NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM

NEWSLETTER

Winter 2021

IN THIS ISSUE

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DATES TO REMEMBER

Hands-On Training & Education Course Dates:
Two-week Practitioner Course Dates:
Jan 31–Feb 11, 2022
Aug 8-19, 2022

One-week Manager's Course Dates:
Sandia – April 4-8, 2022
NCERC - Jun 6-10, 2022

Course Registration:
https://ncsp.llnl.gov/trng_apply.php

LINKS TO REMEMBER

- NCSP Website
- NCSP Program Management
- NCSP Mission and Vision
- NCSP Five-Year Execution Plan
- NCSP Planning Calendar
- Previous NCSP Newsletters
- CSSG Taskings
- Nondestructive Assay Program

A Message from the NCSP Manager

Please enjoy this Winter 2021 edition of the NCSP newsletter. The NCSP annual Technical Program Review (TPR) is coming up in February (see details below for registering). While we had hoped to have an in-person TPR this year, because we must start putting plans in place in November and with the evolving requirements for in-person meetings, the management team once again decided to host the TPR virtually this year. We all hope to be back in person in 2023. As we begin to evolve out of the pandemic and into our new normal, we are beginning to see previous constraints lifted and are again realizing the benefits of face-to-face interactions. We are looking forward to an in-person ANS meeting in June and to begin joining our international partners to participate in person for our collaborative tasks. We are planning for an accident dosimetry exercise this year as well as tackling some ambitious integral experiments and nuclear data measurements. We will continue to meet DOE's NCS and computational code training needs. Despite COVID limitations, we have had an outstanding year in each of our technical program elements. Be proud of all that you have accomplished this year.

May you have a safe and happy holiday season, and may you all have a prosperous new year!

NCSP Technical Program Review and Joint Meetings

This year's NCSP Technical Review Program (TPR) and joint meetings will be held virtually, hosted by Oak Ridge National Lab (ORNL). Please mark your calendar for February 14 - 18. The Nuclear Data Advisory Group (NDAG) and Analytical Methods Working Group (AMWG) will meet on Monday, February 14, the TPR will be held Tuesday – Thursday, February 15 - 17 and the Criticality Safety Support Group (CSSG) will meet Friday, February 18. Please go to https://ncsp.llnl.gov/program-management/annual-tpr to register, access the week-long agenda and the 2021 TPR presentations. If you have any questions, please send an email to ncspteam@ornl.gov.

A Note from the Criticality Safety Support Group (CSSG)

The Criticality Safety Support Group (CSSG) wants your input!
What specific challenges do you have that might benefit from the experience and broad perspective of the CSSG?

Please contact
David Hayes (CSSG Chair) dkhayes@lanl.gov
Mikey Brady (CSSG Deputy Chair) mikeybrady@aol.com
Or any CSSG member
CSSG web page link, https://ncsp.llnl.gov/criticality-safety-support-group

Criticality Safety Coordination Team (CSCT)

Happy 2022 from the new chair for the criticality safety coordination team (CSCT), Cris Eberle. In addition to wishing you all the best for 2022, I'd like to briefly describe the CSCT's history, function, and recent work.

The DOE CSCT was formed in 1997 as a response to the DNFSB's recommendation for maintaining criticality safety expertise. The CSCT provides federal DOE support to line management, which includes promoting consistent program oversight, sharing technical information, discussing NCS lessons learned, mentoring NCS staff, assisting implementation of NCS improvements, and promoting continuous improvement via written recommendations and consensus reports. This year the CSCT has reviewed and provided recommendations for revisions to DOE-STD-1134 and DOE-HDBK-3010. As part of a team effort, we have reviewed various NCS incidences reported in ORPS, and we are beginning a review for comment of the job task analysis of DOE-STD-1173. For more information about the CSCT please visit the NCSP website: https://ncsp.llnl.gov

2021 Annual CSEWG Meeting at Nuclear Data Week(s)

From November 15-19, 2021, CSEWG held its annual meeting during Brookhaven National Laboratory's Nuclear Data Week(s)[1]. The combined event was held via zoom (due to COVID travel restrictions) and there were 175 registered attendees. This was CSEWG's 3rd fully virtual meeting and, by all accounts, it was a success. The timetable and talks are available at https://indico.bnl.gov/event/13121/overview for registered participants. This meeting began with the welcoming of the new ENDF Library Manager, Gustavo Nobre, the announcement that ENDF/B-VIII.1's release will be delayed until February 2024 due to COVID induced delays, and the adoption of a draft Code of Conduct. This last point is notable since CSEWG is known for its lively physics and engineering discussions. However, as professionals, we must endeavor to keep our discussions civil, collegial, and inclusive. The Code of Conduct is posted at https://indico.bnl.gov/event/13121/page/385-code-of-conduct.

