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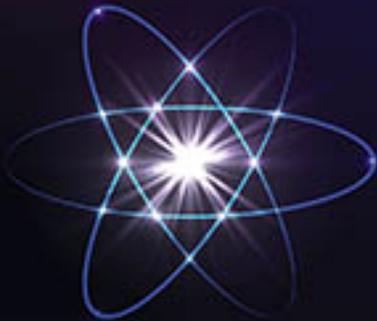
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**DATES TO REMEMBER**

Hands-On Training & Education Course Dates:  
Two-week Practitioner Course Dates:  
Aug 9-20, 2021  
Jan 31–Feb 11, 2022      Aug 8-19, 2022

One-week Manager's Course Dates:  
Jun 7-11, 2021

Course Registration:  
[https://ncsp.llnl.gov/trng\\_apply.php](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](#)
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**A Message from the NCSP Execution Manager**

Summer is officially here, which is the busiest time of the year for the NCSP. We have some big activities on the horizon for the summer – to name a few:

- MCNP™ User Symposium,
- SCALE User Workshop,
- NCSP Training and Education COVID makeup sessions, 1-week NCERC Criticality Safety Officer/Manager course (completed in June) and the August 2-week NCS Engineer hands-on course,
- 5-year plan development and FY2022 budget planning, and
- TEX-Plutonium Thermal Scattering Law critical experiments at the NCERC.

The annual Budget Execution Meeting is now being planned virtually and look forward to starting up our face-to-face integral experiment meetings twice per year at Sandia National Laboratory and Los Alamos National Laboratory. Hope everyone has a great summer and stay safe!

– Doug Bowen, ORNL

**Annual NCSP Budget Execution Meeting**

For the second year due to the COVID-19 pandemic, the annual NCSP Budget Execution meeting will be hosted virtually by ORNL on Wednesday, July 28<sup>th</sup>, and Thursday, July 29<sup>th</sup>. The FY2022 NCSP budget will be finalized during the meeting and will allow the management team to finalize the main and integral experiment 5-year plans by August 15<sup>th</sup>. The meeting is by invitation only and an agenda will be sent out in the near future.



## NCSP Technical Program Review and Joint Meetings

This year's NCSP Technical Review Program (TPR) was hosted virtually by Oak Ridge National Laboratory (ORNL), February 23 – 25, 2021. The [agenda](#) accommodated a total of 68 presentations from international collaborators, NCSP task managers, and technical principal investigators. More than 180 people registered for the TPR and the meeting averaged about 110 attendees over the three-day period. The [presentations](#) are now available.



## A Message from the Criticality Safety Support Group

The Criticality Safety Support Group (CSSG) has been working on Tasking 2021-01 related to a proposed Criticality Safety Coordinating Team (CSCT) drafted revision to DOE-STD-1134. It is anticipated that the Tasking response will be complete and available on the NCSP website very soon. All CSSG taskings and responses are found on the NCSP web site at [https://ncsp.llnl.gov/cssg\\_tasking.php](https://ncsp.llnl.gov/cssg_tasking.php).

We would also like to announce a change in CSSG leadership and a new member.

- Beginning in October, the start of FY22, David Hayes will be moving into the Chair seat and Mikey Brady-Raap will be taking over as the Deputy Chair of the CSSG. We look forward to their leadership. We thank David Erickson for his support as the Chair for the past few years.
- Beginning in October, Kevin Kimball will transition to Emeritus status. To support this change the CSSG formed a nominating committee, then solicited, and received, applicable resumes from many qualified individuals. After significant discussion two candidates were selected to forward to the full CSSG for consideration. We congratulate **Kevin Reynolds, Y12**, as the new CSSG member. We would also like to thank all applicants for their time and look forward to future opportunities to engage with them. Please visit the CSSG web page, <https://ncsp.llnl.gov/cssg.php> to read Kevin's bio.

