1.74000+000	2.310-002	3.77007+001
2.00	1.35000+000	2.272-002	3.62659+001
2.25	1.05000+000	2.104-002	3.39104+001
2.50	8.21000-001	2.073-002	3.41345+001
2.75	6.39000-001	2.062-002	3.33255+001
3.00	4.98000-001	1.811-002	2.94208+001
3.25	3.88000-001	1.954-002	3.17113+001
3.50	3.02000-001	1.570-002	2.53703+001
3.75	2.35000-001	1.104-002	1.78311+001
4.00	1.83000-001	1.317-002	2.13258+001
5.00	6.74000-002	3.691-002	1.49652+001
9.00	1.23000-003	9.357-002	9.46598+000
13.00	2.26000-005	9.811-002	9.94232+000
17.00	4.14000-007	1.241-001	1.25637+001
25.33	1.00000-010	3.880-001	1.88706+001
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U

FAST BREEDER REACTOR


S31F24 EBR-II CRS 5D3
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 18cm, Z = + 16.8cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	78.5
>0.5 MeV	(4.08 x 10^{14} †)	43.3
>0.1 MeV	-	19.3
Thermal, - °C	-	-

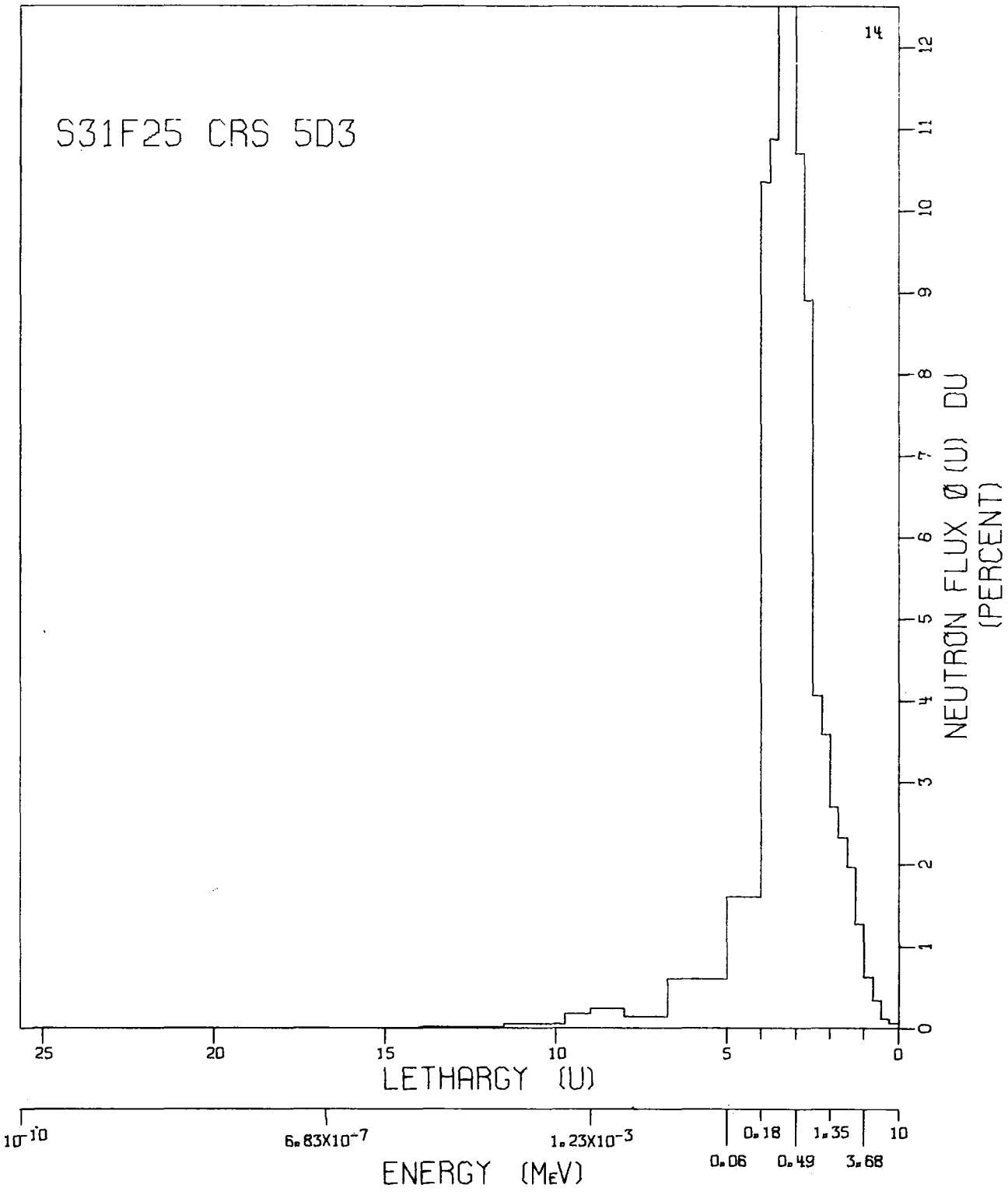
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F24 through 31F26 (above ℄ 5D3)

S31F24 EBR-II CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.128-003	2.33476+000
0.50	6.07000+000	2.190-003	4.53996+000
0.75	4.72000+000	7.052-003	1.44971+001
1.00	3.68000+000	1.165-002	2.41986+001
1.25	2.87000+000	2.045-002	4.25345+001
1.50	2.23000+000	2.881-002	5.90522+001
1.75	1.74000+000	3.368-002	7.01961+001
2.00	1.35000+000	4.167-002	8.49152+001
2.25	1.05000+000	4.696-002	9.66394+001
2.50	8.21000-001	4.199-002	8.82568+001
2.75	6.39000-001	5.123-002	1.05720+002
3.00	4.98000-001	7.954-002	1.64994+002
3.25	3.88000-001	1.038-001	2.15113+002
3.50	3.02000-001	1.035-001	2.13505+002
3.75	2.35000-001	7.551-002	1.55679+002
4.00	1.83000-001	7.569-002	1.56507+002
5.00	6.74000-002	1.605-001	8.31156+001
6.75	1.17000-002	1.068-001	3.15407+001
8.00	3.36000-003	1.770-003	7.33556-001
9.00	1.23000-003	3.825-003	1.96857+000
9.75	5.83000-004	1.506-003	1.04313+000
11.50	1.01000-004	2.911-004	8.58750-002
14.00	8.32000-006	4.465-004	9.24874-002
16.50	6.83000-007	1.127-005	2.33113-003
25.33	1.00000-010	8.561-007	5.01422-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


14
S31F25 CRS 5D3
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble; R = 18cm Z = +31.7cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	66.0
>0.5 MeV	(1.41×10^{14} †)	24.9
>0.1 MeV	-	10.1
Thermal, - °C	-	-