The meeting followed the traditional CSEWG committee structure of Formats, Covariance, Measurement, Validation, and Evaluation sessions. In these, three themes emerged:

[1] Due to the large number of contributions from CSEWG, USNDP, NDAG and WANDA sessions, Nuclear Data Week actually took two weeks!

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- While CSEWG does not feel ready to generate adjusted nuclear data libraries at present, work should continue developing tools and methods so that we can in the future. This was discussed at length during the summer mini-CSEWG meeting and reiterated in this meeting several times during the Covariance Committee session.
- The changes to the ENDF/B thermal scattering library are both exciting and stretching the legacy ENDF-6 format to its limits.
- The loss in reactivity in simulations of light water reactors noted by ORNL[2] has been traced to small changes in the ^{238}U neutron capture cross section, leading to decreased production of ^{239}Pu. It is unclear at this point whether the change to ^{238}U is incorrect or whether there is a compensating effect that now also needs correction.

Formats & Processing Committee: Both the legacy ENDF-6 format and the GNDS format were discussed. During the meeting, several shortcomings of the ENDF-6 format and its support for thermal neutron scattering data were discussed. In addition to improving the validation of the thermal neutron data, CSEWG developed a strategy to deal with the dearth of MAT numbers available given the avalanche of new thermal neutron evaluations. GNDS-2.0 is expected to be finalized in the December WPEC subgroup meeting and full implementation already exists in LLNL's FUDGE processing code system. Both ORNL's AMPX and LANL's NJOY code systems are not far behind with full implementation expected in the next year or two.

Covariance Committee: The covariance committee meeting this year covered covariance data for ENDF/B-VIII.1, target accuracy assessments, and methods development. Talks from IAEA and ORNL outlined new covariance data for actinides being developed as part of the INDEN project. A talk from WPEC Subgroup 46 detailed the results of target accuracy assessments using the ENDF/B-VIII.0, JEFF-3.3 and JENDL-4.0 libraries in simulations of several advanced reactor systems. Issues were noted in the NJOY processing and in several ENDF/B evaluations. Finally, a slew of methods development efforts were detailed by LANL, ORNL, LLNL, BNL and Univ. of Michigan.

Measurements Committee: Despite COVID, experiments are proceeding! The Measurements Committee outlined many new experimental efforts around the CSEWG collaboration:
- LANL presented progress on LENZ, SPIDER, and SREFT detectors for outgoing charged particle data and presented ChiNu PFNS results for ^{235}U and ^{238}U.
- ORNL outlined the resonance measurements being performed at GELINA for Zr isotopes.
- RPI outlined capture measurements on ^{54}Fe, ^{nat}Ta, ^{238}U and ^{235}U as well as thermal total capture and thermal neutron die-away measurements.
- BNL presented beta decay data measurements for ^{140}La and ^{130}I.
- U. of Notre Dame presented measurements of $^{13}C(\alpha,n)^{16}O$ which may inform both the CIELO/INDEN ^{16}O evaluation and astrophysics.

In addition to these, updates to the Neutron Standards and EXFOR projects were presented.

Validation Committee: Validation of the next ENDF/B release has been stalled for more than a year due to the lack of clarity on how ENDF/B library reviews will be performed. As of November's CSEWG, evaluation reviews are happening again (for the first time in nearly 20

[2] J. Nucl. Eng. 2, 318-335 (2021) https://doi.org/10.3390/jne2040026

years!). We expect enough evaluations will have passed this Phase I review for the Validation Committee to begin its work before next Fall. In the meantime, the LANL validation of INDEN's ^{239}Pu for the fast region was presented, validation of ENDF/B-VIII.0's graphite evaluations continued at ORNL and 14 MeV neutron induced gamma data validation continued at LLNL. In addition, the impact of FENDL-3.2 on ITER and FNSF fusion reactor computational benchmarks was presented by Univ. of Wisconsin.

