OAK RIDGE National Laboratory

SCALE Newsletter

Number 47 Spring 2015

In This Issue

Welcome New SCALE Users!

SCALE 6.1 was released through the Radiation Safety Informational Computational Center (RSICC) in July 2011 and subsequently distributed through the Nuclear Energy Agency (NEA) Data Bank in France and the Research Organization for Information Science and Technology (RIST) in Japan. As of March 2015 there have been over 3500 distributions of SCALE 6.1, including nearly 2400 distributions to individuals who had not previously used any version of SCALE. The number of new SCALE 6.1 users is nearly equivalent to the total number of SCALE users in 2009. The distribution centers have shipped nearly 9000 copies of SCALE versions 5.0–6.1 to over 6300 unique users in 54 different nations, as shown in Fig. 1. The distribution centers continue to license approximately 100 new users each month. If you are one of the new users of SCALE, we welcome you to our community and hope you find SCALE useful in your work.

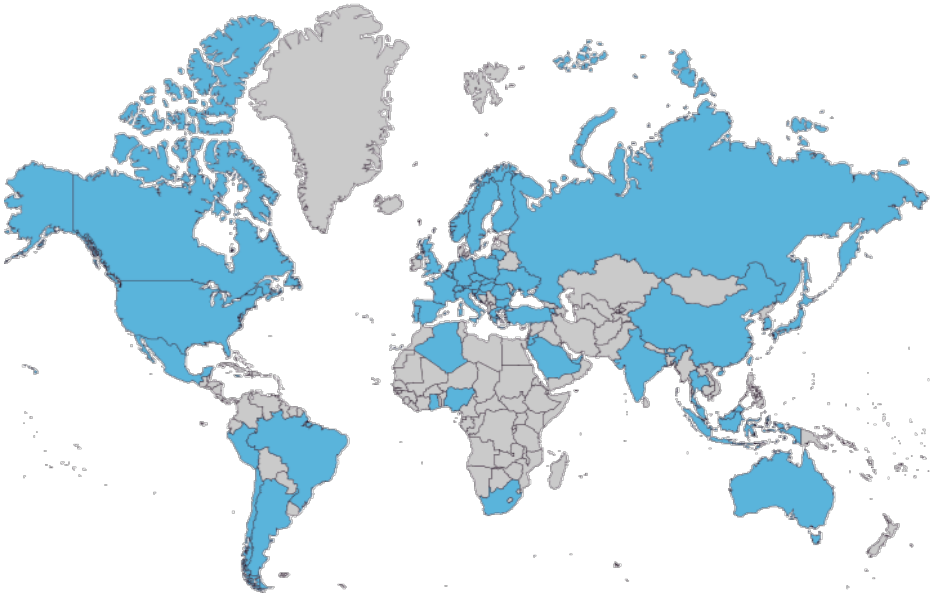


Fig. 1. Nations where SCALE is licensed.

There are many resources for new users including:

- How-to primers on many topics (http://scale.ornl.gov/training_primers.shtml),
- Validation reports (http://scale.ornl.gov/validation.shtml),
- Training courses (http://scale.ornl.gov/training.shtml).
- User discussion forum on Google Groups (https://groups.google.com/forum/?hl=en&fromgroups#!forum/scale-users-group), and
- E-mail helpline (scalehelp@ornl.gov).

SCALE 6.2 Status

Development and testing of SCALE 6.2 continues as the team prepares advanced, robust features for the community. Many of these advancements are documented in recent SCALE publications listed later in this newsletter.

We are pleased to announce the next step towards the final version of SCALE 6.2 with the release of SCALE 6.2 Beta4. It has been nearly a year since we released Beta3, and Beta4 has numerous new and enhanced features, some of which are highlighted below. Many improvements have been realized thanks to the feedback we received from our beta testing community.

- Several SCALE sequences have been updated to perform resonance self-shielding of multigroup cross sections and one-dimensional neutron transport calculations using the modern *XSProc* module. XSProc provides the capabilities of BONAMI, CENTRM, PMC, WORKER, and XSDRN and has been demonstrated to produce equivalent results to the prior independent codes. With XSProc, runtime and memory requirements are substantially improved, especially when performing calculations with many unit cells. Generally, speedups of about 3x are realized, but in an extreme test case with hundreds of unique materials, the cross section processing and cell homogenization time was reduced from 5 days to 3.7 minutes while still obtaining equivalent results. By the final release of SCALE 6.2, all sequences will operate with XSProc. However, as of this beta release, XSProc is only partially implemented across SCALE, as shown in Table 1, where modernized sequences with XSProc and legacy sequences that run that standalone codes are identified.

Table 1. Sequence modernization in SCALE 6.2 Beta4

Sequence	Modern	Legacy
CSAS-MG	✓	
CSAS1	✓	
CSAS1X	✓	
CSAS5	✓	
CSAS6	✓	
CSASI	✓	
CSASIX	✓	
MAVRIC	✓	
SAS1		✓
STARBUCS		✓
T-NEWT		✓
T-XSDRN	✓	
T-XSEC	✓	
T5-DEPL		✓
T5-DEPL		✓
TDEPL		✓
TDEPL-1D		✓
TSUNAMI-1D		✓
TSUNAMI-2D		✓
TSUNAMI-3D_K5	✓	
TSUNAMI-3D_K6	✓	

- An initial version of the *Fulcrum* graphical user interface is introduced to SCALE. Fulcrum is a cross-platform graphical user interface designed to create, edit, validate and visualize SCALE input, output, and data files. Historically, SCALE has provided several special-purpose graphical user interfaces which operate only on specific platforms and are loosely integrated with SCALE's computational and data components. Fulcrum, in contrast, is intended to provide a single user interface that directly integrates with SCALE's internal resources to provide a consistent experience between Fulcrum and SCALE's command line interface.

