



Overview of the US DOE Nuclear Criticality Safety Program (NCSP)

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Presentation Outline



- History and drivers for US Nuclear Criticality Safety Program (NCSP)
- NCSP management and organization structure
- Expert advisors to the NCSP
- Collaborations – Domestic and International
- Program work structure – Technical Program Elements
- Non-destructive Assay (NDA) Program
- NCSP website overview
- Summary

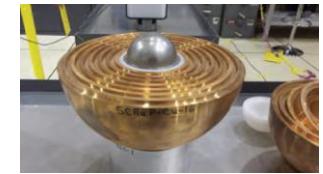


NUCLEAR CRITICALITY SAFETY PROGRAM
U.S. DEPARTMENT OF ENERGY

<https://ncsp.llnl.gov/>
<https://nda.llnl.gov>



Hot CMM measurements of the Flattop critical assembly natural uranium reflector to support a benchmark evaluation



The SCR α P Cu Reflected Pu Subcritical Measurement

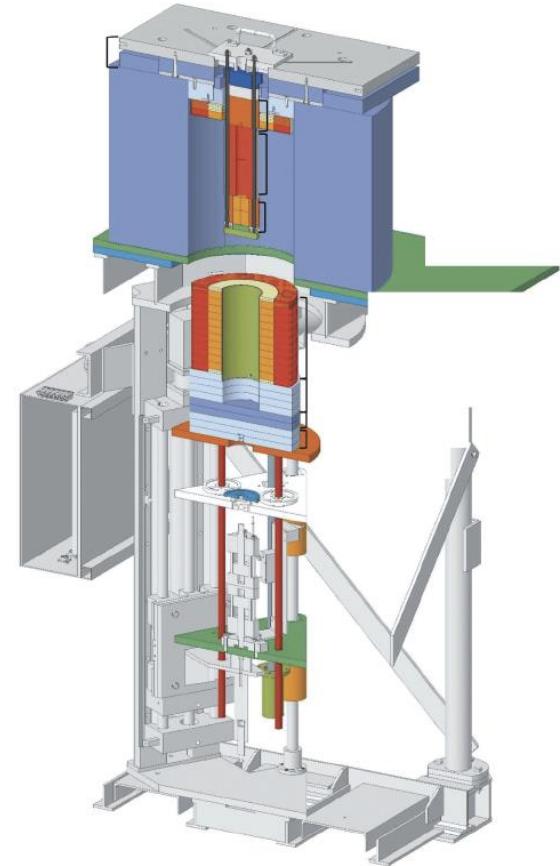
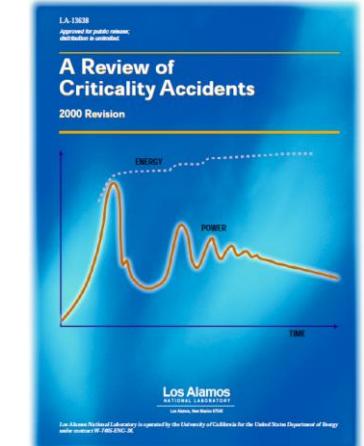
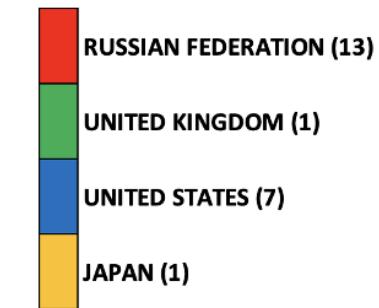
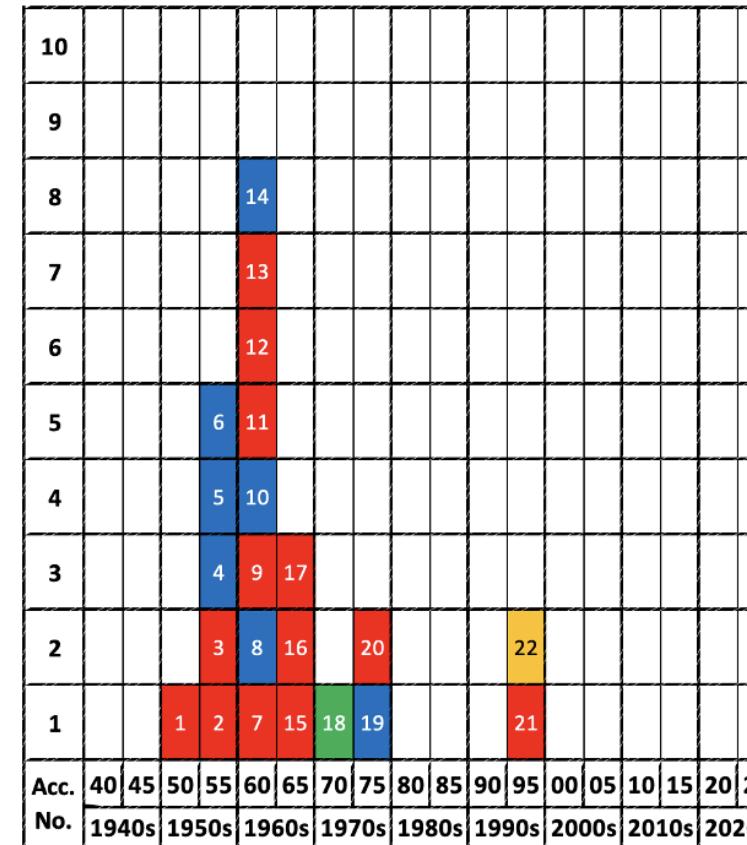


Fig. 14. Cutaway diagram of the KRUSTY experiment on the Comet assembly.

KRUSTY Critical Experiment on COMET Critical Assembly – Joint NASA/NCSP Experiment Nuclear Science and Engineering, Volume 195, Supplement 1, 2021.

What is a Criticality Accident and Why We Care about Nuclear Criticality Safety

- **Criticality Accident:** the release of energy as the result of inadvertently producing a self-sustaining or divergent chain reaction
- 22 Process Facility Criticality Accidents
 - 21 involving solution/slurry (4 chemistry “gone bad”)
 - 1 involving metal ingots
 - 0 involving powders, transportation, or storage
- Consequences
 - 9 deaths (US-2, Japan-2, and Russia-5)
 - 3 personnel required limb amputations

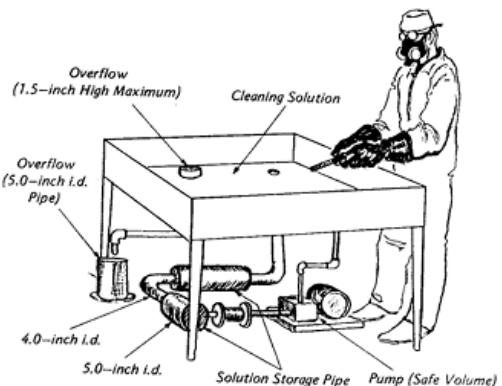


The chronology of process criticality accidents worldwide since the beginning of the nuclear age.

NCSP Assists with Worker/Public Safety



- **Primary purpose of Nuclear Criticality Safety is to protect workers and the public of this unique radiological hazard handling fissile material outside of a nuclear reactor**
- There is significant regulatory structure for Nuclear Criticality Safety
 - 10 CFR Part 50 – Domestic Licensing of Production and Utilization Facilities
 - 10 CFR Part 70 – Domestic Licensing of SNM
 - 10 CFR Part 71 – Packaging & Transportation
 - 10 CFR Part 830 – Nuclear Safety Management
 - NRC/**DOE** regulations & guidance documents