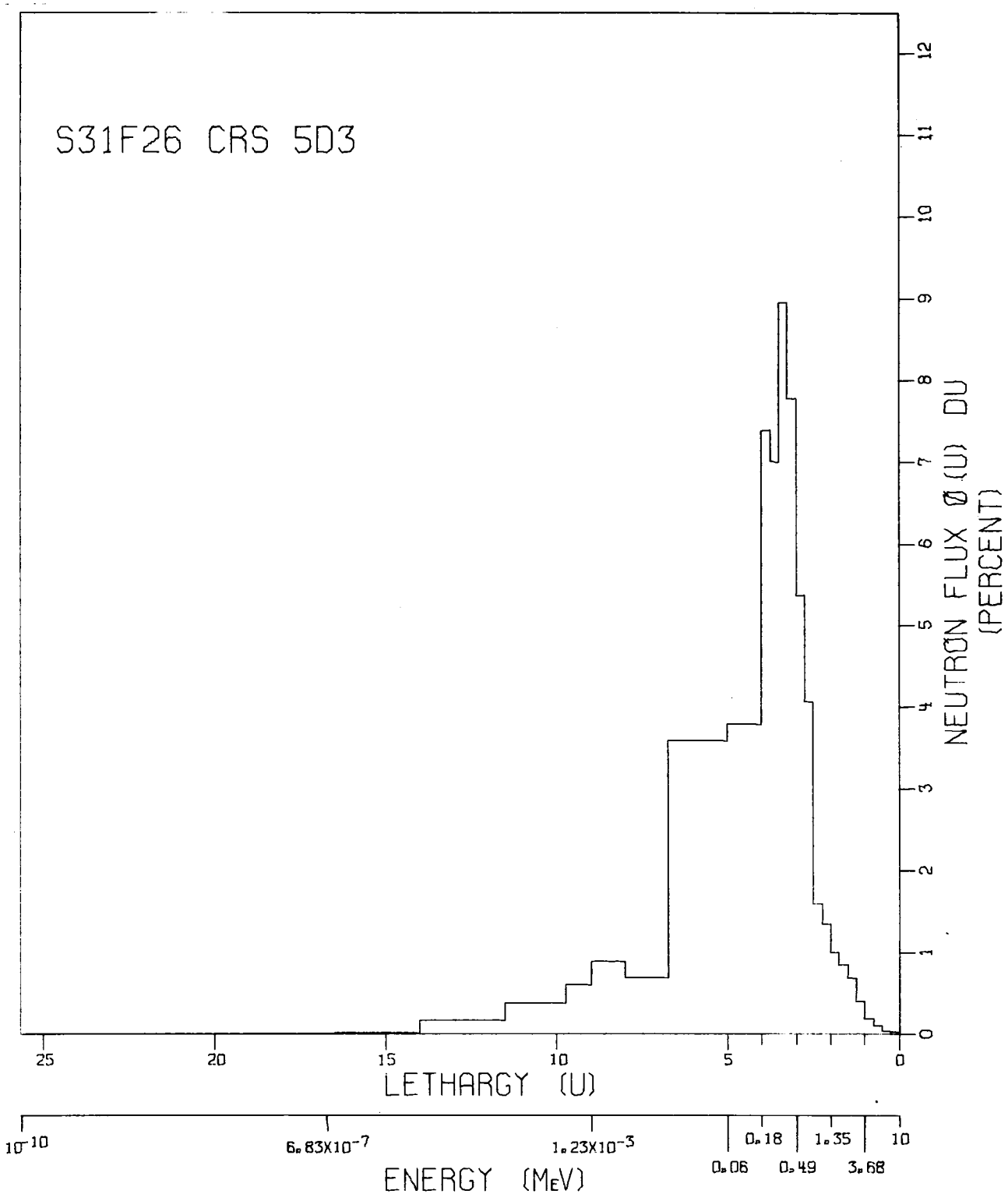
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F24 through 31F26 (above ℄ 5D3)

S31F25 CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	5.532-004	1.99206+000
0.50	6.07000+000	1.065-003	3.84011+000
0.75	4.72000+000	3.410-003	1.21919+001
1.00	3.68000+000	6.172-003	2.23025+001
1.25	2.87000+000	1.262-002	4.56643+001
1.50	2.23000+000	1.983-002	7.06926+001
1.75	1.74000+000	2.310-002	8.37177+001
2.00	1.35000+000	2.742-002	9.71849+001
2.25	1.05000+000	3.608-002	1.29126+002
2.50	8.21000-001	3.996-002	1.46084+002
2.75	6.39000-001	8.915-002	3.19894+002
3.00	4.98000-001	1.067-001	3.84998+002
3.25	3.88000-001	1.422-001	5.12300+002
3.50	3.02000-001	1.481-001	5.31402+002
3.75	2.35000-001	1.091-001	3.91173+002
4.00	1.83000-001	1.035-001	3.72171+002
5.00	6.74000-002	6.361-002	5.72736+001
6.75	1.17000-002	4.171-002	2.14193+001
8.00	3.36000-003	6.988-003	5.03723+000
9.00	1.23000-003	9.587-003	8.57927+000
9.75	5.83000-004	4.948-003	5.95983+000
11.50	1.01000-004	2.948-003	1.51224+000
14.00	8.32000-006	1.168-003	4.20840-001
16.50	6.83000-007	8.788-005	3.16157-002
25.33	1.00000-010	6.297-006	6.41381-004
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F26 CRS 5D3
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 18cm Z = +44.2cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

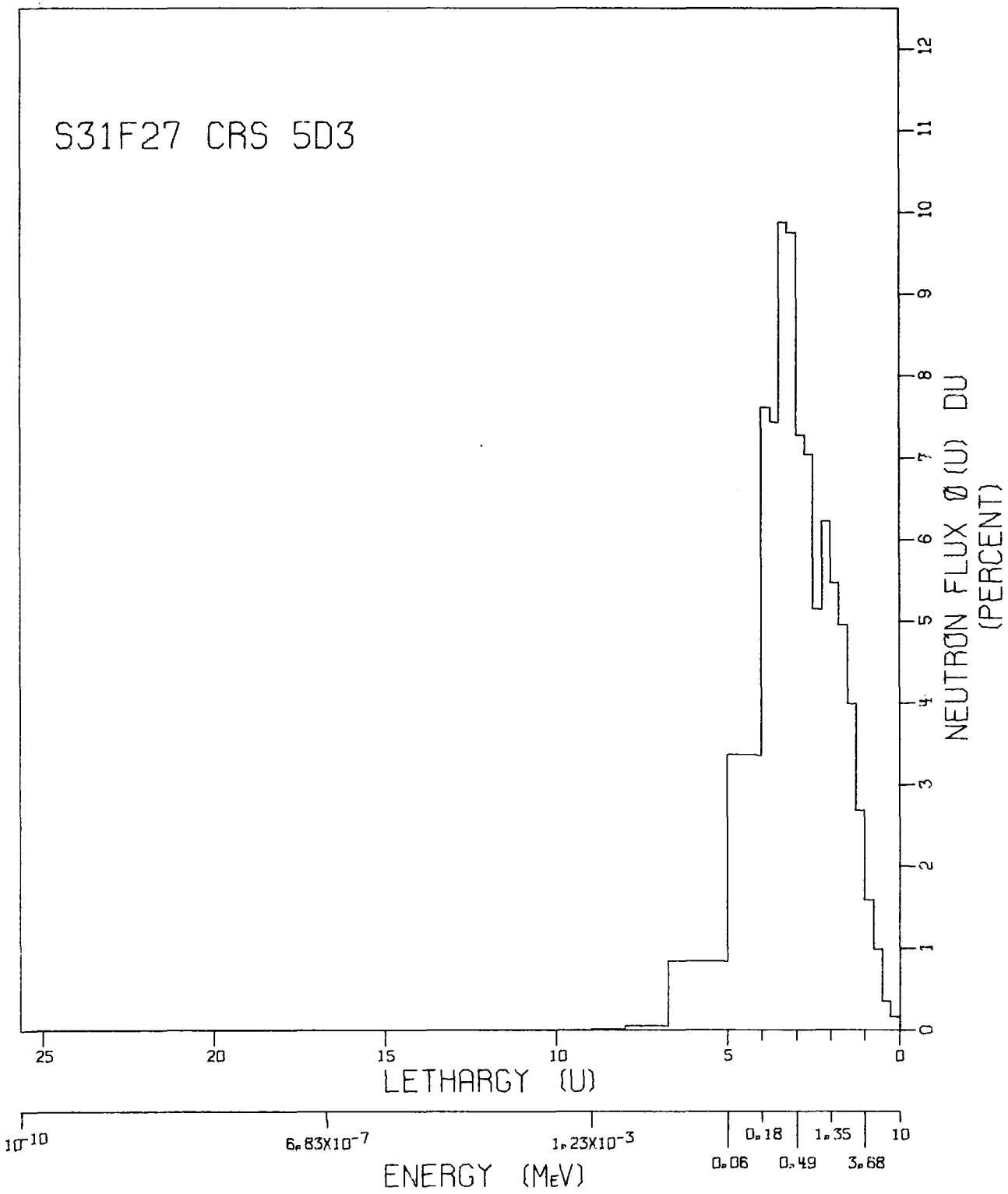
Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	57.5
>0.5 MeV	(5.62 x 10^3 †)	18.1
>0.1 MeV	-	5.1
Thermal, - °C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)
†In series of spectra 31F24 through 31F26 (above ¢ 5D3)

