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Neutron Physics Division

THE LOW-ENERGY NEUTRON SPECTRUM OF THE ORNL TOWER SHIELDING REACTOR BEAM

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ABSTRACT

An estimate of the spectrum of neutrons having energies between 0.4 and 1.5 MeV emitted by the ORNL Tower Shielding Reactor (TSR-II) has been made. Spherical, hydrogen-filled proportional counters were used to obtain the data. The unfolded result of the measurement is presented as a histogram of flux vs energy.

Spherical, hydrogen-filled proportional counters, constructed according to the design of Benjamin[1] but having radii of 2.36 cm, have been used to obtain an estimate of a portion of the neutron spectrum of the ORNL Tower Shielding Reactor (TSR-II) unshielded beam. The energy range embraced by this measurement extends from 0.4 to 1.5 MeV. To cover this range three counters, having hydrogen pressures of 1, 3, and 10 atm respectively, were required. Each counter is useful only within relatively narrow energy limits. The lower limit is established as the point where gamma-ray events become important; the upper where counter wall effect becomes excessive. (A moderate degree of wall effect is corrected for in data analysis.)

All detectors were located on the centerline of the TSR-II beam hole at a distance of 6 ft from the reactor.

The pulse-height spectra resulting from the measurements were unfolded using a slightly modified version of the SPEC4 code of Benjamin.[2] The high-energy ($>$ 1.5 MeV) spectrum required as an input to this code was from an earlier measurement of the TSR-II beam made with an organic scintillator spectrometer.

The results of the unfolding are shown as Fig. 1. The lack of agreement observed where results from 2 counters overlap is imperfectly understood. It is believed to result from small errors in pulse-height analyzer linearity and zero, from errors in detector energy calibration, or from both sources. These errors are difficult to eliminate.

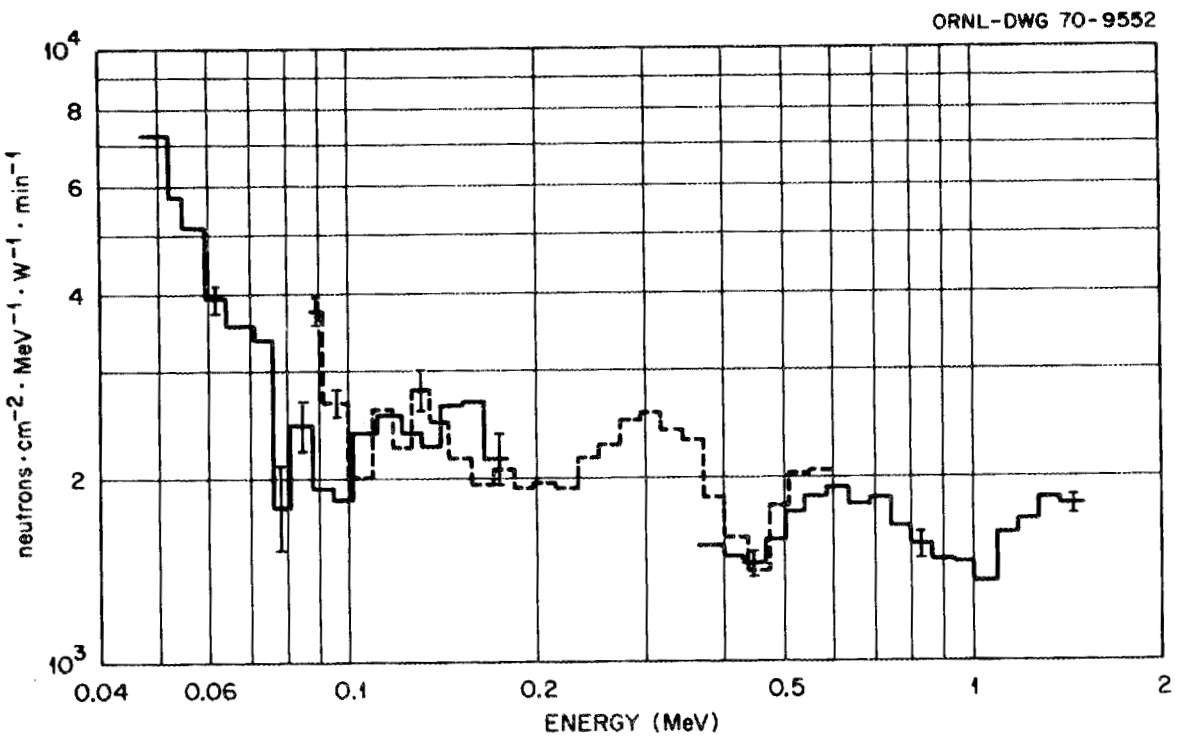

Fig. 1. TSR-II Bare Beam at 6 feet.

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1. P. W. Benjamin et al., Nucl. Instr. Meth. 59, 77 (1968).

2. P. W. Benjamin and C. D. Kemshall, The Analysis of Recoil Proton Spectra, AWRE Report No. 07/67 (1967).

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