

## ORIGEN-ARP

ORIGEN-ARP, the current supported version of ORIGEN, is included in the SCALE software package. It contains the latest version of the OrigenArp Windows user interface and PlotOPUS interactive plotting program.

ORIGEN-ARP is a sequence in SCALE that serves as a fast and easy-to-use system to perform nuclear irradiation and decay calculations with the ORIGEN code using problem-dependent cross sections. ARP (Automatic Rapid Processing) uses an algorithm that allows the generation of cross-section libraries for the ORIGEN code by interpolation over pre-generated cross-section libraries. The interpolations are carried out on the following variables: burnup, enrichment, and moderator density (optional). The OrigenArp GUI provides an easy-to-use Windows interface with menus, toolbars, and forms that allow the user to set up, run, and view results of ORIGEN-ARP calculations in an integrated user-friendly environment.

PlotOPUS is a Windows GUI designed to plot ORIGEN results that have been post-processed with the OPUS utility. Input for OPUS and viewing plots with PlotOPUS are handled automatically by the integrated OrigenArp GUI.

The ORIGEN-ARP libraries in SCALE include a large number of fuel assembly designs. All light water reactor (LWR) libraries and VVER libraries are based on TRITON/NEWT 2-D depletion models. All BWR libraries contain moderator density dependent cross sections. The available libraries include:

- BWR:
  - GE 7x7, 8x8 , 9x9, 10x10
  - ABB 8x8
  - ATRIUM-9 and ATRIUM-10
  - SVEA-64 and SVEA-100
- PWR
  - Siemens 14x14
  - Westinghouse CE 14x14 and 16x16
  - Westinghouse 14x14, 15x15, 17x17, 17x17 OFA
- CANDU reactor fuel (28- and 37-element bundle designs)
- MAGNOX graphite reactor fuel
- Advanced Gas Cooled (AGR) fuel
- VVER-440 flat enrichment (1.6% - 3.6%) and profiled enrichment (average 3.82%, 4.25%, 4.38% )
- VVER-1000
- MOX BWR 8x8-2, 9x9-1, 9x9-9, 10x10-9
- MOX PWR 14x14, 15x15, 16x16, 17x17, 18x18

Several major features of the ORIGEN nuclear data in SCALE are described below.

- The basic neutron reaction cross sections are based on evaluations from ENDF/B-VI, the European Activation File (EAF-99), and FENDL-2 data. There are 854 nuclides with evaluated cross section data in SCALE.
- Fission product yields are from ENDF/B-VI, Release 2 (ENDF/B-VI.2), with data for 1119 fission products.
- Explicit fission product yields for 30 actinides. The addition of yields for higher-order actinides is designed to address data requirements for actinide transmutation studies. The addition of explicit yields improves fission product inventory and decay property predictions.
- Photon emission line-energy data from ENDF/B-VI, ENSDF, and JEF-2.2 evaluated data for 2101 nuclides. The library contains gamma rays emitted from the nucleus during  $\alpha$ ,  $\beta$ , electron capture, and isomeric transitions, characteristic fluorescent X-rays from electron capture or emission of internal conversion electrons, and photons from positron annihilation. Continuum spectra are binned as pseudo-line data. The library has approximately 115,000 individual photon lines. The library gives improved gamma spectral calculations, particularly at short cooling times.