## Congratulations!

### Excellence Award Program

The Office of Safety, Infrastructure and Operations (NA-50) established an annual Excellence Award program to recognize teams and individuals for exceptional accomplishments in support of NA-50 efforts to achieve the National Nuclear Security Administration mission. The NA-50 Excellence Award winners are recognized for outstanding accomplishments involving innovation, effectiveness, teamwork, overcoming adversity, and enabling future success. This year, the NCSP program had the following winners and we want to add our congratulations on a job well done.

- Theresa Cutler, LANL – TEX HEU Experiment During COVID-19 Team
- Jesse Norris, LLNL – TEX HEU Experiment During COVID-19 Team
- Catherine Percher, LLNL – TEX Plutonium Benchmark Team

### David Brown, Brookhaven National Laboratory

On June 1<sup>st</sup>, 2021, David Brown will become the Head of the National Nuclear Data Center, Chair of the US Nuclear Data Program and Chair of the Cross Section Evaluation Working Group. David replaces Alejandro Sonzogni in these functions.

David Brown obtained his PhD degree from Michigan State University in 1998, was a post-doc at the Institute for Nuclear Theory at the University of Washington in Seattle for two years, and post-doc at Lawrence Livermore National Laboratory before being converted to a staff scientist in 2003. He left Livermore to join Brookhaven National Laboratory in 2011. He has been the Manager of the Evaluated Nuclear Data File library for 8 years and NNDC Deputy Head since 2018.



### Catherine Percher

Catherine Percher is the new NCSP Task Manager for Lawrence Livermore National Laboratory (LLNL), taking over for David Heinrichs. While new to the official task manager role, Catherine is not new to the NCSP or criticality safety. Catherine has been a staff member of the Nuclear Criticality Safety (NCS) Division at LLNL for 14 years, starting as an NCS engineer supporting fissile material operations. For the past 10 years, she has been supporting the NCSP mission, mainly in the area of integral experiment design and benchmarking. She also serves as an instructor for the NCSP's hands-on criticality safety training courses.



Catherine is very active in the American Nuclear Society, serving as the NCS Division chair in 2019/2020 and various roles on the Executive Committee. She has been active in NCS standards development and is a member of the ANS Subgroup 8 Consensus Committee. She is currently serving as the General Chair and leading the planning of the next NCSD Topical meeting, to be held in Anaheim, CA in June 2022. Catherine received her B.S. in Nuclear Engineering from MIT and an M.S. in Nuclear Engineering from the University of California, Berkeley. Before coming to LLNL, Catherine completed the professional development program at the Defense Nuclear Facilities Safety Board.

## MUSiC: Measurement of Uranium Subcritical and Critical

The Measurement of Uranium Subcritical and Critical (MUSiC) has been completed at the DOE's National Criticality Experiments Research Center (NCERC) located in the Nevada National Security Site (NNSS). The primary goal of the campaign was to perform benchmark measurements of similar highly enriched uranium (HEU) systems that span a wide range of reactivities. This was accomplished by measuring ten configurations of the Rocky Flats shells (93.16% U-235 enriched hemishells) with effective multiplication factors spanning between deeply subcritical ( $\sim 0.64$ ) through delayed critical. Details of the measured configurations are listed in Table 1. Pictures of assembling a configuration and members of the crew are shown in Figure 1.

*Table 1. Configurations of the Rocky Flats shells measured with estimates of the multiplication.*

Configuration	Shells	Mass (kg)	Multiplication	$k_{eff}$
1	3-24	13.0428	2.8	0.64
2	3-30	21.6432	3.9	0.74
3	3-34	29.0415	5.3	0.81
4	3-38	37.9617	8.3	0.88
5	3-40	42.9722	11.4	0.91
6	3-42	48.4099	18.4	0.95
7	3-44	54.2785	46.6	0.98
8	3-46 (60 mil spacer)	60.6183	Critical	>1
9	3, 5-46 (24 mil spacer)	60.4438	Critical	>1
10	9-46	59.2075	>150	0.99