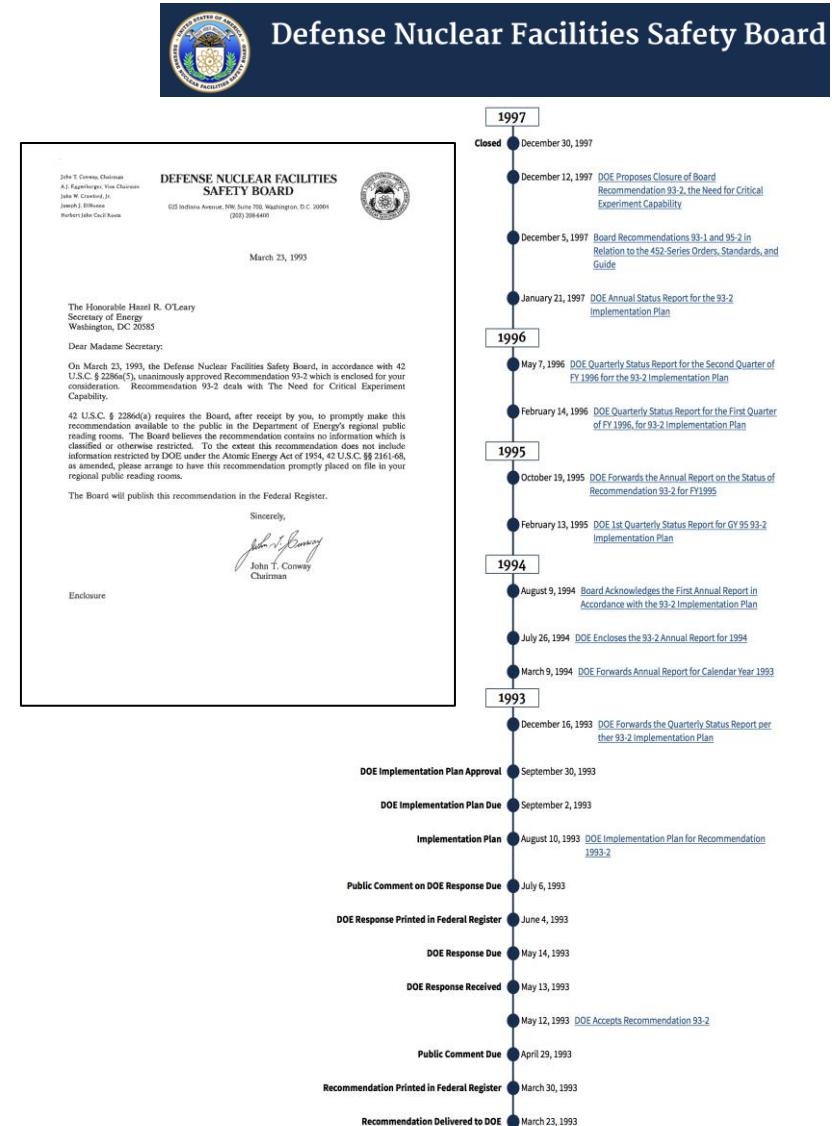
Background / History



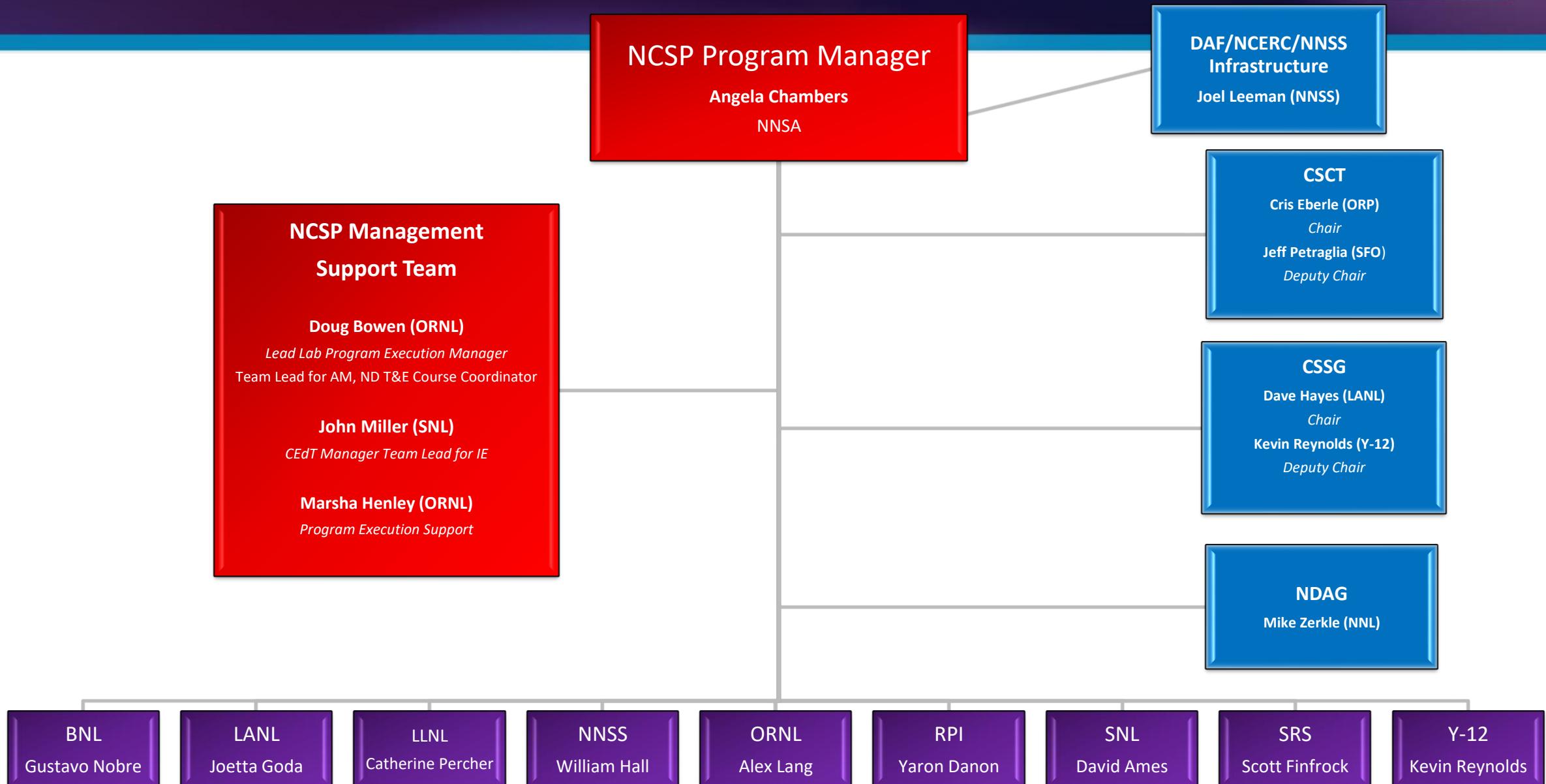
- Defense Nuclear Facilities Safety Board (DNFSB)

Recommendations 93-2 and 97-2:

- 93-2 (3/23/1993): Need for a general-purpose critical experiment capability that will ensure safety in handling and storage of fissionable material.
- 97-2 (5/19/1997): Need for improved criticality safety practices and programs to alleviate potential adverse impacts on safety and productivity of DOE operations.
- 97-2 encompassed ongoing DOE activities of 93-2 while broadening scope to address important cross-cutting safety activities needed to ensure NCS throughout the Complex.
- **DOE Implementation Plan for Board Recommendation 93-2 and 97-2 resulted in establishment of the US Nuclear Criticality Safety Program (NCSP)**
 - ORNL has had a significant role since this time to lead and expand the NCSP



NCSP Organization Chart



DOE/NNSA NCSP 10-yr. Mission and Vision



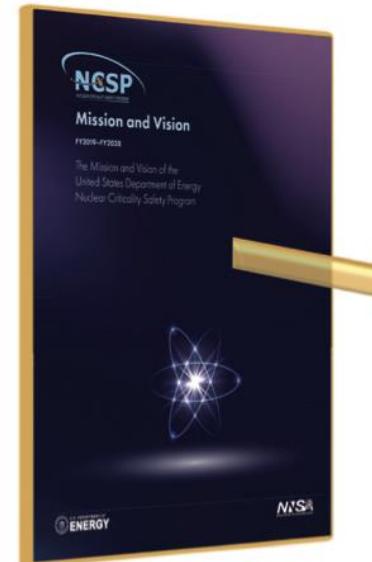
• Mission

- Provide sustainable expert leadership, direction and the technical infrastructure necessary to develop, maintain and disseminate the essential technical tools, training and data required to support safe, efficient fissionable material operations within the Department of Energy.

• Vision

- Continually improving, adaptable and transparent program that communicates and collaborates globally to incorporate technology, practices and programs to be responsive to the essential technical needs of those responsible for developing, implementing and maintaining nuclear criticality safety

10-Year Mission & Vision



5-Year Plan



Work Tasks



FY2024 NCSP "Make It Happen List"



Five Year Execution Plan –
for the
Mission and Vision
of the
United States Department of Energy
Nuclear Criticality Safety Program

February 2024, Revision 1

FY 2024 through FY 2028

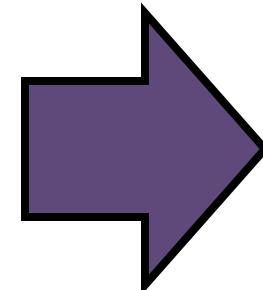
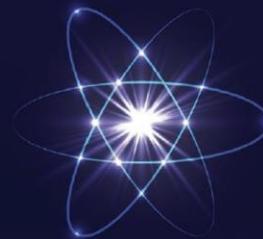


Table 2.4 NCSP "Make-It-Happen" List for FY2024

No.	Milestone	Technical Program Element	Lead Site
1	CAAS testing with GODIVA IV (IER 605)	IE	AWE/LLNL/LANL
2	Fabricate and test cooling design for the TEX/MOX experiment (IER 296)	IE	IRSN/LANL/LLNL
3	Complete control room upgrades at NCERC*	IE	LANL
4	Submit benchmark evaluation of experiments for the Flattop benchmark series (IER 423)	IE	LANL
5	Complete measurement campaign (IER 153)	IE	LANL
6	Submit benchmark to independent reviewer(s) (IER 537)	IE	LANL
7	Complete measurements for TEX/CI (IER 499)	IE	LANL/LLNL
8	Complete measurements for GODIVA IV Shielding Benchmark (IER 498)	IE	LANL/LLNL/ORNL
9	Additional Manager/CSO hands-on courses due to heightened demand	IE	LANL/ORNL/LLNL/SNL
10	Complete GODIVA characterization report (IER 574)	IE	LANL/SNL
11	Submit benchmark evaluation for publication (IER 532)	IE	LLNL
12	Perform AFFRI dosimetry intercomparison international exercise (IER 484)	IE	LLNL/IRSN/AWE
13	Submit benchmark evaluation of epithermal experiments (IER 441)	IE	SNL
14	Publish revision of the manual governing NCSP Integral Experiments	IE	SNL
15	Final release of ENDF/B-VIII.1 Nuclear data library	ND	BNL
16	Complete DICER transmission measurements of Pu-239 at LANSCE	ND	LANL
17	Complete fabrication of the U-233 PPAC	ND	LLNL
18	Complete Zr-92 nuclear data measurements at GELINA	ND	ORNL
19	Validation of accelerator structure design with completion of accelerator section #1 site acceptance testing at RPI. (RPI ND3)	ND	RPI/NNL

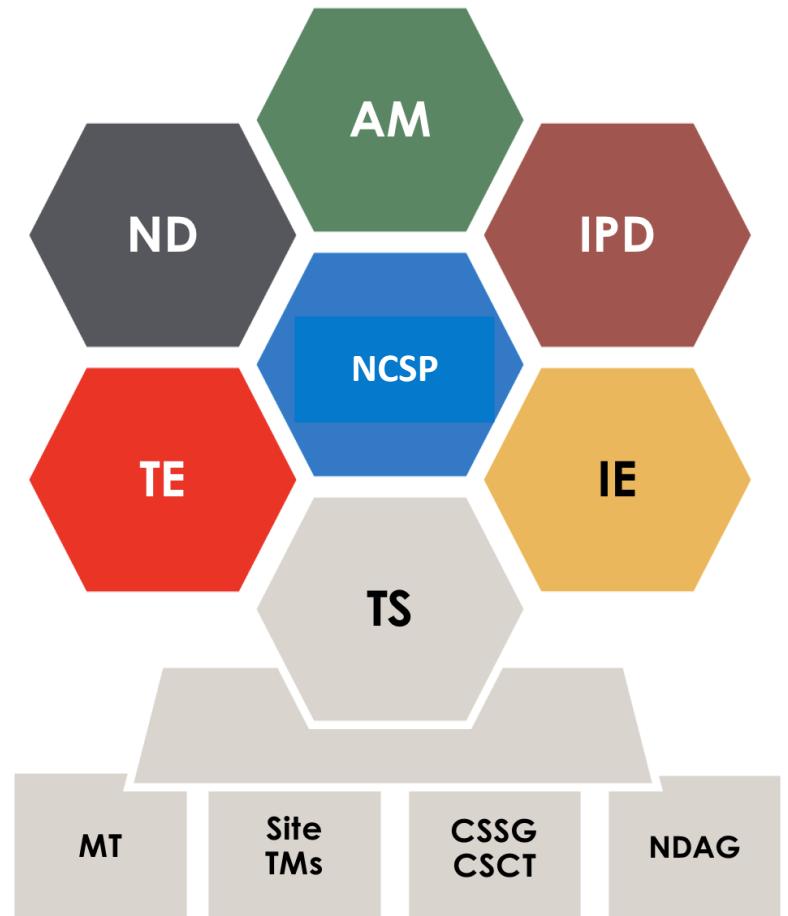
*Funding for control room upgrades provided by NA-19's Capabilities-based Investment Program (CBI)

