Oak Ridge National Laboratory

SCALE Newsletter

Number 26 July 2002

Special points of interest:

- SCALE 5 to be released in 2003
- SCALE PHYSOR 2002 workshop in October
- SCALE ORNL workshops in October
- CSPAN-VI and ESPN GUIs available as free downloads

Inside this Issue:

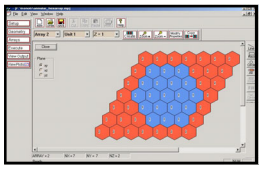
New Graphical User Interfaces for KENO-VI and SAS4

Two new SCALE graphical user interfaces (GUIs), CSPAN-VI and ESPN, have been completed and are available to download from the SCALE website. Both programs are written in Visual C++ and run on Windows 95, NT 4.0, or later versions of Windows.

CSPAN-VI (**C**riticality **S**afety **P**rocessor for **An**alysis with KENO-**VI**) is designed to assist users in the setup and execution of the CSAS6/KENO-VI sequence. KENO-VI is the latest version of the KENO Monte Carlo criticality safety code. KENO-VI contains a large set of geometrical bodies including cuboids, cylinders, hexprisms, spheres, cones, dodecahedrons, elliptical cylinders, ellipsoids, hoppers, parallelpipeds, planes, rhomboids, and wedges. The flexibility of KENO-VI is increased by the following features: intersecting geometry regions; hexagonal as well as cuboidal arrays; regions, holes, arrays, and units rotated to any angle and truncated to any position; and the use of an array boundary that intersects the array.

CSPAN-VI is a fully capable user interface for CSAS6/KENO-VI, including the following capabilities:

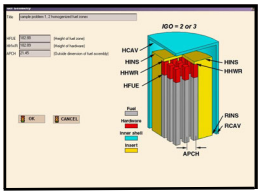
- Read/edit existing CSAS6/KENO-VI input files
- Set up CSAS6/KENO-VI input files
- Run CSAS6/KENO-VI
- View output
- View 2-D color plots
- Call KENO3D directly for interactive 3-D viewing



Hexagonal array setup screen in CSPAN-VI

ESPN (**E**asy **S**hielding **P**rocessor **In**put) is a similarly designed GUI for the SAS4 shielding sequence. SAS4 uses the 3-D Monte Carlo shielding code MORSE-SGC along with automated variance reduction techniques specifically designed for spent fuel cask analyses. The SAS4 sequence performs a 1-D adjoint calculation with XSDRNPM to generate the biasing parameters for MORSE-SGC. A generic cask model is included in SAS4 that enables several simplified cask geometry input options.

ESPN can read existing SAS4 input files, perform error checking, execute SCALE and display the output. Included in ESPN is the capability to check the geometry model by generating and viewing 2-D color plots of the geometry model using the SCALE module PICTURE.



Simplified cask geometry setup screen in ESPN

SCALE PHYSOR 2002 Workshop in Korea

(October 14–18, 2002)

A SCALE workshop on criticality safety and spent fuel characterization is being planned in conjunction with the PHYSOR 2002 meeting in Seoul, Korea. The workshop will be hosted by Korea Atomic Energy Research Institute (KAERI) in Taejon, Korea, in cooperation with the OECD/NEA Data Bank and RSICC. The course is scheduled for the week of October 14–18, 2002, immediately following the PHYSOR meeting.

The workshop will cover the widely recognized KENO V.a criticality safety code and the ORIGEN-ARP depletion and decay code from the SCALE software package. The registration fee is $1,800. **Registration deadline is August 2, 2002**. You can get more information and register online at www.ornl.gov/scale/workshop_korea.html.

ORIGEN-ARP 2.0 Release

For more information on ordering software from RSICC, go to: http://www-rsicc.ornl.gov/ORDER.html

The upgraded version of ORIGEN-S will be available in SCALE5.

