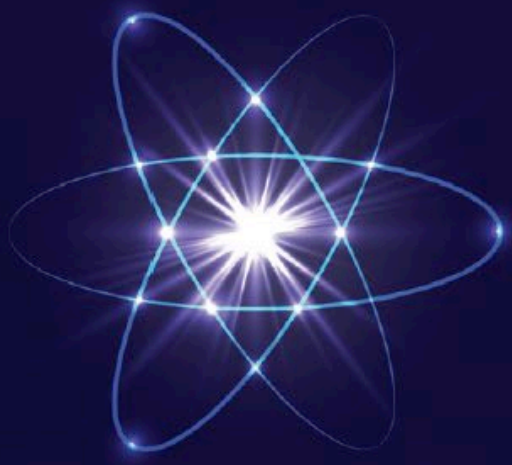
NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM

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

April 2024, Revision 2

FY 2024 through FY 2028

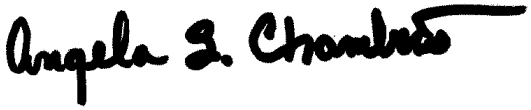


U.S. DEPARTMENT OF ENERGY

NNSA
National Nuclear Security Administration

Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan for Fiscal Years 2024 through 2028, dated August 21, 2023.

Approved:



Dr. Angela Chambers
Manager
Nuclear Criticality Safety Program

Revision History

Modification	Section	Date
Revision 0 – initial issue	All	
Revision 1 – Update for site hosting the annual Technical Program Review	Main Plan, Appendix A	February, 2024
Revision 1 – Update for site hosting the DOE Community of Practices Workshop	Main Plan, Appendix A	February, 2024
Revision 2 – See Addendum 1	Main Plan, Technical Program Elements	April 2024

Addendum 1 to the United Sates Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan
FY 2024 through FY 2028 Revision 2 Changes, April 2024
Main Plan Changes:

1. Appendix C changes for Los Alamos National Laboratory (LANL) foreign trips:
    - Add a second participant to the Compound Nuclear Reactions and Related Topics meeting.
2. Appendix C changes for Oak Ridge National Laboratory (ORNL) foreign trips:
    - Add the FUDGE/(MC)GIDI/GNDS Introductory Course in Paris, France in May 2024. Attendance at this workshop is useful for ORNL staff to use the open-source codes FUDGE and GIDI plus to generate and use nuclear data in the GNDS format. This is necessary to continue ND work at ORNL. Luiz Leal and Kemal Ramic will attend. A trip report will be due in quarter 3 to the NCSP manager.
    - Update the location of the ISO TC85/SC5/WG8 Nuclear Criticality Safety meetings and SC5 Plenary from Paris, France to London, UK.
3. Make-It-Happen List (MIHL) for FY24 Updates:
    - No. 3, Complete control room upgrades at NCERC will be replaced with Complete upgrade of first control room at NCERC.
    - No. 8, Complete measurements for GODIVA IV Shielding Benchmark (IER 498) will be replaced with Complete design of a molybdenum sensitive experiment (IER 517).
    - No. 12, Perform AFFRI dosimetry intercomparison international exercise will be associated with IER 602 and not IER 484.
    - No. 13, Submit benchmark evaluation of epithermal experiments (IER 441) will be replaced with Complete epithermal critical experiments. (IER 441).
4. FY24 Budget Changes are from the final post Continuing Resolution Work Breakdown Structure allotments received from the NCSP Program Manager, Angela Chambers on April 2, 2024.

Final Budget Allocation by Site:

FY24 Budget in $K					
LAB	**TPE**	**5YP Budget**	**Approved Funding**	**Enacted Budget per TPE**	**Enacted Budget Per Site**
ANL	TS	15	-1	14	**14**
ANL Total					
BNL	AM	75	-5	70	
	ND	360	-35	325	
	TS	140	-10	130	
BNL Total					**525**
LANL	AM	1435	-25	1410	
	IE	10400	-100	10300	
	IPD	100	0	100	
	ND	1409	-39	1370	
	TE	527	0	527	
	TS	275	0	275	
LANL Total					**13982**
LLNL	AM	260	-30	230	
	IE	1550	0	1550	
	IPD	700	-60	640	
	ND	430	-70	360	
	TE	390	-15	375	
	TS	145	-5	140	
LLNL Total				0	**3295**
NNL	TS	29	-4	25	
NNL Total					**25**
NNSS	IE	4394	-334	4060	
NNSS Total				0	**4060**
ORNL	AM	2260	-260	2000	
	IE	215	-15	200	
	IPD	150	-20	130	
	ND	1995	-95	1900	
	TE	340	0	340	
	TS	1134	-34	1100	
ORNL Total				0	**5670**
PNNL	AM	0	0	0	
	IE	0	0	0	
PNNL Total				0	**0**
RPI	ND	580	-42	538	
RPI Total				0	**538**
				0	
SNL	IE	1225	-45	1180	
	TE	240	0	240	
	TS	280	-20	260	
SNL Total				0	**1680**
SRS	IPD	30	-17	13	
	TS	20	-8	12	
SRS Total				0	**25**
Y12	AM	30	-10	20	
	IE	0	0	0	
	TE	0	0	0	
	TS	25	-20	5	
Y12 Total					**25**
Total Budget		**31158**	**-1319**	**29839**	**29839**

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ACRONYMS AND DEFINITIONS

ACE	"A Compact ENDF" file
ADVANCE	Automated Data Verification and Assurance for Nuclear Calculations Enhancement
AM	Analytical Methods
AMPX	Nuclear cross-section processing code
ARH	Atlantic Richfield Hanford
AWE	Atomic Weapons Establishment
BNL	Brookhaven National Laboratory
CAAS	Criticality Accident Alarm System
CEA	Commissariat à l'Énergie Atomique
CED	Critical Experiment Decision
COG[1]	Lawrence Livermore National Laboratory Monte Carlo Computer Code
CritView	A plotting and interpolation software program designed to display criticality data from the ARH-600 Criticality Handbook
CRP	Coordinated Research Projects
CSEWG	Cross Section Evaluation Working Group
CSSG	Criticality Safety Support Group
DAF	Device Assembly Facility
DOE	Department of Energy
ENDF	Evaluated Nuclear Data File
EOC	Explanation of Change (for out-year peaks and dips in budget plots)
FUDGE	Lawrence Livermore National Laboratory nuclear data management infrastructure
FY	Fiscal Year
GELINA	Linear Accelerator in Geel, Belgium
IAEA	International Atomic Energy Agency
ICSBEP	International Criticality Safety Benchmark Evaluation Project
IE	Integral Experiments
IER	Integral Experiment Request
INL	Idaho National Laboratory
IPD	Information Preservation and Dissemination
IRMM	Institute for Reference Materials and Measurements
IRSN	Institut De Radioprotection et De Sûreté Nucléaire

KENO[2]	Monte Carlo Criticality Computer Code
LA	Los Alamos (report)
LANL	Los Alamos National Laboratory
LINAC	Linear Accelerator
LLNL	Lawrence Livermore National Laboratory
MCNP®[3]	Monte Carlo N-Particle Computer Code
MSTS	Mission Support and Test Services
NCERC	National Criticality Experiments Research Center
NCS	Nuclear Criticality Safety
NCSET	Nuclear Criticality Safety Engineer Training
NCSP	Nuclear Criticality Safety Program
NCSU	North Carolina State University
ND	Nuclear Data
NDA	non-destructive assay
NDAG	Nuclear Data Advisory Group
NJOY	Nuclear cross-section processing code
NNDC	National Nuclear Data Center
NNL	Naval Nuclear Laboratory
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
OECD/NEA	Organization for Economic Cooperation and Development/Nuclear Energy Agency
ORNL	Oak Ridge National Laboratory
PNNL	Pacific Northwest National Laboratory
POC	Point of Contact
RPI	Rensselaer Polytechnic Institute
RSICC	Radiation Safety Information Computational Center
SAMMY[4]	R-matrix nuclear data evaluation code
SCALE[5]	A modular modeling and simulation system for nuclear safety analysis and design
SNL	Sandia National Laboratories
SQA	Software Quality Assurance
SRS	Savannah River Site

S/U	Sensitivity/Uncertainty
TACS	Training Assembly for Criticality Safety
TE	Training and Education
TSUNAMI	Tool for Sensitivity and Uncertainty Analysis Methodology Implementation
US	United States of America
UT	University of Tennessee
V&V	Verification and Validation
WPEC	Working Party on International Nuclear Data Evaluation Corporation
WPNCS	Working Party on Nuclear Criticality Safety
Y12	Y-12 National Security Complex

[1]COG was originally developed to solve deep penetration problems in support of underground nuclear testing. Variance reduction techniques are very important to these problems and hence the name COG was chosen as in "to cog the dice" or cheat by weighting.

[2]KENO is a family of Monte Carlo criticality codes whose name came from an observation of the KENO game in which small spheres, under air levitation, arbitrarily move about in a fixed geometry.

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[4]SAMMY is a nuclear reaction code used to performed nuclear data evaluations in the resolved and unresolved resonance region within the R-matrix theory in the Reich-Moore approximation as well as other formalisms by fitting measured data convoluted with their corresponding experimental corrections.

[5]SCALE is a system of well-established codes and data for performing nuclear safety (criticality, shielding, reactor physics and fuel irradiation) analyses.

United States Department of Energy

Nuclear Criticality Safety Program
Five-Year Execution Plan

1.0 Nuclear Criticality Safety Program Mission and Vision

The Nuclear Criticality Safety Program (NCSP) Mission and Vision, as stated in The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2019-2028 (https://ncsp.llnl.gov/docs/NCSP_MISSION_VISION.pdf), are the following:

- The NCSP mission is to provide sustainable expert leadership, direction, and technical infrastructure necessary to develop, maintain, and disseminate essential technical tools, training, and data required to support safe and efficient fissionable material operations within the United States (U.S.) Department of Energy (DOE).

- The NCSP will be a 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.

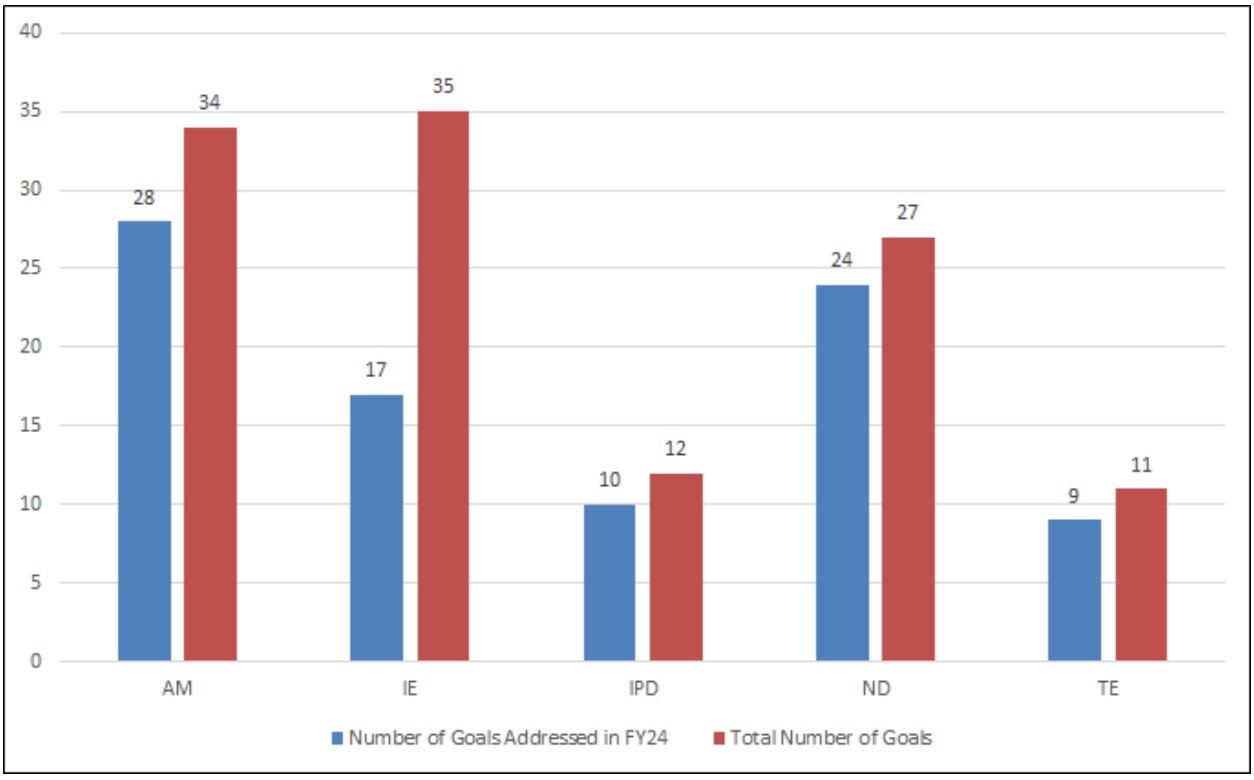
The NCSP is funded by the National Nuclear Security Administration (NNSA). Dr. Angela Chambers (NA-ESH-21) is the NCSP Manager. She is supported by the Criticality Safety Support Group (CSSG) and the Nuclear Data Advisory Group (NDAG), regarding technical matters, and by the Criticality Safety Coordinating Team (CSCT), consisting of Federal Criticality Safety Practitioners at the sites regarding DOE field criticality safety issues. Charters for the CSCT, CSSG, and the NDAG can be found on the NCSP website at: (http://ncsp.llnl.gov/).

The NCSP Mission and Vision is achieved by identifying and accomplishing a set of five-year programmatic goals in five broad technical program elements that support identified ten-year goals. The NCSP Five-Year Plan defines tasks that are designed to accomplish specific goals identified in the NCSP Mission and Vision. The current Five-Year Plan has been developed to accomplish these Mission and Vision goals with the advice and assistance of experts appointed by the NCSP manager or working under charters approved by the NCSP manager. The five technical program elements are:

- Analytical Methods (AM)
- Information Preservation and Dissemination (IPD)
- Integral Experiments (IE)
- Nuclear Data (ND)
- Training and Education (TE)

The NCSP Mission and Vision provides specific goals for each program element. Each task in the current Five-Year Plan aligns with a specific NCSP Mission and Vision goal. The number of goals addressed by the current Five-Year Plan is provided in Figure 1.1. Figure 1.1 indicates the NCSP is on track to accomplish a significant number of Mission and Vision goals in FY24. The subsequent discussion provides a summary of the projected task accomplishments and technical gaps for each program element. In FY24, a limited budget is available to initiate new tasks.

Figure 1.0 Summary of NCSP Mission and Vision Program Element Goals



The Analytical Methods (AM) program element provides for the development, distribution, and maintenance of state-of-the-art analytical capabilities for the processing of nuclear data from the Evaluated Nuclear Data File (ENDF) and the radiation transport analysis capabilities needed to perform nuclear criticality safety analyses. The Five-Year Plan tasks specifically supports 28 of 34 AM goals (82%) required to develop and sustain state-of-the-art cross-section processing and radiation transport modeling capabilities and expertise needed for criticality safety analyses. Regarding the overall AM technical gap over the next 5 years, the NCSP is continuing to make a modest investment at each site for succession planning efforts. University tasks, envisioned to assist in these goals, have been completed in FY23. Technical gaps still exist for the following Analytical Methods attributes and goals that require further consideration and either prioritization by the NCSP program, modification, or deletion of the goal.

Table 1.1 Analytical Methods Attribute/Goal Technical Gaps

Analytical Methods Attribute	Goal for the Analytical Methods Attribute Technical Gaps
Processing codes and data libraries	
Ability to process - Input evaluations in standard formats from all international compilations - Reaction cross section/energy/angle - Covariances (reaction/energy/angle)	Process new covariance evaluations for thermal scattering law data, collision kinematics, fission energy distributions
Radiation Transport Codes	
Geometry - 1D - generalized 3D - CAD/computer-aided engineering (CAE) interface - Time dependence (e.g., Godiva ringing)	Couple modern NCS radiation transport software with CAD/CAE packages
	Develop and maintain time-dependent geometry modeling capability
S/U Methods	

Analytical Methods Attribute	Goal for the Analytical Methods Attribute Technical Gaps
Sensitivity analysis capabilities - Sensitivity profiles - Similarity assessment - Covariance data (differential, integral, computational)	Develop and deploy methods to provide integral experiment correlation data
	Provide correlation data for integral benchmark experiments
Covariance adjustment	Develop and maintain S/U covariance adjustment capabilities per new CSEWG recommendation

The Integral Experiments (IE) program element maintains a fundamental capability for the DOE NCSP to be able to perform critical, subcritical, and fundamental physics measurements, to address site-specific needs on a prioritized basis, and this program element also supports maintaining a fundamental nuclear material handling capability, which enables hands-on NCS training programs and various other programs for the DOE NCSP and other Government Agencies. The Five-Year Plan tasks specifically support 17 of 35 (49%) IE goals to assess, design, perform, and document integral experiments. Technical gaps still exist for the following Integral Experiment attributes and goals that require further consideration and either prioritization by the NCSP program, modification, or deletion of the goal. Many of the remaining technical gaps for this program element are capability enhancements that are difficult to fund with the modest NCSP budget (most are line-item proposed capabilities).

Table 1.2 Integral Experiments Attribute/Goal Technical Gaps

Integral Experiment Attribute	Goal for the Integral Experiment Attribute Technical Gaps
Facilities	
Support for all security category nuclear material operations	Acquire building capable of supporting modular (singular campaign mode) critical assemblies
Support for all nuclear material types and forms	Develop authorization basis to support powders and solutions
Low-scatter facilities	Design and deploy low-scatter capabilities
Machine shop hot/cold	Standup cold machine shop at NCERC
	Standup hot machine shop at NCERC
Support for dynamic experiments	Develop infrastructure to support dynamic experiments
Dosimetry laboratory	Sustain
Radiochemistry laboratory	Design and deploy radiochemistry laboratory at NNSS
Experiment Equipment	
Fast burst reactor	Investigate restoring SPR-III to service
	Develop a conceptual design of a Np burst reactor
Solution reactor	Investigate solution reactor design and location
	Construct solution reactor
Precision measurements	Acquire precision measurements instrumentation at NCERC
Fast benchmark assembly	Design and build Jezebel
Materials	
Nuclear: access to all nuclear material types and forms	Investigate acquisition of low-enriched metal (≤ 20% U)
	Investigate acquisition of Np metal
	Acquire Np metal
	Acquire Jezebel plutonium

The Information Preservation & Dissemination (IPD) program element preserves primary documentation supporting criticality safety [e.g., benchmark critical experiments from the International Criticality Safety Benchmark Evaluation Project (ICSBEP)] and makes this information available for the benefit of the technical community including international partners (e.g., IRSN, AWE, CEA, and OECD) through the NCSP website. Funding support by the NCSP also allows critical benchmark and computational validation experts to lead and participate in the ICSBEP Technical Review Group meetings at OECD each year. The Five-Year Plan tasks specifically support 10 of 12 (83%) IPD goals for preserving and disseminating

technical, programmatic, and operational information important for nuclear criticality safety. Technical gaps still exist for this program element that are likely to be removed from the NCSP docket due to the impractical nature of goal implementation.

Table 1.3 Information Preservation & Dissemination Attribute/Goal Technical Gaps

Personnel/Facilities	
Maintenance/development of unclassified and classified web-based repositories with controlled access as needed for important data for criticality safety. Examples include but are not limited to: - ICSBEP benchmarks - Classified benchmarks - Critical ex	Develop and maintain searchable criticality safety professional phonebook, include site/facility criticality safety point of contact (POC), include key words for experience/evaluation expertise
Maintenance/development of unclassified and classified web-based repositories with controlled access as needed for important data for criticality safety. Examples include but are not limited to: - ICSBEP benchmarks - Classified benchmarks - Critical ex	Implement a process to rapidly disseminate information (e.g., operational upsets, emergency response) to criticality safety professionals ("Crit spam")

The Nuclear Data (ND) program element includes the measurement, evaluation, testing, and release in the U.S. ENDF library of neutron cross-section data for nuclides of high importance to nuclear criticality safety analyses. The Five-Year Plan tasks specifically support 24 of 27 (89%) ND goals to improve and disseminate measured and evaluated differential cross-section and covariance data needed by the AM element to support NCS analyses. Overall, many goals are addressed within the current ND budget targets; however, technical gaps do exist, and some ND goals cannot be addressed. Examples of goals not addressed are listed in the following table. Documenting best practices for ND evaluations can be completed without specific funding but should be reflected as ND work is performed. Developing new analysis tools for the utilization of new experimental capabilities (time projection chamber – TPC, Chi-Nu, and correlated data) is pending. Developing new evaluations with covariance data for fission product yields and delayed neutron data is pending re-establishing and sustaining the needed experience.

Table 1.4 Nuclear Data Attribute/Goal Technical Gaps

Personnel	
Nuclear data evaluators	Document best practices for nuclear data evaluations (knowledge management)
Models and Calculations	
Capability to evaluate experimental data	Develop new analysis tools to fully utilize new experimental capabilities such as the time projection chamber (TPC), Chi-Nu, and correlated data
Evaluations	
Cross section and other nuclear reaction evaluations with covariance data for priority NCSP nuclear data needs	Develop new evaluations with covariance data for fission product yields and delayed neutron data—will require re-establishing and sustaining expertise in this area

The Training and Education (TE) program element identifies, develops, and facilitates training needs and educational resources (including hands-on training with fissionable material systems) in areas where no suitable alternative exists. The primary purpose of the TE element is to maintain and enhance the technical abilities and knowledge of those who impact or are impacted directly by the practice of criticality safety.

The Five-Year Plan tasks specifically support 9 of 11 (82%) TE goals in FY24. The tasks primarily support the development and maintenance of the classroom and "hands-on" training courses at the Nevada Field Office, SNL and NNSS. Technical gaps still exist for the following Training & Education attributes and goals that require further consideration and either prioritization by the NCSP program, modification, or deletion of the goal. Developing best practices through a review of training and qualification program throughout the DOE complex to assess competency would result in significant NCSP expense to track training and qualification records for the DOE, which would be tedious and somewhat subjective. Further, this goal could be addressed as a CSSG tasking to at least provide sites with consistent assessment of competency if NCS staff move from site-to-site during their careers. The development of deployable training for operations and process supervisors involving fissionable material is very impractical and expensive; however, simulation methods could be envisioned for this purpose.

Table 1.5 Training and Education Attribute/Goal Technical Gaps

Personnel/Facilities	
Efficient application of training and qualification of criticality safety engineers within criticality safety programs	Develop best practices through a review of training and qualification programs throughout the DOE complex to include approaches for assessment of competency
Provision of criticality safety training not readily available from other sources	Develop and maintain deployable training for operators and process supervisors

Although some technical gaps exist in each program element, execution of the NCSP Five-Year Plan will support and accomplish a significant number of Mission and Vision goals (88 of 119 or 74%) in FY24. As a result, the NCSP will be able to accomplish the overall mission to provide sustainable expert leadership, direction, and technical infrastructure needed to support safe, efficient fissionable material operations within the DOE. NCSP Mission and Vision goal and attribute alignment on NCS community needs will be discussed for realignment in the next revision.

2.0 Technical Program Elements

As mentioned above, the NCSP includes the following five technical program elements:

- Analytical Methods
- Integral Experiments
- Information Preservation and Dissemination
- Nuclear Data
- Training and Education

A description of how each of these elements contributes to the enhancement of criticality safety is contained in the NCSP Mission and Vision document. This Five-Year Execution Plan contains the road map for each of the five technical program elements, including a budget, tasks, and milestones for completing the work and achieving the NCSP Vision. All tasks are approved based on their contribution to the achievement of the five- and ten-year goals in the Mission and Vision document. Funding figures are provided for each program element section. The status of all milestones will be reported to the NCSP Manager in quarterly reports that are due no later than three weeks from the last day of the month following the end of the quarter.

Funding for NCSP activities for FY2024-FY2028 are shown in Figures 2.0-1 – 2.0-5. The costs in the outyears depicted in Figure 2.0-1 are cost estimates based on current projections that may not reflect reality.

Finally, the goal of the NCSP is to provide "transparent responsiveness" for the DOE and Stakeholders. Therefore, this Plan and all accomplishments achieved under the auspices of the NCSP are posted in a timely manner on the NCSP website at: http://ncsp.llnl.gov/.

Figure 2.0-1 NCSP Funding Overview (FY2024-FY2028) – Total ($k)

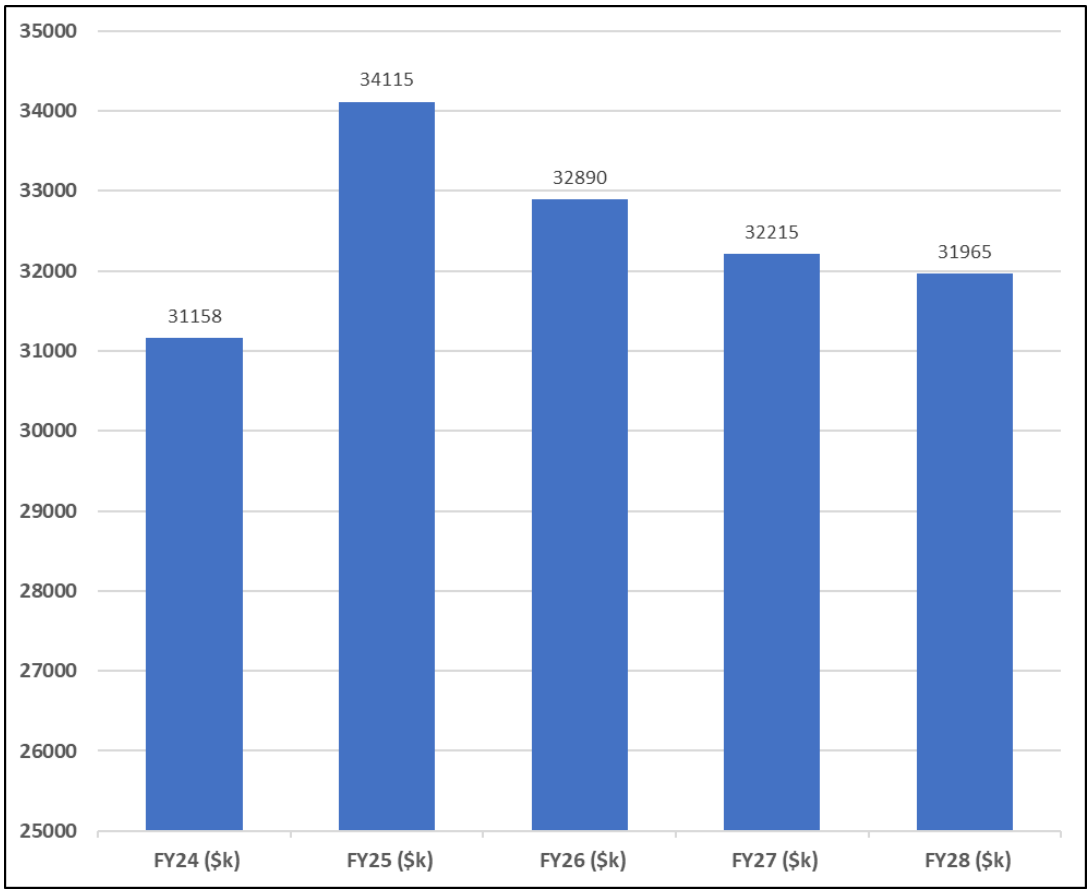


Figure 2.0-2 NCSP Funding Overview (FY2024) – By Technical Program Element ($k)

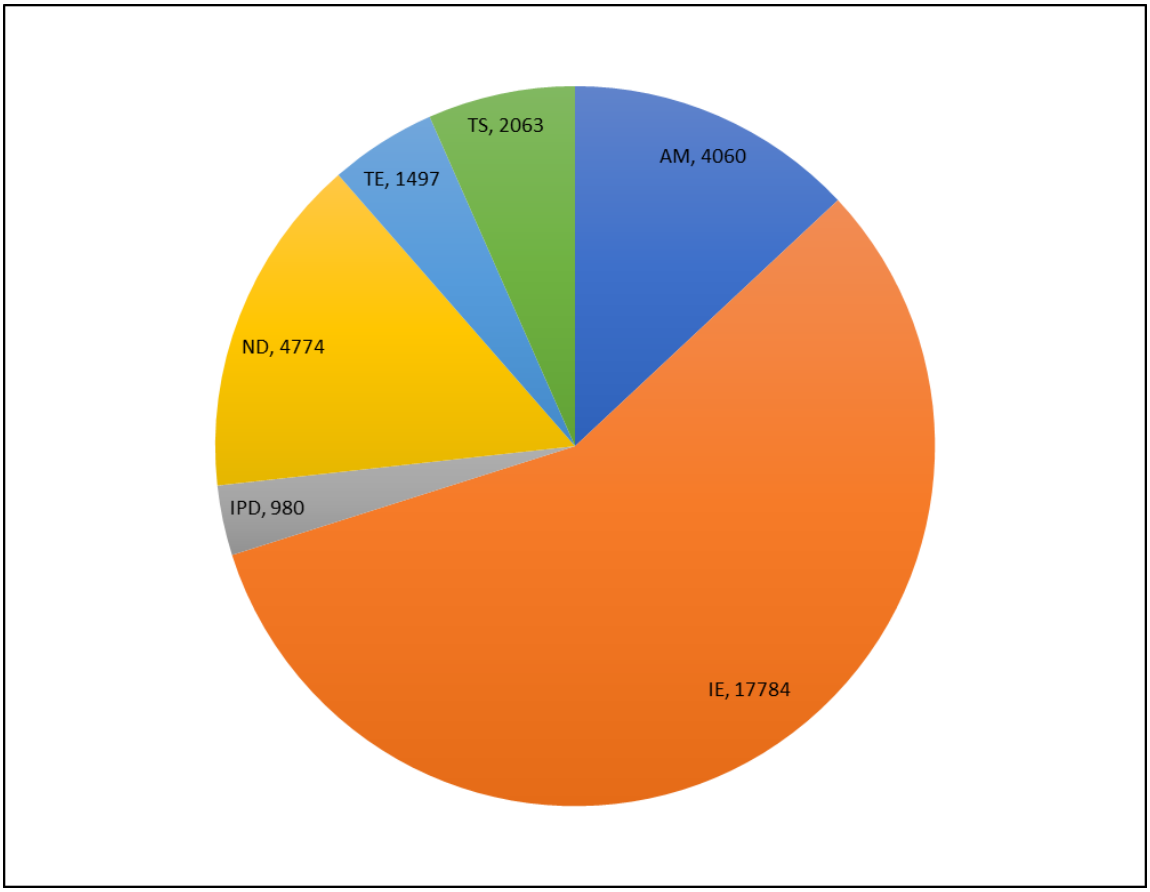


Figure 2.0-3 NCSP Funding Overview (FY2024-FY2028) – By Technical Program Element ($k)

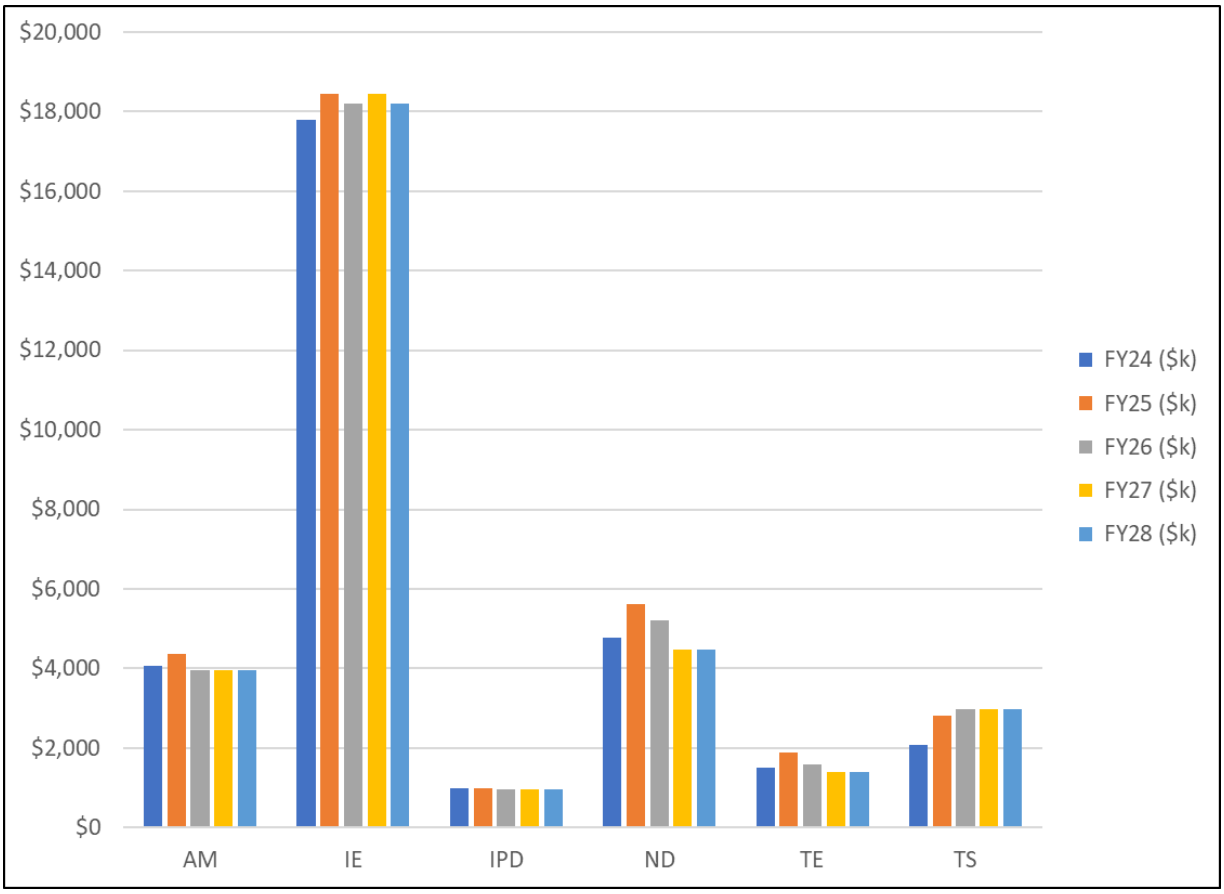


Figure 2.0-4 NCSP Funding Overview (FY2024-FY2028) – By Site

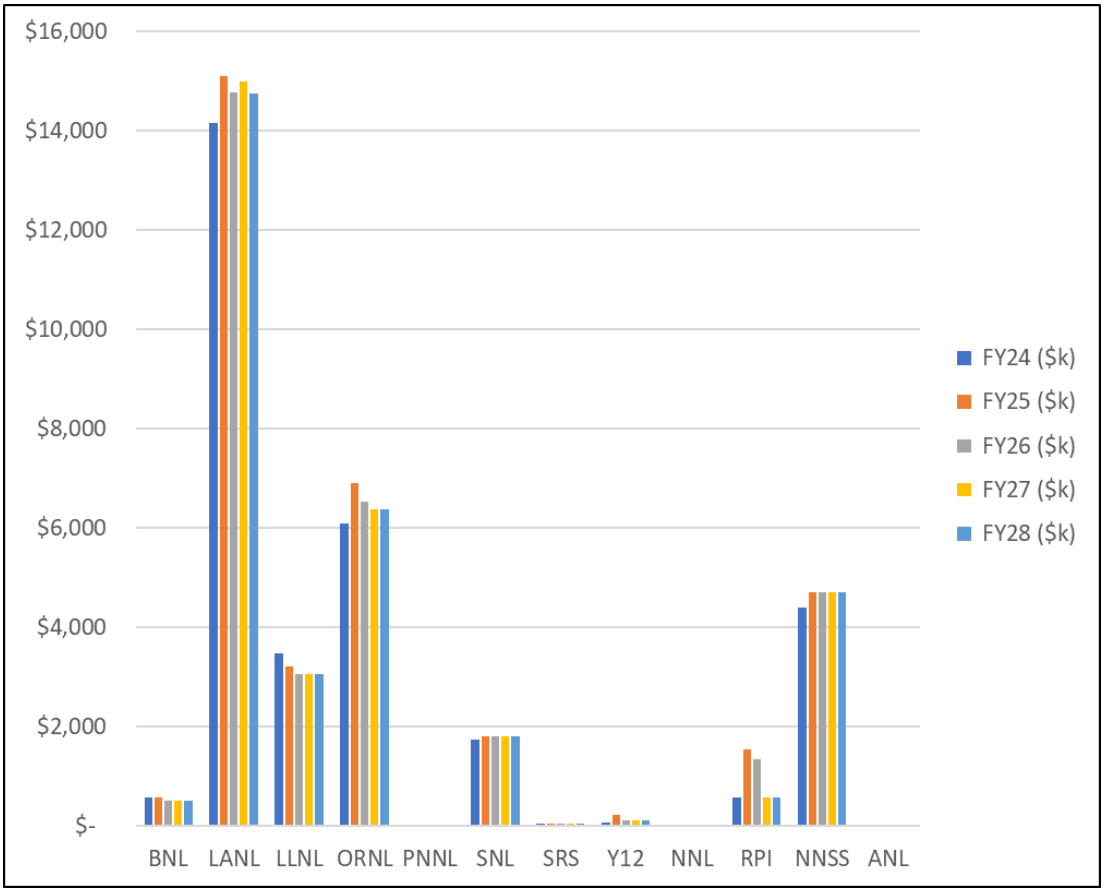


Figure 2.0-5 NCSP Funding Overview (FY2024) – By Site ($k)

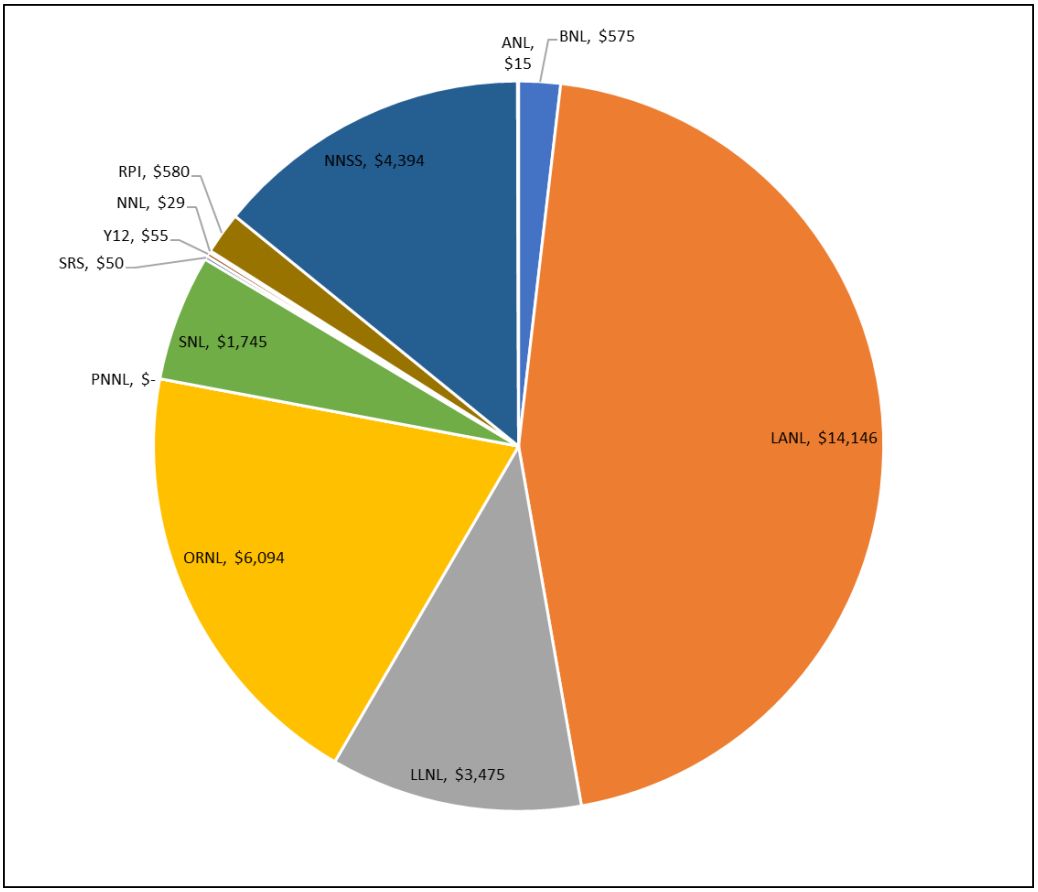


Table 2.1 shows the FY24 continuing resolution site-splits for NCSP sites. The site budget allocations will correspond to the FY23 enacted budget until the FY24 budget is approved. Once the FY24 budget is approved, the FY24 budgets, as shown in Table 2.2, are applicable.

Table 2.1 NCSP FY2024 Continuing Resolution Budget (FY23 Enacted)

IV. Funding Guidance[1]

Program / Obligation Control Level (OCL)	President's FY 2024 Budget Request	FY 2024 CR Annual Estimate	FY 2024 Enacted	Difference between Request vs. Enacted
Safety and Environmental Operations (DP0909000)				
Nuclear Criticality Safety Program (DP0909010)	$30,189,000	$29,080,000		$1,109,000

FY 2024 Nuclear Criticality Safety Program (NCSP)				
Performer	**AY**	**IP version 0**	**Changes**	**IP version 1**
Argonne National Laboratory (ANL)[2]	2024	$0.00	$14,025.00	$14,025.00
Brookhaven National Laboratory (BNL)	2024	$0.00	$537,625.00	$537,625.00
Fluor Marine Propulsion (FMP) [3]	2024	$0.00	$569,415.00	$569,415.00
Lawrence Livermore National Laboratory (LLNL) [2]	2024	$0.00	$3,219,120.00	$3,219,120.00
Los Alamos National Laboratory (LANL) [2]	2024	$0.00	$13,203,785.00	$13,203,785.00
Nevada National Security Site (NNSS)	2024	$0.00	$4,108,390.00	$4,108,390.00
Oak Ridge National Laboratory (ORNL) [2]	2024	$0.00	$5,697,890.00	$5,697,890.00
Pacific Northwest National Laboratory (PNNL)	2024	$0.00	$0.00	$0.00
Sandia National Laboratories (SNL)	2024	$0.00	$1,631,575.00	$1,631,575.00
Savannah River Site (SRS) [2]	2024	$0.00	$46,750.00	$46,750.00
Y-12 National Security Complex (Y-12) [2]	2024	$0.00	$51,425.00	$51,425.00
Headquarters [2]	2024	$0.00	$0.00	$0.00
Total, NCSP	**2024**	**$.00**	**$29,080,000.00**	**$29,080,000.00**

Table 2.2 NCSP Final Site Splits (FY2024 – FY2028)*

Row Labels	FY24 ($k)	FY25 ($k)	FY26 ($k)	FY27 ($k)	FY28 ($k)
Brookhaven National Laboratory	575	575	500	500	500
Los Alamos National Laboratory	14146	15106	14776	15001	14751
Lawrence Livermore National Laboratory	3475	3205	3055	3055	3055
Oak Ridge National Laboratory	6094	6896	6531	6381	6381
Pacific Northwest National Laboratory	0	0	0	0	0
Sandia National Laboratory	1745	1795	1795	1795	1795
Savanah River Site	50	50	50	50	50
Y-12 National Security Complex	55	210	105	105	105
Naval Nuclear Laboratory	29	29	29	29	29
Rensselaer Polytechnic Institute	580	1530	1330	580	580
Nevada Nuclear Security Site	4394	4694	4694	4694	4694
Argonne National Laboratory	15	25	25	25	25
Grand Total**	**31158**	**34115**	**32890**	**32215**	**31965**
Projected NCSP Budget**	**31158**	**30675**	**30675**	**30675**	**30675**

*CSSG funds for FY24 have been distributed to the NCSP sites. Site split data are estimates.
**Grand totals provided are costs needed to maintain current capabilities. Projected NCS budgets in FY25-FY28 are based on information from NNSA.

Table 2.3 NCSP Final Site Splits – FY2024 and FY2024 Continuing Resolution (FY23 Enacted)

Site and Technical Program Element	FY24 ($k)	FY24 CR - FY23 Enacted
BNL	**$ 575**	**$ 537**
AM	$ 75	$ 70
ND	$ 360	$ 336
TS	$ 140	$ 131
LANL	**$ 14,146**	**$ 13,203**
AM	$ 1,435	$ 1,339
IE	$ 10,400	$ 9,706
IPD	$ 100	$ 93
ND	$ 1,409	$ 1,315
TE	$ 527	$ 492
TS	$ 275	$ 257
LLNL	**$ 3,475**	**$ 3,243**
AM	$ 260	$ 243
IE	$ 1,550	$ 1,447
IPD	$ 700	$ 653
ND	$ 430	$ 401
TE	$ 390	$ 364
TS	$ 145	$ 135
ORNL	**$ 6,094**	**$ 5,688**
AM	$ 2,260	$ 2,109
IE	$ 215	$ 201
IPD	$ 150	$ 140
ND	$ 1,995	$ 1,862
TE	$ 340	$ 317
TS	$ 1,134	$ 1,058
PNNL	**$ -**	**$ -**
AM	$ -	$ -
IE	$ -	$ -
SNL	**$ 1,745**	**$ 1,629**
IE	$ 1,225	$ 1,143
TE	$ 240	$ 224
TS	$ 280	$ 261
SRS	**$ 50**	**$ 47**
IPD	$ 30	$ 28
TS	$ 20	$ 19
Y12	**$ 55**	**$ 51**
AM	$ 30	$ 28
IE	$ -	$ -
TE	$ -	$ -
TS	$ 25	$ 23
NNL	**$ 29**	**$ 27**
TS	$ 29	$ 27
RPI	**$ 580**	**$ 541**
ND	$ 580	$ 541
NNSS	**$ 4,394**	**$ 4,101**
IE	$ 4,394	$ 4,101
ANL	**$ 15**	**$ 14**
TS	$ 15	$ 14
Grand Total	**$ 31,158**	**$ 29,080**

2.1 NCSP FY2024 "Make-It-Happen" List

The task milestones for FY2024 are listed in the task tables by site throughout this 5-year plan document. The NCSP Manager, working with the site task managers, has identified 18 milestones that are **high priority** for the program These are listed in Table 2.2, below, in no particular order. These tasks are slated to be completed by the end of FY2024 and progress will be tracked through the regular quarterly reporting process.