This initial implementation provides input editing and navigation, interactive geometry visualization for KENO V.a and most KENO-VI capabilities, job execution, overlay of mesh results within a geometry view, and plotting of data from ORIGEN (Oak Ridge Isotope GENeration) binary composition files. An error-checking parser interactively identifies poorly formed input with spelling errors or data entry omissions for all SCALE sequences. The Hierarchical Input Validation Engine (HIVE) will identify the allowed data ranges and interdependencies in the input and then will report inconsistencies to the user. Fulcrum will interactively process standard composition data to produce a mixing table, list expanded input aliases for review, provide an internal listing of input as is required for Sampler material and geometry perturbation analysis, and launch the SCALE sample problems.

The layout of panels in Fulcrum is highly configurable to accommodate the preferences of many users. An example layout for a spent fuel cask analysis is shown in Fig. 2. Many additional features will be implemented in Fulcrum prior to production release.

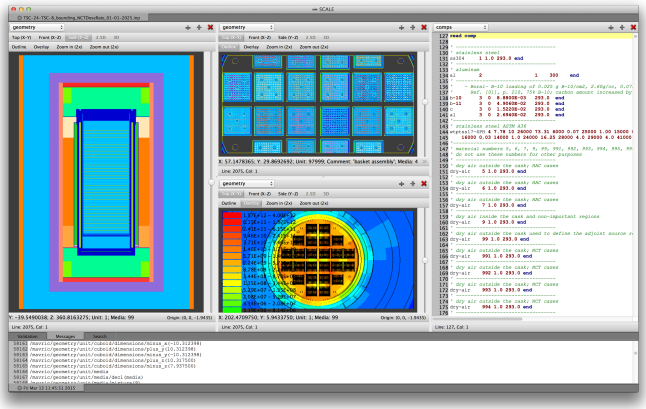


Fig. 2. SCALE graphical user interface – Fulcrum.

- The *AMPX* codes are now available with SCALE for the generation of cross section data for SCALE. AMPX processes data in the ENDF format to produce continuous-energy (CE) and multigroup (MG) neutron, gamma, and coupled neutron/gamma libraries. It can also produce cross section covariance data files.
- ENDF/B-VII.1 nuclear data libraries are introduced in Beta4 for neutron, gamma, and coupled neutron/gamma calculations in CE and MG modes.
- An updated neutron cross section covariance library is introduced in Beta4 which has been assembled from a variety of sources, especially high-fidelity covariance evaluations from ENDF/B-VII.1.
- A new binary data format is introduced in Beta4 and applied to modernize the format of the AMPX multigroup cross section data libraries, replacing the AMPX Working and Master formats that were designed in the 1960s.
- The CE Monte Carlo capabilities are substantially improved in terms of accuracy and memory requirements. *KENO* is specifically enhanced with problem-dependent Doppler broadening, parallel capabilities, fission source convergence diagnostics, resonance upscattering techniques, and reaction rate tallies, with further improvements for problem-dependent Doppler broadening and reaction rate tallies provided with Beta4.
- New CE Monte Carlo capabilities are introduced for radiation shielding with *MAVRIC/Monaco*, sensitivity analysis with *TSUNAMI-3D*, and depletion with *KENO/TRITON*. For Beta4, the CE *TSUNAMI-3D* eigenvalue capabilities are extended to also compute the sensitivity of ratios of reaction rates to cross section data. Also for Beta4, CE depletion calculations with *KENO* have been substantially improved, especially in terms of efficiency and accuracy for a wide range of applications.
- The *Sourcerer* sequence provides a hybrid technique for reliable fission source convergence.
- The *Sampler* stochastic sampling tool quantifies uncertainties and correlations for many computed quantities that result from uncertainties in input parameters, and it propagates nuclear data uncertainties for neutron interactions, fission product yields, and decay data through any MG sequence. In Beta4 there is a known issue with the operation of Sampler on Windows that requires a simple workaround. Please see the "Known Issues" section of the Readme file for more information.
- The new *Polaris* tool provides for rapid lattice physics analysis of pressurized water reactor (PWR) fuel assemblies with simplified input. For Beta4, Polaris has been enhanced to provide improved results, especially for temperature dependence and burnup predictions. Boiling water reactor (BWR) capabilities are planned for the final SCALE 6.2 release.
- The new *ORIGAMI* tool provides for convenient characterization of used nuclear fuel with axially and radially varying burnup. For Beta4, *ORIGAMI* is updated to provide a new input format and improved output.
- A new graphical user interface, *ORIGAMI Automator,* is introduced in Beta4 to facilitate the quantification of isotopics as a function of time for a large set of fuel assemblies, especially for use in severe accident analysis.

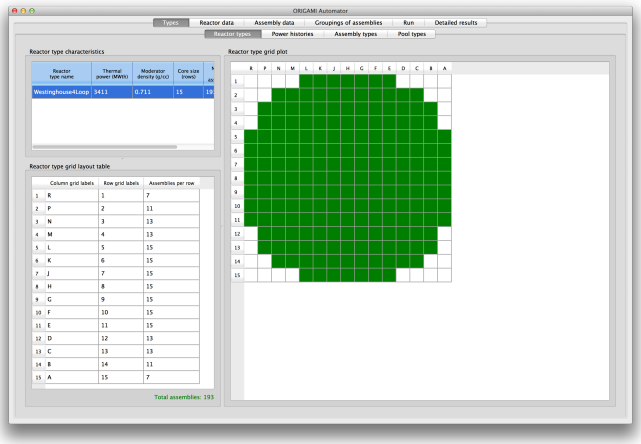


Fig. 3. ORIGAMI Automator.

- The *TRITON* two-dimensional lattice physics capabilities are enhanced in Beta4 with a material swap capability that allows a user to switch the material present during a depletion calculation. This is especially useful for removable absorber materials.
- *ORIGEN* has been enhanced for Beta4 to provide an alternative solver based on the Chebyshev Rational Approximation Method (CRAM), which provides improved fidelity and runtimes relative to the traditional technique.
- Numerous other SCALE modernization enhancements are available for developers, such as modular physics application programming interfaces (APIs) for CE and MG Monte Carlo, as well as *ORIGEN*. Modular data resources are available for MG and CE cross-section data, cross section covariance data, and *ORIGEN* data. The new modular geometry package *Atlas* is available for transport analysis and model visualization.

