DATES TO REMEMBER FY2018

- Jan 5, 2018 — Request for Proposals Solicitation FY2019-2023
- Feb 2, 2018 — Written Proposals Due
- Mar 27-28, 2018 — NCSP Technical Program Review at ORNL

Hands-On Training & Education Course Dates

Two-week Practitioner Course Dates:

Jan 29 – Feb 9, 2018 Aug 13 – 24, 2018

One-week Manager's Course Dates:

Jun 11 – 15, 2018 Apr 16 – 20, 2018

Course Registration: http://ncsp.llnl.gov/training.php

LINKS TO REMEMBER

- NCSP WEBSITE
- CSSG TASKINGS
- NCSP HISTORY & PROGRAM OVERVIEW
- NCSP ORGANIZATION CHART
- NCSP MISSION AND VISION
- NCSP FIVE-YEAR EXECUTION PLAN
- NCSP ACCOMPLISHMENTS
- NCSP PLANNING CALENDAR
- PREVIOUS NCSP NEWSLETTERS

Dr. Angela Chambers
NCSP Manager

Happy Holidays and a Prosperous New Year to All!

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Welcome our newest NCSP Management Team Member

Dr. Thomas Miller
ORNL
NCSP $C_E dT$ Manager

Dr. Thomas Miller's research interests include deterministic and Monte Carlo transport methods, particularly for criticality safety, radiation shielding, and charged particle transport. Examples include designing and evaluating benchmark experiments for criticality accident alarm systems, investigating active interrogation and electron probe microanalysis techniques for the detection of nuclear material, designing a passive activation detector and developing modern yield estimation techniques for post nuclear detonation forensics. From 2004 to 2006, Dr. Miller worked at the Bettis Atomic Power Laboratory in the Shield Design and Development Group. Dr. Miller received his Ph.D. and M.S. in Nuclear Engineering from the University of Tennessee in 2004 and 2001, respectively. His dissertation involved creating an event generator for the Monte Carlo code HETC-HEDS to model the particle production of high-energy nucleus-nucleus collisions for NASA, and his master's thesis involved performing bulk shielding design calculations for the Spallation Neutron Source at ORNL around the mercury target and along the neutron beam lines.

ANALYTICAL METHODS

SCALE Users' Group Workshop
(Article submitted by Brad Rearden)

The first ever SCALE Users' Group Workshop was held September 26–28, 2017 with 130 registered participants from NRC, DOE, national laboratories, industry, and academia. The opening plenary session featured keynote speakers Drew Barto from the Nuclear Regulatory Commission who described 41-year history of the SCALE Code System for the criticality, shielding, and source terms analysis of spent fuel as well as Larry Wetzel from BWXT who described 30-years of applying SCALE for criticality safety assessment and criticality accident alarm analysis.

Technical sessions were provided on the following topics:

- Criticality Safety
- Depletion and Source Terms
- Nuclear Data
- Radiation Shielding
- Reactor Physics
- Sensitivity and Uncertainty Analysis

A panel discussion was held on the 40-year heritage of SCALE featuring:

- Mike Westfall, ORNL (ret.), Originator of SCALE, 1976
- Lester Petrie, ORNL (ret.) - Principal developer and architect of SCALE, 1976-2016
- Cecil Parks, ORNL - SCALE Project Leader, 1979-1994
- Steve Bowman, ORNL - SCALE Project Leader, 1995-2009
- Brad Rearden (moderator), ORNL – Manager, SCALE Code System, 2009-present

A series of photos from the workshop are available at: https://www.ornl.gov/scale/scale/2017-scale-users-group-workshop-photos

Technical tours were provided of the following ORNL facilities:

- High Flux Isotope Reactor
- ORNL Spent Fuel Experimental Facility
- Historical ORNL Graphite Reactor
- National Center for Computational Sciences

The full agenda with links to the presentations is available at: https://www.ornl.gov/scale/scale/2017-scale-users-group-workshop

A series of photos from the workshop are available at: https://www.ornl.gov/scale/scale/2017-scale-users-group-workshop-photos

INTEGRAL EXPERIMENTS

Testing of Y-12 criticality accident alarm detectors was recently performed at NCERC using the Godiva IV Fast Burst Reactor (Article submitted by Chris Haught)

The obvious benefits of the National Critical Experimental Research Center (NCERC) to DOE are the capabilities to perform new integral benchmark experiments and to train NCS Engineers at the types of facilities that are no longer maintained at most universities. Another benefit that may not be as obvious is reestablishing a capability to test detectors used in criticality accident alarm systems in an environment that closely simulates accident conditions.

Testing of Y-12 criticality accident alarm detectors was recently performed at NCERC using the Godiva IV Fast Burst Reactor. The testing was accomplished with the collaboration of Y-12 personnel who established testing criteria and data acquisition, Lawrence Livermore National Laboratory (LLNL) personnel who helped design the tests and acquire dose estimates at the detectors, and Los Alamos National Laboratory (LANL) personnel who set up the equipment and operated the Godiva IV reactor.

