NCSP Activities and Accomplishments in FY13

Analytical Methods (AM)

LANL AM

- MCNP6-Beta3 released to RSICC. This version included major overhaul and improvements to MPI parallel processing capabilities.

- MCNP Classes: criticality class at Sandia; criticality class at LANL; introductory class at LANL; variance reduction class at LANL.

- MCNP V&V: testing for MCNP6-Beta3; incorporated LANL SB-CS criticality validation suite into MCNP6 collection.

- Contributed to final report on On-The-Fly Doppler broadening as part of DOE NEUP project with Michigan and ANL.

- Six MCNP-related papers presented at ANS Winter meeting.

- MCNP user support: included 1-day session with Pantex criticality safety analyst, and consultation with LANL criticality safety group.

- Beta3 version of ENDF/B-VII.1 ACE library created, tested, and deployed on local systems following NJOY update to fix a bug. Documentation of this library is in progress.

- An NJOY2012 CD has been prepared for distribution through LANL's Technology Transfer department.

- An NJOY2012 manual is ready for unrestricted release; LA-UR-12-27079.

- Decision made to investigate principal eigenvector format as compact storage scheme for ACE covariance information.

- ENDF/B-VII.1 based cross-section covariance matrices prepared for major actinides. Scripts were developed to process these data into preliminary ACE format and results of memory requirements appear promising.

- MCNP library based on ENDF/B-VII.1 finalized and will be distributed to RSICC with the production release of MCNP6 (LA-UR-13-20137).

- User's guide for MCNP eigenvalue sensitivities created (LA-UR-13-22251).

- Proposed ACE covariance format published (LA-UR-13-22347).

- Prototype capability developed in MCNP6 to read proposed covariance format, generate sensitivities, and estimate uncertainties for keff (currently supports cross sections, fission nu, and fission chi).

- Submitted summary for the ANS Summer Meeting on the new format and data compression techniques.

- Developed novel technique in MCNP6 to compute sensitivities for angular scattering distributions using Legendre moments.

- Initiated revision to NJOY/ERRORR to support new MCNP S/U capability.

- Provided a 1-week MCNP criticality class for the LANL Criticality Safety Group as part of certification for new SB-CS criticality-safety analysts.

- Major effort to assist with MCNP6 verification and release

  - Incorporated new MCNP data libraries (from Data Team) with ENDF/B-VII.1 into MCNP6 release package

  - Corrections to continuous S(a,b) scattering physics

  - Additional improvements in parallel processing

- V&V testing and documentation, with MCNP5 & MCNP6 (LA-UR-13-22196).

- Updated MCNP website to include all recent criticality safety reports on MCNP.

- Provided NJOY User support (via email).

- Distributed NJOY2012 to DOE users at ANL, Bettis, BNL, ORNL, LLNL, and LANL.

- Prepared the final production distribution of MCNP6 for RSICC, including MCNP5, ENDF/B-VII.1 nuclear data libraries, and MCNP Reference Collection. Extensive testing was performed on many platforms, and planned distribution was made by RSICC in July 2013.

- Taught 2 Introduction to MCNP classes, with 28 students.

- Worked with several summer interns at LANL, all doing NCSP-related work.

- Twelve hours of lectures on Monte Carlo were presented to 24 students at XCP Computational Physics Workshop.

- MCNP support: user support, MCNP Forum support, web page updates, and updates to MCNP Reference Collection.

- Ten MCNP-related papers and talks were presented at M&C-2013, ANS Mathematics & Computation conference, by LANL staff and university collaborators.

- Reviewed and submitted papers to the ANS Nuclear Criticality Safety Division topical conference scheduled for September 2013.

- Developed a prototype capability for sensitivities to subcritical measurements at NCERC. The capability was validated against a recent series of measurements involving the Thor core.

- Presented the sensitivity/uncertainty work at ANS Mathematics and Computation Topical and ANS Summer meeting in Atlanta.

- Submitted five summaries to the ANS Winter meeting in Washington, DC on NCSP supported and/or related work.

- The ENDF71x library was described in a presentation during the ANS Summer meeting.

- Provided NJOY User support to internal and external users.

- Developed an NJOY99 patch to allow ACE processing of the new IAEA International Reactor Dosimetry Fission/Fusion File (IRDFF). NJOY2012, which uses allocatable arrays, can process this file with no upgrade.

- RSICC initiated public distribution of MCNP6 in late July. Demand was exceptional, as within the first two weeks 770 copies were distributed without user cost – the majority through a subsidy from the LANL ASC Program.

- MCNP/NJOY Sensitivity/Uncertainty

  - Created prototype version of MCNP6 to write sensitivity output in SCALE format

- Prepared report on MCNP S/U status
- Preliminary results published and presented at ANS NCSD Topical Meeting

- MCNP Development Work
  - Continued development of fission matrix capability for MCNP
  - Produced 16 LANL reports on R&D and summer student work for criticality, including fission matrix, alpha eigenvalue calculations, sensitivity/uncertainty, temperature effects on cross-sections, and depletion

- MCNP User Support and Training
  - Provided assistance with new MCNP6 installation & V&V
  - Taught 2 MCNP classes: Criticality and Variance reduction
  - Presented Monte Carlo lectures to students at LANL Computational Physics Workshop

- MCNP Professional Society Activities
  - Presentation at 23rd International Conference on Transport Theory
  - Presentations (3) at Nuclear Criticality Safety Division NCSD-2013 topical conference
  - Presentation to NRC Commissioner visiting LANL

- American National Standards
  - Coauthor of ANSI/ANS-10.7-2013, "Non-real-time, high-integrity software for the nuclear industry - developer requirements," approved & released 2013

- NJOY Development and Support
  - Issued updates for njoy99 and njoy2012 that resolved user-reported processing issues
  - Provided end-user support to a variety of internal and external users

LLNL AM

- Current COG versions (e.g., COG10) in the LLNL 830 inventory have been reviewed and re-approved per LLNL Executive Management Operational Directive, *Interim Compensatory Actions Related to 830 Software.*

- At the request of Brookhaven National Laboratory, completed a feasibility assessment for deploying COG (and associated library maker files) to Brookhaven National Laboratory for automated nuclear data library creation and integral data testing.

- At the request of North Carolina State University, completed a feasibility assessment for using COG (and associated $S(\alpha,\beta)$ library maker files) for testing their new scattering law data.

- Revised LLNL administrative procedures formalizing practices for configuration management and archiving of (non-executable) source code.

- Accepted an invitation for COG to participate in a Monte Carlo Special Session dedicated to Monte Carlo codes at the SNA + MC 2013 conference. Preparation of demonstration materials and posters for the session is in progress.

- Current COG versions (e.g., COG10) are listed in the LLNL 830 Software Inventory https://830sw.llnl.gov updated on March 13, 2013.

- Released LLNL-CODE-635601, the latest COG11.1BETA2 version, to RSICC for limited distribution as Export Control Information together with:

  - COG11.1 Abstract, LLNL-ABS-635652

  - COG11.1 Manual Supplement, LLNL-SM-635621

  - JEF-2.2, JEFF-3.1.2, and ENDFB7R1 nuclear data libraries

- New features disclosed in the COG11.1BETA2 version update include:

  - Crit Detector Variance Reduction (Hybrid Mode)

  - Delayed Fission Gammas

  - Nuclear Resonance Fluorescence

  - Radiation Decay

- Provided LLNL-CONF-640038, *COG11.1 Description, New Features, and Development Activities*, to Dr. Jean-Christophe Trama in support of the Monte Carlo Codes Invited Session at SNA-MC2013.

- Successfully demonstrated the COG geometry feature within ARDRA for automatic 3D mesh generation for massively parallel S_N simulations.

- Implemented LANL processed ENDF/B-VII.1 MCNP6 data libraries for use in COG11.1:

  - MCNP.71nc

  - PT.MCNP.71nc

  - T.MCNP.71nc

- Implemented the ENDL2011 data library in COG11.1 to enable automatic V&V by LLNL P&LS including intercomparison to ARDRA and MERCURY results.

- Commenced processing of IAEA thermal scattering law data libraries provided by IKE Stuttgart.