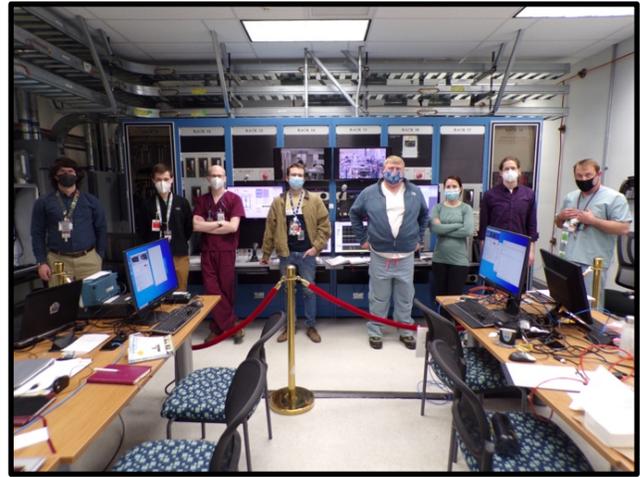


Figure 1. (Left) Experiment assembly. (Right) MUSiC support crew.

The experiment consisted of an 8-week campaign that was split into two phases. The first phase was executed December 7-17. The goal of the first phase was to determine (1) the configurations that would be used for the critical measurements, (2) the reactivity worth per unit separation, and (3) the reactivity worth for aluminum replacement hemishells. The second phase consisted of the main measurement campaign and was executed over 6 weeks of operations between February 16<sup>th</sup> and April 2<sup>nd</sup>. The campaign achieved a high degree of success despite setbacks due to Covid-19 and last-minute facility-dictated scheduling changes.

The experiment setup for phase 2 is shown in Figure 2. Three sets of measurements were performed for each subcritical configuration: passive, passive with a Cf-252 source at the center of the Rock Flats shells, and active performed with a DT generator. Measurements were performed with 3 NCERC detector systems and 1 University of Michigan system including a NoMAD, an array of 4 small-volume He3 tubes, the Rossi-alpha measurement rapid organic (n, gamma) discrimination detector (RAM-RODD), and the Organic Scintillator Array (OSCAR) which was operated by graduate students from Michigan. The various detection systems will provide a unique opportunity for cross-validation and obtaining results independent of a specific detector system.

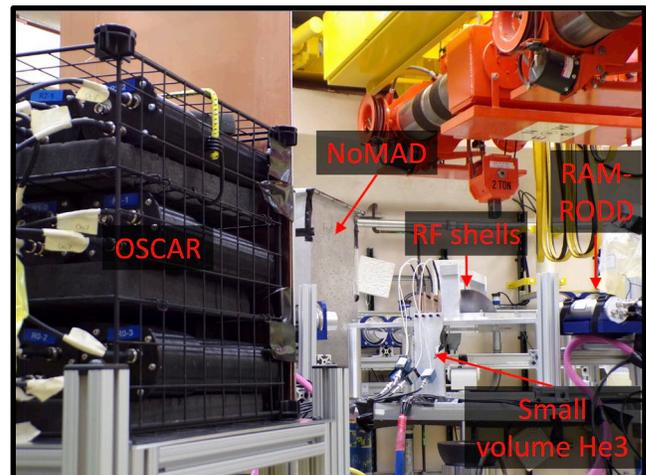
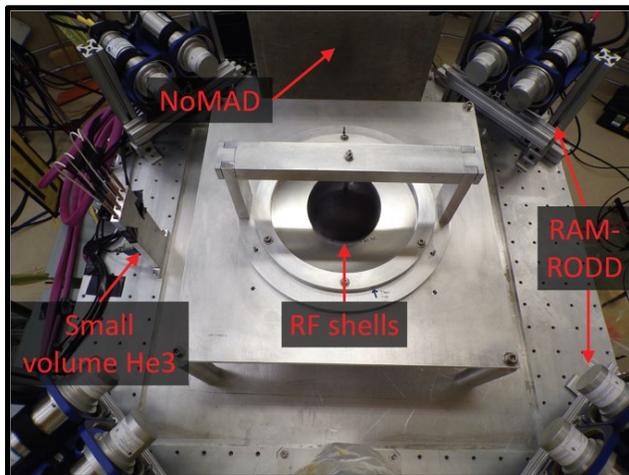