S31F26 CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.706-004	1.98201+000
0.50	6.07000+000	3.128-004	3.63774+000
0.75	4.72000+000	9.181-004	1.05881+001
1.00	3.68000+000	1.774-003	2.06752+001
1.25	2.87000+000	3.988-003	4.65325+001
1.50	2.23000+000	6.877-003	7.90663+001
1.75	1.74000+000	8.370-003	9.78642+001
2.00	1.35000+000	1.009-002	1.15374+002
2.25	1.05000+000	1.355-002	1.56353+002
2.50	8.21000-001	1.570-002	1.85061+002
2.75	6.39000-001	4.072-002	4.71326+002
3.00	4.98000-001	5.343-002	6.21706+002
3.25	3.88000-001	7.755-002	9.01371+002
3.50	3.02000-001	8.973-002	1.03883+003
3.75	2.35000-001	7.019-002	8.11682+002
4.00	1.83000-001	7.383-002	8.56362+002
5.00	6.74000-002	1.514-001	4.39854+002
6.75	1.17000-002	2.510-001	4.15867+002
8.00	3.36000-003	3.395-002	7.89333+001
9.00	1.23000-003	3.535-002	1.02036+002
9.75	5.83000-004	1.799-002	6.98968+001
11.50	1.01000-004	2.598-002	4.29904+001
14.00	8.32000-006	1.545-002	1.79539+001
16.50	6.83000-007	1.560-003	1.81022+000
25.33	1.00000-010	6.414-005	2.10732-002
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F27 CRS 5D3
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 18cm Z = -4.6cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	79.8
>0.5 MeV	(6.75 x 10^{14} †)	47.8
>0.1 MeV	-	24.7
Thermal, - °C	-	-

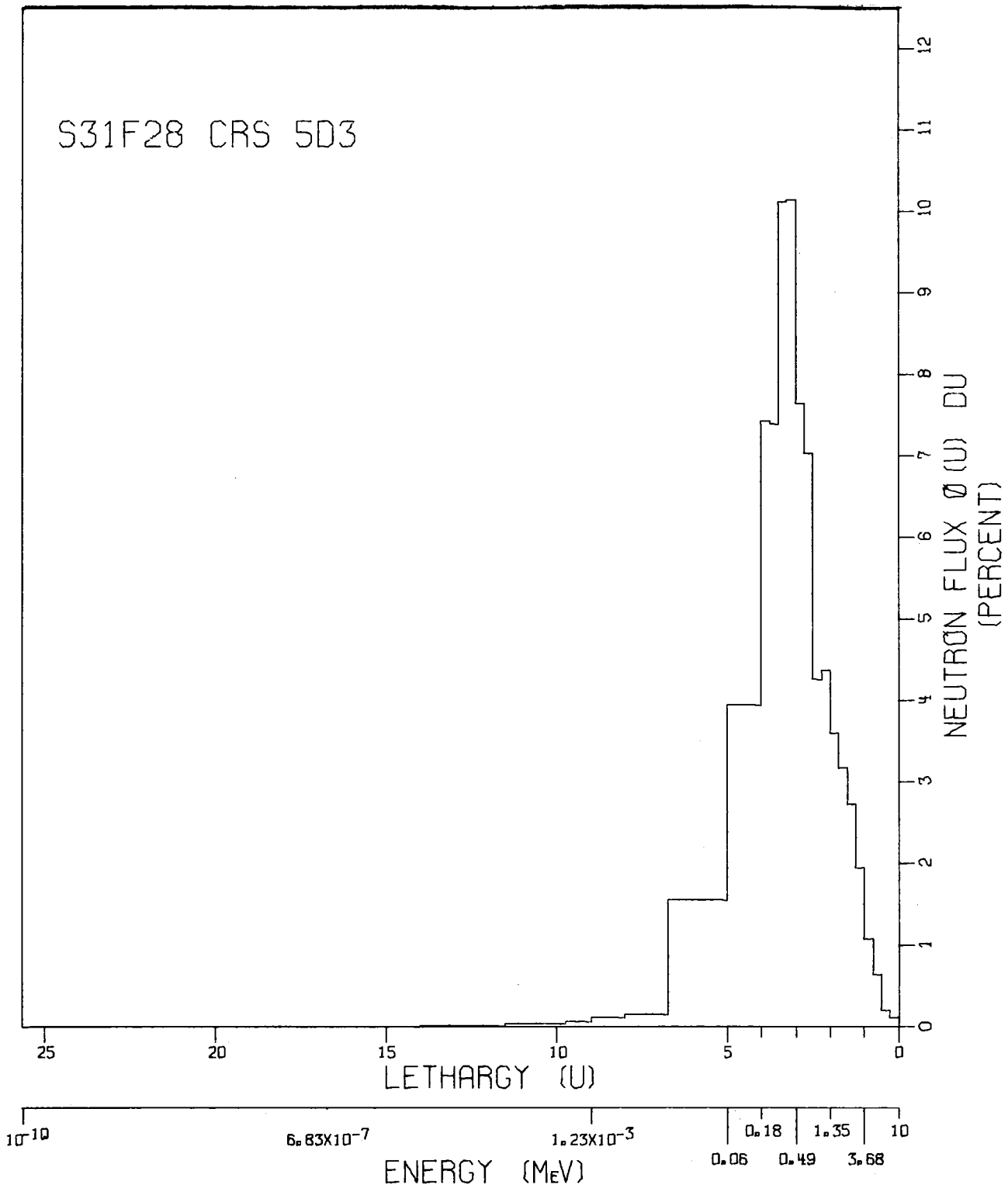
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F27 through 31F29 (below ℄ 5D3)

S31F27 CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.613-003	2.41674+000
0.50	6.07000+000	3.493-003	5.23901+000
0.75	4.72000+000	9.957-003	1.48102+001
1.00	3.68000+000	1.572-002	2.36302+001
1.25	2.87000+000	2.663-002	4.00879+001
1.50	2.23000+000	4.018-002	5.95901+001
1.75	1.74000+000	4.912-002	7.40748+001
2.00	1.35000+000	5.540-002	8.16855+001
2.25	1.05000+000	6.249-002	9.30389+001
2.50	8.21000-001	5.060-002	7.69513+001
2.75	6.39000-001	7.053-002	1.05298+002
3.00	4.98000-001	7.251-002	1.08825+002
3.25	3.88000-001	9.728-002	1.45842+002
3.50	3.02000-001	9.897-002	1.47785+002
3.75	2.35000-001	7.458-002	1.11249+002
4.00	1.83000-001	7.613-002	1.13897+002
5.00	6.74000-002	1.344-001	5.03511+001
6.75	1.17000-002	5.805-002	1.24046+001
8.00	3.36000-003	2.086-003	6.25645-001
9.00	1.23000-003	2.147-004	7.99528-002
9.75	5.83000-004	1.019-005	5.10606-003
11.50	1.01000-004	1.089-005	2.32346-003
14.00	8.32000-006	1.081-005	1.62050-003
16.50	6.83000-007	1.095-005	1.63967-003
25.33	1.00000-010	1.626-006	6.89189-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F28 CRS 5D3
NEUTRON FLUX Ø (U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble; R = 18cm Z = -18.3cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	78.7
>0.5 MeV	(3.86 x 10^{14} †)	40.1
>0.1 MeV	-	18.1
Thermal, °C	-	-

