

## **SCALE Training: SCALE Criticality Safety Calculations**

Oak Ridge National Laboratory,

### **Training summary:**

This training course, which is appropriate for novice through advanced users, provides instruction on the use of the CSAS criticality safety sequences in SCALE, which use KENO and Shift Monte Carlo neutron transport codes for criticality safety calculations.

KENO-VI is a 3D generalized geometry Monte Carlo code that allows for versatile modeling of complex geometries. KENO-V.a, with less versatility in geometry modeling than KENO-VI, is fast code that allows users to build complex geometry models using basic geometrical bodies. Shift is available with both KENO-V.a and KENO-VI geometry capabilities. Both versions of KENO and Shift provide convenient, efficient methods for modeling repeated and nested geometry configurations. All transport codes can use ENDF/B-VII.1 or ENDF/B-VIII.0 cross-section data distributed with SCALE 6.3 to perform either continuous energy or multigroup calculations.

This training course uses the Fulcrum user interface for interactive model setup, 2D and 3D visualization, computation, and output review. Instruction is provided on the SCALE material input and resonance self-shielding capabilities and Fulcrum's capabilities for visualizing fluxes, reaction rates, and cross-section data.

### **Notes:**

This training will be taught with SCALE 6.3. No prior knowledge of SCALE is required.

**Day 1**

|                                                              |
|--------------------------------------------------------------|
| Introduction to SCALE and the training material              |
| Logistics, Introductions, and Overview of SCALE              |
| CSAS Sequence and Input Fundamentals                         |
| Composition inputs: Basic Standard Compositions and Workshop |
| Composition inputs: Atom and Weight Percent and Workshop     |
| Composition inputs: Solutions and Workshop                   |
| KENO-VI geometry, including reflected solution exercise      |
| Problem set K6.1: Godiva, Green block, and Rocky Flats       |

**Day 2**

|                                                    |
|----------------------------------------------------|
| Review problem set K6.1                            |
| How to run SCALE/Intro to visualization            |
| Geometry modification data, including Y30 exercise |
| Problem set K6.2: Hopper and Cross                 |
| Review problem set K6.2                            |
| KENO-VI Holes including demo                       |
| KENO-VI Arrays including demo                      |
| Problem set K6.3: Pins in a tank and 4a-4m         |
| Review problem set K6.3                            |

**Day 3**

|                                                                 |
|-----------------------------------------------------------------|
| Resonance Self-shielding and unit cell data                     |
| Unit cell data exercises                                        |
| KENO parameter and other data                                   |
| Problem set K6.4: Annular hex array, goslar, and castor         |
| Review set K6.4                                                 |
| Review of KENO-VI                                               |
| KENO V.a geometry, including reflected solution sphere exercise |
| Problem set K5.1: Godiva and Rocky Flats                        |

**Day 4**

|                                                                       |
|-----------------------------------------------------------------------|
| Review problem set K5.1                                               |
| Introduction to Monte Carlo theory, source convergence, uncertainties |
| Visualization of KENO geometries, results, and data                   |
| Problem Set K5.2: Rocky Flats, Cylindrical Tank, Cylinder in Annulus  |
| Review problem set K5.2                                               |
| KENO V.a Holes including demo                                         |
| KENO V.a Arrays including demo                                        |
| Problem Set K5.3: 1F27, Lollypop, 4a-4m                               |

**Day 5**

|                                                            |
|------------------------------------------------------------|
| Continue problem set K5.3                                  |
| Review Problem set K5.3                                    |
| Problem set K5.4: Pins in a tank and Shipping cask         |
| Review problem set K5.4                                    |
| Review KENO V.a                                            |
| Review of CSAS outputs - open discussion, and certificates |