Figure 2. Experiment setup. (Left) View from above. (Right) View from the side with all detector systems visible.

MUSiC is a very simple HEU system, and therefore, the measurements will provide valuable results for nuclear data validation. We are currently in the process of analyzing the large amount of measured data including performing neutron noise analysis methods such as Feynman variance-to-mean, Rossi-alpha, and neutron pulsed source with data from each detector system. The large range of reactivities measured and the number of different detector systems employed makes the results from MUSiC of value to many in the scientific community. We are in the process of preparing several publications for peer-review based on the results of these measurements. The MUSiC experiment will also be evaluated as both a critical and one or more subcritical benchmarks for the ICSBEP Handbook. That work has also begun.

## **University of New Mexico Pipeline for Criticality Safety Professionals (FY2021 LANL TE6 task)**

In 2016, the Nuclear Criticality Safety Division (NCSD) at Los Alamos National Laboratory (LANL) identified a need for an accelerated academic and experience-based program to attract, educate, and retain a workforce capable of fulfilling LANL's nuclear criticality safety mission. This program was developed in part to address rising attrition rates of nuclear criticality safety engineers, but also to stabilize LANL's NCSD.

The industry-wide nuclear criticality safety discipline anticipates significant attrition over the next 2 decades. According to a recent compensation study by the American Nuclear Society's (ANS) Nuclear Criticality Safety Division, more than 50 percent of criticality safety engineers have more than 21 years of professional experience; the age of criticality safety engineers is skewed toward those nearing the end of their career. [1] Additionally, LANL's NCSD experienced significant attrition from 2011-2012. Even following aggressive recruiting and retention efforts over the subsequent five years, staffing levels had not stabilized enough to robustly support laboratory operations.

LANL envisioned a student pipeline program that would build awareness of nuclear criticality safety as a profession with university students, address current and future staffing shortages in the National Nuclear Security Administration (NNSA) complex, and provide mentoring and teaching opportunities to current LANL criticality safety engineers. This pipeline program would develop academic coursework for upper-level engineering classes with teaching and mentoring collaboration from other Department of Energy (DOE) sites such as the Y-12 National Security Complex and Lawrence Livermore National Laboratory (LLNL).

Through the pipeline courses, students are provided with collaborative learning opportunities in traditional in-person settings as well as virtual learning platforms with both practicing criticality safety engineers and experienced engineering professors. The students receive instruction in basics such as DOE regulations, ANS standards, criticality safety parameters, control development, hand calculations, criticality calculations using MCNP, and process condition analysis. Students are also assigned a sample Criticality Safety Evaluation Document (CSED) as a final project, working closely with a criticality safety engineer to develop.

The first three years of the university pipeline program have been very successful. More than 80 upper level-classmen have been introduced to nuclear criticality safety at four universities; New Mexico State University (2017), Idaho State University (2018), Texas A&M University (2017 – Present), University of California – Berkeley (2018 – Present). Through this coursework, more than 20 students have participated in summer internships where they developed CSEDs and other technical documents with a qualified co-author. Some students

have been invited to continue working for LANL part-time through the following year. Seven summer interns have been offered full-time positions; two of which have reached full qualification. This program has also resulted in the issuance of more than thirty CSEDs for operations at LANL and eight other technical documents, delivering real mission impact while developing the students.