The Y-12 Criticality Accident Alarm System (CAAS) has existed essentially as presently configured since 1957 (except in the recently constructed HEUMF storage facility). The system today consists of 18 detection stations located throughout six Y-12 nuclear facilities. Each station is equipped with two scintillation detectors and those stations located in fissile material processing areas have a credited range of 400 feet. This large range of coverage is sufficient to provide the processing areas with overlapping station coverage. Since the inception of this CAAS system, it was common practice to test the system detectors at fast burst reactors as a means for qualifying detectors for service in the system.

Criticality Accident Alarm System.

In 2016 an assessment of the Y-12 CAAS system was conducted by the DOE Office of Enterprise Assessments. One issue the assessment identified was that not all detectors in service at Y-12 were properly qualified (and this was primarily a consequence of losing this capability within DOE after closing the critical experiment facility at TA-18 in LANL). In addition to the assessment issue concerning existing detectors, there is a need to buy and qualify new detectors at Y-12 to replenish the supply of spares needed to replace existing detectors that are failing.

To help resolve the issue of proper detector qualification, tests were performed at NCERC using Godiva IV to generate intense neutron and gamma radiation pulses with new and existing Y-12 detectors located in very close proximity to the reactor. The output from each detector was connected to the control room where data logging equipment recorded the initiation of the pulse, the output of each detector, and the moment of each alarm signal trigger. The total testing consisted of three pulses of increasing magnitude ending with a super-prompt pulse of $1.08 reactivity corresponding to a reactor temperature rise of 149°F and a pulse width of 70 µs (FWHM). The estimated dose at the detector locations is 87 rad (in air) and the corresponding estimate for dose rate is 1.24 Mrad/s. The testing verified the ability of the detectors to tolerate the maximum expected radiation exposure and sensitivity to detect a minimum width pulse. Such conditions necessary for qualifying the detectors to those two criteria are difficult to create without a critical experiment facility and a reactor such as Godiva IV. This testing represents the successful restoration of a much-needed capability in DOE.

INTEGRAL EXPERIMENTS (cont'd)

KRUSTY ACHIEVES CRITICALITY!
(Kilopower Reactor Using Stirling TechnologY)
A Joint NCSP/NASA Project

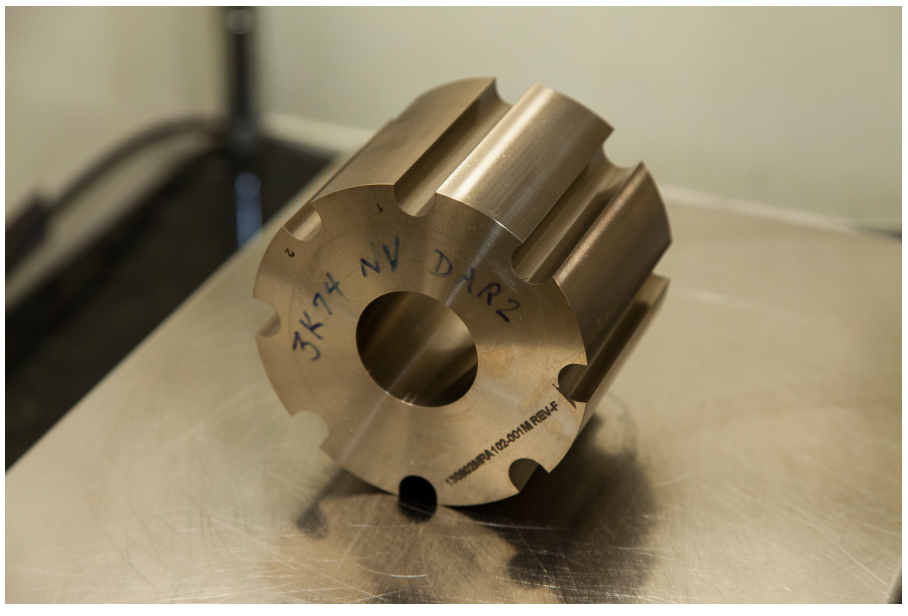
The National Aeronautics and Space Administration (NASA) has partnered with NNSA to test a prototype fission reactor coupled to a Stirling engine in an experiment entitled KRUSTY (Kilopower Reactor Using Stirling TechnologY) to fuel potential future space missions.

The DOE NCSP has partnered with NASA's Space Technology Mission Directorate to develop and test the Kilopower reactor at NNSA's National Criticality Experiments Research Center (NCERC) in the Device Assembly Facility (DAF) at the Nevada National Security Site (NNSS).

Los Alamos National Laboratory partnered with NASA's Glenn Research Center in Cleveland, Ohio to design and perform initial testing of the Kilopower reactor design with contributions from NASA's Marshall Space Flight Center in Huntsville, Alabama. Initial testing was completed using a surrogate (non-fissile) reactor core and resistive heating elements at the NASA Glenn Research Center.

NNSS, the Nevada Field Office, the NNSA Production Office, Y-12, LANL, Lawrence Livermore National Laboratory, and Sandia National Laboratories all are contributing to completion of the design, safety analysis, fabrication, and final testing of the KRUSTY experiment.

KRUSTY Experimental Assembly on the truck ready for shipment to NCERC in Nevada.



