

§3. Measurements of Environmental Neutrons in Toki Area

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From the view points of estimation of environmental neutron doses caused by operation of the fusion reactor and promotion of understanding of the population about environmental safety around the nuclear facility, it is important to know the feature of the variation of background neutron energy spectra before starting operation of the nuclear fusion facility, because the neutron energy spectrum in the natural environment varies depending on the weather condition and solar activities as well as the geographic condition.

For estimation of neutron flux densities based on neutron energy spectra moderating type neutron spectrometer(NIFS neutron spectrometer) which was composed of 6 series of $25^{\phi} \times 300^l$ cylindrical He-3 counters covered with polyethylene moderators whose thickness was distributed from 0[mm] to 100[mm]. Response functions of these counters with different type moderators were calculated with Monte Carlo code named MCNP. Absolute efficiency of the response functions were determined by comparison between the counting rates measured with the NIFS spectrometer and those derived from the neutron energy spectrum estimated by using the well calibrated neutron counters of Fukuyama university with the assumption that the pattern of the neutron energy spectrum in Toki was same as that of Fukuyama except for their relative intensities.

The calibration measurements were carried out on the first floor in the building of the R&D Laboratories in NIFS in December, 2008. Another series of measurements with the NIFS neutron spectrometer was also carried out in the same month of 2008. Measuring time of each counter was 8000 [s] respectively.

The absolute efficiencies of the response matrix for NIFS spectrometer could be determined using the energy spectrum in Toki estimated on the basis of the spectrum observed in Fukuyama area whose intensity was about 10 % less than those in the former one. With the aid of this

response matrix obtained here the neutron energy spectrum was calculated by using counting rates measured with the NIFS spectrometer. The neutron energy spectrum is shown in Fig.1. The total flux density accumulated from 10^{-8} [MeV] to 10^3 MeV is about 8.2×10^{-3} [$\text{n cm}^{-2}\text{s}^{-1}$] which is in good agreement with the other studies.^{1,2)}

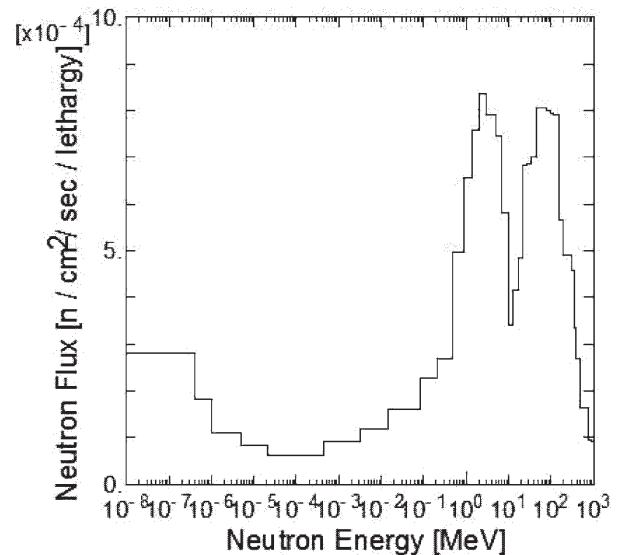


Fig.1. Neutron energy spectrum observed on the first floor of the Experimental Laboratory in NIFS

- 1) Kowatari, M. et al., J.Nucl.Sci.Technol.**42(6)** (2005) 495.
- 2) Nakamura, T. et al., J.Nucl.Sci.Technol.**42(10)** (2005)843.