



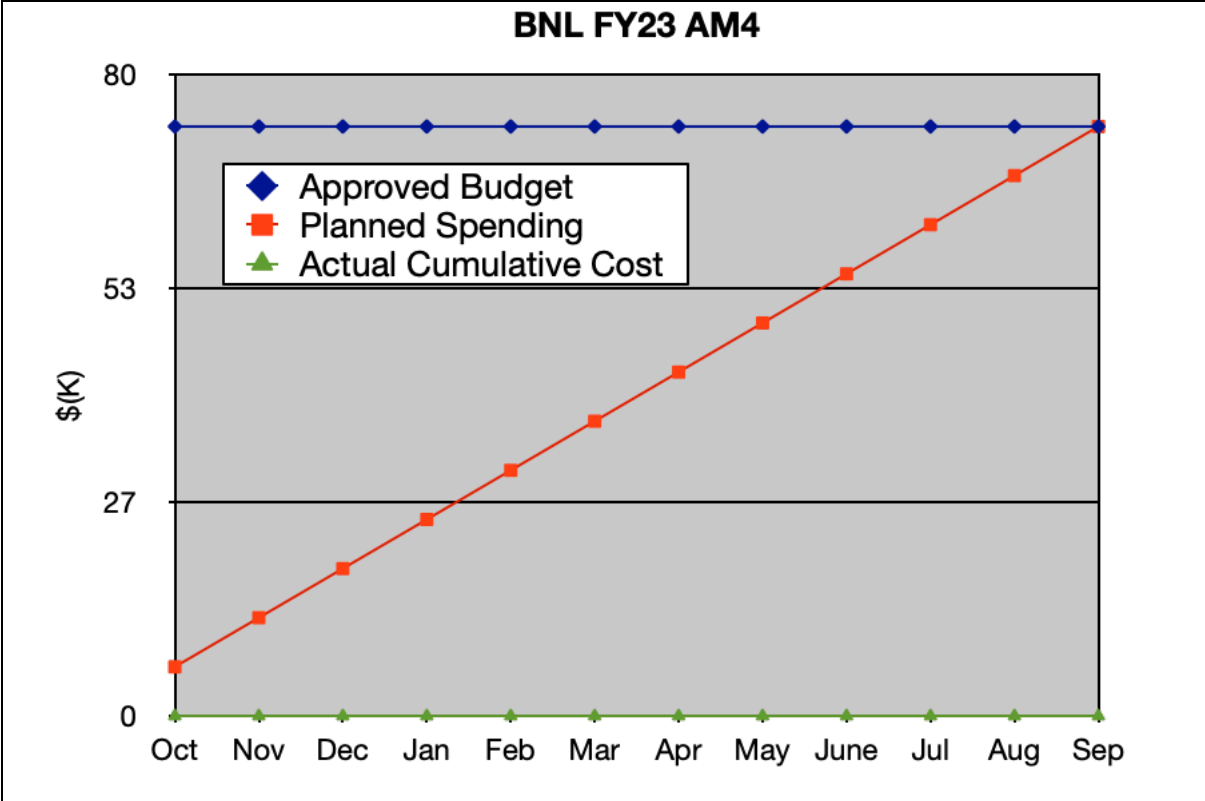
# NUCLEAR CRITICALITY SAFETY PROGRAM (NCSP)

**FY2023 4<sup>th</sup> QUARTER REPORTS**

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> AM4 <b>M&amp;O Contractor Name:</b> BNL <b>Point of Contact Name:</b> Gustavo Nobre <b>Point of Contact Phone:</b> 631-344-5205	<b>Reference:</b> DP0909010 <b>Date of Report:</b> 2 November, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 3,524
  2. Approved FY 2023 Budget = \$ 70,000
  3. Total FY 2023 Budget w/Carryover: \$73,524
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$0
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$0
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$0
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$0
  8. Projected carryover into FY 2024 = \$73,524
- NOTE:** Include commitments as part of spending





## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="color: blue;">■</span>	On Schedule <span style="color: green;">■</span>	Behind Schedule <span style="color: yellow;">■</span>	Missed Milestone <span style="color: red;">■</span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
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## NCSP Quarterly Progress Report (FY-2023 Q4)

<b>Q1</b>	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		The work has not started yet.
<b>Q2</b>	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		The work has not started yet.
<b>Q3</b>	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		The work has not started yet and likely will be performed on FY24.
<b>Q4</b>	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		Per discussion at the NCSP Budget Execution Meeting, work on this task will be postponed until FY24.

