New Analysis Capabilities and Nuclear Data Upgrades in ORIGEN-ARP Version 3

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Over the past few years there has been a concerted effort to upgrade and expand the basic nuclear data used by the ORIGEN-S depletion and decay code. As part of this effort the nuclear decay library was upgraded to use primarily ENDF/B-VI data, and this library was released with SCALE 4.2 in 1994. In 2001, the neutron source methods in ORIGEN-S were significantly enhanced with more rigorous and general methods for the evaluation of spontaneous fission neutrons, neutrons arising from (alpha, n) reactions in an arbitrary matrix, and delayed neutrons arising from short-lived fission products. Since this work was completed several major upgrades of nuclear data have been implemented, and these upgrades are the subject of this paper. This work includes:

(1) Replacement of the basic neutron reaction cross sections (compiled from cross-section evaluations from the 1960's) with evaluations from ENDF/B-VI, the European Activation File (EAF-99), and FENDL-2 data. The number of nuclides and neutron reactions that can be simulated by the code dramatically increases as a result of this upgrade.
(2) Upgrade and expansion of the fission product library from ENDF/B-V to the latest 1993 revision of ENDF/B-VI, release 2 (ENDF/B-VI.2), increasing the number of fission products to from 879 to 1110.
(3) Expansion of the actinides with explicit fission product yields.
(4) Upgrade of the photon emission line-energy data, originally developed for ORIGEN2 in 1985, using ENDF/B-VI and ENSDF photon emission data.

These data upgrades are to be released in late 2003 in SCALE 5, and as a separate depletion and decay analysis code package ORIGEN-ARP Version 3. This standalone depletion package contains a new version of the OrigenArp Windows graphical user interface designed for rapid menu-driven problem setup, execution, and post-analysis data processing and visualization. The package also contains new cross-section libraries for MAGNOX, AGR, VVER 440 and VVER 1000 reactors. Also, the new ORIGEN-ARP methods have been expanded for the analysis of MOX fuel, and the package contains MOX cross-section libraries for most European MOX reactor types and fuel assembly designs.