1 of 3 machined KRUSTY core components.

LANL's Advanced Nuclear Technology Group and Advanced Nuclear Experiments Group are responsible for conducting the KRUSTY experiments at NCERC.

The Y-12 National Security Complex in Oak Ridge, Tennessee cast and machined the reactor core which was delivered to the DAF earlier this past fall.

Assembly of the KRUSTY experiment began at DAF shortly after the arrival of the Y-12 fabricated core and the NASA components including the Stirling converters, shielding materials, sodium heat pipes, and beryllium oxide reflector. The uranium core is subcritical in air, but once surrounded by the beryllium oxide (BeO) reflector, it becomes critical.

LANL experimenters at NCERC began the approach to critical on November 14 with aligning the core and platen guide tube on the COMET assembly. The platen will slowly raise the BeO reflector around the uranium core in order to achieve criticality.

On November 15, a series of approach to critical measurements was made while increasing the height of the BeO reflector surrounding the core by slowly raising the platen. The final configuration measured on November 15 consisted of a height of 9 inches of BeO reflector surrounding the core. Based upon neutron multiplication measurements, the extrapolated critical configuration was predicted to be a height of 11.3 inches of BeO reflector.

On November 16, the approach to criticality continued. A repeat of the previous day's 9 inch BeO reflector configuration was re-measured to ensure no changes had occurred overnight. **Shortly before 1500 Pacific Standard Time, KRUSTY achieved criticality with 11.25 inches of BeO reflector!** The configuration had approximately 10 cents of excess reactivity.

In the upcoming months KRUSTY will continue to conduct a series of critical experiments to characterize and benchmark the experiment culminating in the full power demonstration. The full power demonstration will provide NASA with information on the feasibility of small fission reactors for deep space and manned Mars missions.

KRUSTY Experimental Assembly at NASA Glenn Research Center undergoing final checks before being prepared for shipment to NCERC where the Y-12 fabricated fuel will be placed into the assembly.

INTEGRAL EXPERIMENTS (cont'd)

KRUSTY ACHIEVES CRITICALITY! (cont'd.)

The following is a list of upcoming KRUSTY experiments:

- Cold Critical: Measure the reactivity worth of reactor components (fuel, radial reflector, axial reflectors, and shielding) – Room temp. Data (particularly Beryllium Oxide) will be used to develop ICSBEP Benchmark.
- Cold Critical: Measure the reactivity of the assembled reactor including fuel, heat pipes, heat pipe clamps, reflector pieces, and shielding – Room temp. Validate modeling assumptions used in computer codes that simulate the reactor operation and testing.
- Cold Critical: Measure the reactivity worth of a boron-carbide rod placed at various positions within the center of the core – Room temp.
- Not Critical: Heat Soak of assembly at full temperature (800C) using electric heating to verify data acquisition and 'set' the heat pipes/ clamps.
- Warm Critical: Operating the reactor at a series of low temperatures – 200 C to 400 C. Determine temperature coefficient of reactivity. Validate transient modeling to support decision to operate at full power.
- Full Power Run: High temperature, 28-hour test – 800 C. Steady-state operations followed by a series of transient tests to demonstrate reactor load following.

LANL, IRSN, and RPI Conduct Neutron Clustering Measurements at the RPI-RCF (Article submitted by Bill Myers)

Los Alamos National Laboratory, in collaboration with the Institut de radioprotection et de sûreté nucléaire (IRSN), and Rensselaer Polytechnic Institute (RPI) performed measurements investigating neutron clustering at the RPI Walthousen Reactor Critical Facility (RCF) in August. Neutron clustering is a theoretical phenomenon where in a critical system at very low power, neutrons will appear to cluster together. The RCF is 100 watt research reactor at RPI with UO_2 fuel (4.81 w/o), and measurements were performed with the LANL NOMAD detectors (15 ^{3}He tubes in polyethylene) outside of the core and additional ^{3}He detectors in the core.

Researchers at the RCF Control Panel. In the foreground, Peter Caracappa (RPI). In the background, Wilfried Monange (IRSN). Standing, Nicholas Thompson (then RPI, now LANL). At the Panel, Glenn Winters (RPI).

Because this effect can only be seen at very low neutron levels, the reactor was brought to critical, but at very low powers. Measurements were made at 14 critical configurations ranging from 1 watt to 0.5 milliwatts in power. Researchers at LANL and IRSN are working to analyze the data. If successful, this will be the first observation of neutron clustering.

Rian Bahran (left) and Mark Nelson (right) setting up the NOMAD detectors next to the reactor core.