A major upgrade of the SCALE ORIGEN-S point depletion and decay code (see the January 2002 issue) is now available in the ORIGEN-ARP 2.0 package from RSICC. The methods and nuclear data used to calculate the neutron source intensities and energy spectra in ORIGEN-S have been extensively upgraded using the computational algorithms and data from the SOURCES-4B code (RSICC package CCC-661). The (alpha,n) source can now be calculated for any problem-specific matrix of alpha source and target materials. This upgraded version of ORIGEN-S will be available in SCALE 5.

ORIGEN-ARP 2.0 also includes a new version of the OrigenArp for Windows GUI to accommodate these new features.

Ian Gauld of ORNL presented a paper on this upgrade entitled "New Neutron Source Algorithms in the ORIGEN-S Code" at the American Nuclear Society (ANS) Radiation Protection and Shielding Division (RPSD) 2002 Topical Meeting in April. This paper has been selected as one of the most interesting RPSD 2002 Topical Meeting papers that will be featured in a special session entitled "Highlights of RPSD 2002" at the upcoming ANS Meeting November 17–21 in Washington, DC.

Error in Beryllium Metal Cross-Section Data

For more information about this discrepancy, please read the discussion on pages 395 and 396 of the SCALE Notebook

A very significant error in the beryllium metal cross-section data contained in the 238- and 44-Group ENDF/B-V libraries was recently discovered by SCALE users at ORNL. Several critical experiments that involved beryllium metal as the reflector were found to have > 1% difference in calculated k-eff values between different versions of SCALE (4.3 vs. 4.4a).

The Be metal data (BEBOUND, nuclide ID 4309) in SCALE 4.4 and 4.4a contains a factor of 2 scaling error in the Be thermal scattering transfer arrays. This error can result in non-conservative errors in calculated k-eff values of > 1%. Users should download the corrected data from the SCALE Download page and install according to the directions provided in the README file. This error is NOT present in SCALE 4.3. This error is NOT present in BE, nuclide 4009 (Be free gas model).

For more information on the differences between the Be free gas (BE, nuclide ID 4009) and Be metal (BEBOUND, nuclear ID 4309) cross-section data, please read pages 395-396 of the SCALE Notebook.

SCALE Training Courses at ORNL

(October 14–18 and 21–25, 2002)

For information or to register online, go to:

http://www.ornl.gov/scale/trcourse.html

The SCALE staff at Oak Ridge National Laboratory (ORNL) are offering two training courses this fall. The courses emphasize hands-on experience solving practical problems on PCs. There will be workgroups of two persons each. No prior experience in the use of SCALE is required to attend.

The registration fee is $1,800 for one course or $3,000 for both courses **($300 discount if you register at least one month in advance)**. Foreign nationals must register at least 2 months in advance for security clearance. A copy of the SCALE software and manual on CD may be obtained for an additional fee of $700, and the KENO3D 3-D visualization tool on CD is available for $800 (single license).

Registrations are accepted on a first-come basis. Registration forms submitted directly from the Web are preferred. Registration via FAX or e-mail is also acceptable. The registration fee may be paid by check, travelers checks, bank transfer, or credit card (Visa or MasterCard only). The upcoming SCALE course agendas are included on page 3 of this issue.

SCALE Source Terms & Shielding Course Agenda (October 14–18, 2002)

Monday
Overview of SCALE System
Introduction to SCALE Shielding Sequences
ORIGEN-ARP
Plotting ORIGEN Results with OPUS/PlotOPUS
OrigenArp/PlotOPUS Demo
ORIGEN-ARP Problem Definitions
ORIGEN-ARP Problem Session
How to Create ORIGEN-ARP Libraries

Tuesday
Material Information Processor
SAS2 Depletion/Decay/Source Terms Analysis Sequence
SAS2 Problem Definitions
SAS2 Problem Session

Wednesday
SAS1 1-D Shielding Sequence
SAS1X 1-D Combined Criticality/Shielding Sequence
SAS1 Problem Session

Thursday
SAS4 3-D Monte Carlo Shielding Analysis Sequence
SAS4 Variance Reduction Techniques
SAS4 MARS Geometry Option
SAS4 Validation/Limitations
ESPN Demo
SAS4 Problem Definitions
SAS4 Problem Session

Friday
QADS 3-D Point Kernel Shielding Analysis Sequence
QADS Problem Definitions
QADS Problem Session
Shielding Course Wrap-up

The course will conclude with lunch on Friday.