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/Cl (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)**

2.2 Analytical Methods Technical Program Element

2.2.1 Program Element Description

The Analytical Methods (AM) technical program element provides the development and maintenance of state-of-the-art analytical capabilities for processing nuclear data from the ENDF, and the radiation transport analysis needed to support NCS evaluations for subcriticality and shielding. An essential aspect of the AM capabilities is the human expertise required to develop the analytical software, provide software configuration control, and train and assist the user community. Figures for each site provide information about the total budget for the approved tasks for each FY. Following this information, a table is provided with the following: task name, task title, description, budget, collaborators, and FY24 milestones. The list of collaborators may include IRSN, AWE, or another NCSP site. These international collaborators have provided a list of tasks of interest to each organization and are provided in Appendix E (IRSN) and Appendix F (AWE).

2.2.2 Approved Tasks

For each site, the following sections provide a task description, scope, budget, and milestones for each AM task approved by the NCSP manager.

Figure 2.2-1 NCSP AM Budget (FY2024-FY2028)

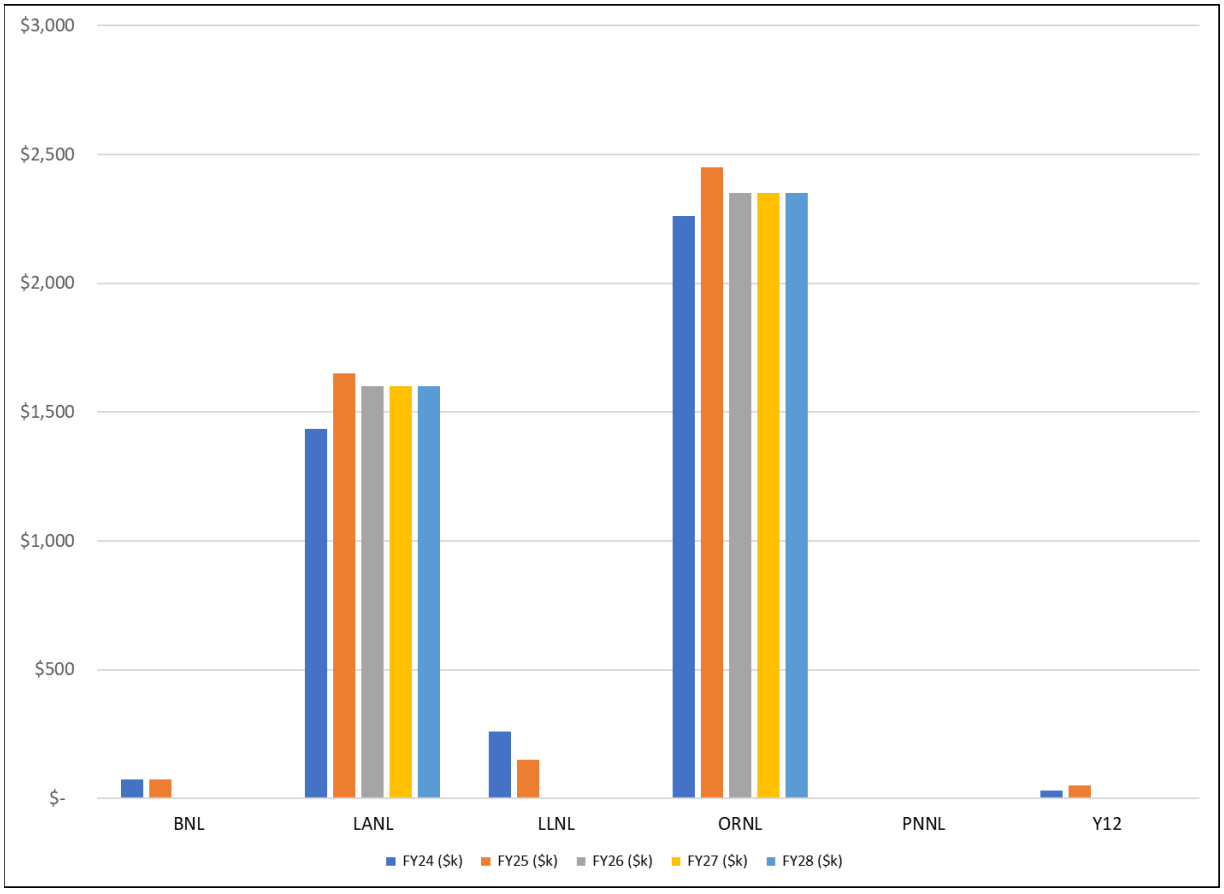
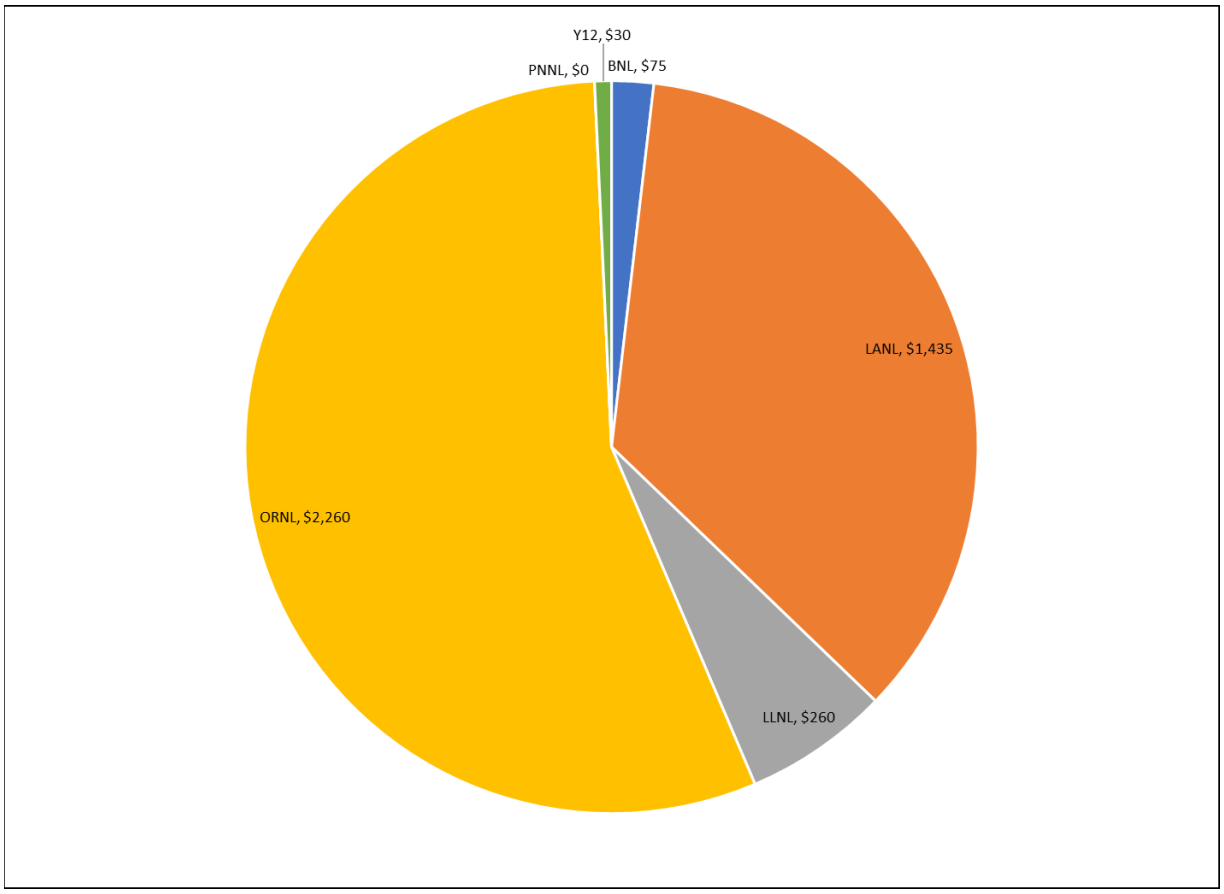


Table 2.5 NCSP AM Budget by Site (FY24)

NCSP Site	Budget ($k)
BNL	75
LANL	1435
LLNL	260
ORNL	2260
PNNL	0
Y12	30
Grand Total	4060

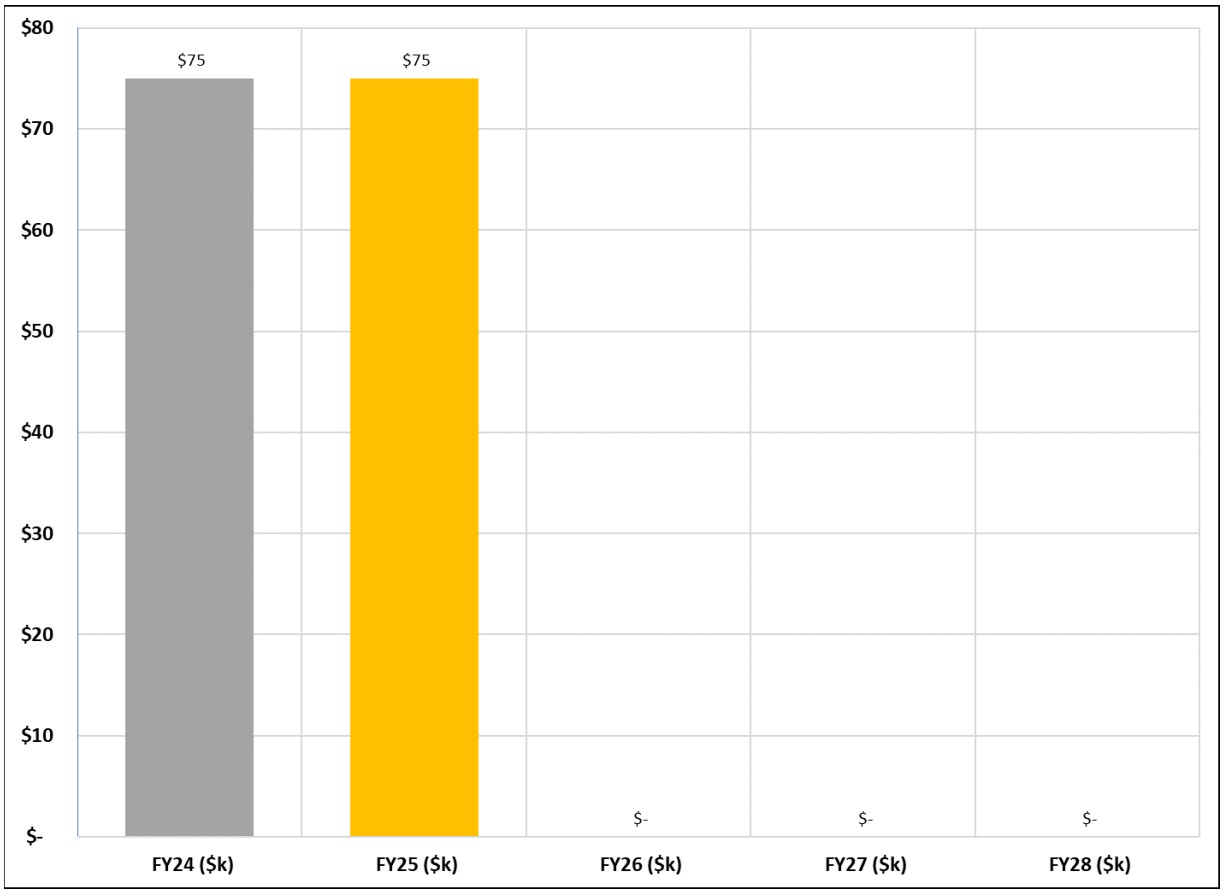
Figure 2.2-2 NCSP AM Budget by Site (FY2024)



2.2.2.1 Brookhaven National Laboratory (BNL)

Task Name	BNL AM4
Collaborators	LLNL (LLNL-AM4)
Task Title	Thermal Scattering and Self-Shielding in GNDS/FUDGE
Proposal Submitted	FY17 (5-yr task)
Task Budget (FY24)	$75K
Task Description	The focus for this task will be resonance self-shielding, including probability tables or multi-band techniques for both Monte Carlo and deterministic transport. Parameters and data for energy and spatial self-shielding will be incorporated into GND and FUDGE. Additional focus will be on testing Doppler broadening of thermal scattering laws.
FY24 Milestones	All 4 Quarters ○ Provide a status report on generating a draft document defining the TNSL code or software interface in the NCSP Quarterly Progress Report. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.2-3 BNL AM Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
Funding is essentially fixed each year for BNL-AM4, "Thermal Scattering and Self-Shielding in GNDS/FUDGE" for FY24-FY25. The task is due to be completed by FY25.

2.2.2.2 Los Alamos National Laboratory (LANL)

Task Name	LANL AM1
Collaborators	IRSN (IRSN-AM8)
Task Title	MCNP® Maintenance and Support, Uncertainty Analysis Development, and Modernization
Proposal Submitted	Ongoing
Task Budget (FY24)	$1100K
Task Description	This is a continuing task for the maintenance of the basic capabilities for performing Nuclear Criticality Safety calculations with the Monte Carlo N Particle (MCNP®) computer code, including general code maintenance, user support, improved nuclear data libraries, Verification and Validation (V&V), documentation, user training, and implementation of limited new capabilities; focus on modernizing MCNP for next-generation computing hardware; continue to develop MCNP-Whisper for continuous-energy sensitivity-uncertainty analysis, and contribute to the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) Working Party on Criticality Safety. LANL reports will be issued and posted on the MCNP website for all tasks.
FY24 Milestones	All 4 Quarters o Provide a status report on MCNP6 user support in NCSP Quarterly Progress Reports. o Provide status reports on LANL participation in US and International analytical methods collaborations in NCSP Quarterly Progress Reports. o Provide status reports on ENDF/B-VIII.1 nuclear data and covariance data testing activities. Quarter 1 o Provide reports on summer intern work accomplished. Quarter 2 o Provide the status of all MCNP6 and Whisper progress at the NCSP Technical Program Review. o Provide report(s) on MCNP6.3.1 updates and verification/validation results. Quarter 3 o Provide MCNP6 Criticality training course. o Provide report on the status of the integration of MCNP V&V, Whisper, and LABS benchmark suites. Quarter 4 o Provide a report on the impact of the available temperature treatments within the thermal neutron scattering and resolved resonance regions. o Provide a report on Whisper 2.0 updates.

Task Name	LANL AM2
Collaborators	None
Task Title	NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization
Proposal Submitted	Ongoing task
Task Budget (FY24)	$300K

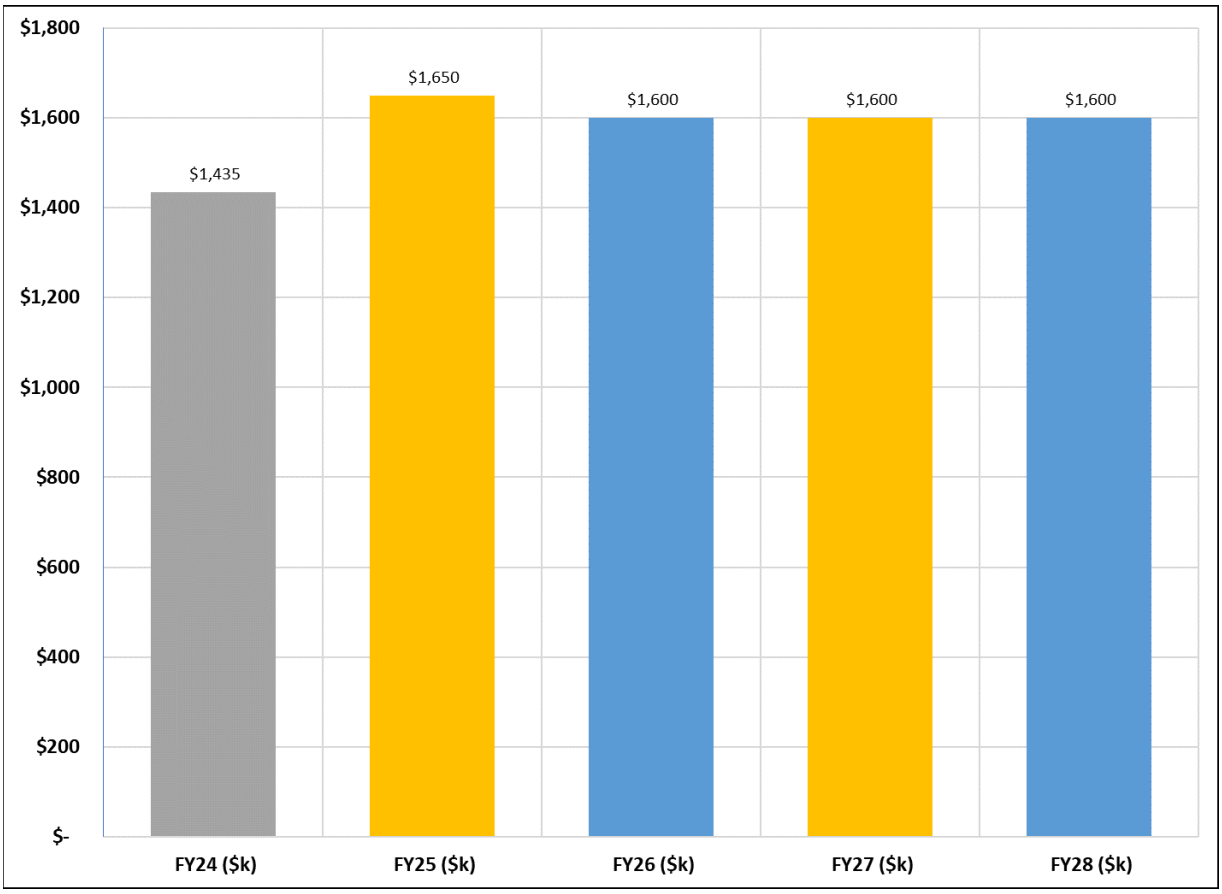
Task Description	This is a continuing task to support the development and maintenance of the NJOY nuclear data processing code system, implement capabilities as needed to process new general-purpose nuclear data files in the continuously evolving ENDF-6 format, provide support to NJOY users, modernize NJOY to adapt to modern code practices, new data formats, and next-generation computing hardware, and contribute to the NDAG, the Cross Section Evaluation Working Group (CSEWG), the Working Party on International Nuclear Data Evaluation Corporation (WPEC) and the International Atomic Energy Agency (IAEA) Coordinated Research Projects (CRP) as approved by the NCSP Manager. All NJOY updates will be distributed to users through a LANL-maintained website.
FY24 Milestones	All 4 Quarters o Provide a status report on NJOY maintenance and user support in the NCSP Quarterly Progress Reports. o Provide status reports on LANL participation in US and International analytical methods collaborations in the NCSP Quarterly Progress Reports. Quarter 1 - None Quarter 2 - None Quarter 3 - None Quarter 4 o Update the resonance reconstruction library to process EDA resonance parameters (which requires the use of the general R-matrix formalism in combination with relativistic kinematics) and create a comprehensive test suite. o Start the development work of a covariance processing component for a modernized NJOY and demonstrate initial capabilities: reading covariance data from ENDF files, perform basic covariance testing, conversion of covariance matrices to and from uncertainties and correlation matrices.

Task Name	LANL AM3
Collaborators	Rensselaer Polytechnic Institute
Task Title	Development of an Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6
Proposal Submitted	FY17
Task Budget (FY24)	$0K (use of FY23 carryover)
Task Description	LANL will enhance the physics treatment in MCNP6 so that it can perform fast on-the-fly sampling of S(alpha, beta) data at arbitrary temperature. RPI will develop thermal data libraries for selected materials to support on-the-fly S(alpha, beta) sampling for temperature ranges applicable to NCS and will test the data with MCNP6.
FY23 Milestones	All 4 Quarters o Provide status and update of work in NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2

	o Test on-the-fly temperature dependent S(alpha, beta) scattering with the new data files for Be and O in BeO using MCNP6 and deliver the new data files to LANL. Quarter 3 – None Quarter 4 o Provide a final report for the project.

Task Name	LANL AM5
Collaborators	IRSN (IRSN-AM13), ORNL (ORNL-AM10), LLNL (LLNL-AM5), Y12-AM1
Task Title	Proposed Benchmark Intercomparison Study
Proposal Submitted	FY22 (Budget Execution Meeting)
Task Budget (FY24)	$35K
Task Description	From 2018 to 2022, IRSN led a k-eff intercomparison exercise based on a common set of benchmarks for different codes' validation databases. The codes involved in the intercomparison exercise are COG (LLNL), MCNP (LANL), SCALE (ORNL) and MORET (IRSN). The intercomparison exercise included 272 datasets from different validation databases. The results of this study led to some improvements to the validation databases and to identify/confirm nuclear data issues regarding processing, data evaluation, etc. A summary report is in progress. Given the benefit to all the activity participants, the study has been extended until FY2025. Further studies include new benchmarks, new k-eff comparisons, shielding benchmarks and beta-effective measurements. A second report is planned at the end of the extension phase.
FY24 Milestones	All 4 Quarters o Provide status on LANL AM5 activities in NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 - None Quarter 3 – None Quarter 4 – None

Figure 2.2-4 LANL AM Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The LANL AM budget decreased in FY24 to provide funding for other program elements. The increases after FY24 are to restore the reduced budget. The reduction after FY25 is due to the completion of LANL AM5.

2.2.2.3 Lawrence Livermore National Laboratory (LLNL)

Task Name	LLNL AM3
Collaborators	IRSN (IRSN-AM5), (AWE-AM1), ORNL (ORNL-AM6)
Task Title	Slide Rule Application
Proposal Submitted	FY15
Task Budget (FY24)	$25K
Task Description	This is an ongoing task to support work to generate and update a criticality slide rule, including for plutonium systems. IRSN is the lead on this task.
FY24 Milestones	All 4 Quarters o Provide status on LLNL AM3 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

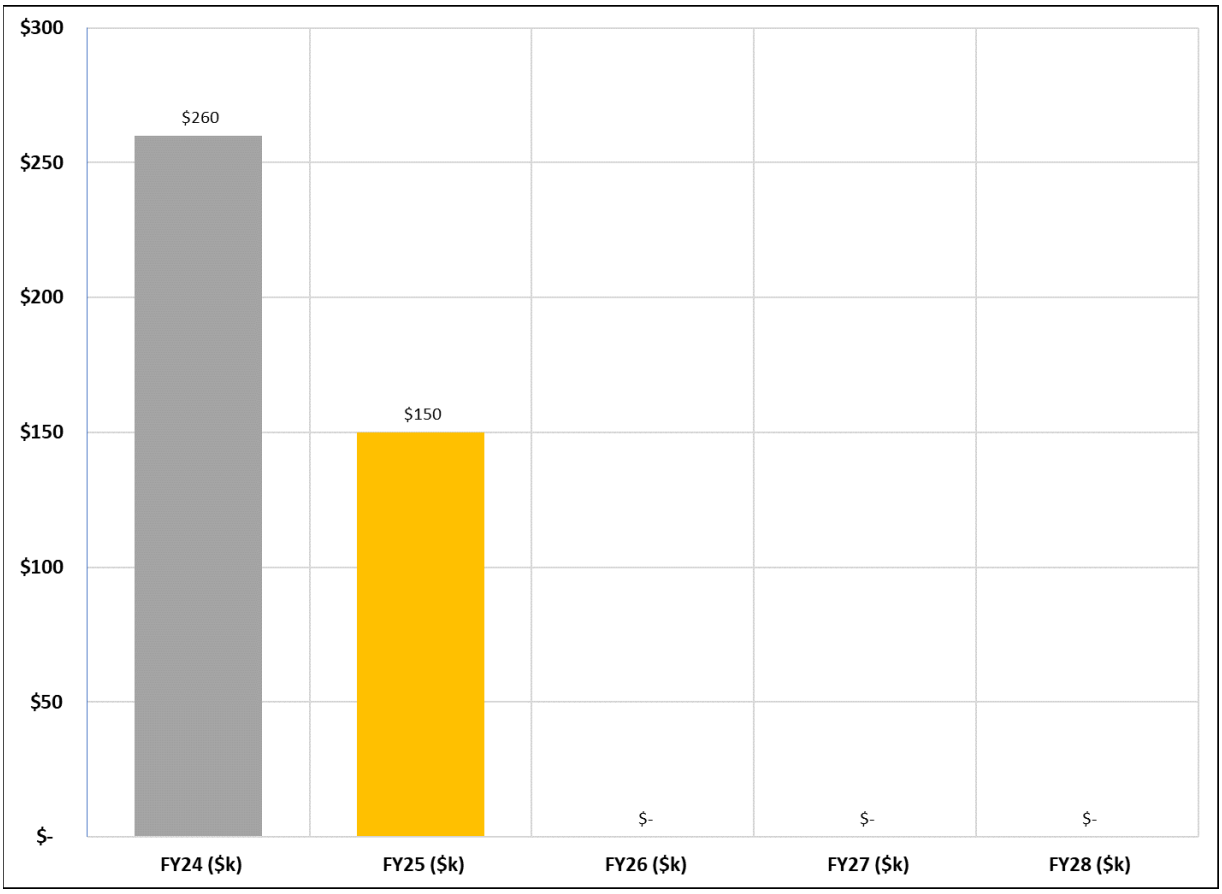
Task Name	LLNL AM4
Collaborators	BNL (BNL AM4)
Task Title	Thermal Scattering and Self-Shielding in GNDS/FUDGE
Proposal Submitted	FY2017 (5-yr task)
Task Budget (FY24)	$100K
Task Description	The focus for this task will be resonance self-shielding, including probability tables or multi-band techniques for both Monte Carlo and deterministic transport. Parameters and data for energy and spatial self-shielding will be incorporated into GND and FUDGE. Additional focus will be on testing Doppler broadening of thermal scattering laws.
FY24 Milestones	All 4 Quarters o Provide status report on GNDS/FUDGE in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL-AM5
Collaborators	IRSN (IRSN-AM13), ORNL (ORNL-AM10), LANL (LANL-AM5), Y12 (Y12-AM1)
Task Title	Proposed Benchmark Intercomparison Study
Proposal Submitted	FY22 (Budget Execution Meeting)
Task Budget (FY24)	$35K
Task Description	From 2018 to 2022, IRSN led a k-eff intercomparison exercise based on a common set of benchmarks for different codes' validation databases. The codes involved in the intercomparison exercise are COG (LLNL), MCNP (LANL), SCALE (ORNL), and MORET (IRSN). The intercomparison exercise included 272 datasets from different validation databases. The results of this study led to some improvements to the validation databases and to identify/confirm nuclear data issues regarding processing, data evaluation, etc. A summary report is in

	progress. Given the benefit to all the activity participants, the study has been extended until FY2025. Further studies include new benchmarks, new k-eff comparisons, shielding benchmarks and beta-effective measurements. A second report is planned at the end of the extension phase.
FY24 Milestones	All 4 Quarters o Provide status on LLNL AM5 activities in NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL-AM9
Collaborators	
Task Title	COG Data Library Generation and Testing
Proposal Submitted	FY24 (Budget Execution Meeting)
Task Budget (FY24)	$100K
Task Description	This task allows for the generation of nuclear data libraries for use in COG in order to test beta pre-release and production data files using COG's extensive benchmark suites and participation in the CSEWG validation working group.
FY24 Milestones	All 4 Quarters o Provide status on LLNL AM9 activities in NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.2-5 LLNL AM Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The LLNL AM budgets gradually decrease due to the completion of LLNL-AM2, LLNL-AM3, LLNL-AM4 and LLNL-AM5 tasks through FY26.

2.2.2.4 Oak Ridge National Laboratory (ORNL)

Task Name	ORNL-AM1
Collaborators	None
Task Title	Radiation Safety Information Computational Center (RSICC)
Proposal Submitted	Ongoing
Task Budget (FY24)	$750K
Task Description	RSICC ongoing approved task to collect, update, package, and distribute software and associated nuclear data libraries (i.e., SCALE, MCNP, VIM, and COG and nuclear data processing (i.e., NJOY, AMPX and SAMMY) to the NCS community. The NCS community includes DOE and NNSA M&O NCS staff, e.g., LANL, LLNL, SNL, SRNS, etc., DOE-EM M&O NCS staff, e.g., PGDP, PORTS, SRNL, etc. This does not include NRC-regulated NCS staff, M&O subcontractors, and independent consultants. University students in Nuclear Engineering programs performing NCS analysis is also included. Also, test and disseminate processed nuclear data associated with the software.
FY24 Milestones	All 4 Quarters o Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide quarterly distribution totals. o Provide status on RSICC activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL-AM2
Collaborators	IRSN (IRSN-AM8)
Task Title	SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section and Generation/Modernization
Proposal Submitted	Ongoing
Task Budget (FY24)	$1100K
Task Description	Ongoing, approved task to provide SCALE/KENO/TSUNAMI maintenance and user support for performing Nuclear Criticality Safety (NCS) calculations with the SCALE package. Work tasks include sustaining and continually improving SCALE NCS features through user-driven enhancements, software quality assurance (SQA) and V&V; assuring adaptability to various computing platforms and compilers; providing improved user interfaces and user documentation consistent with modern engineering software; supporting responsive communication to SCALE criticality safety users through SCALE Newsletters, email notices, and updates on the SCALE website, and training. The task also includes support for modernizing the software infrastructure and capabilities to improve quality and reliability and to ensure long-term sustainability of the NCS capabilities.
FY24 Milestones	All 4 Quarters o Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide a brief trip summary report to NCSP Manager on items of NCSP interest. o Provide a status report on TSUNAMI upgrades that may include: o Update documentation (user guidance for CLUTCH [F* studies]) o Code improvements in the following areas:

	○ Direct Perturbation (DP) calculations for specific reactions for both CE and MG transport, ○ Automated DP calculations ○ Improve existing CE sensitivity tallies to obtain more accurate scattering sensitivity coefficients, ○ Enable implicit sensitivity calculations with MG CLUTCH, ○ Implement MG IFP using the existing MG CLUTCH framework, ○ Add capability to calculate F*(r) importance function with Denovo for CLUTCH calculations, ○ Uncertainty impacts on integral parameters, ○ Template for VADER input generation (TSUNAMI-IP), ○ Runtime improvements (optimize sensitivity tallies in CE), ○ Progress with MG (in parallel). ○ Provide a status report on VADER to include: ○ VADER support and maintenance, ○ Correlation coefficient integration, ○ Generation of an improved manual containing methodology descriptions and consistent with deployed capabilities ○ Status report on Sampler improvements ○ Investigate the feasibility of integrating automated manufacturing tolerance assessment. ○ Adding a subset of CSAS5S search options (To replace CSAS5S) ○ Status report on CSAS improvements that may include: ○ CSAS support ○ Replacing deprecated HTML based output with equivalent visualization options in FULCRUM, ○ Enhance analysis by adding a toolbox to FULCRUM which may include visualization and post-processing capabilities for the CSAS/TSUNAMI output (visualizing fission points, particle tracks and region/mesh tallies, and utilities to help while post-processing the CSAS output), ○ Add missing frequency tables in CSAS-Shift, ○ Add missing data in problem characterization output edit in CSAS-Shift, ○ Enhanced source convergence metrics and testing, add more visual testing results. ○ Inherit Shift threading capability (shared memory parallelism) to SCALE sequences (CSAS-, TSUNAMI- and MAVRIC-Shift) ○ SCALEHELP ○ SCALE 7.0 Support that could include: ○ Continued improvements to the CSAS manual, especially related to Shift integration, Shift error messages, and new geometry implementation. ○ Porting improvements to SCALE 6.3.x as appropriate within Export Control limitations ○ SCALE training as approved by ORNL task manager. ○ Publish quarterly newsletter to users to communicate software updates, user notices, generic technical advice, and training course announcements. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 - None

Task Name	ORNL-AM3

Collaborators	IRSN (IRSN-AM9)
Task Title	AMPX Maintenance and Modernization
Proposal Submitted	Ongoing
Task Budget (FY24)	$300K
Task Description	Ongoing, approved task to develop and maintain the AMPX nuclear data processing code system to provide cross-section and covariance data libraries for NCS radiation transport software such as SCALE. In addition, the task includes additional effort to implement new software enhancements needed to improve the quality and reliability of the nuclear data libraries that AMPX produces. The overall development and maintenance work effort will ensure the AMPX software is up-to-date and conforms to ENDF/B formats and procedures. Moreover, the development and enhancements to the AMPX software will enable improved nuclear data processing capabilities needed to provide reliable nuclear data libraries to support radiation transport methods development and analyses.
FY24 Milestones	All 4 Quarters o Provide status on ORNL AM3 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 - None

Task Name	ORNL-AM6
Collaborators	IRSN (IRSN-AM5), AWE (AWE-AM1), LLNL (LLNL-AM3)
Task Title	Slide Rule Application
Proposal Submitted	FY15
Task Budget (FY24)	$25K
Task Description	This is a continuing task with IRSN, ORNL, and LLNL to modernize the existing SlideRule accident response tool. ORNL developed the initial SlideRule, and under this task, IRSN will update the SlideRule using modern radiation transport tools (e.g., SCALE, MCNP, COG, etc.) and expand the SlideRule capabilities. IRSN, ORNL, and LLNL on the SlideRule modernization effort and perform review tasks as needed to assess the performance of the updated SlideRule capability.
FY24 Milestones	All 4 Quarters o Provide status on ORNL AM6 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL-AM10
Collaborators	IRSN (IRSN-AM13), LLNL (LLNL-AM5), LANL (LANL-AM5), Y12 (Y12-AM1)
Task Title	Proposed Benchmark Intercomparison Study
Proposal Submitted	FY22 (Budget Execution Meeting)
Task Budget (FY24)	$35K

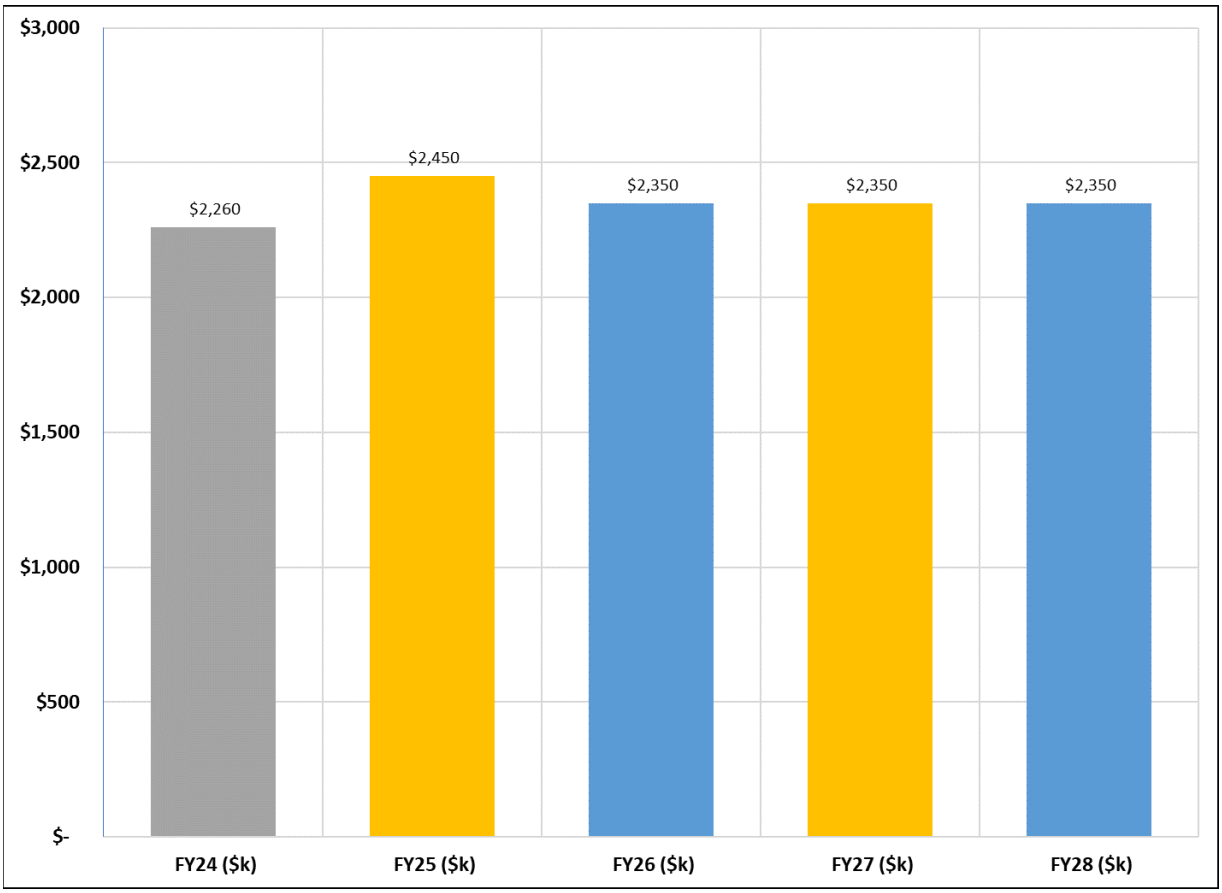
Task Description	From 2018 to 2022, IRSN led a k-eff intercomparison exercise based on a common set of benchmarks used on different codes' validation databases. The codes involved in the intercomparison exercise are COG (LLNL), MCNP (LANL), SCALE (ORNL) and MORET (IRSN). The intercomparison exercise included 272 datasets from different validation databases. The results of this study led to some improvements to the validation databases and to identify/confirm nuclear data issues regarding processing, data evaluation, etc. A summary report is in progress. Given the benefit to all the activity participants, the study has been extended until FY2025. Further studies include new benchmarks, new k-eff comparisons, shielding benchmarks, and beta-effective measurements. A second report is planned at the end of the extension phase.
FY24 Milestones	All 4 Quarters o Provide status on ORNL AM10 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL-AM17
Collaborators	None
Task Title	Expansion of the Verified, Archived, Library of Inputs and Data (VALID)
Proposal Submitted	FY20
Task Budget (FY24)	$50K
Task Description	Improve analytical methods and nuclear data tools for ensuring accurate criticality safety analyses that appropriately balance safety margins with operational flexibility. This task will generate TSUNAMI models for the 190 233U KENO models already in VALID, add deuterium-moderated models generated in FY18 University Task, and identify high-value benchmark experiments and add them to the library.
FY24 Milestones	All 4 Quarters o Provide status on ORNL AM17 activities in NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL-AM19
Collaborators	PNNL-AM1
Task Title	Analysis of Sum-of-Fractions for Nuclide Mixtures
Proposal Submitted	FY20
Task Budget (FY24)	$0K (Complete using FY23 carryover)
Task Description	Develop a technical foundation for the use of Sum-of-Fractions for nuclides in optimally moderated and fully reflected systems
FY23 Milestones	All 4 Quarters o Provide status on ORNL AM19 activities in NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None

	Quarter 4 – None

Figure 2.2-6 ORNL AM Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:

The ORNL budgets are essentially flat from FY24-FY28 except for a modest increase in ORNL-AM3 funding, then the budgets decrease each year through FY26 due to the closeout of tasks ORNL-AM6, ORNL-AM10, ORNL-AM17, ORNL-AM18, and ORNL-AM19 tasks in the outyears.

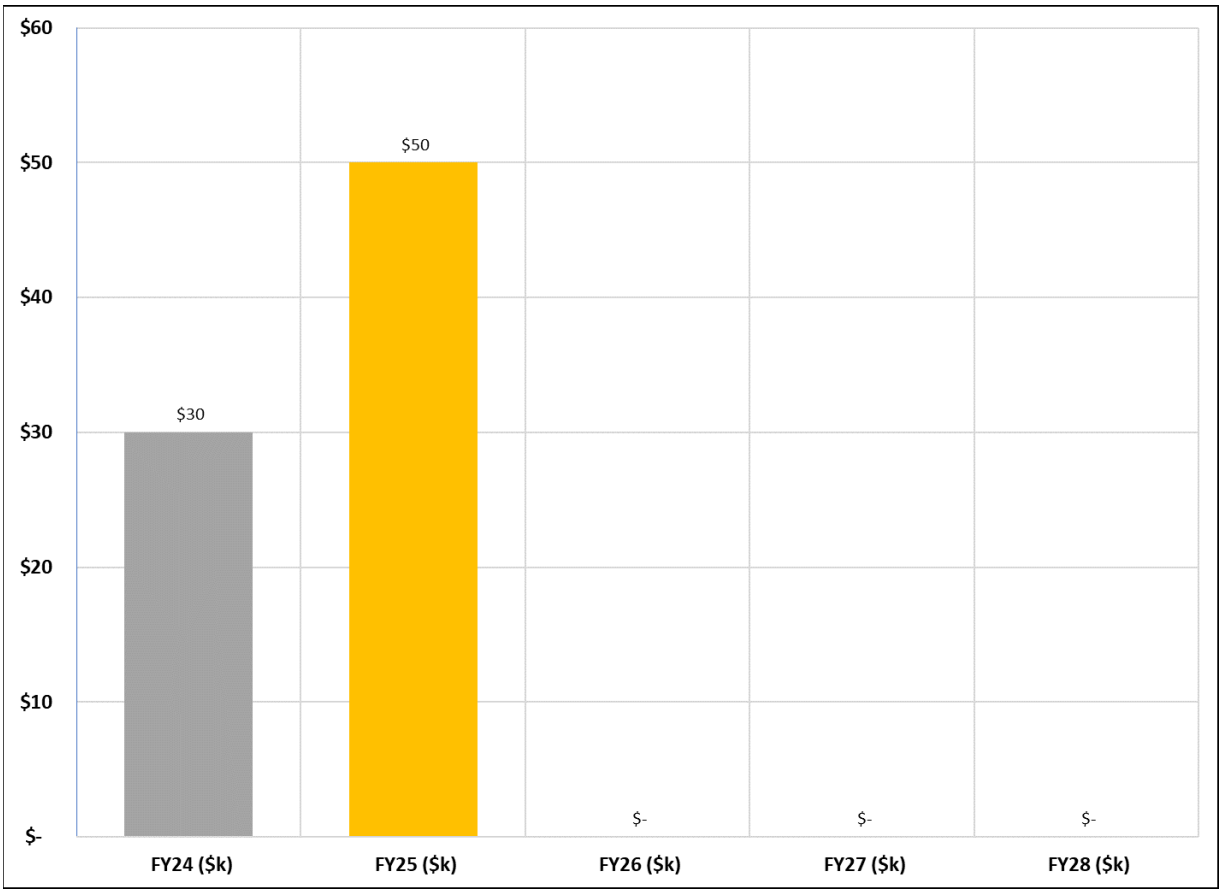
2.2.2.5 Pacific Northwest National Laboratory (PNNL)

Task Name	PNNL-AM1
Collaborators	ORNL-AM19
Task Title	Analysis of Sum-of-Fractions for Nuclide Mixtures
Proposal Submitted	FY20
Task Budget (FY24)	$0K (Complete using FY23 carryover)
Task Description	Develop a technical foundation for the use of Sum-of-Fractions for nuclides in optimally moderated and fully reflected systems
FY24 Milestones	All 4 Quarters o Provide status on PNNL AM1 activities in NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

2.2.2.6 Y-12 National Security Complex (Y12)

Task Name	Y12-AM1
Collaborators	IRSN (IRSN-AM13), LLNL (LLNL-AM5), LANL (LANL-AM5), ORNL (ORNL-AM10)
Task Title	Proposed Benchmark Intercomparison Study
Proposal Submitted	FY22 (Budget Execution Meeting)
Task Budget (FY24)	$30K
Task Description	From 2018 to 2022, IRSN led a k-eff intercomparison exercise based on a common set of benchmarks for different codes' validation databases. The codes involved in the intercomparison exercise are COG (LLNL), MCNP (LANL), SCALE (ORNL), and MORET (IRSN). The intercomparison exercise included 272 datasets from different validation databases. The results of this study led to some improvements to the validation databases and to identify/confirm nuclear data issues regarding processing, data evaluation, etc. A summary report is in progress. Given the benefit to all the activity participants, the study has been extended until FY2025. Further studies include new benchmarks, new k-eff comparisons, shielding benchmarks and beta-effective measurements. A second report is planned at the end of the extension phase.
FY24 Milestones	All 4 Quarters o Provide status on Y12 AM1 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.2-7 Y-12 AM Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The Y12 budget for FY23 is to support the Y12-AM1 task in collaboration with IRSN (IRSN-AM13), LLNL (LLNL-AM5), LANL (LANL-AM5), and ORNL (ORNL-AM10)

2.3 Information Preservation and Dissemination (IPD)

2.3.1 Program Element Description

The IPD program element preserves primary documentation supporting criticality safety and makes this information available for the benefit of the technical community. The NCSP website (http://ncsp.llnl.gov) is the central focal point for access to criticality safety information collected under the NCSP, and the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources.