Evaluation Committee: CSEWG evaluation work has become so complex that the Evaluation Committee split the work into several subcommittees: TSL, neutron, FPY and decay and charged particles. We detail sessions for each subcommittee:

- **TSL:** The TSL sublibrary saw the addition of many new evaluations: ZrH from ESS[3], CaH_2, UC, and U metal from NCSU, ZrC from NNL, delta phase YH_2 to $YH_{1.31}$ from LANL and candidate evaluations for polyethylene from an RPI/ORNL/ESS collaboration and reactor graphite from Univ. of Sharja[4]. Many more evaluations are expected because of the ESS's NJOY+NCrystal[5] project, but these are delayed while we resolve the MAT number issue described in the Formats session. In addition, the IAEA presented results from the TSL processing code intercomparison project and LLNL shared the TSL capabilities of the FUDGE processing code.
- **Neutrons:** To begin this session, the ENDF Library Manager presented an overview of the current state of the ENDF/B-VIII.1 library preparations. Next, there were extensive discussions of the re-evaluation of the major actinides by the IAEA, ORNL, Josef Stefan Inst. And LANL. The focus of these re-evaluations is the RRR, URR and PFNS. The ^{238}U RRR took special focus because of its role in the "burnup conundrum". The ^{238}U capture cross section was slightly modified in ENDF/B-VIII.0, decreasing the production of ^{239}Pu and lowering reactivity in long burnup reactor simulations. This effect was first reported to CSEWG by ORNL and verified by simulations by the Josef Stefan Inst. and elsewhere. We are now investigating the changes to assess their correctness and whether there are other compensating errors. Finally, LANL provided updates on ^{16}O, ^{9}Be, ^{59}Ni and ^{181}Ta evaluations, and ORNL provided updates on the ^{63,65}Cu evaluations.
- **FPY and decay:** LLNL provided an extensive overview of experimental work at NCSERC and PNNL by a collaboration between LLNL, LANL, PNNL and Oregon State U. In addition, LANL, LLNL, LBNL and BNL are all actively engaged in evaluation activities. We expect new fission product evaluation s for all major actinides as part of ENDF/B-VIII.1.
- **Charged particles:** IAEA presented an overview of the "Technical Meeting on (α, n) nuclear data evaluation and data needs" and LANL presented a short summary of light element charged particle evaluations.

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[3] European Spallation Source (https://europeanspallationsource.se)

[4] In the United Arab Emirates

[5] NJOY+NCrystal Library (2021) https://github.com/highness-eu/NJOY-NCrystal-Library

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A parallel-plate avalanche counter for the prompt fission neutron spectrum measurement

Ching-Yen Wu and Roger A. Henderson

Neutrons, gamma's, and fission fragments are among the prompt fission observables. Their precision measurements are fundamental to advance our understanding of fission and any application of fission. For our programmatic need, the χ matrix, which defines as the outgoing neutron spectrum as a function of incoming neutron energy, is sparsely populated and poorly measured for $^{233,235,238}U$ and $^{239,240}Pu$. To improve the quality of those χ matrices, a joint LANL-LLNL project was undertaken to measure their prompt fission neutron spectra at the LANSCE/WNR facility using neutron detector arrays and a charged-particle detector for the fission-fragment detection. A typical setup is shown in Fig. 1, where one of neutron detector array with a charged-particle detector is given.

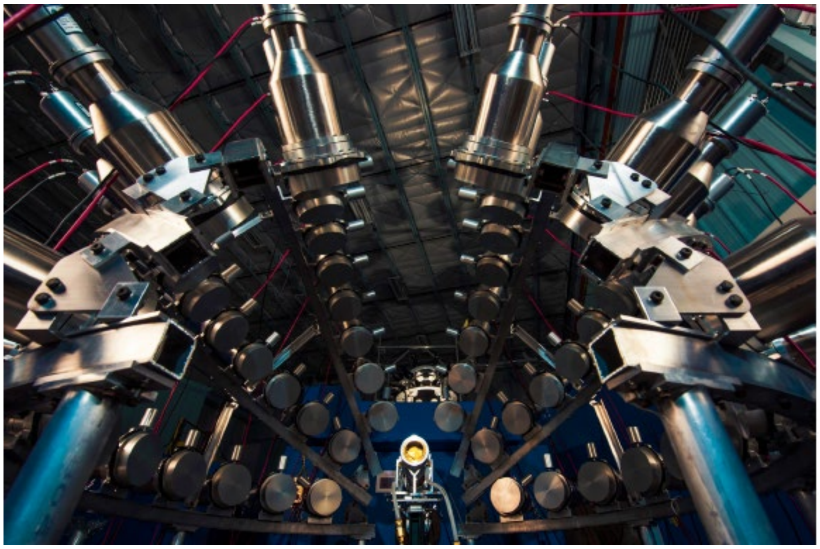


Fig. 1 An array of 54 liquid scintillators for the neutron detection surrounding multiple PPAC's, located in the lower center of picture, for the fission-fragment detection.

