

ORIGEN-ARP 5.1

ORIGEN-ARP 5.1, the current supported version of ORIGEN, is included in the SCALE 5.1 software package. This standalone depletion package can be installed from the SCALE 5.1 installation DVD by users who don't want the entire SCALE 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-S code using problem-dependent cross sections. ARP (Automatic Rapid Processing) uses an algorithm that allows the generation of cross-section libraries for the ORIGEN-S 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-S 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 5.1 have been significantly expanded. 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 upgrades of the ORIGEN nuclear data were made in SCALE 5.0, as described below.

- Replacement of the basic neutron reaction cross sections (compiled from cross section evaluations from the 1960's) with current evaluations from ENDF/B-VI, the European Activation File (EAF-99), and FENDL-2 data. The update resulted in 854 nuclides with evaluated cross section data in SCALE 5.0, compared to 567 in SCALE 4.4a and 692 in ORIGEN2.
- Upgrade and expansion of the fission product yields from ENDF/B-V to the 1993 revision of ENDF/B-VI, release 2 (ENDF/B-VI.2), increasing the number of fission products from 879 to 1119.
- Expansion of the actinides with explicit fission product yields from 5 to 30. 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.
- Upgrade of the photon emission line-energy data from ENDF/B-VI, ENSDF, and JEF-2.2 evaluated data. This update yielded 2101 nuclides with photon data, compared to just 418 nuclides in the previous library. The new library contains gamma rays emitted from the nucleus during α , β , 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 new library has about 115,000 individual photon lines, compared to 12,000 lines in the previous library. The new library gives improved gamma spectral calculations, particularly at short cooling times, and corrects a number of deficiencies previously identified in the library.
- The ORIGEN-ARP methods have been expanded to allow the analysis of MOX fuel. MOX cross-section libraries for most European MOX reactor types and fuel assembly designs are now included. New cross-section libraries for MAGNOX, AGR, VVER 440 and VVER 1000 reactors have been added too.