The production release of SCALE 6.2 is anticipated in late 2015.

SCALE Workshops at M&C + SNA + MC 2015

The SCALE team will present two workshops at Joint International Conference on Mathematics and Computation (M&C), Supercomputing in Nuclear Applications (SNA) and the Monte Carlo (MC) Method conference in Nashville, TN.

New Features in SCALE 6.2

Sunday, April 19, 2015, 8:00 AM – 12:00 PM

SCALE 6.2 provides several new capabilities, as well as significant improvements in many existing features. This workshop will provide a survey of the new capabilities and provide examples for their use. Capabilities featured in this workshop will include:

- Fulcrum – An integrated user interface to edit code input, visualize geometry and nuclear data, launch calculations, and display results.
- Polaris – Light water reactor lattice physics capability with simplified input and efficient operation.
- Sampler – Stochastic sampling tool to quantify effects of uncertainties in neutron and gamma cross-section data, decay constants, and fission product yields, as well as dimensions and material compositions on any computed result.
- ORIGAMI – Convenient tool for computing spent fuel assembly isotopics and decay heat with ORIGEN.
- Parallel KENO – Eigenvalue Monte Carlo calculations using message passing interface (MPI) parallelism.
- Sourcerer – Criticality safety sequence that calculates an accurate starting source distribution for Monte Carlo analysis through the use of an automated deterministic calculation.
- CE TSUNAMI-3D – Eigenvalue and generalized response sensitivity coefficient calculation tool using CE Monte Carlo methods.
- CE MAVRIC – Efficient deep-penetration shielding analysis performed with CE calculations.
- CE TRITON – Depletion analysis performed with CE KENO Monte Carlo calculations.

SCALE 6.2 Developer's Workshop

Thursday, April 23, 2015, 1:30 PM – 5:30 PM

This workshop will introduce several of the modular physics and nuclear data capabilities that are building blocks of SCALE 6.2 and will provide coding examples so that developers can integrate them as APIs in other software projects. Capabilities featured in this workshop will include:

Physics and geometry APIs:

- XSProc for multigroup cross section resonance self-shielding, energy group collapse, and spatial homogenization
- CE and MG physics for Monte Carlo analysis
- ORIGEN depletion, decay and activation analysis and associated utilities; isotopic composition data
- Atlas geometry package for Monte Carlo and Method-of-Characteristics (MoC) transport and visualization

Data APIs:

- Master and working formatted multigroup cross section data libraries
- SCALE Standard Composition Library
- CE cross section data libraries
- Cross section covariance libraries
- Activation, depletion, and decay data libraries

Monte Carlo Codes Poster Session at M&C + SNA + MC 2015

Tuesday, April 21, 2015, 5:30 PM – 7:30 PM

- This poster session will provide a forum for Monte Carlo code development teams to showcase their recent code developments and discuss their newest code features. A similar post session was presented at the SNA + MC 2013 conference in Paris, France, with the SCALE Poster from that session shown below in Fig. 4.

Teams from ORNL will present the following posters:

- SCALE Code System - B. T. Rearden, D. E. Peplow, and C. M. Perfetti
- Shift - T. M. Evans, G. G. Davidson, T. M. Pandya
- ADVANTG – S. W. Mosher, S. R. Johnson, I. M. Ibrahim

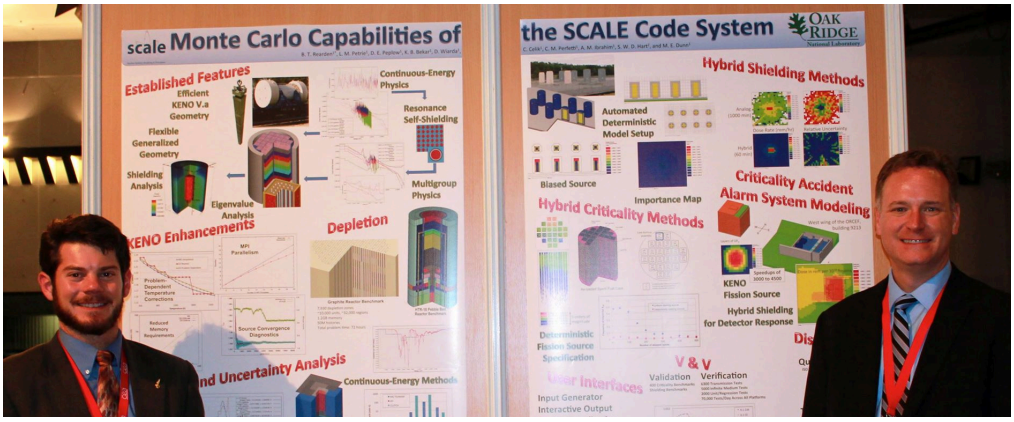


Fig. 4. Chris Perfetti (left) and Brad Rearden (right) present SCALE Monte Carlo Capabilities at SNA + MC 2013.

SCALE Publications

The SCALE team provides numerous publications on development and application activities in peer-reviewed journals, technical reports, and conference publications. Often, publications are jointly created with users and developers throughout the community. A summary of some recent and pending publications is provided here.

Peer-Reviewed Journal Articles

M. L. Williams, D. Wiarda, W. J. Marshall, and B. T. Rearden, "Covariance Applications in Criticality Safety, Light Water Reactor Analysis, and Spent Fuel Characterization," *Nuclear Data Sheets*, **123**, 92-96 (2015).

G. Arbanas, M. L. Williams, L. C. Leal, M. E. Dunn, B. A. Khuwaileh, C. Wang, H. Abdel-Khalik, "Advancing Inverse Sensitivity/Uncertainty Methods for Nuclear Fuel Cycle Applications," *Nuclear Data Sheets*, **123**, 51-56 (2015).