Major efforts were made in LLNL to develop such a charged-particle detector suitable for the proposed measurements. One critical requirement for this detector is to provide a precise timing for fission event, which can be provided by a gas counter running at avalanche mode. In addition, it also has other advantages such as the tolerance of a high α rate (up to a few of 10^7 /s) and the resistance of resulting radiation damage. A detector with 10 individual PPAC's (parallel-plate avalanche counters) packed in one enclosure was proposed and fabricated in LLNL. Stable operation of PPAC's was achieved by regulating the gas flow using a feedback monitoring loop installed in a gas handling system. The fission signals were processed by custom-made amplifiers of high gain and high bandwidth before sent to the digitizers in the data acquisition system.

For a successful campaign of measurements, the quality of target is one of determined factors. High quality and highly uniformed actinide targets were produced in LLNL using the electrodeposition method. In the past, targets of ^{235,238}U and ^{239}Pu were fabricated with the deposition on both sides of titanium foils. A total mass up to ~ 100 mg for each isotopes was distributed over 10 target foils before assembled into PPAC's. Lately a single-sided deposition on the titanium foil was developed for ^{240}Pu using the newly designed plating cell, shown in Fig. 2. A total of 12 target foils with mass ~ 1.6 mg each was fabricated for ^{240}Pu. A typical target foils is shown in Fig. 3 with thickness variation no more than 4%. The measurement of χ matrix for ^{240}Pu is scheduled in FY21. All target materials with purity higher than 99% were sourced from the Oak Ridge National Laboratory. These materials were then chemically purified to remove all but the nuclide of interest prior to deposition onto the titanium foil.

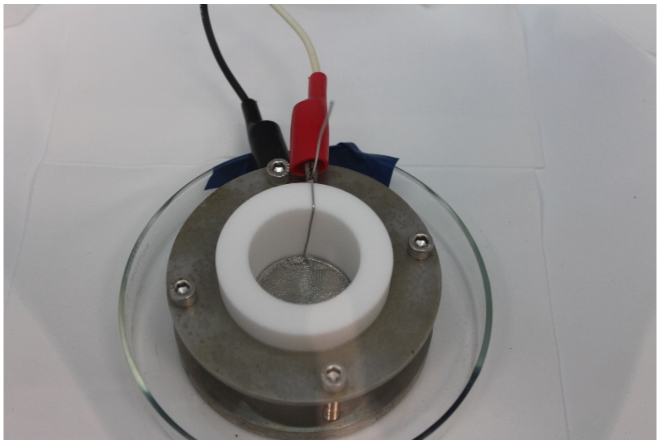


Fig. 2 The plating cell used for the electrodeposition of ^{240}Pu on titanium foil (black electrode) with platinum mesh as anode (red electrode).

The measurement has been completed for ^{235}U and ^{239}Pu and is ongoing for ^{238}U. The results for ^{239}Pu have been published and provided the most comprehensive and precisely determined χ matrix. The results will be published for ^{235}U soon and for ^{238}U and ^{240}Pu as well in the future. A similar measurement for ^{233}U is in proposal stage.

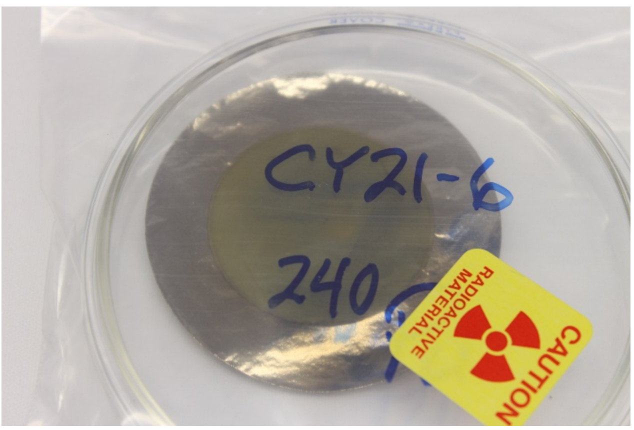


Fig. 3 ^{240}Pu target with a mass about ~ 1.6 mg over an area of 4 cm diameter was deposited on a titanium foil with an area of 6.35 cm diameter and 3 μm thickness.