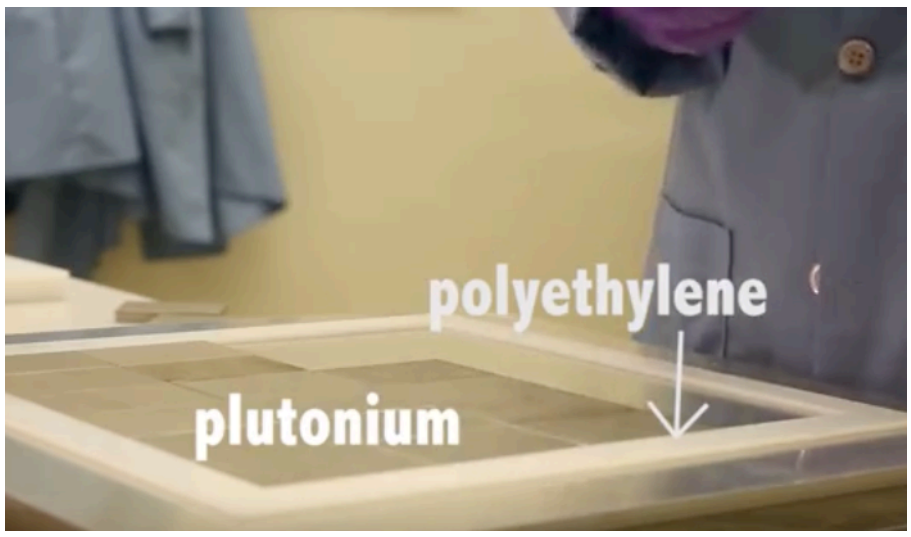
Some of the members of the experiment team. From left to right, Eric Dumonteil (IRSN), Wilfried Monange (IRSN), Rian Bahran (LANL), Nicholas Thompson (then RPI, now LANL), Alex McSpaden (LANL), and Jesson Hutchinson (LANL).

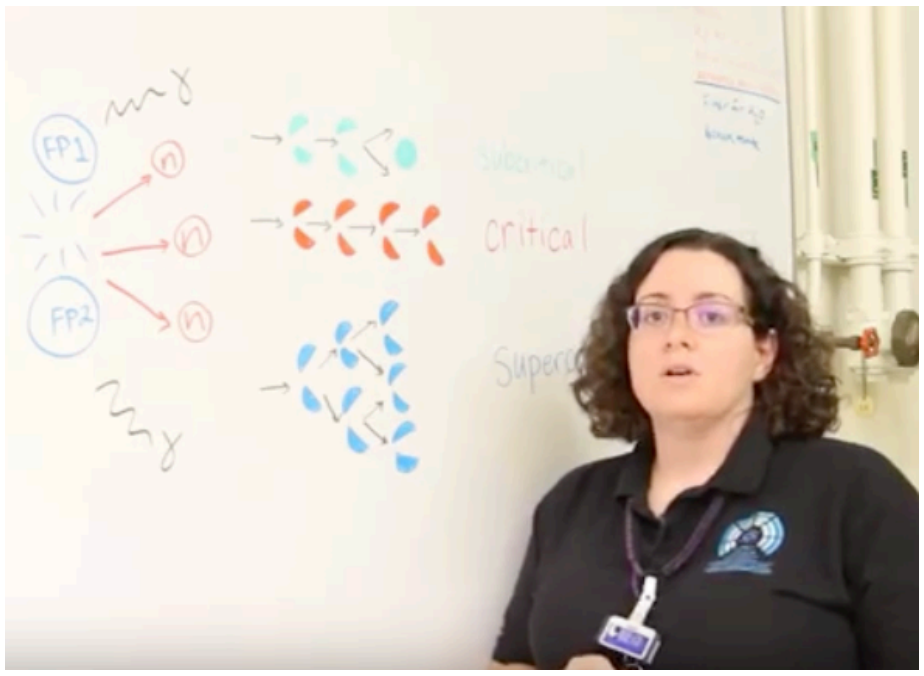
INTEGRAL EXPERIMENTS (cont'd)

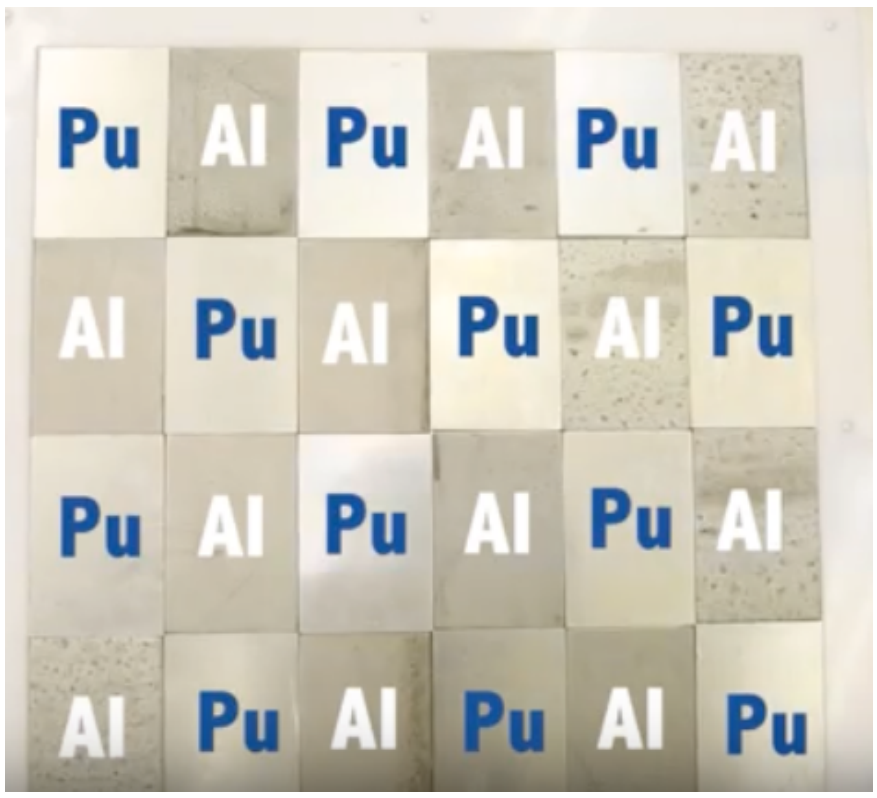
The Thermal/Epithermal eXperiments (TEX) is an ongoing critical experiment campaign being conducted by Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL) (Article submitted by Catherine Percher)