M. T. Pigni, M. W. Francis, I. C. Gauld, "Investigation of Inconsistent ENDF/B-VII.1 Independent and Cumulative Fission Product Yields with Proposed Revisions," *Nuclear Data Sheets*, **123**, 231-236 (2015).

B. T. Rearden, L. M. Petrie, D. E. Peplow, K. B. Bekar, D. Wiarda, C. Celik, C. M. Perfetti, A. M. Ibrahim, S. W. D. Hart, M. E. Dunn, and W. J. Marshall, "Monte Carlo Capabilities of the SCALE Code System," *Annals of Nuclear Energy* (2014) – available online.

S. P. Hamilton, T. M. Evans, "Efficient Solution of the Simplified P_N equations," *Journal of Computational Physics*, **284**, 155–170 (2015).

G. Radulescu, I. C. Gauld, G. Ilas, and J. C. Wagner, "Approach for Validating Actinide and Fission Product Compositions for Burnup Credit Criticality Safety Analyses," *Nucl. Tech.*, **188(2)**, 154–171 (2014).

N. M. George, K. A. Terrani, J. J. Powers, A. Worrall, and G. I. Maldonado, "Neutronic Analysis of Candidate Accident-Tolerant Cladding Concepts in Pressurized Water Reactors," *Annals of Nuclear Energy*, **75**, 703–712 (2015).

N. M. George, I. Maldonado, K. Terrani, A. Godfrey, J. Gehin, and J. Powers, "Neutronics Studies of Uranium-bearing Fully Ceramic Microencapsulated Fuel for Pressurized Water Reactors," *Nucl. Tech.*, **188(3)**, 238–251 (2014).

C. Gentry, I. Maldonado, A. Godfrey, K. Terrani, J. Gehin, and J. Powers, "A Neutronic Investigation of the Use of Fully Ceramic Microencapsulated Fuel for Pu/Np Burning in PWRs," *Nucl. Techn.,* **186(1)**, 60–75 (2014).

J. M. Scaglione, D. E. Mueller, and J. C. Wagner, "An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses: Criticality (keff) Prediction," Nuc. Tech., **188**, 266–279, December (2014).

M. Salvatores, G. Palmiotti, G. Aliberti, P. Archier, C. De Saint Jean, E. Dupont, M. Herman, M. Ishikawa, T. Ivanova, E. Ivanov, S. J. Kim, I. Kodeli, G. Manturov, R. McKnight, S. Pelloni, C. Perfetti, A. J. M. Plompen, B. T. Rearden, D. Rochman, K. Sugino, A. Trkov, et al., "Methods and Issues for the Combined Use of Integral Experiments and Covariance Data: Results of a NEA International Collaborative Study," *Nuclear Data Sheets,* **118**, 38–71 (2014).

Technical Reports

T. M. Miller and D. E. Peplow, *Guide to Performing Computational Analysis of Criticality Accident Alarm Systems*, ORNL/TM-2013/211 (2013)

B. Ade, A. Worrall, J. Powers, S. Bowman, G. Flanagan, and J. Gehin, *Safety and Regulatory Issues of the Thorium Fuel Cycle*, NUREG/CR-7176 (ORNL/TM-2013/543) (2014).

G. Ilas, I. C. Gauld, R. M. Westfall, and M. Pigni, *Evaluation of Hanford B Reactor Experiments (PTA-069 and PTA-084) for Code and Data Benchmarking*, ORNL/TM-2014/53 (2014).

D. G. Renfro, D .C. Chandler, D. H. Cook, G. Ilas, P. Jain, and J. Valentine, *Preliminary Evaluation of Alternate Designs for HFIR Low-enriched Uranium Fuel*, ORNL/TM-2014/154 (2014).

ANS Annual Meeting, Atlanta, GA June 2013

T. M. Miller and D. E. Peplow, "Corrected User Guidance to Perform Three-Dimensional Criticality Accident Alarm System Modeling with SCALE."

A. M. Ibrahim, D. E. Peplow, and R. E. Grove, "Novel Hybrid Monte Carlo/Deterministic Technique for Shutdown Dose Rate Calculations."

D. E. Peplow, A. M. Ibrahim, and R. E. Grove, "Propagation of Uncertainty from a Source Computed with Monte Carlo."

Nuclear Criticality Safety Topical Meeting, Wilmington, NC, September 29 -October 3, 2013

T. M. Miller and D. E. Peplow, "Guidance Detailing Methods To Calculate Criticality Accident Alarm Detector Response and Coverage."

A. M. Ibrahim, D. E. Peplow, K. B. Bekar, C. Celik, J. M. Scaglione, D. Ilas, and J. C. Wagner, "Hybrid Technique in SCALE for Fission Source Convergence Applied to Used Nuclear Fuel Analysis."

Institute of Nuclear Materials Management (INMM) 55th Annual Meeting, Atlanta, GA, July 20 – 24, 2014

G. Radulescu, R. A. Lefebvre, D. E. Peplow, M. L. Williams, and J. M. Scaglione, "Dose Rate Analysis Capability for Actual Spent Fuel Transportation Cask Contents."

K. Banerjee, and J. M. Scaglione, "Feasibility of Direct Disposal of Dual Purpose Canisters from Criticality Perspective."

J. M. Scaglione, K. Banerjee, K. R. Robb, and R. A. LeFebvre, "The Used Nuclear Fuel Storage, Transportation, and Disposal Analysis Resource and Data System."

ANS RPSD Topical Meeting, Knoxville, TN, Sept. 14–18, 2014

A. M. Ibrahim, D. E. Peplow, R. E. Grove, and S. R. Johnson, "The Multi-Step CADIS Method for Shutdown Dose Rate Calculations and Uncertainty Propagation."