NCSP Support for International Nuclear Criticality Safety Standards

The International Standards Organization (ISO) conducts plenary meetings annually to conduct business on ISO consensus standards. Under ISO Technical Committee 85 (TC85), "Nuclear Energy, Nuclear Technologies, and Radiological Protection," Subcommittee 5 (SC5), "Nuclear Fuel Cycle," Working Group 8 (WG8), "Nuclear Criticality Safety," there are eleven standards that are available to support the storage, handling, and processing of fissionable material outside of reactors. The COVID-19 pandemic has ruled out face-to-face meetings; however, a great deal of work is being completed virtually. The table below provides information on the ISO standards for NCS.

Current ISO WG8 Standards

Number	ISO Standard	Standard Title	Revision Date
1	ISO-7753:1987	Nuclear Energy – Performance and testing requirements for criticality detection and alarm systems	01-AUG-1987
2	ISO-14943:2004	Nuclear fuel technology — Administrative criteria related to nuclear criticality safety	01-OCT-2004
3	ISO-27467:2009	Nuclear criticality safety — Analysis of a postulated criticality accident	15-FEB-2009
4	ISO-27468:2011	Nuclear criticality safety — Evaluation of systems containing PWR UOX fuels — Bounding burnup credit approach	01-JUL-2011

5	ISO-11311:2011	Nuclear criticality safety — Critical values for homogeneous plutonium-uranium oxide fuel mixtures outside of reactors	01-JUL-2011
6	ISO-11320:2011	Nuclear criticality safety — Emergency preparedness and response	01-OCT-2011
7	ISO-16117:2013	Nuclear criticality safety — Estimation of the number of fissions of a postulated criticality accident	01-OCT-2013
8	ISO-1709:2018	Nuclear energy - Fissile materials - Principles of criticality safety in storing, handling and processing	01-FEB-2018
9	ISO-21391:2019	Nuclear criticality safety -- Geometrical dimensions for subcriticality control -- Equipment and layout	01-AUG-2019
10	ISO 22946:2020	Nuclear criticality safety — Solid waste excluding irradiated and non-irradiated nuclear fuel	08-JAN-2020
11	ISO 23133:2021	Nuclear criticality safety — Nuclear criticality safety training for operations	01-JAN-2021

In calendar year 2021, two virtual meetings were performed and work was completed on internal WG8 policies and procedures in addition to projects on proposed and active standards. Two proposed standards are currently going through the committee development phase: proposed risk assessment standard and a proposed standard for computational method validation. Several other standards are going through the revision process: ISO-1709:2018, ISO-7753:1987, ISO-16117:2013, and ISO-11311:2011. The next meeting is tentatively scheduled for May 2022. Doug Bowen volunteers his time to support the ISO standards as WG8 convenor, and the NCSP provides travel support, as necessary. Please contact Doug if you are interested in providing support to the ISO NCS standards.

ANS Winter Summary

The 2021 American Nuclear Society (ANS) Winter Meeting was conducted as a hybrid meeting (in-person and virtual) November 30 – December 3, 2021. The Nuclear Criticality Safety Division (NCSD) sponsored the technical session, "Recent Nuclear Criticality Safety Program Technical Accomplishments" on Wednesday, December 1 from 12:30 – 2:15 PM EST. These papers were presented at the NCSP Technical Program Review in February 2021, and were selected by the NCSP Manager as best papers to be presented at NCSP cost at the Winter ANS meeting. These and other papers presented at the 2021 NCSP Technical Program Review are available on the NCSP website, https://ncsp.llnl.gov/program-management/ncsp-quarterly-progress-reports-and-accomplishments/fy2021-tpr-presentations.

