DOE/NNSA Nuclear Criticality Safety Program
Nuclear Data Program

WANDA-2026 Workshop

Presented by:
Douglas G. Bowen, Ph.D.
NCSP Execution Manager
ORNL Nuclear Criticality Safety Program Director
Oak Ridge National Laboratory

Securing the Future of Fission: An Overview of the DOE/NNSA Nuclear Criticality Safety Program (NCSP)

Mission, Vision, and Mandate

Driven by Safety Mandates

Established following DNFSB recommendations 93-2 and 97-2 to provide general purpose critical experiment capability and improve safety practices across the DOE.

$34.79M
FY26 Budget

Supports sustainable expert leadership and essential technical infrastructure for safe fissionable material operations.

Integrated Planning Cycle

- 10-Year Mission & Vision
- 5-Year Plan
- Annual Work Tasks

Six Technical Program Elements

Nuclear Data (ND)
Focuses on measurement and evaluation of nuclear cross-sections using tools like SAMMY and centers like NNDC.

Analytical Methods (AM)
Development and maintenance of essential criticality safety software suites.

Technical Support (TS)
Encompasses program execution, succession planning, and the Criticality Safety Support Group (CSSG).

Training & Education (TE)
Provides hands-on training courses for practitioners and managers at sites like the National Atomic Testing Mussum.

Information Preservation & Dissemination (IPD)
Manages the ICSBEP benchmark handbook, technical reports, and the central NCSP website to share knowledge globally.

Integral Experiments (IE)
Execution of subcritical, critical, and prompt supercritical experiments to provide data for benchmark evaluations.

Key Experimental Facilities & Sites

NCERC at the NNSS

Primary U.S. site for subcritical and critical experiments located in the Device Assembly Facility.

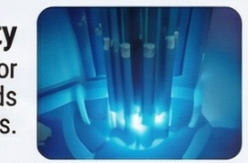
Specialized Assembly Machines
NCERC utilizes four primary machines for experiments.

Planet | Comet | Godiva IV | Flattop

Experiment Regime	Primary Facility	Machine / Machine Type
Subcritical	NCERC	Rocky Flats shells, BeRP ball, Np-237 sphere
Delayed Critical	NCERC / Sandia	Planet, Comet, Godiva IV, Flattop / 7uPCX
Prompt Supercritical	NCERC	Godiva IV (< 300°C pulse)

Sandia Pulse Reactor Facility

SNL provides unique capabilities for critical experiments using UC_3 rods and water-moderated systems.



International Collaboration

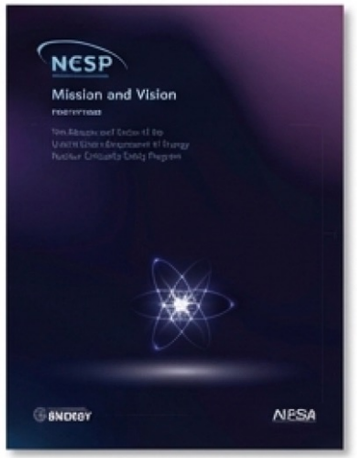
Partners with international facilities like JRC-Geel (GELINA) in Belgium and the RPI LINAC for high-resolution nuclear data measurements.

Strategic Direction: Mission and Vision

MISSION

To provide sustainable expert leadership, direction, and 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 DOE.

