

NCSP 4th Qtr FY2007 Accomplishments

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT **INL**

- The 2007 Edition of the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* was published in September and distribution was initiated. Twenty-two new evaluations were included; however actions on two evaluations were not completed in time for publication. These two will be linked from the Handbook to the Internet and made available as soon as they are finalized.
- VNIITF Vanadium experiments were completed. A Technical Audit of the Program was conducted in August. J. Blair Briggs, Jim Felty, Dick McKnight, David Hayes and Rene Sanchez participated. Overall consensus is that the experiments were performed to high standards with careful attention to detail. Reports of these experiments will be submitted for publication in the 2008 Edition of the ICSBEP Handbook.
- The agreement on the planned collaboration on the IRSN Structural Materials Experimental Program was nearly finalized.
- Initial planning documentation for 2008 was completed.

ANALYTICAL METHODS DEVELOPMENT AND CODE SUPPORT

ANL

- Completed final editing of chapter on Resonance Theory (R. Hwang).
- Analytical treatment for the unresolved resonance region has been validated for ^{235}U and an NSE paper documenting the method is in preparation. Work is beginning to extend this treatment to fissile elements and to “pare down” the code for implementation in principal NCSP physics codes.
- Developed and documented rigorous methodology for evaluation of covariance data based on Monte Carlo (D. Smith). Two papers on this Monte Carlo based methodology have been written/presented and collaboration is engaging with BNL, Petten and Vienna to implement the methodology.
- Produced and presented 3 papers on Source Convergence work and VIM/MCNP library verification and validation work at ICNC’07.
- Verification of new *xseditor* has been completed and it is being fully implemented in VIM.

LANL

- Developed two ways to compute the dominance ratio of a critical system. This is important for better convergence testing and for preventing false convergence (LA-UR-07-5462 and LA-UR-07-6637).
- Participated in OECD/NEA Working Group on Nuclear Criticality Safety. Presented overview of MCNP advances and status (LA-UR-07-5506).
- Released NJOY99.259, which includes the ERRORJ module for covariance data processing. ERRORJ test problems have been added to the NJOY test suite.
- Completed MCNP5 1.50, which is undergoing final internal testing.
- Created ENDF70, a continuous-energy MCNP data library based on ENDF/B-VII. ENDF70 provides data for 392 isotopes at 5 temperatures and is undergoing final internal testing.
- Developed code for creating 1-group cross sections for MCNP. This is useful for code verification (LA-UR-07-4594).

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LLNL

- Commenced beta testing COG version 11 with ENDF/B-VII.0 data.
- Coordinated and published the results of an inter-comparison study involving eight codes with participation from six laboratories: UCRL-TR-233310, "ENDF/B-VII.0 Data Testing for Three Fast Critical Assemblies."

ORNL

- SCALE version 5.1 released through RSICC in November 2006:
 - Provided 800 responses to users requesting technical assistance.
 - Four SCALE 5.1 workshops (KENO or TSUNAMI) provided.
 - Two SCALE Newsletter issues published.
- SCALE development and website maintenance (www.ornl.gov/sci/scale):
 - CE-KENO and MG-KENO compared for >400 benchmarks.
 - Updates on >30 SCALE modules, data and program libraries.
- AMPX Maintenance and Library Generation:
 - Processed all ENDF/B-VII nuclides for prototypic CE-KENO library.
 - Major upgrades to the POLIDENT module.
 - Updated SCALE 5.1 covariance library to include full-energy range covariance evaluations for ^{233}U , ^{235}U , ^{238}U , and ^{239}Pu .
- Novel Monte Carlo adjoint solution developed and tested for TSUNAMI.
- TSURFER: Uncertainty methods tested to establish most effective bias determination techniques and completed prototype code for SCALE-6.
- RSICC activities: See www-rsicc.ornl.gov for monthly newsletters:
 - Distributed 616 software packages and updated 9 packages.
 - 185 SCALE & 161 MCNP packages distributed.
 - Electronic notebook entries for SCALE and MCNP.
- CE-KENO participation in international Monte Carlo code comparison study led by LLNL using ENDF/B-VII data--results published.
- TSUNAMI support for ISOTEK ^{233}U validation completed using ENDF/B-VII ^{233}U cross-section data.
- TSUNAMI analysis of IRSN structural experiments initiated.
- OECD WPNCs EG on Uncertainty Methodology for NCS initiated.