NCSP Technical Program Elements (TPM)



NCSP Budget: ~\$30M

- **Analytical Methods (AM) – 15% of budget**
 - Maintain and improve the Production Codes and Methods for Criticality Safety Engineers (MCNP/SCALE, NJOY/AMGX)
- **Nuclear Data (ND) – 13% of budget**
 - Perform Measurements of Basic Nuclear (Neutron) Physics Cross-Sections and Generate New Evaluated Cross-Section Libraries and Covariance Data for Use in Production Criticality Safety Codes
- **Information Preservation and Dissemination (IPD) – 4% of budget**
 - Protects Valuable Analyses and Information Related to Criticality Safety (includes ICSBEP)
- **Integral Experiments (IE) – 52% of budget**
 - Critical and Subcritical Experiments at the Critical Experiments Facility (CEF) at the Device Assembly Facility (DAF) in Nevada and Sandia National Laboratory Pulse Reactor Facility—provides integral tests of codes and data
- **Training and Education (TE) – 6% of budget**
 - Web-based training modules and 1- & 2-week Hands-On Criticality Safety courses for Criticality Safety Engineers, Line Management, and Oversight Personnel
- **Technical Support (TS) – 10% of budget**
 - Managerial and technical support



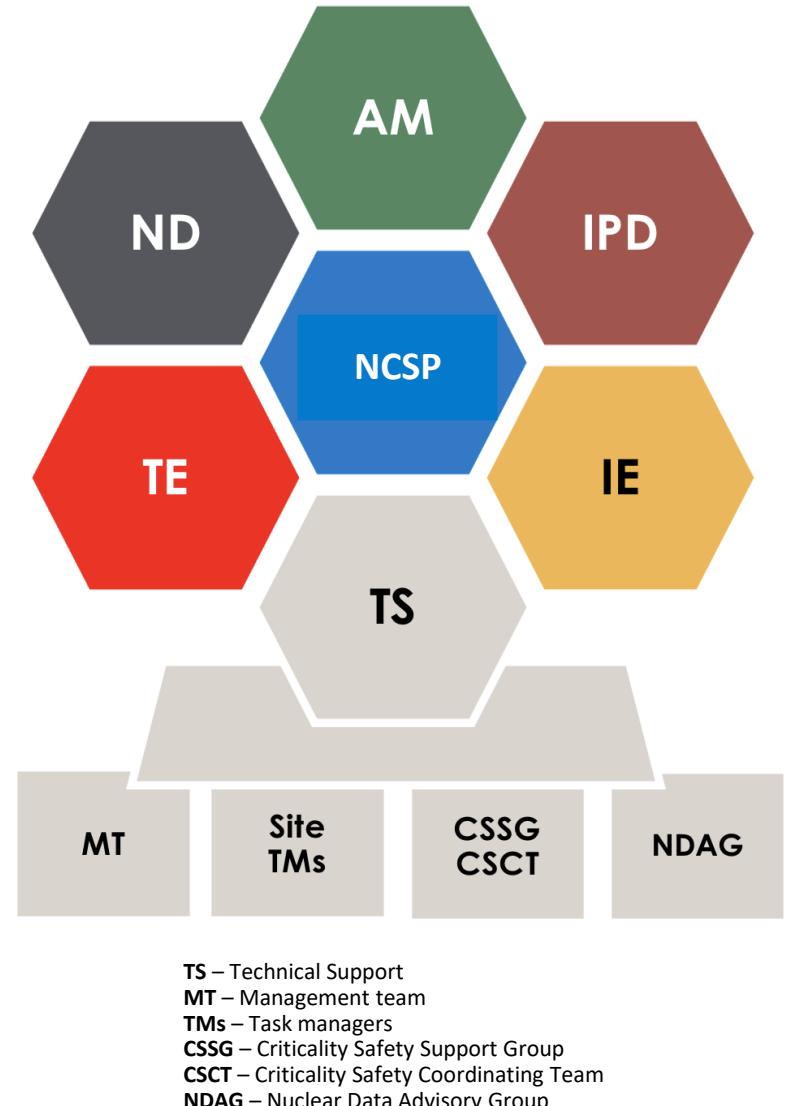
TS – Technical Support
MT – Management team
TMs – Task managers
CSSG – Criticality Safety Support Group
CSCT – Criticality Safety Coordinating Team
NDAG – Nuclear Data Advisory Group

NCSP Technical Program Elements (TPM)

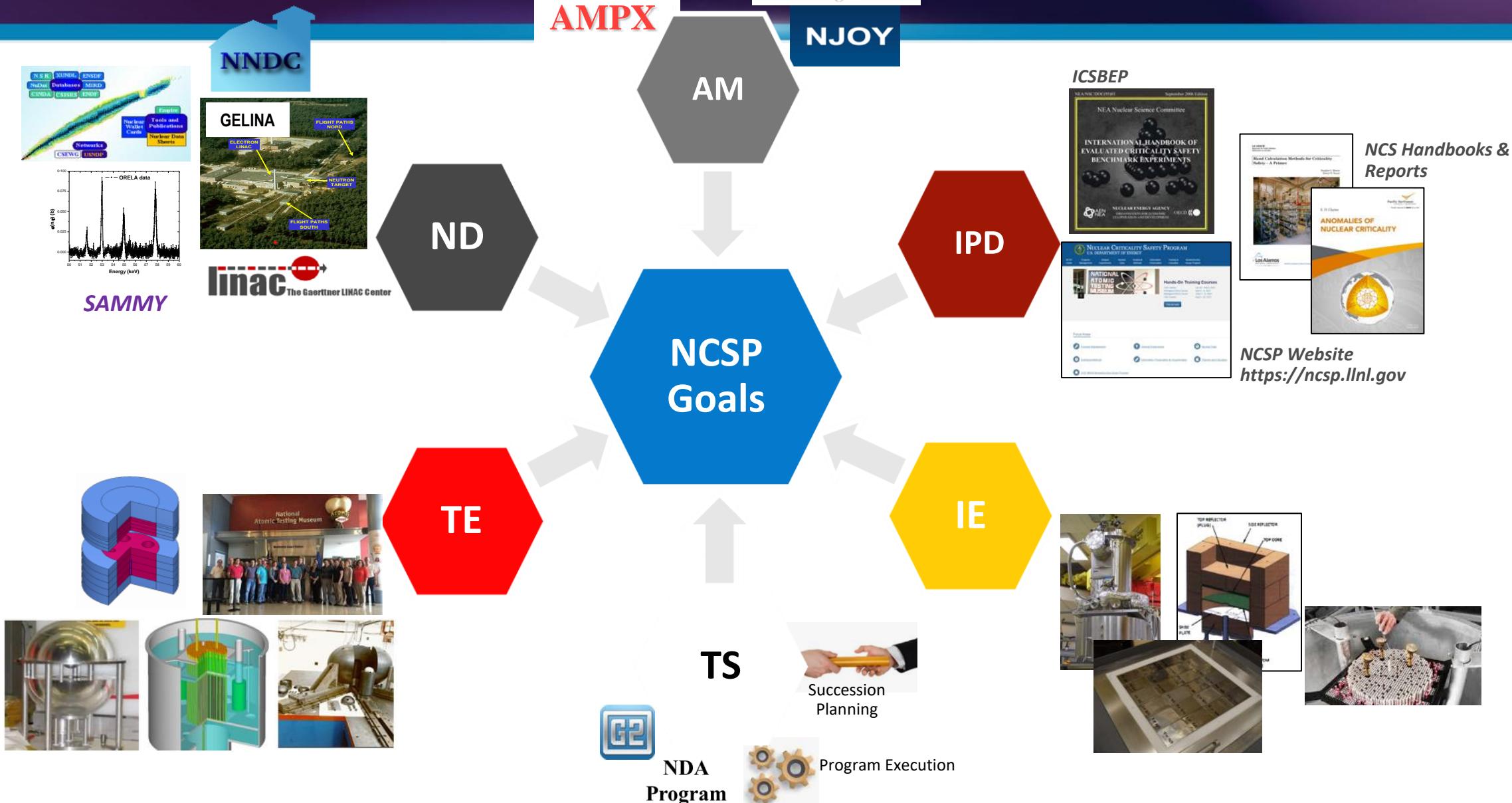


- **Management Support Team (MT)**
 - Bowen, Miller, Henley – Responsible for daily execution of the NCSP world-wide
- **Site Task Managers (now known as Site Program Managers)**

