INTERNATIONAL NUCLEAR DATA COMMITTEE

Report on Australian Activities May 1967 - May 1968

1. Data Compilation

CINDA continues to be used effectively for compiling data for the A.A.E.C. master library tape. It has enabled the preparation of a range of data sets for various nuclides for use in reactor physics calculations. In particular it has been most useful in tracking down strength functions for fission product data studies.

DASTAR output has been requested for U235 from the I.A.E.A. Nuclear Data Unit and the information has been used in subsequent evaluation work.

2. Evaluation of Nuclear Data

Some fission and capture cross section data for U235 from DASTAR is being analysed with single and multilevel fits to compare with the current A.A.E.C. data file of resonance parameters. Uncertainties in the capture cross section hamper these calculations. We are proposing to obtain alpha values also to provide further checking of the level fitting process.

Single and multilevel fits to the U233 cross sections below 11 eV have been completed. Although the multilevel formula used was the Feshback, Porter and Weisskopf approximation, the prime aim was to obtain a consistent set of resonance spins. Good agreement with the qualitative results of the channel theory of fission was obtained.

A method for calculating the probability of missing levels in slow neutron spectroscopy has been completed and will be published shortly. The method no longer seeks to correct an experimental distribution of resonance parameters but calculates the overlapping probability directly from the known resonance profile. The correction depends on the ratio $\Gamma/\langle D\rangle$ and is $\lesssim 30\%$ for U233.

Analytical studies on thermal neutron cross sections have been completed. This work supplements previous Monte Carlo calculations in an attempt to define precise statistical limits on unknown cross sections. Again the work is ready for publication.

Many of the ideas on development of cross sections from resonance parameters are embodied in the reactor physics group cross section generation code GUNYA. GUNYA is a flexible code with the following principles built in :

1) Input should be in a flexible format that can be readily adapted to any data source (e.g. magnetic tape, graphical, tabular, etc.). The tedium of preparation and the risk of human error are both reduced. Data is automatically checked for validity with recovery action taken where

possible rather than abandoning the job.

2) Flexible Execution should direct the calculation according to the requirements and experimental data available for particular nuclides. Interpolations across unmeasured data regions are possible and internal provision is made for any unknown data.

3) Output is in a form suitable for preliminary investigation of data, or for direct loading into reactor physics code libraries.

Prediction of data for the thermal to the MeV region is being investigated especially for inelastic scattering and it is anticipated that a computer code will allow prediction, and interpolation of existing data, over the range from 0.001 eV to 10 MeV.

3. Measurement Programme

(a) Fission Physics - Nubar versus Neutron Energy

A detailed study of the variation of nubar for U235 is being undertaken for neutron energies from thermal to 1 MeV. The experiment should be completed shortly with the results becoming available in one to two months.

Similar measurements on U233 and Pu241 will follow and the results are expected to be available later in 1968.

(b) Fission Physics - A.A.E.C.-I.A.E.C. Collaborative Programme

A study of K X-ray spectra and charge distributions from the thermal fission of U235, U233 and Pu241 is being undertaken on a collaborative basis with the staff of Bhabha Atomic Research Centre. The work is to be carried out at Lucas Heights with Indian staff seconded for the project. The equipment is very nearly ready and we expect the secondment of Indian staff to begin in May.

(c) Neutron Capture Gamma Ray Studies

The study of resonance capture spectra has continued. A paper on natural copper has been published, two papers on nickel and gold are complete, results on titanium and lead are available, while zinc, cobalt and manganese are being studied next.

The study of the mass region from 50 - 70 is producing

information on p- and d-wave cross sections and resonances.

ORNL data on lead and iron have been analysed and submitted for publication, together with information on the separated isotopes Fe^{54} and Fe^{56}.

Thermal capture gamma ray studies have been carried out on separated Fe^{56}, natural scandium, natural calcium and natural potassium in association with University of Melbourne and Townsville University College, using the Commission's high flux reactor HIFAR. Gamma - gamma coincidence measurements are also being undertaken.

The University of Melbourne has continued its use of the Betatron bright line scattering measurements on U233 and tungsten. The capture gamma width in the 132 eV resonance of cobalt is being measured.