Figure 2.3-1 IPD Budget (FY2024-FY2028)

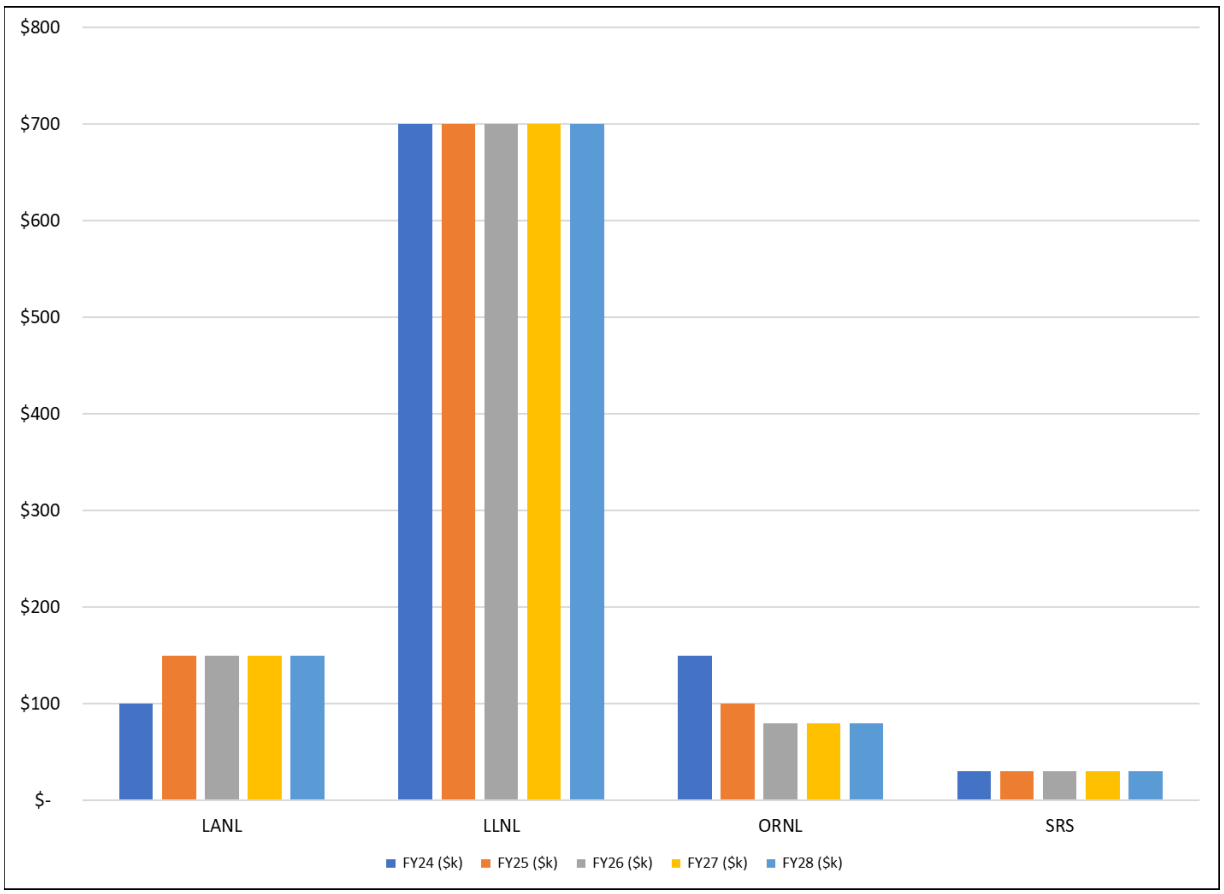
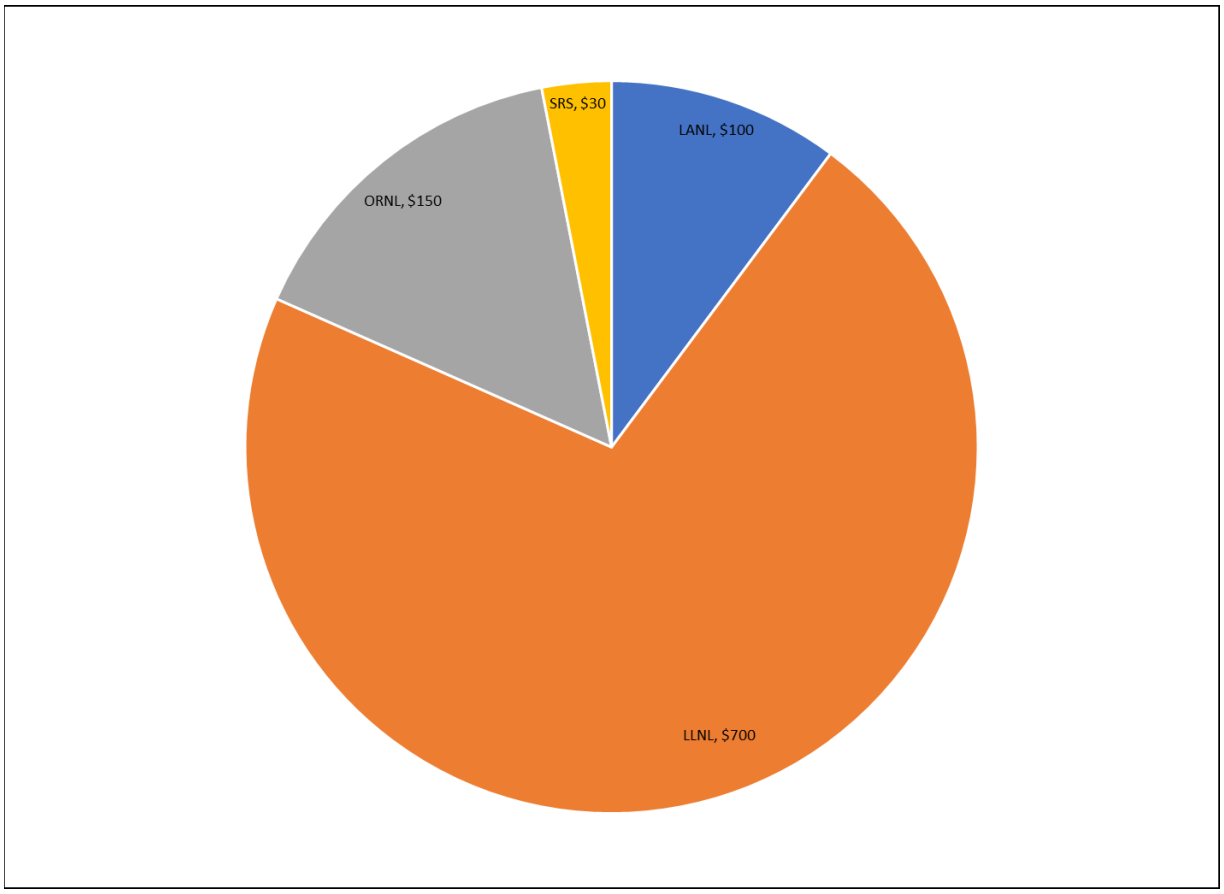


Table 2.6 NCSP IPD Budget by Site (FY24)

NCSP Site	Budget ($k)
LANL	100
LLNL	700
ORNL	150
SRS	**30**
Grand Total	980

Figure 2.3-2 IPD Budget by Site (FY2024)

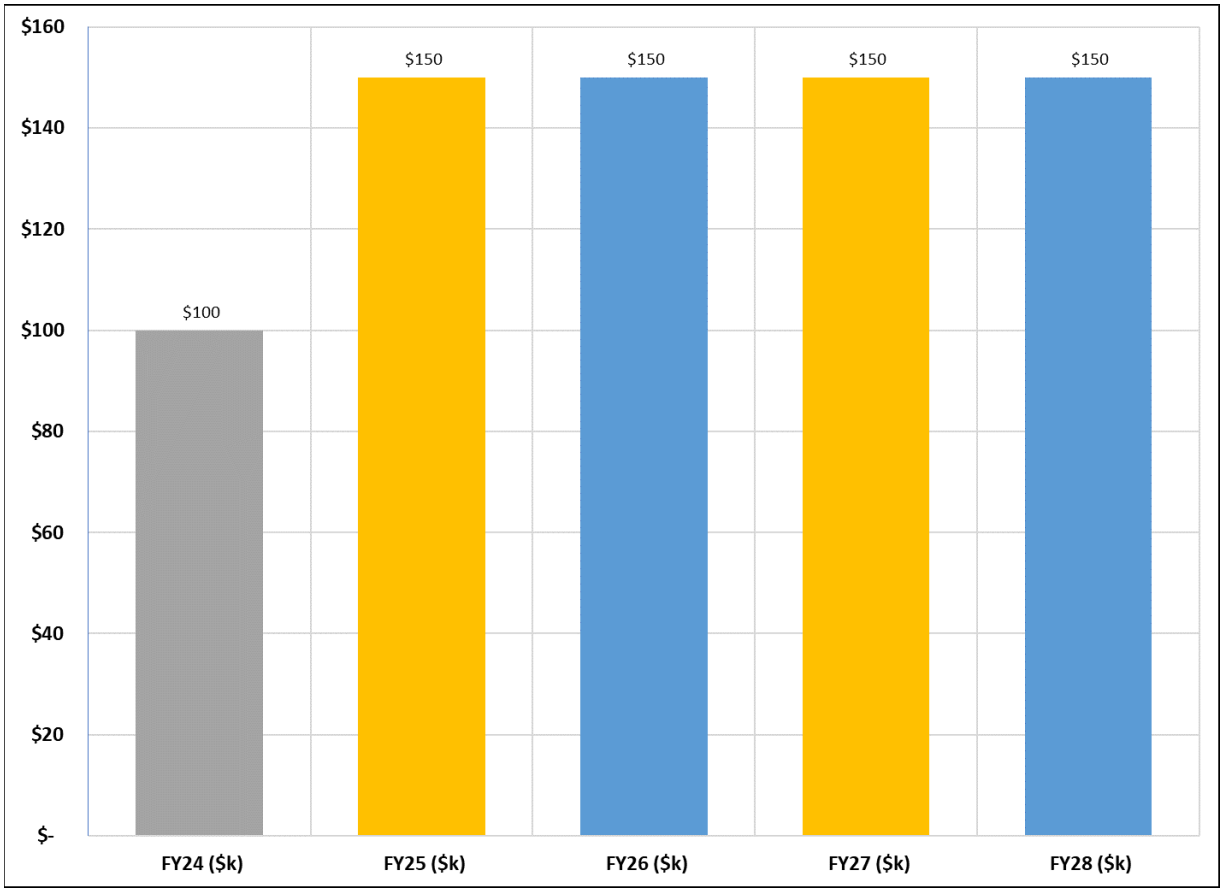


2.3.2 Approved Tasks

2.3.2.1 Los Alamos National Laboratory (LANL)

Task Name	LANL IPD3
Collaborators	LLNL IPD5
Task Title	IT Support at NNSS
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	There is one LLNL and two LANLIT staff (cyber security support and information technology support) that support JLON (laboratory) activities in NV, with NCSP covering the equivalent of 1 FTE between them. These staff provide classified (cyber security/system compliance and system administration) and unclassified system support. LANL and LLNL support is required for this task. See LLNL IPD5.
FY24 Milestones	All 4 Quarters ○ Provide status on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.3-3 LANL IPD Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
LANL IPD funding increases after FY24 to FY27 to account for actual resource cost.

2.3.2.2 Lawrence Livermore National Laboratory (LLNL)

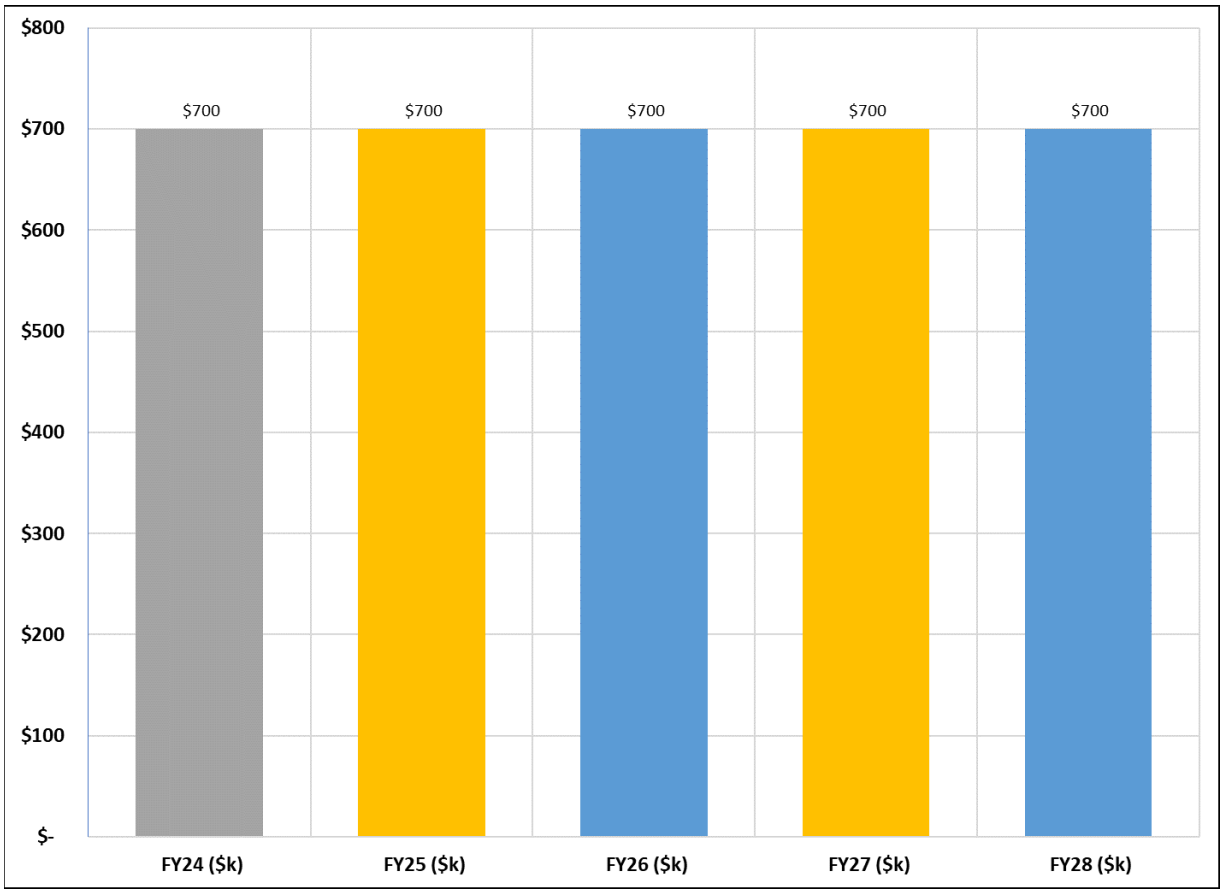
Task Name	LLNL IPD1
Collaborators	IRSN (IRSN-IPD1), AWE (AWE-IPD1)
Task Title	Conduct ICSBEP for Benchmarks of the 5-Year Plan and publish annual revision to the Handbook
Proposal Submitted	Ongoing
Task Budget (FY24)	$300K
Task Description	This is an ongoing approved task that provides independent and Technical Review Group (TRG) reviews for newly completed integral experiments for publication as NCSP contributions to the International Criticality Safety Benchmark Evaluation Project (ICSBEP). Priority historical experiments may also be evaluated and reviewed (internal, independent, and TRG) as resources allow. All NCSP funded experiments will be finalized and published on the NCSP website within two quarters of receipt of an Experiment Design Team reviewed and approved draft report (CED-4a). LLNL IPD1 will also provide leadership, coordination, and publication support for the OECD/NEA ICSBEP.
FY24 Milestones	All 4 Quarters o Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. o Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL IPD2
Collaborators	None
Task Title	Maintain the NCSP Website and Systems
Proposal Submitted	Ongoing
Task Budget (FY24)	$250K
Task Description	This is an ongoing approved task for operation, maintenance, and modernization of the NCSP website. The NCSP website is the central focal point for access to criticality safety information collected under the NCSP and is the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources.
FY24 Milestones	All 4 Quarters o Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL IPD5
Collaborators	LANL IPD3

Task Title	IT Support at NNSS
Proposal Submitted	Ongoing
Task Budget (FY24)	$150K
Task Description	There is one LLNL and two LANL IT staff (cyber security support and information technology support) that support JLON (laboratory) activities in NV, with NCSP covering the equivalent of 1 FTE between them. These staff provide classified (cyber security/system compliance and system administration) and unclassified system support.
FY24 Milestones	All 4 Quarters o Provide status on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.3-4 LLNL IPD Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
Budgets for LLNL IPD are identical FY24-FY28.

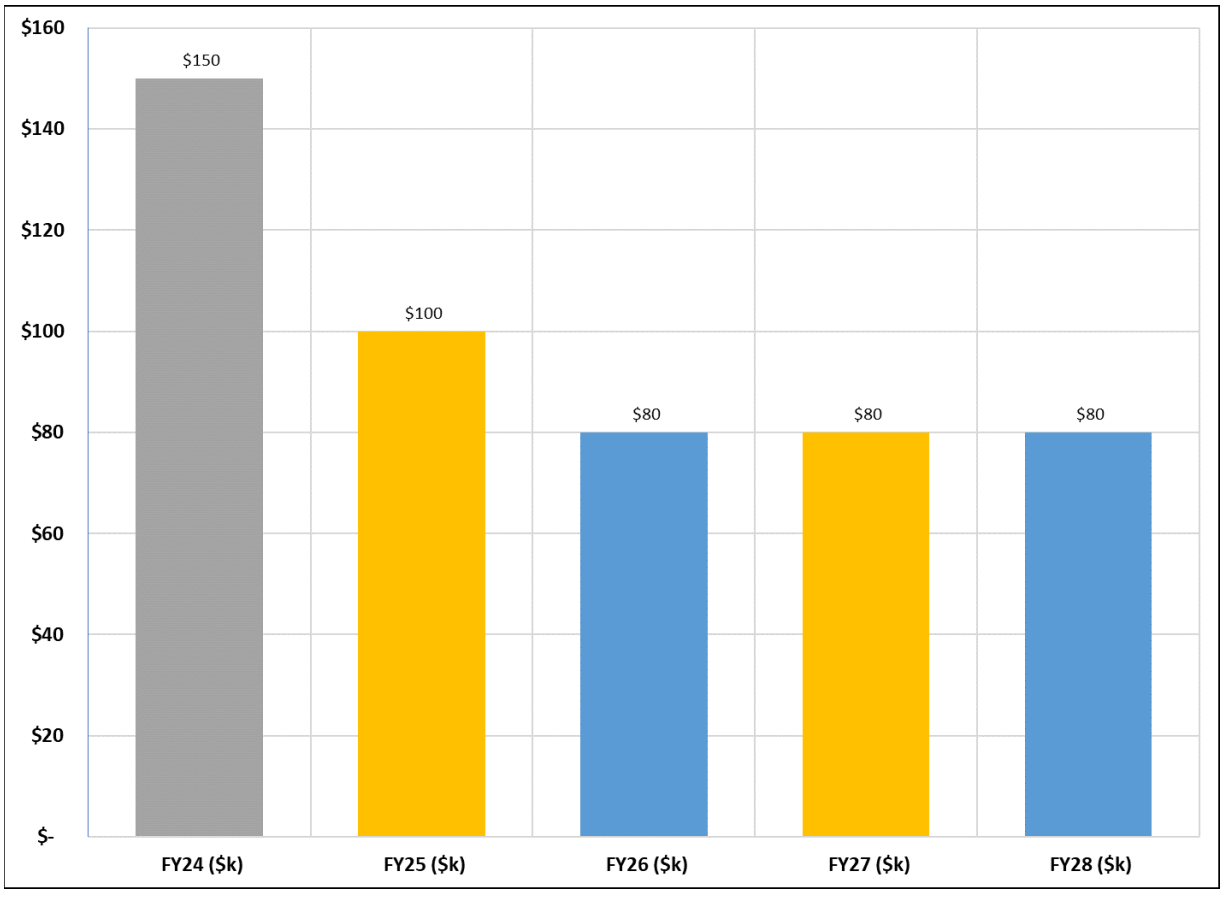
2.3.2.3 Oak Ridge National Laboratory (ORNL)

Task Name	ORNL IPD3
Collaborators	OSTI.gov
Task Title	Nuclear Criticality Safety Repository
Proposal Submitted	FY22, ongoing
Task Budget (FY24)	$70K
Task Description	Create a front-end and document repository at OSTI.gov to archive all NCSP and, possibly, documents related to Nuclear Criticality Safety in the community for easy access. ORNL will work with OSTI.gov on the development of the front-end and metadata needed to ensure NCS document searches are accurate and efficient. In the long-term, ORNL will work with LLNL to begin to archive legacy NCS reports and other documents that may be important to the NCS community.
FY24 Milestones	All 4 Quarters o Provide a status report about progress on the development of the NCSP repository at OSTI.gov in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL IPD4
Collaborators	IRSN (IRSN-IPD2)
Task Title	Nuclear Criticality Safety - Learning From Experience (LFE) Database
Proposal Submitted	FY22-25
Task Budget (FY24)	$50K
Task Description	The Nuclear Criticality Safety Program (NCSP) is a multi-lab collaboration dating back to the mid-1990's and a repository of NCSP documents has been hosted by LLNL for some time (website at https://ncsp.llnl.gov/). LLNL intends to continue hosting the website content to support NCSP execution; however, the NCSP website is not intended to serve as a document repository long-term. The LLNL website is subject to stringent security requirements and the use of the website as a document repository is not an efficient use of resources. A significant number of NCSP reports and deliverables end up at the DOE Office of Scientific and Technical Information (OSTI). OSTI is a specialized repository for this document collection. All documents in the collection are meant to be unlimited in distribution and publicly releasable; however, not all NCSP documentation have been sent to OSTI and still reside at the NCSP sites.
FY24 Milestones	All 4 Quarters o Provide a status report about progress on the development of the NCSP LFE database working with international collaborators. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL IPD5
Collaborators	N/A
Task Title	Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation
Proposal Submitted	FY19
Task Budget (FY24)	$30K
Task Description	Complete the final stages of the ICSBEP shielding benchmark process and defend in the ICSBEP TRG meeting in FY23. Convert the ICSBEP evaluation format to the SINBAD format and defend at upcoming meeting in FY24.
FY24 Milestones	All 4 Quarters ○ Provide a status report about progress on the HPRR benchmark. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.3-5 ORNL IPD Budget Trend (FY2024-FY2028)

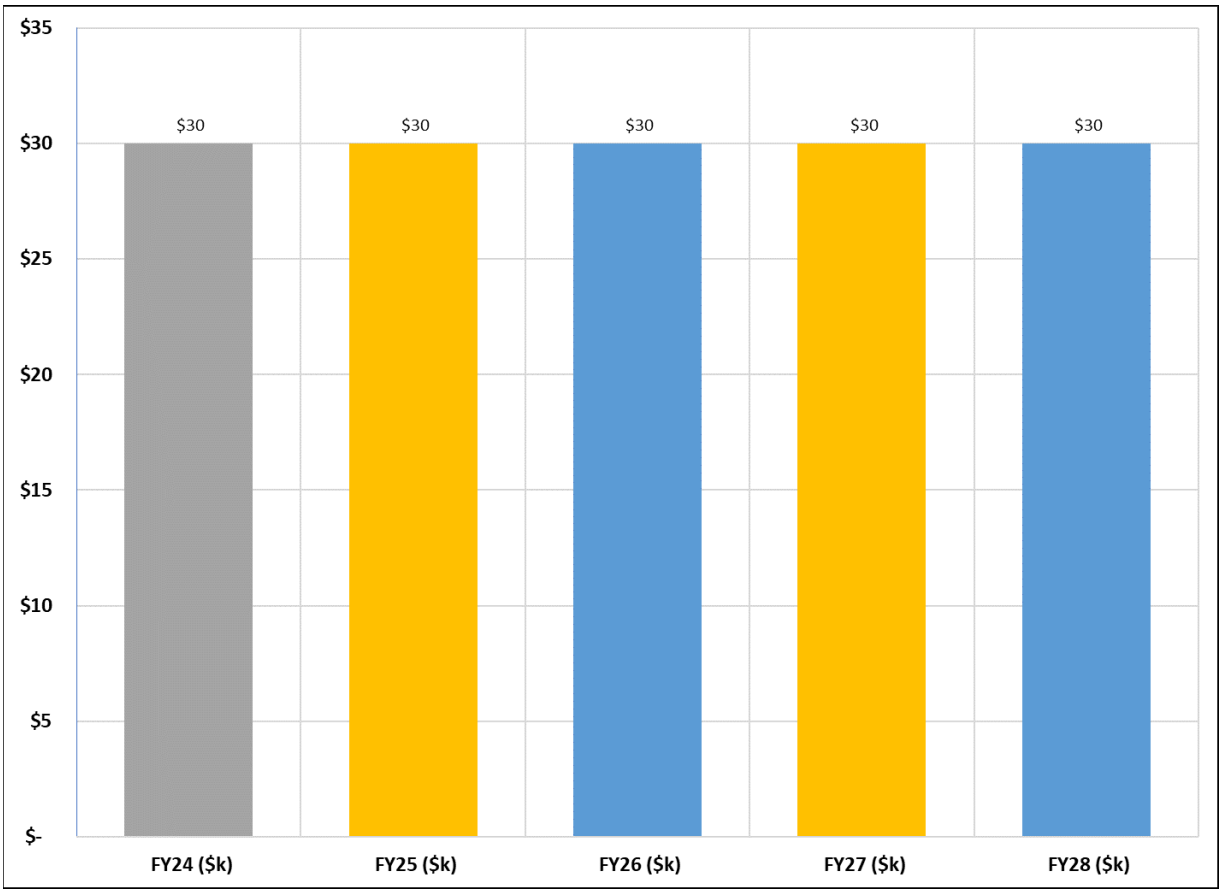


EOC – for out-year peaks and dips in budget plots:
The drop in budgets for FY25-FY28 reflect decreased scope for the LFE database and completion of the Health Physics Research Reactor benchmark.

2.3.2.4 Savannah River Site (SRS)

Task Name	SRS IPD1
Collaborators	None
Task Title	ARH-600 Reissue (CritView)
Proposal Submitted	FY18, ongoing
Task Budget (FY24)	$30K
Task Description	The following tasks are identified for ongoing CritView development. 1) Create a beta version of the new database incorporating all of the new data (LA-10860 and SCALE) 2) Perform verification testing on the beta code/database to ensure that everything is working correctly. 3) Work with the SRS clearance office to obtain clearance for public release for both the code and the data. 4) Deliver the final version of the code and database to LANL for inclusion on the NCSP website.
FY24 Milestones	All 4 Quarters • Provide status reports on SRS progress with CritView in the NCSP Quarterly Progress Reports. Quarter 1 • Complete beta version of new database. Quarter 2 • N/A Quarter 3 • Complete verification testing and finalize code/database version. Quarter 4 • Obtain clearance for public release of the code and data. • Deliver final product to LANL.

Figure 2.3-6 SRS IPD Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
SRS IPD budgets are the same over the period FY24-FY28.

2.4 Integral Experiments (IE)

2.4.1 Program Element Description

The IE program element maintains a fundamental capability for the DOE NCSP to be able to perform critical, subcritical, and fundamental physics measurements, within the limits of its resources, to address criticality physics needs, emerging data improvement needs by DOE programs, and specific site needs on a prioritized basis. This program element supports the cost of the LANL NCERC permanent party staff and supports maintaining a fundamental nuclear material handling capability, which enables hands-on NCS training programs and various other programs for the DOE NCSP and other government agencies. Figure 2.4-1 shows NCERC Utilization for FY22.

Figure 2.4-1 NCERC Utilization
(Referenced from LA-UR-23-21555)

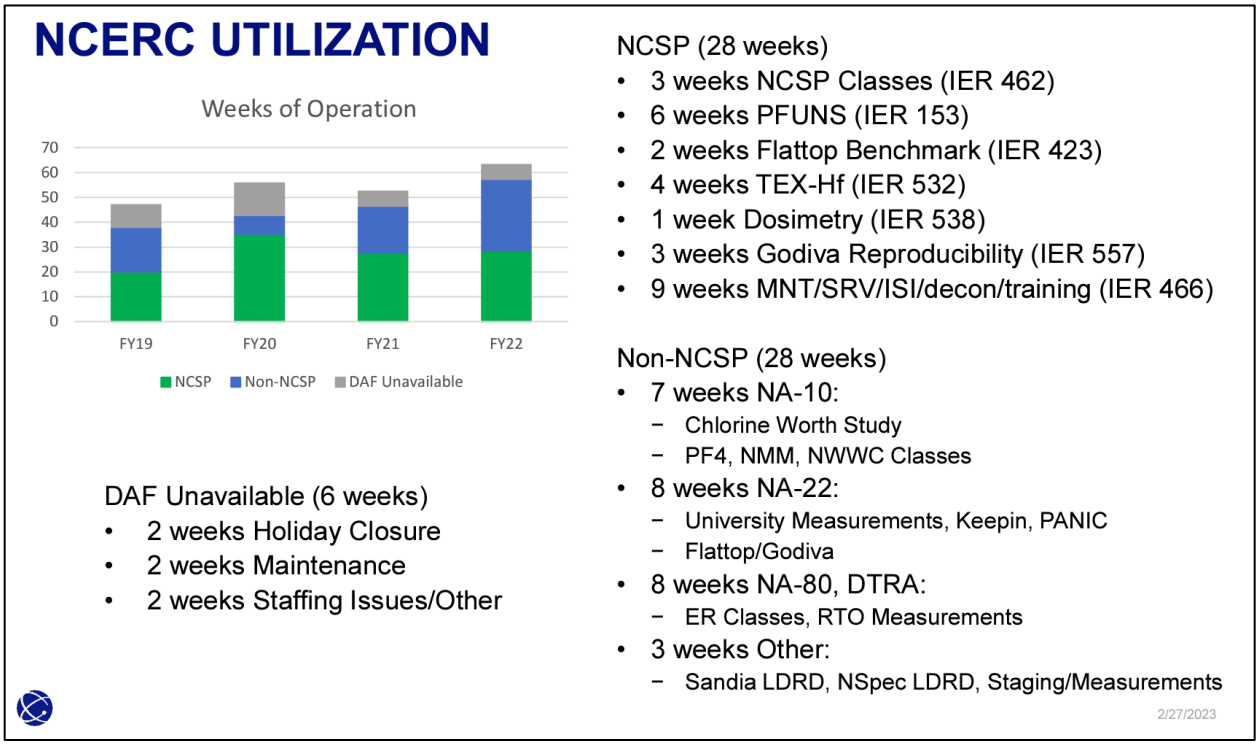


Figure 2.4-2 IE Budget (FY2024-FY2028)

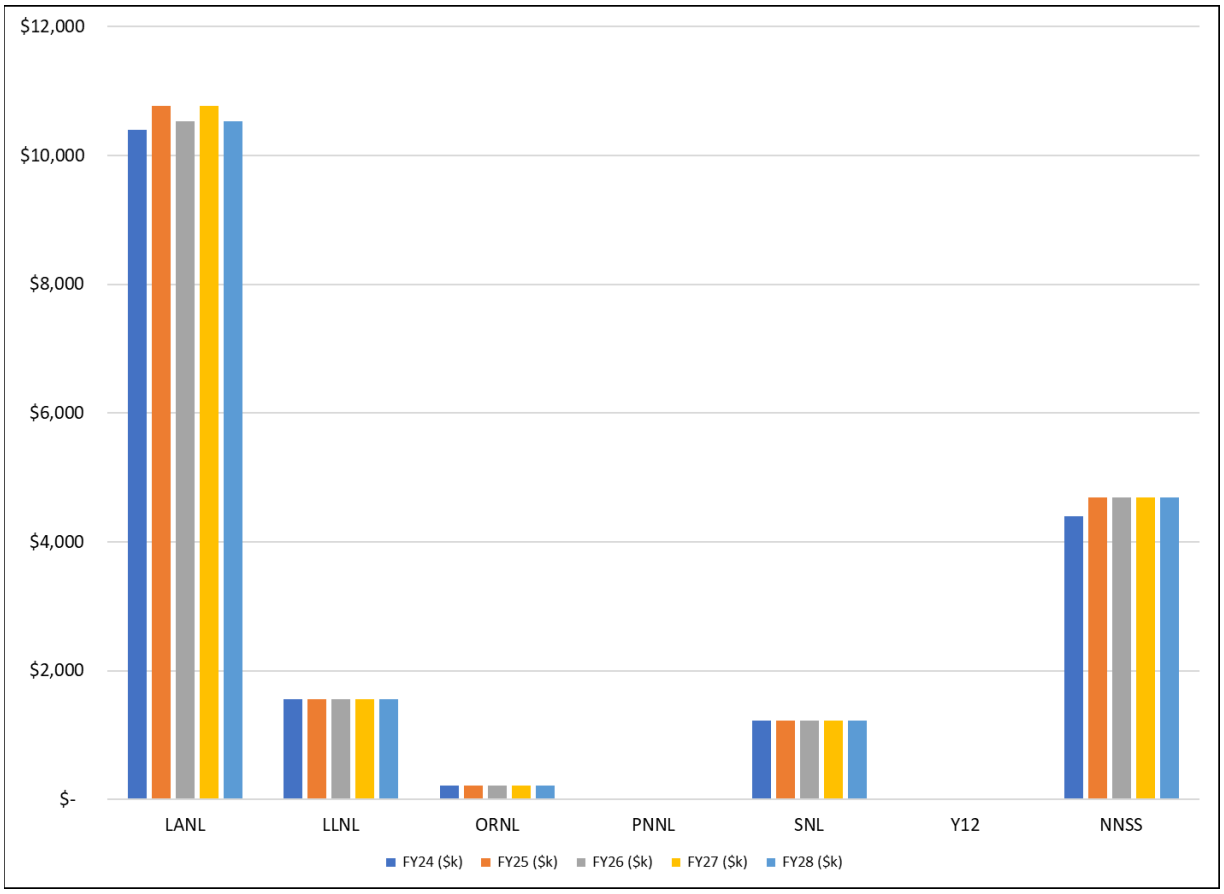
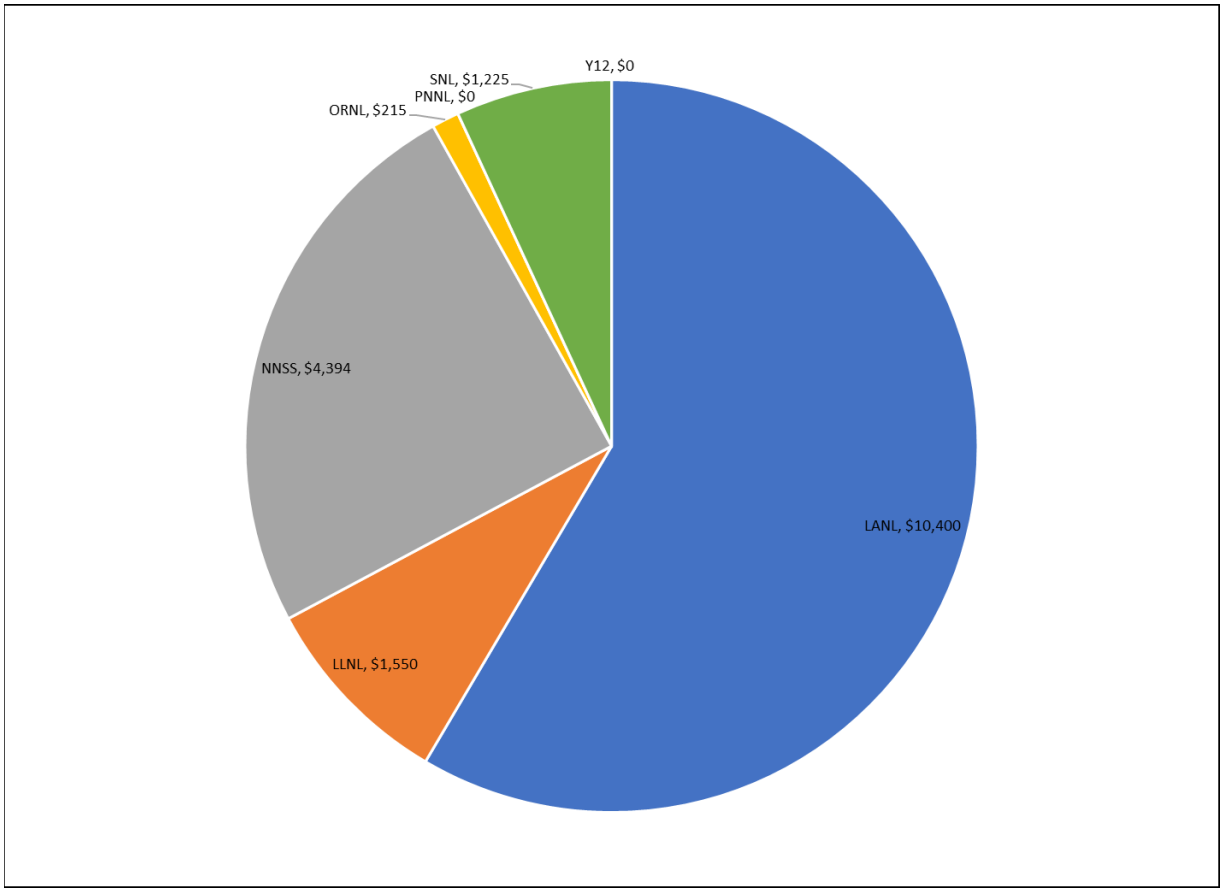


Table 2.7 NCSP IE Budget by Site (FY24)

NCSP Site	Budget ($k)
LANL	10400
LLNL	1550
NNSS	4394
ORNL	215
PNNL	0
SNL	1225
Y12	0
Grand Total	**17784**

Figure 2.4-3 IE Budget by Site (FY2024)



All Integral Experiment tasks and milestones are published as a standalone document. Contact the NCSP Program Manager, Dr. Angela Chambers, if you have a 'Need-to-Know.'

2.5 Nuclear Data (ND)

2.5.1 Program Element Description

The ND program element includes the measurement, evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to NCS analyses. The NCSP continues to improve coordination of ND activities by fostering a strong collaborative effort among all the national and international resources in this highly technical area. The objective is to solve the highest priority ND problems relevant to criticality safety in a timely manner. This program element is essential for the NCSP because it provides the nuclear cross-section data required by the AM program element. Refer to Appendix B for the schedule, milestones, and deliverables associated with specific nuclear data measurement, evaluation, and publication. Milestones not contained in Appendix B are delineated below.

Figure 2.5-1 ND Budget (FY2024-FY2028)

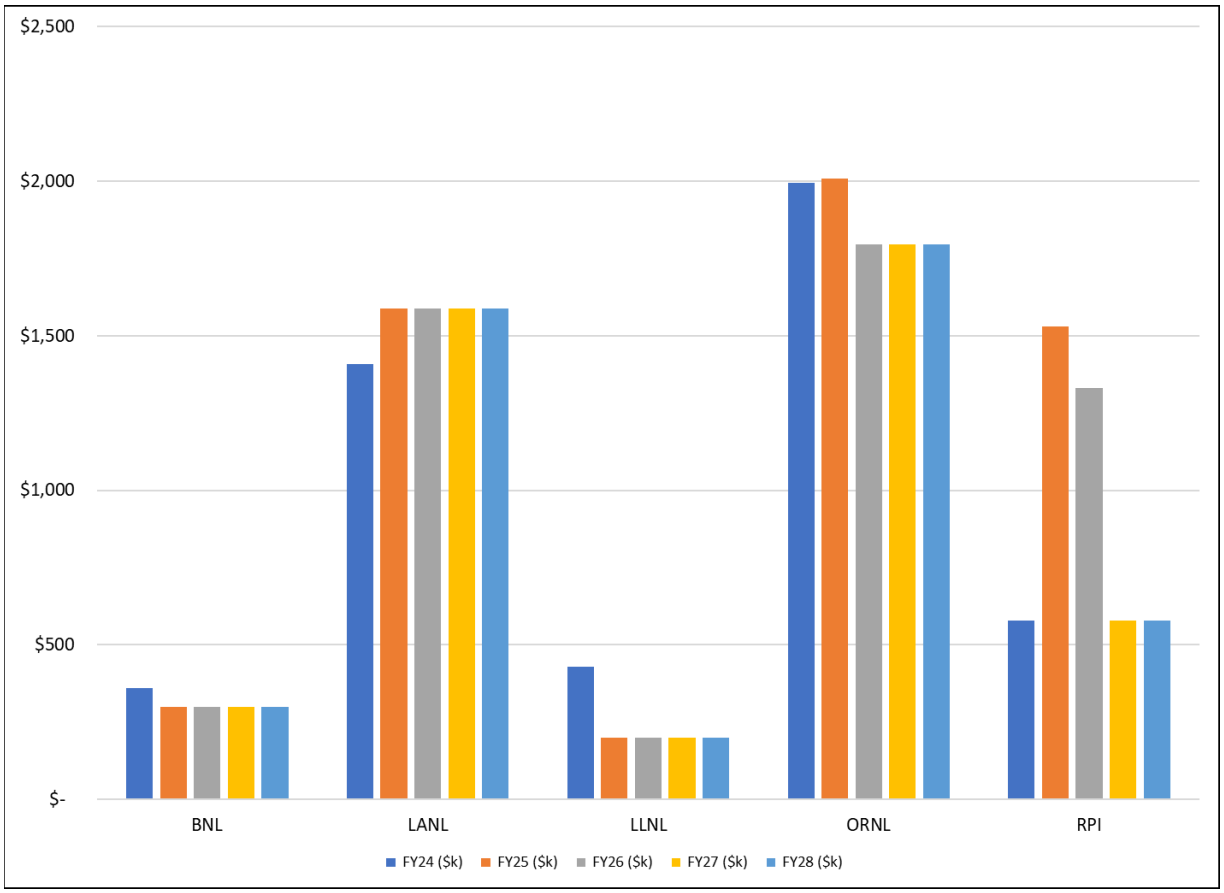
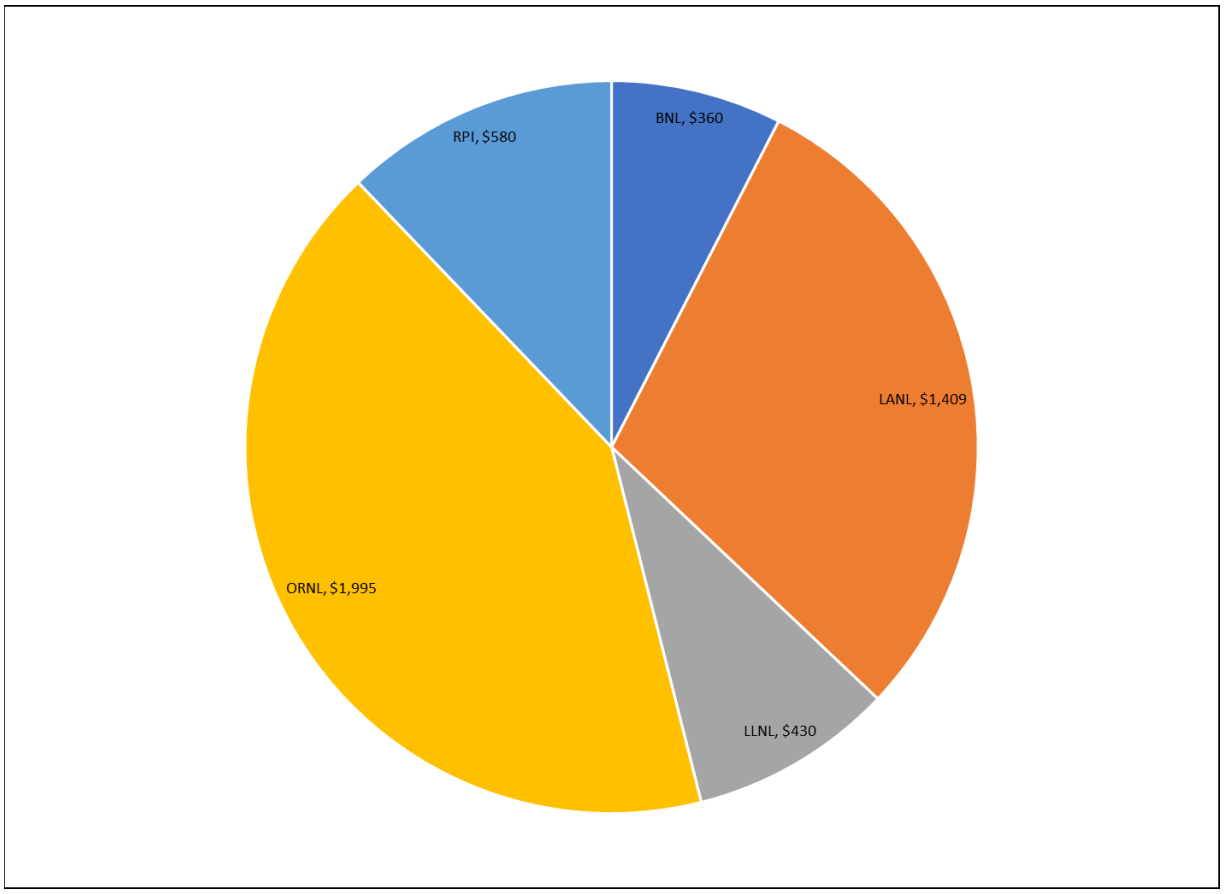


Table 2.8 NCSP ND Budget by Site (FY24)

NCSP Site	Budget ($k)
BNL	360
LANL	1409
LLNL	430
ORNL	1995
RPI	580
Grand Total	**4774**

Figure 2.5-2 ND Budget by Site (FY2024)

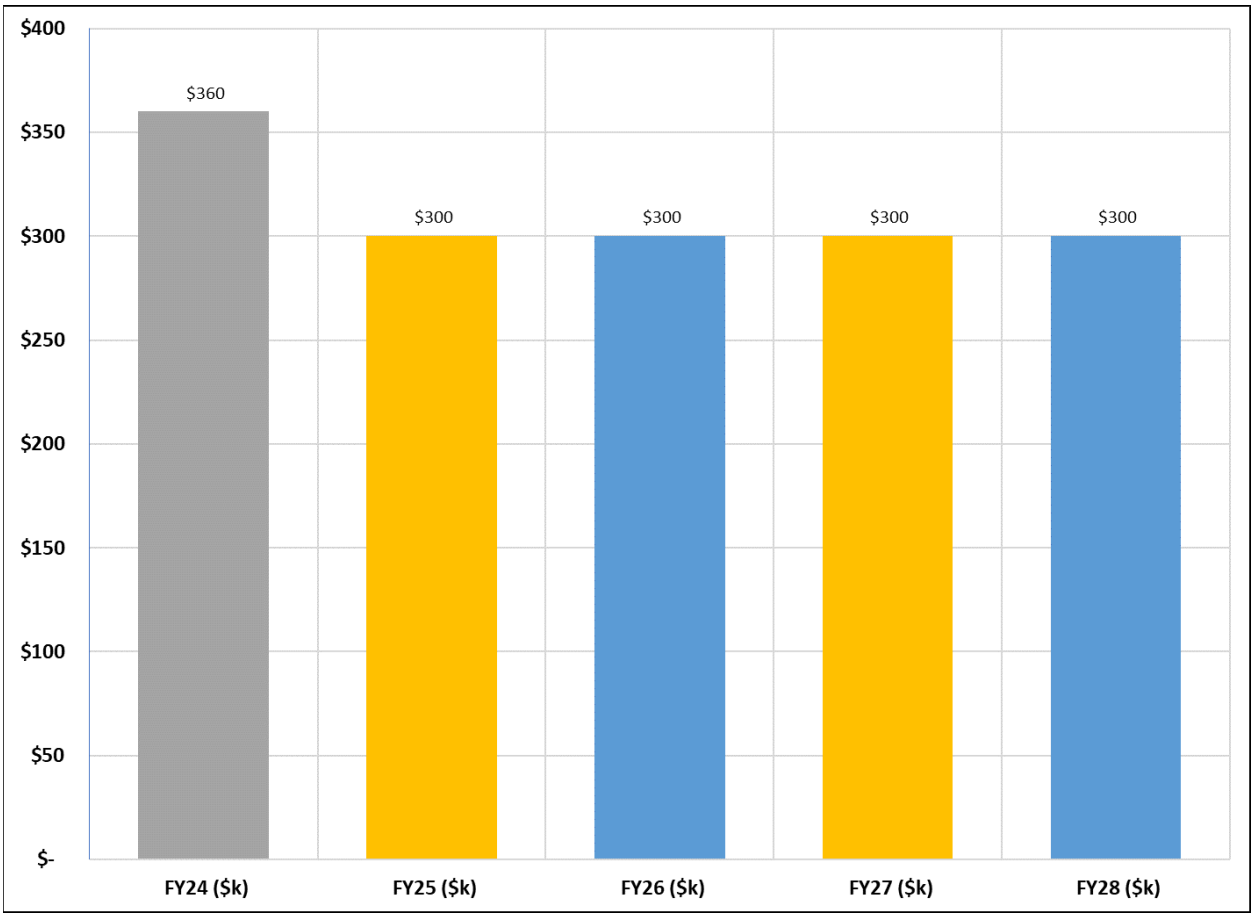


2.5.2 Approved Tasks

2.5.2.1 Brookhaven National Laboratory (BNL)

Task Name	BNL ND1
Collaborators	None
Task Title	National Nuclear Data Center (NNDC) Support to the NCSP
Proposal Submitted	Ongoing
Task Budget (FY24)	$360K
Task Description	This is an ongoing approved task to provide technical support to the NCSP to ensure that NCSP cross-section evaluations are checked, processed, visualized, reviewed, archived, and made available through the National Nuclear Data Center (NNDC) Gitlab system as candidate evaluations for the future versions of the ENDF/B library. Maintain Atlas of Neutron Resonances as a unique resource of thermal and resonance data and their uncertainties.
FY24 Milestones	All 4 Quarters o Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required. Provide status reports on all ND1 activities in the NCSP Quarterly Progress Reports. o If mandated by CSEWG, release new ENDF library. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.5-3 BNL ND Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The BNL ND budgets are stable from FY24-FY28 for their single ND task (ND1). The $60k decrease in FY25 is based on projected budgets in the outyears.