### ACCOMPLISHMENTS

Progress has been made in the efforts to define a probability distribution function (PDF) and to develop a numerical technique to smooth the theoretical PDF generated with the code FUDGE. Focus is now to process and analyze the previous developments. This work was forced to a halt since the postdoc responsible for it took a permanent position in the UK. During the 2023 Budget Execution Meeting it was requested and accepted that the current funds of this task will be carried over to FY24 and combined with FY24's budget to allow for Dave Brown to work on it and conclude the task.

### PUBLICATIONS

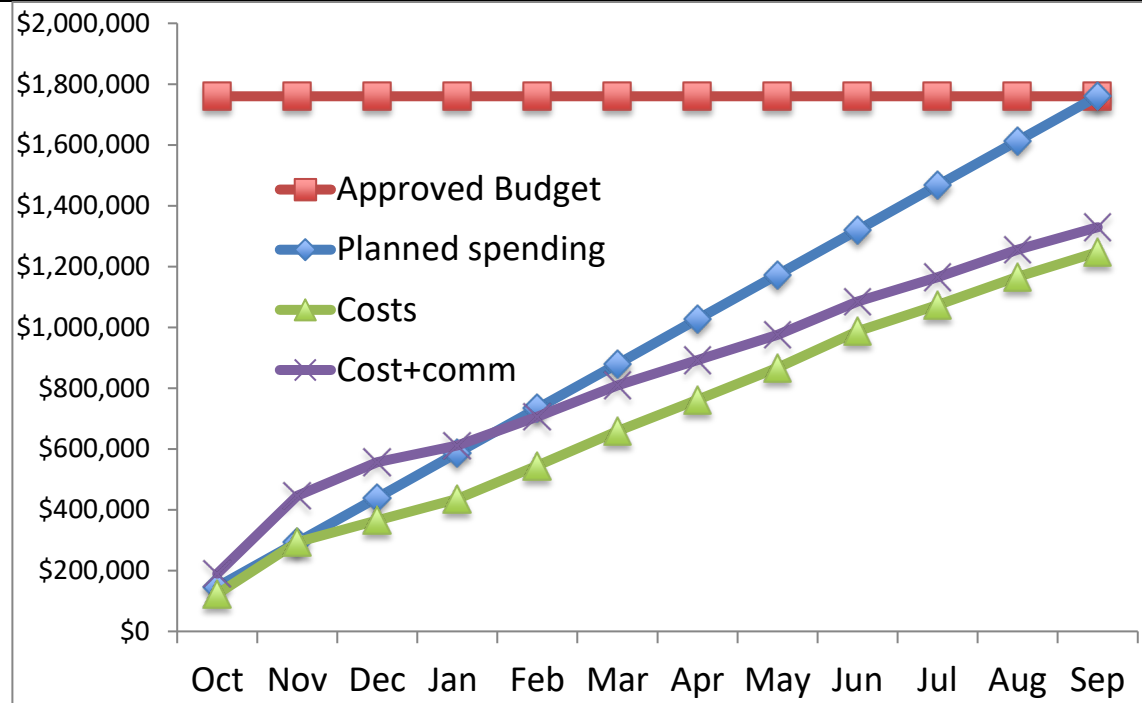
Any publications created during the quarter should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov).