Recently revised for FY2026-FY2035



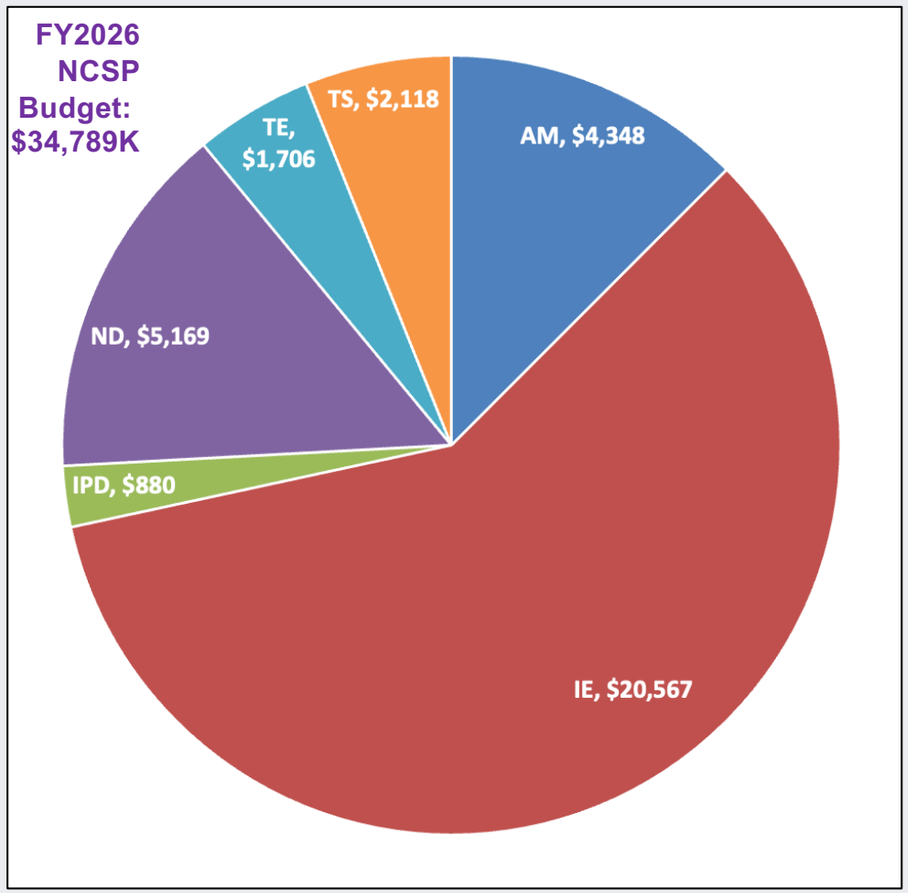
VISION

A continually improving, adaptable, and transparent program that communicates and collaborates globally to incorporate technology, practices, and programs responsive to the technical needs of those maintaining nuclear criticality safety.

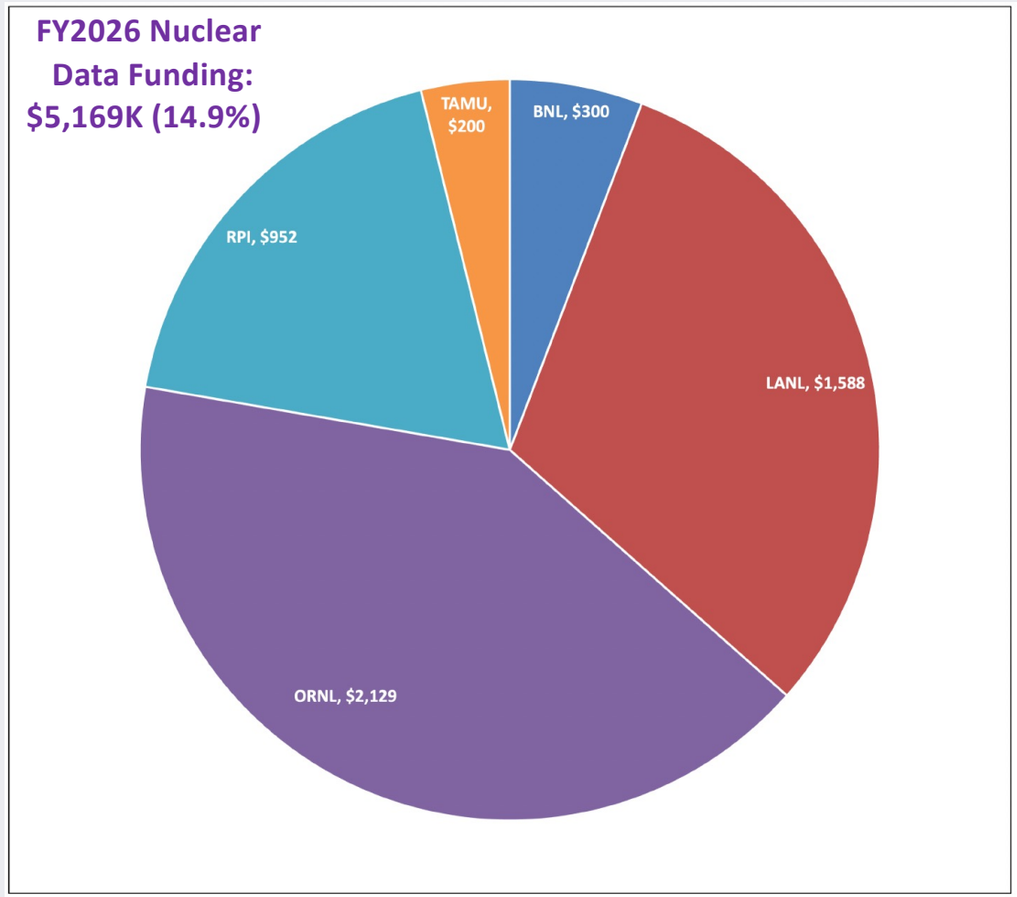
https://ncsp.llnl.gov/sites/ncsp/files/2025-11/ncsp_mission_vision_-_fy2026-2036_final.pdf