NUCLEAR DATA

ANL

- Continued testing of ENDF/B-VII.0 data evaluations; extended validation analyses on Cr and presented additional results indicating poor performance of Cr data at November CSEWG and June NDAG meetings.
- Organized / chaired NDAG June NDAG meeting.
- Obtain and organize responses to NCSP Manager on NDAG "tasks."
- Participate in NCSP Program meetings and provide input as requested by NCSP Program management.
- Participated in the June planning meeting for the "Low-Fi" covariance data.
- Produced and presented 2 papers on Nuclear Data Needs for Advanced Fuel Cycles and Nuclear Data Validation at ICNC'07.

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- Participated in the initial testing of the NCSP web implementation of NCSP Requests for Critical Experiments.

BNL

- Released ENDF/B-VII.0 library on December 15, 2006. Many BNL fission product evaluations were included as part of ENDF/B-VII.0.
- Published journal article “ENDF/B-VII.0: Next Generation Evaluated Nuclear Data Library for Nuclear Science and Technology” on December 31, 2006. The corresponding author and 7 additional co-authors were from BNL.
- Performed massive calculation of sensitivity matrices needed for low fidelity covariances in the fast neutron region for all fission products.
- Produced low-fidelity covariances for 219 fission products included in ENDF/B-VII.0 in the energy range 5 keV – 20 MeV. The results were sent to ORNL for merging with the low energy covariance data in August 2007.
- Initiated work on organizing the CSEWG Annual Meeting to be held on November 6-8, 2007 at BNL.

LANL

- Performed sensitivity calculations on Np criticals to determine impacts of various reactions as function of energy. Performed GNASH calculations for several reactions. Submitted two papers on this work to PHYSOR 2008.
- Simulated suite of eight Ti benchmarks from ICSBEP (including the VNIITF experiments) using several variations of Ti data. Will investigate elastic scattering angular distributions early in FY08 on path toward final updated evaluations.
- Submitted a paper on evaluations and validation of dosimetry isotopes for ENDF/B-VII to NDS.
- Organized codes and procedures necessary for low-fidelity covariance project.

ORNL

- Completed cross section evaluation and testing for ^{239}Pu :
 - New evaluation of resonance parameters and full-range covariances using LANL covariances in high energy range.
 - Benchmark testing with KENO and MCNP; TSURFER applied to identify evaluation corrections.
- ^{233}U , ^{235}U , ^{238}U , and ^{239}Pu resonance parameter covariance evaluations:
 - Conversion of File 32 covariance into File 33 for ^{233}U , ^{235}U , ^{238}U , and ^{239}Pu completed.
 - Testing of the File 33 data covariance for benchmark calculations using TSUNAMI code.
- Continued evaluator support for SAMMY version released by RSICC:
 - Completed transition plan for training modeling specialist.
 - Published “SAMMY User Guidance for ENDF-Formats.”
- Produced ^{55}Mn preliminary resonance evaluation with covariance data and initiated update with recently measured ORELA data.
- $^{39,40,41}\text{K}$ evaluations progressing as planned subsequent to unexpected retirement of ORNL evaluator.
- Completed automated procedure for assembling low-fidelity covariance files. Testing begun but not completed – see issues.

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- Chlorine: Revised evaluations submitted to NNDC at BNL:
 - $^{35,37}\text{Cl}$ resonance covariance evaluations updated and tested with PUFF and SAMMY prior to submission.
- Titanium covariance evaluation completed to support SRS need.
- AccApp07 Conference (July 29–August 2, 2007):
 - Presented paper on ORELA and NCSP Nuclear Data program.
- Paper presented on AMPX covariance processing capabilities with results for NCSP covariance evaluation efforts.

DIFFERENTIAL MEASUREMENTS

ORNL

- Completed reliable ORELA operation for ~700 hours (~1000 hours since restart in FY 2006) with power levels between 4.5–6 kW, 525 Hz frequency, 8 ns pulse width, and 10^{-8} torr vacuum.
- Additional ^{41}K transmission and ^{55}Mn capture measurements completed in response to evaluator requests.
- Completed ^{41}K data reduction for transmission and capture measurements.
- Completed data reduction for ^{55}Mn capture measurements.
- Procured ^{52}Cr samples and completed capture measurements.
- ^{52}Cr transmission measurement initiated.
- Procured $^{58,60}\text{Ni}$ samples. Good ORELA transmission data available.
- Identified ^{53}Cr sample requirements for measurements--enriched ^{53}Cr sample will most likely be needed.