The TEX project uses existing NCSP fissile assets to create high-precision critical assemblies that span a wide range of fission energy spectra and the assemblies can be easily modified to include different materials of interest to address gaps in integral benchmarks. The first two TEX experiments achieved criticality in FY2017. LLNL produced a short video describing the design of the plutonium-fueled TEX configurations and explaining the approach to critical methodology, which can be viewed here: https://www.youtube.com/watch?v=D46aPz6d9-I

Catherine Percher
Lawrence Livermore National Laboratory
Nuclear Criticality Safety Division





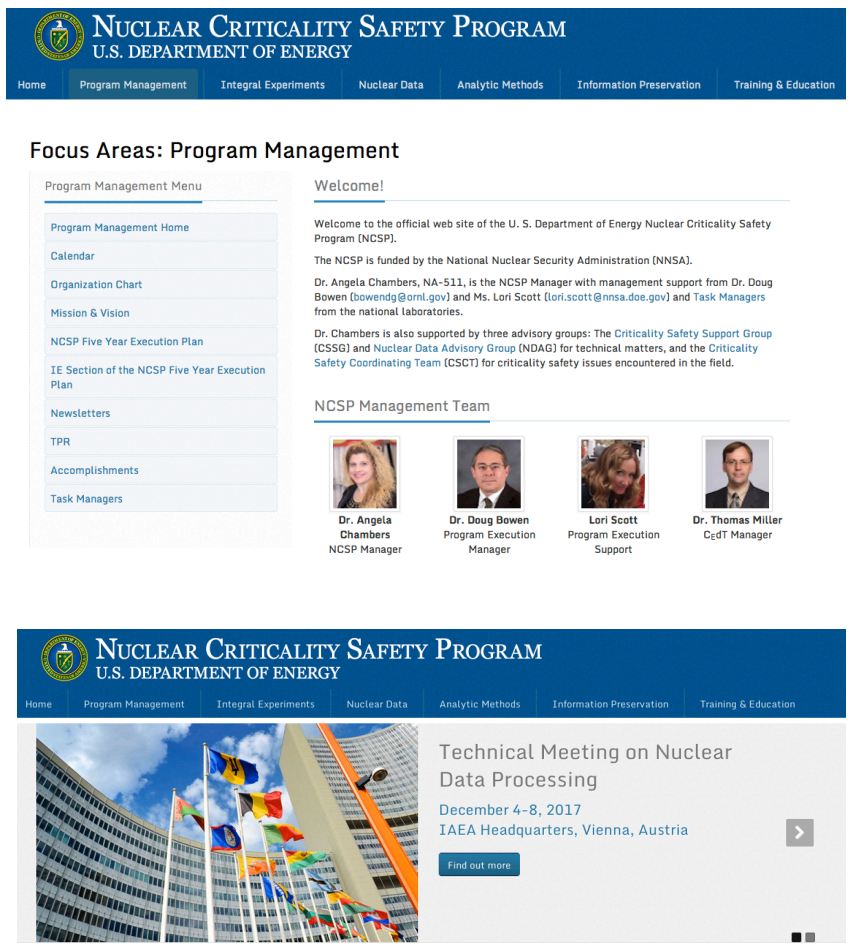


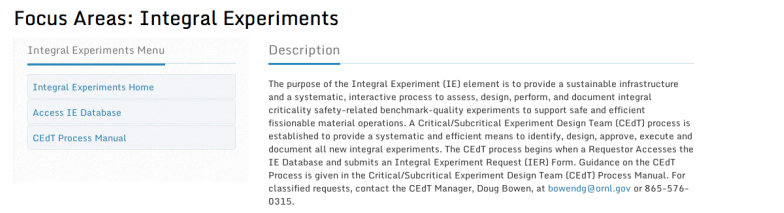
INFORMATION PRESERVATION & DISSEMINATION

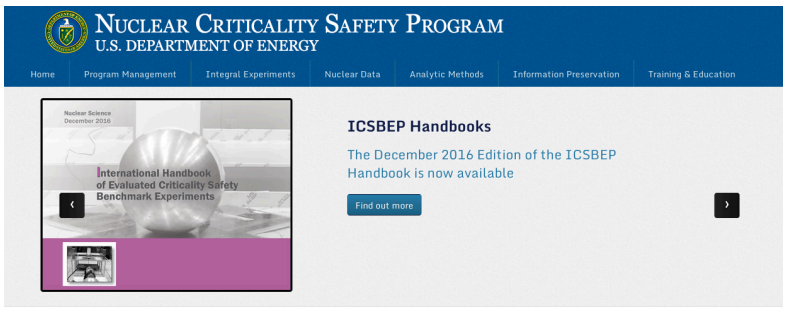
Check out our new website!!!