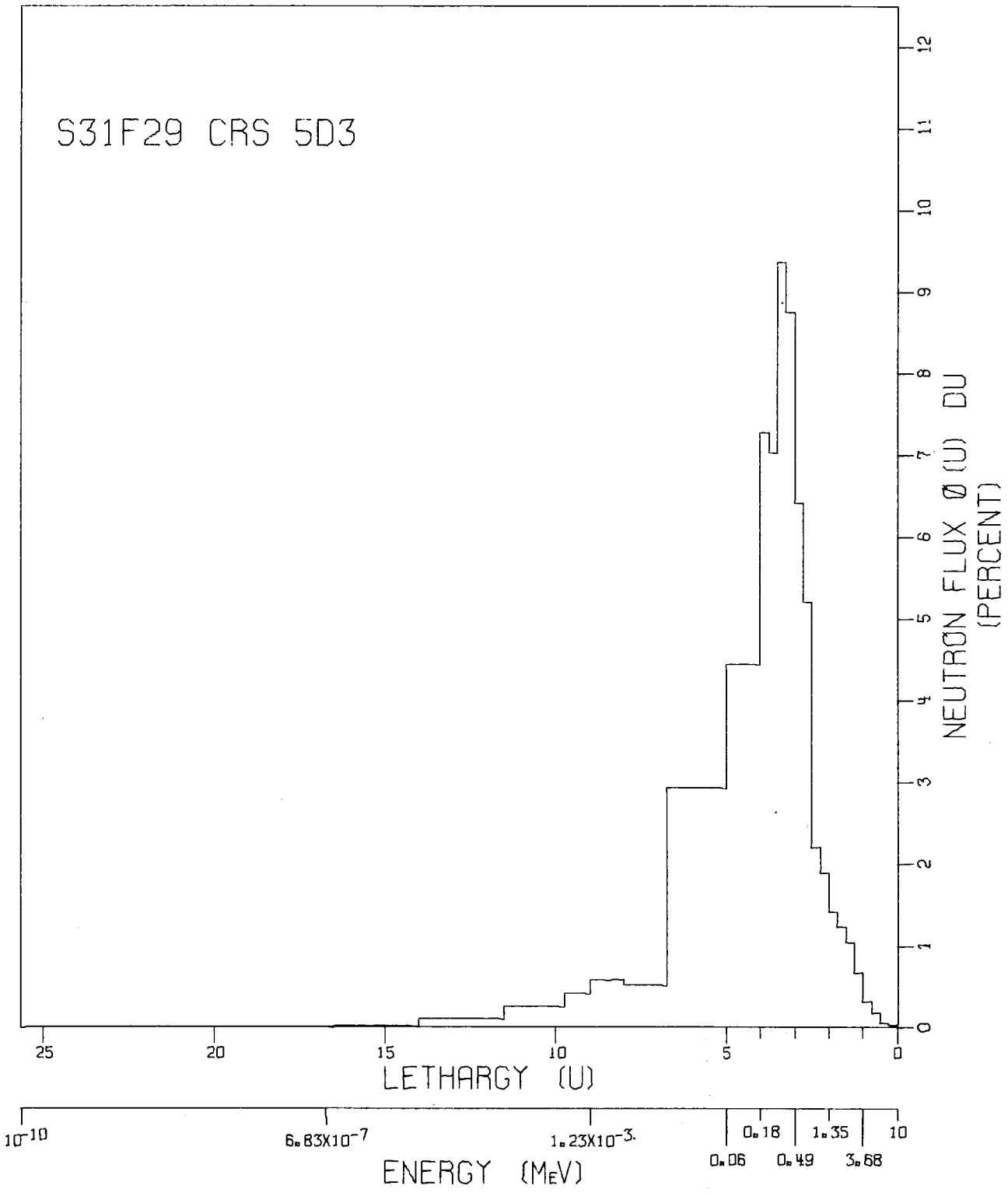
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F27 through 31F29 (below 5D3)

S31F28 CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.041-003	2.32546+000
0.50	6.07000+000	1.949-003	4.35905+000
0.75	4.72000+000	6.386-003	1.41668+001
1.00	3.68000+000	1.069-002	2.39623+001
1.25	2.87000+000	1.927-002	4.32596+001
1.50	2.23000+000	2.738-002	6.05599+001
1.75	1.74000+000	3.135-002	7.04996+001
2.00	1.35000+000	3.634-002	7.99136+001
2.25	1.05000+000	4.388-002	9.74246+001
2.50	8.21000-001	4.179-002	9.47982+001
2.75	6.39000-001	7.039-002	1.56743+002
3.00	4.98000-001	7.617-002	1.70489+002
3.25	3.88000-001	1.012-001	2.26344+002
3.50	3.02000-001	1.013-001	2.25664+002
3.75	2.35000-001	7.408-002	1.64813+002
4.00	1.83000-001	7.429-002	1.65770+002
5.00	6.74000-002	1.574-001	8.79169+001
6.75	1.17000-002	1.086-001	3.46009+001
8.00	3.36000-003	7.423-003	3.32013+000
9.00	1.23000-003	4.162-003	2.31133+000
9.75	5.83000-004	1.843-003	1.37760+000
11.50	1.01000-004	2.409-003	7.66918-001
14.00	8.32000-006	6.420-004	1.43501-001
16.50	6.83000-007	1.098-005	2.45117-003
25.33	1.00000-010	7.554-007	4.77427-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F29 CRS 5D3
NEUTRON FLUX Ø (U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 18cm Z = -32.6cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	64.4
>0.5 MeV	(1.08×10^{14} †)	22.7
>0.1 MeV	-	7.3
Thermal, -°C	-	-

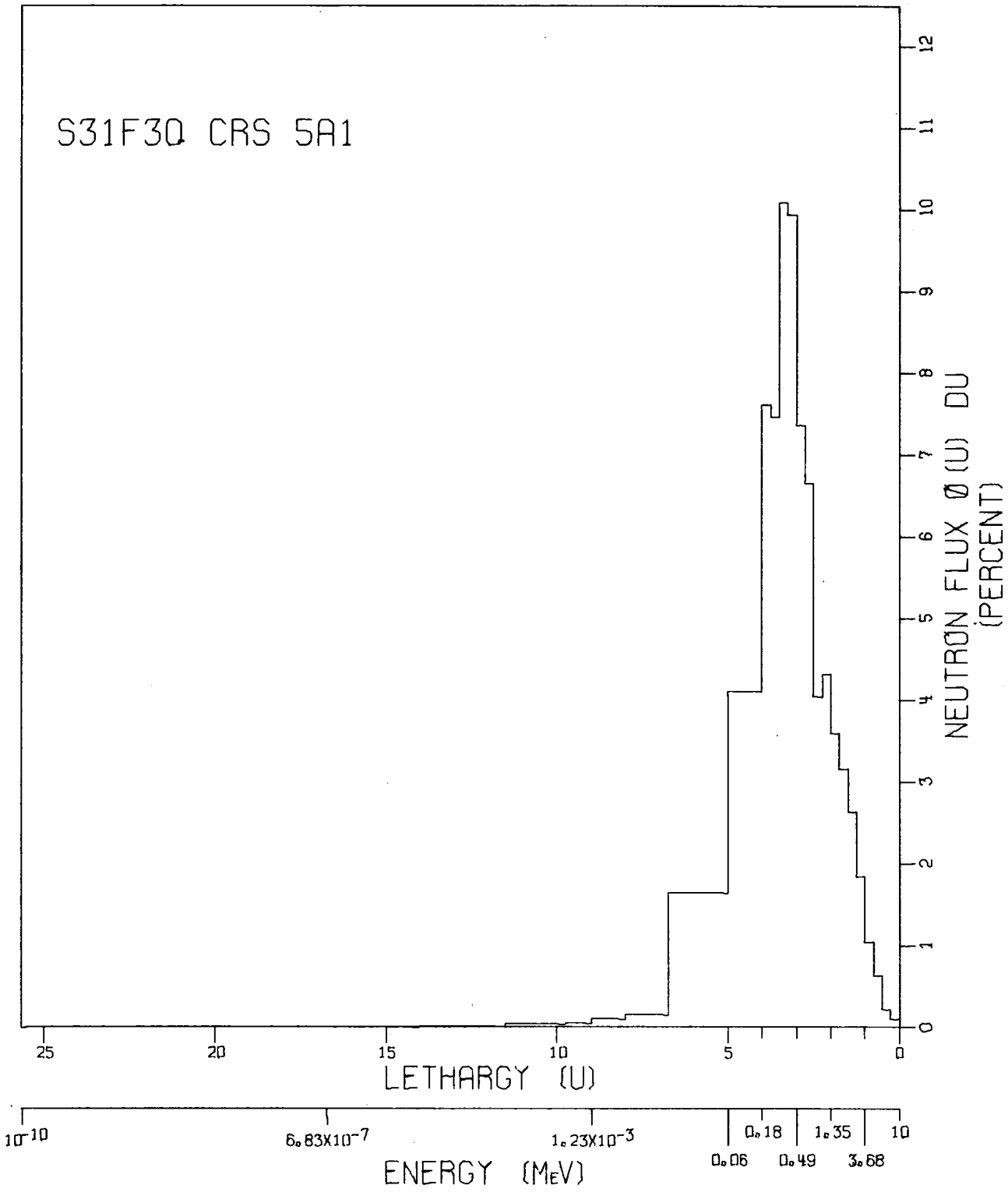
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F27 through 31F29 (below ℄ 5D3)