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	N/A		
Q2			
Q3			
Q4			

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> AM1, 2, 3, 5, 7 <b>M&amp;O Contractor Name:</b> LANL <b>Point of Contact Name:</b> Joetta Goda/Bob Little/Jen Alwin <b>Point of Contact Phone:</b> 505-667-2812/505-665-3487/505-667-7252	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET

















1. Carryover into FY 2023 = \$ 260,000
  2. Approved FY 2023 Budget = \$ 1,500,000
  3. Total FY 2023 Budget w/Carryover = \$ 1,760.000
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$ 364,894  
(plus \$191,414 commits= \$556,308)
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$ 293,789  
Sum=\$658,683 (plus \$150,754 commits =\$809,437)
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$ 328,923  
Sum=\$987,606 plus \$97,451 commits = \$1,085,057
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$ 259,916  
Sum=\$1,247,522 plus \$81,924 commits=\$1,329,446
  8. Projected carryover into FY 2024 =
- NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete	On Schedule	Behind Schedule	Missed Milestone
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on MCNP6 user support activities (AM1)		
Q1	Provide a status report on LANL participation in US and International analytical methods collaborations (AM1)		














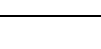
## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide a status report on ENDF/B-VIII.1 processing and testing activities (AM1)		
Q1	Provide a status report on summer intern work activities (AM1)		
Q1	Provide a status report on MCNP6 Criticality training course activities (AM1)		
Q1	Provide a status report on NJOY maintenance and user support activities (AM2)		
Q1	Provide a status report on LANL participation in US and International analytical methods collaborations (AM2)		
Q1	Provide a status report on ACETk photonuclear and photoatomic ACE support table (AM2)		
Q1	Provide a status report on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 activities (AM3)		
Q1	Provide a status report on LANL participation in US and International analytical methods collaborations (AM5)		
Q2	Provide a status report on MCNP6 user support activities (AM1)		
Q2	Provide a status report on LANL participation in US and International analytical methods collaborations (AM1)		
Q2	Provide a status report on ENDF/B-VIII.1 processing and testing activities (AM1)		
Q2	Provide a status report on MCNP6 and Whisper progress activities (AM1)		
Q2	Provide a status report on NJOY maintenance and user support activities (AM2)		
Q2	Provide a status report on LANL participation in US and International analytical methods collaborations (AM2)		



## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide a status report on ACEtk photonuclear and photoatomic ACE support table (AM2)		
Q2	Complete the ACEtk photonuclear and photoatomic ACE support tables, both specifications and interface (AM2)		
Q2	Provide a status report on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 activities (AM3)		
Q2	Provide a status report on LANL participation in US and International analytical methods collaborations (AM5)		
Q3	Provide a status report on MCNP6 user support activities (AM1)		
Q3	Provide a status report on LANL participation in US and International analytical methods collaborations (AM1)		
Q3	Provide a status report on ENDF/B-VIII.1 processing and testing activities (AM1)		
Q3	Provide MCNP6 Criticality training course (AM1)		
Q3	Merge additional benchmark input files into the Los Alamos Benchmark Suite (LABS) targeting new additions to ICSBEP and remaining input files from Whisper-1.1 library (AM1)		
Q3	Develop and test MCNP_PSTUDY revision (AM1)		
Q3	Provide a status report on NJOY maintenance and user support activities (AM2)		
Q3	Provide a status report on LANL participation in US and International analytical methods collaborations (AM2)		
Q3	Provide a status report on ACEtk photonuclear and phototoxic ACE support table (AM2)		
Q3	Provide a status report on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 activities (AM3)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q3	Provide a status report on LANL participation in US and International analytical methods collaborations (AM5)		
Q4	Provide a status report on MCNP6 user support activities (AM1)		
Q4	Provide a status report on LANL participation in US and International analytical methods collaborations (AM1)		
Q4	Provide a status report on ENDF/B-VIII.1 processing and testing activities (AM1)		
Q4	Process and test ENDF/B-VIII.1 candidate evaluations and provide a documented assessment (AM1)		
Q4	Contingent upon successful processing, integrate and test ENDF/B-VIII.0-based covariance data library for Whisper-1.2 (AM1)		
Q4	Obtain approval to open-source the Los Alamos Benchmark Suite (LABS) (AM1)		In progress. See accomplishments section for status of discussions with the Feynman Center.
Q4	Issue an MCNP V&V report, expanded to include LABS releases (AM1)		
Q4	Provide a status report on NJOY maintenance and user support activities (AM2)		
Q4	Provide a status report on LANL participation in US and International analytical methods collaborations (AM2)		
Q4	Provide a status report on ACETk photonuclear and photoatomic ACE support table (AM2)		
Q4	Demonstrate initial capabilities of "scion" processing component, which will perform tasks including integration, linearization, and interpretation of distribution data. (AM2)		
Q4	Provide a status report on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 activities (AM3)		
Q4	Provide data files and report for h-h2o and graphite on-the-fly S(alpha,beta) temperature effects. (AM3)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Provide a status report on LANL participation in US and International analytical methods collaborations (AM5)		
Q4	Issue final report on all LANL results related to the ICSBEP Benchmark Comparison Study (AM5)		