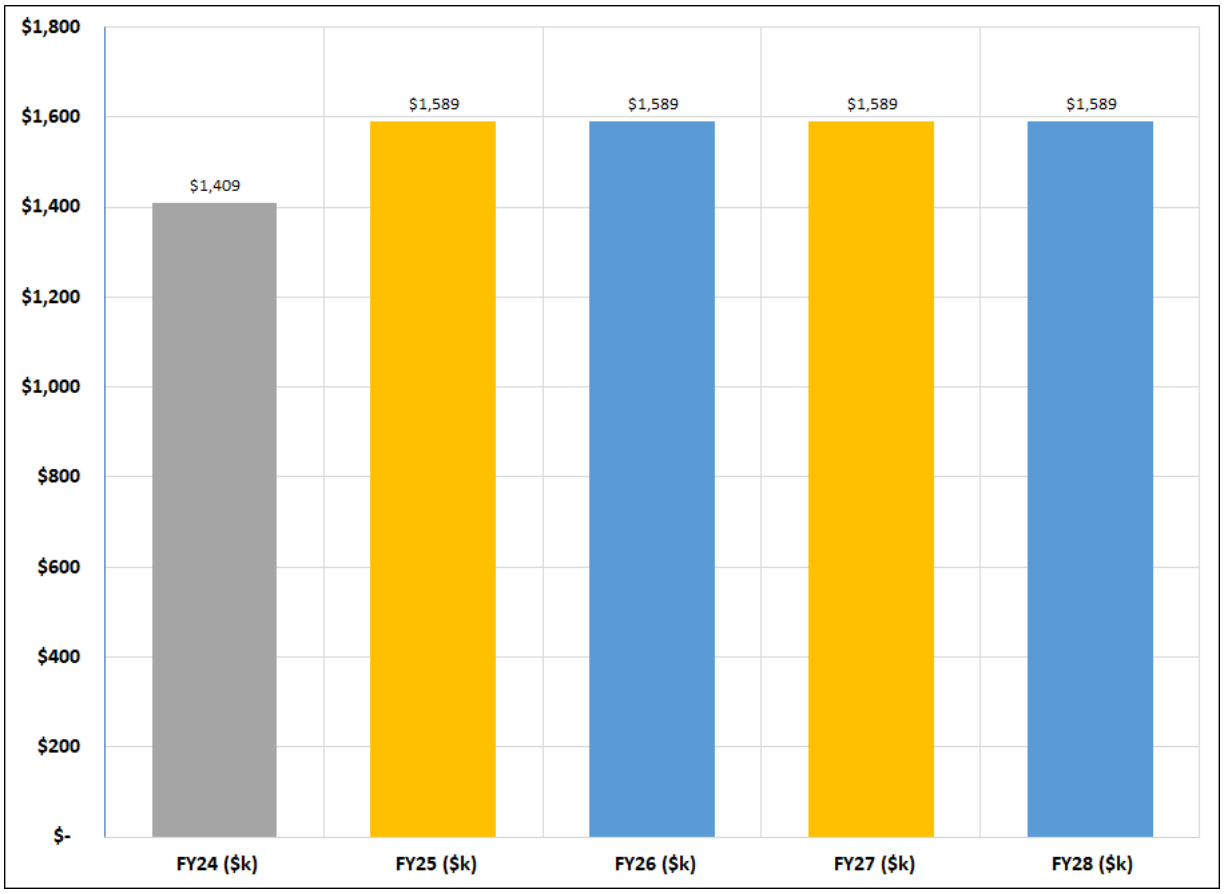
2.5.2.2 Los Alamos National Laboratory (LANL)

Task Name	LANL ND1
Collaborators	
Task Title	Nuclear Data Evaluation and Testing
Proposal Submitted	Ongoing
Task Budget (FY24)	$800K
Task Description	This is an ongoing approved task to provide differential data evaluation and covariance development in the energy region above the resonance range for heavy elements (often in partnership with resonance-range work from ORNL), and over the entire ENDF energy range for light elements. Particular focus will be on neutron fission. Perform data testing analysis with new evaluated sets. Contribute to NDAG, CSEWG, INDEN, WPEC, and IAEA CRP. The LANL nuclear data evaluations are performed in accordance with the milestone schedule in Appendix B.
FY24 Milestones	All 4 Quarters o Provide status reports on LANL participation in US and International Nuclear Data collaborations in the NCSP Quarterly Progress Reports Quarter 1 o Conduct CSEWG Evaluation and Covariance sessions. o Report data testing results with beta releases of ENDF/B-VIII.1 at CSEWG. Quarter 2 – None Quarter 3 – None Quarter 4 o Deliver nuclear data evaluations as indicated in Appendix B of this document.

Task Name	LANL ND2
Collaborators	IRSN-ND1
Task Title	Nuclear Data Measurements at LANSCE
Proposal Submitted	Ongoing
Task Budget (FY24)	$609K; Note: $180k of initial $789k provided directly in LLNL-ND13.
Task Description	Ongoing task to perform NCSP measurements as specified in the NCSP 5-year plan, Appendix B.
FY24 Milestones	All 4 Quarters o Provide status report on all activities in the NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 o Deliver nuclear data measurements as indicated in Appendix B of this document.

Task Name	LANL ND2a
Collaborators	
Task Title	Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240
Proposal Submitted	FY20
Task Budget (FY24)	$0K (Complete using FY23 carryover)
Task Description	Building upon recent improvements in measurements techniques for uranium-235, plutonium239 and uranium-238 (ongoing), this work is to measure the prompt fission neutron spectra (PFNS) for plutonium-240. This work has low technical risk, building upon previously established measurement and evaluation techniques. This work will be done using the Chi-Nu detectors at WNR, part of the LANSCE/LANL facility, with analysis carried out by a postdoc (to be hired) supervised by senior staff. Please note the Chi-Nu detectors include a liquid scintillator array for the high-energy (HE) tail and a lithium glass array for the low-energy (LE) tail with measurements performed separately. The Pu240 fission detector was fabricated and tested by LLNL and delivered to LANL during 2022. The experiment and analysis were completed during FY23. A small amount of carryover funding will be used in FY24 to support ongoing collaboration with evaluators as well as presentation(s) and publication(s) regarding the task.
FY24 Milestones	All 4 Quarters o Provide status report on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 - None

Figure 2.5-4 LANL ND Budget Trend (FY2024-FY2028)



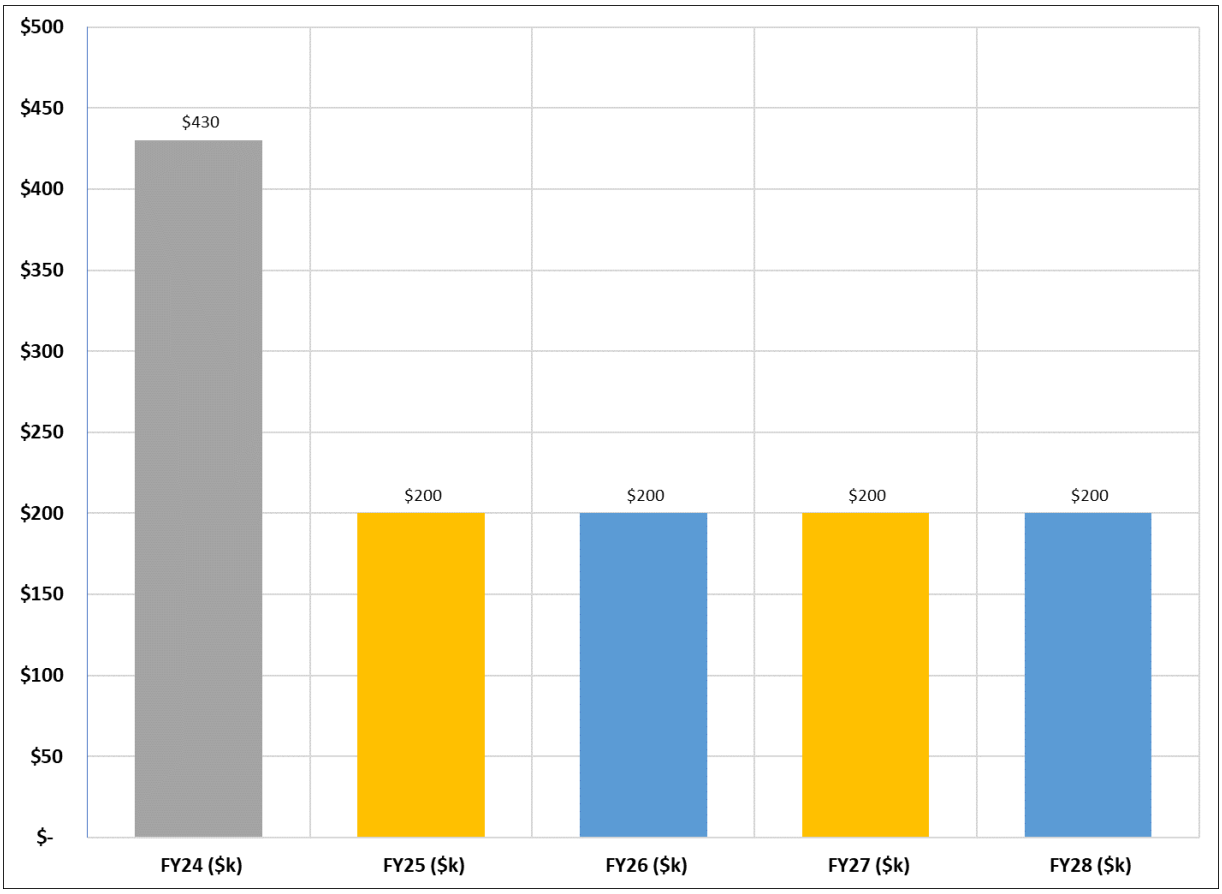
EOC – for out-year peaks and dips in budget plots:
Restoration of LANL ND2 in the outyears leads to a stable budget from FY25-FY28.

2.5.2.3 Lawrence Livermore National Laboratory (LLNL)

Task Name	LLNL ND12
Collaborators	North Carolina State University and Naval Nuclear Laboratory
Task Title	Thermal Scattering Law Evaluations and Methods Development
Proposal Submitted	FY21
Task Budget (FY24)	$250K
Task Description	This task will cover performing TSL evaluations as listed in the NCSP 5-year plan Appendix B TSL priority list. In addition to the TSL evaluations, the task includes developing and performing the atomistic simulations that are needed to support such evaluations. As part of the evaluations process, continued updates will be performed to account for any emerging published and/or measured data related to materials properties, integral cross sections data, and benchmarks that are sensitive to the TSL. The task will continue to improve upon evaluation methods to account for advanced thermal scattering models and codes, and to relax approximations (e.g., incoherent, cubic, elementary diffusion models, etc.) and to address community observations. Development and implementation of advanced evaluation methods that involve the use of AI/ML will continue. All completed evaluations will be contributed to the ENDF/B database.
FY24 Milestones	All 4 Quarters o Provide status on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4– None

Task Name	LLNL ND13
Collaborators	LANL
Task Title	PPAC Target Fabrication
Proposal Submitted	
Task Budget (FY24)	$180K; Note: $180k of funding provided from LANL-ND2.
Task Description	Fabrication of PPAC target for LANL ND2 task in accordance with appendix B of the NCSP 5-year plan.
FY24 Milestones	All 4 Quarters o Provide status on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4– None

Figure 2.5-5 LLNL ND Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
There are decreases in the LLNL ND budget due to completion of PPAC target fabrication work for U-233 for LANL after FY24.

2.5.2.4 Oak Ridge National Laboratory (ORNL)

Task Name	ORNL ND1
Collaborators	IRSN (IRSN-ND1), JRC-Geel, RPI (RPI-ND1)
Task Title	Nuclear Data Measurements
Proposal Submitted	Ongoing
Task Budget (FY24)	$640K
Task Description	Cross-section measurements and the production of new cross-section evaluations with covariance data in accordance with priorities specified in the 5-year plan, Appendix B.
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in the NCSP Quarterly Progress Reports o Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest o Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL ND2
Collaborators	IRSN (IRSN-ND1), JRC-Geel, RPI (RPI-ND1)
Task Title	Nuclear Data Evaluations and Testing
Proposal Submitted	Ongoing
Task Budget (FY24)	$640K
Task Description	Cross-section evaluations and nuclear data testing of new cross-section evaluations with covariance data in accordance with priorities specified in the 5-year plan, Appendix B.
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in the NCSP Quarterly Progress Reports o Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. o Complete cross-section evaluation deliverables per the nuclear data schedule in Appendix B Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

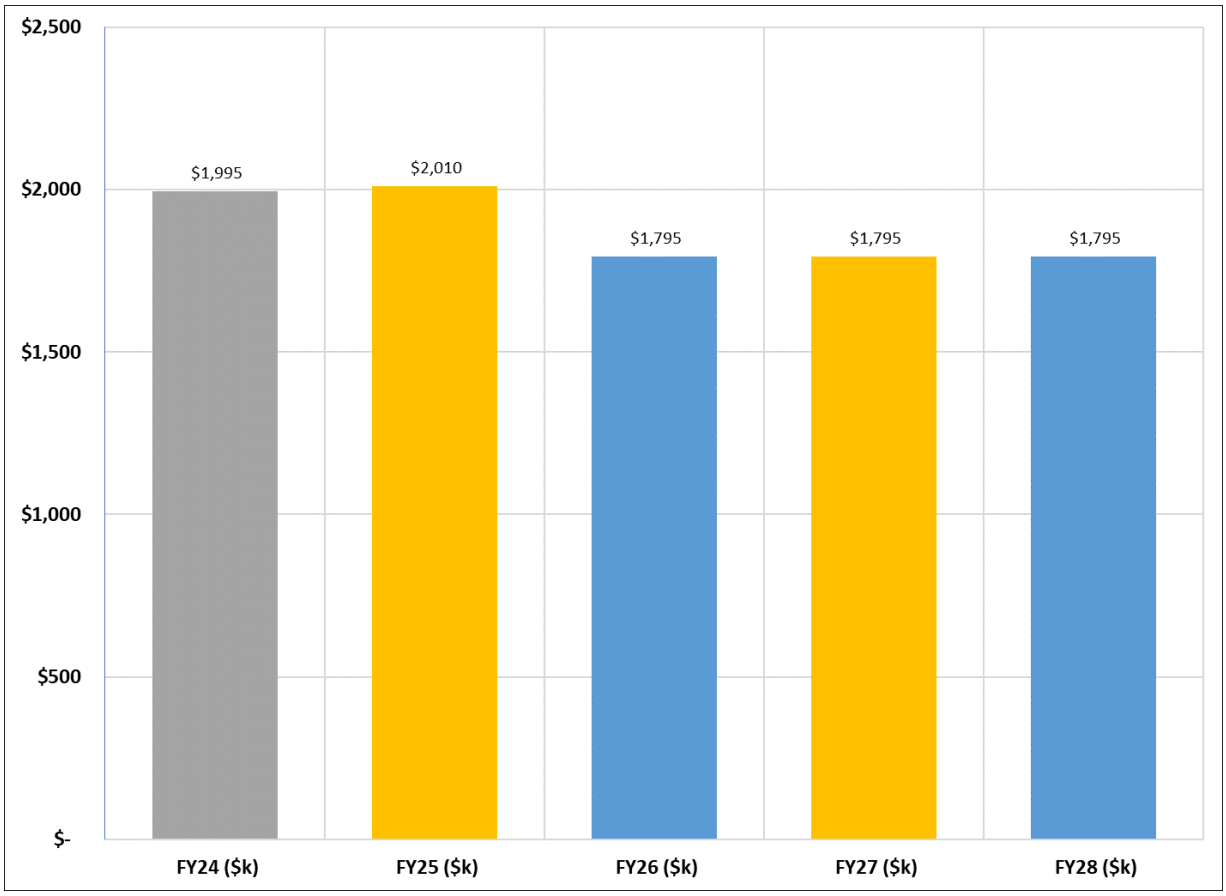
Task Name	ORNL ND3
Collaborators	JRC-Geel, Rensselaer Polytechnic Institute
Task Title	Isotopic Sample Leases to Support ND1 ND Measurements
Proposal Submitted	Ongoing
Task Budget (FY24)	$65K

Task Description	This "task" is to separate out funding for natural and stable, isotopically enriched samples, for nuclear data measurements aligned with the priorities and schedule provided in Appendix B. The task also supports activation analysis to demonstrate the likely lease options to negotiate with DOE Office of Science- Nuclear Physics (DOE/SC-NP)
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in the NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL ND6
Collaborators	JRC-Geel, Rensselaer Polytechnic Institute
Task Title	SAMMY Nuclear Data Evaluation Code Modernization
Proposal Submitted	Ongoing
Task Budget (FY24)	$400K
Task Description	This a continuing task to modernize the SAMMY software that is an essential tool needed by nuclear data evaluators to analyze measured cross-section data and produce nuclear data evaluations with covariance data for the NCSP. SAMMY is primarily used to analyze differential data from the RPI Gaertner linear accelerator, IRMM Geel Electron Linear Accelerator (GELINA), and Los Alamos Neutron Science Center (LANSCE) to produce nuclear data evaluations. An initial step toward modernization will be the merger of SAMMY under the SCALE continuous integration (CI) development framework. Once complete, SAMMY will be developed under the SCALE software quality assurance plan (SQAP) thereby providing increased confidence in the quality of the data evaluations developed and deployed by SAMMY. Once SAMMY is completely under SQA and integrated with the SCALE/AMPX CI development framework, the work will be performed to modernize SAMMY by utilizing modern computing frameworks and libraries that harness the emerging computing power of parallel architectures, and that enable a rapid development of new data analysis capabilities. The overall modernization work effort will ensure the SAMMY software is up-to-date and positioned for long-term sustainability to support NCSP nuclear data evaluation needs.
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in the NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 - None

Task Name	ORNL ND9
Collaborators	JRC-Geel, Rensselaer Polytechnic Institute
Task Title	Evaluation of Thermal and Resolved Resonance Ranges of UO_2 and PUO_2
Proposal Submitted	FY19
Task Budget (FY24)	$250K
Task Description	Develop a new method for consistent evaluation of thermal neutron scattering libraries (TSL) and (resolved) resonance differential cross section data.
FY24 Milestones	All 4 Quarters ○ Provide status reports on all activities in the NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.5-6 ORNL ND Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The ORNL ND budgets decrease slightly in FY26 due to the completion of the ORNL ND9 task.

2.5.2.5 Rensselaer Polytechnic Institute (RPI)

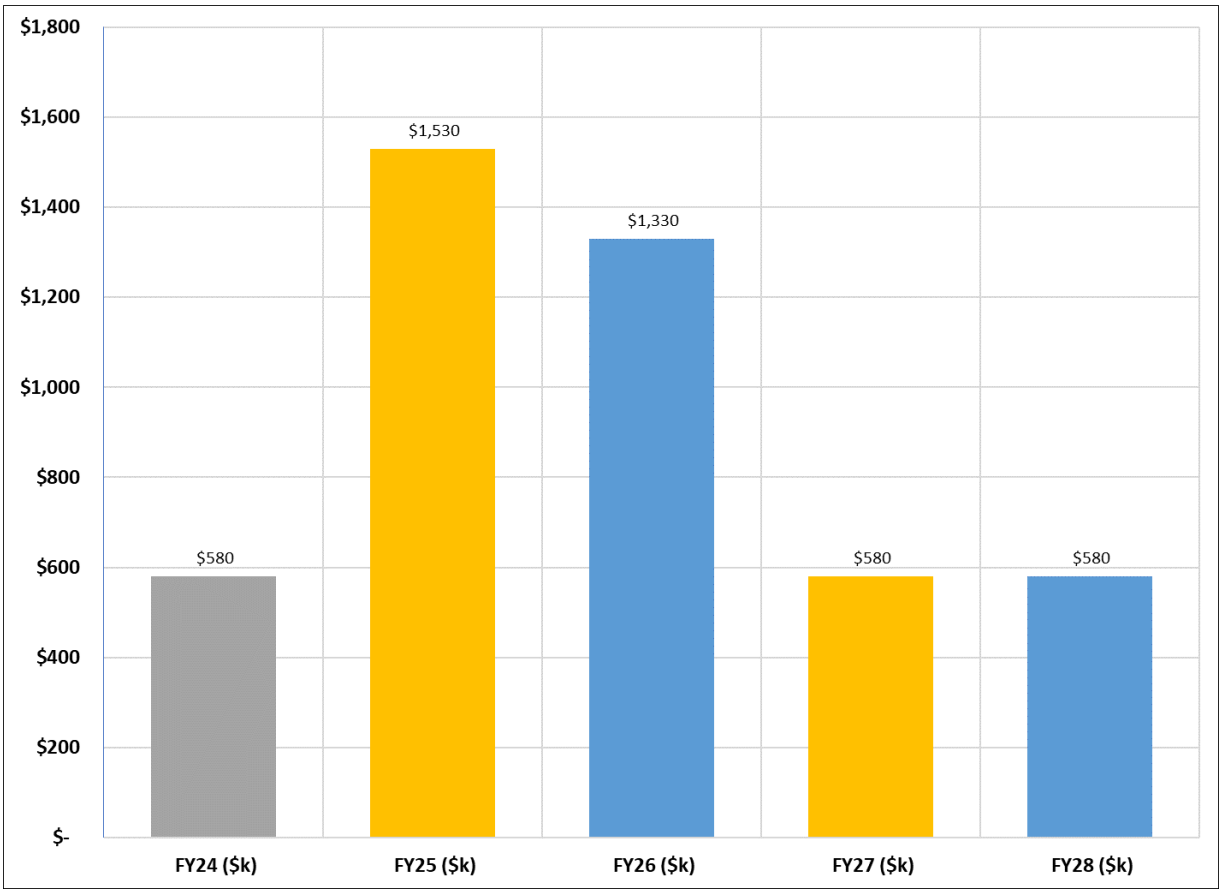
Per agreement between Naval Reactors (NA-30) and the Nuclear Criticality Safety Program, the NNL acts as the Maintenance and Operations Contractor (MOC) for work conducted at the RPI linear accelerator facility. NNL voluntarily administers NCSP contracts supporting these RPI tasks in conjunction with the Naval Reactors nuclear data measurements and evaluations program.

Task Name	RPI ND1
Collaborators	IRSN (IRSN-ND1), ORNL (ORNL-ND1, ORNL-ND2) Naval Nuclear Laboratory
Task Title	Resonance Region Nuclear Data Measurement Capability
Proposal Submitted	Ongoing
Task Budget (FY24)	$480K
Task Description	This is an ongoing approved task in collaboration with IRSN and ORNL to support the resonance region Nuclear Data Measurement Capability at RPI and to perform cross-section measurements and qualification of the new capabilities. Aligns with LANL-ND1 and ORNL-ND1 (evaluation) and IRSN-ND1 (evaluation).
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in NCSP Quarterly Progress Reports o Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. Quarter 1 o Complete analysis of measurement from previous year Quarter 2 – None Quarter 3 o Complete nuclear data measurements (transmission/capture or scattering) per the nuclear data schedule in Appendix B Quarter 4 o Complete measurements data analysis and provide the data to ORNL as needed to support the evaluation effort per the nuclear data schedule in Appendix B

Task Name	RPI ND3
Collaborators	Naval Nuclear Laboratory, ORNL
Task Title	LINAC Nuclear Data Capabilities Maintenance Plan
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	This is an ongoing approved task to support the Linear Accelerator (LINAC) 2020 Nuclear Data Capabilities Maintenance Plan in collaboration with Naval Reactors (NA-30) who is co funding 2/3 of the total refurbishment costs. To be able to continue to deliver a reliable neutron beam with the proper conditions required for these experiments, a long-term maintenance and update plan is being implemented.
FY24 Milestones	All 4 Quarters o Provide status report on all LINAC refurbishment activities in the NCSP Quarterly Progress Reports Quarter 1 • Complete initial engineering plan for LINAC Control System. • Complete SAT of TPV Accelerator Section. • Place contract for refurbishment services support (RSS)

	• Place contracts for new RF Windows and elbows based on selection of UHV flange design. • Extend the Financial Assistance Award (FAA) funding grant through CY2025 with cost escalation. Quarter 2 • Design and procurement of currently funded auxiliary system components. Quarter 3 • Develop and publish new refurbishment project plan with updated timelines and projected costs. Quarter 4 • Initiate priority procurements for new project plan and schedule new LINAC shutdown date and demolition activities.

Figure 2.5-7 RPI ND Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The $100k increase in FY24, $950K increase in FY25, and $750K increase in FY26 are due to LINAC refurbishment cost escalation and newly identified procurements. Costs for ND1 and ND3 are fixed in the outyears at FY24 levels.

2.6 Training and Education (TE)

2.6.1 Program Element Description

The TE program element continues to offer hands-on training courses as needed by DOE and identify training needs and develop training resources in areas where no suitable materials exist. The primary purpose of the TE element is to maintain the technical capabilities of criticality safety professionals and provide for the training and education of people entering the criticality safety discipline from related scientific fields. A significant portion of the TE work effort is to provide both the 2-week hands-on criticality safety courses for criticality safety engineers and 1-week hands-on criticality safety courses for Criticality Safety Officers, process supervisors, and managers.

Each year, at the annual Budget Execution Meeting, the NCSP Manager will review and determine the location of the classroom portion of the Hands-on Training course. Out-year budget profiles will be revised at that time, and funding profiles will not be increased until the location of the course is determined.

Figure 2.6-1 TE Budget (FY2024-FY2028)

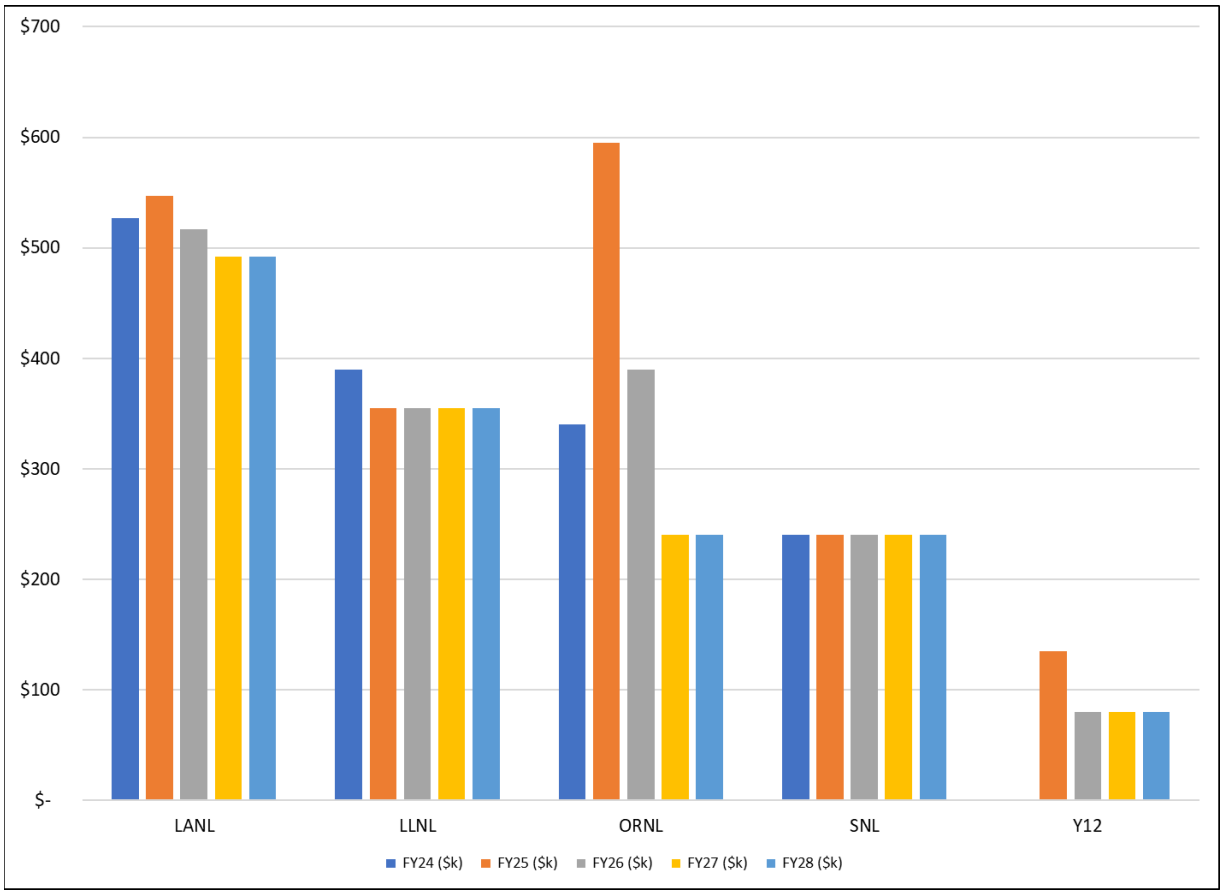
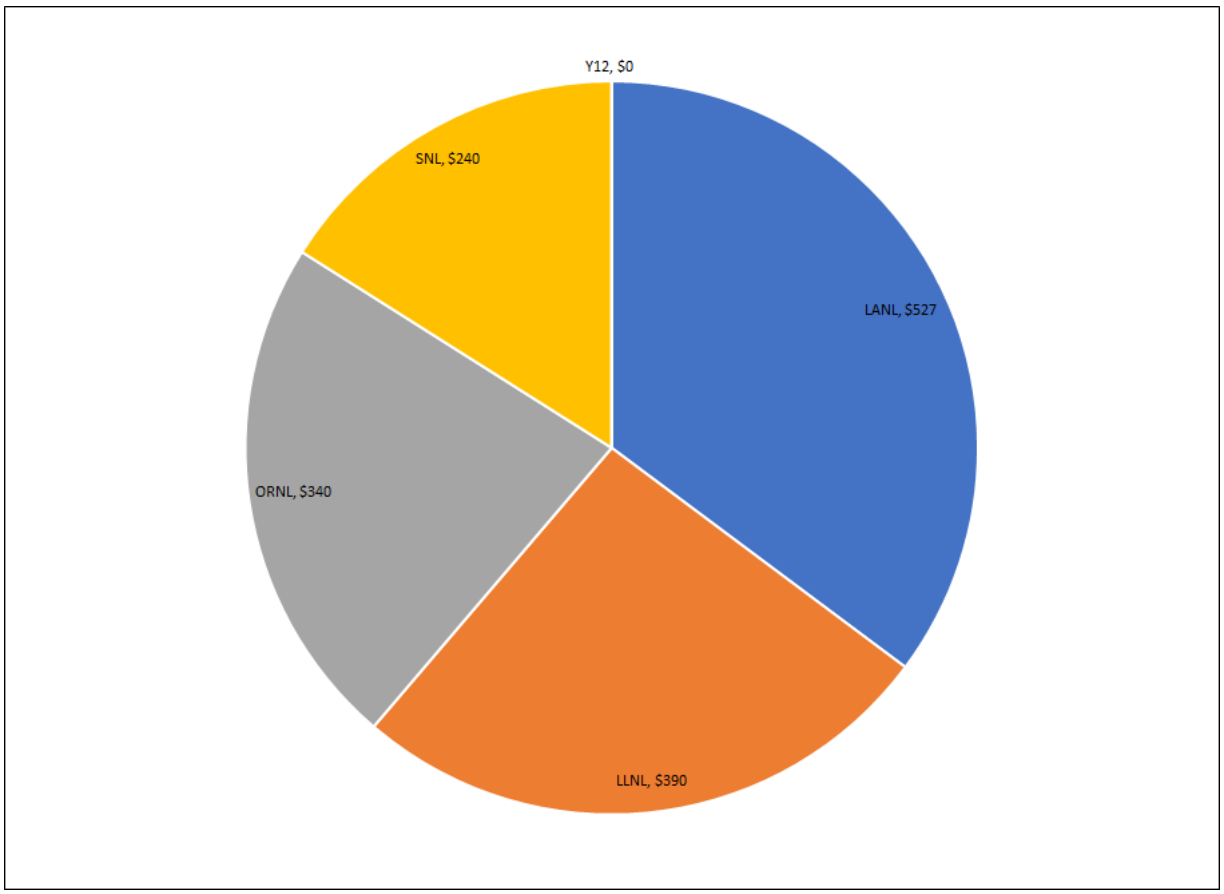


Table 2.9 NCSP TE Budget by Site (FY24)

NCSP Site	Budget ($k)
LANL	527
LLNL	390
ORNL	340
SNL	240
Y12	0
Grand Total	**1497**

Figure 2.6-2 TE Budget by Site (FY2024)



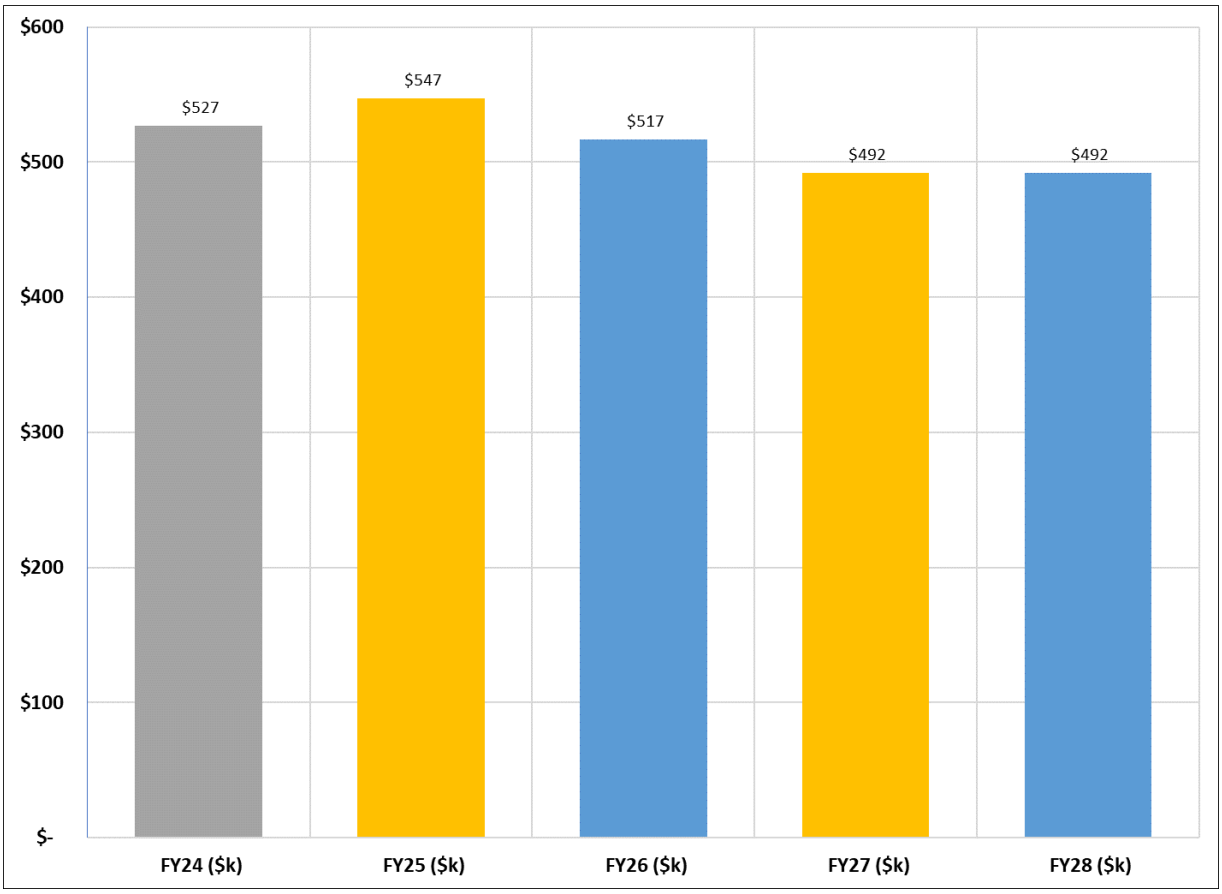
2.6.2 Approved Tasks

2.6.2.1 Los Alamos National Laboratory (LANL)

Task Name	LANL TE3
Collaborators	IRSN (IRSN-TE1), AWE (AWE-TE1)
Task Title	Conduct Hands-On Criticality Safety Training Course at NCERC
Proposal Submitted	Ongoing
Task Budget (FY24)	$492K
Task Description	This is an ongoing approved task to conduct criticality safety hands-on training at NCERC according to an integrated schedule developed by ORNL and approved by the NCSP manager. This also supports LANL coordination of DAF access for participants in the NCERC Hands-on course.
FY24 Milestones	All 4 Quarters o Provide status reports on all activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LANLTE6
Collaborators	LLNL TE8
Task Title	Development of University Pipeline for Criticality Safety Professionals
Proposal Submitted	FY18
Task Budget (FY24)	$35K
Task Description	Development of a University Pipeline for Criticality Safety Professionals.
FY24 Milestones	All 4 Quarters o Provide status and update on LANL TE6 work in the NCSP Quarterly Progress Reports Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.6-3 LANL TE Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
The reduction in FY25 funding is due to the postponement of tasks TE4 and TE8.