Presented papers included:

- "RPI LINAC refurbishment and upgrade project", Yaron Danon (Rensselaer Polytechnic Institute, (RPI)), Peter Brand (RPI), Michael Bretti (RPI), Brian Epping (Naval Nuclear Laboratory - KAPL), Timothy H. Trumbull (Naval Nuclear Laboratory - KAPL)
- "Low-energy Reactions of the n+233U Nuclear Compound System and its Initial Validation", Marco T. Pigni (Oak Ridge National Laboratory), Roberto Capote (International Atomic Energy Agency), Andrej Trkov (Jožef Stefan Institute)
- "Preliminary RAM-RODD results for the MUSiC subcritical configurations", Robert A. Weldon (Los Alamos National Laboratory (LANL)), Theresa E. Cutler (LANL), Joetta M. Goda (LANL), Jesson D. Hutchinson (LANL), William L. Myers (LANL), George E. McKenzie (LANL), Alexander T. McSpaden (LANL), Lauren Misurek (LANL), Rene G. Sanchez (LANL)
- "Design of Temperature-Dependent Critical Experiments with SPRF/CX", Justin B. Clarity (Oak Ridge National Laboratory (ORNL)), Ryan C. Gallagher (ORNL), Mathieu Dupont (ORNL), Chris W. Chapman (ORNL)
- "Photo Doppler Velocimetry and Gamma/Neutron Yield Measurements of Godiva-IV Critical Assembly", Lucas A. Snyder (Lawrence Livermore National Laboratory (LLNL)), Dan Bower (LLNL), Robert Buckles (Mission Support and Test Services (MSTS)), David

Fittinghoff (LLNL), Joetta M. Goda (LANL), Mark May (LLNL), Michael Pena (MSTS), John C. Scorby (LLLNL)

Special Issue of Nuclear Science and Engineering celebrates the Tenth Anniversary of Operations at NCERC

The National Criticality Experiments Research Center (NCERC) is a general-purpose critical experiment facility, the only one in the US and one a few that remain operational throughout the world. NCERC is located at the Nevada National Security Site (NNSS), formerly known as the Nevada Test Site, and is operated by Los Alamos National Laboratory (LANL). This year, NCERC celebrated its 10th year of operation.

To commemorate the first ten years of operations and experiments, a special issue of Nuclear Science and Engineering was prepared with papers focusing on each of the four critical assemblies and one on Radiation Test Object (RTO) measurements. A link to the open access issue can be found at https://www.tandfonline.com/toc/unse20/195/sup1?nav=tocList. Dr. Angela Chambers, the NCSP Federal Program Manager, authored the foreword for the special issue. An excerpt below provides a brief overview of the history of NCERC.

> "NCERC is the US's flagship, multi-functional, criticality experiments facility. It is one of two of DOE's remaining operational critical experiments facilities. NCERC's significant fissile material inventory and world class expertise support a variety of nuclear security missions, including nuclear criticality safety research and training, nuclear emergency response, nuclear nonproliferation, and support for other government agencies making it the only critical experiments facility of its kind in the Western Hemisphere.
>
> NCERC can trace its history back to the World War II days of the Manhattan Project's "Project Y" located at Los Alamos, New Mexico. The need for determining the critical mass for fissile materials and how that mass is affected by surrounding materials and conditions was evident during the early days of Project Y. Following two separate fatal accidents over the course of a year, in 1946, it also became evident that a way to conduct these experiments remotely was necessary to ensure the safety of the experimenters.
>
> Thus began an era of remotely operated critical experiments at Los Alamos' Pajarito Canyon, designated as Technical Area 18. Eventually, the facility became known as the Los Alamos Critical Experiments Facility (LACEF). For over 50 years, LACEF conducted an astounding number of experiments which contributed to a variety of programs related to the application of nuclear science and engineering, including space nuclear propulsion, basic measurement of nuclear parameters, kinetic behavior of chain reacting systems, nuclear weapons safety, nuclear criticality safety, development of radiation detectors, and training for the next generation of nuclear scientists and engineers.
>
> In the early 2000s, DOE decided to relocate the LACEF materials and equipment to the Device Assembly Facility at the Nevada National Security Site, formerly known as the Nevada Test Site. LANL staff began the arduous task of safely and securely disassembling and relocating the LACEF equipment and materials while working with NNSS staff to implement the necessary facility modifications and technical safety bases required to restart the operations."

The special issue was envisioned as a way to document the work done following relocation and place it within the historical context. It provides a resource to access references for the majority of the work performed over the decade. During the first 10 years of NCERC operations, almost 50 separate critical experiments have been performed utilizing the critical assemblies during 750 days of operations. Figure 1 shows the number of days of each assembly was operated each year. Approximately 20 subcritical experiments have also been performed. In addition to subcritical experiments, various measurement campaigns and training activities have been performed with RTOs, totaling more than 500 days of subcritical operations performed in the NCERC high bays. Figure 2 shows the number of days of subcritical operations performed each year.