- Provided a (reformatted) paper and two posters to the Monte Carlo Codes Invited Session of the SNA-MC2013 conference:

  - LLNL-CONF-640038, *COG11.1 Description, New Features, and Development Activities*

  - LLNL-POST-644394, *COG11.1 – New Features, Data, V&V*

  - LLNL-POST-644395, *COG11.1 – Practical Applications*

- Completed a comparative study of available thermal scattering law libraries as processed by LLNL, LANL, BNL et al., and a laboratory report is in preparation:

  - ENDF/B-III, VI.0, VI.2, VII.0, VII.1

  - IAEA-2007

  - JEF-2.2

  - JEFF-3.0, 3.1, 3.1.1, 3.1.2

- Successfully compiled and verified proper execution of COG11.1 for MAC platforms.

- Implemented time-dependent emission of delayed neutrons into LLNL multiphysics methods, and testing is in progress.

ORNL AM

- RSICC activities: See rsicc.ornl.gov for monthly newsletters.

  - Distributed 567 software packages and updated 14 software packages

  - 58 SCALE and 175 MCNP packages distributed

  - RSICC quarterly report issued

- SCALE activities: See scale.ornl.gov for newsletters

  - Demonstrated initial continuous-energy (CE) sensitivity analysis capability in TSUNAMI

  - 176 requests for users assistance answered through scalehelp@ornl.gov e-mail

  - 5 feature modifications were implemented through the SCALE QA program for deployment with the SCALE 6.1.2 patch

  - Six SCALE training courses were planned for Spring 2013.

- AMPX Maintenance and Modernization

  - Completed FY12 AMPX annual report and submitted to NCSP Manager

  - Updated CE data meshing scheme in the resolved resonance range to allow processing of evaluations with large RR range and threshold reactions in the RR (e.g., 19 F and 16 O)

  - Added utility module to extract NJOY-generated probability tables from an MCNP library and import to SCALE CE libraries—facilitates SCALE/MCNP probability table comparisons

  - Participated in November 2012 ENDF CSEWG Meeting and presented AMPX status and chaired ENDF Formats and Processing Session

  - Completed CE KENO and AMPX CE library profiling study to assess SCALE CE data memory footprint and transport CPU times—developed modernization plan to improve CE data/transport efficiency

- RSICC activities: See rsicc.ornl.gov for monthly newsletters.

  - Distributed 1136 software packages and updated 12 software packages

  - 180 SCALE and 538 MCNP packages distributed

  - RSICC quarterly report issued

- SCALE activities: See scale.ornl.gov for newsletters

  - Distributed SCALE 6.1.2 patch to RSICC and announced to SCALE users for download—SCALE 6.1.2 includes several important updates, especially related to TSUNAMI sensitivity/uncertainty calculations

  - 282 requests for user assistance answered through scalehelp@ornl.gov e-mail

  - Three feature modifications implemented through the SCALE QA program for deployment with the SCALE 6.1.2 patch

  - Registrations were processed for six SCALE training courses for Spring 2013

- Spring 2013 SCALE Newsletter distributed
- SCALE online discussion forum created and populated with hundreds of topics from the former SCALE eNotebook
- SCALE 6.2 is in preparation for a beta release in Q3

- AMPX Maintenance and Modernization
  - Initiated effort to combine AMPX and SCALE software configuration control and build—combining SCALE/AMPX software infrastructure is key step to AMPX SQA efforts as much of SCALE testing infrastructure will be used for AMPX development and SQA
  - Converted AMPX library functions that treat point-wise and kinematic data from Fortran to C++ and added unit tests
  - Converted AMPX/ENDF reading routines for files needed for kinematic processing from Fortran to C++
  - Added an interface layer that will make it easy to add support for the new ENDF GND format
  - Initiated rewrite of AMPX collision kinematics module to develop more modern, modular capability
  - Provided updated nuclear data libraries for SCALE 6.2 beta package

- RSICC activities: See rsicc.ornl.gov for monthly newsletters.
  - Distributed 781 software packages and updated 20 software packages
  - 149 SCALE and 309 MCNP packages distributed
  - RSICC quarterly report issued

- SCALE activities: See scale.ornl.gov for newsletters.
  - 148 requests for user assistance answered through scalehelp@ornl.gov e-mail
  - Implemented ISO 9001 compliant quality assurance program
  - 25 feature modifications implemented through the SCALE QA program for deployment with beta release of SCALE 6.2 in July 2013. Significant criticality safety features include:
    - ENDF/B-VII.0 CE libraries with improved accuracy
    - Significantly reduced memory requirements for CE KENO
    - Prototypic CE TSUNAMI-3D
    - Sampling tool for assessing geometric and material uncertainties in safety systems as well as correlations in critical experiments
    - Parallel version of KENO
    - Fission convergence diagnostics (Shannon entropy)
    - Hybrid method for determining KENO starting source distribution from a deterministic calculation
  - Six SCALE training courses in Spring 2013, providing a total of 74 man-weeks of training to a diverse group of domestic and international participants

- Developed benchmark specification for WPNCS Expert Group on Advanced Monte Carlo Techniques
- Presented ORNL AM accomplishments report at NCSP Technical Program Review Meeting on May 31, 2013

- AMPX Maintenance and Modernization.

  - Finalized and tested nuclear data libraries for SCALE 6.2 beta package

  - Completed rewrite of the AMPX collision kinematics module

  - Generated ENDF/B-VII.0 CE library with new AMPX collision kinematics module and initiated library testing

  - Initiated development of journal article documenting details of AMPX cross-section processing capabilities and modernization efforts

  - Participated in OECD/NEA WPEC meetings including subgroup meeting to develop new, modern ENDF format—provided presentation on QA needed for new international data format

- RSICC activities: See rsicc.ornl.gov for monthly newsletters.

  - Distributed 1628 software packages and updated 18 software packages

  - 203 SCALE and 1123 MCNP packages distributed

  - RSICC quarterly report issued

- SCALE activities: See scale.ornl.gov for newsletters.

  - SCALE Annual Report issued

  - 185 requests for user assistance answered through scalehelp@ornl.gov e-mail

  - Four feature modifications implemented through the SCALE QA program

  - SCALE 6.2 beta1 distributed to select users

  - Three SCALE training courses scheduled for Fall 2013

  - Half-day SCALE tutorial provided at NCSD 2013 with 40 attendees

  - 11 ORNL papers on SCALE methods and analysis presented at NCSD 2013

  - Paper on ORNL AM technical accomplishments submitted for the invited NCSP session at the November 2013 ANS Winter Meeting

  - Invited paper on SCALE Monte Carlo capabilities prepared for SNA-MC 2013 conference and subsequent journal publication

- AMPX Maintenance and Modernization.

  - Completed milestone to merge AMPX configuration control and build with SCALE—allows AMPX development to be performed under SCALE QAP

  - Updated MG and CE library generation to use new, modern AMPX collision kinematics processing capability developed as part of AMPX modernization

  - Generated initial ENDF/B-VII.1 CE and MG libraries with latest AMPX tools in SCALE repository—initiated testing of new libraries for SCALE 6.2

- Generated ENDF/B-VII.1 covariance libraries for testing of new covariance data for possible release with SCALE 6.2

Integral Experiments (IE)

ANL IE

- Provided NDAG review of all new IERs.

- Provided mentoring role on design analysis of IERs.

- Reviewed all available C_EdTs with participation on C_EdT team and provided specific comments to all team members.

LANL IE

- Three training sessions with OJT occurred in Q1 to help enable qualifying more critical assembly operators (Comet and Godiva IV).

- Drafts were submitted to the C_EdT for review and comment. XCP‑7 began modeling of the sub‑critical multiplication measurements using the list‑mode version of MCNP5.1.60 (internal). Models used for the pre‑measurement predictions were modified to match the measurement actually performed.

- Planning and operations for getting Godiva IV approved for burst operations was performed. By the end of the quarter, Godiva was operational for delayed critical operations and ready to begin the approach to prompt critical process.

- A Joint LANL/CEA Valduc workshop was held to discuss data and simulation comparisons from the Caliban subcritical measurements campaign performed in June 2012.

- A revision of the Jezebel benchmark, PU‑MET‑FAST‑001, "Bare Sphere of Plutonium‑239 Metal (4.5 at.% 240Pu, 1.02 wt.% Ga)," Revision 3, was submitted to the International Handbook of Evaluated Criticality Safety Benchmark Experiments.

- Talks were presented at the ANS 2012 Winter Meeting:
  - Comparison of MCNP-Based Transport Codes for Subcritical
  - Calculations, Kimberly Clark *(LANL/UNLV)*, Avneet Sood, William Myers, Jesson Hutchinson *(LANL)*, Denis Beller *(UNLV)*
  - Generating List-Mode Data for Simulated Subcritical Neutron Measurements Using MCNP II, Avneet Sood, J. D. Hutchinson, W.L. Myers, C. J. Solomon *(LANL)*

- Complete all surveillances and ISIs that were scheduled.