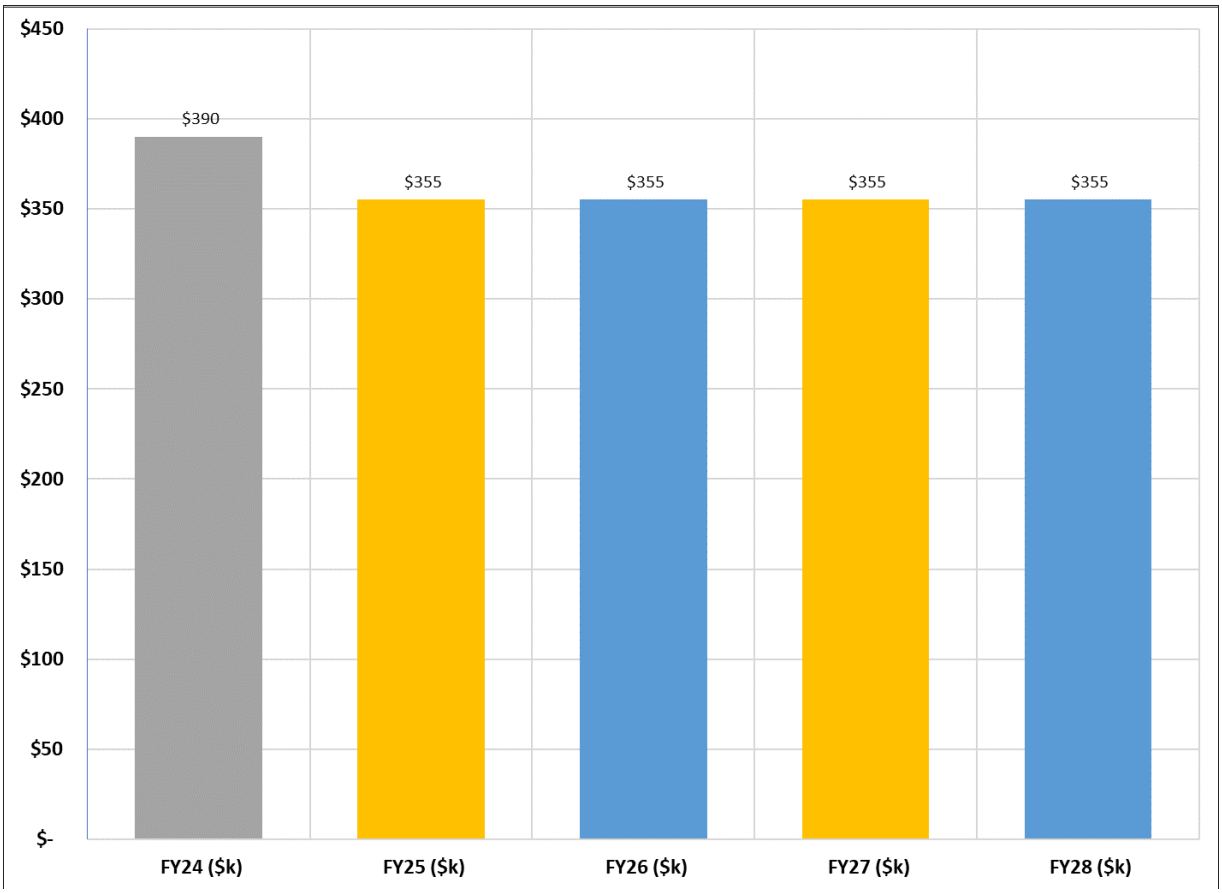
2.6.2.2 Lawrence Livermore National Laboratory (LLNL)

Task Name	LLNL TE1
Collaborators	IRSN (IRSN-TE1), AWE (AWE-TE1)
Task Title	Conduct Hands-on Training at the DAF (TACS)
Proposal Submitted	Ongoing
Task Budget (FY24)	$275K
Task Description	This is an ongoing approved task to provide unique "hands-on" training at the Device Assembly Facility (DAF) using the Training Assembly for Criticality Safety (TACS). This task also supports continued LLNL coordination of the course registration process for all courses at NSF, NATM, NCERC and SNL.
FY24 Milestones	All 4 Quarters o Provide a status report on LLNL TE1 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL TE3
Collaborators	None
Task Title	Classroom Criticality Safety Training
Proposal Submitted	Ongoing
Task Budget (FY24)	$80K
Task Description	This is an ongoing approved task to provide LLNL support classroom instruction at the Nevada Site Facility and participation in TE development activities.
FY24 Milestones	All 4 Quarters o Provide a status report on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL TE8
Collaborators	LANL TE6
Task Title	Development of University Pipeline for Criticality Safety Professionals
Proposal Submitted	FY21 – Direct request to the NCSP Manager
Task Budget (FY23)	$35K
Task Description	Development of a University Pipeline for Criticality Safety Professionals.
FY23 Milestones	All 4 Quarters ○ Provide status reports on all training activities to the NCSP Manager, to include photos and content for the quarterly newsletter Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.6-4 LLNL TE Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
LLNL TE funding is stable over the five-year period except for a reduction due to the completion of the pipeline task in FY24.

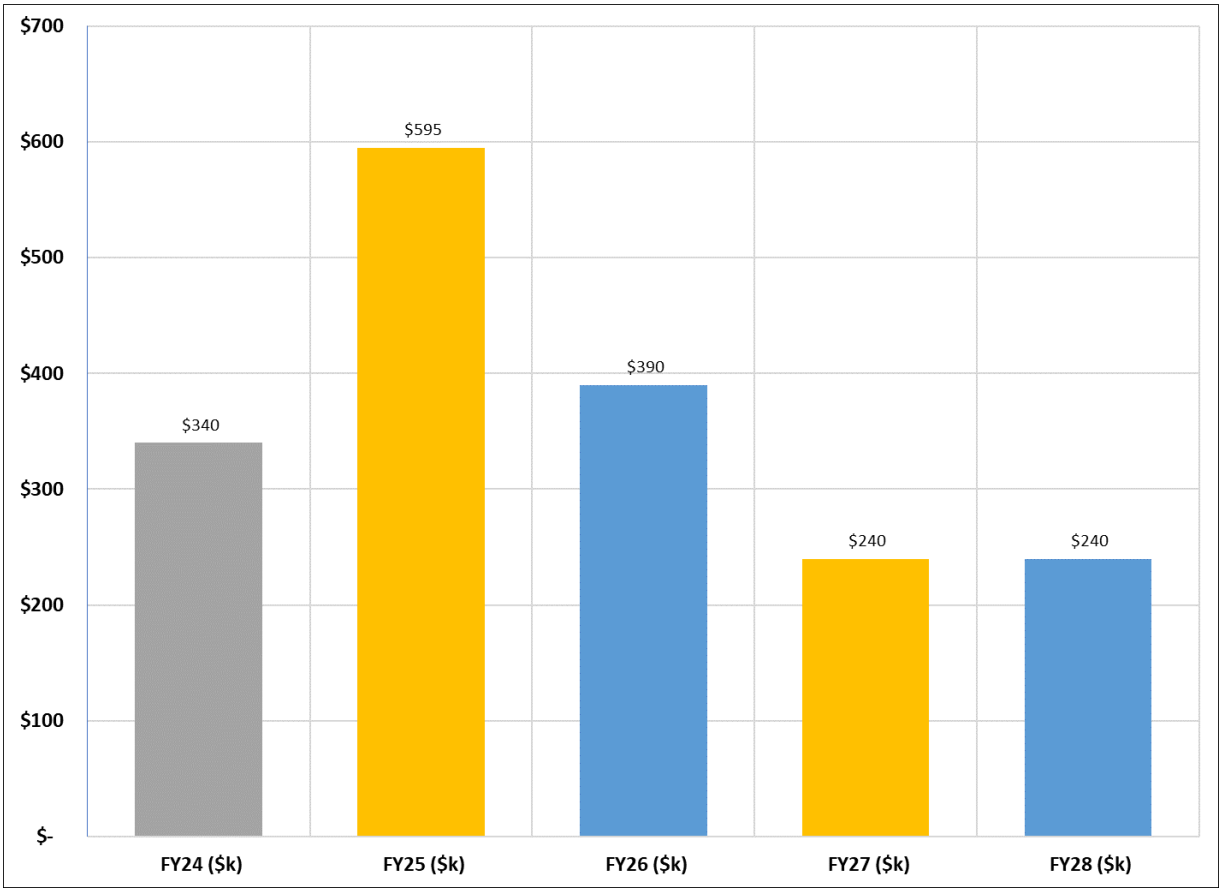
2.6.2.3 Oak Ridge National Laboratory (ORNL)

Task Name	ORNL TE1
Collaborators	IRSN (IRSN TE1), AWE (AWE TE1)
Task Title	Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program
Proposal Submitted	Ongoing
Task Budget (FY24)	$240K
Task Description	Ongoing ORNL task to manage the collaborative multi-laboratory development, designing, and scheduling of the multi-faceted and phased NCSP training program and manage the execution of the program. The task also includes support for an ORNL nondestructive assay (NDA) expert, an NCS expert, and an NCS expert with federal experience to support the 2-week hands-on and manager courses.
FY24 Milestones	All 4 Quarters o Provide a status report on implementation of the NCS training program in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL TE11
Collaborators	None
Task Title	Revision of the LA-12808 Nuclear Criticality Safety Guide
Proposal Submitted	FY21
Task Budget (FY24)	$0K (Complete using FY23 carryover)
Task Description	ORNL to revise this document to make clarifications and enhancements because of almost 25 years of NCS lessons learned since the last revision.
FY24 Milestones	All 4 Quarters o Provide a status report on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL TE14
Collaborators	Georgia Institute of Technology, Texas A&M University
Task Title	Nuclear Criticality Safety Training and Pipeline Development
Proposal Submitted	FY22
Task Budget (FY24)	$100K
Task Description	Develop a new university-based nuclear criticality training certificate program with the intent to develop a pipeline of nuclear criticality specialists into Department of Energy Laboratory complex. This program will attract students across the United States but will have a regional focus on the Southeastern United States.
FY24 Milestones	All 4 Quarters ○ Provide a status report on activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.6-5 ORNL TE Budget Trend (FY2024-FY2028)

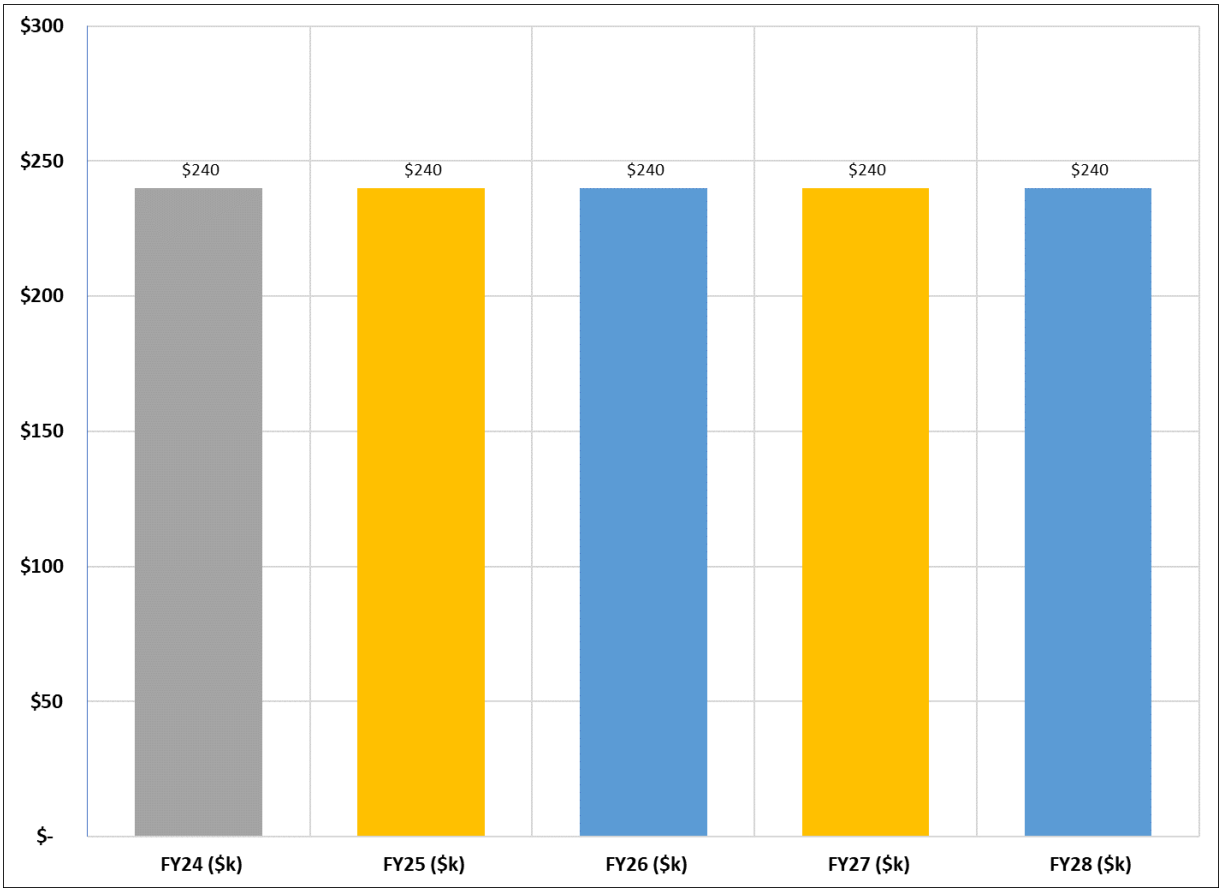


EOC – for out-year peaks and dips in budget plots:
The ORNL TE budget increases due to work on the NCSET NCS library tasks (ORNL-TE6, ORNL-TE7, ORNL-TE8, ORNL-TE13). This work will be completed by FY26 resulting in the budget drop for FY27/FY28.

2.6.2.4 Sandia National Laboratories (SNL)

Task Name	SNL TE1
Collaborators	IRSN (IRSN-TE1), AWE (AWE-TE1)
Task Title	Prepare for and Conduct Hands-on Criticality Safety Training at SNL
Proposal Submitted	Ongoing
Task Budget (FY24)	$240K
Task Description	This is an ongoing approved task to conduct hands-on criticality safety training classes at SNL according to an integrated schedule developed by ORNL and approved by the NCSP Manager. Provide Human Factors and Equipment Reliability module support to the training class.
FY24 Milestones	All 4 Quarters ○ Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the NCSP one- and two-week training classes in accordance with the approved schedule. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.6-6 SNL TE Budget Trend (FY2024-FY2028)

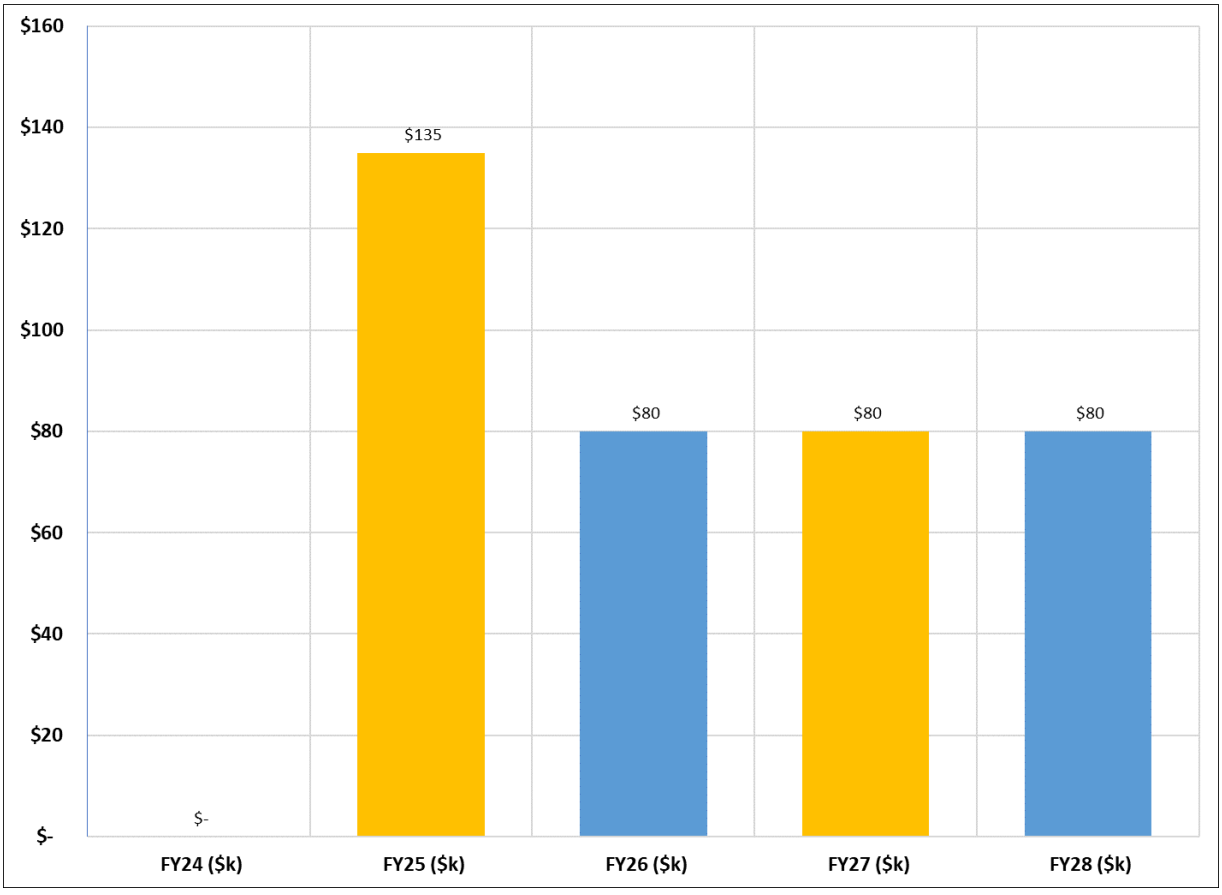


EOC – for out-year peaks and dips in budget plots:
SNL TE budgets are unchanged over the five-year budget period.

2.6.2.5 Y-12 National Security Complex

Task Name	Y12 TE1
Collaborators	
Task Title	Conduct Hands-On Criticality Safety Training Course (Lecture support week 1 of 2-week hands-on course and course material development)
Proposal Submitted	Ongoing
Task Budget (FY24)	$0K (Complete using FY23 carryover)
Task Description	This is an ongoing integrated, approved task for Y12 to assist in conducting the current criticality safety training classes at NFO and NCERC (as necessary). This task will also involve assisting with generating new training materials at the NFO classroom portion of the course as necessary.
FY24 Milestones	All 4 Quarters ○ Provide a status report of Y12 activities to support the hands-on training courses. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 2.6-7 Y-12 TE Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:

Y-12 TE funding was reduced in FY24 due to excess carryover. Task TE2 is a 1-year task starting in FY24 for NCS tutorials. After FY25, the Y-12 TE budget returns to a nominal level.

3.0 NCSP Technical Support

3.1 Program Element Description

NCSP Technical Support to assist the NCSP Management Team in the program management and execution of the NCSP and funding for the succession planning of key program elements as defined in the 10-year Mission and Vision.

Figure 3.1-1 NCSP Technical Support (FY2024-FY2028) - by Laboratory

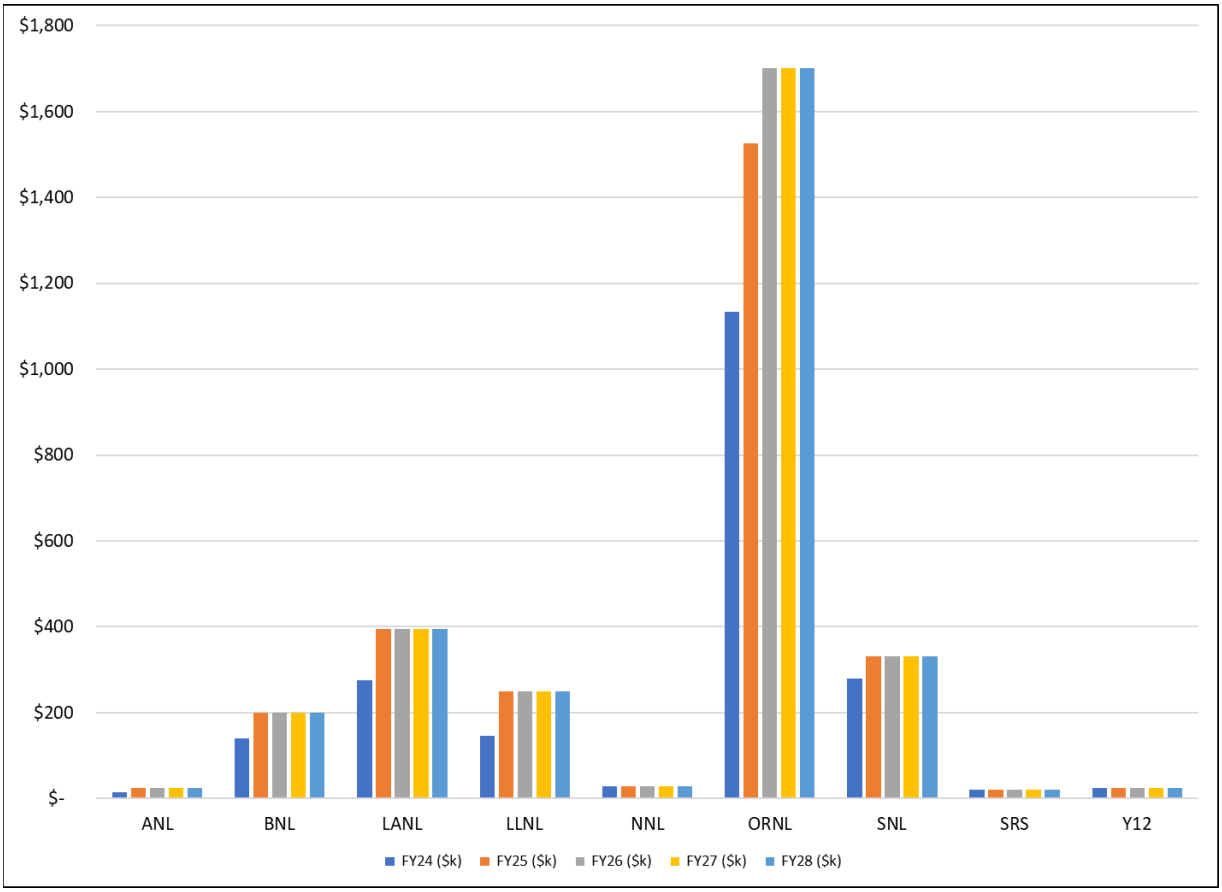
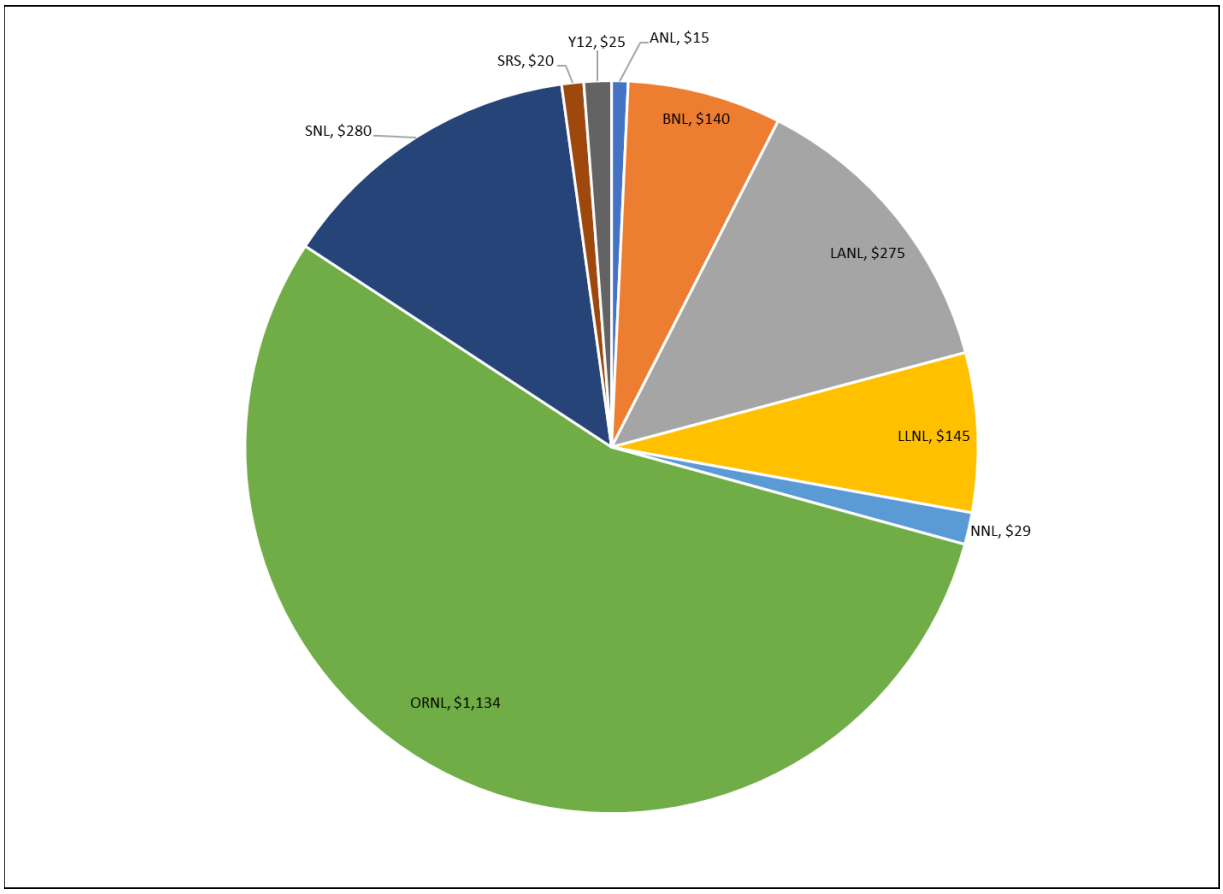


Table 2.10 NCSP TS Budget by Site (FY24)

NCSP Site	Budget ($k)
ANL	15
BNL	140
LANL	275
LLNL	145
NNL	29
ORNL	1134
SNL	280
SRS	20
Y12	25
Grand Total	**2063**

Figure 3.1-2 NCSP TS Budget by Site (FY2024)

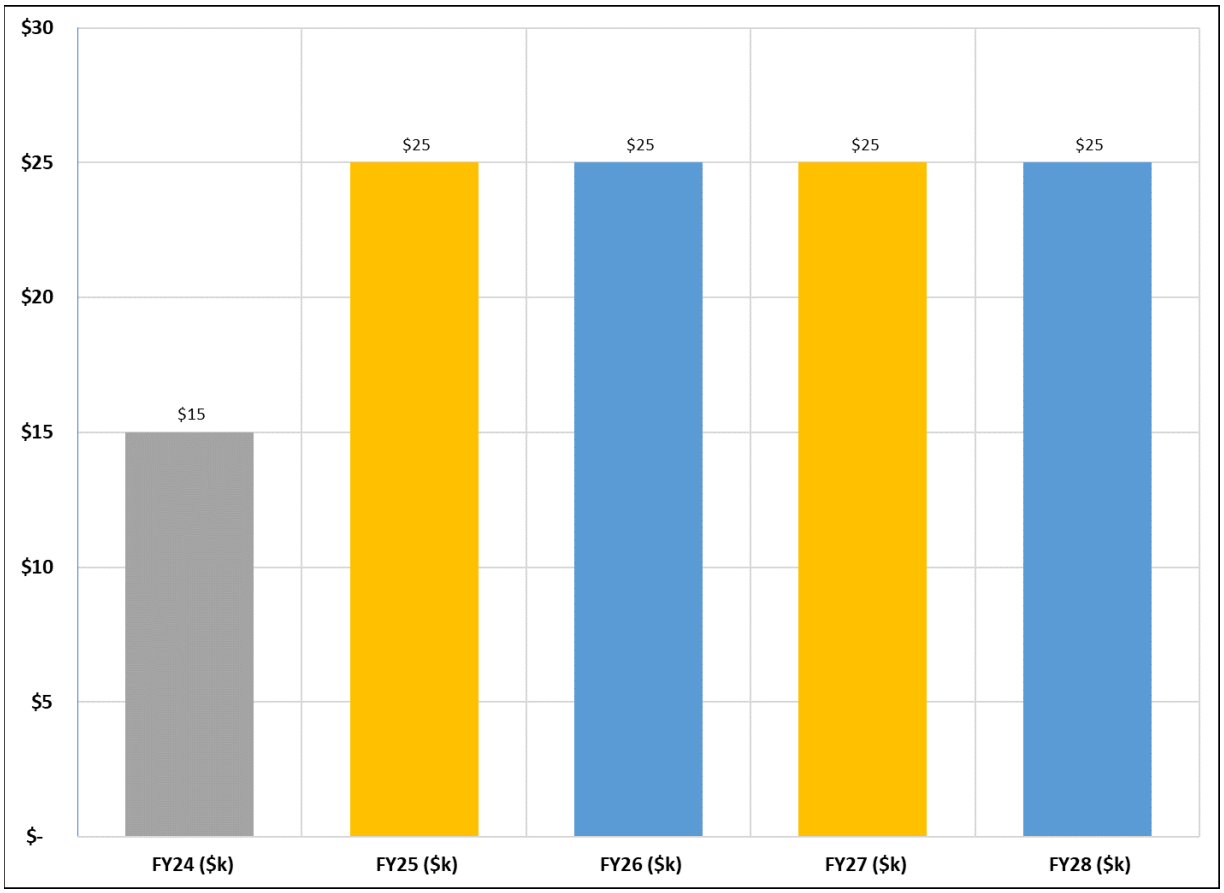


3.2 Approved Tasks

3.2.1 Argonne National Laboratory (ANL)

Task Name	ANL TS1
Collaborators	None
Task Title	ANL – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$15K (Member funding: #1 $15k)
Task Description	ANL will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status report of activities in the NCSP quarterly progress reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-1 ANL TS Budget Trend (FY2024-FY2028)



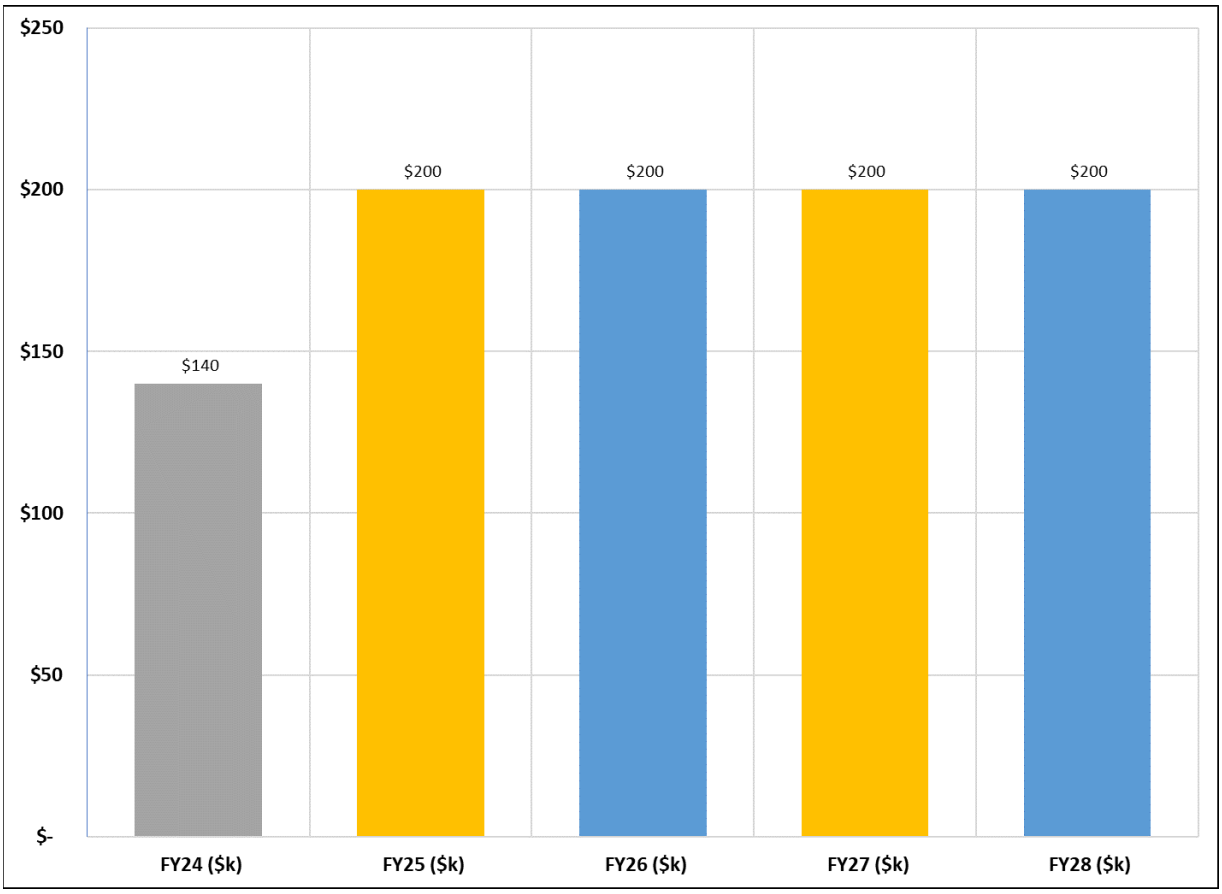
EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.2 Brookhaven National Laboratory (BNL)

Task Name	BNL TS6
Collaborators	None
Task Title	BNL – ND Succession Planning
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the nuclear data analysis capabilities that currently exist at BNL. The work associated with this task is to develop and execute ND Succession Planning at BNL as defined in the NCSP Mission and Vision document for nuclear data analysis capabilities needed to support operations at the National Nuclear Data Center.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager annual report of succession planning efforts. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	BNL TS7
Collaborators	None
Task Title	NCSP Technical Program Review Planning and Execution
Proposal Submitted	
Task Budget (FY24)	$40K
Task Description	Funding to plan and execute the NCSP Technical Program review in FY24. Information about what the funding covers is provided in Appendix A. Work will be done in accordance with the NCSP Management Team guidance.
FY24 Milestones	Successful completion of the NCSP Technical Program Review

Figure 3.2-2 BNL TS Budget Trend (FY2024-FY2028)



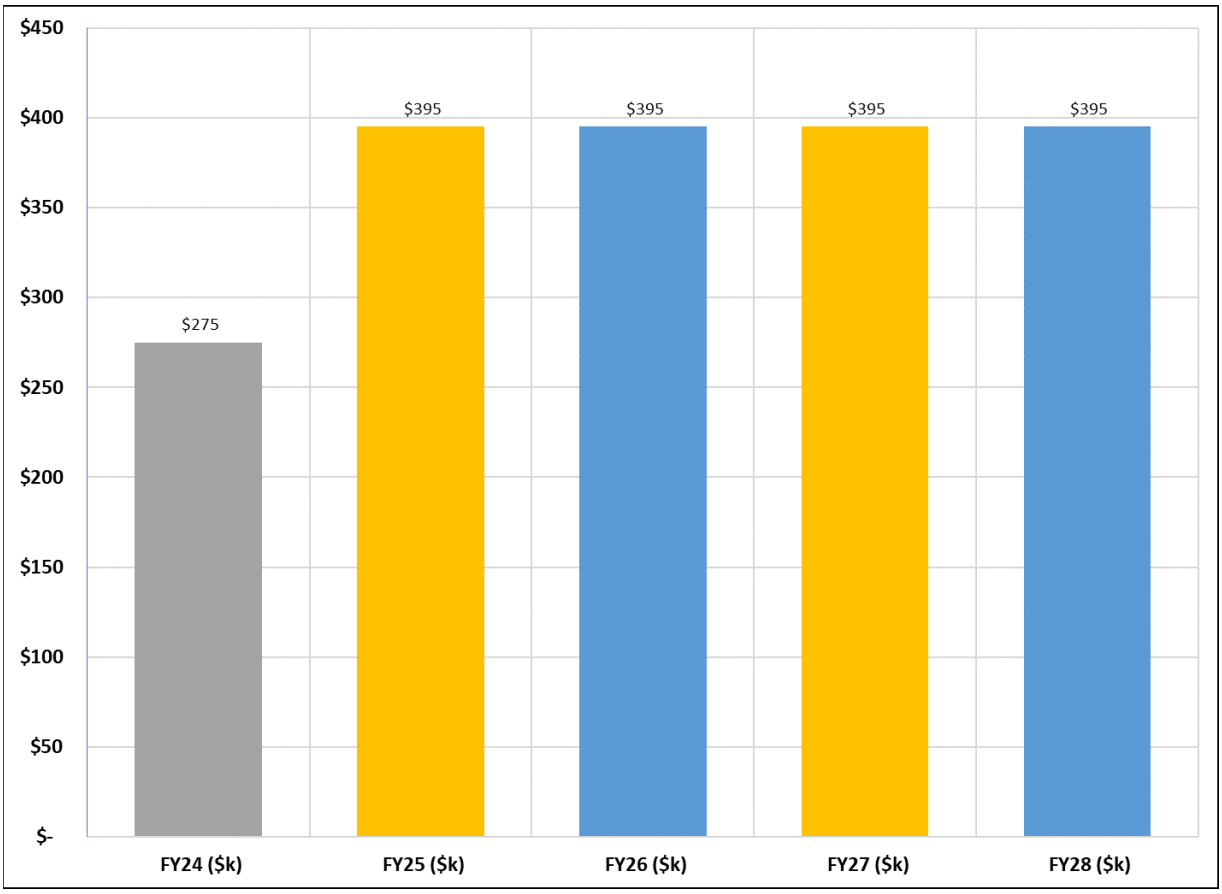
EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.3 Los Alamos National Laboratory (LANL)

Task Name	LANL TS4
Collaborators	None
Task Title	LANL – AM, IE, ND Succession Planning
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the analytical methods, integral experiments and nuclear data capabilities that currently exist at LANL. The work associated with this task is to develop and execute AM, IE, and ND Succession Planning at LANL as defined in the NCSP Mission and Vision document for cross-section processing developers, radiation transport methods developers, experimentalists, and nuclear data evaluators.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager annual report of succession planning efforts. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LANL TS5
Collaborators	None
Task Title	LANL – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$175K (Member funding: #1 $50k, #2 $45k, #3 $45k, and #4 $35k)
Task Description	LANL will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status on LANL TS5 activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-3 LANL TS Budget Trend (FY2024-FY2028)



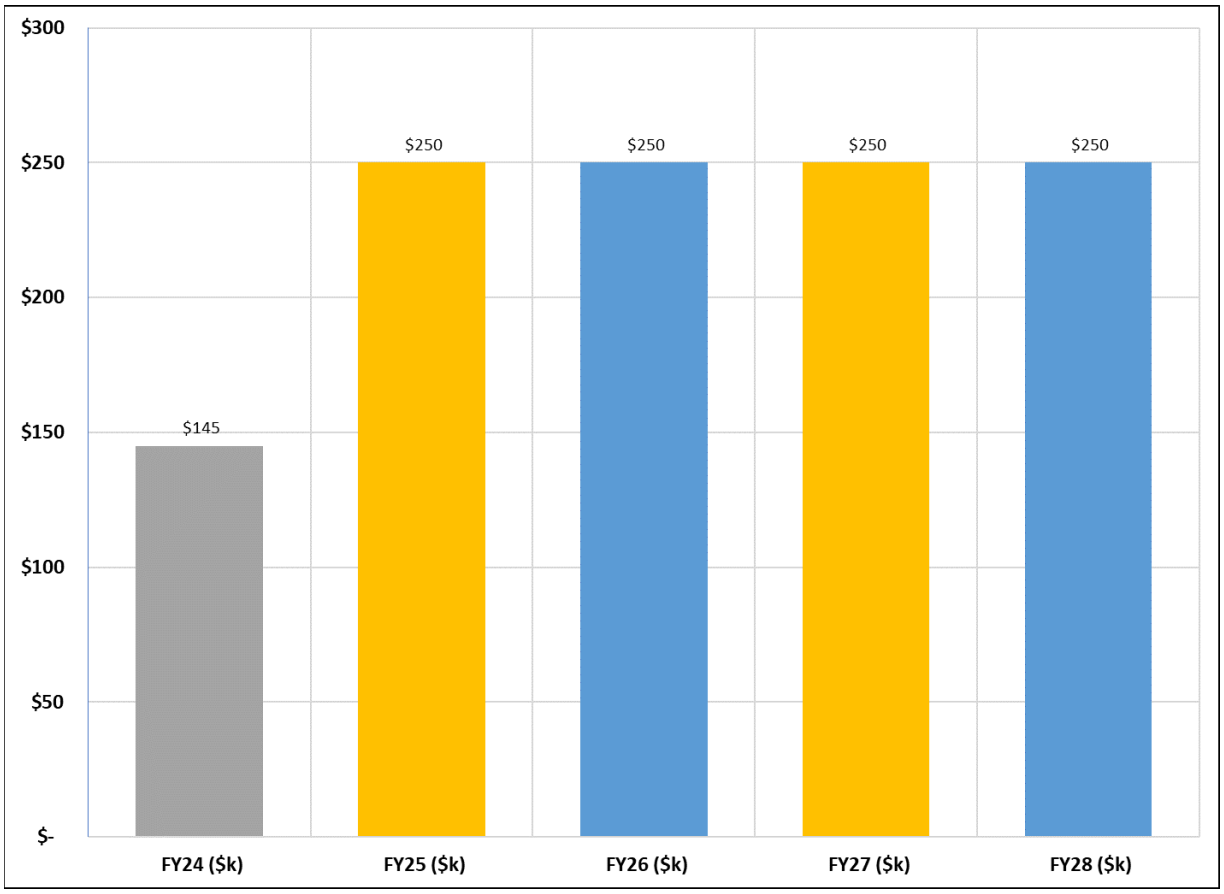
EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.4 Lawrence Livermore National Laboratory (LLNL)

Task Name	LLNL TS5
Collaborators	None
Task Title	LLNL – AM, IE, ND Succession Planning
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the analytical methods and integral experiment capabilities that currently exist at LLNL. The work associated with this task is to develop and execute AM and IE Succession Planning at LLNL as defined in the NCSP Mission and Vision document for integral experiment equipment Support, facility support, and radiation transport methods developers.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager annual report of succession planning efforts. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	LLNL TS6
Collaborators	None
Task Title	LLNL – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$45K (Member funding: #1 $45k)
Task Description	LLNL will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status and update on LLNL TS6 work in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-4 LLNL TS Budget Trend (FY2024-FY2028)

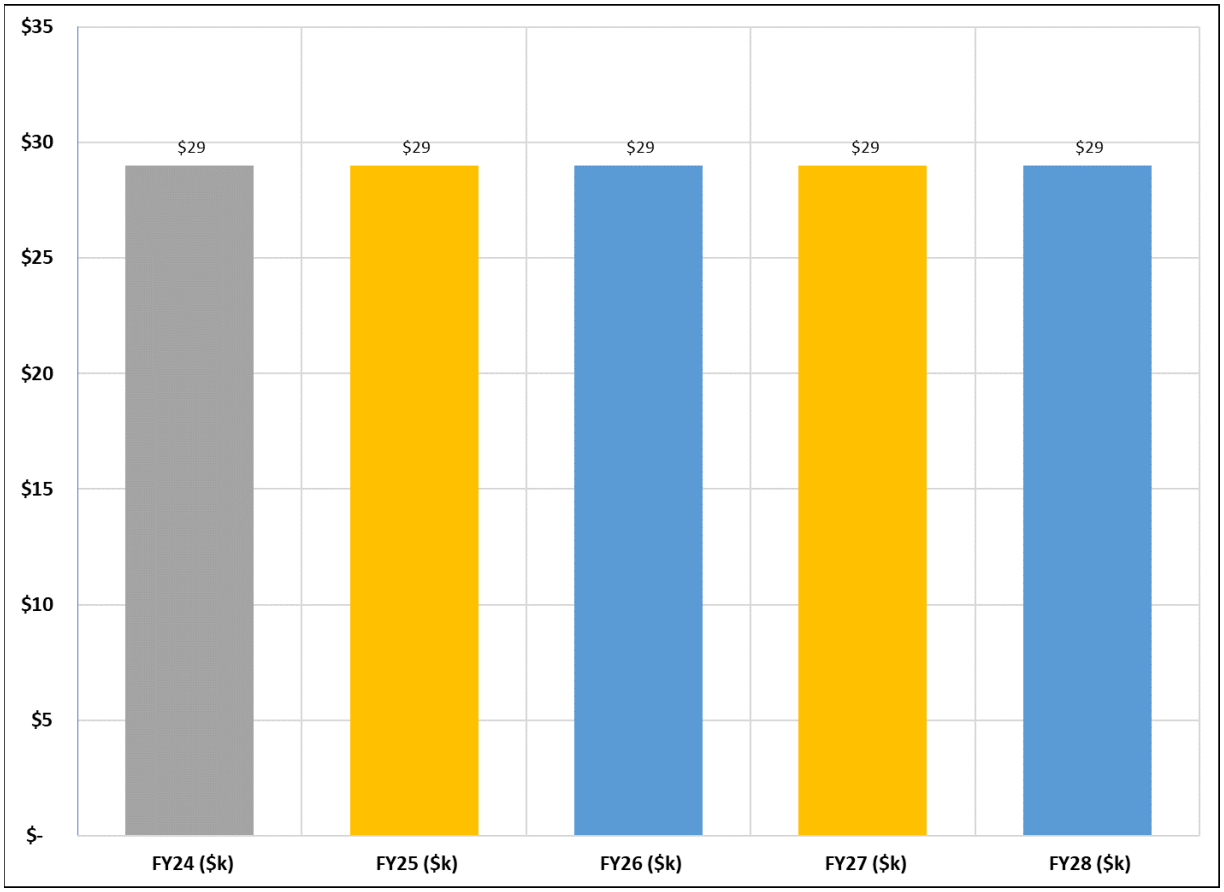


EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.5 Naval Nuclear Laboratory (NNL)

Task Name	NNL TS9
Collaborators	None
Task Title	NNL – Support for NDAG Chair activities
Proposal Submitted	Ongoing
Task Budget (FY24)	$29K
Task Description	Provide support for NDAG Chair activities, participate in relevant Working Groups and domestic and international nuclear data meetings as the nuclear data lead for the NCSP, and coordinate NCSP ND element work program with current and future DOE needs. Support the development of the 5-year plan by coordinating and planning nuclear data prioritization meetings and working with the NCSP management team for tracking progress nuclear data tasks over the course of the year.
FY24 Milestones	All 4 Quarters o Provide status report on all NDAG chair activities in NCSP Quarterly Progress Reports, Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-5 NNL TS Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
Budgets are stable over the 5-year period.

3.2.6 Oak Ridge National Laboratory (ORNL)

Task Name	ORNL TS2
Collaborators	None
Task Title	ORNL – Support for Lead Lab to Execute the NCSP
Proposal Submitted	Ongoing
Task Budget (FY24)	$700K
Task Description	Ongoing ORNL task to support the NCSP Management Team in the program management and execution of the NCSP.
FY24 Milestones	All 4 Quarters o Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. o Manage 5-year plan development and maintenance and oversee the Integral Experiment Request (IER) process and manage main 5-year plan and IER Milestones Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 o Organize and lead the Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY o Publish final Five-Year Plan.