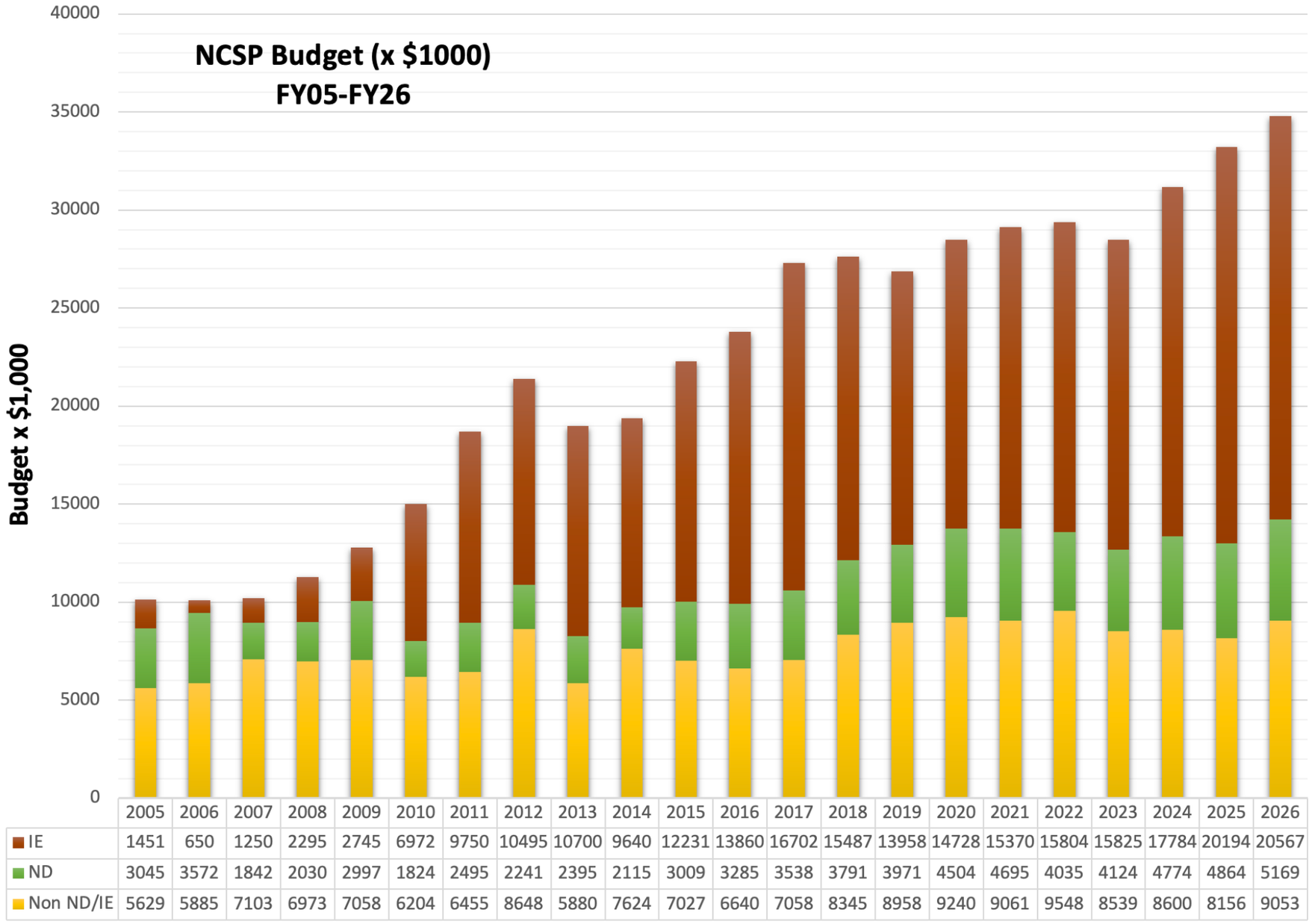
NCSP Overall and Nuclear Data Budget (FY2026)

