FACTS

energy SCIENCES & TECHNOLOGY DEPARTMENT

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BROOKHAVEN NATIONAL LABORATORY

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Nuclear Data for Nuclear Energy

Brookhaven National Laboratory is operated by Brookhaven Science Associates, a not-for-profit research management company, under contract with the U.S. Department of Energy.

The design and simulation of electrical power plants, which produce energy from nuclear fission require large amounts of low-energy nuclear physics data. This data describes

- interaction of neutrons with materials in a nuclear reactor, and
- radioactivity produced when a radioactive material decays.

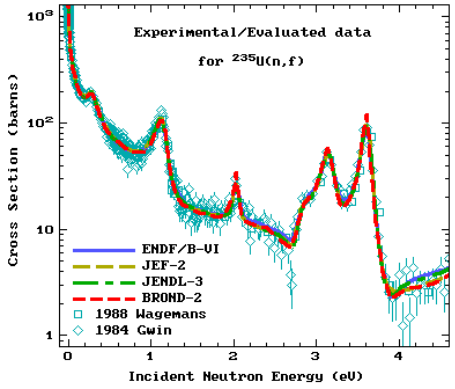
Nuclear reaction data is either measured experimentally using neutrons produced in an accelerator or in a nuclear reactor or calculated using models of the nuclear physics interactions**.** Nuclear radioactivity data is measured in similar experiments by observing the radiations from activated nuclei.

Nuclear data is used in nuclear engineering codes which calculate

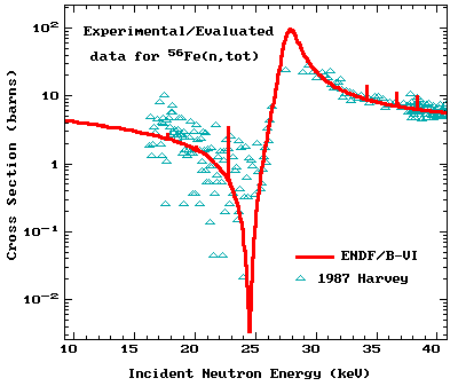
- criticality of a nuclear reactor core,
- burn up of nuclear fuels in a reactor,
- flux profile and spatial distribution of energy released within the reactor core,
- activation of and radiation damage to and reactor components,
- radiation shielding of people and equipment in and around a nuclear power plant,
- safe transport of nuclear materials, and
- overall safety of a nuclear plant's operation.

Without validated nuclear data, such calculations could not be carried out.

The nuclear data used in the United States is produced by the effort of the Cross Section Evaluation Working Group, which was organized in 1966 and is led by the National Nuclear Data Center (NNDC). Nuclear data measurements are often conflicting and do not cover all materials, reaction types, and energy ranges required. As a result, individuals with training in low energy nuclear physics "evaluate" nuclear data to produce the comprehensive data files needed. An evaluator will attempt to resolve discrepancies in experimental measurements and use nuclear physics models to fill in the data gaps. The data is stored in computer files in the internationally adopted ENDF format. The data's validity is tested by comparing calculated results with measured parameters from an "integral" experiment. The U.S. nuclear data library, ENDF/B-VI contains nuclear reaction data for 325 stable and long-lived nuclei and decay data for 979 radioactive products.



One example of the critical importance of good nuclear data is need to have accurate knowledge of the minimum in the iron cross section at 25 keV. This minimum provides a window for neutrons to escape through a reactor shield. An accurate knowledge of this minimum allows for a smaller design margin and thereby saves cost**.**



The National Nuclear Data Center is the focal point of the US effort to collect, store and evaluate nuclear data. It is impossible for the NNDC to do this work alone. Its effort is supplemented by national and international networks of scientists, which do the work of compilation and evaluation of nuclear data in agreed formats using common methodology. The international activities are carried out through the efforts of the International Atomic Energy Agency and the Nuclear Energy Agency. All of the data collected in these activities is distributed by NNDC to users, largely over the Internet. More than 250,000 data retrievals were made over the Internet in the past year.

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Reviewing new evaluations for ENDF data library.