S31F29 CRS 5D3

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.781-004	1.96104+000
0.50	6.07000+000	5.247-004	3.70340+000
0.75	4.72000+000	1.669-003	1.16821+001
1.00	3.68000+000	3.093-003	2.18833+001
1.25	2.87000+000	6.550-003	4.63948+001
1.50	2.23000+000	1.046-002	7.29937+001
1.75	1.74000+000	1.216-002	8.62891+001
2.00	1.35000+000	1.436-002	9.96168+001
2.25	1.05000+000	1.897-002	1.32915+002
2.50	8.21000-001	2.160-002	1.54608+002
2.75	6.39000-001	5.205-002	3.65736+002
3.00	4.98000-001	6.395-002	4.51738+002
3.25	3.88000-001	8.739-002	6.16543+002
3.50	3.02000-001	9.382-002	6.59311+002
3.75	2.35000-001	7.042-002	4.94360+002
4.00	1.83000-001	7.278-002	5.12473+002
5.00	6.74000-002	1.770-001	3.12048+002
6.75	1.17000-002	2.048-001	2.05912+002
8.00	3.36000-003	2.555-002	3.60679+001
9.00	1.23000-003	2.308-002	4.04368+001
9.75	5.83000-004	1.215-002	2.86692+001
11.50	1.01000-004	1.713-002	1.72076+001
14.00	8.32000-006	9.298-003	6.55874+000
16.50	6.83000-007	9.128-004	6.42987-001
25.33	1.00000-010	4.096-005	8.16840-003
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F30 CRS 5A1
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 22.5cm Z = +16.8cm

Spectrum Code

Code: SAND-II Calculation: WADCO [36]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	78.0
≥0.5 MeV	(3.38 x 10^{14} †)	40.3
>0.1 MeV	-	17.8
Thermal, - °C	-	-

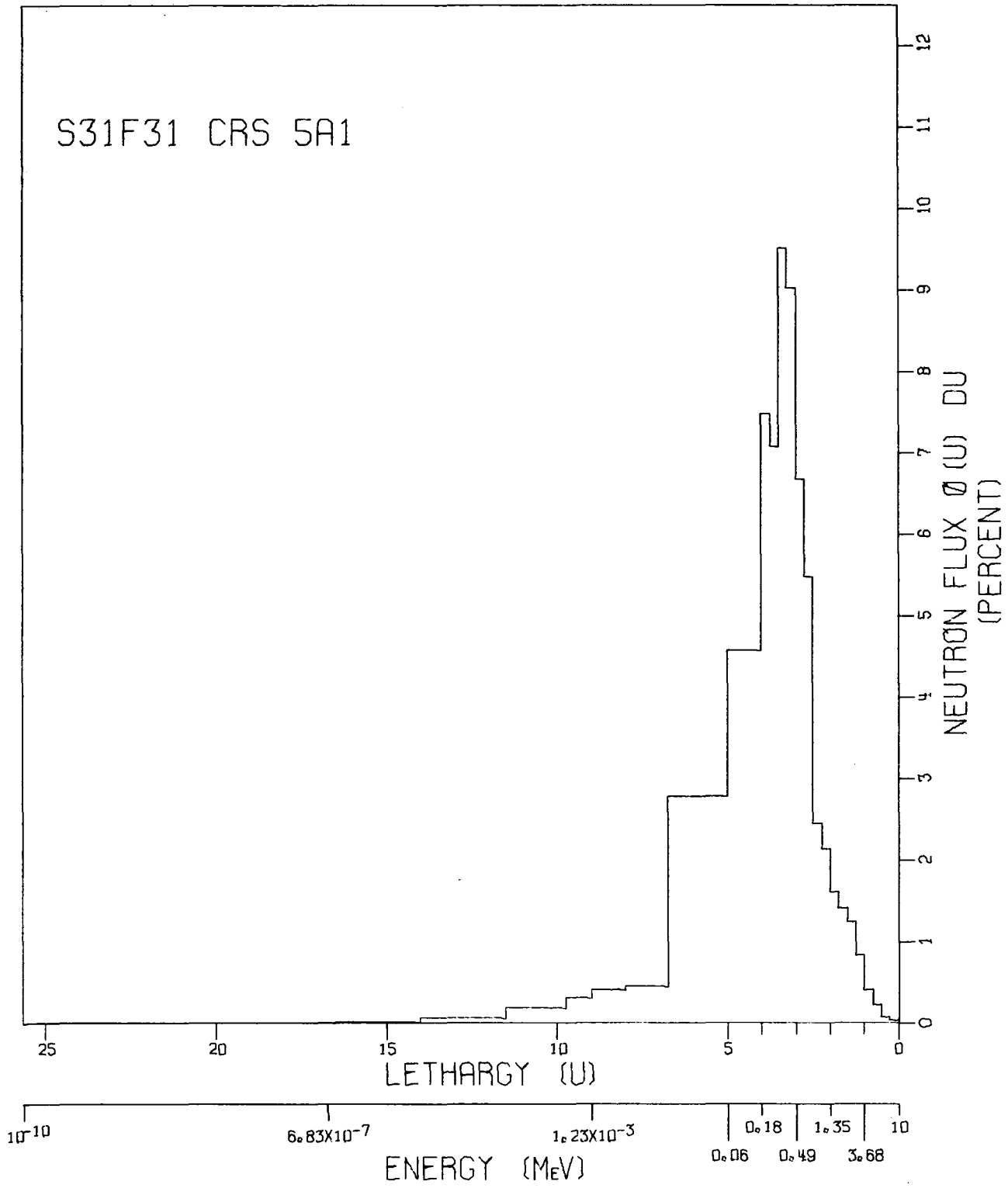
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F30 through 31F32 (above ℄ 5A1)

S31F30 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.023-003	2.35058+000
0.50	6.07000+000	2.058-003	4.73415+000
0.75	4.72000+000	6.318-003	1.44156+001
1.00	3.68000+000	1.030-002	2.37554+001
1.25	2.87000+000	1.818-002	4.19783+001
1.50	2.23000+000	2.652-002	6.03155+001
1.75	1.74000+000	3.127-002	7.23221+001
2.00	1.35000+000	3.638-002	8.22768+001
2.25	1.05000+000	4.333-002	9.89480+001
2.50	8.21000-001	3.971-002	9.26382+001
2.75	6.39000-001	6.657-002	1.52451+002
3.00	4.98000-001	7.341-002	1.68997+002
3.25	3.88000-001	9.919-002	2.28080+002
3.50	3.02000-001	1.011-001	2.31595+002
3.75	2.35000-001	7.483-002	1.71217+002
4.00	1.83000-001	7.618-002	1.74810+002
5.00	6.74000-002	1.637-001	9.40649+001
6.75	1.17000-002	1.147-001	3.75891+001
8.00	3.36000-003	7.444-003	3.42437+000
9.00	1.23000-003	3.830-003	2.18745+000
9.75	5.83000-004	1.525-003	1.17223+000
11.50	1.01000-004	2.081-003	6.81340-001
14.00	8.32000-006	3.204-004	7.36678-002
16.50	6.83000-007	1.105-005	2.53716-003
25.33	1.00000-010	8.979-007	5.83652-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F31 CRS 5A1
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 22.5cm Z = +31.7cm

Spectrum Code

Code: SAND-II Calculation: WADCO [38]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	69.7
>0.5 MeV	(1.22 x 10^4 †)	26.2
>0.1 MeV	-	8.9
Thermal, - °C	-	-

