**Subgroup 9 Status Report: Fission Neutron Spectra**
24 May 2000

Subgroup 9 has been primarily concerned with determining a physically correct prompt fission neutron spectrum matrix for the n + 235-U system.

The following work has been done:

1. Measurements of the differential spectrum, together with uncertainties, have been collected for 12 experiments by N. Kornilov and P. Staples. The experiments span an incident neutron energy range of thermal to 5.0 MeV, which means that no experimental determinations of the spectrum that we have include the physical effects of second- and third-chance fission.

2. A set of 30 integral cross section measurements in the n(thermal) + 235-U system have been compiled by W. Mannhart following a careful analysis and evaluation of the existing experimental database. These provide integral tests of the prompt fission neutron spectrum for thermal neutron induced fission under the assumption that the corresponding cross sections for the specific reactions are known exactly.

3. The Los Alamos model has been used to calculate a new prompt fission neutron spectrum matrix for the n + 235-U system. Energy-dependent compound-nucleus formation cross sections for the inverse process were used throughout. The matrix includes first-, second-, and third-chance fission components and also includes the neutrons evaporated prior to fission in second- and third-chance fission. It has been calculated for 19 incident neutron energies ranging from 0.0 to 15.0 MeV. The nuclear level-density parameters used in the calculations were determined in least-squares adjustments to the measured differential spectra assembled by N. Kornilov and P. Staples. The matrix is considered complete except for the following:

4. The measurements of the thermal-neutron-induced spectrum are not in agreement. This means that the calculated thermal spectrum depends upon which measurement, or measurements, is used to determine the nuclear level-density parameter for this case. A number of candidate thermal spectra have therefore been calculated for testing against the set of 30 integral cross-section measurements. The candidate spectra have been forwarded to W. Mannhart who has calculated the 30 integral cross sections using each of the candidate spectra. His results are now being studied.

5. The measurements of the 0.5-MeV-neutron-induced spectrum are also not in complete agreement. This problem has been partially resolved, however, by use of the fact that the Los Alamos model also calculates, using the identical input, the average prompt neutron multiplicity "nu-bar" which has been measured (many) times.

6. The question of the influence of possible scission neutrons on the prompt fission neutron spectrum matrix is being studied by N. Kornilov and F.J. Hambsch.

It is worth noting here that the prompt fission neutron spectrum matrix for the n + 235-U system in ENDF/B-VI, also calculated using the Los Alamos model, was based upon only one measurement of the differential spectrum together with the existing experimental database of "nu-bar" values.

Finally, following a determination of the best candidate spectrum for thermal fission, the complete matrix will be sent to the Subgroup 9 for their scrutiny. This will be followed by a meeting of the Subgroup 9.