- Completed measurements for DTRA.

- Performed foil irradiations.

- Continued the relocation of TA-18 materials to NCERC vaults (three activities).

- Devised plan on path forward for Godiva burst.

- Supported Probability of Failure on Demand calculations in support of Change Notice 2.

- Hired an additional Cognizant Systems Engineer.

- Completed design of 6 sample transfer capsule (Rabbit) concepts.

- Identified appropriate end fittings for tubing that allow for easy positioning and reconfiguration.

- Initiated design of Rabbit control system.

- Developed an understanding of the basic theory of neutron transport and the derivation of the point kinetics models and performing a literature review is in process to leverage progress that has been made in the modification of the models to analyze systems that are not correctly predicted by the standard point kinetics equations. Term-by-term comparison of MCNP simulations and analytic solutions with the intent to evaluate the computational capabilities to reproduce test problem results to reveal gaps in point kinetics models is also in progress. These comparisons will be used in FY14 to plan and design experiments using the critical machines at NNSS.

- An experiment plan was created to begin the review process for DAF operations.

  - Completed characterizing Godiva up to 99.6 cents above delayed critical. Operations beyond prompt-critical were halted because of issues

  - Continued preparation in support of CEF‐PLN‐017, Godiva Pulse Energy Test Plan

  - Continued working with INL for planning shipments of ZPPR plates and diluents

  - Summer student have been assembling/testing a Rossi-Alpha measurement system that uses modern list-mode data acquisition technology

  - A Crit evaluation was completed for unpacking materials. Items were unpacked from shipping containers and placed in Vault storage

  - Several planning telecons were held in support of hosting the CEA visit to DAF in Fy2013 Q4

  - Technical papers were presented at the ANS summer meeting held in Atlanta, Ga. Rene Sanchez presented a paper entitled "MCNP Simulations in Support of the Heat Pipe In Flat-Top Experiment." This paper summarized the calculations conducted with MCNP to plan the core loading for the Flat-top assembly to ensure it had enough excess reactivity to heat up to the necessary temperature to enable the heat pipe to produce electricity. A paper was presented for "LANL CALIBAN Subcritical Measurements"

  - NCSP technical interactions with CEA/Valduc were represented at the Working Meeting for CEA/US basic Science Agreement supporting Stockpile Stewardship held in Albuquerque, NM. A paper was presented for "P183 Nuclear Data, Experiments, and Training"

  - A paper was presented for "Godiva Core Assembly and Startup for NCSP" at the NCSP Technical seminar held in Washington DC

- As part of the operator qualification program, the formal bi-annual lectures for crit assembly operator training was provided.

- Various "hands on" operations for currently "unqualified" crew members were performed throughout Q3.

- All routine operations (surveillances, maintenances, procedures, etc.).

  - Joint LANL/CEA Measurements

  - NCSP Material Moves & Repack

- Godiva Operations (completed Godiva S/U Plan)
- Comet Operations
- Flat-Top Operations
- Conditionally qualified one new crew member for delayed critical operations on Godiva IV
- Certified two new crew members as critical assembly operators. Each operator must finish their machine specific OJT to be a fully qualified crew member for each machine

- Commenced prompt critical and above burst operations on the Godiva IV assembly to complete the Godiva IV startup plan.

- Completed performance of "Device Assembly Facility/NCERC Godiva Test Plan" to address facility concerns.

- Completed performance of CEF‑PLA‑017, Godiva Pulse Energy Test Plan to close out Condition of Approval (COA) for startup.

- A revised experiment plan was created to continue the review process for DAF operations.

- Continued work on uncertainty analysis.

- Continued assembling/testing a Rossi-Alpha measurement system that uses modern list-mode data acquisition technology. Comet low‑power measurements were made at several multiplications with 4 small He‑3 tubes in the spindle to supply rossi‑alpha data.

- Conducted an extended irradiation run on Comet and Flattop in support of the US Nuclear Forensic program. Foils were recovered; some were shipped to LANL while the rest were measured in the DAF Count Room. The Comet measurements were the first to use the automated Sample Changer in the NCERC count room. Progress is being made to allow unattended operation of this changer: currently sources may only be moved in Hot Ops, which requires a full complement of people, which is prohibitively expensive in most cases. For the Comet run, the changer was only operated during the business day. For the Flattop irradiation, foils were recovered and shipped to UNLV for LLNL and to PNNL. In addition, two foils stayed at DAF and PNNL used their HPGe coincidence counter in the DAF Count Room to record fission fragment spectra.

- Hosted joint measurement campaign with CEA/Valduc under the CEA/US basic Science Agreement supporting Stockpile Stewardship held "P183 Nuclear Data, Experiments, and Training" (follow on campaign to 2012 Caliban measurement campaign). Measurements were performed using Godiva IV, Flattop, and Planet (Class Foil experiment).

- MCNP6 simulations were being run to support a series of measurements performed (in 2012) on the BeRP Ball with polyethylene reflection and various detector configurations. The resulting list-mode data obtained from PTRAC output files are being compared to the measured data to determine the accuracy of the detector models and the quality of the simulated list-mode data. Preliminary results show the inferred keff value from simulated data to be around 20% lower than keff determined from the measured data, which is inconsistent with prior results from other comparisons. The reason for the large difference in keff is being evaluated. A draft report is being prepared for technical review.

- Three o-ring materials were chosen to be tested during the design phase of the pneumatic sample transfer system to be used for NCERC at the DAF: ethylene propylene diene monomer (EPDM), silicone, and platinum cured silicone. The materials were irradiated on

the Comet critical assembly. A 1-hour (3600 second live time) gamma ray spectrum was measured for each irradiated o-ring material using a high purity germanium detector to determine what activation products, if any, were produced. A report summarizing the results was created for review.

- Christopher Lu (post-masters student in NEN-2) won an award in the 2013 Los Alamos Student Summer Symposium for a presentation discussing design work associated with the NCERC Rabbit system.

LLNL IE

- Completed all major facility renovations and installed moveable shielding, workbenches and fume hood in the NAD Laboratory.

- Requested a NAD irradiation as an "add on" to the LANL foil irradiation experiment scheduled in March for a "dry run" of the NAD Lab.

- Completed and submitted LLNL-ABS-609356, *COG Preliminary Results for a SILENE Criticality Excursion Benchmark Experiment* for presentation in June at the ANS National Meeting in Atlanta.

- Completed full integration of the classified IER/C_EdT process, which by design, is exactly the same as the unclassified IER/C_EdT process. This new classified ESN web application includes all content from the unclassified web application plus additional classified uploads for (Juliet), (Material #2) and (Romeo).

- Received technical information from AWE under JOWOG-30 pertaining to their Bonner multisphere spectrometer, NAD "locket" and CIDAS (CAAS).

- VNIITF completed HEU/Mo experiments 17.1 and 17.2 (HMF094) and 17.3 and 17.4 (HMF020), which are undergoing review for classification and export control.

- Completed a preliminary design for an advanced hybrid ^{3}He/^{4}He solid-state neutron spectrometer.

- Provided NCSP Management a prioritized list of ZPPR fuel and diluent plates for scheduling shipments.

- Participated in a face-to-face meeting with the ND analysis C_EdT member in San Diego in November to discuss planning for TEX.

- Received a cost estimate of $3M from Y-12 for fabrication U(19.9)-10Mo alloy fuel for TEX, which is cost prohibitive.

- Submitted IER and BCR for an "add on" Flattop irradiation of LLNL NADs during NCERC "hands-on" training activities scheduled for April 4, 2013. These activated NADs will be used in a "live test" of the NAD Laboratory.

- Submitted a draft Final Design Report on March 29, 2013, for the review and concurrence of the C_EdT Team.

- Received notification that LLNL-ABS-609356, *COG Preliminary Results for a SILENE Criticality Excursion Benchmark Experiment* was accepted for presentation in June at the ANS National Meeting in Atlanta.

- Provided ND analysis (NCT #2), including a (classified) summary report to the C_EdT.

- Provided additional member (7uPCX 0.855), including ICSBEP external review of LEU-COMP-THERM-078.

- Provided additional member support (7uPCS 0.800) and concluded these experiments will provide benchmark quality data that are acceptable for ICSBEP publication.

- Arranged an AWE visit to NNSS under JOWOG-30 to facilitate their participation.