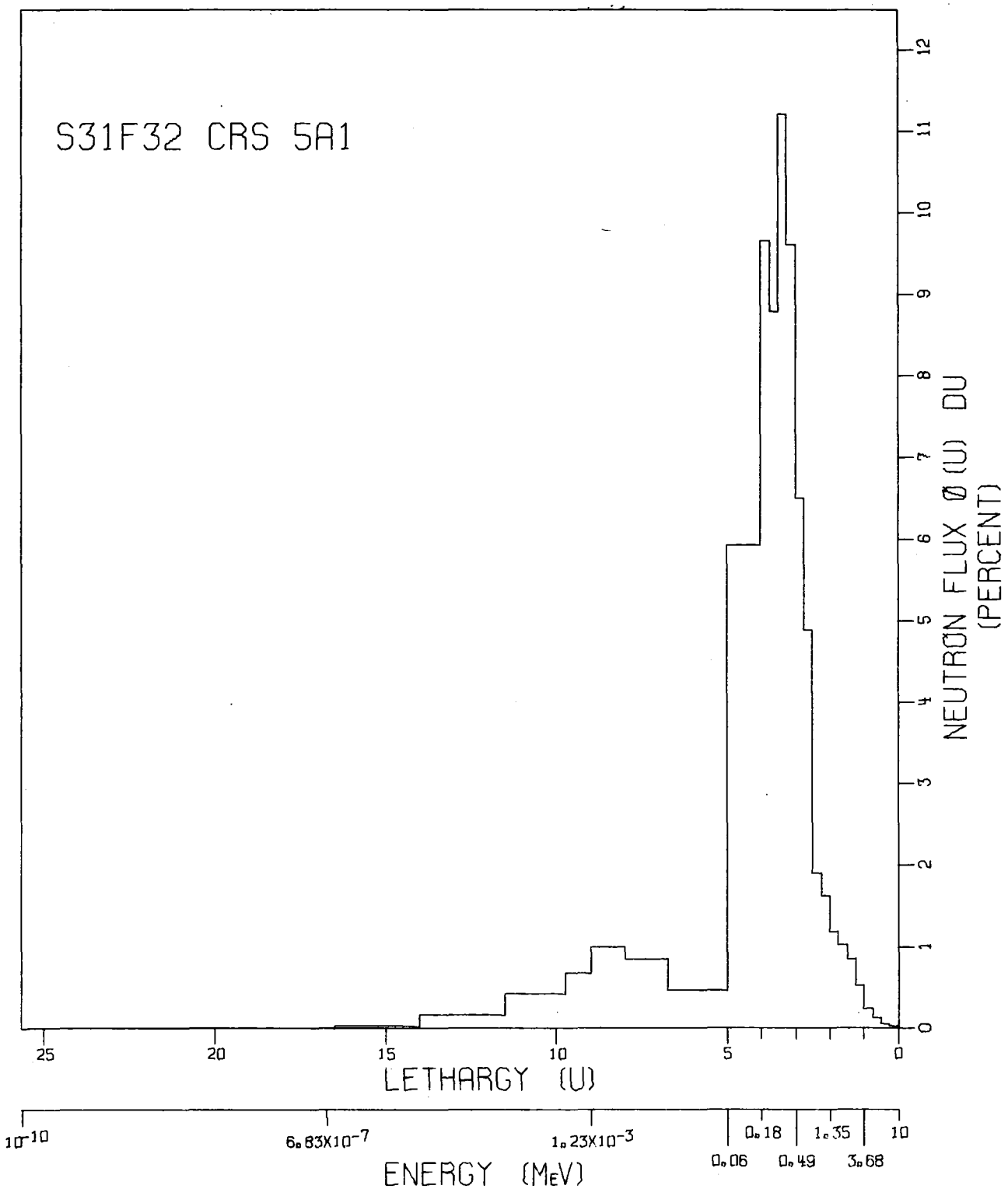
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F30 through 31F32 (above ¢ 5A1)

S31F31 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	3.682-004	2.04815+000
0.50	6.07000+000	6.982-004	3.88838+000
0.75	4.72000+000	2.189-003	1.20872+001
1.00	3.68000+000	4.039-003	2.25448+001
1.25	2.87000+000	8.308-003	4.64313+001
1.50	2.23000+000	1.260-002	6.93978+001
1.75	1.74000+000	1.402-002	7.84903+001
2.00	1.35000+000	1.631-002	8.92955+001
2.25	1.05000+000	2.142-002	1.18425+002
2.50	8.21000-001	2.405-002	1.35792+002
2.75	6.39000-001	5.481-002	3.03828+002
3.00	4.98000-001	6.647-002	3.70443+002
3.25	3.88000-001	9.001-002	5.01047+002
3.50	3.02000-001	9.525-002	5.28133+002
3.75	2.35000-001	7.097-002	3.93082+002
4.00	1.83000-001	7.486-002	4.15832+002
5.00	6.74000-002	1.827-001	2.54189+002
6.75	1.17000-002	1.943-001	1.54172+002
8.00	3.36000-003	2.217-002	2.46890+001
9.00	1.23000-003	1.629-002	2.25209+001
9.75	5.83000-004	9.067-003	1.68729+001
11.50	1.01000-004	1.301-002	1.03096+001
14.00	8.32000-006	5.545-003	3.08572+000
16.50	6.83000-007	4.530-004	2.51756-001
25.33	1.00000-010	2.229-005	3.50729-003
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F32 CRS 5A1
NEUTRON FLUX Ø (U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10⁻¹⁰
6.83X10⁻⁷
1.23X10⁻³
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble; R = 22.5cm Z = +44.2cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	60.3
>0.5 MeV	(4.97×10^{3} †)	18.9
>0.1 MeV	-	6.2
Thermal, -°C	-	-

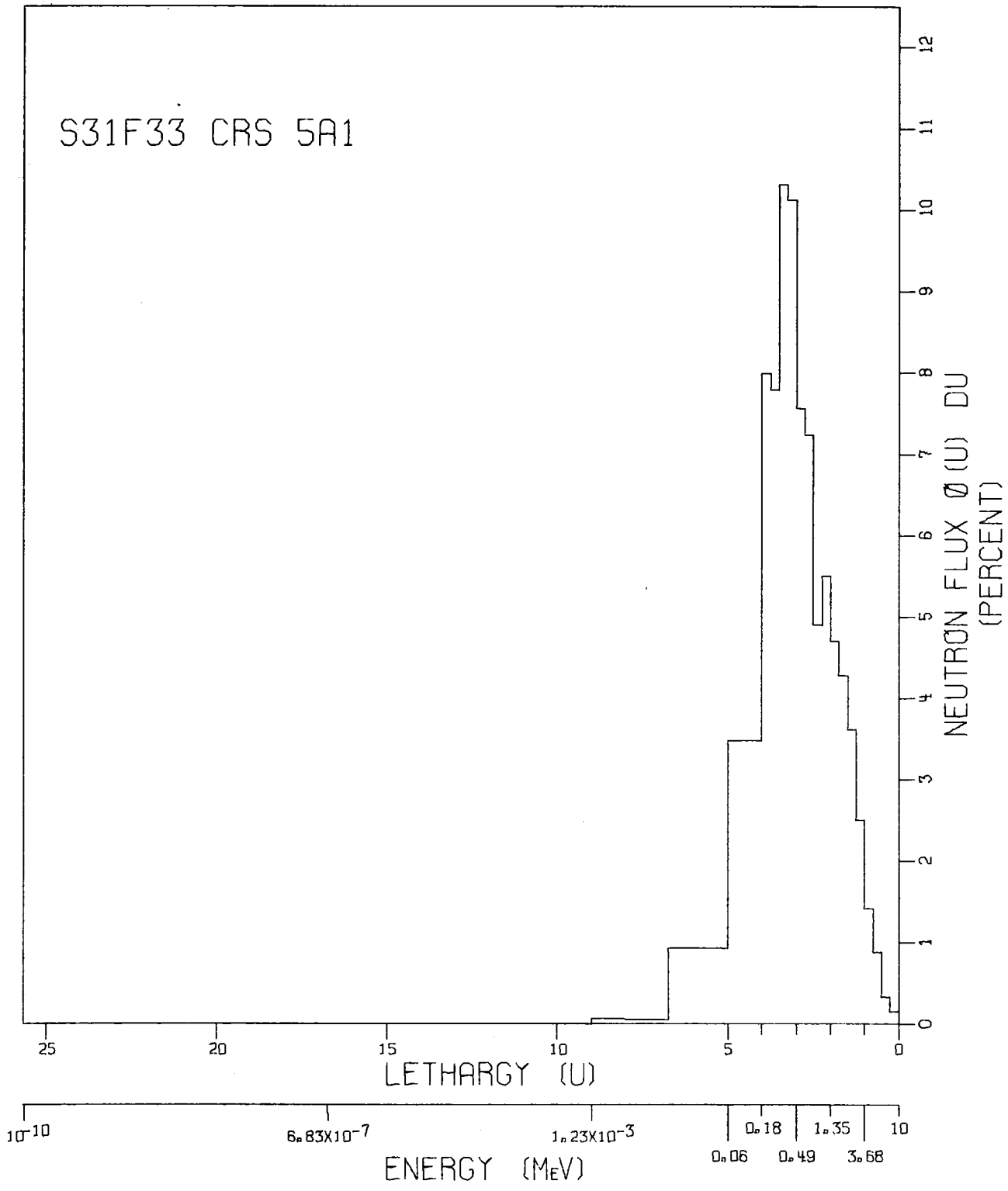
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F30 through 31F32 (above ℄ 5A1)