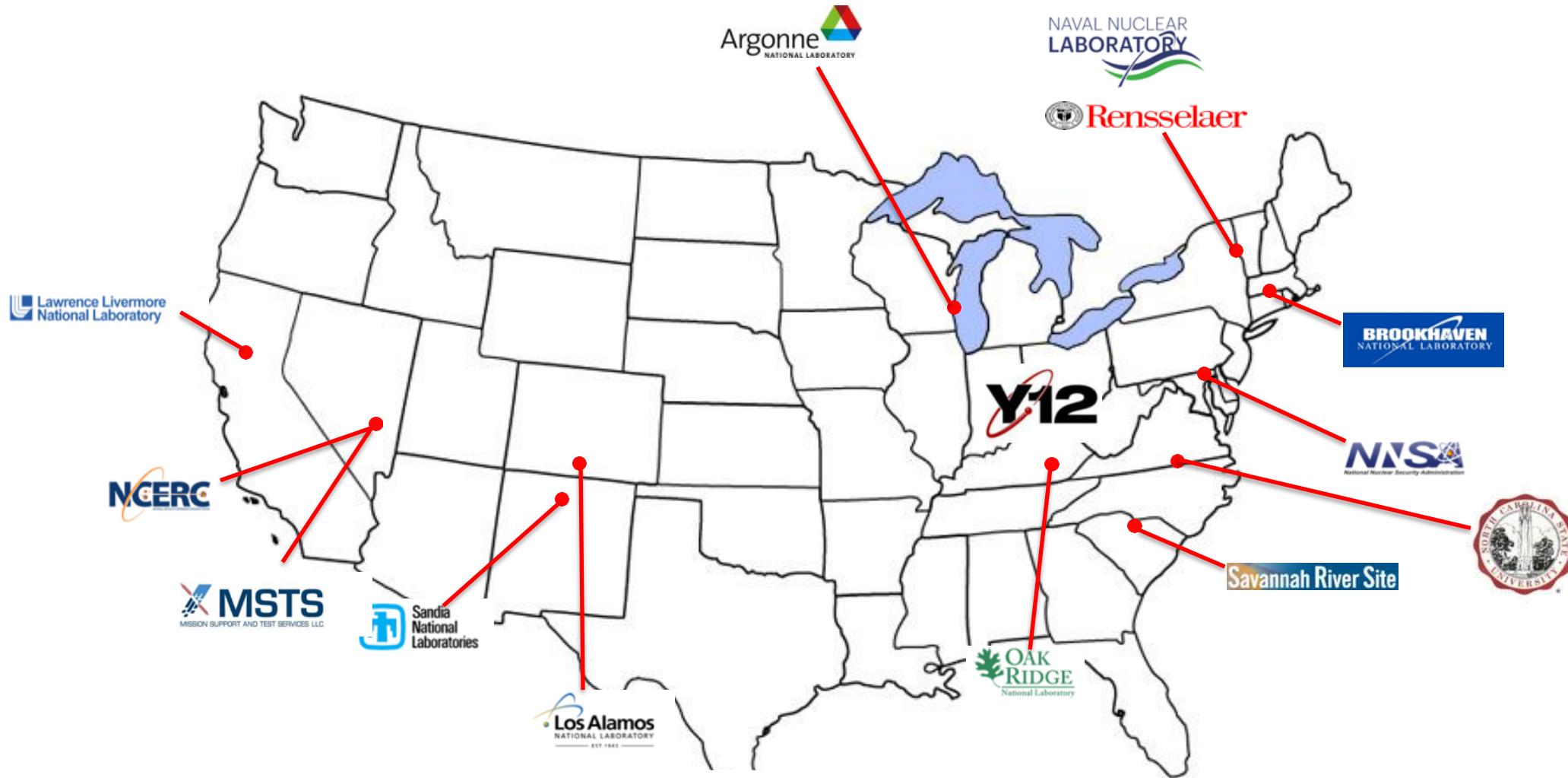
BNL Gustavo Nobre	LANL Joetta Goda	LLNL Catherine Percher	NNSS William Hall	ORNL Alex Lang	RPI Yaron Danon	SNL David Ames	SRS Scott Finfrock	Y-12 Kevin Reynolds
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- **Criticality Safety Support Group (CSSG)**
 - <https://ncsp.llnl.gov/program-management/criticality-safety-support-group-cssg>
 - The CSSG functions as the technical support group to the Nuclear Criticality Safety Program (NCSP) Manager, providing operational and technical expertise pertinent to the criticality safety needs of DOE missions. CSSG taskings and tasking reports can be assessed via website link
- **Criticality Safety Coordinating Team (CSCT)**
 - <https://ncsp.llnl.gov/program-management/criticality-safety-coordinating-team-csct>
 - The Criticality Safety Coordinating Team (CSCT) consists of the federal DOE Headquarters and Field Office criticality safety subject matter experts chartered in support line management to share information about promoting consistent NCS program oversight, sharing NCS information, communicating lessons learned, and assist in the field implementation of NCS improvements.
- **Nuclear Data Advisory Group (NDAG)**
 - <https://ncsp.llnl.gov/nuclear-data/nuclear-data-advisory-group>
 - The Nuclear Data Advisory Group (NDAG) gathers and evaluates differential and integral nuclear data, identifies deficiencies, and recommends priorities on meeting DOE criticality safety needs to the Criticality Safety Support Group (CSSG) and NCSP Manager.



Technical Program Element Activities



NCSP Domestic Collaborators



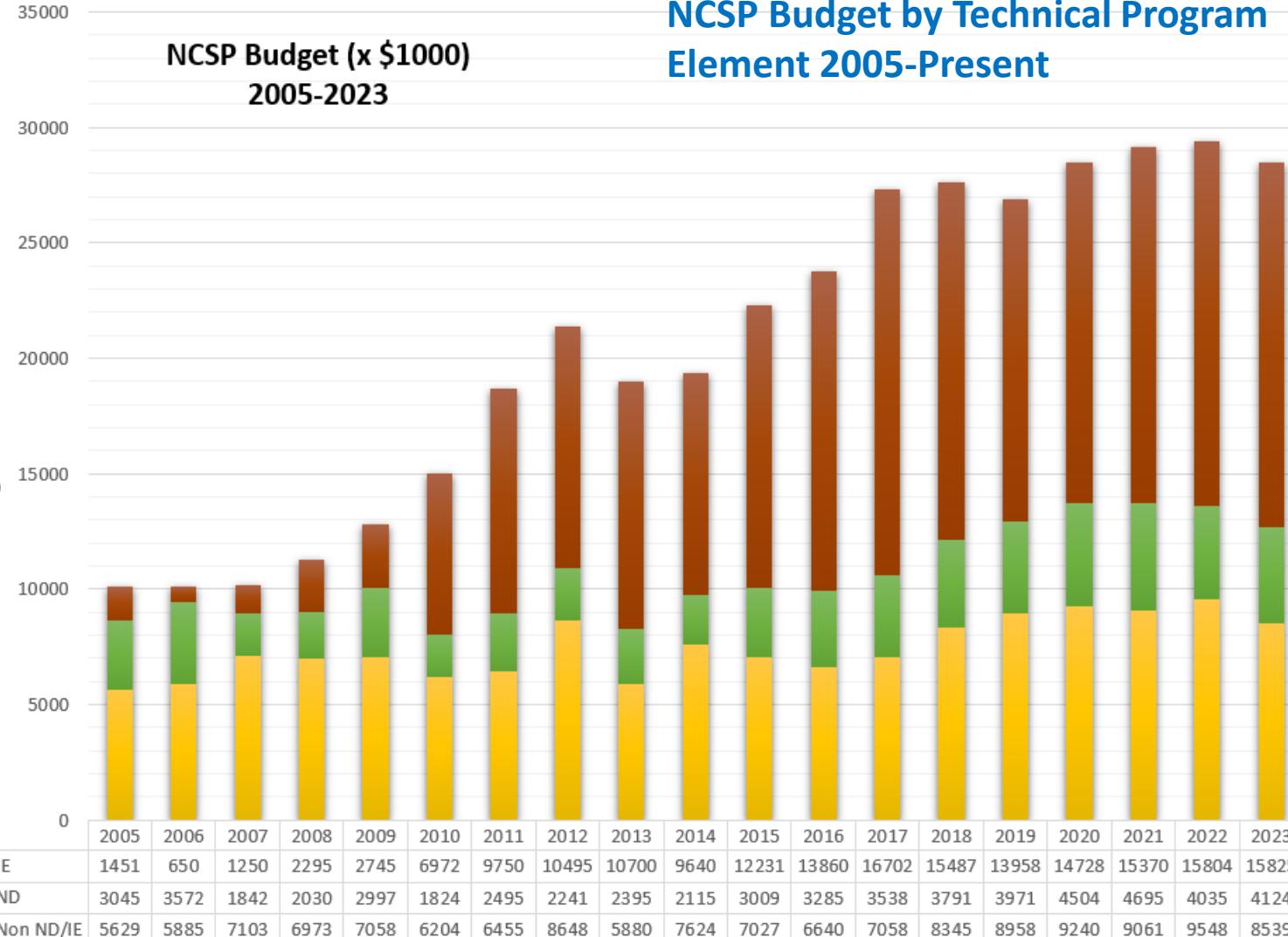
NCSP International Partners



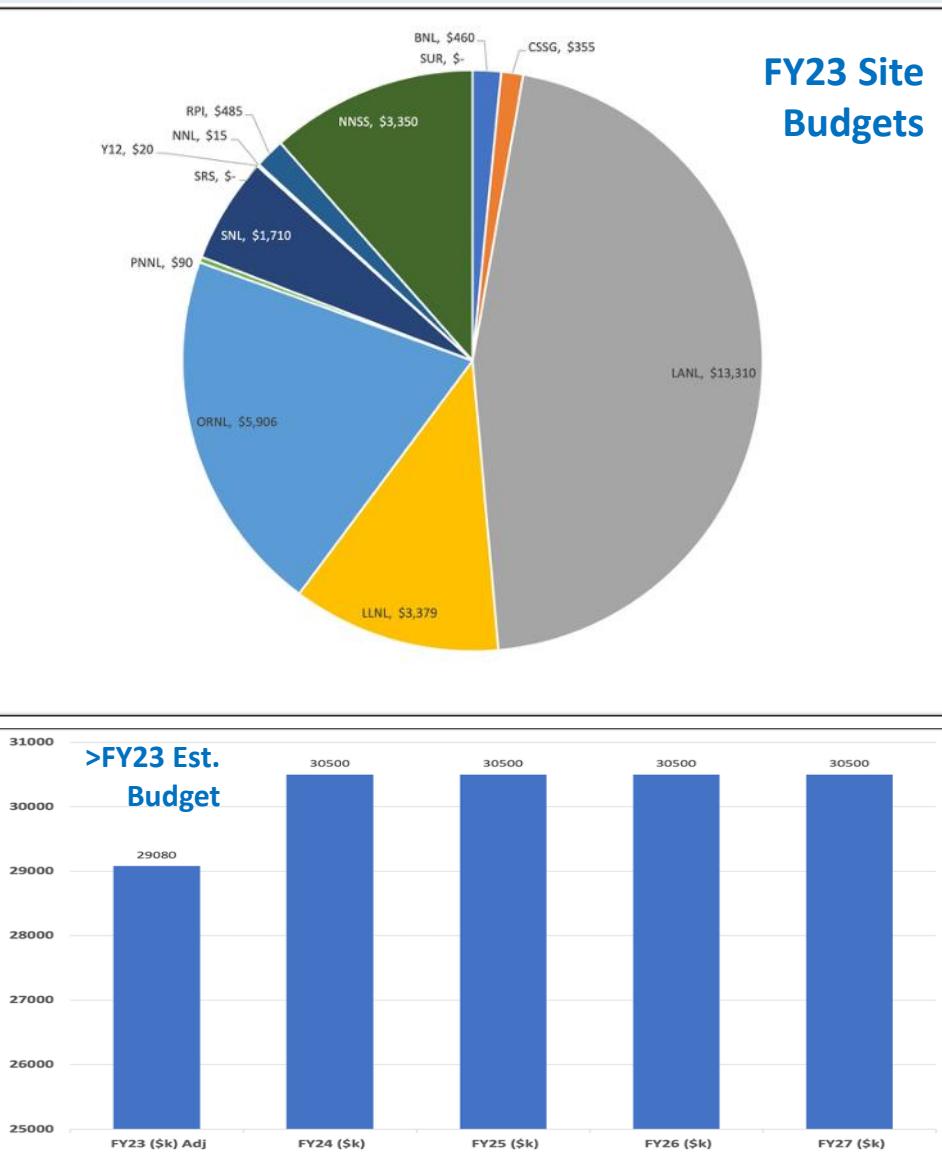
- Atomic Weapons Establishment (AWE), UK (JOWOG-30)
- Institut De Radioprotection et De Sûreté Nucléaire (IRSN), France (Formal MOU with NCSP)
- Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA), France (Nuclear Data Evaluations)
- Institute for Reference Materials and Measurements (IRMM), Belgium (Differential Nuclear Data Measurements)
- Organization for Economic Cooperation and Development (OECD) / Nuclear Energy Agency (NEA), Headquarters in France (ICSBEP, WPEC, and WPNCS)
- National Nuclear Laboratory, United Kingdom
- Japan Atomic Energy Agency