- External reviews of the VNIITF ICSBEP evaluations HMM020, HMF094 and HMF093 for HEU/Mo experiments 17.3, 17.4; 17.1, 17.2; and 18.1, respectively, are complete.

- LLNL met with NSTec and NNSA to discuss the Romeo *Safety Basis Strategy*, *Environmental Strategy*, and *Security Strategy*.

- LLNL met with NNSA to discuss Romeo program execution planning and support strategy from multiple organizations.

- Completed an "add on" Flattop irradiation of LLNL NADs during NCERC "hands-on" training activities.

- Completed LLNL-TR-635203, LLNL Final Design for Determining Reference Values of the GODIVA-IV Radiation Field within the DAF Report.

- Presented LLNL-PRES-637574, *COG Preliminary Results for a SILENE Criticality Excursion Benchmark Experiment* at the ANS Meeting in Atlanta on June 18, 2013.

- Completed subcritical experiments for a non-NCSP sponsor involving two classified assemblies and the BeRP ball within numerous reflector configurations.

- Continued liaison with AWE for JOWOG-30.

- Completed I VNIITF ICSBEP evaluations HMM020, HMF094 and HMF093 for HEU/Mo experiments.

- Provided briefings with LLNL Senior Managers in DO, GS, O&B and WCI on Romeo *Preliminary Design*, *Safety Basis Strategy*, *Environmental Strategy*, and *Security Strategy*.

- Met with NNSA to discuss Romeo program execution planning and support strategy from multiple organizations.

- Scheduled steady-state subcritical measurements for September 2013 with participation from AWE, LANL, LLNL and SNL. All equipment was received, inspected, staged.

- Continuing to liaise with AWE, CEA and IRSN for their participation.

- Completed (ICSBEP) additional member support for (BUCCX) on August 26, 2013.

- Completed (ICSBEP) additional member support for (water height) on September 11, 2013.

- Completed (ICSBEP) additional member support for (split table) on September 13, 2013.

- Visited INL archives and located fabrication drawings and material specifications for PANN fuel in support (TEX).

- Assisted the evaluators, reviewers and international partners to complete VNIITF evaluations HMM020, HMF094 and HMF093 for HEU/Mo experiments 17.3, 17.4; 17.1, 17.2; and 18.1.

- Completed Preliminary Design for Romeo and provided the draft report to the C_EdT Team and NCSP Manager.

- Completed full system integration of the classified IER/C_EdT process to mirror the unclassified IER/C_EdT process. Documentation provided to NCSP during the Program Review Meeting in Washington, DC. One-on-one training provided to users as requested.

NNSS IE

- Supported the DNFSB Staff Visit on 12/4/12, and responded to items raised in the Board's 8/5/10 letter. Discussion during the visit included status and resolution of these items.

- As a follow-up to the initial OIG Audit meetings, responded to information requests made on 10/23/13 and 1/10/13. These requests focused on ORR and CORR issues and CAPs. All requested information to date has been provided.

- Supported NCERC FLATTOP Critical Assembly Machine post-maintenance testing and Nuclear Material Handling & Measurement activities.

- Participated in conference calls to discuss and prepare for INL ZPPR support shipments. Participants on the call included NSTec, LANL, and INL.

- Successfully completed final GODIVA Start-up activities; thus completing all NCERC Start-up Plan actions.

- Provided operations support to LANL.

- Provided support to LANL Crew Training.

- Provided non-NCSP support to NCNS and LANL on the Debris Collection Irradiation effort.

- Provided non-NCSP support to LANL on DTRA Measurements.

- Provided non-NCSP support to LANL on N-Pod Certifications.

- Provided non-NCSP support to OPSIS activities.

- Completed renovations to Building 23-703 and assisted in the establishment of the LLNL NAD Lab.

- As a follow-up to the initial OIG Audit meetings and first quarter requests, responded to an information request made on 3/5/13. This request focused on ORR and CORR issues and CAPs. All requested information to date has been provided.

- Supported NCERC Critical Assembly Machine and Nuclear Material Handling & Measurement activities. Completed material movements and unpacking in preparation for training activities. Provided support to DTRA foil storage activities.

- DAF management met with NCERC program and security personnel to discuss upcoming Godiva characterization activity and address concerns.

- Commenced Godiva Start-up activities; Godiva is the last of the Critical Assembly Machines for NCERC. Graded approach to Burst is being conducted as part of the start-up activity. Project has completed one evolution and is waiting on NNSA/AMSS release to continue evolutions.

- Successfully concluded the DAF portion of OPSIS activities. Provided support for project equipment transfer from the DAF. OPSIS Team 2 conducted a hot wash and discussed results and lessons learned.

- Provided support to Flattop and Planet Operations.

- Provided support to Godiva Maintenance & Operations and Start-up Activities.

- Completed (100%) the following NCSP IERs (NCSP Training).

- The RTBF NCSP Program Manager traveled to Washington, D.C., to attend and participate in the NCSP Program Review on May 30, 2013.

- Supported NCERC Critical Assembly Machine and Nuclear Material Handling and Measurement activities. Completed material movements and unpacking in preparation for training activities.

- The revised Safety Basis Strategy for NCERC DSA/TSR Change Notice 4 was submitted to NNSA/NFO.

- IG Audit conference calls were conducted to answer the last of the audit team questions prior to the finalization and distribution of the Final Report in May 2013.

- The RTBF NCSP Program Manager kicked off the Rabbit System planning and estimating meeting on June 20, 2013, following receipt of the LANL preliminary design. An estimate for NSTec FY14 activities associated with this installation will be prepared and submitted to NNSA/HQ at the FY14 Task Manager Meeting.

- Efforts were successfully completed to implement a DSA page change, process the Change Notice 7, and procedure change revisions so LANL was able to complete the required surveillance on June 27-29, 2013.

- Provided support to NCSP Training Courses; DTRA Measurements; LLNL NAD Irradiations; NA-42 Measurements; ISIS Procedure Walk Down; Flattop and Comet Foil Irradiations; DTRA Measurements (Foil Irradiation & Counting); NCT Repack/Measurements; and general operations/material moves.

- A total of 26 Integral Experiment Requests through 68 separate activities were supported in FY13.

- Supported NCERC Critical Assembly Machine and Nuclear Material Handling & Measurement activities. Completed material movements and unpacking in preparation for training activities.

- Estimates for the Rabbit System Installation were developed for both major and minor modification scenarios. The estimate and schedule for this effort will be finalized once the "minor" determination is confirmed.

- The 100% version of the DAF DSA Addendum and Probability of Failure on Demand document for NCERC Operation DSA/TSR Change Notice 4 was submitted to NNSA/NFO for review and approval.

- Completed GODIVA Startup activities the week of September 9-12, 2013, which concluded the NCERC startup phase of the NCSP Program.

- Completed PECOS interaction validation testing.

- Provided support to GODIVA start-up operations; LANL/CEA measurements and crew training (PLANET); DTRA measurements; GODIVA modeling and experiment; Foil Irradiation/Counting (NCNS); DTRA measurements; COMET operations; NA-42 operations; and general operations/material moves/surveillance.

ORNL IE

* Completed AM-analysis support and completed review of documentation.

* Investigation and assessment of ORNL NCS documents (e.g., design documents, analyses, mechanical drawings, etc.) for previous Oak Ridge split-table critical experiment apparatus—documentation should help facilitate new split-table design.

* Completed AM-analysis support, which included calculations needed to determine the yield of the experiments.

* Completed AM-analysis support for, which included reviewing SCALE and MCNP models and determining the system sensitivity to removing components from the detailed model to create a simplified model.

* ORNL Dixon Callihan/Joe Thomas/ Libby Johnson NCS Document Inventory and associated ORCEF documentation searched for previous split-table design features—15 pages on the design of two different ORCEF split tables provided to SNL.

* Interacted with team lead to develop and review models that could be considered.

SNL IE

* The capability and authorization of the Sandia Critical Experiments was maintained.

* Staff proficiencies were maintained by performing critical operations.

* Development of the preliminary design for a split-table machine is underway.

* The capability and authorization of the Sandia Critical Experiments was maintained.

* Staff proficiencies were maintained by performing critical operations.

* Benchmark evaluation was completed and submitted for ICSBEP review.

* Development of the preliminary design for a split-table machine is progressing.

* The capability and authorization of the Sandia Critical Experiments was maintained.

* Staff proficiencies were maintained by performing critical operations.

* Development of the preliminary design for a split-table machine is ongoing.

* The capability and authorization of the Sandia Critical Experiments was maintained.