S31F32 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.138-004	1.93715+000
0.50	6.07000+000	4.077-004	3.69735+000
0.75	4.72000+000	1.200-003	1.07945+001
1.00	3.68000+000	2.328-003	2.11566+001
1.25	2.87000+000	5.163-003	4.69889+001
1.50	2.23000+000	8.570-003	7.68432+001
1.75	1.74000+000	1.010-002	9.20996+001
2.00	1.35000+000	1.208-002	1.07678+002
2.25	1.05000+000	1.629-002	1.46638+002
2.50	8.21000-001	1.867-002	1.71682+002
2.75	6.39000-001	4.893-002	4.41695+002
3.00	4.98000-001	6.474-002	5.87550+002
3.25	3.88000-001	9.590-002	8.69262+002
3.50	3.02000-001	1.124-001	1.01438+003
3.75	2.35000-001	8.811-002	7.94685+002
4.00	1.83000-001	9.660-002	8.73889+002
5.00	6.74000-002	2.367-001	5.36191+002
6.75	1.17000-002	3.251-002	4.20070+001
8.00	3.36000-003	4.226-002	7.66333+001
9.00	1.23000-003	4.025-002	9.06046+001
9.75	5.83000-004	2.002-002	6.06750+001
11.50	1.01000-004	2.920-002	3.76875+001
14.00	8.32000-006	1.565-002	1.41833+001
16.50	6.83000-007	1.654-003	1.49709+000
25.33	1.00000-010	7.094-005	1.81773-002
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F33 CRS 5A1
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble; R = 22.5cm Z = -4.6cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	81.4
>0.5 MeV	(5.59 x 10^{14} †)	46.1
>0.1 MeV	-	22.7
Thermal, -°C	-	-

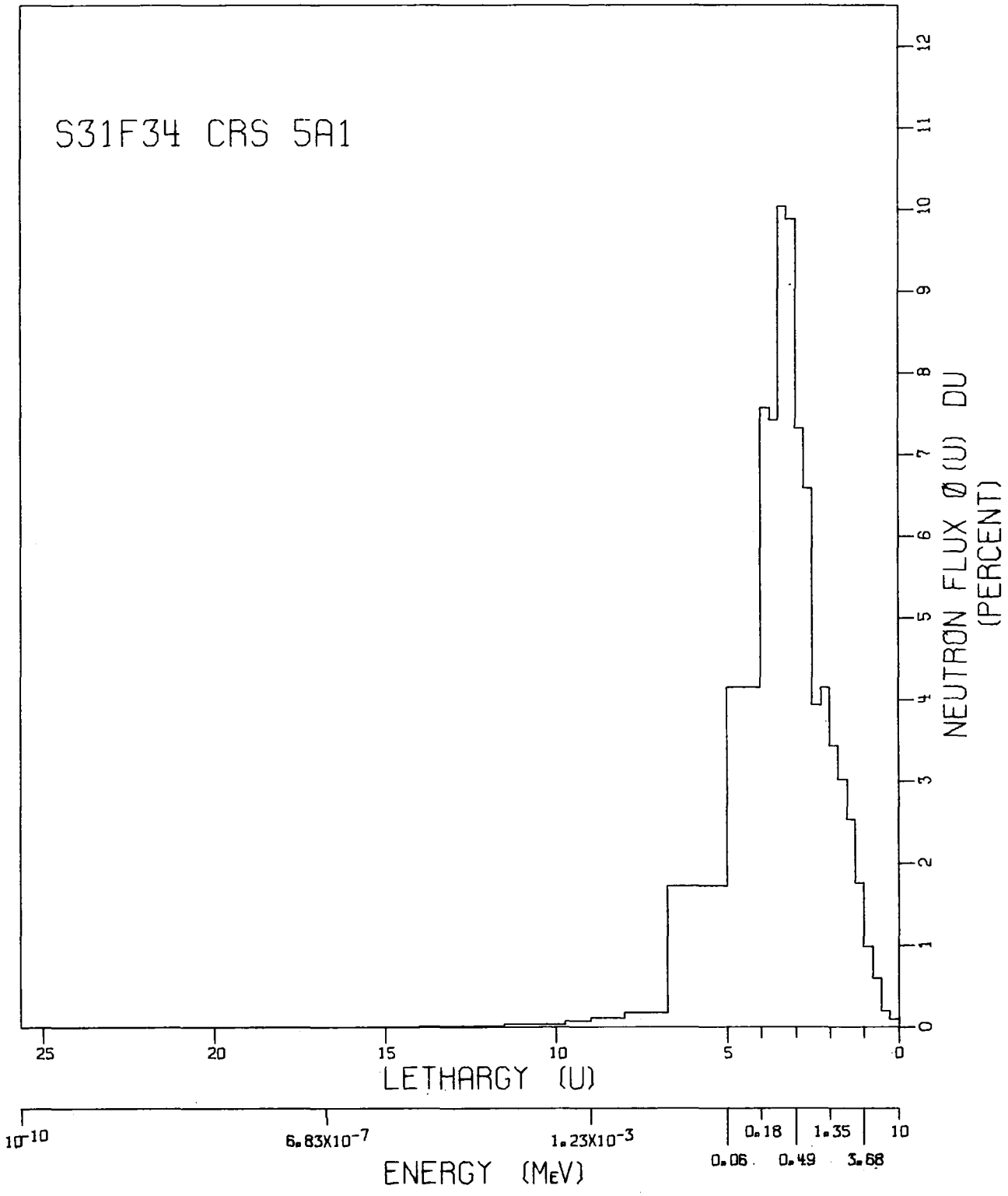
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F33 through 31F35 (below ℄ 5A1)

S31F33 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	1.486-003	2.45910+000
0.50	6.07000+000	3.272-003	5.42134+000
0.75	4.72000+000	8.727-003	1.43409+001
1.00	3.68000+000	1.404-002	2.33164+001
1.25	2.87000+000	2.486-002	4.13345+001
1.50	2.23000+000	3.640-002	5.96257+001
1.75	1.74000+000	4.244-002	7.07065+001
2.00	1.35000+000	4.772-002	7.77222+001
2.25	1.05000+000	5.525-002	9.08655+001
2.50	8.21000-001	4.822-002	8.10231+001
2.75	6.39000-001	7.256-002	1.19673+002
3.00	4.98000-001	7.538-002	1.24987+002
3.25	3.88000-001	1.010-001	1.67318+002
3.50	3.02000-001	1.033-001	1.70451+002
3.75	2.35000-001	7.814-002	1.28757+002
4.00	1.83000-001	7.985-002	1.31979+002
5.00	6.74000-002	1.385-001	5.73048+001
6.75	1.17000-002	6.417-002	1.51470+001
8.00	3.36000-003	2.457-003	8.14142-001
9.00	1.23000-003	2.164-003	8.90045-001
9.75	5.83000-004	9.660-006	5.34830-003
11.50	1.01000-004	1.092-005	2.57552-003
14.00	8.32000-006	1.085-005	1.79630-003
16.50	6.83000-007	1.099-005	1.81755-003
25.33	1.00000-010	1.632-006	7.63950-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F34 CRS 5A1
NEUTRON FLUX Ø (U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MeV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 22.5cm Z = -18.3cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	77.5
>0.5 MeV	(3.15 x 10^{14} †)	39.4
>0.1 MeV	-	17.2
Thermal, -°C	-	-