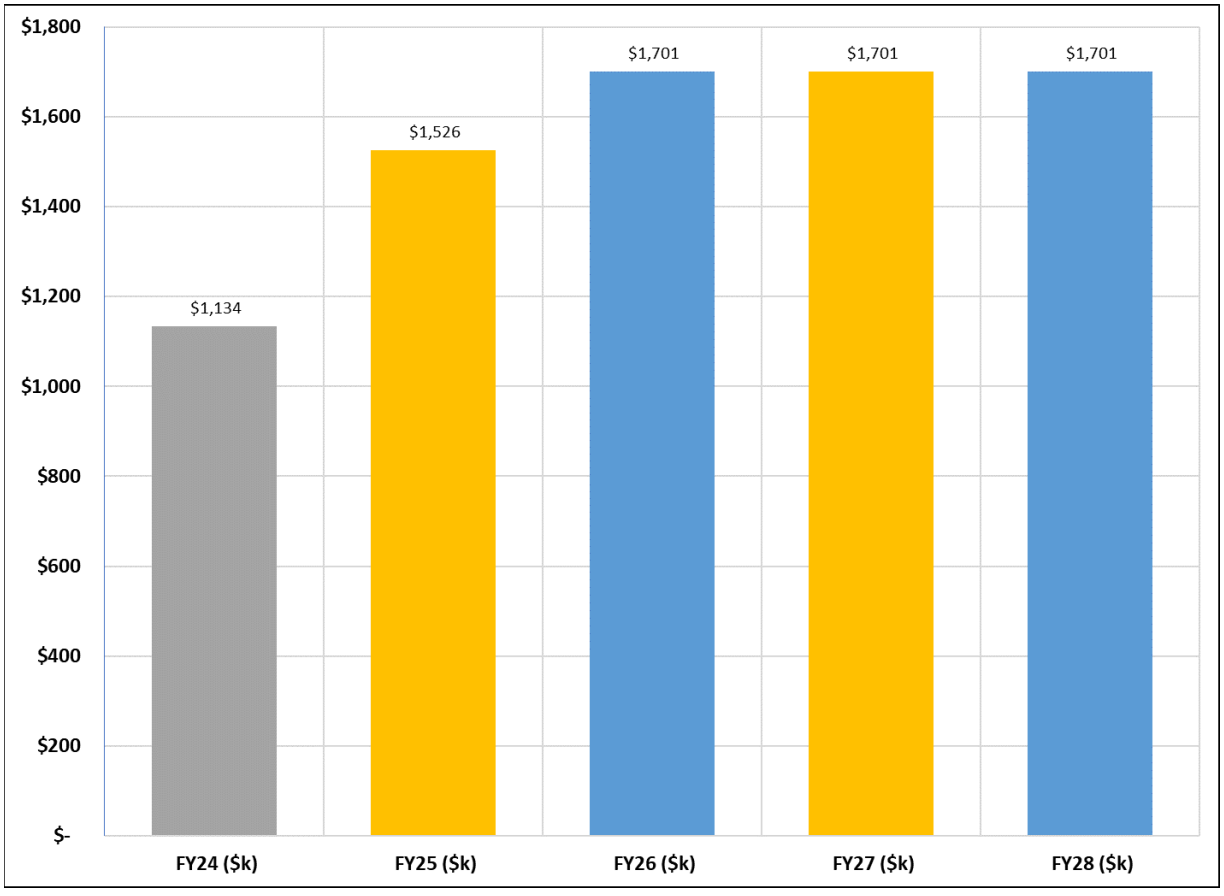
Task Name	ORNL TS7
Collaborators	None
Task Title	ORNL – AM, ND Succession Planning
Proposal Submitted	Ongoing
Task Budget (FY24)	$100K
Task Description	Task to address key nuclear data and analytical methods succession planning needs for the NCSP. As part of this task, junior ORNL staff (e.g., post-doctoral staff member or entry-level staff member) will work with key ORNL ND and AM specialists to complete NCSP ND and AM work tasks thereby training the next generation of experts to perform key NCSP nuclear data and analytical methods tasks.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager annual report of succession planning efforts. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL TS8
Collaborators	None
Task Title	ORNL – NCSP Program Management Tools Development
Proposal Submitted	Ongoing
Task Budget (FY24)	$189K
Task Description	This task continues work initiated in FY2017 to develop a program management tool that will improve the overall efficiency of managing the NCSP. A new IER database has been created and implemented. This funding will be used to maintain the IER database in the G2 system, fix programming errors, and to modestly enhance the system as needed to support IE 5-year plan objectives.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager a status report of progress on the new IER system in G2 in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL TS12
Collaborators	None
Task Title	ORNL – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$65K (Member funding: #1 $5k, #2 $30k, #3 $5k, and #4 $25k)
Task Description	ORNL will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status and update on ORNLTS12 work in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	ORNL TS13
Collaborators	None
Task Title	ORNL – NDA Technical Support Group and NDA Technical Infrastructure Project
Proposal Submitted	Ongoing
Task Budget (FY24)	$80K
Task Description	This task involves the creation of an NDA program Mission and Vision document and 5-year plan to initiate a new federal program to resolve criticality safety issues related to fissionable material holdup and other issues related to NDA technology for NCS purposes. A DOE standard, development of ANSI/ANS-8.28 standard for NDA NCS administrative practices, and support for the NDA Technical Support Group (TSG). Sites involved currently are ORNL, SRS, and Y-12. LLNL is currently helping with NDA website development. ORNL will work with NNSA NA-ESH-21 staff to help lead this task.
FY24 Milestones	All 4 Quarters ○ Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-6 ORNL TS Budget Trend (FY2024-FY2028)



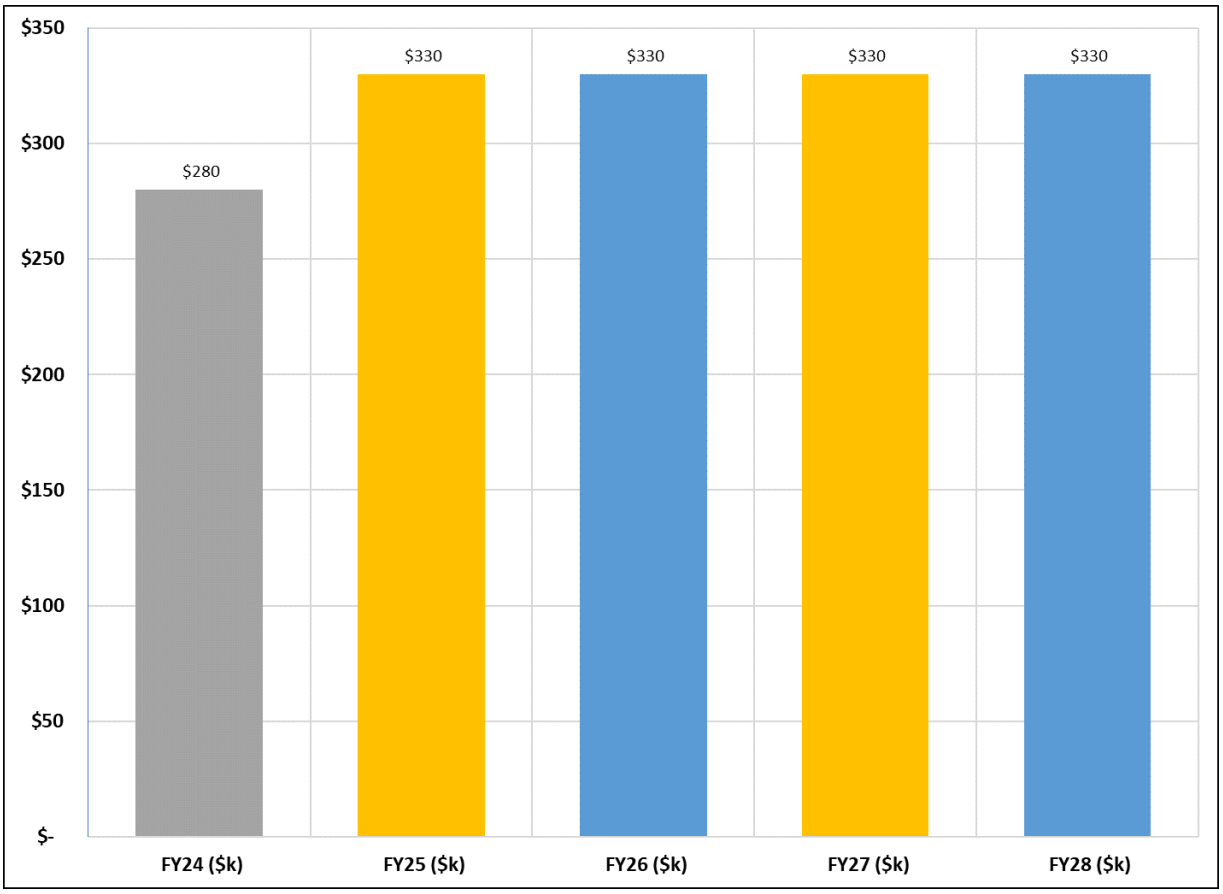
EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.7 Sandia National Laboratory (SNL)

Task Name	SNL TS3
Collaborators	None
Task Title	SNL – Support for Experimentalist Succession Planning
Proposal Submitted	Ongoing
Task Budget (FY24)	$80K
Task Description	In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. At SNL, there is a need to maintain the integral experiment expertise using the SNL critical experiment capabilities. The work associated with this task is to develop and execute IE Succession Planning for new experimentalists at SNL.
FY24 Milestones	All 4 Quarters o Provide NCSP Manager annual report of succession planning efforts. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Task Name	SNL TS12
Collaborators	None
Task Title	SNL – NCSP Integral Experiment Manager Support
Proposal Submitted	Ongoing
Task Budget (FY24)	$200K
Task Description	Activities for this task include integral experiment request (IER) tracking, experimental facility metrics, IER duties, Work for Others tracking/approval, keeping the NCSP management team informed about DAF NCSP activities, 5YP IE plan support, working with task MGRs to submit BCR forms, conduct integral experiment (IE) telecons to track IE NCSP work, availability of NCERC and Sandia critical assemblies for NCSP work, and other tasks at the discretion of NCSP manager or execution manager.
FY24 Milestones	All 4 Quarters o Provide the NCSP manager with a summary of NCSP IER support in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-7 SNL TS Budget Trend (FY2024-FY2028)

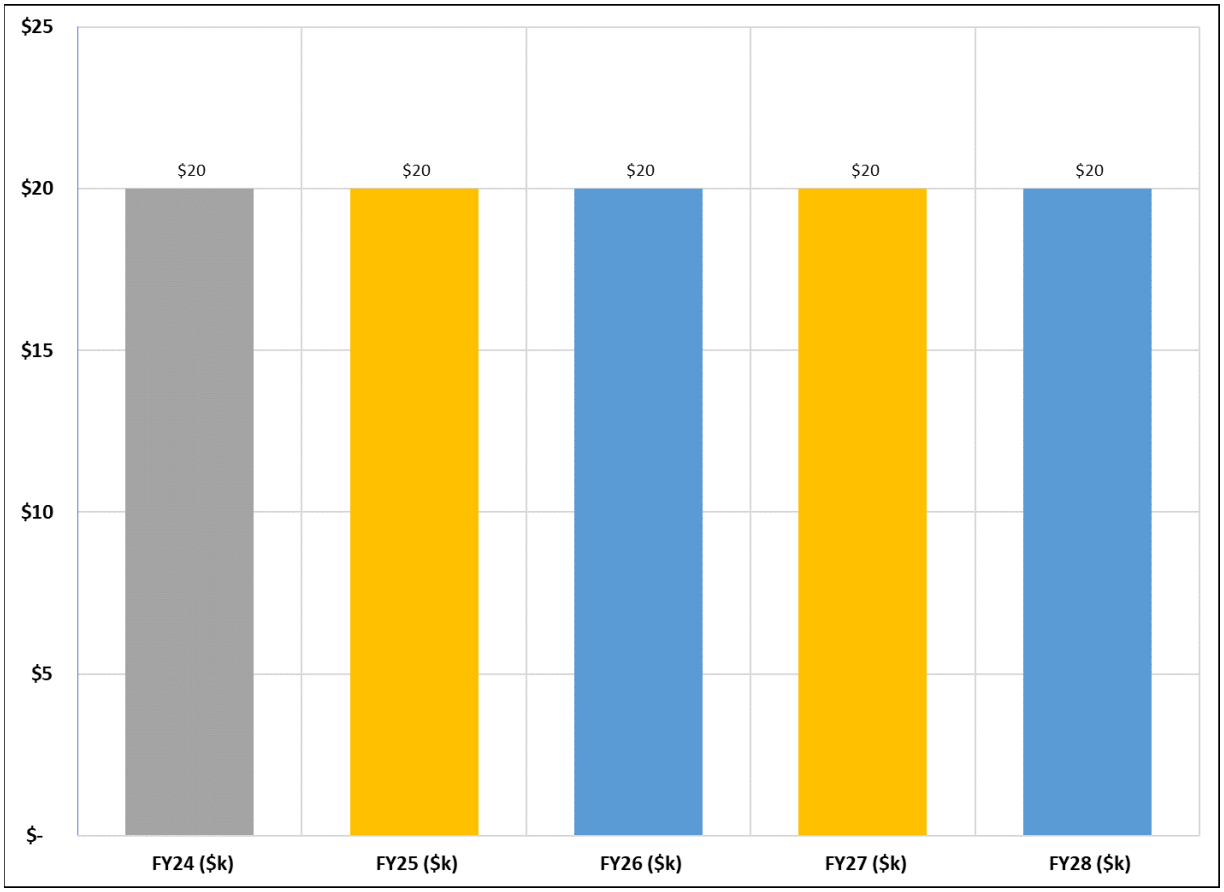


EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.8 Savannah River Site (SRS)

Task Name	SRS TS16
Collaborators	None
Task Title	SRS – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$20K (Member funding: #1 $20k)
Task Description	SRS will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status and update on work in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-8 SRS TS Budget Trend (FY2024-FY2028)

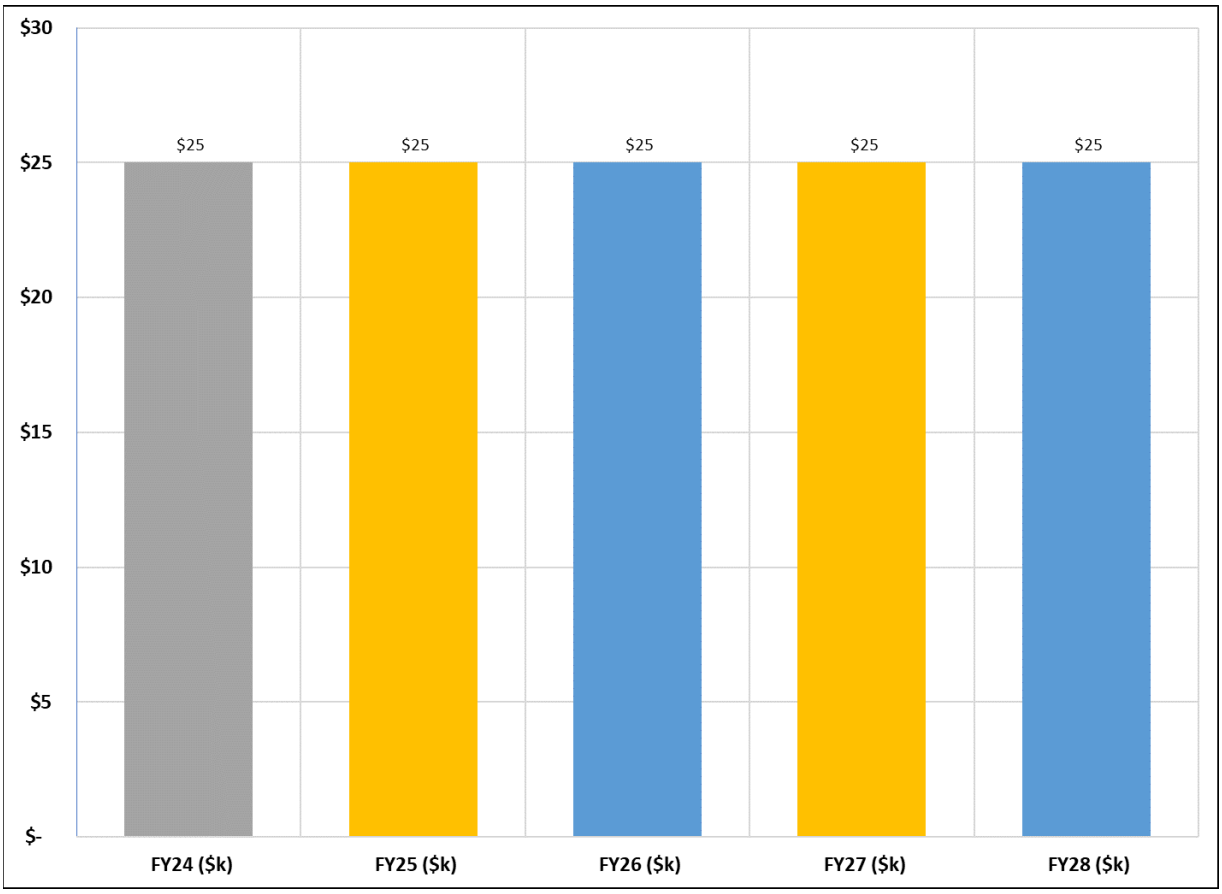


EOC – for out-year peaks and dips in budget plots:
Budget increases in FY25 to restore succession planning funds.

3.2.9 Y-12 National Security Complex (Y12)

Task Name	Y12 TS16
Collaborators	None
Task Title	Y12 – CSSG Funding
Proposal Submitted	Ongoing
Task Budget (FY24)	$25K (Member funding: #1 $25k)
Task Description	Y12 will support CSSG members who are recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as documented and provided on the NCSP Website.
FY24 Milestones	All 4 Quarters o Provide a status and update on work in the NCSP Quarterly Progress Reports. Quarter 1 – None Quarter 2 – None Quarter 3 – None Quarter 4 – None

Figure 3.2-9 Y12 TS Budget Trend (FY2024-FY2028)



EOC – for out-year peaks and dips in budget plots:
Budgets are stable over the 5-year period.

APPENDIX A: Work Authorization Statements for Nuclear Criticality Safety Program Funding for Execution Year FY2024

Provided to the NA-91 Budget Office in August 2023

Argonne National Laboratory (ANL): $15K
Task: Criticality Safety Support Group

Reflects funds for a voting member of the Criticality Safety group to support participation of the Criticality Safety Support Group.

ANL POC: Jim Morman (630-252-6076), jamorman@anl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Brookhaven National Laboratory (BNL): $575K
Task: Analytical Methods, Nuclear Data

Reflects funds to continue supporting nuclear data activities, including shepherding new data evaluations through the Cross-Section Evaluation Working Group (CSEWG) process, subsequent publication of these data in the United States Evaluated Nuclear Data File (ENDF), and nuclear data succession planning, a s delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager.

Brookhaven National Laboratory (BNL): Allocation of $40k of NCSP funding to BNL under WBS 50.7.1.2.1 Program Support to fund BNL hosting the annual NCSP technical program review. The funding may be used to support planning for the meeting as well as fees to cover the meeting location including main auditorium/presentation room, smaller breakout meeting rooms, any needed audio/video/IT support for presentations, office equipment/supplies necessary to support meeting, escorts for foreign national meeting attendees and presenters, as necessary, food including coffee and other beverages and snacks for morning and afternoon breaks due to limited time and inaccessibility of other beverage/food options for meeting participants, personnel necessary to support conduct of meeting. This also includes any penalty costs should the meeting be cancelled or postponed (i.e., due to emerging conditions such as COVID-19 levels). If allowable costs exceed the initial allocation of $40k for any reason, the NCSP will allocate up to an additional $30k to BNL to cover those additional costs. If such a need arises, please keep the NNSA Program Manager, Angela Chambers, apprised as soon as possible.

BNL POC: Gustavo Nobre (631-344-5205), gnobre@bnl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Los Alamos National Laboratory (LANL): $14,146K
Tasks: Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group

Reflects funds to continue analytical methods; information preservation and dissemination; integral experiments; nuclear data; and training and education support, as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager; succession planning for cross-section processing developers, radiation transport developers, experimentalists, and/or nuclear data developers/evaluators; and for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

LANL POC: Joetta Goda (505-667-2812), jgoda@lanl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Lawrence Livermore National Laboratory (LLNL): $3,475K
Tasks: Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group

Reflects funds to continue support for analytical methods; information preservation and dissemination; integral experiments; nuclear data; training and education, as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager; succession planning for equipment support, facility support, and/or radiation transport developers; and for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

LLNL POC: Catherine Percher (925-423-9345), percher1@llnl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Nevada National Security Site (NNSS): $4,394K
Task: Integral Experiments

Reflects funds for MSTS (NNSS) continue support for integral experiments and training and education tasks as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan.

NNSS POC: Sylvia Wright-Reader (702-2950597), WrightSD@nv.doe.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Naval Nuclear Laboratory (NNL): ($29K)
Task: NDAG Chair Support

Reflects funds for NNL to provide NDAG chair support. Funds will be sent to the NNL M&O partner, Fluor Marine Propulsion (FMP).

NDAG Chair funds for Mike Zerkle at NNL.

NNL POC: Tim Trumbull (518-395-5203), timothy.trumbull@unnpp.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Oak Ridge National Laboratory (ORNL): $6094K
Tasks: NCSP Technical Support, Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, and Training and Education

Reflects funds to continue support for analytical methods; information preservation and dissemination; integral experiments; nuclear data; and training and education, as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager; Technical Support for NCSP management; and for succession planning for cross-section processing developers, radiation transport developers, and/or nuclear data evaluators/experimentalists/developers, and for support to the Criticality Safety Support Group (CSSG). The NCSP Technical Support funds may be used to support the DOE Community of Practices Workshop held at ORNL February 13 – 15, 2024. The meeting expenses incurred by the host include, but are not limited to, logistics, website, lunch and break refreshments, IT/AV support, administrative support, and printed material.

ORNL POC: Douglas G. Bowen (865-576-0315), bowendg@ornl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Pacific National Northwest Laboratory (PNNL): $0K
Tasks: Integral Experiments

Reflects funds to continue support for analytical methods as discussed in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager.

PNNL POC: Travis Zipperer (206-528-3474), travis.zipperer@pnnl.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Rensselaer Polytechnic Institute (RPI): ($580K)
Task: Nuclear Data Support at RPI

Reflects funds to conduct differential measurements as delineated in the Nuclear Criticality Safety Execution (NCSP) FY24 Five-Year Plan and continue work, as defined in the RPI LINAC 2022 Nuclear Data Capabilities Maintenance Plan, or as directed by the NCSP Manager. Funds will be sent to the NNL M&O partner, Fluor Marine Propulsion (FMP).

RPI POC: Yaron Danon (518-276-4008), danony@rpi.edu
NNL POC: Tim Trumbull (518-395-5203), timothy.trumbull@unnpp.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Sandia National Laboratories (SNL): $1,745K
Tasks: Integral Experiments, Training and Education, Technical Support

Reflects funds to continue support for integral experiments; training and education; Integral Experiment Manager Support, and succession planning for experimentalists as, delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan or as directed by the NCSP Manager.

SNL POC: Gary Harms (505-845-3244), gaharms@sandia.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Savannah River Site (SRS): $50K
Tasks: Information Preservation and Dissemination and the Criticality Safety Support Group

Reflects funds to update and maintain ARH-600 as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager, to support the NDA Technical Support Group and NDA Technical Infrastructure Project, and for participation in the CSSG, as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

SRS POC: Scott Finfrock (803-557-1317), Scott.Finfrock@srs.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

Y-12 National Security Complex (Y-12): $55K
Tasks: Analytical Methods, Training and Education, Nuclear Data, and the Criticality Safety Support Group

Reflects funds to support the training and education program, the design of integral experiments involving systems with enriched uranium, chlorine, and lithium-6, and the study of a solution reactor design in collaboration with IRSN, as delineated in the Nuclear Criticality Safety Program (NCSP) FY24 Five-Year Plan, or as directed by the NCSP Manager. Further, an additional task is funded for general NCSP and CSSG support, as required.

Y-12 POC: Kevin Reynolds (865-241-9067), kevin.reynolds@pxy12.doe.gov
DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

NCSP Manager: Hold Back – $0K
Reflects DOE HQ Hold Back for the CSSG that will be held as HQ reserve funds.

DOE POC: Angela Chambers, NNSA (806-573-6407), Angela.Chambers@nnsa.doe.gov

APPENDIX B: Nuclear Data Priorities, Basis Statements, and Milestones

Nuclear Data Measurements							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Cesium (^{133}Cs)		LANL	LANL	LANL			
Basis	^{133}Cs is an important fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DICER and DANCE instruments will be used at LANSCE to provide necessary data to support a new evaluation.						
Chlorine (^{35}Cl)	ORNL	ORNL	ORNL				
	LANL	LANL	LANL				
Basis	Measurement of the ^{35}Cl(n,p) cross section using LENZ at LANL. FY23 will be for LENZ at WNR and focus on the energy range from 100 keV to 15 MeV (LANL work on this experiment is funded by GAIN). FY24 and FY25 will be LENZ at Lujan and focus on the energy range from 1 keV to 500 keV. Chlorine is present in fuel cycle facilities in Pu solutions, electrorefining processes, chloride salts, and as brine/drift in some repository environments. Improved ^{35}Cl(n,p) cross sections needed for poison credit in these in these environments. A need for improved ^{35}Cl cross sections has been specifically identified at LANL and Y-12.						
Chromium (^{50,53}Cr)			ORNL				
Basis	Measurement of the ^{53}Cr neutron capture cross section in the 2-10 keV energy range is needed to resolve discrepancies observed in historical fast assembly benchmarks containing stainless steel. The RPI measurement will address data request by CSEWG and IAEA. ORNL will measure ^{50,53}Cr neutron capture below 10 keV at GELINA using diluted samples to reduce or minimize multiple scattering and neutron sensitivity effects impacting prior measurements. ^{50}Cr data over the RR range are needed.						
Fluorine (^{19}F)			ORNL	ORNL			
	RPI	RPI					
Basis	Measurement of the ^{19}F inelastic scattering reaction channels at GELINA that appear to be underestimated in the current evaluation. Analysis and evaluation of the angular distributions in the RRR. Errors in fluorine may be contributing to bias in ^{233}U benchmarks. Fluorine is used in the uranium enrichment process and molten salt reactor coolants. This measurement also support the resolution of the bias observed in the Teflon $(C_2F_4)_n$ moderated configurations in the recently completed Curie critical experiment. RPI will perform a fast quasi-differential scattering measurement on Teflon.						
Neodymium (^{143}Nd)	LANL						
Basis	^{143}Nd is an important stable fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). DOE-SC funded DANCE measurements at LANSCE. NCSP funding will be used to complete the analysis of the DANCE data.						
Neptunium (^{237}Np)			ORNL	ORNL	ORNL		
			LANL	LANL	LANL		
Basis	Measurement of ^{237}Np nuclear data at LANL. ^{237}Np is an actinide of interest in nuclear criticality safety for applications at ORNL and other sites. Applications include ^{238}Pu production w/ HFIR at ORNL and ATR at INL (low NCSP priority) and critical/subcritical assemblies for LANL. Nuclear data improvements will improve critical mass estimates. On the HPRL there is a request for fission cross section in the energy range from 200 keV to 20 MeV. The application list was fast systems, and the required accuracy is 1.5-4%. This requirement comes from the desire to improve the current low accuracy in the covariance matrix (6-8%).						

Nuclear Data Measurements							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Nickel (^{58}Ni)					LANL	LANL	LANL
Basis	Neutron elastic and inelastic scattering data has been demonstrated to be inadequate for many isotopes important to criticality safety. This includes both integrated cross sections and differential angular distributions. A new system being developed at LANSCE, call CoGNAC (The Correlated Gamma-Neutron Array for sCattering) is a system of detectors capable of simultaneously detecting both neutrons and gamma rays, and is designed to measure neutrons, gamma rays, and correlated neutron-gamma emission from elastic and inelastic scattering reactions. From these data, scattering reaction cross sections and outgoing particle angular distributions are extracted. This system combines the excellent time resolution and high detection efficiency of liquid scintillators with the superior particle energy resolution and near-perfect capability to separate neutron and gamma-ray signals in modern CLYC detectors. LANL will be demonstrating CoGNAC in the next few years and propose that it be used to measure scattering from a high-priority NCSP isotopes starting in FY27. Ni-58 has been selected as the initial target isotope of interest but would be open to discussion of a higher-priority isotope between now and then.						
Plutonium (^{239}Pu)	LANL	LANL	LANL				
Basis	There has been a recent IRSN request for a new measurement of the ^{239}Pu neutron total cross section at low neutron energies to better enable a new resonance evaluation of the plutonium isotopes. This evaluation work is concentrated on the evaluation of ^{239}Pu to improve benchmark calculations for thermal plutonium solutions, which remain problematic despite much work over the years. While transmission (total cross section) data are available in the low-energy region, most of these data are not of the quality needed to inform the resonance evaluation. Capabilities afforded by the new DICER (Device for Indirect Capture Experiments on Radionuclides) instrument at LANSCE (Los Alamos) promise higher-quality data to support the evaluation work.						
Plutonium (^{240}Pu)	LANL						
	LLNL						
Basis	Measure ^{240}Pu prompt fission neutron energy spectra (PFNS) with Chi-Nu detector at LANL (LANCSE/WNR). The need for more accurate PFNS has been recognized. Supports applications with WG Pu and reactor grade Pu. This is a joint LANL/LLNL measurement.						
Samarium (^{149}Sm)	LANL						
Basis	^{149}Sm has a thermal capture cross section of 40,000 b and is an important stable fission product for burnup credit. ^{149}Sm builds up like ^{135}Xe in power reactor fuel, but does not decay out of spent nuclear fuel. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DANCE and DICER instruments have been used at LANSCE to measure necessary data under DOE-SC and LDRD funding. Accurate ^{149}Sm cross sections are important for NR. NCSP funding will be used to complete the analysis of this measurement.						
Samarium (^{151}Sm)					LANL	LANL	LANL
Basis	^{151}Sm is an important fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DICER and DANCE instruments will be used at LANSCE to provide necessary data.						
Strontium (^{86,87}Sr)				ORNL	ORNL		
Basis	Enriched ^{86,87}Sr transmission and capture measurements at GELINA are needed to supplement existing ^{88}Sr ORNL measurements to support complete RR evaluation for natural strontium isotopes for ENDF/B. ^{86,87}Sr are minor isotopes representing about 18% of natural strontium.						
Tantalum (Ta)	RPI	RPI					
Basis	Fast quasi-differential scattering measurements will be performed by RPI to assess the adequacy of Ta elastic and inelastic scattering data. Tantalum is used at Y-12 for recovering uranium from machine turnings and at LANL for Pu casting operations in PF-4 where it may provide modest moderation and reflection of fissile material. Tantalum is chosen due to its material properties, as it is one of the few materials that can contain molten plutonium metal. Due to this characteristic, tantalum is often used as crucible, distributer, launder, or molds for plutonium casting operations. The wall thickness of these materials varies from a few mm all the way up to a few cm.						

Nuclear Data Measurements							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Uranium (^{233}U)	LANL	LANL	LANL	LANL			
Basis	^{233}U neutron capture measurements in resonance range and the unresolved fast energy range at the Lujan center at LANCE/LANL using the DANCE detector. ORNL report on ^{233}U data assessment concluded that a new evaluation with revised (renormalized) fission cross section is needed. After re-evaluation of the ^{233}U, new capture cross section measurements (resonance region) may be needed to support this evaluation. NCS applications at LANL (CMR), ORNL, DAF/NCERC, disposition of irradiated LWBR modules at INL/NRF. LANL will measure capture cross section using the DANCE detector multiplicity features in FY20-FY22. Prompt fission neutron spectra will be measured at LANSCE / Chi-Nu in FY24-FY26. PPAC will be fabricated by LLNL.						
Uranium (^{236}U)					ORNL	ORNL	
Basis	^{236}U high-resolution transmission measurements in the RRR at GELINA or LANL to complement recent LANL fast energy evaluation. ^{236}U is a minor activation product present in HEU. Improved ^{236}U cross section evaluation supports all DOE programs using HEU and storage, transportation, and disposal of spent nuclear fuel.						
Vanadium (^{51}V)			ORNL	ORNL			
Basis	Recent vanadium measurements showed large multiple scattering corrections needed to be accounted for neutron energies below 10 keV. Additional measurements are needed at GELINA possible using diluted samples on order to reduce or minimize the neutron sensitivity to experimental setup. Vanadium is used in some fissile material containers.						
Zirconium (^{90,91,92,94,96}Zr)	ORNL	ORNL	ORNL				
Basis	Neutron capture and possibly transmission measurements in resonance range at GELINA. Old ORELA transmission data on enriched isotopes are available for analysis. Isotopically enriched samples are required. Zirconium is a key structural element that is primarily used in cladding for fuel rods and is currently in consideration for use with advanced nuclear fuel matrices in the form of zirconium hydride. The main application is reactor fuel cladding. ^{nat}Zr transmission and capture measurements were recently completed by ORNL. NR continues to be unsatisfied with Zr evaluations in ENDF. Inelastic scattering measurements at least on ^{92}Zr. ^{90,91}Zr measurement completed. ^{92,94}Zr samples to be ordered in FY2023 and shipped to GELINA in FY2024. ^{92}Zr measurement to be completed and ^{94}Zr measurement started in FY2024						
Berylium (Be)	NNL	NNL					
	Beryllium metal is a reflector material used in materials testing reactors (ATR) and advanced reactor designs. NNL will perform additional subthermal transmission measurements with new well characterized samples to support TSL evaluation validation. (NR funded – RPI measurements)						
ZrH_x		NNL	NNL				
Basis	Zirconium hydride is an advanced moderator material used in TRIGA reactors and in several advanced reactor designs. NNL will perform subthermal transmission measurements to support TSL evaluation validation. (NR funded – RPI measurements)						
ZrC			NNL	NNL			
Basis	Zirconium carbide is an advanced coating used in high performance TRISO fuel and as a hydrogen corrosion barrier. NNL will perform subthermal neutron transmission measurements to support TSL evaluation validation. (NR funded – RPI measurements)						
Petrolatum	NNL						
Basis	Petrolatum is a heavy paraffinic oil and a moderator better than water that is occasionally used in fissile handling areas. NNL performed subthermal transmission measurements to support TSL evaluation validation. (NR funded – RPI measurements)						