* Staff proficiencies were maintained by performing critical operations.

* Development of the preliminary design for a split-table machine is progressing.

Information Preservation and Dissemination (IPD)

HANFORD IP&D

* Data sets from different tests in Hanford Reactors have been compiled into report; final editing and clearance planned for next quarter to finalize report.

* Preliminary draft for the report has been completed; final technical and editorial review and clearance planned for next quarter.

- Provide updated and document changes to data files to LLNL for posting on the NCSP website has been completed. The report, MCNP5 Calculations Replicating Additional ARH-600 Data (2012 Subset), CHPRC-01905, Revision 0, documents updated data files generated for the CritView program. This report and associated CritView database have been cleared for public release and provided to LLNL for posting on the NCSP website. LLNL posted the material on the NCSP website.

- Issued combined letter report updating the existing compilation of data (reactor and special test) and documenting Th-U Tree data and possible benchmark listing (PRC-NS-00028, Rev. 2).

- Hanford issued three files to correct an inconsistency between the concentration units used for UO_2 in the ARH-600 database and the MCNP calculations provided in the CritView database files. These files were peer reviewed as part of our document release process and were sent in October to LLNL for placement on the NCSP website.

  - PRC-NS-00009_-_Rev_01.pdf
  - CHPRC-NS-01905_-_Rev_01.pdf
  - CritView-v102.zip

LLNL IP&D

ICSBEP

- Assisted evaluators, reviewers and international partners in preparation and completion of NCSP evaluations for ICSBEP publication. These evaluations were presented at the ICSBEP TRG meeting at OECD NEA Headquarters on May 15-17, 2013.

  - HMM020 in external review complete. VNIITF HEU/Mo 17.3/17.4
  - HMF094 internal review complete. VNIITF HEU/Mo 17.1/17.2
  - LCT078 evaluation in preparation. SNL 7UpCX 0.855
  - PMF001 for LANL Jezebel major revision

- LLNL external reviewer observed LANL subcritical measurements and began review.

- Updated the NCSP website to deploy the latest "September 2012" version of the ICSBEP handbook. The handbook is available on-line and may be downloaded.

- Provided ICSBEP TRG comments on evaluations provided under other (non-NCSP) auspices.

- Updated the "2013 New Evaluations" on the ncsp.llnl.gov/ICSBEP/ webpage to include the latest versions to be published by OECD/NEA.

- OECD/NEA generated 2,850 sensitivity/ uncertainty data files as described in a paper to be presented at the ANS Winter Meeting. This contribution together with the ~516 and ~200 files provided by ORNL and IPPE in DICE represent ~75% of ICSBEP benchmarks.

Website and Red Net

- Performed annual security testing on classified NCSP website as required by LLNL iSRD security plan.

- Deployed ICSBEP content received from OECD/NEA on the NCSP ICSBEP website.

- Established and confirmed ESN connectivity from NNSS to classified NCSP website.
- Completed the annual Post Accreditation Self-Assessment for NCERC network (NTS-SLAN).
- Upgraded NTS-SLAN TACLANE from 100MB to Gigabit (1000MB).
- Completed installation of the Profile Unity software on NTS-SLAN to fix LANL switches/routers network ACLS issues.
- Migrated classified NCSP website to OpenSSO Authentication as required by LLNL iSRD security plan.
- Created and distributed 72 ICSBEP DVD copies to NCSP users.
- Converted "It Can Happen Here!" VHS tape to DVD and distributed five copies to SRS, LSO and DOE HQ.
- Established and confirmed ESN connectivity from DOE Germantown to classified NCSP website.
- Created 20 heritage video collection DVDs and sent to DNFSB.
- Transferred all unclassified content and into classified NCSP website.
- Completed software upgrades on NTS-SLAN classified network (DAF-NCERC) and diskless systems to Windows 7/Office 2010.
- Completed reconfiguration of the classified network routers to allow access to the ESN from all three laboratory classified networks in Nevada.
- Provided escorts and classified communications support at NCERC for OPSIS.
- Implemented new "Type of IER process" functions for Non-C_EdT and Full C_EdT Process Experiments on both classified and unclassified IER request forms.
- Deployed a new sorting function "Display Classified IER" on classified IER request form.
- Attended 2013 ANS annual meeting and performed a live multimedia demonstration of the NCSET modules for Buckling Conversion and Surface Density Methods.
- Established and confirmed ESN connectivity from LANL to classified NCSP website.
- Performed annual review and system certification tests on LLNL classified network as required by DOE/NNSA security plan.
- Completed LANL Facility Centered Assessment (FCA) on NTS-SLAN network with zero findings.
- Conducted annual classified account revalidation for all NTS based accounts.
- Completed redesign of the "NCSP Manager Approval DOE HQ Only" web page in "Maintenance & Non-NCSP IER Status & Administration".
- Attended the 2013 ANS NCSD Topical and presented the paper "The Official Website of the U.S. Department of Energy's Nuclear Criticality Safety Program".
- Established and confirmed ESN connectivity from Y12 to the classified NCSP website.

- Completed and received 1-year accreditation extension on the NTS-SLAN from LAFO. Working on revising the LANL cyber security plan to extend NTS-SLAN to NSF facility in Las Vegas and U-1A underground facility.

- Upgraded 3 TACLANES network equipment to improve functionality.

- Added an additional ~1000 entries to the LLNL Bibliography for a total of 16,969 citations and increased the number of digital report copies to 2,837.

ORNL IP&D

- The Dixon Callihan NCS Document Inventory (878 entries when supplemented with documents from the Joe Thomas and Libby Johnson collections) was transmitted to NCSP IP&D Manager and subsequently installed as a searchable PDF file under the training section on the NCSP/LLNL website.

- Completed letter report documenting work progress on the development of algorithms for the determination of experimental uncertainty correlations—report submitted to NCSP Manager.

- Established subcontract with Texas A&M to continue development of SCALE capability for determination of experimental uncertainty correlations—cost commitment for subcontract reflected in spending profile.

- Performed initial analyses of historical Hanford reactor data using SCALE burnup analysis capabilities in an effort to assist Hanford in developing method to extract actinide integral cross section data from reactor data.

- Expanded SCALE capability for determination of experimental uncertainty correlations.

- Initial capabilities from prototypic tool called "Proteus" merged into the SCALE production tool called "Sampler".

- SCALE/Sampler enhanced to provide improved capabilities for related parametric uncertainties (e.g., uncertainty in enrichment where the 238U content is a function of uncertainties in the 235U content).

- Sampler will be deployed in the SCALE 6.2 beta release in Q4.

- SCALE/TSUNAMI models generated for 5 new NCSP-sponsored ICSBEP benchmark evaluations:
  - HEU-MET-FAST-093 and -094
  - HEU-MET-MIXED-020
  - LEU-COMP-THERM-078
  - Revision to PU-MET-FAST-001

- SCALE models generated and reviewed following ORNL VALID QA plan.

- SCALE used to generate energy-dependent sensitivity profiles with multigroup TSUNAMI.

- The quality assured input files and sensitivity profiles provided to LLNL for inclusion in the ICSBEP Handbook.

Nuclear Data (ND)

ANL ND

- Presented results of ANL data testing at November CSEWG and NDAG meetings.

- Led CSEWG discussion of covariance data needs for data adjustment applications.

- Led CSEWG discussion of Covariance QA Procedures and presented updates of Covariance QA Document.

- Participated in November meeting of WPEC Subgroup 33 on "Combined Use of Integral Experiments and Covariance Data" and presented ANL results for the SG33 data adjustment exercise.

- Performed validation testing of the WPEC/SG34 new evaluation for ^{239}Pu (by ORNL/CEA) and submitted results for inclusion in the final report for SG34.

- Contributed to the WPEC Subgroup 33 invited ND2013 conference paper on "Combined Use of Integral Experiments and Covariance Data".

- An error in the ANL codes to produced MCNP input decks for detailed benchmark models was discovered, and correction of all affected decks in the ANL Validation Suite has been completed and verified.

- Supported NCSP management in revision of NCSP Mission and Vision document.

- Participated in IAEA Standards meeting and mentoring young LANL postdoc on the issue of evaluating fission neutron spectra.

- Continued work on development and verification of the ANL Validation Suite.

- POC supported NCSP management in revision of NCSP Mission and Vision document, annual revision of NCSP Five-Year Plan, and Quarterly Reports.

- Expanded ANL Validation Suite by adding twenty-five BFS configurations and nine KBR configurations.

- Wrote draft report documenting the ANL Validation Suite.