### ACCOMPLISHMENTS

- AM1 - MCNP® Maintenance and Support, Uncertainty Analysis Development, and Modernization
  - **Education**
    - One in-person Introduction to MCNP6 class taught at LANL with 14 students: See separate summary of MCNP classes for full breakdown of classes and attendance information.
    - Mentoring an RPI graduate student working on on-the-fly temperature treatment of thermal neutron scattering. The summer student efforts have included (also see AM3 below):
      - Working with W. Haeck on defining an alternate ACE thermal neutron scattering formalism to hold the temperature-dependent data.
      - Working with M. Rising and C. Josey on the MCNP team to work on writing and integrating new reading, interpreting, and sampling functions for this newly structured data.
  - **R&D Work**
    - For the two papers submitted and accepted at the 2023 ICNC conference, two corresponding presentations were prepared for the conference. The overall NCSP V&V report detailing all the MCNP6.3 calculations is under construction. It is based on the contents of these two papers. A couple of general observations on the MCNP6.3 criticality V&V results:
      - Using the new MCNP6.3 fission matrix convergence testing and acceleration techniques provides equally valid results in comparison to the default MCNP6.3 algorithms.
      - Using the new MCNP6.3 HDF5-formatted PTRAC capability reduces the computational cost of the subcritical multiplication benchmark simulations by ~20% in comparison to the legacy PTRAC capability.
    - The Whisper open-source release is pending LANL Feynman Center for Innovation (FCI) approval. FCI has raised some concerns on licensing Whisper as open-source after having been released alongside MCNP6 through RSICC. We are iterating with FCI to find the best path forward; once approved the code will be made available on GitHub.
      - Update: FCI at LANL has reached out about open-source licensing of MCNP6-related software. We are in active discussions on this topic, with hopes that the Whisper code can proceed toward an open-source license
    - Adding recent subcritical multiplication benchmarks to V&V testing framework. A study on the verification and computational cost of MCNP6.3 features for subcritical multiplication benchmarks is documented in the LA-UR-23-26336 full paper and the LA-UR-23-30891 presentation contributed to the 2023 ICNC meeting.
    - The NCSP-specific V&V report with new MCNP6.3 features (e.g., Doppler Broadening Rejection Correction, Automated Acceleration and Convergence Testing) is being drafted. A portion of the report is documented in the LA-UR-23-25883 full paper and the LA-UR-23-30811 presentation contributed to the 2023 ICNC meeting.
    - The updates to the MCNP\_PSTUDY tool are currently being evaluated. Development of a revised tool will take place after the initial scoping work is completed. Some initial investigation into a Python-based input generation tool has been underway with the idea that a



## NCSP Quarterly Progress Report (FY-2023 Q4)

Python-based input generation tool would be a complete replacement with superior capabilities compared to the existing MCNP\_PSTUDY tool.

- The Whisper code is being prepared for the inclusion of new ENDF/B-VIII.0 covariance data.
  - Options to allow the user to select the covariance data are being added (see covariance data comment below in the MCNP Data section).
  - A new CMake-based build system has been integrated for more general configuring and building options.
  - Investigated Whisper USL calculations using ENDF/B-VIII.0 nuclear data and processed covariances. See 2023 User Symposium presentation LA-UR-23-30432.