A. M. Ibrahim, D. E. Peplow, J. L. Peterson, and R. E. Grove, "Analysis of Shutdown Dose Rate in Fusion Energy Systems Using Hybrid Monte Carlo/Deterministic Techniques."

PHYSOR 2014, Kyoto, Japan, Sept. 28–Oct. 3, 2014

B. T. Rearden, L. M. Petrie, D. E. Peplow, K. B. Bekar, D. Wiarda, C. Celik, C. M. Perfetti, and M. E. Dunn, "Enhancements in Continuous-Energy Monte Carlo Capabilities for SCALE 6.2."

B. T. Rearden, R. A. Lefebvre, J. P. Lefebvre, K. T. Clarno, M. A. Williams, L. M. Petrie, and U. Mertyurek, "Modernization Enhancements in SCALE 6.2."

C. M. Perfetti and B. T. Rearden, "Continuous-Energy Monte Carlo Methods for Calculating Generalized Response Sensitivities using TSUNAMI-3D."

S. W. D. Hart, G. I. Maldonado, C. Celik, L. C. Leal, "Problem-Dependent Doppler Broadening of Continuous-Energy Cross Sections in the KENO Monte Carlo Computer Code."

J. J. Powers, A. Worrall, K. A. Terrani, J. C. Gehin, and L. L. Snead, "Fully Ceramic Microencapsulated Fuels: Characteristics and Potential LWR Applications."

J. J. Powers, J. C. Gehin, A. Worrall, T. J. Harrison, and E. E. Sunny, "An Inventory Analysis of Thermal-spectrum Thorium-fueled Molten Salt Reactor Concepts."

ANS Winter Meeting, Anaheim, CA, Nov 9–13, 2014

K. Banerjee, J. M. Scaglione, and R. A. LeFebvre, "Integrated Data and Analysis Tool for Used Nuclear Fuel Management."

J. J. Powers, "Fully Ceramic Microencapsulated Fuel in FHRs: A Preliminary Reactor Physics Assessment."

C. M. Perfetti and B. T. Rearden, "Performance Enhancements to the SCALE TSUNAMI-3D Generalized Response Sensitivity Capability."

Waste Management 2015, Phoenix, AZ, March 15–19, 2016

K. Banerjee, J. M. Scaglione, R. A. LeFebvre, G. Radulescu, and K. R. Robb, "Streamlining Analysis Capabilities for Used Nuclear Fuel Management."

International High-Level Radioactive Waste Management, Charleston, SC, April 12–16, 2015

K. Banerjee, J. M. Scaglione, and J. B. Clarity, "Disposability of Loaded U.S. Dual-Purpose Canisters from a Criticality Standpoint."

R. T. Jubin, K. Banerjee, and T. Severynse, "Evaluation of Filler Materials to Control Post-closure Criticality of Dual Purpose Canisters."

S. E. Skutnik, M. L. Williams, R. A. Lefebvre, "ORIGAMI: A New Interface for Fuel Assembly Characterization with ORIGEN."

ANS M&C Topical Meeting, Nashville, TN, April 19-23, 2015

B. T. Rearden, K. B. Bekar, C. Celik, C. M. Perfetti, and S. W. D. Hart, "Advancements in Monte Carlo Capabilities for SCALE 6.2."

B. T. Rearden, R. A. Lefebvre, J. P. Lefebvre, K. T. Clarno, M. A. Williams, L. M. Petrie, U. Mertyurek, B. R. Langley, and A. B. Thompson, "Modernization Strategies for SCALE 6.2."

W. A. Wieselquist, "The SCALE 6.2 ORIGEN API for High Performance Depletion."

Tara M. Pandya, Seth R. Johnson, Gregory G. Davidson, Thomas M. Evans, and Steven P. Hamilton, "Shift: A Massively Parallel Monte Carlo."

A. M. Ibrahim, D. E. Peplow, and R. E. Grove, "Acceleration Of Shutdown Dose Rate Monte Carlo Calculations Using The Multi-Step CADIS Hybrid Method."

C. M. Perfetti and B. T. Rearden, "Metrics for Diagnosing Undersampling in Monte Carlo Tally Estimates."

G. Ilas, I. C. Gauld, E. Sunny, M. Westfall, and J. Nguyen, "Modeling and Simulation of Hanford B Reactor Experiments."

F. Bostelmann, F. P. Weiß, A. Aures, K. Velkov, W. Zwermann, B. T. Rearden, M. A. Jessee, M. L. Williams, D. Wiarda, W. A. Wieselquist, "Uncertainty and Sensitivity Analysis in Criticality Calculations with Perturbation Theory and Sampling."

ANS Annual Meeting, San Antonio, TX, June 7–11, 2015

V. Sobes, B. T. Rearden, D. E. Mueller, W. J. Marshall, J. M. Scaglione, and M. E. Dunn, "Upper Subcritical Limit Calculations with Correlated Integral Experiments."

Do you have a publication documenting the application of SCALE to a challenging analysis scenario? Submit your publication to scalehelp@ornl.gov and it may appear in a future edition of the SCALE Newsletter!

SCALE Team Structure

The SCALE team consists of 44 talented and diverse staff members from ORNL's Reactor and Nuclear Systems Division. Most of our team members hold advanced degrees in nuclear engineering, physics, and/or computer science. SCALE development, testing, deployment, and training are organized into task-oriented teams as shown below in Fig. 5.