NCSP Budget (>2005)



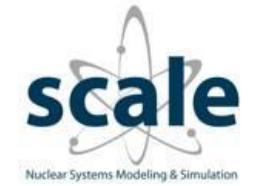
NCSP Budget by Technical Program Element 2005-Present



US DOE NCSP – Analytical Methods Technical Program Element



- Radiation transport code methods, geometries, physics (e.g., MCNP & SCALE)
 - NCSP supports the annual SCALE User's Workshop and MCNP User Symposia
 - SCALE and MCNP training is also supported
- Cross-section evaluation and processing software (e.g., SAMMY, NJOY, AMPX, FLASSH, FUDGE, PREPRO data evaluation and testing, code-dependent continuous and multi-group data libraries)
- Sensitivity and uncertainty analysis techniques providing sensitivity profiles, similarity evaluations, uncertainty propagation and data adjustment (e.g., SCALE TSUNAMI, MCNP Whisper)
- Oak Ridge Radiation Safety Information Computational Center (RSICC)
 - NCSP supports the free distribution of SCALE/MCNP to university students
- International Projects – Project lead: IRSN
 - Nuclear Criticality Safety SlideRule revision
 - Benchmark Intercomparison exercises



NJOY



US DOE NCSP – Information Preservation & Dissemination Technical Program Element



- NCSP website is maintained through this TPM
- Website contains reference information for the NCS community
 - Links to applicable federal regulations (DOE orders, standards, guides)
 - Links to NCS domestic and international consensus standards
 - NCS handbooks of critical benchmark experiments (ICSBEP handbook), subcritical limits, critical mass curves, key guides (Nuclear Safety Guide, ARH-600, experimental logbooks, criticality accident lessons learned, Primers, etc.)
 - Bibliographic data for NCS community references
 - Availability via LLNL or ORNL repositories
 - Information to assist with OSTI searches for NCS or NCSP references
 - Foreign travel reports for NCSP funded trips
 - Learn from Experience (LFE) Database that provides information about NCS-specific events
 - International collaboration (UK, US, and FR)

The screenshot shows the official website for the Nuclear Criticality Safety Program (NCSP) of the U.S. Department of Energy. The header features the NCSP logo and the text "NUCLEAR CRITICALITY SAFETY PROGRAM U.S. DEPARTMENT OF ENERGY". The navigation menu includes links to NCSP Home, Program Management, Integral Experiments, Nuclear Data, Analytical Methods, Information Preservation, Training & Education, and Nondestructive Assay Program. A featured image of a modern building complex is displayed. The "MCNP®" section includes links to the MCNP Website, Training Courses, News & Information, and MCNP User Symposia. The "Learning from Experience (LFE) Database" section is highlighted. The "Focus Areas" section lists Program Management, Integral Experiments, Nuclear Data, Analytical Methods, Information Preservation & Dissemination, and Training and Education, each with a corresponding icon. The "Latest News" section links to CritView, NCSP Newsletters, NCSP Planning Calendar, Five-Year Execution Plan, Five-Year Execution Plan: Proposals, NCSP Mission & Vision, Past Annual NCSP Technical Program Review – Presentations, Enroll in NCSP hands-on training courses, Explore self-study criticality safety training modules, Explore criticality safety key references and handbooks, Submit a Nuclear Data Request, Learning from Experience (LFE) Database, Acknowledgements to NCSP, Signed Memos to Decline Non-Conference-Related NCSP Program Execution Meetings, Updated Guidance on Conference-Related Activities and Spending, NCSP History, and NCSP Presentation Template. The "Our Services" and "Our Groups" sections also contain various links to program components and external resources.



NCSP Integral Experiments Technical Program Element



- NCSP integral measurements are performed at
 - Sandia National Laboratories (SNL) and
 - National Criticality Experiments Research Center (NCERC), currently operated by Los Alamos National Laboratory
 - NCERC is located at the Nevada National Security Site (NNSS) inside the Device Assembly Facility (DAF)
- Types of experiments that can be performed
 - Subcritical
 - Rocky Flats shells, BeRP ball, Np-237 sphere, TACS shells, etc.
 - Critical/Delayed Supercritical
 - NCERC: Planet, Comet, Godiva IV, Flattop
 - Sandia: Sandia Pulse Reactor critical assembly (2 fuel types, currently)
 - Prompt Supercritical
 - NCERC: Godiva IV (< 300 deg. C pulse)

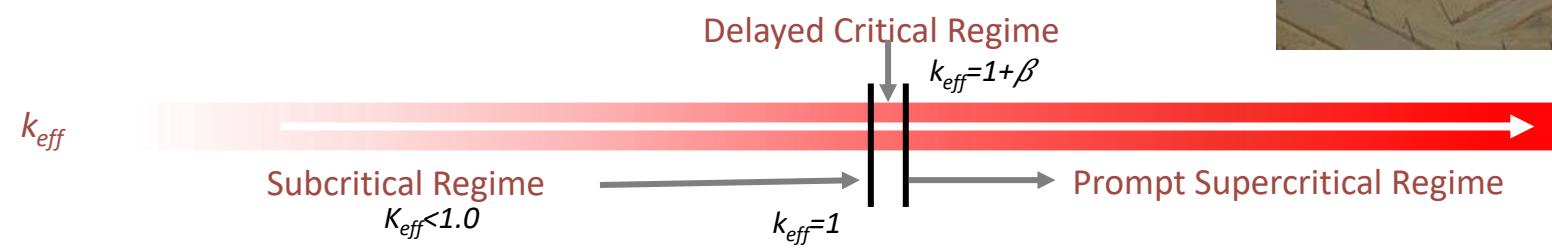
DAF/NCERC



SNL/TA-V/SPR Facility



SPR Facility

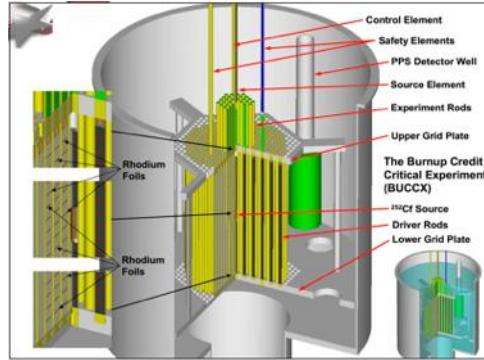


NCSP Critical Assemblies

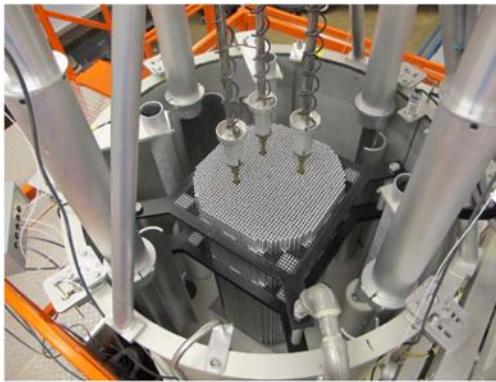


Sandia National Laboratory

SNL – BUCCX – U(4.31)/Fission Product Experiments



SNL – 7uPCX – U(6.9) UO₂ rods



NCERC/DAF

NCERC – Np-237 Sphere



NCERC – BeRP Ball



NCERC – TACS



NCERC – Godiva IV



NCERC – Flattop



NCERC – Planet



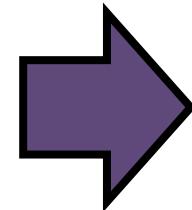
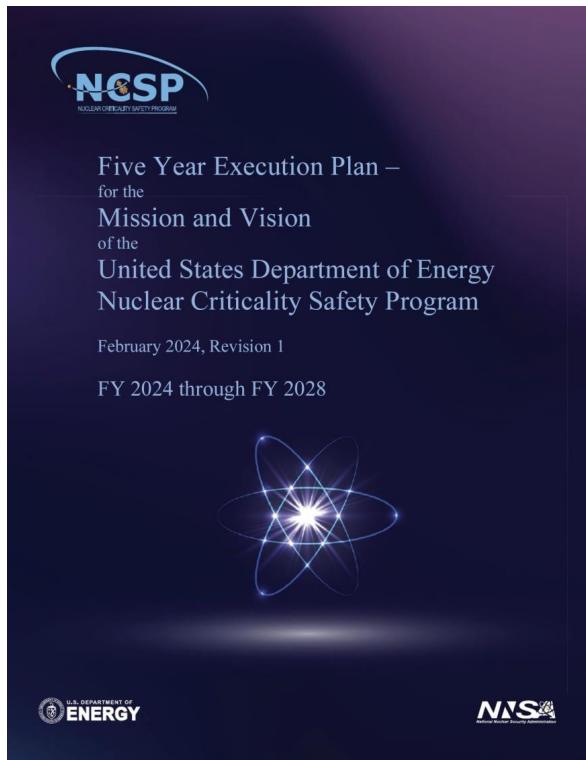


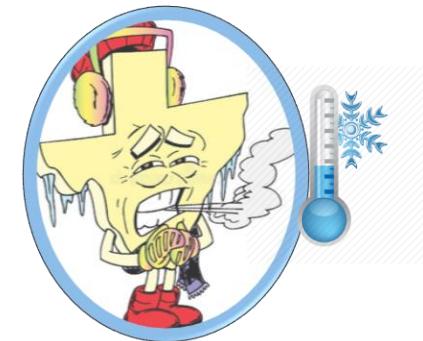
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18	Complete Zr-92 nuclear data measurements at GELINA	ND	ORNL
19	Validation of accelerator structure design with completion of accelerator section #1 site acceptance testing at RPI. (RPI ND3)	ND	RPI/NNL

*Funding for control room upgrades provided by NA-19’s Capabilities-based Investment Program (CBI)