NCSP Funding Distribution by Technical Program Element



NCSP Nuclear Data Funding Distribution by NCSP Site





	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
IE	1451	650	1250	2295	2745	6972	9750	10495	10700	9640	12231	13860	16702	15487	13958	14728	15370	15804	15825	17784	20194	20567
ND	3045	3572	1842	2030	2997	1824	2495	2241	2395	2115	3009	3285	3538	3791	3971	4504	4695	4035	4124	4774	4864	5169
Non ND/IE	5629	5885	7103	6973	7058	6204	6455	8648	5880	7624	7027	6640	7058	8345	8958	9240	9061	9548	8539	8600	8156	9053

Observations

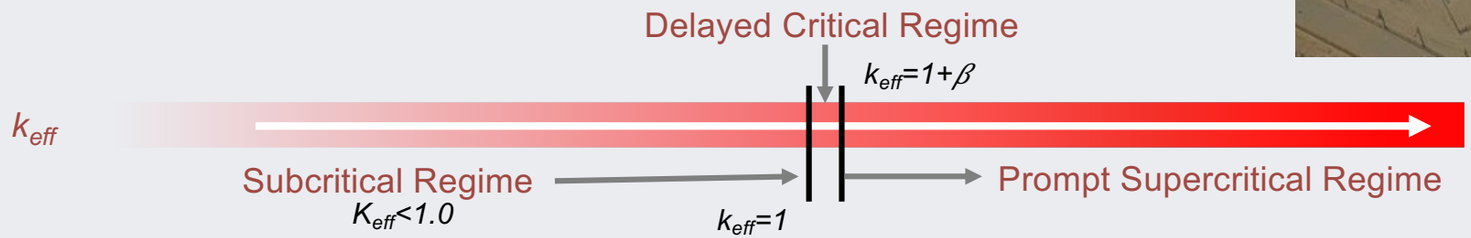
- IE budget is increasing from an average of 45% of the budget to ~60%.
- ND budget has stayed about the same at about 15% of the budget
- AM, IPD, TE, TS budgets have had to decrease because of IE budget increases
  - FY26 (~26%) is less than the average (~38%)

NCSP Integral Experiments

- 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



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

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/

From Gaps to Guidance: The NCSP Nuclear Data Cycle

The NCSP Nuclear Data cycle transforms identified data deficiencies into validated files for the U.S. Evaluated Nuclear Data File (ENDF) library.

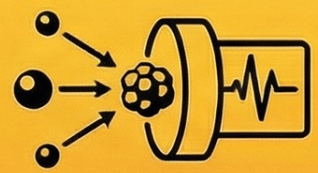
1

NDAG identifies critical data gaps and priorities.

The Nuclear Data Advisory Group assesses needs to ensure technical work aligns with program requirements.

2

National labs conduct precise differential measurements.



ORNL, LANL, and university partners measure energy regions for actinides and structural materials.

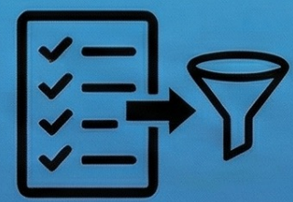
3

Specialized codes process raw measurement data.

Experts use tools like SAMMY to convert raw findings into formal evaluated data files.

4

Rigorous testing ensures high data quality.



BNL and the NNDC perform quality checks and Phase I testing before final approval.

5

Validated data is released to ENDF.

Final approved data is archived and made available for global nuclear criticality safety analyses.