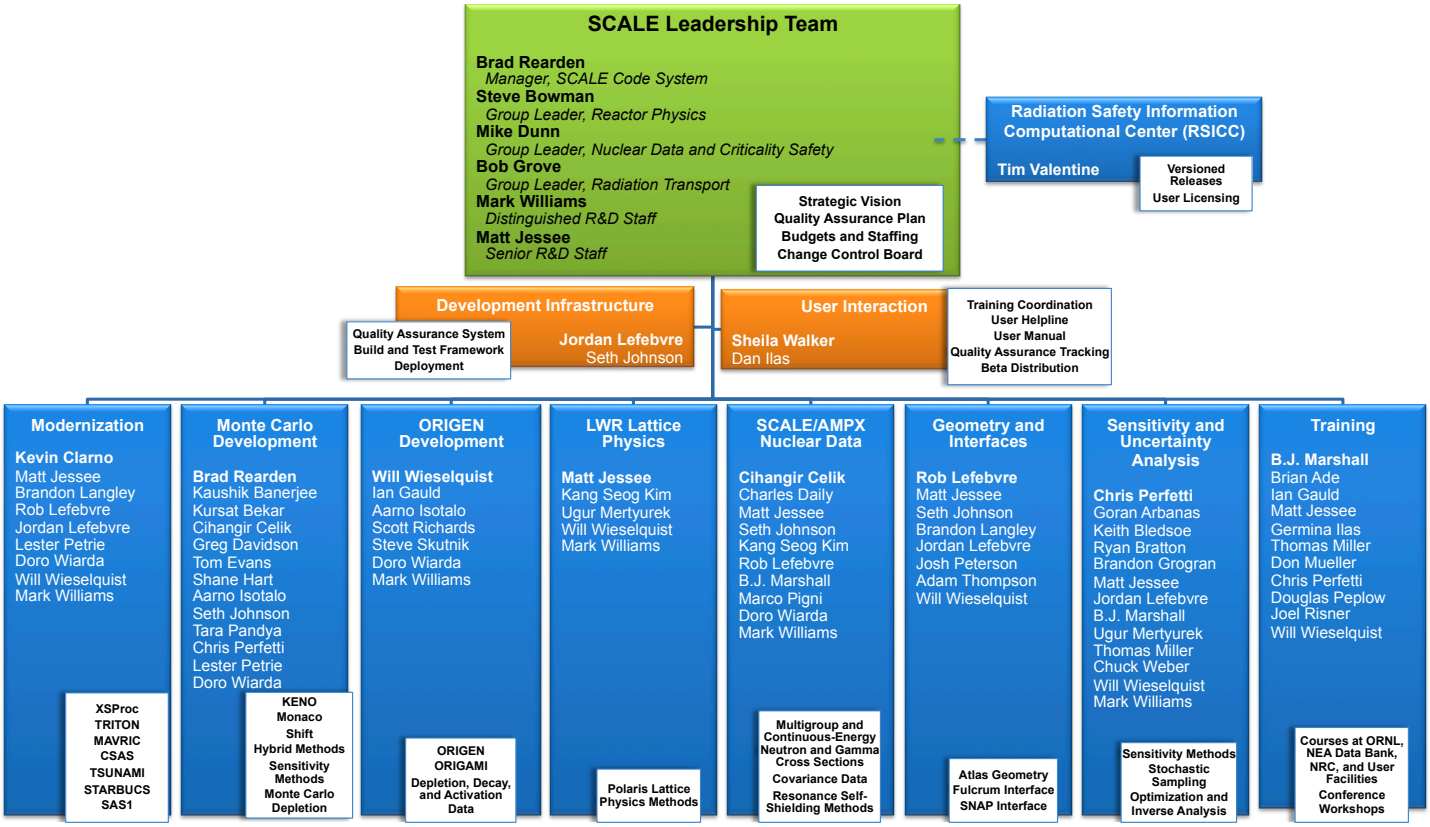


Fig. 5. SCALE Team Structure

SCALE Quality Assurance Program

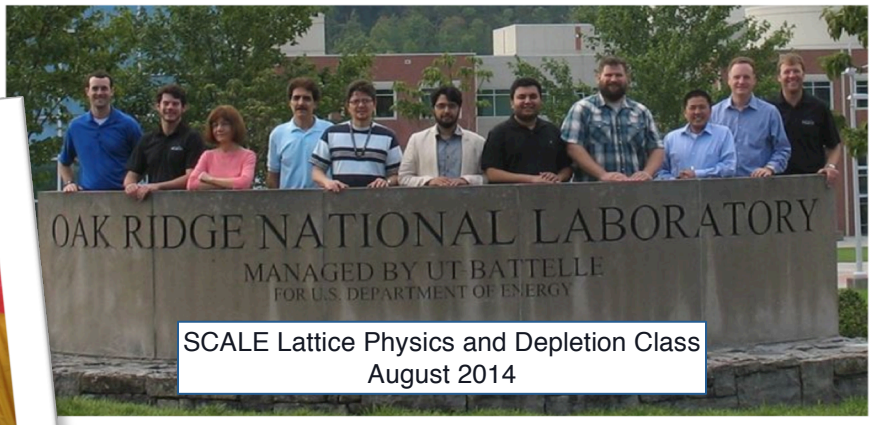
The SCALE quality assurance (QA) program was updated in 2013 to provide improved high-quality software and data to the user community. The new QA program is compliant with international standards in ISO 9001-2008, US Department of Energy Order 414.1D, and the ORNL Standards Based Management System, and it is consistent with US Nuclear Regulatory Commission guidelines in NUREG/BR-0167 as well as ASME NQA-1. SCALE QA program implements a streamlined Kanban process with continuous integration of new features and an automated test system that performs approximately 100,000 tests per day on Linux, Macintosh, and Windows operating systems. The QA program provides for rapid introduction of new features for deployment to end users. However, the SCALE Team makes no guarantees regarding the performance of SCALE for any specific purpose, and users should independently submit the software to their own site- or program-specific testing and validation prior to use.