In the spring of 2020, a team of LANL criticality safety engineers met with Dr. Christopher Perfetti of the University of New Mexico (UNM) to discuss a future pipeline with UNM. The team [Figure 1] was able to meet and interact with some of the students as well to get their feedback on a pipeline program with the possibility of a future in nuclear criticality safety within the DOE complex. Many students were very receptive to the suggestion and curious to learn more about careers in nuclear criticality safety.

After further discussion with UNM staff, information comprising on-the-job experiences and various philosophies pertinent to practicing nuclear criticality safety was pulled together to compliment Dr. Perfetti's [Figure 2] academic teachings in his *Nuclear Criticality Safety Lectures*. During the fall 2021 semester, and for the foreseeable future, the team plans to interact with Dr. Perfetti's students to provide discussion panels and guidance on how to pursue a future in nuclear criticality safety. The team will also be collaborating with Dr. Perfetti to present material they have prepared and share of their experience and knowledge.



**Figure 1: Left to Right: Bill Crooks (NCS Division Leader), Norann Nell Calhoun, Kaelin Glover, Mandy Bowles-Tomaszewski, Ryan Kamm, Kristy Yancey Spencer**

In addition to supporting the *Nuclear Criticality Safety Lectures*, LANL's NCSD is developing a master's thesis topic that would enable a UNM graduate student to pursue research aligned with nuclear criticality safety focus areas. The graduate student will be mentored by qualified analysts within the NCSD, and Dr. Kristy Spencer will serve as the LANL graduate advisor for the student. The goals of this pilot program are to fund the UNM student through a significant professional development milestone and to recruit the student into the field of nuclear criticality safety.



**Figure 2: Dr. Christopher Perfetti (UNM Assistant Professor)**

## References

(1) LA-UR-17-24422. *Los Alamos National Laboratory Nuclear Criticality Safety Pipeline for Expedited Qualification of Personnel*. Andrew R. Wysong, Mary Beth Lujan, Alicia Salazar-Crockett, Travis A. Smith. 2017-06-01

## IER 497 CAAS Testing Work at NCERC for Y-12

A report entitled "UPF and Y-12 Criticality Accident Alarm System (CAAS) Radiation Testing Report" was released by Consolidated Nuclear Security LLC in March 2021. Information from the Introduction and Conclusion follow.

This report documents the experimental conditions and results for the testing of the Mirion Technologies CAAS-3S Criticality Accident Alarm System (CAAS) for the Y-12 National Security Complex (Y-12) and Uranium Processing Facility (UPF). The testing was conducted at the Godiva IV Burst Reactor at the National Criticality Experiments Research Center (NCERC) at the Nevada National Security Site (NNSS) during the week of January 11, 2021. The testing was conducted in accordance with 25774-QL-POA-JR00-00002-VDE-27.0, CAAS-3S Radiation Testing of Cabinet Components Test Plan. The tests subjected the CAAS-3S system to intense and short duration mixed neutron and gamma radiation fields and to high integrated radiation doses. The purpose of the test was to environmentally qualify various CAAS-3S components in a radiation environment.

Successful completion of the tests was predicated on the collaborative efforts of several organizations. Sandia National Laboratory (SNL) and Lawrence Livermore National Laboratory (LLNL) provided dosimetry to estimate photon and neutron dose. Los Alamos National Laboratory (LANL) manages the NCERC facility, operated the Godiva IV reactor, and provided field support for CAAS-3S placement and communications interface for data acquisition systems supplied by Mirion Technologies. Throughout the test campaign, Y-12 and UPF personnel provided technical support in determining changes to the test schedule, as needed, interpretation of the results, and comparison between the measured dosimetry data and predicted results. Throughout the test campaign, Mirion personnel provided technical support in the operation of the CAAS-3S system itself.