BNL ND

- New evaluations are being stored in the GForge server as they are submitted to the NNDC and, QA is being performed on them as they arrive using the ADVANCE Continuous Integration System. Results of tests available at http://www.nndc.bnl.gov/endf/b7.dev/qa/. To date, ADVANCE has checked new commits consisting:
  - 1 deuteron-incident evaluation
  - 5 decay evaluations and
  - 111 neutron-incident evaluations

- Posted ACE-formatted versions of development library on NNDC website.

LANL ND

- New high-energy evaluations for all nickel isotopes were submitted to NNDC. These evaluations perform well in Ni-reflected critical systems.

- Combining our PFNS code package with the CoH code to perform PFNS calculations at higher incident neutron energies, including pre-equilibrium neutron spectrum. Developing new UQ tools to perform a final evaluation including model calculations and experimental data. In particular, these new UQ tools focus on generating realistic experimental covariance matrices and on the issue of very low evaluated uncertainties that have obtained so far.

- Several Los Alamos scientists participated in the annual CSEWG meeting at BNL in November. Talks were presented on evaluation and data testing work. LANL chaired the Data Evaluation and Data Validation sessions.

- An invited talk on LANL evaluation and data testing work to support ENDF/B-VII.1 was given at the ANS Winter Meeting.

- Participated in the Fall NDAG meeting.

- A very good (chi-square per degree of freedom is 2.0) single-channel R-matrix fit to all the experimental data (total and differential cross sections) for n+13C scattering at incident neutron energies up to 5 MeV was obtained, and now extending the fit to higher energies by adding data and channels for the excited states of 13C.

- LANL presented many talks (including plenary and invited) on NCSP-relevant nuclear data work at ND2013 in March.

- Compiling experimental P(nu) data when available, as well as computing P(nu) distributions using our Monte Carlo Hauser-Feshbach capabilities. These data will be provided in ENDF format in Q4.

- Continuing efforts to develop a full evaluation capability to revisit the prompt fission neutron spectrum for n+239Pu. Significant advances have been made in quantifying realistic covariance matrices of experimental data. Performed calculations up to 20 MeV incident neutron energy, and plan to incorporate pre-equilibrium physics in our next iteration. Similar computational capabilities will be available for U235 and U238 as well, although more work will remain to analyze experimental data for those isotopes.

- n+9Be: Legendre coefficients for elastic scattering angular distributions have been generated from the 10Be R-matrix analysis, and added to the evaluation at energies up to 10 MeV. In addition, the cross section for the 9Be(n,p)9Li reaction, which has a threshold above the current range of the R-matrix analysis at 14.26 MeV, has been evaluated up to 20 MeV using new experimental data, as has the 9Be(n,gamma) capture reaction.

- n+C: The new evaluation for n+13C scattering reported last quarter has been used to correct measurements of the n+C total cross section in order to use them as n+12C data in the 13C system R-matrix analysis. New data were also included in the analysis for the 12C(n.n')12C*(4.44) cross section. These results were reported at the Nuclear Data Conference (ND2013) in March. More work is needed on n+12C in order to use it as a standard cross section at energies below 2 MeV.

- Continued development of evaluation capabilities for Pu239 prompt fission neutron spectra. Merging the Los Alamos model with the pre-fission neutron evaporation for higher neutron incident energies. This work will also be extended to the U235 and U238 evaluations.

- Participated in the annual WPEC meeting and Sub-Group meetings related to 239Pu and GND (Generalized Nuclear Data) format, held at NEA Headquarters in Paris.

- Finishing the Jezebel reevaluation relevant for nuclear data testing. A final draft has been distributed to the ICSBEP working group in July. A summary has been submitted to the ANS Winter meeting and a paper has been submitted to the NCSD Topical meeting. A Nuclear Science and Engineering article is being written.

- n+16O: Total cross section data have been corrected for the presence of contaminants. An example is the Okhubo measurement over the first resonance, which was uncorrected for the presence of hydrogen in the target. This correction will affect the low-energy cross section received for n+16O in further R-matrix work on the 17O system as part of the international Cielo evaluation effort.

- n+12C: The measurements of the n+C total cross section corrected for 13C content have been used in the n+12C (13C system) R-matrix analysis. New data were also included in the analysis for the 12C(n.n')12C*(4.44) cross section. The correction for 13C in the total cross section is small, but important to make in the energy region below 2 MeV, where carbon is used as a standard cross section. Latest results were reported at a recent IAEA meeting on the standards in Vienna.

- The prompt fission neutron multiplicity distributions P(nu) were evaluated for neutron-induced reactions on U-235, U-238 and Pu-239, from thermal up to 20 MeV. Systematics from Terrell and Frehaut were used to guide this work, as well as CGMF calculations at the thermal point. New ENDF-formatted test files were produced and will be sent to the NNDC at BNL shortly.

- Developed a new suite of computational tools for the evaluation of the prompt fission neutron spectrum (PFNS) for neutron-induced fission reactions on 239Pu, 235U and 238U, for incident neutron energies from thermal up to 20 MeV. Our PFNS code was rewritten and implemented as part of our COH code. Detailed modeling of pre-fission neutrons up to 20 MeV has been implemented and preliminary calculations performed in the case of n+239Pu, showing significant deviations from the ENDF/B-VII.1 values near multi-chance fission thresholds. Also, some of the input parameters (e.g., energy release, total kinetic energy) entering in the Los Alamos model have been extended to include a more physical energy dependence than what has been used in ENDF/B evaluations so far.

- New Uncertainty Quantification (UQ) tools have been implemented to produce realistic experimental covariance matrices. They have been applied successfully to the description of available experimental data for the n+239Pu PFNS (see D.Neudecker et al., LA-UR-13-24743) in the framework of the ChiNu collaboration. Several approaches (generalized-least-square, unified Monte Carlo, ...) have been tested to combine experimental data with model predictions.

- n+9Be: Relative Legendre coefficients were generated for the elastic angular distributions from the 10Be R-matrix analysis at energies up to 10 MeV. These were included with the previous cross-section files that give very good representations of the total and (n,alpha) cross sections. The remaining evaluation task is to increase the (n,2n) cross section to better represent the experimental data above 4 MeV, and correspondingly decrease the elastic cross section in this energy range to maintain the same total cross section. The data testing on Be-reflected integral assemblies including the new angular distributions, which are quite different from the existing ones, will be done during 1Q2014.

- Relevant for nuclear data testing, the Jezebel reevaluation was published in the ICSBEP Handbook as PU-MET-FAST-001, Revision 3, Sept. 2013. A paper at the NCSD Topical was presented. A paper was submitted to the 2013 ANS Winter Meeting and was accepted. Nearing completion of an invited manuscript for a special issue of Nuclear Science and Engineering.

ORNL ND

- Differential Data Measurements at IRMM.
    - Completed 5-week visit at IRMM to perform neutron cross section experiments for the thin Ce sample and obtained data for the sample and empty aluminum canister for the boron, sulfur, and sodium filter configuration
    - Completed 183 W transmission data reduction for new data using the experimental setup that corrects for data gaps in previous IRMM measurements—performed data testing and 183 W data have been provided to the evaluator
    - Performed 186 W transmission measurements with new experimental setup to correct for data gaps in previous IRMM measurements
    - Initiated data reduction for measured Ca transmission data

- Performed analysis and assessment of the existing ENDF/JEFF/JENDL resolved resonance evaluations for the Ca and Ce isotopes.

- MIT PhD student and ORNL completed analysis of the 63 Cu and 65 Cu transmission data—analysis of capture and angular distribution data in progress.

- Initiated analysis of new 235 U fission/capture data from LANL—will meet with LANL staff in Q2 to discuss details of measurements.

- Completed preliminary 56 Fe resonance evaluation and initiated testing.

- Completed preliminary tungsten isotopic evaluations—currently waiting on updated 184 W transmission data from IRMM to complete evaluations.

- Initiated work with international Cielo data working group to assess performance of ORNL 16 O resonance evaluation previously completed under the NCSP.

- Participated in the November 2012 CSEWG meeting at BNL and presented ORNL differential measurement and evaluation work accomplishments for the NCSP during the past year.

- Prepared and presented invited paper on ORNL differential measurement accomplishments during NCSP special session at the November 2012 ANS Winter Meeting in San Diego.