SCALE KENO V.a Course Agenda (October 21–25, 2002)

Monday
Overview of SCALE System
Introduction to CSAS
Standard Composition Library
Material Information Processor
Resonance Self-Shielding
Unit Cell Geometry–Lattice Cell/Multiregion
CSPAN Demo
Problem Session 1

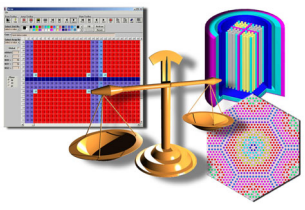
Tuesday
KENO V.a Parameters
KENO V.a Geometry
KENO V.a Plot Data
Problem Session 2

Wednesday
Introduction to KENO V.a Output
KENO3D Tutorial
Holes
Arrays
Problem Session 3

Thursday
KENO V.a Output – How to Read It
Start Data
Bias Data
Boundary Data
Mixing Table
Search Data
Problem Session 4

Friday
Monte Carlo Uncertainties
Code and Data Validation Issues
Conclusion/Questions and Answers

The course will conclude with lunch on Friday.



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SCALE Electronic Notebook:
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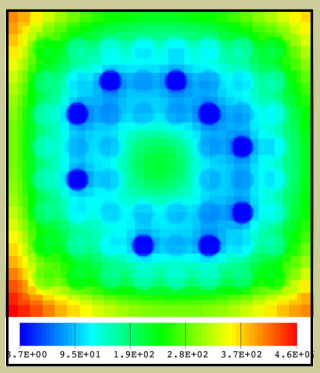

SAS2D BWR fuel assembly 2-D flux distribution

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From Our Mailbox . . .

Looking for help getting cattle scales verified for a local fair in the State of Maine.

Can you please advise?

New SAS2D 2-D Depletion Sequence in SCALE 5

ORNL is preparing a new 2-D depletion sequence named SAS2D for release in SCALE 5 (now scheduled for 2003). SAS2D implements a similar approach to the current SAS2H sequence, but the 2-D arbitrary-geometry discrete-ordinates code NEWT is used to provide a transport solution and cross-section collapse in place of XSDRNPM.

Because an explicit assembly model is possible in NEWT, no cell weighting procedure is necessary. The explicit assembly model allows specification of multiple depletion materials, e.g., spatially variable fuel enrichments, BPRs, IBAs, as well as non-depleted absorbers (control rods/blades, etc.). The neutron flux calculated in each unique material region can be used to collapse cross sections and perform an ORIGEN-S depletion for each region. Additionally, the fission and capture rates provide time-dependent power distributions that are used to normalize relative depletion rates across the domain.

Note that multiple pin-cell descriptions are supported in SCALE 5; hence, only one pass through BONAMI and NITAWL is necessary to prepare problem-specific cross sections for any number of mixtures. However, since ORIGEN-S remains a point-depletion code, multiple passes through COUPLE and ORIGEN are necessary, one for each material to be depleted. This sequence is repeated as dictated by the number of depletion steps in the user input specifications.

SAS2D allows specification of a variable number of libraries on a cycle-by-cycle basis. This allows the user to specify, for example, a finer depletion timestep structure for the first cycle during which BPRs are depleted, but a larger timestep in later cycles, where cross sections change less rapidly with time. Another feature of SAS2D is the timetable input block that allows time-dependent variation of temperatures and concentration multipliers to be defined for any given set of nuclides or for a whole material. This gives the user the ability to explicitly define boron letdown for each cycle, or to remove or add concentrations to the model, as in the removal of a BPR and replacement with water.