NUCLEAR DATA STRATEGY & EXECUTION: 2026-2030 ROADMAP

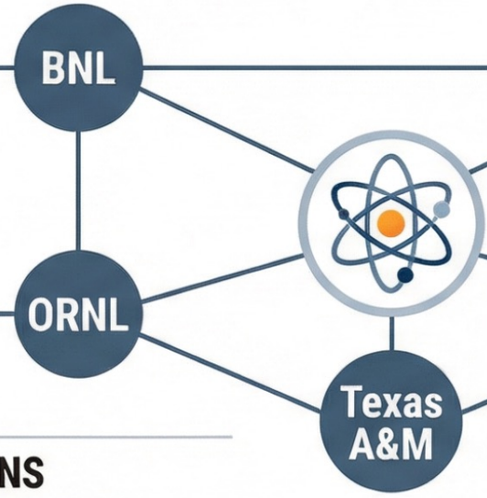
THE COLLABORATIVE NETWORK

BROOKHAVEN NATIONAL LABORATORY (BNL): THE ARCHIVE

Manages the National Nuclear Data Center (NNDC), archives cross-section evaluations, and maintains the "Atlas of Neutron Resonances".

OAK RIDGE NATIONAL LABORATORY (ORNL): THE RESONANCE LEADER

Coontinates cross section measurements in the resonance region and is currently modernizing the SAMMY evaluation code.



LOS ALAMOS NATIONAL LABORATORY (LANL): THE FAST REGION

Leads evaluation in the fast energy region and light elements, utilizing the LANSCE facility for fission and scattering measurements.

RPI & TEXAS A&M: SPECIALIZED RESEARCH

RPI maintains the LINAC facility for resonance measurements, while TAMU focuses on Thermal Scattering Law (TSL) evaluations and atomistic simulations.

PRIORITY MEASUREMENT CAMPAIGNS

CHLORINE (33, 37Cl) FOR POISON CREDIT

High-priority measurement needed to validate safety in repository environments.

ACTINIDES: Pu, U, AND Np

Critical mass estimates for Neptunium-237 and resonance evaluations for Plotonium isotopes to support MCX fuel applications.

THERMAL SCATTERING MATERIALS

Planned transmission measurements for Paraffin, Zirconium Hydride, and Mobilmet machining oil.

THERMAL SCATTERING LAW (TSL) PRIORITIES

	MATERIAL CATEGORY	SPECIFIC ISSTOPES/COMPBUNDS
1	Oils/Hydrecarbons	Light Paraffinlc Oil, Paraffin
2	Uranium Compounds	Uranyl Floorida, Uranyl Hitrate, Li_2O_3
3	Specialized Reactor Materials	U-Mo (Research Reactors), Zrrconium Hydride

TECHNICAL INFRASTRUCTURE & TOOLING

EVALUATION

MODERNIZING SAMMY

A critical task to ensure the sustainability of the primary nuclear data evaluation code for analyzing differential data.

TESTING

CNI-Nu, DANCE, DICER, TPC

ADVANCED MEASUREMENT INSTRUMENTATION

Deployment of specialized tools to capture high-fidelity reaction data.

TESTING

BRIDGING THE KNOWLEDGE GAP

A strategic focus on documenting "best practices" to preserve expert evaluation knowledge for future generations.

EVALUATION MILESTONES (FY2026-FY2032)

FY2026-2028: MAJOR ISOTOPES (U-235, Pu-239)

Uranium-235 **Plutonium-239**

Scheduled for extensive R Matris evaluation extensions to higher energy ranges.

FY2028-2030: STRUCTURAL & KEY MATERIALS

Beryllium **Carbon** **Iron**

Finalizing evaluations for Bervillum-9, Carbon-12, and Iron-88.

FY2030-2032: LONG-TERM DELIVERABLES

Cl → Ne → Phase I Testing → CSEWC Approval

Multi-phase testing for Chiorine S5 and Neodymium-143 extending through FY2022.