## Training and Education

### Two-week Practitioner Course Dates:

***Aug 9-20, 2021 – Class is full***

***Jan 31–Feb 11, 2022 – registration is open***

***Aug 8–12, 2022 – registration is open***

The first week (lectures and workshops) will be 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 course is 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. Due to COVID-19, there will be limits on the number of students attending the course. MSTS, LANL, ORNL, LLNL, SNL, Y12 and NFO staff participate in the course execution. Due to COVID-19, the first week of the 2-week course may be held virtually.

### One-week Manager's Course Dates:

**NCERC Manager Course – Jun 7-11, 2021 (course was held in person)  
New course dates for FY2022 not yet available**

The NCERC Manager Course in June is slated to be the course pilot for a new content applicable to Criticality Safety Officers (CSOs) in addition to process supervisors, NCS managers, regulators, and others with NCS program responsibilities.

The 1-week Manager/CSO 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® 2021 User Symposium

The 2021 MCNP® User Symposium will be held virtually via Webex during the week of July 12th. There will be no registration fee, but registration is required and available at [www.lanl.gov/mcnp2021](http://www.lanl.gov/mcnp2021). The deadline to register is June 28 (registration for non-US citizens has already closed).

The symposium will include presentations from the MCNP development team and from MCNP users internal and external to Los Alamos. We have received over 50 abstracts from MCNP users throughout the world. We expect to post a preliminary agenda on the above website by June 14.

Please direct any questions or comments to [mcnp2021@lanl.gov](mailto:mcnp2021@lanl.gov).

### 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>

Aug 16 – 20, 2021	Introduction to MCNP6 (online)
Aug 30 – Sept 1, 2021	Using NJOY to Create MCNP ACE Files & Visualize Nuclear Data (online)
Oct 4 – 8, 2021	Intermediate MCNP6 (online)

Oct 18 – 22, 2021	Unstructured Mesh with Attila4MC (online)
Nov 15 – 19, 2021	Introduction to MCNP6 (online)
Nov 29 – Dec 1, 2021	Variance Reduction with MCNP6 (online)



## SCALE Users' Group Workshop

Registration, <https://scalemeetings.ornl.gov/register/>, is open for the 5<sup>th</sup> annual SCALE Users' Group Workshop that will be held virtually from Oak Ridge National Laboratory August 4-6, 2021. Please see the meeting website at <https://scalemeetings.ornl.gov> for registration and draft agenda. The meeting will be offered free of charge to participants. Registration is limited to a total of 200 participants and each tutorial session is open to a maximum of 25 registrants.

You are invited to participate in the meeting and contribute with presentations and discussions on impactful and innovative applications of SCALE. In addition to technical sessions and ten hands-on tutorials, we will host the "SCALE Open Mic" session where participants can present lightning talks and engage the audience in lively Q&As and the "Best SCALE Model Contest" which provides an opportunity for all end users to present their most innovative models and compete for special recognition. The models presented last year are showcased in a 2021 SCALE calendar, [https://scalemeetings.ornl.gov/wp-content/uploads/2021/04/SCALE\\_Calendar\\_2021\\_DIGITAL.pdf](https://scalemeetings.ornl.gov/wp-content/uploads/2021/04/SCALE_Calendar_2021_DIGITAL.pdf). All are welcome to contribute to the new "SCALE Validation" session with interesting applications and comparisons between calculations and measurements.

Any related inquiries are welcome at [scalehelp@ornl.gov](mailto:scalehelp@ornl.gov).

## SCALE Fall Courses

The next training block to be held by ORNL will be in October - November 2021. At this time we have no certainty on whether the training will be in-person, virtual, or hybrid.

Oct 11 – 15, 2021	SCALE/TRITON Lattice Physics and Depletion
Oct 18 - 22, 2021	SCALE/ORIGEN Standalone Fuel Depletion, Activation, and Source Term Analysis
Oct 25 - 29, 2021	SCALE Computational Methods for Burnup Credit
Nov 8 - 12, 2021	Nuclear Data Fundamentals and AMPX Libraries Generation