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The AMPX-2000 Operating System for Producing Continuous Energy and Multi-Group Cross-Sections from Basic Data Libraries Using the ENDF-6 Formats

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The AMPX system was developed in the early 1970's to produce multigroup neutron and gamma-ray cross-section libraries, based on data taken from the Evaluated Nuclear Data Files (ENDF/B). The formats and procedures employed in the ENDF/B files have evolved from their first version distributed in the mid 1960's to the present format, designated as ENDF-6. Because there are obvious advantages for using the same data format in cross-section libraries developed in different countries, the ENDF/B, JENDL, JEF, CENDL, and BROND files, developed in the USA, Japan, the OECD, China, and Russia, respectively, now all employ this format. The only processing system that can completely process ENDF formats is the NJOY system developed at the Los Alamos National Laboratory (LANL), and it is universally used to process the various data collections previously mentioned.

The AMPX system, last released in 1992, maintained a comprehensive collection of processing capabilities up through ENDF/B Version V (ENDF/B-V); however, the substantial differences between ENDF/B-VI and earlier versions made it impractical to simply upgrade many of the major processing codes in this system.

The U.S. Nuclear Regulatory Commission (NRC) has supported the development and maintenance of the SCALE system developed at the Oak Ridge National Laboratory (ORNL) for analyzing spent fuel shipping casks and other radiation safety problems. Most SCALE cross-section libraries have been produced by AMPX. SCALE uses integral-transport methods for self-shielding resolved resonances, as opposed to the Bondarenko method used in NJOY. Because of the SCALE needs, coupled with the opinion that there should be at least one independent code system that can process ENDF data, the NRC has sponsored a 5–6 person year effort to upgrade AMPX.

The effort was initiated in 1994, and the resulting code system has been written and is being tested, with a release expected early in 2002. The AMPX package includes a complete re-write of the major processing codes. These new codes use many novel and innovative procedures to perform the processing tasks of the original AMPX system and to process the new ENDF-6 formats. As an example, a single set of integration routines is used to produce group-averaged data and scattering matrices for all particles and all nuclear processes. The integration feature was implemented by making the codes that read the ENDF/B libraries produce a tabular "kinematics" data file, written in a structure that precludes the code that makes multigroup data from having any knowledge of the basic physics or particle type involved in the nuclear reaction being treated. The details of the new techniques will be described in the full paper.