INTEGRAL EXPERIMENTS

LANL

- Completed our first subcritical noise experiment using the BRP-ball RTO.
- Received authorization for the startup of the CEF warehouse and received first shipment.
- Successfully supported all required DAF TSR surveillances, maintenance activities.
- Completed 2nd training/proficiency at VNIITF in August 2007. Discussions continuing with SNL for possible operator training in FY08 in conjunction with 7 up CX. Further training in France following resolution of contractual issues.
- Completed the outline for the new LACEF crew member and crew chief certification program.
- Supported various NCSP planning activities including 5-year and 10-year vision development.

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ORNL

- Worked with LANL to assess equipment and assure adequate neutron sources in place for FY 2007 measurement.
- Provided technical oversight for performance of the first DAF subcritical experiment:
 - ^{252}Cf neutron noise analysis technique was utilized in measuring the multiplication factor for the polyethylene-reflected BeRP Ball (beryllium-reflected plutonium metal sphere).
 - Data reduction and interpretive analysis performed.
- Outline of draft white paper on subcritical measurement technology and plan completed in September.

INFORMATION PRESERVATION AND DISSEMINATION

Fluor Hanford

CRITVIEW

- The CritView beta review package is in final review prior to controlled release on the NCSP web site.
- A draft of Documentation of CritView features is complete, and is now in review.

DATABASE

- Abstracts/Proceedings from the 2006 and 2007 Transactions of the American Nuclear Society, the St Petersburg ICNC Meeting (May 28 - June 1, 2007), and past documentation from the 1960s – 1990s were reviewed and included in the database. A total of 126 papers containing parameter studies will be included in the final version, and will be provided to LLNL for inclusion on the NCSP web site.

LLNL

- Developed and deployed web base multimedia training “Fundamentals of Criticality Safety for Non-material Handlers.”
- Implemented beta versions revision two of the online Request for Integral Experiments form (CED-0).
- Continuously updated FY2007 Activities / Accomplishments web pages.

ORNL

- Dr. Ray Murray, one of the principal ORCEF Heritage participants, completed “voiceover” summaries of the 32 topics of the final DVD versions of the ORCEF Heritage sessions.
- The ORCEF Heritage is in final editing and DVD production by the ORNL Visual Instrumentation department. Final version contains 11 sessions with 32 topics and several hundred subtopics.
- Contract issued for former Oak Ridge Electron Linear Accelerator (ORELA) Director to edit seven sessions of recording for the ORELA Heritage video.

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TRAINING AND QUALIFICATIONS

ANL

- Participated in the CSSG review of Y-12.
- Participated in CSSG meetings and conference calls; prepared summary notes from meetings and conference calls during the quarter.
- Participated in completion of CSSG Tasking 2007-1 through 2007-7.
- Completed the NCSET module on cross section measurements and dataset preparation; published it via the NCSP web site.
- Continued discussions with LLNL staff to finalize NCSET module on hand calculations and multimedia prototype module. NCSET module aborted by LLNL staff.

LLNL

- Provided a demonstration on 07/26/2007 to AWE personnel
- Completed a class on 07/26/2007
- Completed a class on 08/23/2007
- Scheduled eight new classes for FY2008
- HS3201-W/HS3201-P class has been awarded 32 continuing education credits by the American Academy of Health Physics (AAHP)

ORNL

- Completed initial draft of the TSUNAMI primer.
- The chapters address:
 - Introduction
 - 1D Example – 10% UO₂ sphere infinitely reflected by H₂O
 - Reading the output
 - 3D Example – 10% UO₂ 9_9 pin lattice
 - Making Changes to the input to get more accurate results
 - TSUNAMI IP
 - Bias and Uncertainty Calculation

NUCLEAR CRITICALITY SAFETY PROGRAM SUPPORT

ANL

- Completed review and prioritization of proposed NCSP tasks for FY08 (Tasking 2007-01).
- Completed review of ORNL NCS infractions 5/24 (part of Tasking 2007-02).
- Completed technical review of the preclosure criticality analysis and license application sections for YMP (Tasking 2007-03).
- Completed review of the Fluor-Hanford draft criticality safety evaluation report (Tasking 2007-04).
- Completed review and submitted comments on draft standard DOE-STD-1189 (Tasking 2007-05).
- Completed CSSG self-assessment (Tasking 2007-06).
- Completed review of the technical basis for IEZ at Y-12 (Tasking 2007-07).
- Planned and hosted CSSG and NCSP meetings at ORNL (ORNL members).
- Participated in reviews of documents, participated in CSSG meetings and conference calls (CSSG members).