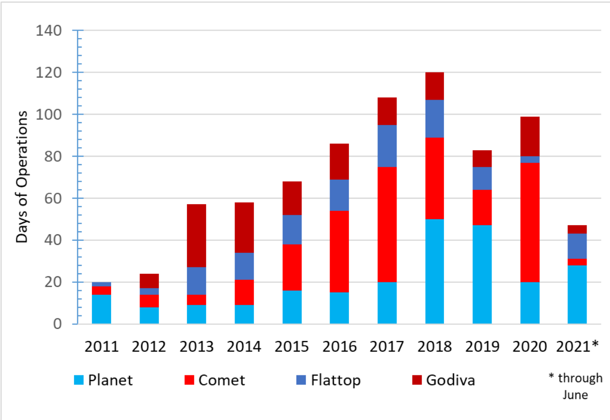


Figure 1: Critical Assembly Operations

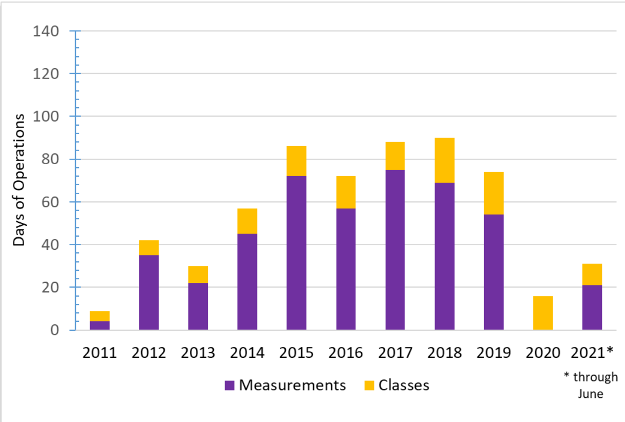


Figure 2: Subcritical Operations

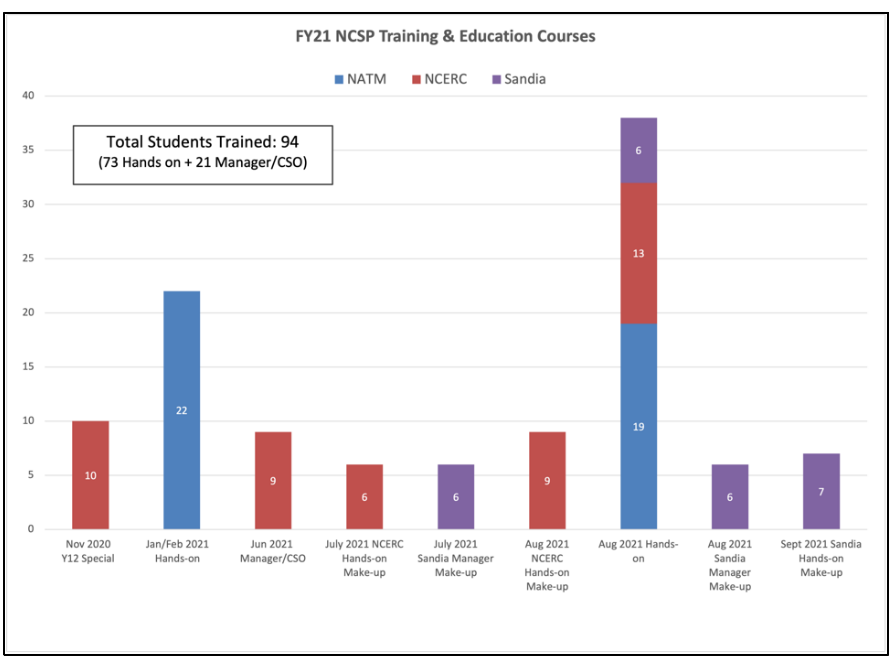
Papers in the special issue are presented in a sequence that corresponds to the order the critical assemblies achieved first critical at their new home at NCERC. Planet was the first assembly to perform a critical operation at NCERC, or anywhere in the Device Assembly Facility (DAF). First critical occurred on June 15, 2011. Comet, which has a similar operating principle to Planet, was next on August 11, 2011. Flattop, with its massive stationary and moveable reflectors required careful alignment, achieved critical on November 29, 2011 with the uranium core. Flattop's other existing core, composed of plutonium, was taken critical separately, several years later on August 9, 2016. The last critical assembly to achieve criticality at NCERC was Godiva IV on October 24, 2012. One year later the first super-prompt critical operation occurred with a Godiva burst on September 10, 2013. The last paper in this issue encompasses operations with Radiation Test Objects (RTO) and Inspection Objects (IO). By design, these operations remain subcritical at all times. RTO Operations actually began while the critical assemblies were being installed and dates back to 2007, before the adoption of the designation NCERC.