SCALE 6.1.3 Update

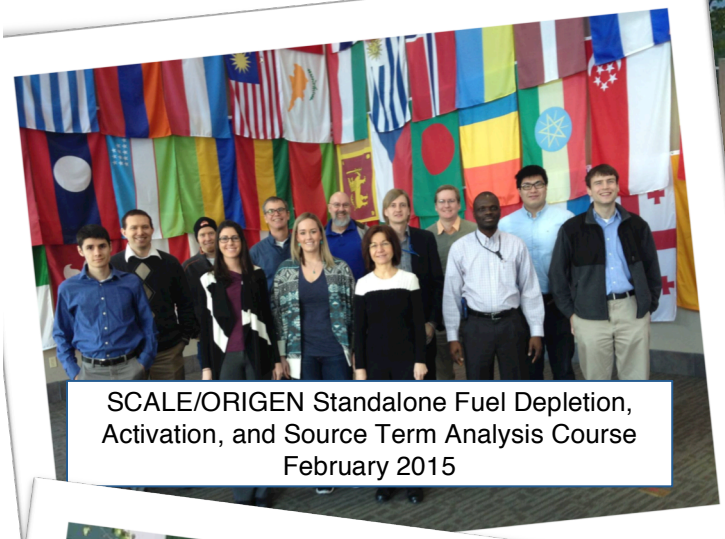
The SCALE 6.1.3 update is available to provide compatibility with additional Linux operating systems. This comprehensive update includes enhancements previously released as SCALE 6.1.1 and SCALE 6.1.2 but provides no additional updates in functionality. This update is recommended for all users of SCALE 6.1 and 6.1.1 and for Linux users of 6.1.2. Details of the enhancements and instructions for requesting and installing this update are available at http://scale.ornl.gov/downloads_scale6-1.shtml.

See http://scale.ornl.gov/moreinfo.shtml to download a copy of the SCALE QA plan.

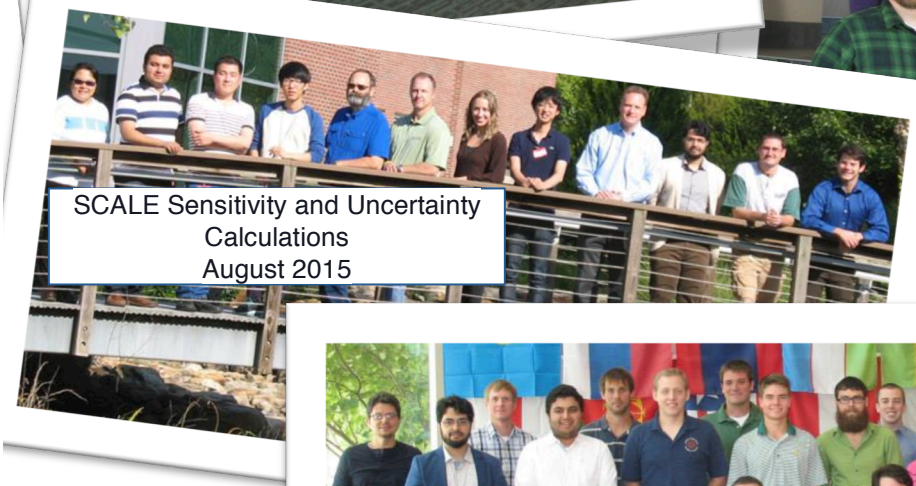
Recent SCALE Photos



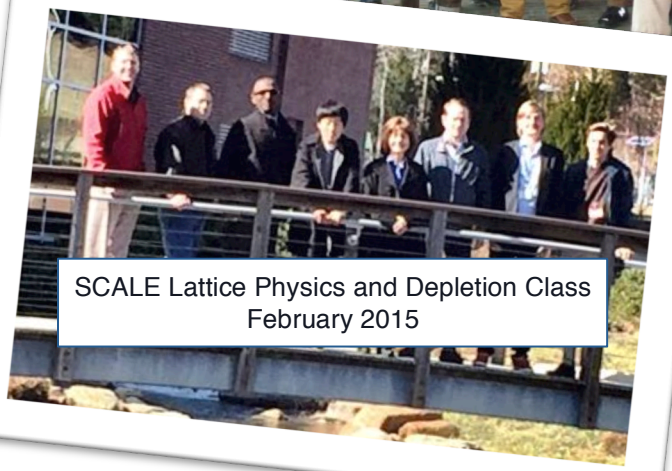
SCALE Lattice Physics and Depletion Class
August 2014

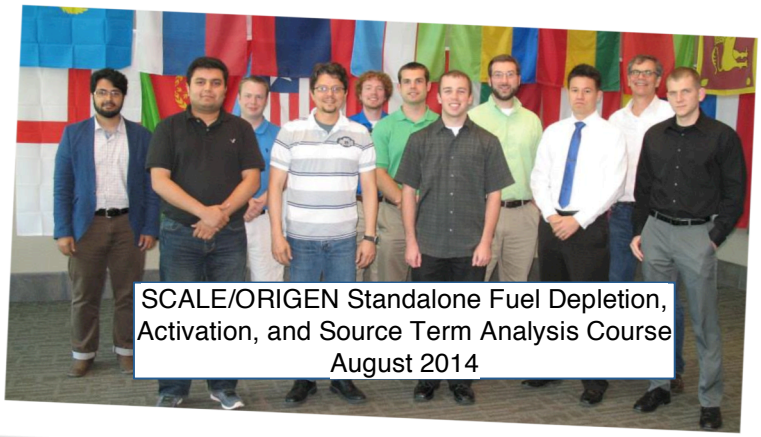

SCALE/ORIGEN Standalone Fuel Depletion, Activation, and Source Term Analysis Course
February 2015


SCALE Criticality Safety and Radiation Shielding Course
February 2015


SCALE Sensitivity and Uncertainty Calculations
August 2015


SCALE Criticality Safety Calculations Course
August 2014


SCALE Lattice Physics and Depletion Class
February 2015


SCALE/ORIGEN Standalone Fuel Depletion, Activation, and Source Term Analysis Course
August 2014

SCALE Spotlight

SCALE is developed, tested, documented, and maintained by approximately 40 talented and diverse staff members within the Reactor and Nuclear Systems Division at Oak Ridge National Laboratory. The SCALE Spotlight provides a profile of a team member in each edition.