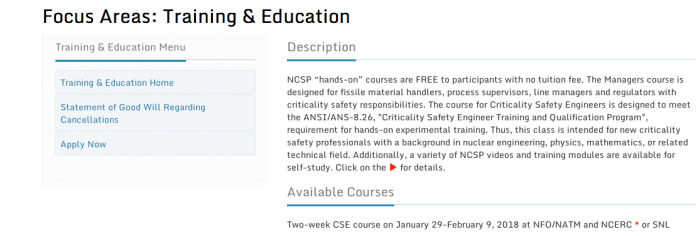
https://ncsp.llnl.gov/

Thanks to Lawrence Livermore National Laboratory, we have a new and recently designed NCSP website.









Please contact **Lori Scott** for information or contributions:
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NUCLEAR DATA

Los Alamos National Laboratory – ND Activities

- Prompt Fission Gamma Spectra (PFGS) for U235, U238 and Pu239 have been finalized and included in the beta-5 release of the ENDF/B-VIII library. The gamma-ray multiplicity distributions P(Ng;Einc) have also been evaluated based on CGMF calculations for incident neutron energies from thermal up to 20 MeV, using a new format developed for this quantity. We will try to incorporate the multiplicity-dependent PFGS in the files as well before the official release of the library. The CGMF-calculated PFGS get significantly softer as the gamma multiplicity is increased.
- New Prompt Fission Neutron Spectra (PFNS) for both U235 and Pu239 have been included into the beta-5 release of the ENDF/B-VIII library. The U235 PFNS makes use of chi-nu data, while the preliminary chi-nu data could only be used to validate the evaluated Pu239 PFNS a posteriori. A new evaluation for Pu239 PFNS will be performed in FY18 using all of Chi-Nu data (low- and high-energy), which should be available then.
- Covariance matrices were evaluated for both nuclei, and include for the first time more than one incident neutron energy covariance matrix. Cross-energy correlations could not be included in the library due to format limitations.
- A publication on the new prompt fission gamma-ray evaluations is in preparation. The most relevant results are being documented as part of the Special Issue of the Nuclear Data Sheets accompanying the release of the ENDF/B-VIII library.
- Note that NJOY patches have been developed to handle the new format for P(nu), P(nu_gamma), and multiplicity-dependent spectra. Last-minute changes to the format were discussed and informally accepted, leading to the need for last-minute efforts to develop a robust NJOY patch that can handle the new files. This work is still in progress, but is very close to being successfully handled.
- ENDF/B-VIII.0 data testing continues. We are keeping up with the beta releases and processing the data.

Lawrence Livermore National Laboratory – ND Activities

- NCSU completed updating the thermal scattering laws (Be, BeO, C (crystalline), C(nuclear), SiC, SiO2, UO2, UN, C5H8O2, CH2) which were contributed to ENDF/B-VIII.beta4. All libraries are now based on optimized a,b grids and enhanced elastic scattering models. This update is included in ENDF/B-VIII.beta5 (test) and ENDF/B-VIII.0 (production) releases. Additionally, a modified version of NJOY has been completed to enable independent testing and QA of the contributed TSL libraries.
- NCSU finalized the thermal scattering law library for heavy paraffinic oil. A modified version of NJOY2016 was created to treat viscous materials using a Langevin representation of the diffusional component of the TSL. Based on this, the TSL for hydrogen in oil was generated. In the process, it was discovered that NJOY2016 computes the diffusive S(a,b) onto a finer grid (before convoluting with the bound component) and has a hardwired default cutoff (10-7) that arbitrarily limits this computation. This can result in the exclusion of a significant portion of the diffusive component from the convolution. To address this issue, the cutoff value was set to 10-14–10-15. A cutoff for the number of b grid points in the convolution was increased to facilitate these changes.
- NCSU finalized *FLASSH* beta2. This version has a phonon expansion algorithm that is much faster than in the previous version, temperature scaling for the α,β grid, an optimized automatic α,β gridding algorithm, and input error checks in *FLASSH* GUI. Several bugs have been fixed including: a compatibility bug between the GUI and the calculation kernel in relation to the Debye-Waller matrix; a bug related to the calculation of n-th phonon order of S(α,β); a bug in reading the DOS (with eal=0 option) and scatterer number choice; and a bug in the plotting window legend generation.

Oak Ridge National Laboratory – ND Activities

Resonance Evaluation for the Isotopes of Gadolinium in collaboration with IRSN.