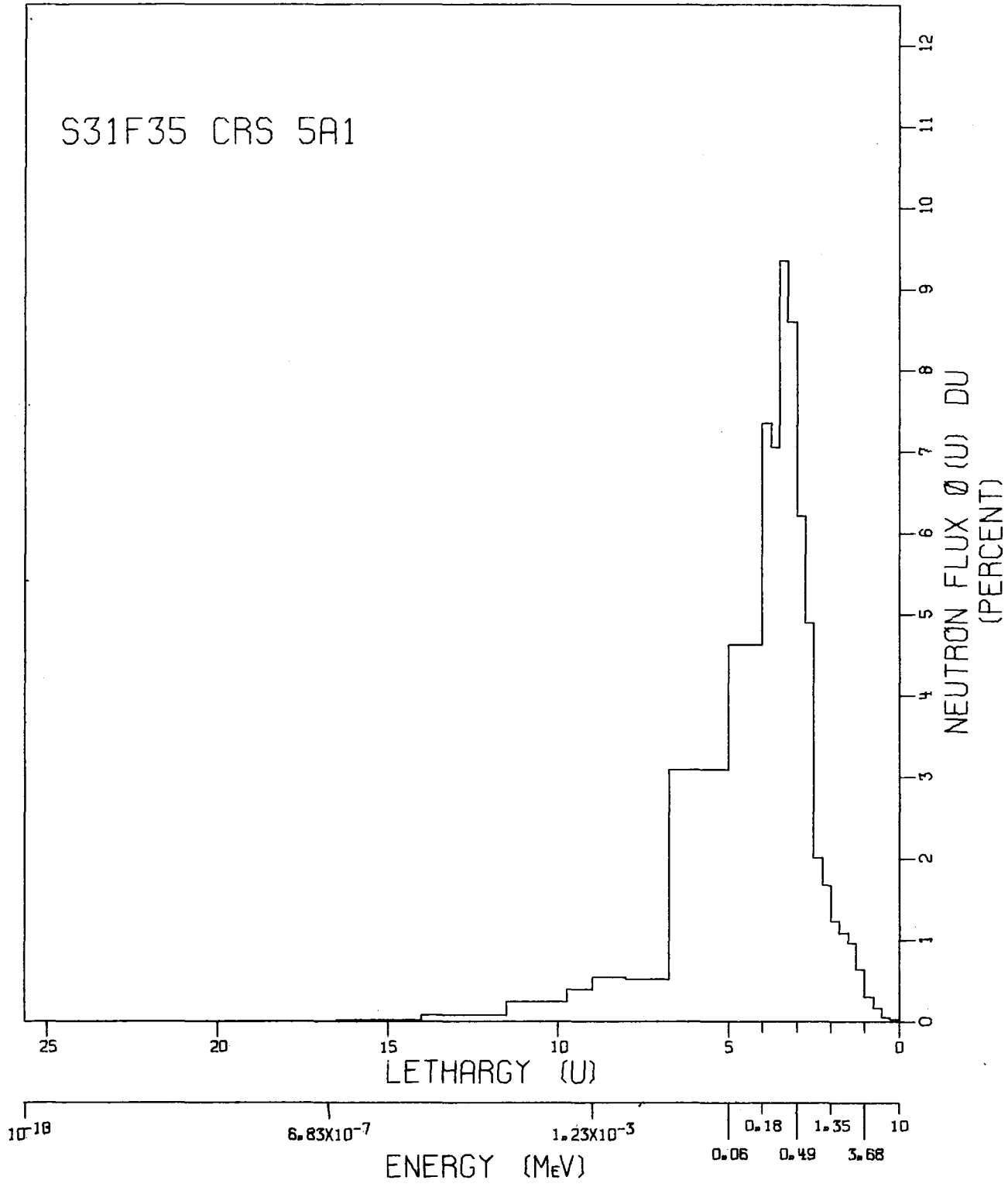
*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F33 through 31F35 (below ℄ 5A1)

S31F34 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	9.686-004	2.33213+000
0.50	6.07000+000	1.969-003	4.74462+000
0.75	4.72000+000	5.959-003	1.42433+001
1.00	3.68000+000	9.778-003	2.36237+001
1.25	2.87000+000	1.748-002	4.22798+001
1.50	2.23000+000	2.553-002	6.08335+001
1.75	1.74000+000	2.995-002	7.25795+001
2.00	1.35000+000	3.488-002	8.26513+001
2.25	1.05000+000	4.165-002	9.96605+001
2.50	8.21000-001	3.871-002	9.46083+001
2.75	6.39000-001	6.604-002	1.58453+002
3.00	4.98000-001	7.305-002	1.76201+002
3.25	3.88000-001	9.863-002	2.37613+002
3.50	3.02000-001	1.006-001	2.41451+002
3.75	2.35000-001	7.449-002	1.78561+002
4.00	1.83000-001	7.580-002	1.82253+002
5.00	6.74000-002	1.656-001	9.96844+001
6.75	1.17000-002	1.207-001	4.14409+001
8.00	3.36000-003	8.549-003	4.12017+000
9.00	1.23000-003	4.524-003	2.70681+000
9.75	5.83000-004	1.965-003	1.58270+000
11.50	1.01000-004	2.639-003	9.05180-001
14.00	8.32000-006	5.366-004	1.29241-001
16.50	6.83000-007	1.105-005	2.65883-003
25.33	1.00000-010	7.956-007	5.41854-005
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U


S31F35 CRS 5A1
NEUTRON FLUX Ø(U) DU
(PERCENT)
0
1
2
3
4
5
6
7
8
9
10
11
12
25
20
15
10
5
0
LETHARGY (U)
10-10
6.83X10-7
1.23X10-3
0.18
1.35
10
0.06
0.49
3.68
ENERGY (MEV)

Reactor Description

Name: Experimental Breeder Reactor-II

Type: Fast, test Power Level: 62.5 MWt

Coolant: Sodium Moderator: -

Location: National Reactor Testing Station, Idaho Falls, Idaho

Spectrum Facility Description

Control rod thimble: R = 22.5cm Z = -32.6cm

Spectrum Code

Code: SAND-II Calculation: WADCO [35]

Lower Energy Limit	Neutron Flux* $n/cm^2 \cdot sec^{-1}$	Spectrum-Averaged Cross-Section $\bar{\sigma}$, mb
>1 MeV	-	67.4
>0.5 MeV	(9.02 x 10^{13} †)	22.9
>0.1 MeV	-	7.0
Thermal, -°C	-	-

*Fast flux based on $^{54}Fe(n,p)^{54}Mn$ reaction (8); Thermal flux based on $^{59}Co(n,\gamma)^{60}Co$ reaction or Ag-Co technique (11)

†In series of spectra 31F33 through 31F35 (below ℄ 5A1)

S31F35 CRS 5A1

LETHARGY (U)	LOWER ENERGY LIMIT (MEV)	FLUX FRACTION PER GROUP	NORMALIZED FLUX PER LETHARGY INTERVAL
0.25	7.79000+000	2.673-004	1.99523+000
0.50	6.07000+000	5.019-004	3.74960+000
0.75	4.72000+000	1.551-003	1.14961+001
1.00	3.68000+000	2.968-003	2.22265+001
1.25	2.87000+000	6.309-003	4.73035+001
1.50	2.23000+000	9.700-003	7.16595+001
1.75	1.74000+000	1.075-002	8.07236+001
2.00	1.35000+000	1.252-002	9.19870+001
2.25	1.05000+000	1.681-002	1.24708+002
2.50	8.21000-001	1.976-002	1.49873+002
2.75	6.39000-001	4.911-002	3.65268+002
3.00	4.98000-001	6.191-002	4.62834+002
3.25	3.88000-001	8.585-002	6.41074+002
3.50	3.02000-001	9.372-002	6.97112+002
3.75	2.35000-001	7.068-002	5.25214+002
4.00	1.83000-001	7.351-002	5.47849+002
5.00	6.74000-002	1.845-001	3.44269+002
6.75	1.17000-002	2.159-001	2.29840+002
8.00	3.36000-003	2.571-002	3.84130+001
9.00	1.23000-003	2.161-002	4.00868+001
9.75	5.83000-004	1.141-002	2.84860+001
11.50	1.01000-004	1.636-002	1.73917+001
14.00	8.32000-006	7.743-003	5.78124+000
16.50	6.83000-007	8.013-004	5.97415-001
25.33	1.00000-010	3.730-005	7.87444-003
		1.000+000	

ONE LETHARGY INTERVAL = 0.25U