Some FY2025 Significant Accomplishments (NCSP Support)

- 1st Reactor Graphite Workshop (ReGra) at BNL (July 2025)
- ENDF Hackathon (BNL) hosted by ORNL (August 2025)
- LANL completed ^{240}Pu Prompt Fission Neutron Spectrum evaluation based on differential experiments (LANL/LLNL Chi-Nu Team)
- ^{233}U Parallel-Plate Avalanche Counter (PPAC) was built and tested in LLNL and shipped to LANSCE
- ^{133}Cs metallic transmission measurements completed late-2025 at DICER (LANL) to support burnup credit applications
- ^{239}Pu neutron transmission measurements at DICER (LANL) to support NCS applications with thermal Pu solutions
- TAMU evaluation of the U_3Si_2 and U_3O_8 libraries are complete and is undergoing QA checks

FY2025 NCSP "Strategic Priorities List"

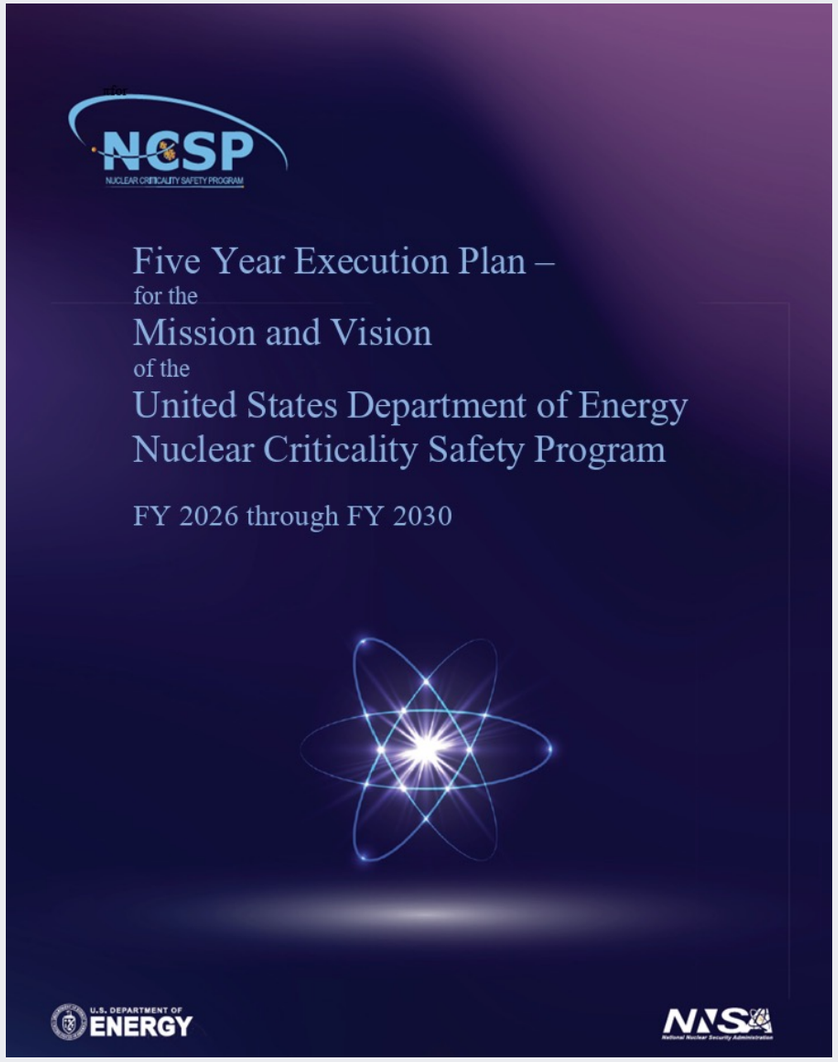


Table 2.2 NCSP "Strategic Priorities List" for FY2026

#	Milestone Description	Task/IER #	TPE	Lead Site
1	Complete updated SlideRule plutonium report.	ASNR AM5 LLNL AM3 ORNL AM6	AM	ASNR/ORNL/LLNL
2	MCNP - Provide design support and code methodology verification and validation for criticality accident alarm system analyses.	LANL AM01	AM	LANL
3	SCALE – enhance the automated direct perturbation capability with reaction-specific perturbations for confirmatory analyses of sensitivity calculations and their verification	ORNL AM02	AM	ORNL
4	Finish procurement for SPR/CX Temperature dependent benchmark.	IER 304	IE	SNL/ORNL
5	Increase Planet's rated load capacity.		IE	LANL
6	Perform joint experiment campaign at NCERC with ASNR to support neutron detection, analysis, and simulations for Fukushima Daiichi fuel debris removal.	LANL IE35	IE	LANL
7	Perform NCERC critical experiment for Ta validation supporting Pu processing operations.	IER 607	IE	LANL
8	Execute MOX experiments at NCERC in collaboration with ASNR.	IER 296	IE	LANL/ASNR
9	Complete TEX-Fe experiments.	IER 519	IE	LANL/LLNL
10	Providing training and fissionable material handling support to dynamic subcritical experiments.	IER 629	IE	LANL
11	Perform Beryllium-Reflected Uranium (BeRU) experiments.	IER 590	IE	LANL/NNL
12	Complete TEX-Lithium procurements.	IER 575	IE	LANL/LLNL
13	Provide guidance document to Y-12 regarding which TSLs to use for machine oils and coolants in NCS evaluations based on PNDA measurements.	IER 620	IE	LLNL