- The extension of the upper energy limit for the resolved resonance region based on evaluation of differential experimental data is underway.
- Results of the integral experiments performed at the ZED-II reactor at CNL are being incorporated into the evaluation using the developed SAMINT methodology of systematically combining evaluation information from differential and integral experiments.
- An initial attempt has been made to extend the SAMINT methodology to the evaluation of the unresolved resonance region to allow for the systematic incorporation of proprietary IRSN integral experiments with significant sensitivity to the isotopes of gadolinium. Through the NCSP collaboration with IRSN, the new gadolinium evaluations will be able to benefit from the information contained in proprietary IRSN integral benchmarks without the necessity to share the exact benchmark specifications.

Please contact **Lori Scott** for information or contributions:
Lori.Scott@nnsa.doe.gov

TRAINING & EDUCATION

Los Alamos National Laboratory Nuclear Criticality Safety Pipeline for Expedited Qualification of Personnel (Article submitted by Andrew Wysong)

The Los Alamos National Laboratory's (LANL) Nuclear Criticality Safety Division (NCS) is partnering with New Mexico State University (NMSU) and Texas A&M University (TAMU) to develop an accelerated academic and experience-based program to attract, educate, and retain a workforce capable of fulfilling LANL's nuclear criticality safety mission. The Pipeline program was conceived to expedite the recruitment and qualification of LANL's nuclear criticality safety professionals. This partnership's short-term mission is to provide academic curricula, concurrent with professional experience gained under the guidance of a qualified mentor, to upper division undergraduate or graduate level students. The long-term mission is expediting the LANL qualification process and other requirements leading to a full-time Criticality Safety Analyst (CSA) position within LANL's NCS Division. Additionally, the NCS Pipeline prepares participants with a solid skillset applicable to many other career paths at LANL or other institutions.

Why does LANL need a Pipeline?

A number of issues necessitate an aggressive initiative:

Attrition: at the highest level, the nuclear criticality safety discipline anticipates significant attrition over the next two decades (24-30% for those with 21+ years of professional experience according to the American Nuclear Society); most senior criticality safety professionals within the DOE complex are also nearing retirement age. Locally, LANL's Nuclear Criticality Safety organization experienced significant staffing attrition from 2008-2012. Aggressive recruiting efforts have been underway since, though the level has not yet stabilized at a rate necessary to fully support Laboratory operations.

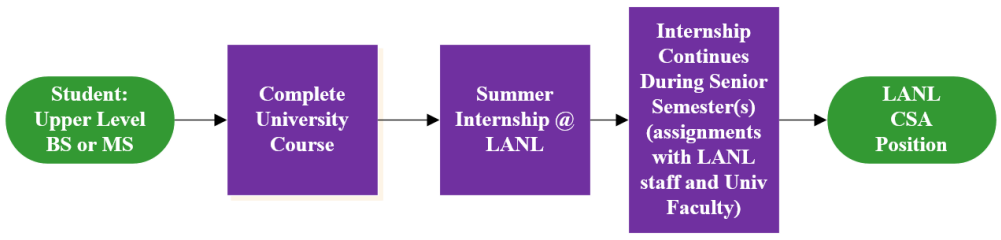
Qualification Requirements: Hiring new CSAs is one thing—training and qualifying them to perform work in a nuclear facility is another. By definition, a CSA qualification program is comprehensive and complex, and while most LANL NCS new hires have either a BS or MS in nuclear engineering, the unique nature of the nuclear criticality safety discipline requires significant additional effort and time— an average of two years—to achieve qualification. A security clearance investigation, while often conducted concurrently with training, can take up to two years to complete.

Academia: Currently, few universities offer criticality safety in their nuclear engineering curricula (Idaho State University, University of Tennessee, and the University of Idaho- Idaho Falls). To our knowledge, there is no university or college in the United States that offers any degree in nuclear criticality safety. Further, limited criticality safety academic programs often result in obscure perceptions of the nuclear criticality safety discipline. All too often, entry level CSAs realize the discipline is not a good fit and leave to pursue other interests. By this point, significant time and effort has been invested by NCS in the potential CSA. Graduate or post-graduate degree opportunities consequently may also be lost.

What does it look like?

By design, the pipeline program begins with an advanced level academic course customized for junior or senior level undergraduate students or graduate students. Successful course completion may progress to a LANL summer internship where the students learn about nuclear criticality safety practices and begin working on facility-specific training requirements leading to full qualification.

A senior year/graduate program internship is offered to students who continuously demonstrate a strong aptitude for the nuclear criticality safety discipline. This internship is conducted during the academic year under direction of LANL staff and university faculty. The combination of academic and professional experience further prepares the student for advanced academic study in graduate school and immediate career



LANL-qualified CSAs serve as affiliated faculty at the university. University faculty and LANL NCS management work jointly to monitor/ measure progress, address emergent issues, and plan enduring gains and opportunities. Due to the rigor of qualification requirements, the feasibility of awarding a university non-thesis graduate degree concurrent with the qualification is being evaluated.

LANL kicked off its NCS student internship program in June 2017 with six interns; each was assigned a mentor and worked on projects that satisfy CSA qualification criteria. The interns completed the LANL annual week-long "CSA Intensive Training Program" where various training requirements were delivered by local and DOE Field Office technical experts. The interns also attended the DOE Criticality Safety Program "Hands-On Training and Education Course" and the University of New Mexico's "Nuclear Criticality Safety Short Course."