TEX Background

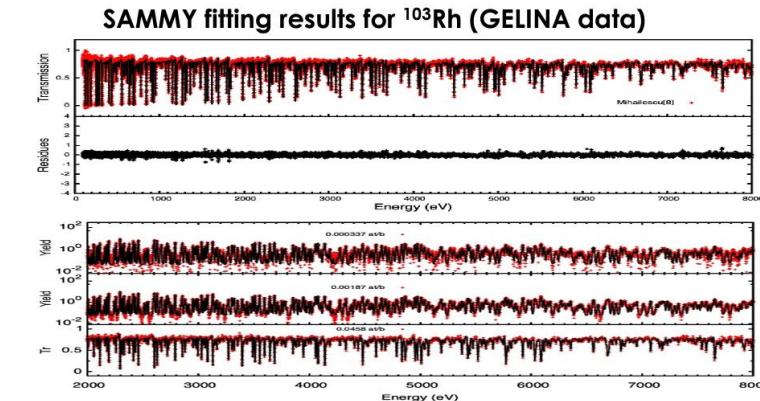
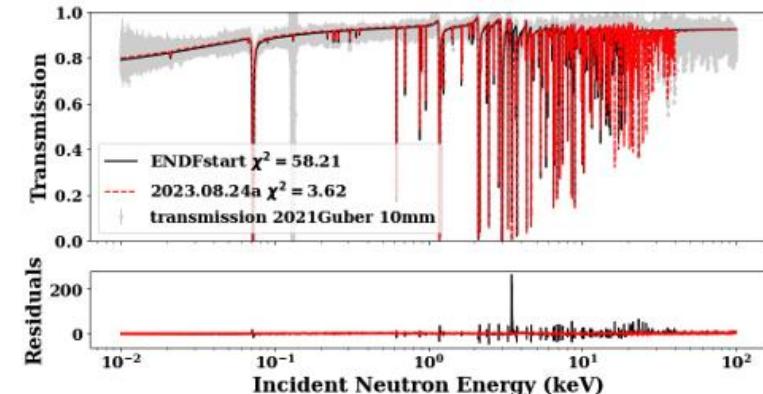
- There is a wide data gap in validation experiments in the intermediate (epithermal) neutron energy range
- The series of Thermal/Epithermal eXperiments (TEX) are designed to investigate the effect of various interstitial materials and conditions on critical mass.
 - TEX – Pu-239
 - TEX – Tantalum
 - TEX – HEU
 - TEX – Hafnium
 - TEX – Low temperature
 - TEX – mixed U and Pu
 - TEX – Pu-240
 - TEX – Lithium and Chlorine
 - TEX – U-233



US DOE NCSP Nuclear Data Technical Program Element



- Performing cross-section measurement (e.g., RPI, GELINA, LANSCE, SNS) and preparing nuclear data evaluations for distribution (ENDF/B)
- Evaluating nuclear data (e.g., SAMMY, EMPIRE, KALMAN, McNASH)
- Developing advanced nuclear data covariance methodologies
- Developing new thermal scattering law measurement and evaluation capabilities
- Support the release of ENDF/B libraries for NCS community support
- Collaborating with ND experts in
 - US: CSEWG
 - EU: IRMM, IRSN, CEA, KIT, FZK
 - OECD: WPNCS, WPEC, ADSNF
 - IAEA
- Reviewing delayed fission gamma deficiencies
- Testing and QA of ND evaluations



US DOE NCSP ND Element

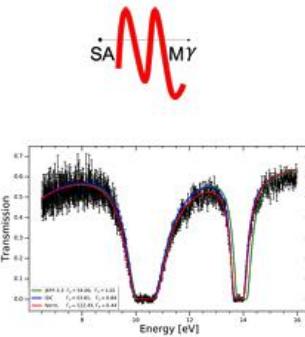


Motivation

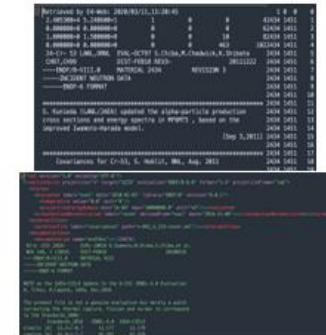
Differential Measurements



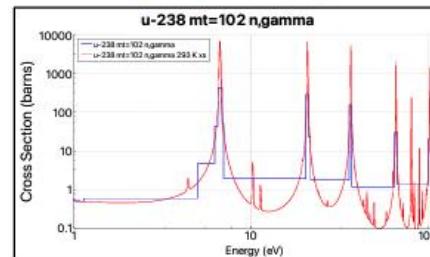
Data Evaluations



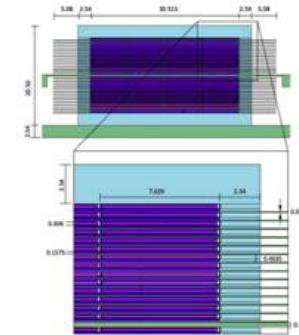
Evaluated Nuclear Data Files (ENDF)



Nuclear Data Processing



Validation / Applications



Foundation

M Percher, C., et al. *Thermal Epithermal eXperiments (TEX): test bed assemblies for efficient generation of integral benchmarks*.
No. LLNL-CONF-776306. Lawrence Livermore National Lab.(LLNL), Livermore, CA (United States), 2019.

Main points:

- There are a few important, high-level steps
- You don't need a pipeline to convey the information in the metaphor

NCSP Differential Experiments



- NCSP differential nuclear data measurements are performed at
 - JRC-Geel GELINA Facility (Geel, Belgium)
 - GELINA is available via collaboration between DOE/NNSA NA-20 and Euratom (JRC-Geel)
 - ORNL Spallation Neutron Source (SNS) (Oak Ridge, TN)
 - Rensselaer Polytechnic Institute Linear Accelerator (RPI LINAC) (Troy, NY)
 - LANL (Los Alamos, NM) LANSCE/Lujan Neutron Scattering Center (LANSCE)



JRC-Geel (GELINA)



RPI LINAC  Rensselaer



LANL LANSCE



ORNL SNS



Photos referenced from:

http://www.linac.rpi.edu/public_html/accelerator.html

<https://neutrons.ornl.gov/sns>

<https://ec.europa.eu/jrc/en/research-facility/linear-electron-accelerator-facility>

<https://lansce.lanl.gov/>

NCSP Nuclear Data Measurements and Evaluations in Progress – FY2024 5-Year Plan



Measurements	
Materials	Site
Cesium (^{133}Cs)	LANL
Chlorine (^{35}Cl)	ORNL LANL
Chromium ($^{50,53}\text{Cr}$)	ORNL
Fluorine (^{19}F)	ORNL RPI
Plutonium (^{239}Pu)	LANL
Plutonium (^{240}Pu)	LANL LLNL
Samarium (^{149}Sm)	LANL
Tantalum (Ta)	RPI
Uranium (^{233}U)	LANL
Zirconium ($^{90,91,92,94,96}\text{Zr}$)	ORNL
Beryllium (Be)	NNL
ZrH_x	NNL
Petrolatum	NNL

Evaluations	
Materials	Site
Beryllium (^9Be)	LANL
Chlorine (^{35}Cl)	ORNL, LANL
Copper ($^{63,65}\text{Cu}$)	ORNL, LANL
Fluorine (^{19}F)	ORNL
Hafnium ($^{176,177,178,179,180}\text{Hf}$)	ORNL, NNL
Iron ($^{54,56,57}\text{Fe}$)	ORNL, BNL
Iron (^{56}Fe)	ORNL, BNL
Lanthanum (La)	ORNL, LANL
Lead ($^{204,206,207,208}\text{Pb}$)	ORNL, BNL, RPI, NNL
Lithium (^6Li)	LANL
Molybdenum (^{95}Mo)	ORNL
Nitrogen (^{14}N)	ORNL
Oxygen (^{16}O)	LANL
Plutonium ($^{238}\text{Pu}, ^{240}\text{Pu}, ^{241}\text{Pu}, ^{242}\text{Pu}$)	LANL
Plutonium (^{239}Pu)	LANL, ORNL

Evaluations	
Materials	Site
Plutonium (^{240}Pu)	ORNL, LANL
Rhodium (^{103}Rh)	ORNL, NNL
Strontium (^{88}Sr)	ORNL
Uranium-233	ORNL, LANL
Uranium-234	ORNL, LANL
Uranium-235	LANL, ORNL
Uranium-236	LANL
Uranium-238	LANL, BNL
Zirconium ($^{90,91,92,94,96}\text{Zr}$)	ORNL, RPI, NNL, BNL
Uranium Metal (U)	LLNL, NCSU
Paraffin ($\text{C}_n\text{H}_{2n+2}$)	LLNL, NCSU
Plutonium Oxide (PuO_2)	LLNL, NCSU
Light Paraffinic Oil (Mineral Oil)	LLNL, NCSU
Uranium Silicide (U_3Si_2)	LLNL, NCSU
Zirconium Carbide (ZrC)	NNL
Beryllium Hydride (BeH_2)	NNL
Polystyrene (C_8H_8) _n	ORNL

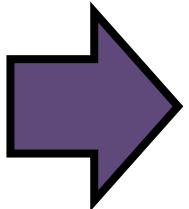
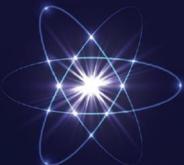
ND TPE



Five Year Execution Plan –
for the
Mission and Vision
of the
United States Department of Energy
Nuclear Criticality Safety Program

February 2024, Revision 1

FY 2024 through FY 2028

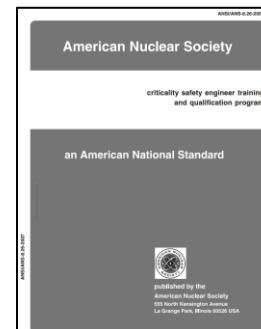


		Element	
1	CAAS testing with GODIVA IV (IER 605)	IE	AWE/LLNL/LANL
2	Fabricate and test cooling design for the TEX/MOX experiment (IER 296)	IE	IRSN/LANL/LLNL
3	Complete control room upgrades at NCERC*	IE	LANL
4	Submit benchmark evaluation of experiments for the Flattop benchmark series (IER 423)	IE	LANL
5	Complete measurement campaign (IER 153)	IE	LANL
6	Submit benchmark to independent reviewer(s) (IER 537)	IE	LANL
7	Complete measurements for TEX/CI (IER 499)	IE	LANL/LLNL
8	Complete measurements for GODIVA IV Shielding Benchmark (IER 498)	IE	LANL/LLNL/ORNL
9	Additional Manager/CSO hands-on courses due to heightened demand	IE	LANL/ORNL/LLNL/SNL
10	Complete GODIVA characterization report (IER 574)	IE	LANL/SNL
11	Submit benchmark evaluation for publication (IER 532)	IE	LLNL
12	Perform AFFRI dosimetry intercomparison international exercise (IER 484)	IE	LLNL/IRSN/AWE
13	Submit benchmark evaluation of epithermal experiments (IER 441)	IE	SNL
14	Publish revision of the manual governing NCSP Integral Experiments	IE	SNI
15	Final release of ENDF/B-VIII.1 Nuclear data library	ND	BNL
16	Complete DICER transmission measurements of Pu-239 at LANSCE	ND	LANL
17	Complete fabrication of the U-233 PPAC	ND	LLNL
18	Complete Zr-92 nuclear data measurements at GELINA	ND	ORNL
19	Validation of accelerator structure design with completion of accelerator section #1 site acceptance testing at RPI. (RPI ND3)	ND	RPI/NNL