Dr. William A. Wieselquist

Fig. 6. Will Wieselquist in New Orleans

Position:

Research and Development Staff - Reactor Physics Group

Focus areas:

Depletion, Lattice Physics, and Uncertainty Quantification Methodology

Most memorable projects:

I joined ORNL in 2012 and shortly thereafter became involved in ORIGEN depletion, Polaris lattice physics, and Sampler uncertainty quantification development. Polaris in particular is special to me because my part in it was designing a completely new, easy-to-use lattice physics input from the ground up. I leaned on numerous applications staff at ORNL for ideas and leveraged my experience as a reactor analyst at the Paul Scherrer Institute from 2009–2012, where I used CASMO/SIMULATE. It was very rewarding to design, implement, test, and deliver a beta release (of a completely new product!) to the sponsor in a couple of years.

Life outside of work:

My wife and I enjoy traveling (the picture above is from a recent trip to New Orleans), hiking, and we recently started playing disc golf. When it rains and/or my wife is busy, I try to remember how to play guitar. I also try to maintain "best uncle" status by sending presents to my six nieces and nephews--I recently sent a small arsenal of super soaker water guns.

Technical Support and Training

The SCALE Team is dedicated to supporting all SCALE users, but the team can only provide limited complimentary technical support for inquiries submitted to scalehelp@ornl.gov. For basic help in getting started with SCALE, new users are encouraged to attend the public training courses where the capabilities of SCALE are presented in detail.

A new venue is now available to facilitate interaction between SCALE users and developers. The SCALE Users Group is a new forum hosted by Google and available at https://groups.google.com/forum/#!forum/scale-users-group.

The primers distributed with SCALE for KENO V.a, KENO-VI, TSUNAMI, and TRITON provide detailed step-by-step instructions to assist new users in learning how to use these modules for criticality safety, sensitivity/uncertainty, lattice physics, and source term calculations. Direct links to the SCALE primers are available at http://scale.ornl.gov/training_primers.shtml.

If your team could benefit from customized technical support or training, additional options are available. The SCALE Team can provide direct support or travel to your site to present customized hands-on courses to provide the expertise needed to solve challenging application scenarios. Please contact scalehelp@ornl.gov for more information.

SCALE Leadership Team

The SCALE Leadership Team consists of the SCALE manager, line managers, program managers, and developers. The Leadership Team meets regularly to discuss the current status and make programmatic and managerial decisions regarding SCALE.

Members of the SCALE Leadership Team are as follows:

Brad Rearden – Manager, SCALE Code System

Steve Bowman – Group Leader, Reactor Physics

Mike Dunn – Group Leader, Nuclear Data and Criticality Safety

Bob Grove – Group Leader, Radiation Transport

Matt Jessee – Senior Developer, Reactor Physics

Mark Williams – Distinguished Developer, Nuclear Data and Reactor Physics

Upcoming SCALE Training Courses

Training courses are provided by developers and expert users from the SCALE Team. Courses provide a review of theory, description of capabilities and limitations of the software, and hands-on experience running problems of varying levels of complexity.

Please see http://scale.ornl.gov/training_2015.shtml for more information.

Dates	Course	Registration Fee
June 29–July 3, 2015	**SCALE Lattice Physics and Depletion** OECD/NEA Data Bank, Issy-les-Moulineaux, Paris, France 2D lattice physics calculations; 1D, 2D, and 3D depletion calculations; resonance self-shielding techniques including Monte Carlo Dancoff factors for non-uniform lattices; generation of libraries for ORIGEN-ARP	€2000
August 10–14, 2015	**SCALE Criticality Safety Calculations** Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA Introductory through advanced criticality calculations using KENO V.a and KENO-VI; resonance self-shielding techniques	$2000
August 17–21, 2015	**SCALE Sensitivity and Uncertainty Calculations** Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA TSUNAMI: 1D, 2D, and 3D k_{eff} sensitivity/uncertainty analysis; 2D generalized sensitivity analysis for lattice physics; reactivity sensitivity analysis; advanced S/U methods for code and data validation using trending analysis and data assimilation (data adjustment) techniques; k_{eff} burnup credit validation	$2000
August 24–28, 2015	**SCALE Lattice Physics and Depletion** Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA 2D lattice physics calculations; 1D, 2D, and 3D depletion calculations; resonance self-shielding techniques including Monte Carlo Dancoff factors for non-uniform lattices; generation of libraries for ORIGEN-ARP	$2000
August 31–Sept. 3, 2015	**SCALE/ORIGEN Stand-alone Fuel Depletion, Activation, and Source Term Analysis Course** Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA Isotopic depletion, activation analysis, and source term characterization using ORIGEN/OrigenArp	$2000

**Full-time university students can register at a reduced rate. Both professional and student registration fees are discounted $200 for each course.*

All attendees must be licensed users of SCALE 6.1, which is available from ORNL/RSICC in the USA, the OECD/NEA Data Bank in France, and the RIST/NUCIS in Japan.

Class size is limited, and a course may be canceled if minimum enrollment is not obtained one month prior to the course. Course fees are refundable up to one month before each class.

FOREIGN NATIONAL VISITORS TO ORNL - Payment MUST be received at least one week prior to attending the training course. All foreign national visitors must register 40 days before the start date of the training course they plan to attend.

SCALE Newsletter
Oak Ridge National Laboratory
Post Office Box 2008
Bldg. 5700
Oak Ridge, TN 37831-6170

Fax: 865-574-3527
E-mail: scalehelp@ornl.gov

SCALE Web Site:
http://scale.ornl.gov

Find us on Facebook
http://facebook.com/Scale.codes

SCALE Newsletter is published by the Reactor and Nuclear Systems Division of the Oak Ridge National Laboratory*

*Managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725

SCALE Newsletter is sponsored by U.S. Nuclear Regulatory Commission, Division of Spent Fuel Management

U.S. Department of Energy, Nuclear Criticality Safety Program

OAK RIDGE National Laboratory