The Fall 2017 semester offered the first session of LANL's NCS course at NMSU and TAMU (expansion to the University of New Mexico and UC-Berkeley is under consideration). The NMSU course is on-line via their Chemical and Materials Engineering department, while the TAMU course is live and via their Nuclear Engineering department. Both courses include a variety of topics such as: parameters (MAGIC MERV), MCNP, hand calculations, criticality accidents and their lessons learned, select American Nuclear Society (ANS) and DOE standards, fuel cycles as they pertain to criticality safety (enrichment, fabrication, and used fuel storage), and criticality safety evaluation development. Lectures by LANL management and staff discussing the myriad aspects of a career in nuclear criticality safety are conducted throughout the semester.

TRAINING & EDUCATION (cont'd)

NCSP Hands-on Training and Education Courses
(Article submitted by Doug Bowen)

2-Week CSE Course – August 14-25, 2017

The NCS Practitioners Course was held at the National Atomic Testing Museum (NATM), the National Criticality Experiments Research Center (NCERC) and Sandia National Laboratories in Las Vegas, Nevada. The courses are designed to meet the ANSI/ANS-8.26, "Criticality Safety Engineer Training and Qualification Program", requirement for hands-on experimental training.

Then NATM portion of the course involves classroom lectures and workshops for NCS Evaluation development and the NCERC and SNL portions of the course involve experiments with the critical assemblies.

NNSS, LANL, ORNL, LLNL, SNL and NFO staff participated in the course execution.

Students handling the BeRP Ball at NCERC shown below.

Completion of a 1-Day Sensitivity/Uncertainty Familiarization Course at the Y-12 National Security Complex
(Article submitted by Doug Bowen)

A 1-Day Sensitivity/Uncertainty familiarization course was conducted at the Y-12 National Security Complex. This familiarization course was conducted in collaboration with LANL and ORNL.

FY2017 PUBLICATIONS

NCSP Technical Program Review

J. Hutchinson, et. al., Subcritical Copper-Reflected α-phase Plutonium (SCRαP) Measurements and Simulations. (Best Paper Award)

R. Bahran, et. al, Progress on the Development of a Neutron Multiplication Measurement Protocol at a Reactor Critical Facility.

R. Sanchez, et.al., Kilowatt Reactor Using Stirling TechnologY (KRUSTY) Experiment Update. (Best Paper Award)

T. Cutler, et. al. Experimental Design to Study Criticality Effects of Plutonium Aging.

D. Hayes, Flattop Startup. (Best Paper Award)

M. Paris, Los Alamos Evaluation Work for ENDF/B-VIII Relevant to the NCSP.

M. Duluc, International Intercomparison Exercise for Nuclear Accident Dosimetry at the DAF using GODIVA-IV (IER148) – MCNP Dosimetry Calculations.

B.J. Marshall, KENO Validation for SCALE 6.2 Release.

M. Jessee, SCALE 6.2 and AMPX Development and Modernization for the NCSP.

F. Brown, et. al., MCNP Progress for NCSP.

F. Brown, LANL-SNL Collaboration for NCS Validation.

D. Heinrichs, Website Modernization. (Best Paper Award)

G. Keefer, Joint AWE-LLNL Subcritical Benchmarks and Training.

D. Hickman, 1st Nuclear Accident Dosimetry Exercise Using Godiva at NCERC.

T. Nelson, TEX-Hafnium Final Design.

C. Percher, BeRP Ball with Composite CH2/Ni Reflector Final Design.

S. Watson, Validating Analytical Methods with MC-15 Measurements.

G. Harms, NCSP IE and T&EP Activities at Sandia.

D. Ames, IER-451 – Titanium Sleeve Experiments in the BUCCX.

L. Clark, FLATTOP - Passive Neutron Spectrometer.

V. Sobes, Progress in Resonance Evaluations of Ce and Gd for the NCSP. (Best Paper Award)

M. Pigni, ORNL Leading Improvements to 235U Evaluation that will Impact Modeling & Simulation for Nuclear Applications.

K. Guber, ORNL Cross Section Measurements in the Resolved Resonance Range for the NCSP. (Best Paper Award)

L. Leal, Nuclear Data Evaluation Work at IRSN in Support of the NCSP.

S. Kahler, ICSBEP Benchmark Data Testing to Support ENDF/B-VIII. 0.

S. Kahler, NDAG Update.

Y. Danon, NCSP Related Nuclear Data Activity at RPI.

D. Brown, ENDF/B-VIII.0 is Coming Soon.

D. Bowen, Status of the NCSP Training and Education Courses.

J. Alwin, et. a.l, Using Whisper to Support Nuclear Criticality Safety Validation Meeting ANSI/ANS-8.24 Requirements and Recommendations.

A. Hawari, Progress of TSL Evaluations at NCSU.

A. Hawari, Development of a Next Generation TSL Code.

C. Chapman, Thermal Energy Scattering Evaluation Framework. (Best Paper Award)

(see next page)

FY2017 PUBLICATIONS (cont'd)

Internal Reports and Journals

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