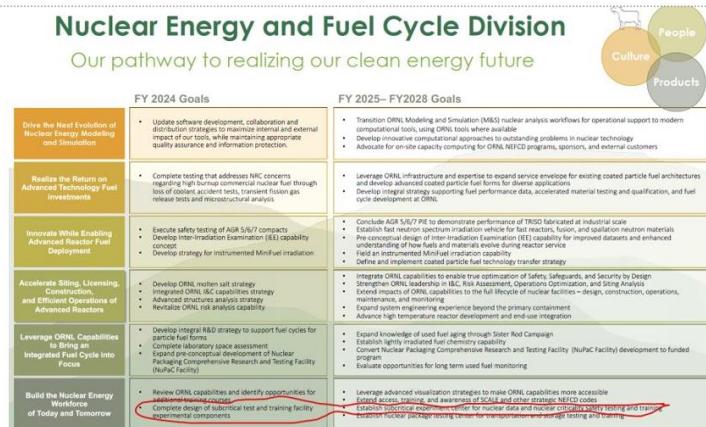
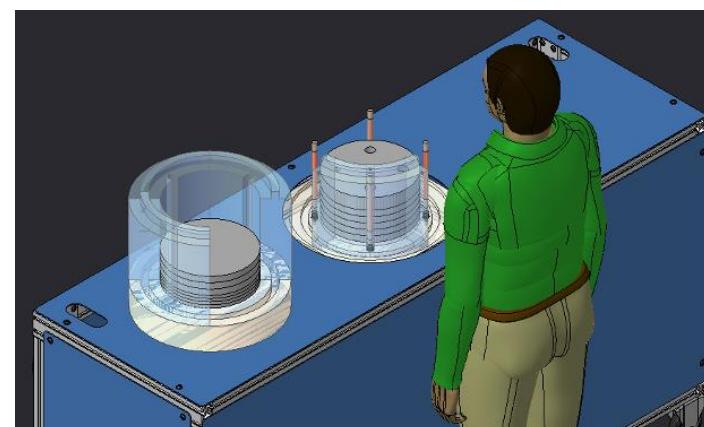
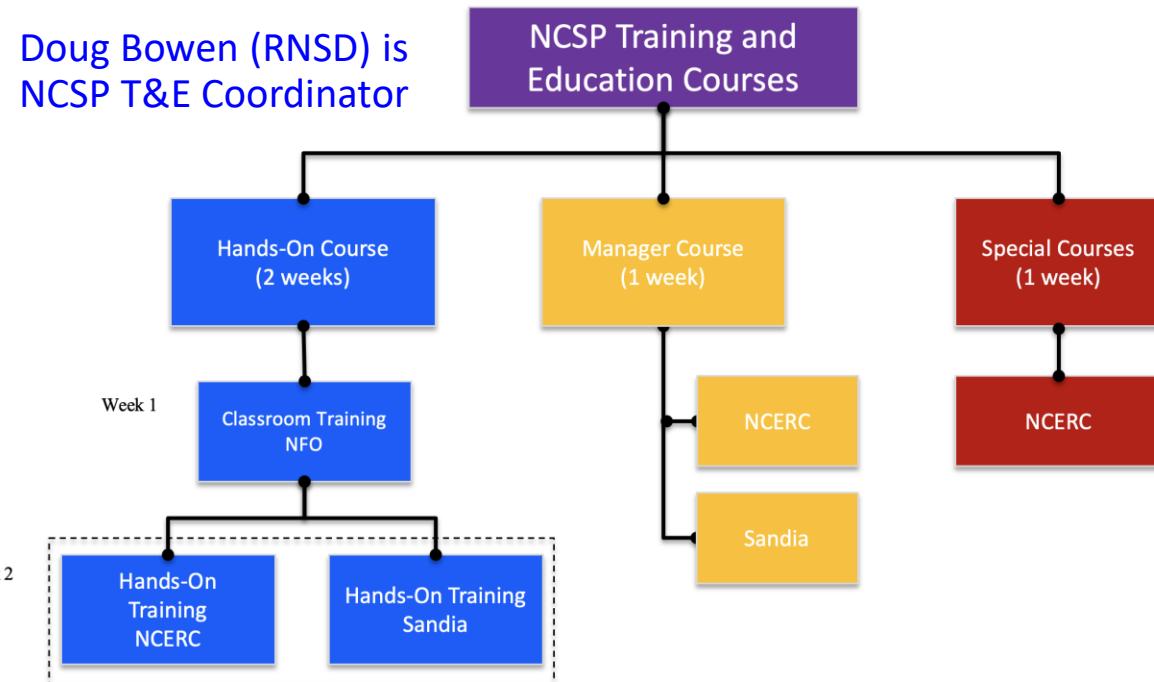
US DOE NCSP Training & Education Technical Program Element



- 2-week hands-on courses
 - Supports NCS Engineering training and qualification requirements from ANSI/ANS-8.26, Section 7.4
- 1-week manager/criticality safety officer courses
 - Supports those in DOE with responsibilities in an NCS program supporting hands-on operations with fissionable materials
- Initiatives
 - DOE/NRC Collaboration on Criticality Safety Support for Commercial-Scale HALEU Fuel Cycles (DNCSH)
 - Oak Ridge Subcritical Assembly (ORSA) for NCS hands-on training for fissile material handlers and students



Doug Bowen (RNSD) is
NCSP T&E Coordinator



2-week Hands-on Course – Week 1

Classroom Portion



Focus: NCS Evaluation Development

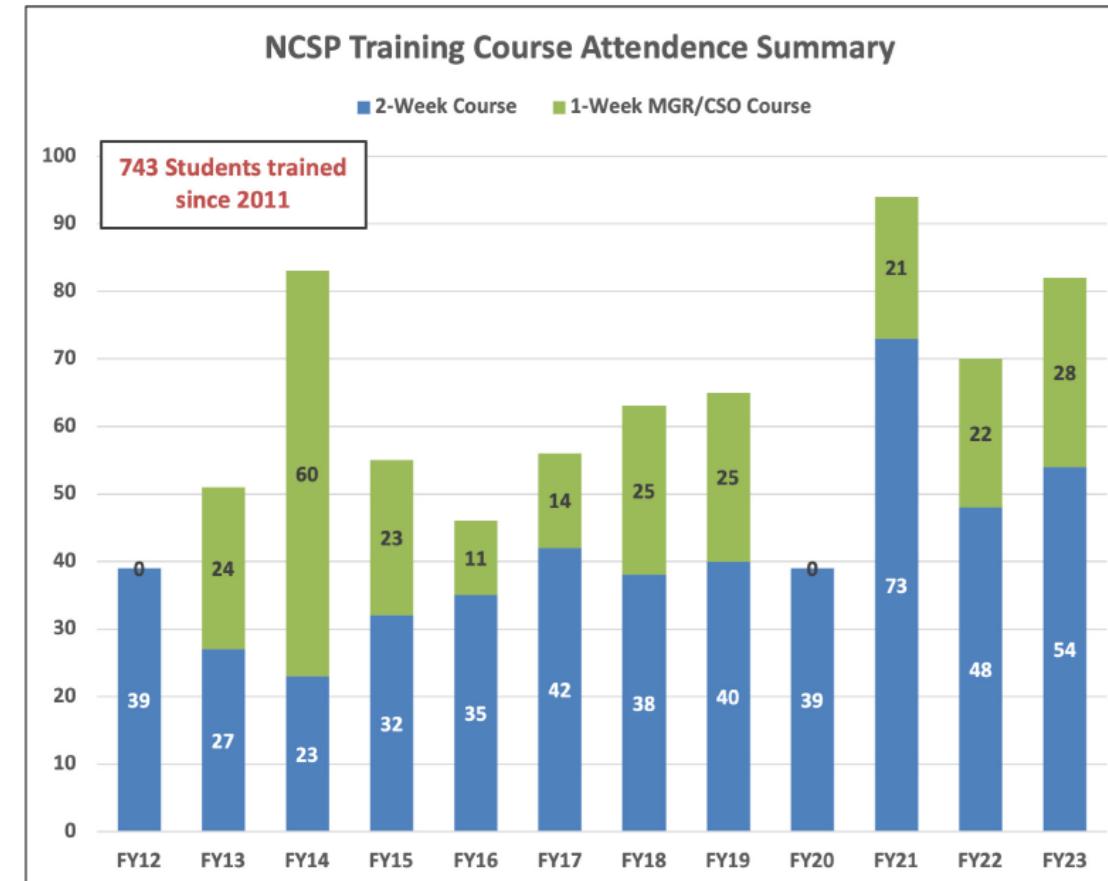
- DOE Requirements, National standards, and the DOE Nuclear Criticality Safety Program NCSP
- Process criticality accident lessons-learned
- NCS fundamentals
- ANSI/ANS-8 consensus standards
- Single unit and array hand calculation methods
- NCS evaluations and evaluation exercise
- Human factors and reliability principles for NCS evaluations
- NDA – interpretation and application of NDA methods and results to NCS evaluations
- Validation of Computational Methods
- Homework and quizzes assigned daily
- Students must pass the course with an overall grade of 80%
 - 70% Written Exam + 30% Participation Grade

- Overview of Sandia and NCERC facilities and assemblies
- Overview of the experiment procedures and methodology
- Neutron dynamics fundamentals and subcritical multiplication
- Nuclear instrumentation
- ANSI/ANS-1 *Conduct of Critical Experiments*
- Lessons learned from experimental accidents
- **Subcritical** and **critical** experiments
 - NCERC – operations with **Planet**, **Flattop**, **Godiva IV**, **BeRP Ball**, **Np-237 Sphere**, and **Training Assembly for Criticality Safety (TACS)**
 - Sandia – **Seven percent critical experiment (7uPCX)**, **Annular Core Research Reactor Core (ACRR) burst**
- Critical experiments and the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook
- Students must pass the course with an overall grade of 80%



NCSP Training and Education Course Statistics

- Capacity for the 2- week course
 - 16 students at Sandia
 - 15 students at NCERC
- Capacity for the 1-week MGR/CSO course is
 - 16 students at Sandia
 - 15 students at NCERC
- FY2023 total capacity
 - 2-week course x 2 courses per year: 62
 - 1-week course x 2 courses per year: 31
- FY2024
 - Offering an additional MGR course at Sandia/NCERC
 - Allows for 62 total students in this course
 - Total capacity for both courses:
 - 124 students per year



Background – DNFSB 2007-1 Safety-Related In Situ NDA of Radioactive Materials



- Defense Nuclear Facilities Safety Board (DNFSB) expressed their concerns about the use of *in situ* NDA techniques (measurement of signature emissions from a specific isotope of interest)
 - Large uncertainties and inaccuracies have occurred in estimating the type and quantity of radioactive material using *in situ* NDA
 - Include incorrect assumptions about shielding and the spatial distribution of radioactive material – as well as poor measuring techniques
 - Measurement errors, in turn, could lead to
 - Potential criticality accident conditions
 - Unexpected radiation exposure to workers
 - Underestimation of radioactive material available for release in accident scenarios

An NDA 10-year mission and vision document is available for download.