List Legend	ORNL	RPI	LANL	LLNL/NCSU	IRSN	NNL	BNL

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Beryllium (^{9}Be)	LANL	LANL	LANL	LANL			
Basis	Be-9 evaluations continue to be challenged by benchmark critical experiments. See pg. 167 of the ENDF/B-VIII.0 report. The accompanying text indicates "there is considerable spread in these Be assembly results." The ENDF/B-VIII.0 evaluation of Be-9 carried over cross sections from ENDF/B-VII.1 but adopted JENDL-4.0 evaluations of elastic scattering angular distribution and (n,2n) angular and energy distributions. This leaves a less-than-satisfactory inconsistency between the elastic angular distributions and integrated cross sections that should be resolved. The proposed approach is to employ a new representation of the four-body (2n,2 alpha) breakup channel in the R-matrix analysis.						
Cesium (^{133}Cs)					LANL	LANL	
					ORNL	ORNL	
Basis	^{133}Cs is an important fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DICER and DANCE instruments will be used at LANSCE to provide necessary data to support a new evaluation. The new evaluation will be worked on following the completion of the DICER/DANCE measurements. LANL will evaluate the fast regions and ORNL the resonance region.						
Chlorine (^{35}Cl)	ORNL	ORNL	ORNL				
	LANL	LANL	LANL				
Basis	Revise ^{35}Cl resonance and fast evaluation based on ^{35}Cl(n,p) measurements. Chlorine is present in fuel cycle facilities in Pu solutions, electrorefining processes, chloride salts, and as brine/drift in some repository environments. Improving ^{35}Cl(n,p) cross sections needed for poison credit in these environments. A need for improved ^{35}Cl cross sections has been specifically identified at LANL and Y-12. When measured (n,p) data from nTOF will be available, a new fit to include those can data can be performed together with the new measurements from LANL. The evaluation will be an ORNL/LANL collaboration, with ORNL focused on the resonance region and LANL on the fast energy region. Note that a first pass of the fast region revision (including covariances) will be performed by LANL in FY23 with support from GAIN.						
Chromium (^{50,53}Cr)			ORNL	ORNL	ORNL		
Basis	Measurement and evaluation of ^{50,53}Cr neutron capture cross section below 10 keV energy range is needed to resolve discrepancies observed in historical fast assembly benchmarks containing stainless steel. ORNL will measure ^{50,53}Cr neutron capture below 10 keV at GELINA using diluted samples to reduce or minimize multiple scattering and neutron sensitivity effects impacting prior measurements. ^{50}Cr data over the RR range is needed. The cluster of s-wave resonances (mainly for ^{53}Cr) in the neutron energy region between 1-10 keV is the major update to be performed in the ENDF/B-VIII.0 library. As in the current release the magnitude of the capture cross sections is inconsistent with benchmark calculations.						
Copper (^{63,65}Cu)	ORNL	ORNL	ORNL	ORNL			
			LANL	LANL			
Basis	A revised evaluation of copper isotopes is needed to improve the benchmark performance above 100 keV up to 300 keV. This will include a statistical analysis of the resonance parameters above 100 keV to quantify the impact of the missing resonances in the measured data as well as a guidance in the level spin assignment. Due to the importance of the copper being used in critical assembly applications as reflector, additional work on the angular distributions is needed. Moreover, since benchmark sensitivity extends above 300 keV, a careful analysis of the high energy cross sections is needed. With the adopted corrections described above, further analyses will be devoted to quantifying the impact of the angular distributions in the RRR on benchmarks calculations and neutron scattering measurements. Current evaluation in ENDF/B-VIII.0 library is performing reasonably well but angular distributions are inconsistent with angular distributions on natural sample (Popov). More work is needed to assess the impact of the angular distribution in benchmark calculations. LANL evaluation work paused until CERBERUS experiment has been benchmarked and can inform the evaluation work.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Fluorine (^{19}F)		ORNL	ORNL	ORNL			
Basis	The evaluation of the ^{19}F inelastic scattering reaction channel is needed since it appears to be underestimated in the current ENDF/B-VIII.0 evaluation. Further analyses and related evaluation of the angular distributions in the RRR are needed. Since fluorine is used in the uranium enrichment process and molten salt reactor coolants, errors in the ^{19}F evaluated data may be contributing to bias in ^{233}U benchmarks.						
Hafnium (^{176,177,178,179,180}Hf)	ORNL		ORNL	ORNL	ORNL		
	NNL		NNL	NNL	NNL		
Basis	Hafnium is a neutron poison used in reactor and fuel cycle applications. IRSN, ORNL and NNL will review the existing Hf URR evaluation and develop new URR evaluations and covariances to improve agreement with the TEX HEU/Hf experiment. New isotopic measurements are needed to make improvements to the RRR, which will lead to a re-evaluation of the RRR once the measurements are completed. Hybrid evaluation based on T. Ware's JEFF-3.1 RRR evaluation with R. Q. Wright's ENDF/B-VIII.0 URR and fast regions developed for ENDF/B-VIII.1. Further Hf evaluation work paused until the TEX-Hf experiment has been benchmarked in order to inform the need for additional Hf measurement and evaluation work.						
Iron (^{54,56,57}Fe)	ORNL	ORNL					
	BNL	BNL					
Basis	The ORNL contribution to ^{56}Fe was the generation of a preliminary ENDF file solving the problem with the benchmark performance. However, a rigorous evaluation work is still needed for the three major isotopes mainly for the assessment of the inelastic scattering reaction channel. ORNL will revise the ^{54}Fe, ^{56}Fe, and ^{57}Fe resonance evaluations. BNL also participating under DOE-SC funding.						
Iron (^{56}Fe)	ORNL	ORNL					
	BNL	BNL					
Basis	Revise high energy resonance region evaluation. Iron is a key element of structural materials in the DOE Complex (e.g., steel) and is used in many configurations (e.g., tanks, piping, admixed material that can serve as neutron absorber, etc.). ^{56}Fe has numerous resonances above the evaluated resonance range, extending far above the threshold for the first inelastic state. Currently, the latest ^{56}Fe evaluation in the ENDF/B data files does not have detailed resonance parameters here; rather, the evaluation provides a pointwise representation. The ^{56}Fe resonance evaluation will significantly improve radiation transport calculations for systems involving iron (i.e., critical benchmark analyses and criticality safety analyses of processes in the DOE Complex). BNL also participating under DOE-SC funding.						
Lanthanum (La)	ORNL	ORNL					
	LANL	LANL					
Basis	^{139}La resonance range evaluation based on ^{nat}La measurements. Lanthanum is an element that is predominantly ^{139}La (99.910 a/o) and a stable fission product. The primary NCS interest is for fission product credit. In the latest version of ENDF nuclear data library, the resonance analysis is based on parameters obtained with an experimental set up which is known to have certain problems. Currently, ENDF/B-VIII evaluations for La do not have adequate covariance data based on experimental data. Improved covariance data are needed to support sensitivity/uncertainty analyses for fission product credit applications. LANL will perform a fast region evaluation and work to merge it with the ORNL resonance region evaluation.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Lead (^{204,206,207,208}Pb)	ORNL						
	RPI						
	BNL						
	NNL						
Basis	Lead is a ubiquitous material in the nuclear industry. Lead possesses not only high photon attenuation properties, which make it almost a universal choice as a gamma-ray shielding material, but also desirable neutronic qualities. Our ability to match experimental data with Pb (reflectors and as a scattering target) is less than we desire. Pb-208 is the majority isotope of natural lead. The current ENDF evaluation is known to suffer from deficiencies in neutron angular distributions. The emphasis of the re-evaluation work is on these angular distributions. We will judge success of this work based on recent semi-integral measurements performed at RPI. ORNL proposed to revisit RRR to address angular distribution concerns. RPI/BNL/NNL/IRSN also have a NE funded collaboration to evaluate Pb at energies relevant to fast reactors.						
Lithium (^{6}Li)	LANL	LANL	LANL				
Basis	The Li-6 evaluation in ENDF/B-VIII.0 was based on a combination of EDA R-Matrix fits to all reactions open in the Li-7 system up to ~ 4 MeV, influenced by the standards GMA 2017 result for the (n,t) reaction, and ENDF/B-VII.1 values above ~4 MeV. Li-6 is important for a number of reasons, including as a detector (and reference) in experiments, for example, for Chi-Nu measurement of prompt fission neutron spectra. It is important to extend the R-Matrix analysis to the full 20 MeV range for better precision and more complete (covariance information) at the important lower energy scale of a few MeV. Supports need at Y-12 for the new electrorefining process.						
Molybdenum (^{95}Mo)		ORNL	ORNL	ORNL			
Basis	Resonance region evaluation. ^{95}Mo is a stable fission product and the primary absorbing nuclide in natural molybdenum. Molybdenum isotopes are currently encountered in irradiated fuel as fission products or in molybdenum alloys in research reactors and space reactors. Current primary interest for NCS is for fission product credit for transport casks, irradiated fuel storage, and reprocessing plants (UPu-MoZr deposits in reprocessing plant equipment for example). Needs identified by NR and IRSN for fission product credit and Y-12 for U-Mo applications (lower priority).						
Neptunium (^{237}Np)				ORNL	ORNL	ORNL	
				LANL	LANL	LANL	
Basis	Fast and RRR/URR evaluation. ^{237}Np is an actinide of interest in nuclear criticality safety for applications at ORNL and other sites. Applications include ^{238}Pu production w/ HFIR and ATR at INL (low NCSP priority) and critical/subcritical assemblies for LANL. Nuclear data improvements will improve critical mass estimates. On the HPRL there is a request for fission cross section in the energy range from 200 keV to 20 MeV. The application list was fast systems, and the required accuracy is 1.5-4%. This requirement comes from the desire to improve the current low accuracy in the covariance matrix (6-8%). ORNL to provide RRR/URR evaluation and LANL the fast energy range evaluation.						
Nitrogen (^{14}N)	ORNL	ORNL	ORNL				
	Nitrogen cross sections are important in the reprocessing process and related analyses. Nitrogen was recently included as action item in the series of INDEN meetings for light nuclei evaluations. In the ENDF/B-VIII.0 library there are no resonance parameters for nitrogen.						
Oxygen (^{16}O)	LANL	LANL	LANL	LANL			
Basis	^{16}O is a pervasive isotope in criticality safety applications, including as a component of water or a component of fissile material. Challenges related to fidelity of ^{16}O evaluations have persisted for decades in validation studies. Extending high-fidelity R-Matrix analysis to higher incident neutron energies should help address these issues.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Plutonium (^{238}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu)	LANL	LANL	LANL	LANL	LANL		
Basis	Minor isotopes of plutonium are always a part of the overall material. It is therefore important that appropriate attention be given to their nuclear data, especially fission data. Los Alamos has committed to consistent evaluations across isotopes. Develop consistent nu-bar evaluation supported by a model code to provide better evaluated nu-bar for minor Pu-isotopes in FY22-FY24. Develop consistent PFNS evaluation supported by a model code to provide better evaluated PFNS for minor Pu-isotopes in FY25-FY27.						
Plutonium (^{239}Pu)	LANL						
	ORNL	ORNL	ORNL				
Basis	^{239}Pu is one of the three major fissile isotopes of interest in Nuclear Criticality Safety. ^{239}Pu is used at LANL, LLNL, Hanford, SRS, and other locations in sufficient quantities to be an NCS concern. ^{239}Pu is a major factor in many ICSBEP benchmarks. NCSP driver includes inadequate agreement of computations with PU-SOL-THERM benchmarks (biased low after CIELO fix). Major experimental campaigns at LANSCE for ^{239}Pu fission cross section and PFNS are nearing conclusion and the resulting data need to be incorporated into an updated evaluation. ORNL to assist with evaluation work. ORNL will perform an updated evaluation in the RRR and URR aimed to improve agreement with TEX Pu experimental results.						
Plutonium (^{240}Pu)		ORNL	ORNL				
	LANL	LANL	LANL				
Basis	^{240}Pu is a meaningful component of almost all Pu benchmark experiments, and a significant component in some. This isotope is the next major constituent of plutonium and can reach 20% or more enrichment in reactor fuel. Some changes were made in ENDF/B-VIII.0, but there have been no accurate prompt fission spectra measurements previously. Such experiments, and subsequent re-evaluation will benefit criticality safety analysis for MOX fuel reprocessing, fabrication, and disposal. LANL will evaluate the ^{240}Pu PFNS based on recent Chi-Nu measurements. ORNL will evaluate RR.						
Rhodium (^{103}Rh)	ORNL						
	NNL						
Basis	Update resonance evaluation based on RPI transmission and capture measurements in the RRR/URR. ^{103}Rh is a stable fission product, NCS interest is for fission product credit. Evaluation priority - elevated per IRSN request.						
Strontium (^{88}Sr)	ORNL						
Basis	Existing R-matrix analysis of ^{88}Sr in the RRR was performed from the fit of ORELA transmission and capture measurements but the evaluation work was never included in the ENDF/B-VIII.0 library. Strontium is a fission product typically found in spent fuel and in high level waste tanks at Hanford and Savanah River.						
Strontium (^{86,87}Sr)				ORNL	ORNL	ORNL	ORNL
Basis	^{86,87}Sr RR evaluation based on transmission and capture measurements performed at GELINA to supplement existing ^{88}Sr ORNL measurements to support complete RR evaluation for natural strontium isotopes for ENDF/B. ^{86,87}Sr are minor isotopes representing about 18% of natural strontium.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Uranium-233	ORNL	ORNL					
	LANL	LANL	LANL	LANL	LANL		
Basis	^{233}U is a fissile nuclide of interest to criticality safety. The availability of ^{233}U is important to NCS applications mainly at Y-12, ORNL, and at NCERC. 1. The evaluation will include the newly evaluated thermal values from the standard evaluation including the updated fission prompt neutron spectrum. Reevaluate differential data to check the renormalization of ORNL fission data. A new fit for the fission cross sections to account for the Guber and n_TOF fission data, that agree within 2% from 10 eV to 100 keV and higher than the current ENDF/B-VIII.0 evaluated data. Above 100 eV, there are serious discrepancies between ENDF and the new experimental fission data (from Guber and n_TOF) of up to 10% in the 1–10 keV range (Guber). Update with the new standards. RPI has ^{233}U capture data, which is likely the Weston data (Danon). 2. New evaluation fast. Fission spectrum is important for intermediate benchmarks. Renormalize to new standards. Evaluation in the RRR is planned at ORNL and in the fast region at LANL. In the RRR the main goal of the new evaluation is to improve the negative bias in the benchmark calculations.						
Uranium-234			LANL	LANL			
		ORNL	ORNL				
Basis	While ^{234}U makes up a small fraction of natural uranium, previous studies have shown that ignoring ^{234}U for HEU metal benchmarks can lead to a non-conservative result by as much as 0.4%. Recent advances in the capabilities of the DANCE detector at LANSCE, combined with improved theoretical modeling of the capture reaction (for example, including the M1 scissors-mode contribution to the gamma strength function) have enabled more accurate evaluations of (n,g) cross sections. This work to update the ^{234}U capture cross section will utilize both the experimental and theoretical advances. ORNL work will focus on checking the RRR to determine if it needs to be revised. In FY25 LANL will attempt a consistent nu-bar evaluation supported by a model code to provide better nu-bar data for minor U-isotopes.						
Uranium-235	LANL	LANL					
	ORNL	ORNL					
Basis	^{235}U is one of the three major fissile isotopes of interest in Nuclear Criticality Safety. ^{235}U is used at LANL, LLNL, Hanford, SRS, and GDPs, Y-12, and other locations in sufficient quantities to be an NCS concern. ^{235}U is a major factor in thousands of ICSBEP benchmarks. Major LANSCE experiments of ^{235}U fission cross section and PFNS are concluding in the next few years, and the resulting data needs to be incorporated into an updated evaluation. Inelastic scattering cross section measurements are also planned, which will allow evaluators to better address these high-uncertainty interactions. Improvement of ^{235}U URR because based on old average resonance parameters. Includes ORNL revisiting ^{235}U URR evaluation.						
Uranium-236	LANL		LANL	LANL			
							ORNL
							NNL
Basis	^{236}U needs to be considered in modeling of spent fuel. Recent advances in the capabilities of the DANCE detector at LANSCE, combined with improved theoretical modeling of the capture reaction (for example, including the M1 scissors-mode contribution to the gamma strength function) have enabled more accurate evaluations of (n,g) cross sections. This work to update the ^{236}U capture cross section will utilize both the experimental and theoretical advances. ORNL/NNL will evaluate ^{236}U high-resolution transmission measurements in the RRR to complement recent LANL fast energy evaluation. ^{236}U is a minor activation product present in HEU. Improved ^{236}U cross section evaluation supports all DOE programs using HEU. In FY25 LANL will attempt a consistent nu-bar evaluation supported by a model code to provide better nu-bar data for minor U-isotopes.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Uranium-238	LANL BNL	LANL BNL					
Basis	^{238}U is a ubiquitous isotope in HEU, LEU, natural uranium, and depleted uranium. It's presence in HEU and LEU fuels makes it a significant contributor to their reactivity and performance. NU and DU are often used as reflectors or shielding materials, and ^{238}U is obviously the dominant isotope in these materials. ^{238}U is a major factor in many ICSBEP benchmarks. Major LANSCE experiments on the ^{238}U fission cross section and PFNS are concluding in the next few years, and the resulting data needs to be incorporated into an updated evaluation. LANL will evaluate PFNS and multiplicity data for ^{238}U. BNL apply correction to gammas under NA-22 funding.						
Vanadium (^{51}V)			ORNL	ORNL	ORNL		
Basis	Vanadium is a key structural element and is predominately ^{51}V (99.75 atom %). Primary NCS application is fire resistant cans. Recent data testing by LANL for ICSBEP critical benchmarks involving vanadium (i.e., HMF25, HMF40, and HMM16) results in an over-predication of the experiment eigenvalue. In addition, the HMF25 series of experiments exhibit an increasing calculated eigenvalue trend with increasing reflector thickness. The integral data testing indicates that there may be deficiencies in either the elastic scattering angular distributions or secondary energy distributions. In addition, the latest ENDF/B-VII.1 resonance evaluation is based on the JENDL-4.0 evaluation and does not have covariance data. Also, the ENDF/B-VII.1 and JENDL 4.0 resonance evaluations are based on the parameters provided in the Atlas of Neutron Resonances up to 42.5 keV, and the entire resolved resonance evaluation (up to 100 keV) is represented by the multi-level Breit Wigner (MLBW) formalism. As a result, the MLBW resonance evaluation does not account for the resonance-resonance interference effects. Therefore, the evaluated resonance parameters are not based on a detailed R-matrix analysis. Differential measurements are needed in the resonance region to accurately predict the neutron resonances, and a corresponding resonance evaluation is needed to provide detailed resonance parameters and covariance data. In addition, the SAMMY evaluation software has the capability to generate angular scattering distributions from the resonance parameters thereby providing detailed resonance scattering structure that will improve the elastic scattering modeling in the evaluation. The request is for ORNL to complete new ^{51}V cross-section measurements and a resonance evaluation to address computational biases with the existing ^{51}V evaluation. New measurement/evaluation of fast scattering angular distribution recommended. One of the goals of the evaluation in the RRR is to describe accurately the energy region below 10 keV where previous measurements were affected by large multiple scattering corrections. As described above in the measurement section newly planned capture yield measurement should provide consistent data in the energy region.						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
Zirconium (^{90,91,92,94,96}Zr)		ORNL	ORNL	ORNL	ORNL		
		NNL	NNL	NNL	NNL		
		RPI	RPI	RPI	RPI		
		BNL	BNL				
Basis	Resonance evaluations. Zirconium is a key structural element that is primarily used in cladding for fuel rods and is currently in consideration for use with advanced nuclear fuel matrices in the form of zirconium hydride. The latest ENDF/B-VII.1 resonance evaluation relies on JENDL-4 data and resonance parameters from the Atlas of Neutron Resonances. As a result, the evaluated resonance parameters are not based on detailed R-matrix analyses. In addition, newer RPI total cross-section measurements on natural zirconium indicate that the older ENDF/B-VI.8 data match the recent RPI measurements better than the newer isotopic evaluations. Furthermore, improved differential measurements of the zirconium isotopes have been identified on the OECD/NEA nuclear data High Priority Request List (HPRL). Differential measurements are needed in the resonance region to accurately predict the neutron resonances for the zirconium isotopes, and corresponding resonance evaluations are needed to provide detailed resonance parameters and covariance data. In addition, the SAMMY evaluation software has the capability to generate angular scattering distributions from the resonance parameters thereby providing detailed resonance scattering structure that will improve the elastic scattering modeling for the zirconium isotope evaluations. NR continues to be unsatisfied with Zr evaluations in ENDF. BNL will re-evaluate the fast and URR regions of all stable Zr isotopes to ensure that the elastic scattering angular distribution is consistent with the rest of the fast region, to improve the inelastic scattering cross sections and to correct issues with the URR evaluation implemented in ENDF/B-VIII.0 (under DOE-SC funding).						
Uranium Metal (U)	LLNL/NCSU						
Basis	TSL evaluation. Requested by the RPI for use in U-235 resonance parameter analysis.						
Paraffin (C_nH_{2n+2})	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. A common moderator and moderating reflector material for which there are numerous critical benchmarks in the ICSBEP Handbook. A thermal scattering law for paraffin will improve simulations through higher fidelity and reduce uncertainties.						
Plutonium Oxide (PuO_2)	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. A common fissile compound for which there are critical experiments in the ICSBEP Handbook. A thermal scattering law for PuO_2 will improve Doppler broadening using advanced methods currently under development as LLNL ND12.						
Light Paraffinic Oil (Mineral Oil)		LLNL/NCSU	LLNL/NCSU	LLNL/NCSU			
Basis	TSL evaluation. Mineral oil and other light paraffinic oils are moderators often found in fissile handling areas (FHAs). A thermal scattering law for light paraffinic oils would reduce excessing margins in nuclear criticality safety evaluations for fissile handling areas containing this class of moderator. TSL requested by NNL.						
Uranium Silicide (U_3Si_2)		LLNL/NCSU	LLNL/NCSU	LLNL/NCSU			
Basis	TSL evaluation. A common fissile compound in use in advanced nuclear reactor fuel. A thermal scattering law for U_3Si_2 will improve Doppler broadening using advanced methods currently under development as LLNL ND12.						
Amorphous Carbon			LLNL/NCSU	LLNL/NCSU	LLNL/NCSU		
Basis	TSL evaluation. Amorphous carbon is present as part of core internals (moderators, reflectors, structural material, fuel assembly structure, etc.) of various advanced nuclear reactors. A thermal scattering law for amorphous carbon will support modeling of graphitic and carbon structures with a representation of graphitization effects, which will improve simulations through higher fidelity and reduced uncertainties.						
Triuranium Octoxide (U_3O_8)			LLNL/NCSU	LLNL/NCSU	LLNL/NCSU		
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law for U_3O_8 will improve Doppler broadening using advanced methods currently under development as LLNL ND12..						

Nuclear Data Evaluations							
Materials	**Pre-FY2024**	**FY2024**	**FY2025**	**FY2026**	**FY2027**	**FY2028**	**Post-FY2028**
U-Mo				LLNL/NCSU	LLNL/NCSU	LLNL/NCSU	
Basis	TSL evaluation. HALEU U-Mo is one of the fuel systems being developed for use in research and test reactors. A thermal scattering law for the HALEU U-Mo fuel system will improve simulations through higher fidelity and reduced uncertainty. Supports design studies related to the conversion of high-performance research and test reactors from HEU to HALEU, fuel cycle facilities producing this fuel system, and transportation analyses.						
Uranyl Fluoride (UO_2F_2)				LLNL/NCSU	LLNL/NCSU	LLNL/NCSU	
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law for UO_2F_2 solutions will improve modeling and simulation of fissile solution systems.						
Uranyl Nitrate ($UO_2(NO_3)_2$)					LLNL/NCSU	LLNL/NCSU	LLNL/NCSU
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law for $UO_2(NO_3)_2$ will improve modeling and simulation of fissile solution systems.						
Plutonium Nitrate ($Pu(NO_3)_4$)						LLNL/NCSU	LLNL/NCSU
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law $Pu(NO_3)_4$ will improve modeling and simulation of fissile solution systems.						
Zirconium Carbide (ZrC)	NNL						
Basis	TSL evaluation. Zirconium carbide is an advanced coating used in high performance TRISO fuel and as a hydrogen corrosion barrier. Evaluation funded by NR.						
Beryllium Hydride (BeH_2)	NNL						
Basis	TSL evaluation. Super-moderator for use in critical mass studies. Evaluation funded by NR.						
Plutonium Hydride (PuH_{2+x})				NNL	NNL		
Basis	TSL evaluation. A common fissile compound in use in fissile material operations using hydride/de-hydride processes. A thermal scattering law for PuH_{2+x} will improve Doppler broadening using advanced methods currently under development as LLNL ND12. Evaluation funded by NR.						
Polystyrene $(C_8H_8)_n$	ORNL						
Basis	Polystyrene is a moderator material found in several thermal systems (PCT001, PCT02, MCT012, MCT013, MCT014, MCT016). Currently, polyethylene is used as a surrogate to represent thermal scattering in polystyrene in neutron transport simulations. This measurement and evaluation will determine the validity of this approximation, as well as inform future substitutions for other hydrocarbons found in benchmarks. RPI could perform sub-thermal transmission measurements to support this TSL evaluation.						

List Legend	ORNL	RPI	LANL	LLNL/NCSU	IRSN	NNL	BNL

B-1 Differential Measurements and Evaluations

(The following list provides the specific milestones to refer to for each element work schedule in Table B-1)

- Beryllium (Be-9)
- Cesium (Cs-133)
- Chlorine (Cl-35)
- Chromium (Cr-50,53)
- Copper (Cu-63,65)
- Fluorine (F-19)
- Hafnium (Hf-176,177,178,179,180)
- Iron (Fe-54,56,57)
- Lanthanum (La)
- Lithium (Li-6)
- Molybdenum (Mo-95)
- Neodymium (Nd-143)
- Neptunium (Np-237)
- Plutonium (Pu-238, 240, 241, 242)
- Plutonium (Pu-239) (LANL/IRSN plus ORNL/IRSN Collaboration)
- Plutonium (Pu-240)
- Samarium (Sm-149, 151)
- Strontium (Sr-86,87)
- Uranium-233 (U-233)
- Uranium-234 (U-234)
- Uranium-235 (U-235)
- Uranium-238 (U-238)
- Vanadium (V-51)
- Zirconium (Zr-90, 91, 92, 94, 96)

<u>Completed Work</u>

- Calcium (Ca)
- Cerium (Ce)
- Cobalt (Co-59)
- Copper (Cu-63, 65)
- Copper (^{nat}Cu) - scattering angular distributions
- Dysprosium (Dy-161, 162, 163, 164)
- Gadolinium (Gd-155, 156, 157, 158, 160)
- Lead (Pb-208)
- Lead (Pb-204,206,207,208)
- Nickel (Ni-58, 60)
- Oxygen (O-16)
- Strontium (Sr-88)
- Tantalum (Ta-181)
- Tungsten (W-182, 183, 184, 186)
- Uranium-236 (U-236)

Completed Differential Measurements and Evaluations – Elements

(Evaluations have been submitted to NNDC and are candidates for the next ENDF release. Testing will be performed as part of ENDF release effort, and additional revisions may be

requested by NNDC before evaluations are formally released. The GANTT charts are retained in the Five-Year Plan pending release of the new evaluations by NNDC.)

Table B-1. Differential Measurements and Evaluations

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Beryllium (Be-9)	11/1/11	9/30/26		
Deliver an improved and more consistent evaluation to NNDC	11/15/19	9/30/20	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/20	2/1/21	BNL	
CSEWG Validation Testing	12/1/20	5/1/21	NDAG	
CSEWG Approval of Complete Evaluation	5/1/21	8/1/21	BNL	
Extend the upper end of the R-Matrix evaluation from 5 MeV to 10 MeV (including inelastic angular distributions), provide R-Matrix parameters, and deliver evaluation to NNDC	10/1/21	9/30/23	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/22	2/1/24	BNL	
CSEWG Validation Testing	12/1/22	5/1/24	NDAG	
CSEWG Approval of Complete Evaluation	5/1/23	8/1/24	BNL	
Extend the upper end of the R-Matrix evaluation as high as practical, report on research to include 4-body breakup reaction and deliver evaluation to NNDC	10/1/22	9/30/26	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/26	2/1/27	BNL:	
CSEWG Validation Testing	12/1/26	5/1/27	NDAG	
CSEWG Approval of Complete Evaluation	5/1/27	8/1/27	BNL	
Cesium (Cs-133)	10/1/23	9/30/26		
Perform transmission and capture measurements using DICER and DANCE at LANSCE, analyze results, publish data, and deliver results to evaluators.	10/1/23	9/30/26	LANL	
Perform complete re-evaluation of the fast energy range including new data from DANCE and DICER	10/1/26	9/30/28	LANL	
Chlorine (Cl-35)	10/1/20	12/30/25		
Perform (n,p) Measurements	10/1/20	9/30/21	ORNL	Funding source: ORNL ND1
Complete WNR measurements of Cl-35(n,p) funded by GAIN	10/1/22	9/30/23	LANL	
Initiate new (n,p) cross section measurement using LENZ at Lujan for 1 keV – 500 keV	10/1/23	9/30/24	LANL	
Complete Lujan measurements of Cl-35 (n,p) from 1 keV to 500 keV, combine with FY23 results	10/1/24	9/30/25	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
from WNR, finalize report on LENZ analysis, and deliver final experimental cross-sections to evaluators				
Resolve Resonance Region Evaluation	10/01/21	9/30/24	ORNL	
Fast Region Evaluation	10/1/22	9/30/25	LANL	
Finalize isotopic Evaluation Resonance Region and Fast Evaluations and Deliver to NNDC	10/1/21	9/30/25	ORNL / LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/16/25	10/30/25	BNL	
CSEWG Validation Testing	11/01/25	11/15/25	NDAG	
CSEWG Approval of Complete Evaluation	11/16/25	12/30/25	BNL	
Chromium (Cr-50, 53)				The two links below describe the problem and motivation for the proposed work. In addition to ORNL plans to 1) to develop procedure to treat experimental effects such as neutron sensitivity and multiple scattering corrections with geometry different from cylindric. https://www.oecd-nea.org/dbdata/hprl/hprlview.pl?ID=518 and https://www.oecd-nea.org/dbdata/hprl/hprlview.pl?ID=519 . Measurements for both isotopes below 10 keV with diluted sample are needed to reduce or minimize the neutron sensitivity of the experimental set up and MS in the sample. Cr50 data over the whole energy ranges is needed.
Perform Capture Measurements	1/1/24	9/30/25	ORNL	
Perform SAMMY Analysis	1/1/24	9/30/27	ORNL	
Resolved Resonance Region Evaluation for Cr-50, 53				
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				
Phase I testing, Post to ENDF/A and Broadcast	10/16/26	10/30/27	BNL	
CSEWG Validation Testing	11/1/26	11/15/27	NDAG	
CSEWG Approval of Complete Evaluation	11/16/26	12/30/27	BNL	
Cu (Cu-63,65)				A revised evaluation on copper isotopes is needed to improve the benchmark performance above 100 keV up to 300 keV. This will include a statistical analysis of the resonance parameters above 100 keV to quantify the impact of the missing resonances in the measured data as well as a guidance in the level spin assignment. Due to the importance of the copper being used in reactor
Perform Capture Measurements	N/A	N/A	–	
Perform SAMMY Analysis	10/1/19	9/30/22	ORNL	
Resolved Resonance Region Evaluation for Cu-63,65				
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Phase I testing, Post to ENDF/A and Broadcast	10/1/22	1/15/23	BNL	applications as reflector, additional work on the angular distributions is needed. Moreover, since benchmark sensitivity extends above 300 keV, a careful analysis of the high energy cross sections might be needed.
CSEWG Validation Testing	1/16/23	1/31/23	NDAG	
CSEWG Approval of Complete Evaluation	2/1/23	3/30/23	BNL	
Work with the IER 537 design team to help optimize the nuclear-data return from the experiment	1/1/21	6/30/23	LANL	
Incorporate improvements into the high-energy evaluations as needed based on IER 537 results and deliver updated evaluations to NNDC	10/1/24	9/30/26	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/24	1/15/25	BNL	
CSEWG Validation Testing	1/16/25	1/31/25	NDAG	
CSEWG Approval of Complete Evaluation	2/1/25	3/30/25	BNL	
Fluorine (F-19)	1/1/24	9/30/26		F-19 might be the main cause bias in ^{233}U solution benchmarks. There are no resonance parameters in the ENDF/B-VIII.0 library because the RRR evaluation was converted to point wise cross sections. There are no high-resolution measured data for F-19 inelastic scattering reaction channel, e.g. (n,n'), (n,n0), (n,n1), that in the current evaluation seems to be underestimated. Analysis and evaluation on the angular distributions in RRR is required.
Perform Inelastic Measurements (IRMM)	1/1/24	12/30/24	ORNL	
Perform SAMMY Analysis	12/30/24	9/30/26	ORNL	
Resolve Resonance Region Evaluation for F-19				
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation	11/1/26	12/31/26	BNL	
Hafnium (Hf-176,177,178,179,180)	10/1/19			Resolved and unresolved resonance evaluations for Hf isotopes have been carried out mainly to address issues on benchmark results in the thermal energy region. IRSN and LLNL will be working on the development of the TEX-Hf experiments focusing in the epithermal energy region. Indeed, MORET calculations of the benchmark sensitive to Hf in the epithermal energy region have demonstrated discrepancies calculated and experimental multiplication factors result. The intent of the proposal is to review and re-evaluate the Hf cross sections in the resolved and unresolved resonance regions with additional covariance and uncertainty information. (ORNL is waiting for IRSN feedback)
Perform assessment of the available Hf evaluation in the resolved and unresolved resonance regions in the JEFF, ENDF and JENDL libraries; Perform detail study of the sensitivity of Hf cross sections in the calculations using the TEX-Hf benchmarks; Examine the results from different cross section libraries; Initiate resonance parameter evaluation in the resolved and unresolved resonance regions.	10/1/19	9/30/20	ORNL/ IRSN/ NNL	
Continue tasks initiated in previous year; Incorporate experimental differential data in the evaluation process as they	10/1/20	9/30/21	ORNL/ IRSN/ NNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
become available; Continue evaluation using computer evaluation tool.				
Complete the resolved resonance and resonance parameter covariance evaluation; Use the evaluation for testing in benchmark calculation; Work with ORNL on the benchmark validation; Submit the evaluation to JEFF and ENDF for further testing;	10/1/21	9/30/25	ORNL/ IRSN/ NNL	
Initiate the unresolved resonance region evaluation; Incorporate experimental differential data in the evaluation process as they become available; Continue evaluation using computer evaluation tool;	10/1/22	9/30/23	ORNL/ IRSN/ NNL	
Complete the unresolved resonance and cross section covariance evaluation; Use the evaluation for testing in benchmark calculation; Work with ORNL on the benchmark validation; Submit the evaluation to JEFF and ENDF for further testing.	10/1/23	9/30/25	ORNL/ IRSN/ NNL	
CSEWG Approval of Complete Evaluations				
Fe (Fe-54, 56, 57)	1/1/13	12/31/24		Although the effort on the Fe isotopes was planned as joint effort between ORNL and IRSN, IRSN mainly led the evaluation effort and it is unclear the status of this set of evaluations. The ORNL contribution to 56-Fe was the generation of a preliminary ENDF file solving the problem with the benchmark performance. However, a rigorous evaluation work is still needed for the three major isotopes mainly for the assessment of the inelastic scattering reaction channel.
Perform Capture Measurements for Fe-54	10/1/21	9/30/22	RPI	
Perform SAMMY Analysis Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC	1/1/21	9/30/24	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/23	10/15/24	BNL	
CSEWG Validation Testing	10/16/23	11/1/24	NDAG	
CSEWG Approval of Complete Evaluation	11/1/23	12/31/24	BNL	
Lanthanum (La)	10/1/17	3/30/24		Updated from FY2019
Transmission and Capture Measurements	10/1/17	6/1/18	ORNL	
Experimentalist Data Reduction and Testing	6/1/18	9/30/19	ORNL	
Resolved Resonance Region Evaluation	10/1/21	6/30/23	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	7/1/22	9/30/23	ORNL	
Finalize Fast Region Evaluation and Deliver to NNDC	10/1/22	12/31/23	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	1/1/24	1/15/24	BNL	
CSEWG Validation Testing	1/15/24	2/1/24	NDAG	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Approval of Complete Evaluation	2/1/24	3/30/24	BNL	
Lead (Pb-204,206,207,208)	10/1/21	12/31/23		Lead is a ubiquitous material in the nuclear industry. Lead possesses not only high photon attenuation properties, which make it almost a universal choice as a gamma-ray shielding material, but also desirable neutronic qualities. Our ability to match experimental data with Pb (reflectors and as a scattering target) is less that we desire. Pb-208 is the majority isotope of natural lead. The current ENDF evaluation is known to suffer from deficiencies in neutron angular distributions. The emphasis of the re-evaluation work is on these angular distributions. We will judge success of this work based on recent semi-integral measurements performed at RPI. ORNL proposed to revisit RRR to address angular distribution concerns
Resolved Resonance Region Evaluation	4/1/21	9/30/23	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/23	10/14/23	BNL	
CSEWG Validation Testing	10/15/23	10/31/23	NDAG	
CSEWG Approval of Complete Evaluation	11/1/23	12/31/23	BNL	
Lithium (Li-6)	10/1/21	8/1/26		
Perform data compilation and add EDA code capabilities to support new R-Matrix evaluation up to 10 MeV	10/1/20	9/30/22	LANL	
Deliver new evaluation using R-Matrix analysis to 10 MeV	10/1/22	9/30/25	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/25	2/1/26	BNL	
CSEWG Validation Testing	11/1/25	5/1/26	NDAG	
CSEWG Approval of Complete Evaluation	5/1/26	8/1/26	BNL	
Molybdenum (Mo-95)	10/1/20	>FY24		
Reduce prior ORELA transmission and capture measurement data, publish data, submit to EXFOR, and deliver to evaluators	10/1/20	9/30/21	LANL	
Transmission and Capture Measurements	10/1/22	>FY24	RPI	
Experimentalist Data Reduction and Testing	TBD	TBD	RPI	
Resolved Resonance Region Evaluation	TBD	TBD	RPI/NNL	IRSN will collaborate on evaluation.
Finalize Resonance Evaluation and Deliver to NNDC	TBD	TBD	RPI/NNL	
Phase I Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	>FY24	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Neodymium (Nd-143)	10/1/22	9/30/23		
Analyze prior DANCE data, publish results, and deliver to evaluators	10/1/22	9/30/23	LANL	
Neptunium (Np-237)	10/1/20	6/30/29		
Assess needs for new Np-237 differential experiments at LANSCE	10/1/20	9/30/21	LANL	
Finalize Np-237 fission measurement at LANSCE using SREFT detector	10/1/24	9/30/27	LANL	
Finalize Fast Region Evaluation including updated nu-bar and PFNS data and Deliver to NNDC	10/1/26	9/30/28	LANL	
Resonance Region Evaluation	10/1/26	9/30/28	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	10/1/26	9/30/28	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/28	11/1/28	BNL	
CSEWG Validation Testing	11/1/28	3/30/29	NDAG	
CSEWG Approval of Complete Evaluation	3/30/29	6/30/29	BNL	
Nickel (Ni-58)	10/1/26	9/30/28		
Measure elastic and inelastic scattering cross sections and angular distributions	10/1/26	9/30/28	LANL	
Nitrogen (N-14)	12/30/20	9/30/25		Nitrogen cross section are important in the reprocessing process and related analyses. Nitrogen was recently included as action item in the series of INDEN meetings for light nuclei evaluations. In the ENDF/B-VIII.0 library there are no resonance parameters for nitrogen.
Transmission and Capture Measurements	–	–		
Experimentalist Data Reduction and Testing	–	–		
Resolved Resonance Region Evaluation	12/30/22	9/30/25	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation				
Phase I Testing, Post to ENDF/A and Broadcast	10/1/24	10/15/25	BNL	
CSEWG Validation Testing	10/15/24	11/1/25	NDAG	
CSEWG Approval of Complete Evaluation	11/1/24	12/30/25	BNL	
Oxygen (O-16)	10/1/13	12/31/26		To be discussed by NDAG in FY2021. Not in App. B tables.
Update evaluation as part of Cielo Project	<FY19	6/30/21	ORNL	This milestones is based on the availability of the (n,a) measured at

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Finalize Evaluation and Deliver to NNDC	7/1/21	9/30/21	ORNL	LANL. After several years, this data should be ready for release and put some light on the magnitude of the (n,a) reaction channel. Moreover, the quality of this evaluation is also linked to the updates in the SAMMY code regarding the multiple incident channel option.
Phase I testing, Post to ENDF/A and Broadcast	10/1/21	10/15/21	BNL	Define post evaluation process
CSEWG Validation Testing	10/15/21	11/1/21	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/21	12/31/21	BNL	
Extend the upper end of the R-Matrix evaluation from 7 MeV to 10 MeV (including new data), provide R-Matrix parameters, and deliver evaluation to NNDC.	10/1/21	9/30/22	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/22	10/15/22	BNL	
CSEWG Validation Testing	10/15/22	11/1/22	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/22	12/31/22	BNL	
Extend the upper end of the R-Matrix evaluation as far above 10 MeV as practical (including additional data) and deliver evaluation to NNDC.	10/1/22	9/30/26	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/26	12/31/26	BNL	
Rhodium (Rh-103)	6/30/21	1/1/23		Reprioritized to FY21-FY23.
Assess data for Resolved Resonance Region Evaluation	6/30/21	9/30/23	ORNL	NNL & IRSN will collaborate
Finalize Resonance Evaluation and Deliver to NNDC			ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/23	10/15/23	BNL	Define post process evaluation
CSEWG Validation Testing	10/15/23	11/1/23	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/23	12/31/23	BNL	
Minor Plutonium Isotopes (Pu-238, Pu-240, Pu-241, Pu-242)	10/1/21	6/30/27		
Attempt a consistent nu-bar evaluation supported by a model code to provide better evaluated nu-bar for minor Pu-isotopes	10/1/21	9/30/23	LANL	
Format and V&V nu-bar means and covariances	10/1/23	6/30/24	LANL	Note: these new tasks acknowledge the significant work required to format and test covariance data.
Attempt a consistent PFNS evaluation supported by a model code to provide better evaluated PFNS for minor Pu-isotopes	10/1/24	9/30/26	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Format and V&V PFNS means and covariances	10/1/26	6/30/27	LANL	Note: these new tasks acknowledge the significant work required to format and test covariance data.
Finalize Evaluation and Deliver to NNDC	7/1/26	9/30/26	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/26	12/31/26	BNL	
Plutonium (Pu-239)	10/1/10	9/30/25		IRSN to collaborate with ORNL evaluation work.
Deliver p(nu) Data in ENDF/B format	10/1/12	9/30/13	LANL	
Update Prompt Fission Neutron Spectra Based on LANSCE Low-Energy Emission Data	10/1/18	3/31/20	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/1/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Update Prompt Fission Neutron Spectra Based on LANSCE High-Energy Emission Data	10/1/18	3/31/20	LANL	
WPEC SG34 Improved Resonance Evaluation	<FY19	TBD	ORNL	
URR Evaluation using Hwang-Leal Methodology	TBD	TBD	ORNL	
Finalize Resonance Region Evaluation and Deliver to NNDC	TBD	9/30/24	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	TBD	BNL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/19	9/30/22	LANL	
Update Fission Cross-Section Based on TPC Results (based on Pu239/U235 ratio data)	10/1/19	9/30/22	LANL	
Update Evaluation Based on LANL Updates and CSEWG & WPEC Testing	10/1/20	>FY24	ORNL	
Procure samples for LANSCE DICER experiment	10/1/23	9/30/24	LANL	
Perform transmission measurements at LANSCE DICER	10/1/23	9/30/24	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Analyze and publish the results of the LANSCE DICER measurement and transmit to evaluators	10/1/24	9/30/25	LANL	
Plutonium-240 (Pu-240)	10/1/19	4/30/26		
Procure a Pu-240 target for PFNS measurements	10/1/19	9/30/20	LANL	
Fabricate, assemble, and test the Pu-240 PPAC target and fission detector components	6/1/20	8/31/21	LLNL	
Obtain final experimental results for Pu-240 PFNS at LANSCE, finalize data analysis, and deliver data to evaluators	9/1/21	3/30/23	LANL	
Update evaluation to include new LANSCE / Chi-Nu prompt fission neutron spectra	3/30/22	9/30/25	LANL	
Resolved Resonance Region Evaluation	10/1/22	9/30/24	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	9/30/25	11/1/25	BNL	
CSEWG Validation Testing	11/1/25	3/31/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	3/31/26	4/30/26	BNL	
Samarium (Sm-149)	10/1/22	9/30/23		
Analyze prior DANCE and DICER data, publish results, and deliver to evaluators	10/1/22	9/30/23	LANL	
Samarium (Sm-151)	10/1/26	9/30/29		
Perform transmission and capture measurements using DICER and DANCE at LANSCE, analyze results, publish data, and submit to EXFOR.	10/1/26	9/30/29	LANL	
Strontium (Sr-86,87)	10/1/25	12/30/28		
Transmission and Capture Measurements (Geel)	10/1/25	9/30/27	ORNL	
Experimentalist Data Reduction and Testing	10/1/27	3/30/28	ORNL	
Resolved Resonance Region Evaluation	4/1/26	9/30/28	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	10/1/28	10/15/28	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/16/28	10/30/28	BNL	
CSEWG Validation Testing	11/1/28	11/15/28	NDAG	
CSEWG Approval of Complete Evaluation	11/16/28	12/30/28	BNL	
Tantalum (Ta)	10/1/15	1/1/23		

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Transmission and Capture Measurements	10/1/15	9/30/21	RPI	ORNL is/was not part of the measurement campaign. However, ORNL is working with NNL to generate an evaluation in the RRR.
Experimentalist Data Reduction and Testing	10/1/21	9/30/22	RPI	
Resolved Resonance Region Evaluation	10/1/18	9/30/22	NNL/ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation			NNL/ORNL	
Finalize Resonance Evaluation and Deliver to NNDC			NNL/ORNL	
Finalize updates to high-energy portion of the ENDF evaluation and coordinate with resonance work at ORNL and NNL to deliver a final product validated with critical experiments	10/1/20	9/30/22	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/22	10/15/22	BNL	
CSEWG Validation Testing	10/15/22	11/1/22	NDAG	
CSEWG Approval of Complete Evaluation	11/1/22	1/1/23	BNL	
Uranium (U-233)	10/1/2019	1/1/28		
Complete review of previous "thin" target U233 measurements and finalize specifications for new "thick" U233 target	10/1/2019	6/30/20	LANL	The measurements will be performed on the basis of the cross section evaluation and the performance with the benchmarks. PPAC fabricated by LLNL.
Complete fabrication of new "thick" U-233 target	7/1/20	6/30/21	LANL LLNL	
Finalize acquisition of U-233 thick target capture data, finalize data analysis, and deliver data to evaluators	7/1/21	9/30/22	LANL	
Resolved Resonance Region Evaluation	4/1/20	9/30/23	ORNL	IRSN will collaborate
Assess data for Unresolved Resonance Region Evaluation	10/1/23	9/30/24	ORNL	
Attempt a consistent nu-bar evaluation supported by a model code to provide better nu-bar data for minor U-isotopes	10/1/24	9/30/25	LANL	Note: Instead of having U-233 separate from 234 and 236, we decided to combine all three.
Format and V&V nu-bar means and covariances	10/1/25	6/30/26	LANL	
Finalize Fast Region Evaluation, including new DANCE capture data, and Deliver to NNDC	10/1/22	9/30/25	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/25	2/1/26	BNL	
CSEWG Validation Testing	12/1/25	5/1/26	NDAG	
CSEWG Approval of Complete Evaluations	5/1/26	8/1/26	BNL	
Complete PFNS measurements at Chi-Nu, finalize the analysis of the results, and publish the data	10/1/23	9/30/26	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Incorporate new PFNS data into evaluation and deliver to NNDC	4/1/25	9/30/27	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/27	10/15/27	BNL	
CSEWG Validation Testing	10/15/27	11/1/27	NDAG	
CSEWG Approval of Complete Evaluations	11/1/27	1/1/28	BNL	
Uranium (U-234)	10/1/11	9/30/25		
Finalize Resonance Evaluation and Deliver to NNDC	10/1/11	9/30/14	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/14	9/30/17	BNL	
CSEWG Validation Testing	10/1/17	12/31/17	NDAG	
CSEWG Approval of Complete Evaluations	10/1/15	12/31/16	BNL	
Revisit capture cross section and covariance based on new DANCE data	4/1/18	3/31/20	LANL	
Update U-234 evaluation based on new capture cross section and deliver to NNDC	10/1/19	9/30/20	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/20	2/1/21	BNL	
CSEWG Validation Testing	12/1/20	5/1/21	NDAG	
CSEWG Approval of Complete Evaluations	5/1/21	8/1/21	BNL	
Check the status the RRR evaluation	10/1/23	9/30/25	ORNL	
Attempt a consistent nu-bar evaluation supported by a model code to provide better nu-bar data for minor U-isotopes	10/1/24	9/30/25	LANL	
Format and V&V nu-bar means and covariances	10/1/25	6/30/26	LANL	
Uranium (U-235)	10/1/11	8/1/25		
Deliver p(nu) Data in ENDF/B Format	10/2/12	9/30/13	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/2/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Review the evaluation of U-235 capture and fission cross sections based on new measurements at LANSCE	4/1/16	9/30/17	LANL	
Resolved Resonance Capture Evaluation Per WPEC SG29 Recommendations	10/1/11	9/30/14	ORNL	
CSEWG Validation Testing	10/1/14	9/30/17	NDAG	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Approval of Complete Evaluation(s)	10/1/17	12/31/17	BNL	
Update Prompt Fission Neutron Spectra Based on LANSCE Low-Energy Emission Data	10/1/15	9/30/18	LANL	
Finalize prompt fission neutron spectra based on LANSCE high-energy emission data from Chi-Nu	10/1/20	3/31/22	LANL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/19	9/30/22	LANL	
Update fission cross section and covariance evaluation based on new TPC results (from U235/U238 ratio data)	10/1/18	9/30/19	LANL	
Update fission cross section based on TPC Results (from Pu-239/U-235 ratio data)	10/1/20	9/30/21	LANL	
Develop consistent evaluation of fission yields, neutron multiplicity, and spectra from thermal to 20 MeV	10/1/19	9/30/22	LANL	
Revisit elastic and inelastic cross sections based on planned LANSCE experiments using Chi-Nu	10/1/21	9/30/24	LANL	
Finalize evaluation and deliver to NNDC	7/1/23	9/30/24	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/23	2/1/25	BNL	
CSEWG Validation Testing	12/1/23	5/1/25	NDAG	
CSEWG Approval of Complete Evaluations	5/1/23	8/1/25	BNL	
Uranium (U-236)	10/1/24	2/1/30		
Attempt a consistent nu-bar evaluation supported by a model code to provide better nu-bar data for minor U-isotopes	10/1/24	9/30/25	LANL	
Format and V&V nu-bar means and covariances	10/1/25	6/30/26	LANL	
Transmission measurements at LANL or GELINA	>2026		ORNL	
Resonance evaluation	>2027		ORNL	NNL will collaborate

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Finalize RRR evaluation and deliver to NNDC	TBD	TBD	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluations	TBD	2/1/30	BNL	
Uranium (U-238)	10/1/12	3/31/24		
Unresolved Resonance Region Evaluation Using the Hwang-Leal Methodology	10/1/13	12/31/15	ORNL	
Finalize URR Evaluation and Deliver to NNDC	1/1/16	1/1/16	ORNL	
Deliver p(nu) Data in ENDF/B Format	10/1/12	9/30/13	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/1/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	1/1/16	1/15/16	BNL	
CSEWG Validation Testing	1/16/16	12/31/16	NDAG	
CSEWG Approval of Complete Evaluation(s)	1/1/17	2/28/17	BNL	
Revisit fission cross section and covariance evaluation based on new TPC data (based on U238/U235 ratio data)	10/1/17	9/30/19	LANL	
Finalize Prompt Fission Neutron Spectra Based on LANSCE Chi-Nu Data	10/1/21	3/31/24	LANL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/20	9/30/22	LANL	
Vanadium (V-51)	12/30/24	12/31/26		Additional task for measurement was described above
Complete Resonance Region Capture Measurements (Geel)	12/30/24	9/30/25	ORNL	Due to enhanced neutron scattering and MS of the thin V sample, experiments with a diluted sample are needed for the energy region below 10 keV.
Perform SAMMY Analysis	12/30/24	9/30/26	ORNL	The evaluation work should be started on the basis on the additional needed measurements

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Finalize Resonance Evaluation and Deliver to NNDC	9/30/25	9/30/26	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/16/26	10/31/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/26	12/31/26	BNL	
Zirconium (Zr-90,91,92,94,96)	9/30/14	12/30/24		Capture and transmission Experiments with different nat-Zr samples have been performed
Deliver Updated High-Energy Evaluation of Zr-90	10/1/14	9/30/15	LANL	
Phase I Testing, Post to ENDF/A and Broadeast	10/1/15	10/15/15	BNL	
CSEWG Validation Testing	10/16/15	10/31/16	NDAG	
CSEWG Approval of Complete Evaluations	11/1/16	12/31/16	BNL	
Transmission and Capture Measurements	3/30/20	10/30/25	ORNL	Delay due to COVID-19
Experimentalist Data Reduction and Testing			ORNL	
Resolved Resonance Region Evaluation	3/30/21	6/30/27	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation	TBD	TBD	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	TBD	TBD	ORNL	

B-2 Differential Measurements and Evaluations – Compounds
(The following list provides the specific GANTT chart to refer to for each element work schedule)

- Paraffin (C_nH_{2n+2})
- Plutonium Oxide **(**PuO_2)
- Light Paraffinic Oil
- Uranium Silicide (U_3Si_2)
- Amorphous Carbon
- U-Mo
- Triuranium Octoxide (U_3O_8)
- Uranyl Fluoride (UO_2F_2)
- Uranyl Nitrate ($UO_2(NO_3)_2$)
- Plutonium Nitrate ($Pu(NO_3)_4$)
- Beryllium (Be) – subthermal transmission (NR funded)
- Zirconium Carbide (ZrC) – subthermal transmission (NR funded)
- Zirconium Hydride (ZrHx) – subthermal transmission (NR funded)
-

<u>Completed Work</u>

- Lucite **(**$C_5O_2H_8$)
- Polyethylene $(CH_2)_n$
- Beryllium (metal)
- Beryllium Oxide (BeO)
- Crystal Graphite
- Reactor Graphite
- Silicon Carbide (SiC)
- Silicon Dioxide (SiO_2)
- Uranium Dioxide (UO_2)
- Uranium Nitride (UN)
- Hexagonal Ice (H_2O) – evaluated by NNL
- Yttrium Hydride (YH_2) – evaluated by NNL
- FLiBe liquid
- Paraffinic Oil
- Uranium Hydride (UH_3) – evaluate by NNL
- Hydrofluoric Acid (HF)
- Water (H_2O)
- Calcium Hydride (CaH_2)
- Reactor Grade Graphite (20% porosity)
- Uranium Carbide (UC)
- Polystyrene $(C_8H_8)_n$
- Uranium Metal (U)
- Polyethylene $(C_2H_4)_n$ – subthermal transmission
- Lucite (C5O2H8) – subthermal transmission
- Polystyrene $(C_8H_8)_n$ – subthermal transmission
- Yttrium Hydride (YH_x) – subthermal transmission
- Petrolatum – subthermal transmission (NR funded)