- Differential Data Measurements at IRMM.
    - Data reduction for Ca transmission data completed and Ca capture data reduced to cross section units
    - All available information and data needed for Ca compiled and prepared to initiate evaluation effort
    - Initiated investigation to determine whether Cu capture data can be analyzed at higher neutron energies—possible solution is to use normalized newer flux, which goes to

higher neutron energies compared to older Cu flux measurements

- Initiated feasibility investigation to re-establish neutron elastic scattering capability for NCSP

- Initiated Ca resolved resonance evaluation.

- MIT PhD student and ORNL worked to extend 63 Cu and 65 Cu capture data to 300 keV.

- ORNL evaluator travel to LANL to work on data resolution of LANSCE 235 U capture and fission data—met with measurement staff to understand experimental data conditions.

- Initiated unresolved resonance evaluation for 235 U using LANL capture data.

- Updated new 56 Fe evaluation to include angular-dependent scattering cross-section in resonance analysis.

- As part of international CIELO nuclear data working group identified needed improvements to 16 O resonance evaluation.

- Initiated work to develop thermal scattering law nuclear modeling analysis capabilities to support analysis of new RPI S(α,β) measurements—obtained GROMACS molecular dynamics software for use in fitting of measured doubly differential scattering cross-sections data.

- Seven ORNL nuclear data papers presented at 2013 International Conference on Nuclear Data (ND2013) in New York, NY.

- Differential Data Measurements

  - Checked EXFOR database for additional Ca measured data to supplement measured data from IRMM—previous ORELA data have sufficient information needed to support evaluation effort

    ◦ Retrieved ORELA high-resolution transmission data for Ca at 200m—extracted information from logbooks and created input files for SAMMY to analyze ORELA data

    ◦ Initiated investigation of two other total cross section data sets in EXFOR

  - Initiated SAMMY analysis using IRMM and ORELA Ca data

  - Continued feasibility investigation to re-establish neutron elastic scattering measurement capability—discussions held with RPI

- Updated 56 Fe evaluation to include inelastic scattering distribution data in resonance analysis—initiated work with NJOY and AMPX developers to update processing codes to process secondary angular distribution data.

- MIT Ph.D. student and ORNL worked to provide angular-dependent scattering cross-section data distributions from 63 Cu and 65 Cu resonance parameters—demonstrated capability to produce angular distribution data in evaluation.

- Performed testing of 235 U capture and fission data using intermediate spectrum benchmark data additional testing in progress with CEA/Cadarache.

- S(α,β): initiated work with ORNL mathematician to identify a procedure to perform data fitting of RPI measured thermal moderator scattering data.

- Participated in OECD/NEA WPEC meeting and international CIELO data project subgroup

meeting for key nuclear data evaluations—as resonance evaluation lead for 16 O, 56 Fe, 235 U, 238 U, and 239 Pu, ORNL presented status reports on each of the evaluations.

- Met with IRSN staff on May 23, 2013 to discuss a possible collaboration to improve and test the 56 Fe and 235 U nuclear data evaluations using IRSN integral benchmark data.

- Presented paper on 235 U resonance evaluation and data testing at June 2013 ANS Meeting.

- Differential Data Measurements.

    - Performed sample preparation analysis for enriched 142 Ce samples needed for cross section measurements at IRMM in FY14 (metallic versus oxide samples)—based on projected cost, oxide samples will be used for enriched samples

    - Continued SAMMY analysis of measured IRMM and ORELA Ca data

    - Obtained new measured 184 W transmission data from IRMM to correct problems identified with the filtered neutron beam in previous IRMM measurements

    - Continued feasibility investigation to re-establish neutron elastic scattering measurement capability in the U.S.

- MIT Ph.D. student and ORNL completed 63 Cu and 65 Cu resolved resonance evaluations, including covariance data—evaluations submitted to NNDC ORNL/MIT 63Cu and 65Cu evaluations complete key NCSP evaluation milestones while also enabling MIT student to complete Ph.D. under ORNL supervision thereby completing key step toward NCSP nuclear data evaluator succession planning goal.

- ORNL evaluator met with RPI staff to discuss differential data measurement conditions for previous RPI measurements of 56 Fe and 235 U in order to perform new SAMMY evaluation—also discussed plans for ORNL/RPI collaboration to complete 16 O resonance evaluation in FY14.

- ORNL met with LANL staff to develop and test processing methods to generate angular distributions from resonance parameters for the new ORNL 56 Fe evaluation—tests included comparisons of SAMMY/NJOY angular distributions and generation of ACE library data for use in MCNP.

- Visit to LANL also enabled ORNL evaluator to continue the 235 U unresolved resonance evaluation and discuss the analysis of the measured 235 U capture data from LANSCE.

- Performed benchmark tests for new tungsten isotopic evaluations (182,183,184,186 W) will update 184 W evaluation with new transmission data from IRMM and submit final tungsten evaluations to NNDC in FY14.

- ORNL evaluator initiated two-month collaboration visit with CEA and IRSN to complete 16 O, 56 Fe, and 235 U resonance evaluations and perform testing with proprietary CEA and IRSN integral data.

RPI ND

- U-238 scattering data analysis paper is 80% done (left over from FY12).

- Fe-56 scattering measurement data analysis is in progress.

- Detector mount was designed and is under construction.

- Flight tubes design completed, material order in process

- Overview paper was presented in the NSCP session of the ANS meeting in San Diego.

- A poster about the new neutron capture detection system was presented by our PhD student during the ANS meeting in San Diego.

- Two PhD students started to work on the project.

- Obtained all the necessary processing codes.

- Coordinated a visit to SNS to meet the instrument scientist and transfer our previously measured data for H_2O and CH_2 to RPI for processing.

- Finished developing new methods for U-238 neutron scattering analysis.

- Collaborated with IAEA on incorporation of the U-238 scattering into a new evaluation, results were presented in the plenary session of ND2013.

- Fe-56 scattering measurement data analysis is in progress.

- Detector mount was completed,4 detectors are mounted

- Materials for evacuated flight-path pipes were ordered.

- A test run with the full detector array was done in order to test the data acquisition (DAQ) system.

- A presentation was given by our graduate student Brian McDermott at the 2013 ANS student conference at MIT.

- Our two PhD students are now using NJOY and can generate S(a,b) from ENDF data..

- A visit to SNS was scheduled to the beginning of April.

- U-238 scattering data analysis completed, paper is under internal review.

- Fe-56 scattering data analysis was completed (currently using the data to develop a new method for inelastic scattering measurements).

- Capture detector mounts was completed; four detectors were mounted and used in a test run.

- Evacuated flight-path pipes were received and are being mounted in the 45m flight station.

- Sample changer was designed, constructed and mounted.

- A report on US experimental activity was given in the WPEC meeting

- A presentation was given in NCSP technical seminar.

- A paper was submitted to the NCSP session in the upcoming ANS 2014 annual meeting.

- Two PhD students and Prof. Liu visited SNS and retrieved previous RPI scattering data for water and polyethylene.

- The polyethylene data were analyzed to differential cross section and compared with evaluations.

- NJOY/MCNP were used to simulate the experimental setup and response to water/polyethylene scattering.

- The molecular dynamics code LAMMPS was used to simulate phonon spectrum and enables prediction of the neutron scattering kernel.

- U-238 scattering data analysis completed, paper is under internal review.

- Fe-56 scattering data analysis was completed, currently using the data to develop a new method for to separate elastic and inelastic scattering events.

- New capture detector was installed in new 45m flight station.

- Evacuated flight-path pipes were installed in the 45m flight station.

- New sample changer was installed.

- A test measurement of Fe capture was completed with the new capture detector array

- A paper was submitted to the NCSP session in the upcoming ANS 2014 annual meeting.

- The polyethylene measured data were processed to differential cross section. The cross section was compared with evaluations using MCNP simulation of the experimental setup including the spectrometer resolution.

- NJOY was used to create a scattering kernel using evaluated data. The scattering kernel was used with MCNP to simulate the experimental setup.

- The molecular dynamics code LAMMPS was used to produce a calculated scattering kernel for water.

Training and Education (T&E)

LANL T&E

- Revised LANL presentation materials for the LANL week one class room training and the NCERC "hands on" training based upon reviewer and student comments collected in FY2012.

- Collaborated with other DOE NCSP stakeholders to plan and develop the one-week course for Criticality Safety Training for Managers.

- Revised LANL presentation materials for the LANL week one class room training and the NCERC "hands on" training based upon reviewer and student comments collected in FY2012 and FY2013.

- Collaborated with other DOE NCSP stakeholders to plan and develop the one-week course for Criticality Safety Training for Managers.