A challenge coin, shown in Figure 3, was designed to commemorate the 10th anniversary. It features an image of the Device Assembly Facility façade on one side and logos for the four critical assemblies plus RTOs on the reverse.

Figure 3: NCERC 10th Anniversary Challenge Coin Design

NCSP Training and Education

The NCSP held a total of 10 weeks of training in FY2021 despite the challenges of COVID-19. The NCSP Training and Education team did a great job conducting these 1- and 2-week courses in a very dynamic environment. The NCSP completes 8 weeks of training in a normal year; however, more courses were necessary in FY2021 to accommodate the backlog from course cancellations in FY2020 and early FY2021. A total of 94 students completed the training in FY2021 compared to only 39 in FY2020. In June 2021, the team also completed the NCERC Criticality Safety Officer (CSO)/Manager course pilot successfully with 9 students from Nuclear Fuel Services and Y-12. Six of the students taking the course were CSOs. The following chart provides information about the distribution of students in the courses over the last year or so. The "NATM" course, as shown in the chart, is the lecture portion of the 2-week hands-on course offered in January and August last fiscal year. Eight weeks of training (two 2-week hands on courses and two 1-week CSO/Manager courses) are currently planned in FY2022. *Report by Doug Bowen, NCSP Training and Education coordinator.*



Two-week Practitioner Course Dates:

Jan 31–Feb 11, 2022 – registration is open for Sandia, closed for NCERC (course to be held in person)
Aug 8–12, 2022 – registration is open (course to be held in person)

The first week (lectures and workshops) will held at the National Atomic Testing Museum (NATM) while the second week (hands-on portion) will be held at the National Criticality Experiments Research Center (NCERC) and Sandia National Laboratories. The courses are designed to meet the ANSI/ANS-8.26, "Criticality Safety Engineer Training and Qualification Program," requirement for hands-on experimental training. The NATM portion of the course involves virtual classroom lectures and workshops for NCS Evaluation development and the NCERC and SNL portions of the course involve hands-on experiments with the critical assemblies. MSTS, LANL, ORNL, LLNL, SNL, Y12 and NFO staff participate in the course execution.

One-week Manager's Course Dates:

SANDIA Manager Course – Apr 4-8, 2022 (course to be held in person)
NCERC Manager Course – Jun 6-10, 2022 (course to be held in person)

The courses are designed for fissile material handlers, process supervisors, line managers and regulators with criticality safety responsibilities. Mission Support and Test Services (MSTS), LANL, ORNL, LLNL, SNL, Y12 and Nuclear Facility Operator (NFO) staff participate in the course execution.

MCNP® Courses

Class Information: https://mcnp.lanl.gov/classes/classinformation.shtml

Fees and Registration Information:
https://laws.lanl.gov/vhosts/mcnp.lanl.gov/classes/CostsRegistrationInfo.shtml

Jan 31 – Feb 4, 2022	OECD/NEA-hosted MCNP6 Intermediate (online)
Feb 7 – 11, 2022	OECD/NEA-hosted MCNP6 Advanced (online)
Apr 11 -15, 2022	Intermediate MCNP6 (online)
Jun 6 – 10, 2022	Introduction to MCNP6 (online)
Jun 20 – 23, 2022	Criticality Calculations with MCSNP6 (online)

SCALE Winter Courses

Class Information: https://www.ornl.gov/scale/training
Fees Information: https://www.ornl.gov/file/fall-2021-registration-fees/display
Registration: https://utconferences.eventsair.com/virtual-scale-spring-2022/virtual/Site/Register

Feb 14 – 17, 2022	SCALE/ORIGEN Standalone Fuel Depletion, Activation, and Source Term Analysis (online)
Feb 21 – 25, 2022	Polaris/PARCS for LWR Core Analysis (online)
Feb 28 – Mar 3, 2022	SCALE Criticality Safety Calculations (online)
Mar 7 – 10, 2022	SCALE Criticality Safety and Radiation Shielding (online)
Mar 14 – 17, 2022	SCALE Sensitivity and Uncertainty Analysis for Criticality Safety Assessment and Validation (online)