<https://nda.llnl.gov>

in situ means “in its original place”

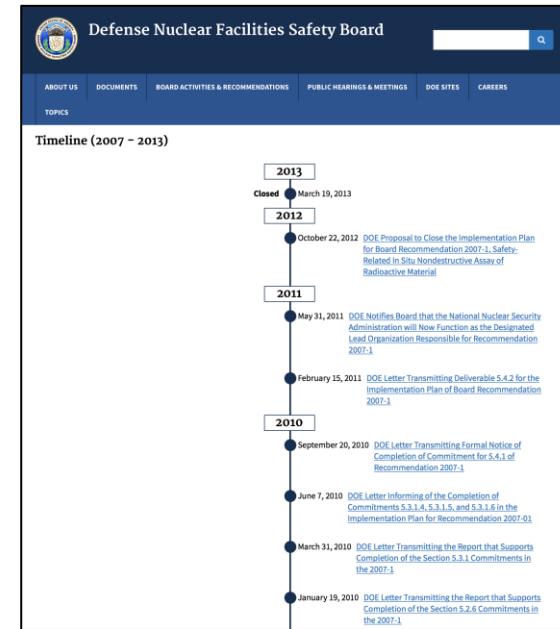
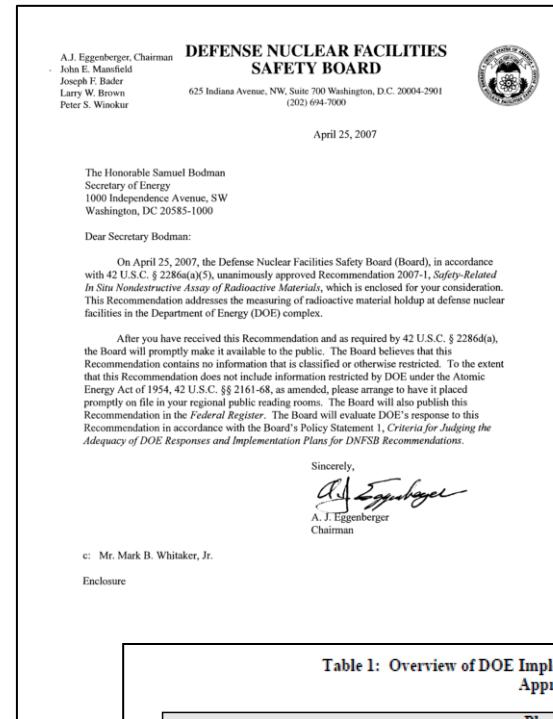


Table 1: Overview of DOE Implementation Plan for DNFSB Recommendation 2007-1 Approach for Major Activities

Table 1: Overview of DOE Implementation Plan for DNFSB Recommendation 2007-1 Approach for Major Activities						
Phase 1		Phase 2				
Evaluate Extent of Condition	Identify State of the Practice and Good Practices	Identify NDA Needs	Gap Analysis	Priorities	Actions	Follow-up Actions
<ul style="list-style-type: none">Develop selection criteria to identify DOE facilitiesIdentify facilities that meet criteriaPrioritize facilities based upon criticality accident risk	<ul style="list-style-type: none">Training & QualificationDesign requirements for new facilities and equipmentStandards for conducting NDAImplementation of standardsR&DQAOversight	<ul style="list-style-type: none">Identify Personnel capabilities and training, equipment capabilities, Directives, R&D, QA and Oversight NeedsIdentify any interim actions	<ul style="list-style-type: none">Conduct Gap Analysis using Extent of Condition, State of the Practice, and NDA holdup measurement needs as the basis.Define Requirements, Programs, and Guidance to Address Gaps	<ul style="list-style-type: none">Prioritize Needs to be addressed from Gap Analysis based on Risk	<ul style="list-style-type: none">Develop and Implement Action Plans to Address Phase 1 PrioritiesIdentification of continuous improvementFeedback as appropriate	<ul style="list-style-type: none">Develop and Implement Action Plans to Address Phase 2 PrioritiesFeedback as appropriateVerify effectiveness of actions

US DOE NCSP Website

Main NCSP Website

<https://ncsp.llnl.gov/>

NDA Program Website

<https://nda.llnl.gov>

Designed around the NCSP structure of technical program elements, non-destructive assay program and NCSP management structure.

NUCLEAR CRITICALITY SAFETY PROGRAM
U.S. DEPARTMENT OF ENERGY

NCSP Home Program Management Integral Experiments Nuclear Data Analytical Methods Information Preservation Training & Education Nondestructive Assay Program

News, Presentations, CSSG Tasking & Responses

[NCSP Technical Program Review Presentations](#) »
[NCSP Newsletters](#) »
[CSSG Tasking & Responses](#) »
[RSICC Newsletters](#) »
[FIESTA 2024 Workshop](#) »

Learning from Experience (LfE) Database

Focus Areas

 [Program Management](#)  [Integral Experiments](#)  [Nuclear Data](#)

 [Analytical Methods](#)  [Information Preservation & Dissemination](#)  [Training and Education](#)

 [DOE NNSA Nondestructive Assay Program](#)

Latest News

[CritView](#)
[NCSP Newsletters](#)
[NCSP Planning Calendar](#)
[Five-Year Execution Plan](#)
[Five-Year Execution Plan: Proposals](#)
[NCSP Mission & Vision](#)
[Past Annual NCSP Technical Program Review — Presentations](#)

Our Services

[Enroll in NCSP hands-on training courses](#)
[Explore self-study criticality safety training modules](#)
[Explore criticality safety key references and handbooks](#)
[Submit a Nuclear Data Request](#)
[Learning from Experience \(LfE\) Database](#) ⓘ
[Acknowledgements to NCSP](#)
[Signed Memos to Declare Non-Conference-Related NCSP Program Execution Meetings](#)
[Updated Guidance on Conference-Related Activities and Spending](#)
[NCSP History](#)
[NCSP Presentation Template](#)

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[Nuclear Data Advisory Group \(NDAG\)](#)
[Site Program Managers](#)

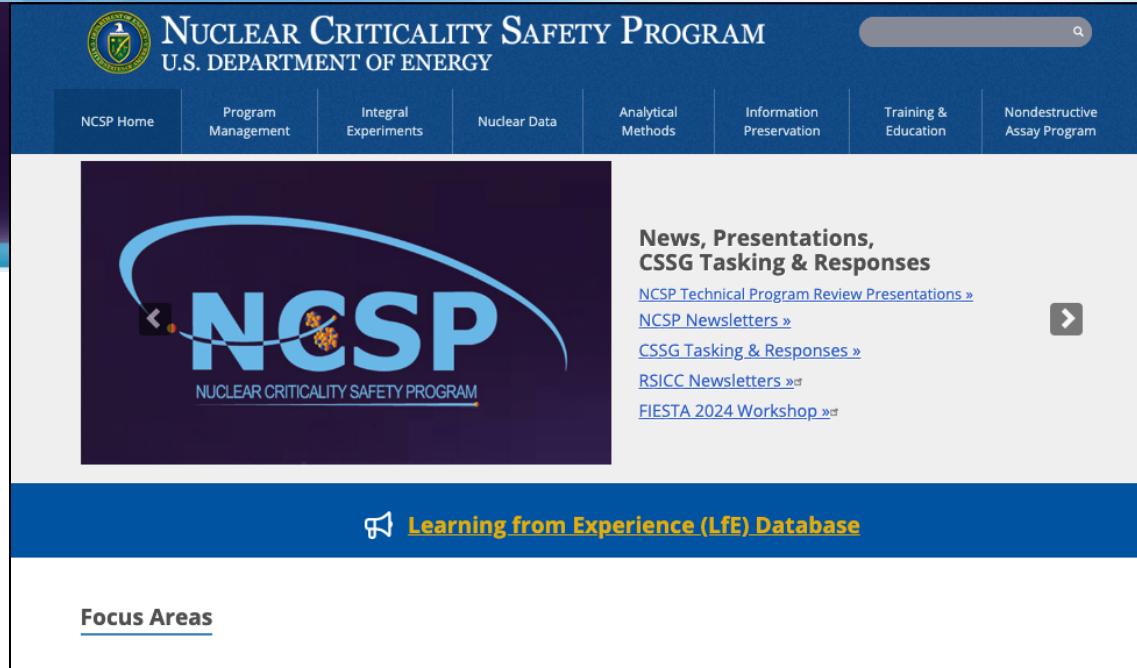
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Email [NCSP Webmaster](#)

US DOE NCSP Website

Main NCSP Website
<https://ncsp.llnl.gov/>

NDA Program Website
<https://nda.llnl.gov>



The screenshot shows the homepage of the Nuclear Criticality Safety Program (NCSP) website. The header features the NCSP logo and the text "NUCLEAR CRITICALITY SAFETY PROGRAM U.S. DEPARTMENT OF ENERGY". Below the header is a navigation menu with links to "NCSP Home", "Program Management", "Integral Experiments", "Nuclear Data", "Analytical Methods", "Information Preservation", "Training & Education", and "Nondestructive Assay Program". The main content area includes a large NCSP logo, a "News, Presentations, CSSG Tasking & Responses" section with links to "NCSP Technical Program Review Presentations", "NCSP Newsletters", "CSSG Tasking & Responses", "RSICC Newsletters", and "FIESTA 2024 Workshop", and a "Learning from Experience (LfE) Database" section.

Latest News

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Summary



- US NCSP is a mature program that:
 - Maintains the infrastructure necessary to ensure safe, efficient operations with fissionable materials
 - Identifies and integrates a Mission and Vision with 5-year work plan to achieve program goals in the following technical focus areas:
 - Analytical Methods
 - Nuclear Data
 - Information Preservation and Dissemination
 - Integral Experiments
 - Training and Education
 - Relies on strong working relationships with US national laboratories, universities, and international collaborators to provide needed capabilities to accomplish NCSP goals
- ORNL has lead-lab responsibility for supporting NNSA in the management and execution of the NCSP
- ORNL is the key US national laboratory for NCS technology infrastructure—providing leadership and tools needed to support nuclear criticality safety

Questions



**Photo from our 2024 Technical Program Review
Hosted by Brookhaven National Laboratory**