- Helped execute the NCSP two week Criticality Safety Practitioner course (one week at LANL, one week at NCERC)

- Collaborated with other DOE NCSP stakeholders to plan and develop the one-week course for Criticality Safety Training for Managers.

- Helped execute one-week course for Criticality Safety Training for Managers.

- Helped execute the NCSP two week Criticality Safety Practitioner course (one week at LANL, one week at NCERC)

- Participated in multiple weekly conference calls associated with the planning of the training courses.

- Printed all classroom materials for both training sessions (one and two-week courses) mentioned above.

- Provided Escorts for PF-4 tours and DAF class execution.

LLNL T&E

- Completed registration and logistics supporting the October NCERC class (cancelled).

- Participated in all T&EP teleconferences.

- Participated in the T&EP Manager's Course development meeting in San Diego on November 12, 2012.

- Presented "New Hands-On Training and Research with the LLNL Training Assembly for Criticality Safety" at the request of the NCSP Manager at the NCSP Special Session of the San Diego ANS Winter Conference.

- Developed curriculum for 3 new modules for the NCSP Manager's Course; namely, NCS Evaluations, Experimental Methodology, TACS Experiments.

- Provided registration and logistics support for the 2-week course held on January 28- February 8, 2013 and the 1-week Managers course on April 1-5, 2013.

- Completed 3 new modules for the 1-week Manager's course: NCS Evaluations, Experimental Methodology, TACS Experiments.

- Provided 4 training modules in support of the 2-week course at NCERC on February 4-8, 2013: Introduction to NCERC, Experimental Methodology, TACS Experiments.

- Completed a new nuclear criticality safety evaluation establishing a CSI for the 12-quart Nucfil container with contents of four TACS hemishells.

- Submitted IER (non-NCSP) to provide first responder training to the FBI.

- Provided registration and logistics support for the 2-week course held on May 5 - May 17, 2013.

- Provided 4 training modules in support of the 2-week course at NCERC: Introduction to NCERC, Experimental Methodology, TACS Experimental Methodology, TACS Hands-On Experiments.

- Provided registration and logistics support for the 1-week Managers course held at Sandia National Laboratory, September 9-13, 2013.

- Updated the T&E portions of the NCSP website to include FY2014 course dates.

- Participated in all T&EP teleconferences.

- Provided the TACS criticality safety evaluation and operational safety plan to facilitate deployment of a 'mobile TACS' at LANL.

- Updated (non-NCSP) to provide first responder training to the FBI in FY2014 Q1.

ORNL T&E

- Organized and led weekly T&E conference calls to coordinate planning for FY13 training courses.

- Special October NCERC hands-on course cancelled per NCSP Manager.

- Prepared and presented invited paper on the NCSP Training and Education Course at the 2012 ANS Winter Meeting in San Diego.

- Initiated development activities for the two Manager's courses to be offered in FY13.

- During the ANS Winter meeting in November, organized and held meetings with course developers from LANL, LLNL and NCERC as well as DOE staff to kick-off the Manager's Course material development.

- Organized and conducted 2-week T&E course in Jan 28-Feb 8, 2013.

- Finalized development activities for initial 1-week "Manager's" course to be offered April 1-5, 2013—all course materials reviewed for accuracy as well as consistency with the 2-week course.

- Initiated efforts to update 2-week course materials based self-evaluation and feedback from students.

- Coordinated development of revised regular course flyers and new Manager's course flyers.

- Coordinated changes to the NCSP website to reflect the new course offerings and improve the user experience with the site.

- Organized and conducted the first 1-week "Manager's" course at NCERC April 1-5, 2013.

- Continued efforts to update 2-week course materials based on self-evaluation, feedback from students, and lessons learned from the first "Manager's" course.

- Initiated efforts to develop a 1-day course for NFO staff at NCERC in FY14.

- Printed and displayed revised regular course flyers and new Manager's course flyers at the ANS Annual Meeting in Atlanta.

- Developed learning objectives for both 2-week and 1-week courses.

- Coordinated changes to the NCSP website to provide more detailed information about the course offerings such as learning objectives and course contents. Updated website content with the latest information.

- Presented summary of T&E course accomplishments at NCSP Technical Program Review Meeting May 31, 2013 in Washington, D.C.

- Organized and led weekly T&E conference calls to coordinate execution of the FY13 training courses—included planning and preparation of the first SNL Manager's course and planning and preparation of the FY14 courses.

- Initiated work to release video recordings of previous courses at LANL and SNL.

- Organized and attended the first 1-week "Manager's" course at SNL September 9-13, 2013—course offered to all LANL supervisors, operators and managers with NCS responsibilities—the course was very successful and received many positive comments.

- Per request of NCSP Manager, prepared promotional flyer for both regular and Manager's courses and distributed at the ANS NCSD topical meeting in Wilmington, NC.

- Collaborating with the TPC of the ANS NCSD Topical Meeting, presented a 15-minute informational presentation on NCSP T&EC courses.

- Identified improvements/modifications to both the regular and Manager's courses—improvements will be implemented in FY14.

SNL T&E

- Preparations are underway for the February 4-8, 2013, offering of the Hands-On course at Sandia.

- Sandia personnel are working with T&EP management and LANL counterparts on the January 28 to February 1, 2013, offering of the LANL course.

- Sandia personnel are working with T&EP management and LANL counterparts on the January 28 to February 1, 2013, offering of the NCERC Hands-On course.

- Sandia personnel are working with T&EP management and LANL/LLNL counterparts on the April 1-5, 2013, offering of the NCERC Manager's course.

- The February 4-8, 2013, offering of the Hands-On course at Sandia was completed for five external and six Sandia students.

- Sandia personnel are working with T&EP management and LANL/LLNL counterparts on the April 1-5, 2013, offering of the NCERC Manager's course.

- Sandia personnel are working with T&EP management and LANL counterparts on the May 6-10, 2013, offering of the LANL course.

- Prepared for the May 13-17 offering of the Sandia Hands-On course.

- Planning is underway for the September manager's course at Sandia.

- The May 13-17, 2013, offering of the Hands-On course at Sandia was completed for eleven students.

- Sandia personnel participated in the delivery of the April 1-5, 2013, offering of the NCERC Manager's course.

- Sandia personnel participated in the delivery of the May 6-10, 2013, offering of the LANL course.

- Development of the course material is underway for the September manager's course at Sandia.

- Design of the facility upgrades was underway at the end of the quarter and completed in mid-July.

- Development of the Sandia Managers course material was completed.

- The Sandia Managers Hands-On Training Course was delivered to a group of LANL material managers on September 9-13, 2013.

- Design of the facility upgrades was underway at the end of the quarter and completed in mid-July.

Criticality Safety Support Group (CSSG)

- Supported November joint CSSG/CSCT Meeting.

- Draft/Support CSSG Tasking 2013-01 (Fire).

- NCSP Mission/Vision meeting at ORNL.

- CSCT and EFCOG call liaison.

- Draft CSSG Tasking 2013-03 (SME Review).

- Mission/Vision/Value meeting support.

- LANL CS Tasking and Review.

- CSSG meeting prep for DC (univ task prioritization).

- CSSG Meeting in DC.

- 3009 comment finalization.

- CSSG/CSCT liaison activities.

- Preparations to support Tasking 2013-04 (Y-12).

- CSSG Tasking 2013-01 (Fire).

- Closed out Tasking 2013-02, LANL Assessment.

- General review of normal CSSG correspondence.

- NCSP Tech seminar meeting in DC .

- Support for Fire Tasking.

- CSSG prioritization of taskings telecom.

- NCSP request for "health of crit program LOIs".

- Travel to LANL to "shadow & interact" with DNFSB/HSS.

- CSSG Tasking 2013-01 (Fire).

- Support/Review of CSSG Tasking 2013-01 (Fire).

- Preparations, support, closure of Tasking 2013-04 (Y-12).

- Continued review of DOE-STD-3009.

- General review of normal CSSG correspondence.

- NCSP/CSSG meeting in Germantown.

- Final reviews of NCSP 5-year plan and Mission/Vision.

- NCSP Topical Meeting Support.

- Support/Review of CSSG Tasking 2013-01 (Fire).

- Preparations, support, closure of Tasking 2013-04 (Y-12).

- Continued review of DOE-STD-3009.

- General review of normal CSSG correspondence.
- CSSG/CSCT liaison activities.
- NCSP/CSSG meeting in Germantown.
- Final reviews of NCSP 5-year plan and Mission/Vision.
- NCSP Topical Meeting Support.