14	Complete procurement in support of BeO experiments.	IER 523	IE	SNL
15	Complete low temperature TEX experiments.	IER 479	IE	LANL/LLNL
16	Complete CAAS Testing with Godiva.	IER TBD	IE	AWE/LANL/LLNL/Y12/ASNR
17	Conduct AFRRI international dosimetry intercomparison.	IER TBD	IE	LLNL/ASNR/DoD
18	Provide a summary of LfE Database entries provided by the NCS community.	ORNL IPD4	IPD	ORNL/ASNR/NNL(UK)/LLNL
19	Complete U-233 PFNS measurements at Chi-Nu and finalize the analysis of the results.	LANL ND02	ND	LANL
20	Complete Zr-94 measurements at GELINA.	ORNL ND1	ND	ORNL
21	Take delivery of all remaining accelerator structures and close FAA.	RPI ND3	ND	RPI/NNL
22	Complete Gadolinium (^{155,157}Gd) nuclear data evaluations as described in Appendix B, Nuclear Data Priorities for FY26.	ORNL ND02 RPI ND01	ND	ORNL/NNL
23	Complete hand calculation tutorial videos.	ORNL TE16	TE	ORNL
24	Execute 1-week Manager Course for AWE at NCERC	ORNL TE01	TE	LLNL/ORNL/LANL

FY2025 NCSP "Strategic Priorities List"

	[illegible]			
14	Complete procurement in support of BeO experiments.	IER 523	IE	SNL
15	Complete low temperature TEX experiments.	IER 479	IE	LANL/LLNL
16	Complete CAAS Testing with Godiva.	IER TBD	IE	AWE/LANL/LLNL/Y12/ASNR
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23	Complete hand calculation tutorial videos.	ORNL TE16	TE	ORNL
24	Execute 1-week Manager Course for AWE at NCERC	ORNL TE01	TE	LLNL/ORNL/LANL

NCSP Nuclear Data Measurements in Progress – FY2026 5-Year Plan

Measurements	
Materials	**Site**
Cesium (^{133}Cs)	LANL
Chlorine (^{35}Cl)	ORNL, LANL, RPI
Chromium (^{50,52,53}Cr)	ORNL
Fluorine (^{19}F)	ORNL
Hafnium (^{nat}Hf)	NNL
Magnesium (^{24,25,26}Mg)	ORNL
Neodymium (^{143}Nd)	LANL
Neptunium (237Np)	ORNL, LANL
Nickel (^{58,60}Ni)	LANL
Plutonium (^{239}Pu)	LANL
Plutonium (^{240}Pu)	LANL, LLNL
Plutonium (^{242}Pu)	LANL
Samarium (^{149}Sm)	LANL

Measurements	
Materials	**Site**
Strontium (^{86,87}Sr)	ORNL
★ Uranium (^{233}U)	LANL, LLNL
Uranium (^{236}U)	ORNL
Vanadium (^{51}V)	ORNL
★ Zirconium (^{90,91,92,94,96}Zr)	ORNL, RPI
Beryllium (Be)	NNL
Light Paraffinic Oil	RPI, NNL
Paraffin (C_nH_{2n+2})	RPI, NNL
Mobilmet	RPI, NNL
ZrH_x	NNL
ZrC	NNL
Petrolatum	NNL