Table B-2. Thermal Scattering Measurements and Evaluations - Compounds

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Paraffin (C_nH_{n+2})	10/1/21	12/31/24		
Thermal Scattering Evaluation	10/1/21	6/30/24	NCSU	
Finalize and Deliver Evaluation to NNDC	7/1/24	7/31/24	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	8/1/24	8/30/24	BNL	
CSEWG Validation Testing	9/1/24	11/31/24	NDAG	
CSEWG Approval of Complete Evaluation	12/1/24	12/31/24	BNL	
Plutonium Oxide (PuO_2)	10/1/22	12/31/23		
Thermal Scattering Evaluation	10/1/22	3/31/23	NCSU	
Finalize and Deliver Evaluation to NNDC	3/31/23	7/31/23	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	8/1/23	9/30/23	BNL	
CSEWG Validation Testing	10/1/23	11/31/23	NDAG	
CSEWG Approval of Complete Evaluation	12/1/23	12/31/23	BNL	
Light Paraffinic Oil	10/1/23	12/31/25		
Thermal Transmission Measurements	TBD	TBD	NNL	
Thermal Scattering Evaluation	10/1/23	12/31/24	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/25	3/31/25	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/25	6/30/25	BNL	
CSEWG Validation Testing	7/1/25	9/30/25	NDAG	
CSEWG Approval of Complete Evaluation	10/1/25	12/31/25	BNL	
Uranium Silicide (U_3Si_2)	10/1/23	12/31/25		
Thermal Scattering Evaluation	10/1/23	12/31/24	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/25	3/31/25	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/25	6/30/25	BNL	
CSEWG Validation Testing	7/1/25	9/30/25	NDAG	
CSEWG Approval of Complete Evaluation	10/1/25	12/31/25	BNL	
Amorphous Carbon	10/1/24	12/31/26		
Thermal Scattering Evaluation	10/1/24	12/31/25	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/26	3/31/26	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/26	6/30/26	BNL	
CSEWG Validation Testing	7/1/26	9/30/26	NDAG	
CSEWG Approval of Complete Evaluation	10/1/26	12/31/26	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
U-Mo	10/1/25	12/31/27		
Thermal Scattering Evaluation	10/1/25	12/31/26	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/27	3/31/27	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/27	6/30/27	BNL	
CSEWG Validation Testing	7/1/27	9/30/27	NDAG	
CSEWG Approval of Complete Evaluation	10/1/27	12/31/27	BNL	
Triuranium Octoxide (U_3O_8)	10/1/24	12/31/26		
Thermal Transmission Measurements	10/1/23	9/30/24	ORNL	Non-NCSP funded SNS measurement
Thermal Scattering Evaluation	10/1/24	12/31/25	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/26	3/31/26	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/26	6/30/26	BNL	
CSEWG Validation Testing	7/1/26	9/30/26	NDAG	
CSEWG Approval of Complete Evaluation	10/1/26	12/31/26	BNL	
Uranyl Fluoride (UO_2F_2)	10/1/25	12/31/27		
Thermal Scattering Evaluation	10/1/25	12/31/26	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/27	3/31/27	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/27	6/30/27	BNL	
CSEWG Validation Testing	7/1/27	9/30/27	NDAG	
CSEWG Approval of Complete Evaluation	10/1/27	12/31/27	BNL	
Uranyl Nitrate ($UO_2(NO_3)_2$)	10/1/26	12/31/28		
Thermal Scattering Evaluation	10/1/26	12/31/27	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/28	3/31/28	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/28	6/30/28	BNL	
CSEWG Validation Testing	7/1/28	9/30/28	NDAG	
CSEWG Approval of Complete Evaluation	10/1/28	12/31/28	BNL	
Plutonium Nitrate ($Pu(NO_3)_4$)	10/1/27	12/31/29		.
Thermal Scattering Evaluation	10/1/27	12/31/28	NCSU	
Finalize and Deliver Evaluation to NNDC	1/1/29	3/3/31/29	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	4/1/29	6/30/29	BNL	
CSEWG Validation Testing	7/1/29	9/30/29	NDAG	
CSEWG Approval of Complete Evaluation	10/1/29	12/31/29	BNL	

APPENDIX C: Fiscal Year 2024 Projected Foreign Travel

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
BNL	Nobre, Brown	OECD/NEA Paris, France	May 2024	2	$12,000	WPEC Annual Meeting and associated subgroup meetings	ND	Provide brief trip summary report to NCSP Manager (Q3).	Present and collaborate at the discussions and expert subgroups related to the development of the Nuclear Data and Analytical Methods tasks in BNL
BNL	Nobre	OECD/NEA Paris, France	Jun 2024	1	$6,000	WPNCS Annual Meeting and associated subgroup meetings	ND	Provide brief trip summary report to NCSP Manager (Q3).	Collaborate in matters relevant to the development of the Nuclear Data task in BNL
LANL	Hale, Paris, Neudecker	IAEA Vienna, Austria	TBD, 2023	3	$18,000	IAEA Consultancy Meeting - INDEN and Nuclear Data Standards	ND	Provide brief trip summary report to NCSP Manager (Q?).	Meetings (INDEN and Neutron Data Standards) are related to nuclear data evaluation of U-238, U-235, and Pu-238-242 fission observables (nu-bar, PFNS, (n,f) cross sections.) These are related to ongoing work in ND1.
LANL	Hutchinson, McKenzie, Whitman, Weldon	Japan	TBD, 2024	4	$24,000	Planning trip with IRSN to STACY	IE	Provide brief trip summary report to NCSP Manager (Q?).	IRSN has been coordinating with JAEA personnel on making measurements at a reconfigured STACY core to support eventual debris measurements at Fukushima. LANL expertise with the MC-15 from NCSP subcritical benchmarks and underwater measurements at the RPI reactor (another IRSN collaboration) are very relevant to the challenge.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
LANL	Alwin, Cutler, Goda, Hutchinson, Sanchez, Amundson	AWE Reading, UK	TBD, 2024	6	$36,000	Coordinate International Collaboration Efforts with AWE and UKNNL	IE, AM, ND, IPD	Provide brief trip summary report to NCSP Manager (Q?).	Coordinate work as described the Five-Year Execution Plan, Appendix F.
LANL	Alwin, Goda, Hutchinson, Thompson,	IRSN Paris, France	TBD, 2024	4	$24,000	Coordinate International Collaboration Efforts with IRSN	IE, AM, ND, IPD	Provide brief trip summary report to NCSP Manager (Q?).	Coordinate work as described the Five-Year Execution Plan, Appendix E.
LANL	TBD	Aldermaston, UK	TBD, 2024	1	$6000	JOWOG 30	AM, IE, IPD, ND, TE	Provide brief trip summary report to NCSP Manager (Q?).	Coordinate efforts for AWE-LANL collaborations and participate in related JOWOG meetings.
LANL	Amundson, Cutler, Hayes, Hutchinson, Kostelac, McKenzie, McMath, McSpaden, Rising, Sanchez, Stetcu, Stolte, Thompson, Weldon, Whitman	Miyagi, Japan	Oct, 2023	15	$90,000	International Conference on Nuclear Criticality Safety (ICNC)	IE	Provide brief trip summary report to NCSP manager (Q1).	Participation provides state of the art information for criticality safety. Note: Listed in both FY23 and FY24 since the planning/attending/charging bridges the fiscal year.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
LANL	Haeck, Riedel, Gibson	IAEA Vienna, Austria	Fall, 2023	3	$18,000	IAEA Consultancy Meeting	AM	Provide brief trip summary report to NCSP Manager (Q1).	Meetings are related to nuclear data processing, the codes and the processed formats. As NJOY developers (AM-2) and processors (AM-1) we play an important role.
LANL	Gibson, Haeck, Kleedtke, Neudecker, Thompson, Paris	OECD/NEA Paris, France	May, 2024	6	$36,000	WPEC Annual Meeting and associated subgroup meetings	ND, AM, IE	Provide brief trip summary report to NCSP Manager (Q3).	Contributor and co-leads of multiple sub-groups and expert groups, including SG45 "Validation of Nuclear Data Libraries (VaNDaL) Project," SG46 ""Efficient and Effective Use of Integral Experiments for Nuclear Data Validation," SG49 "Reproducibility in Nuclear Data Evaluation," and EG-GNDS "Recommended Definition of General Nuclear Database Structure." These groups are focused on activities that overlap with NCSP priorities. Attending WPEC and its Subgroup 49 to present NCSP sponsored Ta181 evaluation as a paramount example of evaluation reproducibility.
LANL	McKenzie, McMath	OECD/NEA Paris, France	May, 2024	2	$12,000	Working Party on Reactor Systems	IE, ND	Provide brief trip summary report to NCSP Manager (Q3).	International meeting on the analysis of reactor systems. There is considerable overlap between reactor systems and critical assemblies. NCSP and NCERC are one of the few options for important research.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
LANL	Alwin, Clark, Hayes, Rising, McKenzie, Hutchinson	OECD/NEA Paris, France	Jun, 2024	6	$36,000	WPNCS Annual Meeting and associated subgroup meetings	AM, ND, IE	Provide brief trip summary report to NCSP Manager (Q3).	Contributors and participants in multiple subgroups aimed at providing and comparing state-of-the-art information for improving MCNP®, Whisper, and other computational methods that are necessary and heavily used in NCSP work. Ongoing subgroups include: benchmark quality assessments and metrics, computational bias methods and comparisons, and benchmark correlation calculational methods.
LLNL	Heinrichs, Percher, Norris, Tamashiro	IRSN Paris, France	TBD, 2023	4	$24,000	Coordinate LLNL International Collaborations with IRSN	AM, IE, IPD, ND, TS	Provide brief trip summary report to NCSP Manager (Q?).	Coordinate joint IRSN-LLNL work as described in Appendix E of the Five-Year Execution Plan.
LLNL	Coleman, Heinrichs	AWE Reading, UK	TBD, 2023	2	$12,000	JOWOG29/30 Meetings	AM, IE, IPD, ND, TE, TS	Provide brief trip summary report to NCSP Manager (Q?).	Coordinate joint AWE-LLNL work as described in Appendix F of the Five-Year Execution Plan.
LLNL	Tamashiro, Siefman, Norris, Percher, Aboud, Araj, Glesmann	Miyagi, Japan	Oct, 2023	7	$42,000	International Conference on Nuclear Criticality Safety (ICNC)	AM, IE, ND, IPD, TS	Provide brief trip summary report to NCSP manager (Q1).	Once every 4 year conference devoted to criticality safety and related disciplines.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
LLNL	Percher	OECD/NEA Paris, France	Feb, 2024	1	$6,000	20th Meeting of the Working Party on Scientific Issues and Uncertainty Analysis of Reactor Systems	IE, ND	Provide brief trip summary report to NCSP Manager (Q2)	Technical meeting of international experts on technical issues relating to the analysis of reactor systems and reactor physics
LLNL	Siefman	Lucca, Italy	May, 2024	1	$6,000	Best Estimate Plus Uncertainty (BEPU) International Conference	IE, ND	Provide brief trip summary report to NCSP Manager (Q3).	Conference on estimating uncertainties relevant to benchmarking and nuclear data.
LLNL	Mattoon, Siefman	OECD/NEA Paris, France	May, 2024	2	$12,000	WPEC Annual Meeting and associated subgroup meetings	AM, IE, ND	Provide brief trip summary report to NCSP Manager (Q3).	Technical meeting of international experts on nuclear data including SG38 (GND) and SG42 (Thermal scattering law).
LLNL	Percher, Coleman	OECD/NEA Paris, France	Jun, 2024	2	$12,000	WPNCS Annual Meeting and associated subgroup meetings	AM, IE, IPD, TS	Provide brief trip summary report to NCSP Manager (Q3).	Participate in activities of the Working Party on Nuclear Criticality Safety and expert group meetings on IE S/U, MC methods, criticality accidents, and experimental needs.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
NNL	NDAG Chair (Zerkle)	Miyagi, Japan	Oct, 2023	1	$6,000	International Conference on Nuclear Criticality Safety (ICNC)	ND	Provide brief trip summary report to NCSP manager (Q1).	Participation provides state of the art information for criticality safety.
NNL	Zerkle	OECD/NEA Paris, France	May, 2024	1	$6,000	WPEC Annual Meeting and associated subgroup meetings	ND	Provide brief trip summary report to NCSP Manager (Q3).	As NDAG Chair, participate in WPEC, SG48 (Thermal Scattering Law) and EG-HPRL
NNL	Zerkle	OECD/NEA Paris, France	Jun, 2024	1	$6,000	WPNCS Annual Meeting and associated subgroup meetings	ND	Provide brief trip summary report to NCSP Manager (Q3).	As NDAG Chair, participate in SG8 on criticality benchmark expert knowledge.
ORNL	Marshall, Bowen, Bekar, Wieselquist, Metwally, Celik, Lang, Shaw, Dupont, Greene, Hart, Chapman	Miyagi, Japan	Oct, 2023	12	$72,000	International Conference on Nuclear Criticality Safety (ICNC)	IE, AM, IPD, TE, ND	Provide brief trip summary report to NCSP manager (Q1).	Participation provides state of the art information for criticality safety.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
ORNL	Bowen Chambers	IRSN, CEA, AWE, Rolls-Royce, JRC-Geel, NNL (UK)	TBD, 2024	1	$10,000	Coordinate NCSP International Collaborations	TS	Provide brief trip summary report to NCSP Manager (Q?).	Proposed trip to NCSP collaborators for NCSP Manager and execution manager to discuss future collaborations.
ORNL	Wiarda, McDonnell, Brown, Pigni	IAEA Vienna, Austria	Oct, 2023	4	$24,000	IAEA Technical Meeting on Nuclear Data Processing	ND	Provide brief trip summary report to NCSP Manager (Q1).	Technical meeting of international experts on nuclear data processing methods and codes. Note: Travel costs may be offset by IAEA funding.
ORNL	Guber, Brown	JRC-Geel Mol, Belgium	Nov, 2023	2	$12,000	Resonance region nuclear data measurements using GELINA facility at JRC-Geel	ND, TS	Provide brief trip summary report to NCSP Manager (Q1).	Continues cross-section measurements to support the production of new cross-section evaluations per the schedule in Appendix B of the Five-Year Plan. Jesse Brown to support half of the visits to supporting succession planning.
ORNL	Pigni	IAEA Vienna, Austria	Nov, 2023	1	$6,000	IAEA International Nuclear Data Evaluation Network (INDEN) on Actinides	ND	Provide brief trip summary report to NCSP Manager (Q1)	Technical meeting of international experts on nuclear data processing methods and codes. Note: Travel costs may be offset by IAEA funding.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
ORNL	Pigni	IAEA Vienna, Austria	Feb, 2024	1	$6,000	IAEA International Nuclear Data Evaluation Network (INDEN) on Structural Methods	ND	Provide brief trip summary report to NCSP Manager (Q2)	Technical meeting of international experts on nuclear data processing methods and codes. Note: Travel costs may be offset by IAEA funding.
ORNL	Guber, Brown	JRC-Geel Mol, Belgium	Apr, 2024	3	$18,000	Resonance region nuclear data measurements using GELINA facility at JRC-Geel	ND, TS	Provide brief trip summary report to NCSP Manager (Q3).	Continues cross-section measurements to support the production of new cross-section evaluations per the schedule in Appendix B of the Five-Year Plan. Jesse Brown to support half of the visits to supporting succession planning.
ORNL	Ramic, Wiarda, Brown, McDonnell, Chapman	OECD/NEA Paris, France	May, 2024	5	$30,000	WPEC Annual Meeting and associated subgroup meetings	ND, TS	Provide brief trip summary report to NCSP Manager (Q3).	Technical meeting of international experts on nuclear data including SG38 (GND), EG-GNDS, SG48 (thermal scatter), SG44 (covariance), SG45 (validation), SG46 (IE for ND evaluation), SG50 (automatic readable experimental data base)
ORNL	Bowen	TBD (France/UK)	May, 2024	1	$6,000	ISO TC85/SC5/WG8 Nuclear Criticality Safety meetings and SC5 Plenary	TS	Provide brief trip summary report to NCSP Manager (Q3).	Provides US leadership to ISO TC85/SC5/WG8 by D. Bowen who also chairs the ANS-8 Subcommittee. A. Lang is added to the list as a backup for WG8 leadership in the future.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
ORNL	Marshall, Bowen, Metwally, Bekar, Wieselquist, Greene	OECD/NEA Paris, France	Jun, 2024	6	$36,000	WPNCS Annual Meeting and associated subgroup meetings	TS, IE, AM	Provide brief trip summary report to NCSP Manager (Q3).	AM collaboration to share expertise and experience on best practices in the NCS community and learn from international user community
ORNL	Guber/Brown	Luxembourg	Jun, 2024	1	$8,000	2023 Joint Steering Committee Meeting between DOE and EURATOM	ND	Provide brief trip summary report to NCSP Manager (Q3).	Present the progress on Action Sheet 66 of the DOE/EURATOM agreement.
ORNL	Guber	JRC-Geel Mol, Belgium	Jun, 2024	1	$6,000	Resonance region nuclear data measurements using GELINA facility at JRC-Geel	ND, TS	Provide brief trip summary report to NCSP Manager (Q3).	Continues cross-section measurements to support the production of new cross-section evaluations per the schedule in Appendix B of the Five-Year Plan. Jesse Brown to support half of the visits to supporting succession planning.
ORNL	Pigni	IAEA Vienna, Austria	Jun, 2024	1	$6,000	IAEA International Nuclear Data Evaluation Network (INDEN) on light nuclei evaluations	ND	Provide brief trip summary report to NCSP Manager (Q3).	IAEA International Nuclear Data Evaluation Network (INDEN), Vienna, 1 week. International nuclear data evaluation collaboration. Represent NCSP and ORNL interests in international nuclear data evaluation. Note: Travel costs may be offset by IAEA funding.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
ORNL	Guber, Brown	JRC-Geel Mol, Belgium	Sep, 2024	2	$12,000	Resonance region nuclear data measurements using GELINA facility at JRC-Geel	ND, TS	Provide brief trip summary report to NCSP Manager (Q4).	Continues cross-section measurements to support the production of new cross-section evaluations per the schedule in Appendix B of the Five-Year Plan. Jesse Brown to support half of the visits to supporting succession planning.
PNNL	Zipperer	Miyagi, Japan	Oct, 2023	1	$6,000	International Conference on Nuclear Criticality Safety (ICNC)	AM	Provide brief trip summary report to NCSP manager (Q1).	Participation provides: 1) State of the art information for criticality safety. 2) Opportunity to inform the international community on the Sum-of-Fractions Method."
RPI	Danon	OECD/NEA Paris, France	May, 2024	1	$6,000	WPEC Annual Meeting and associated subgroup meetings	ND	Provide brief trip summary report to NCSP Manager (Q3).	As CSEWG US Measurements Chair, participate and present in the WPEC meeting, subgroup SG-C (high priority list), and other subgroups. Also actively participate in SG-48 (Advances in Thermal Scattering Law Analysis) and SG-50 (Developing an Automatically Readable, Comprehensive and Curated Experimental Reaction Database)
SNL	Harms, Lutz, Ames, Miller	Miyagi, Japan	Oct, 2023	4	$24,000	International Conference on Nuclear Criticality Safety (ICNC)	IE, TE	Provide brief trip summary report to NCSP manager (Q1).	Participation provides state of the art information for criticality safety.

Lab	Participant(s)	Destination	Date	Count	Costs ($)	Conference/Meeting Title	Task	Milestone	Justification
Y12	Reynolds	Miyagi, Japan	Oct, 2023	1	$6,000	International Conference on Nuclear Criticality Safety (ICNC)	AM, IE	Provide brief trip summary report to NCSP manager (Q1).	Participation provides state of the art information for criticality safety.

APPENDIX D: Baseline Budget Needs for Execution Year FY2024-FY2026

Baseline Budget Needs for Execution Year FY2024

Baseline budget need for the FY2023 Nuclear Criticality Safety Program (NCSP) is $31,138K with 95% of funding supporting NCSP FTE's, equating to approximately 62.3 national laboratory or facility contractor employees, who provide programmatic needs as outlined in the NCSP *The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2019-2028.* All tasks are approved based on their contribution to the achievement of the five- and ten-year goals as outlined in the Mission and Vision document. NCSP includes the following five technical program elements plus support infrastructure, with each having the major deliverables for FY2024.

- Analytical Methods (~8.1 FTEs supported)
    - Criticality Safety Computer Codes SCALE and MCNP support. Maintain RSICC who distributes all software. Development of thermal scattering and self-shielding capabilities in GNDS/FUDGE, and continued work on benchmark intercomparison studies. International collaborations: SCALE, NJOY, MCNP, AMPX work with AWE and IRSN.
- Information Preservation and Dissemination (~2.0 FTEs supported)
    - NCSP website upgrade and maintenance. Three new ICSBEP evaluations and publications (OECD/NEA collaboration) are planned to be completed in FY2024. Complete
- Integral Experiments (~35.6 FTEs supported)
    - A total of 36 critical/subcritical experiments at various stages of design and execution are planned in FY2024 (NCERC and SNL). Permanent party staff at NCERC is supported. International collaborations with AWE and IRSN are included with the planned experiments for FY2024 (see Appendix E and F).
- Nuclear Data (~9.5 FTEs supported)
    - Nuclear data evaluations and measurements prioritized for FY2024 are listed in Appendix B. RPI refurbishment (NR collaboration) continues despite some cost overruns for ancillary equipment. Produce new scattering law data (NCSU and RPI/ORNL collaboration). Modernization of SAMMY resonance analysis software. International collaborations with IRSN are included with the planned experiments for FY2024 (see Appendix E and F). Nuclear data measurements to be performed at IRMM/GELINA led by ORNL.
- Training and Education (~3.0 FTE supported)
    - Two 2-week courses at scheduled with a week of lecture at the National Atomic Testing Museum and hands-on experiments at NCERC and Sandia.
    - One 1-week managers course at Sandia. This course will be used to pilot new Criticality Safety Officer (CSO) training material. One 1-week managers course at NCERC. This course will be used to continue criticality safety training for CSOs and managers.
- NCSP Technical Support (~4.1 FTE supported)
    - Daily execution of the NCSP (ORNL) and support for the CSSG and travel support for two NDAG members. Each site is provided succession planning funds for maintaining key capabilities and NCSP expertise.

The projected list of NCSP over-target requests is listed in Table D.1 below for FY25-FY29. A description for each request is listed below the table.

Table D.1 NCSP Over-Targets (FY2025 – FY2029) ($k)

Rank	Name	FY25	FY26	FY27	FY28	FY29
1	Maintain ability to complete the approved tasks as described in the 5-year Plan	$1,525	$1,525	$1,525	$1,525	$1,525
2	Increase in LANL NEN staff	$600	$600	$600	$600	$600
3	New HEU and DU Experiment Plates	$3,000	$2,500	$2,500	$0	$0
4	Increase in LLNL experiment staff	$400	$400	$400	$400	$400
5	MOX Fuel for NCERC (This fuel is currently stored at LANL TA-55/PF-4 and was generated as part of the ARIES project)	$400	$600	$600	$600	$0
6	RPI Accelerator Refurbishment - Additional Funding	$0	$1,430	$1,230	$480	$0
7	Thermal Chambers for Conducting Pulsed-Neutron Die-Away Integral Experiments	$200	$300	$125	$0	$0
8	Oak Ridge Subcritical Assembly	$250	$250	$0	$0	$0
9	New Nuclear Data staff to support additional nuclear data work	$250	$250	$250	$250	$250
10	Differential measurement funding to support additional staff to increase efficiency	$0	$250	$250	$0	$0
Total		$6,625	$6,625	$8,105	$7,480	$3,855

Maintain Ability to Complete Approved Tasks as Described in the 5-Year Plan

This is an over-target to allow additional resources to ensure sufficient budget is available to complete approved 5-year plan tasks at NCSP sites.

LANL and LLNL Integral Experiment Staff

Additional LANL integral experiment staff are needed to complete additional critical experiments necessary to support the NCSP workload. There are more than 20 experiments in the preliminary or final design stages to be executed and about 4-5 experiments can be performed per year. The qualification of additional crew members will allow for an increase in experimental throughput. This over-target request will support this goal.

New Highly Enriched Uranium (HEU) and Depleted Uranium (DU) Experimental Plates

The current HEU plates have significant oxide corrosion. This corrosion creates a contamination hazard and affects dimensional measurements taken for benchmark experiments. New HEU replacement plates will be alloyed with a small amount of alloying material to prevent gross oxidation buildup. These plates can be manufactured at Y-12 that would support the next generation of NCSP experiments at NCERC. New fuel would decrease contamination and not require operators to use respirators. DU plates are similar to HEU but are used as a non-fissile component in critical assemblies and as a surrogate for various types of experimental testing.

MOX Fuel Rods for Use at SPRF/CX

LANL (@ TA55/PF-4) has unirradiated MOX (U/Pu) fuel rods that would be useful for plutonium and uranium experiments at Sandia's SPRF/CX facility or at NCERC. The MOX rods would need to be disassembled and reassembled in an appropriate configuration for use at SPRF/CX and then transported to SPRF/CX or NCERC. This activity would disposition the fuel to free up space in PF-4 for its pit production mission and would allow fresh U/Pu unirradiated fuel to be available for critical experiments.

RPI New Funding Projections

LINAC operations contract up for renewal for FY2024-FY2026. It is anticipated that RPI-ND1 funding needs will be at approximately $480k per year over that time. The LINAC refurbishment RSSP contract will require

$4M-$5M of additional funding to complete split between FY2024 and FY2025. If deemed necessary, flange replacements will require about $600k of additional funding starting in FY2023 but extending through FY2024. There is an opportunity for the NCSP to mitigate additional refurbishment funding needs, assuming the traditional 2/3 Naval Reactors-1/3 NCSP funding split. This involves ~$1.5M split over FY2024 and FY2025 for RSSP and ~$200k in FY2024 for flange replacement activities.

Thermal Chambers for Conducting Pulsed-Neutron Die-Away Integral Experiments

New thermal chambers will support enhancements for conducting pulsed-neutron die-away integral experiments.

Oak Ridge Subcritical Assembly

This over-target supports fabrication of a graphite reflector and split table stand for the subcritical assembly. The subcritical assembly at ORNL will support fissile material handler and criticality safety officer training for the NCSP and will allow for increased bandwidth for the NCSP training and education capabilities.

New Nuclear Data staff to support additional nuclear data work

Additional nuclear data staff are required to support the ever-increasing NCSP nuclear data workshop, as described in appendix B. This will support Nuclear Data pipelines at NCSP sites to ensure sufficient resources are available to replace attrition at ORNL due to possible staff retirements.

Differential measurement funding to support additional staff to increase efficiency

This ORNL over-target request will allow staff to support work on multiple nuclear data measurements per year at RPI or JRC-Geel (GELINA). Currently, there is only funding available for a single isotope to be measured per year.

Baseline Budget Needs for Execution Year FY2025

Baseline budget need for the FY2025 Nuclear Criticality Safety Program (NCSP) is $30,675K with 95% of funding supporting NCSP FTE's, equating to ~68.3 national laboratory or facility contractor employees, who provide programmatic needs as outlined in the NCSP *The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2019-2028.* All tasks are approved based on their contribution to the achievement of the five- and ten-year goals as outlined in the Mission and Vision document.

NCSP includes the following five technical program elements plus support infrastructure, with each having the major deliverables for FY2025:

- Analytical Methods (~8.8 FTEs supported)
    - Criticality Safety Computer Codes SCALE and MCNP support. Maintain Radiation Safety Information Computational Center who distributes all software. Development of NCS excursion analysis capability, thermal scattering and self-shielding capabilities in GNDS/FUDGE, and continued work on benchmark intercomparison studies. International collaborations: SCALE, NJOY, MCNP, AMPX work.
- Information Preservation and Dissemination (~2.0 FTEs supported)
    - NCSP website upgrade and maintenance. About six new ICSBEP evaluations and publications (OECD/NEA collaboration) are planned to be completed in FY2024.
- Integral Experiments (~36.9 FTEs supported)
    - The approximately two dozen critical/subcritical experiments at various stages of design and execution planned in FY2024 (NCERC and SNL) will continue in FY2025. Some newly proposed experiments may be added to the NCSP manager's priority list. Permanent party staff at NCERC is supported. International collaborations with AWE and IRSN are included with the planned experiments for FY2024 (see Appendix E and F).
- Nuclear Data (~11.3 FTEs supported)
    - Nuclear data evaluations and measurements prioritized for FY2024 are listed in Appendix B. RPI refurbishment (NR collaboration) continues despite some cost overruns for ancillary equipment. Produce new scattering law data (NCSU and RPI/ORNL collaboration). Modernization of SAMMY resonance analysis software. International collaborations with IRSN are included with the planned experiments for FY2025 (see Appendix E and F). Nuclear data measurements to be performed at IRMM/GELINA led by ORNL.
- Training and Education (~3.7 FTE supported)
    - Two 2-week courses at scheduled with a week of lecture at the National Atomic Testing Museum and hands-on experiments at NCERC and Sandia.
    - One 1-week managers course at Sandia and at NCERC. This course will be used to continue criticality safety training for CSOs and managers.
- NCSP Technical Support (~5.6 FTEs supported)
    - Daily execution of the NCSP (ORNL) and support for the CSSG and travel support for two NDAG members. Each site is provided succession planning funds for maintaining key capabilities and NCSP expertise.

Over-targets are listed in Table D.1.

Baseline Budget Needs for Execution Year FY2026

Baseline budget need for the FY2026 Nuclear Criticality Safety Program (NCSP) is $30,675K with 95% of funding supporting NCSP FTE's, equating to ~65.8 national laboratory or facility contractor employees, who provide programmatic needs as outlined in the NCSP *The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2019-2028.* All tasks are approved based on their contribution to the achievement of the five- and ten-year goals as outlined in the Mission and Vision document.

NCSP includes the following five technical program elements plus technical support, with each having the major deliverables for FY2026:

- Analytical Methods (~7.9 FTEs supported)
    - Criticality Safety Computer Codes SCALE and MCNP support. Maintain Radiation Safety Information Computational Center who distributes all software. Work includes thermal scattering and self-shielding capabilities in GNDS/FUDGE, continued work on benchmark intercomparison studies, and completion of the NCS SlideRule. International collaborations: SCALE, NJOY, MCNP, AMPX work.
- Information Preservation and Dissemination (~1.9 FTEs supported)
    - NCSP website upgrade and maintenance. Numerous experiments current in execution phase are planned be in the ICSBEP evaluations development phase in FY2025.
- Integral Experiments (~36.4 FTEs supported)
    - Experiments proposed in FY2024 and FY2025 will continue, and new experiments are likely to be added to the NCSP manager's priority list for FY2026. Permanent party staff at NCERC is supported. International collaborations with AWE and IRSN are included with the planned experiments for FY2026 (see Appendix E and F).
- Nuclear Data (~10.4 FTEs supported)
    - Nuclear data evaluations and measurements prioritized for FY2025 are listed in Appendix B. RPI refurbishment (NR collaboration) continues despite some cost overruns for ancillary equipment. The refurbished RPI LINAC is slated to begin operations in FY2026. Modernization of SAMMY resonance analysis software. International collaborations with IRSN are included with the planned experiments for FY2026 (see Appendix E and F). Nuclear data measurements to be performed at IRMM/GELINA led by ORNL.
- Training and Education (~3.2 FTE supported)
    - Two 2-week courses at scheduled with a week of lecture at the National Atomic Testing Museum and hands-on experiments at NCERC and Sandia.
    - One 1-week managers course at Sandia and at NCERC. This course will be used to continue criticality safety training for CSOs and managers.
- NCSP Technical Support (~6.0 FTEs supported)
    - Daily execution of the NCSP (ORNL) and support for the CSSG and travel support for the NDAG chair. Each site is provided succession planning funds for maintaining key capabilities and NCSP expertise.

Over-targets are listed in Table D.1.

APPENDIX E: International Collaboration with the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) for FY2024

IRSN has an active and growing program of collaboration with the NCSP that aims to underpin and enhance IRSN's nuclear criticality safety. IRSN will provide its expertise and capabilities to support the NCSP's mission and vision so that the collaboration is mutually beneficial to both organizations.

IRSN Reference	IER #	REFERENCE		IRSN Contribution / POC			
		Task Title	DOE Reference	IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
ANALYTICAL METHODS							
IRSN-AM13		Benchmark intercomparison study	ORNL-AM10	Beta-eff calculation comparisons and shielding benchmarks in 2024. IRSN leading.	J. BEZ	D. BOWEN	ORNL
IRSN-AM13		Benchmark intercomparison study	Y12-AM1	Beta-eff calculation comparisons and shielding benchmarks in 2024. IRSN leading.	J. BEZ	K. REYNOLDS	Y12
IRSN-AM13		Benchmark intercomparison study	LANL-AM5	Beta-eff calculation comparisons and shielding benchmarks in 2024. IRSN leading.	J. BEZ	J. ALWIN	LANL
IRSN-AM13		Benchmark intercomparison study	LLNL-AM5	Beta-eff calculation comparisons and shielding benchmarks in 2024. IRSN leading.	J. BEZ	D. HEINRICHS	LLNL
IRSN-AM5		Update of the slide rule	LLNL-AM3	Additional calculations, and work on an operational document.	J. HERTH	D. HEINRICHS	LLNL
IRSN-AM5		Update of the slide rule	ORNL-AM6	Additional calculations, and work on an operational document.	J. HERTH	D. BOWEN	ORNL
IRSN-AM8		Analytical Methods Working Group	ORNL-AM2	IRSN participation in NCSP Analytical Methods Working Group and TPR meeting	S. PIGNET	D. BOWEN	ORNL
IRSN-AM8		Analytical Methods Working Group	LANL-AM1	IRSN participation in NCSP Analytical Methods Working Group and TPR meeting	S. PIGNET	J. ALWIN	LANL
IRSN-AM9		Cross sections processing validation	ORNL-AM3	User experience on AMPX.	V. JAISWAL	D. BOWEN	ORNL
INTEGRAL EXPERIMENTS							
HIGH PRIORITY TASKS							
IRSN-IE25	296	TEX/MOX	LANL-IE33	Leading the design: CED2 to be finalized in 2024 (resolve reviewer feedback), provide material for the experiment, support LANL for CED3a	M. BROVCHENKO	J. GODA	LANL
IRSN-IE25	296	TEX/MOX	LLNL-IE1	Leading the design: CED2 to be finalized in 2024 (resolve reviewer feedback), provide material for the experiment, support LANL for CED3a	M. BROVCHENKO	C. PERCHER	LLNL

IRSN Reference	IER #	REFERENCE		IRSN Contribution / POC			
		Task Title	DOE Reference	IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-IE41	499	Thermal/Epithermal Experiments (TEX) with Chlorine	LLNL-IE1	LLNL will provide CED3A and CED3B. Participation to the experiments.	J-B. CLAVEL	C. PERCHER	LLNL
IRSN-IE46	518	High Multiplication Subcritical (Multiplicity) Benchmark Experiments	LANL-IE3	External Review of ICSBEP evaluation	W. MONANGE	J. GODA	LANL
IRSN-IE51	479	TEX HEU with poly at very low temperatures	LLNL-IE1	Participation to the experiment (at least 2 or 3 configurations expected by LLNL)	J. BEZ	C. PERCHER	LLNL
IRSN-IE52	484	Dosimetry collaboration with Armed Forces Radiobiology Research Institute (AFRRI)	LLNL-IE1	International dosimetry exercise in 2024, IRSN participates	F. TROMPIER	D. HEINRICHS	LLNL
New Action		Critical Experiments using LANL ARIES rods (MOX)	LANL, SNL	CED0 – Explore possible needs for this experiment.	R. VUIART	J. GODA	LANL
MEDIUM PRIORITY TASKS							
IRSN-IE27	498	GODIVA Shielding benchmark	ORNL-IE1	Participation to the measurements campaign	F. TROMPIER	D. BOWEN, R. CUMBERLAND	ORNL
IRSN-IE27	498	GODIVA Shielding benchmark	LANL-IE33	Participation to the measurements campaign	F. TROMPIER	J. GODA	LANL
IRSN-IE34	567	MUSIC subcritical configurations	LANL-IE3	External Review CED4A	J-B CLAVEL	J. HUTCHINSON	LANL
IRSN-IE48	520	TEX Pu-240 Experiment	LLNL-IE1	Participation to the experiments	M. BROVCHENKO	C. PERCHER	LLNL
New Action		Neutron Noise at Fukushima	LANL	Working plan definition	W. MONANGE	J. HUTCHINSON	LANL
LOW PRIORITY TASKS							
IRSN-IE42	121	Neptunium Subcritical Observations (NeSO) experiment	LANL-IE3	Independent review of the ICSBEP evaluation.	W. MONANGE	J. HUTCHINSON	LANL
IRSN-IE45	517	Integral Experiments for Validation of Molybdenum Neutron Cross Sections on the whole energy spectrum	LANL-IE3	Review of CED2 report	R. VUIART	N. THOMPSON	LANL
IRSN-IE47	537	Copper Critical Experiment	LANL-IE3	IRSN is a collaborator	J-B. CLAVEL	T. CUTLER, K. AMUNDSON	LANL
IRSN-IE53	551	True Intermediate Energy System with Pu-239 and Pu-240	LANL-IE3	Contribution to CED2	TBD	J. GODA	LANL
IRSN-IE56	578	Jupiter ZPPR high 240 plates benchmark report	LANL-IE3	Support for review of CED4A	M. BROVCHENKO	J. GODA	LANL
INFORMATION PRESERVATION AND DISSEMINATION							
IRSN-IPD1		ICSBEP reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks are reported in the IE tasks	S. PIGNET	D. HEINRICHS	LLNL
IRSN-IPD2		LFE Database	ORNL-IPD4	Sharing experience on French LFE database	A. BARDELAY	D. BOWEN	ORNL
TRAINING AND EDUCATION							

IRSN Reference	IER #	REFERENCE		IRSN Contribution / POC			
		Task Title	DOE Reference	IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-TE1		Hands-on criticality safety training	ORNL-TE1	IRSN attendance to NCSP classes Possible lectures by IRSN working with NCSP training and education coordinator	S. PIGNET	D. BOWEN	ORNL
IRSN-TE1		Hands-on criticality safety training	SNL-TE1	IRSN attendance to NCSP classes Possible lectures by IRSN working with NCSP training and education coordinator	S. PIGNET	G. HARMS	SNL
IRSN-TE1		Hands-on criticality safety training	LLNL-TE1	IRSN attendance to NCSP classes Possible lectures by IRSN working with NCSP training and education coordinator	S. PIGNET	C. PERCHER	LLNL
IRSN-TE1		Hands-on criticality safety training	LANL-TE3	IRSN attendance to NCSP classes Possible lectures by IRSN working with NCSP training and education coordinator	S. PIGNET	J. GODA	LANL

APPENDIX F: International Collaboration with the Atomic Weapons Establishment (AWE) for FY2024

AWE has an active and growing program of collaboration with the NCSP that aims to underpin and enhance AWE's nuclear criticality safety and associated technologies. AWE will provide its expertise and capabilities to support the NCSP's mission and vision so that the collaboration is mutually beneficial to both organizations.

Reference				AWE Contributions and POCs			
AWE Reference	IER #	Task Description	NCSP Reference	AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
ANALYTICAL METHODS							
AWE-AM1		Slide rule update	LLNL-AM3	Perform calculations; attend meetings; review analysis and reports	C. HODKINSON	C. PERCHER	LLNL
AWE-AM1		Slide rule update	ORNL-AM6	Perform calculations; attend meetings; review analysis and reports	C. HODKINSON	M. DUPONT/C. CELIK	ORNL
INTEGRAL EXPERIMENTS							
AWE-IE2		Development of Passive Neutron Spectrometer (PNS)	LLNL-IE1	Fully commission TLD version of the PNS; Perform validation irradiations at NPL; develop unfolding tools for directionality	P. ANGUS	P. MAGGI	LLNL
AWE-IE3	406	Cf-252 Shielding benchmark	LLNL-IE1	Perform/support PNS(TLD) measurements with a shadow cone.	P. ANGUS	D. HEINRICHS, F. TROMPIER	LLNL
AWE-IE5		Correction factor for dosimetry linked to orientation of the victim	LLNL-IE1	Participate in experiment design; use PNS data to determine directional components of neutron fields (Godiva, Flattop, LLNL RCL)	P. ANGUS	P. MAGGI, F. TROMPIER	LLNL
AWE-IE6	514	ICSBEP shielding benchmark for shipping containers	LLNL-IE1	Participate in experiment design; PNS(TLD) could be deployed as primary measurement device. AWE to do some preliminary design.	P. ANGUS	S. KIM	LLNL
AWE-IE7	153	Measure fission neutron spectrum shape using threshold activation detectors	LANL-IE3	Provide input into foil selection; use AWE unfolding codes to provide independent analysis.	P. ANGUS	T. CUTLER, J. HUTCHINSON	LANL
AWE-IE9	500	AWE/LLNL NCT 5-year measurement campaign	LLNL-IE1	Participate in experiment design, measurements, and reporting. Continue loan of LEMC to LLNL. Determine viability for transport of previously identified materials to the US.	N. KELSALL	W. ZYWIEC	LLNL
AWE-IE10		NAD Research & Development	LLNL-IE1	Develop prototypes, participate in design, execution, and reporting of dosimetry experiments.	P. ANGUS	F. TROMPIER	LLNL
AWE-IE11	538	NAD Exercise	LLNL-IE1	Produce experiment design; participate in exercise; produce final report. Repeat even years.	P. ANGUS	P. MAGGI	LLNL

Reference				AWE Contributions and POCs			
AWE Reference	IER #	Task Description	NCSP Reference	AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
AWE-IE12	603	CAAS/NAD Performance Testing- UNAD Add-on Irradiation Testing on Godiva	PNNL-IE1 LLNL-IE3 LANL-IE33 Y12-IE1	Deploy AWE CIDAAS for test irradiation. Repeat odd years as needed. Proposal FY19-20	T. BIRKETT, S. GARBETT	D HEINRICHS P. MAGGI J. GODA	LLNL LLNL LANL
AWE-IE13	484	Characterization of AFRRI TRIGA reactor radiation field AWE will provide onsite measurement	SNL-IE1b	Provide support to experiment design.	P. ANGUS	G. HARMS	SNL
AWE-IE13	484	Characterization of AFRRI TRIGA reactor radiation field AWE will provide onsite measurement	LLNL-IE1	Provide support to experiment design.	P. ANGUS	A. ROMANYUKHA	LLNL
AWE-IE14	605	CAAS Testing FY24 for AWE	LLNL-IE1 LANL-IE33	CAAS Testing FY24 for AWE	P. ANGUS	D HEINRICHS J. GODA	LLNL LANL
INFORMATION PRESERVATION AND DISSEMINATION							
AWE-IPD1		Conduct benchmark evaluations of legacy IEU integral experiments	LLNL-IPD1	Assess feasibility of sponsoring PhD; determine availability of data. This task requires no NCSP funding	C. HODKINSON	C. PERCHER	LLNL
TRAINING AND EDUCATION							
AWE-TE1		Hands-on criticality safety training	SNL-TE1	AWE personnel to attend training course	C. HODKINSON	G. HARMS	SNL
AWE-TE1		Hands-on criticality safety training	LLNL-TE1	AWE personnel to attend training course	C. HODKINSON	C. PERCHER	LLNL
AWE-TE1		Hands-on criticality safety training	LANL-TE3	AWE personnel to attend training course	C. HODKINSON	J. GODA	LANL
AWE-TE1		Hands-on criticality safety training	ORNL-TE1	AWE personnel to attend training course	C. HODKINSON	D. BOWEN	ORNL

APPENDIX G: International Collaboration with Other Foreign Agencies for FY2024

This table provides details for other international collaborations not covered under Appendix E (IRSN) and F (AWE).

Reference				Contributions and POCs			
Reference	**IER #**	**Task Description**	**NCSP Reference**	**Contribution**	**Technical POC**	**Collaborator POC**	**DOE Lab**
INFORMATION PRESERVATION & DISSEMINATION							
NNL-001	NA	Nuclear Criticality Safety – Learning from Experience (LFE) Database	ORNL-IPD4	NNL to provide key design support for the LFE database and content.	D. HILL UK National Nuclear Laboratory	D. BOWEN C. PERCHER	ORNL LLNL
INTEGRAL EXPERIMENTS							
NNL-002	479	Low Temperature TEX	LLNL-IE1	IER review team support for CED process.	D. HILL UK National Nuclear Laboratory	J. NORRIS C. PERCHER	LLNL
NUCLEAR DATA							
JRC-GEEL-001	NA	Nuclear Data Measurements	ORNL-ND1	Support differential nuclear data measurements at GELINA.	P. SCHILLEBEECKX JRC-Geel	D. BOWEN K. GUBER	ORNL
TRAINING AND EDUCATION							
RR-001	NA	Attending NCSP Manager/Criticality Safety Officer and 2-week hands-on training at NATM and Sandia National Laboratory	ORNL-TE1	Attend NCSP training courses	Various – Rolls-Royce	D. BOWEN M. ZERKLE	ORNL NNL
CEA-001	NA	Attending NCSP Manager/Criticality Safety Officer and 2-week hands-on training at NATM and Sandia National Laboratory	ORNL-TE1	Attend NCSP training courses	Various – French Alternative Energies and Atomic Energy Commission (CEA)	D. BOWEN	ORNL

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