★ Strategic Priority Item

FY2026 Work

Pre-FY2026 Work

Outyear Work

NCSP Nuclear Data Evaluations in Progress – FY2026 5-Year Plan

Evaluations	
Materials	**Site**
Beryllium (^{9}Be)	LANL
Carbon (^{12}C)	LANL
Cesium (^{133}Cs)	ORNL, LANL
Chlorine (^{35,37}Cl)	ORNL, LANL
Chromium (^{50,53}Cr)	ORNL, BNL
Copper (^{63,65}Cu)	ORNL, LANL
Fluorine (^{19}F)	ORNL
★ Gadolinium (^{155,157}Gd)	ORNL, NNL
Hafnium (^{176,177,178,179,180}Hf)	ORNL, NNL
Iron (^{54,56,57}Fe)	ORNL, BNL
Iron (^{56}Fe)	ORNL, BNL
Lanthanum (La)	ORNL, LANL
Lithium (^{6}Li)	LANL
Magnesium (^{24,25,26}Mg)	ORNL
Molybdenum (^{92,94,95,96}Mo)	ORNL, NNL
Nitrogen (^{14}N)	ORNL
Oxygen (^{16}O)	LANL, ORNL
Neptunium (^{237}Np)	ORNL, LANL

Evaluations	
Materials	**Site**
Nickel (^{50,58}Ni)	LANL
Plutonium (^{238}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu)	LANL
Plutonium (^{239}Pu)	LANL, ORNL
Plutonium (^{240}Pu)	ORNL, LANL
Strontium (^{86,87}Sr)	ORNL
Uranium-233	LANL
Uranium-234	ORNL, LANL
Uranium-235	ORNL, LANL
Uranium-236	LANL, ORNL, NNL
Vanadium (^{51}V)	ORNL, LANL
Zirconium (^{90,91,92,94,96}Zr)	ORNL, RPI, NNL, BNL
Light Paraffinic Oil (Mineral Oil)	TAMU
Triuranium Octoxide (U_3O_8)	TAMU
U-Mo	TAMU
Uranyl Fluoride (UO_2F_2)	TAMU
Uranyl Nitrate ($UO_2(NO_3)_2$)	TAMU
Plutonium Nitrate ($Pu(NO_3)_4$)	TAMU

Thermal Scattering Evaluations

★ Strategic Priority Item

FY2026 Work

Pre-FY2026 Work

Outyear Work

NCSP Benefits/Successes

- NCSP support of each major ENDF/B library release supports reduced bias in eigenvalue (k_{eff}) computations to support nuclear criticality safety limit development in process facilities
  - NCSP provided significant support for the ENDF/B-VIII.1 library
- Integral experiment capabilities at NCERC and Sandia are funded by the NCSP to ensure facility availability for sponsor use (non-NCSP) and for new critical experiments to support the NCS community
  - Allows the NCSP to test nuclear data libraries by comparing radiation transport code results to modeled benchmark configurations
- NCSP performs differential measurements at RPI, LANL (LANSCE), ORNL (Spallation Neutron Source) and GELINA (Geel, Belgium)
- NCSP funds all aspects of the nuclear data pipeline to support the NCS community
  - Supporting process operations with hands-on operations with fissionable material
- NCSP supports university proposals for our human resource pipeline – many success stories here

Questions

Our Winter 2026 Newsletter was Published Last Week

NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM

NEWSLETTER

Winter 2026

IN THIS ISSUE

DATES TO REMEMBER

One-week Manager's Course Dates:
- NCERC – Mar. 16-20, 2025 (Full)
- SNL – Apr. 13-17, 2026 (Full)

Two-week Hands-on Course Dates:
- 2-week CSE course – Aug. 3 - 14, 2025 (Full)

NCSP Technical Program Review, Hosted by ORNL at the University of Tennessee Conference Center – March 3-5, 2025 (Register)

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

Great news! The President signed the Energy and Water Bill on January 23 which funds the DOE and NNSA. No government shutdown or further continuing resolution for DOE/NNSA. NCSP funding will be distributed in the February AFP. Adding to this is the recent renaissance in nuclear energy and small reactor design driven primarily by increasing national energy demands and artificial intelligence energy demands. The NCSP community is supporting a number of these small reactor efforts including testing and safety reviews. We also have several shared milestones and collaborations with DOE-NE this year.

The Annual NCSP Technical Program Review will be hosted by ORNL on March 3-5. The registration deadline is February 9. Information on the TPR and how to register can be found on the NCSP website. See you there.

Angela L. Chambers

https://ncsp.llnl.gov/sites/ncsp/files/2026-02/ncsp_newsletter_2026_winter.pdf