### ○ MCNP Support and Maintenance

- Support MCNP6 users. MCNP Forum, website, email, direct interactions, etc.
- Continuous MCNP public website updates posted online.
- The 2023 MCNP User Symposium hybrid event took place September 18-21, 2023 with 300+ individuals registered. A general MCNP6 overview presentation was provided in LA-UR-23-30362. All developer symposium presentations will be uploaded soon to the Reference Collection section of the MCNP web page ([https://mcnp.lanl.gov/reference\\_collection.html](https://mcnp.lanl.gov/reference_collection.html)).
- Continued to support help requests sent in through the [mcnp\\_help@lanl.gov](mailto:mcnp_help@lanl.gov) help service desk.
- Consolidating and archiving past V&V results in repository

### ○ MCNP Data (AM1)

- The processed ENDF/B-VIII.1 beta 2 was released and tested during this quarter.
- ENDF/B-VIII.0 Covariance Library for Whisper
  - All available ENDF/B-VIII.0 covariance data have been processed through NJOY and formatted for Whisper to use. Whisper is being updated to allow for a new choice in covariance data. Full end-to-end verification testing (from application model to USL calculation) of the ENDF/B-VIII.0 data is underway. See updates in the LA-UR-23-30432 presentation given at the 2023 MCNP User Symposium.

### • AM2 - NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization

#### ○ NJOY 2016

1 update to NJOY2016 was released: NJOY2016.72

This update fixes the following issues:

- Fixed an issue in GROUPT related to an error coming up in production matrix calculations. Depending on when a user asks for a production matrix associated to a reaction, it is possible that the reference frame of the previous reaction is used instead (caused by erroneously defining an already declared global variable as local with a "save" attribute). In some circumstances, this causes NJOY2016 to error out (with a message related to unsupported reference frames). No test results had to be updated due to this change.
- Fixed issues in acer to properly print already existing dosimetry and photoatomic ACE files when running a stand-alone acer iopt=7 job.
- The meaning of legord and ifssp in the ERRORR input file has been repurposed when mfcov=34.
- Increased allocation of arrays to accommodate ENDF/B-VIII.1 evaluations.
- Fixed a typo in the name for MT195 in ACER.

Current ENDF/B-VIII.1b2 processing has not shown any issues in NJOY2016.

#### ○ User support

- Various questions on the GitHub issues trackers

## NCSP Quarterly Progress Report (FY-2023 Q4)

- Support on ACE formats: available data for electrons
  - Support on how to use ENDFtk and ACETk at LANL (both internal at LANL and external)
- **NJOY21 - ACETk**
  - ACETk can now read all eprdata formats (both eprdata14 and eprdata17). Next up will be to actually generate new data (this will require more development work in scion but getting to this point is definitely exciting).
  - We are looking into a release of ACETk in which we'll make some updates to the interface for the various ACE types (specifically putting blocks for each type in their own namespace and python subpackage to remove the current block namespace that has almost 100 different blocks for 5 different ACE types).
  - Integration of ACETk in other LANL tools will also require some work on dependencies that do not play well with those LANL tools (the main culprits here are ranges-v3, etc.)
- **NJOY21 - Scion**
  - All outstanding code reviews have been finished.
- **AM3 - Development of an Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 (RPI)**
  - Automation of ACE file formatted OTF data for use in MCNP6.3.
  - Creation of benchmark MCNP6.3 cases for the comparison of OTF data to the ACE data shipped with MCNP6.3.
  - OTF sampling data has been submitted to the LANL MCNP development team in an HDF5 format. This should allow easy access by MCNP through internal tools at LANL.
  - Investigation of the sensitivities of the generation of sampling Probability Density Functions (PDFs) to the initial input alpha and beta grids for leapr. (In Progress).
- **AM5 - Benchmark Intercomparison Study**
  - This project is transitioning away from ICSBEP k-eff comparisons. For FY23 and FY24 the focus will be on beta-eff and shielding benchmark intercomparisons. We have collected some beta-eff results and plan to document and send to IRSN before the end of the CY.

## NCSP Quarterly Progress Report (FY-2023 Q4)

### PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter  
AND
- Are publicly releasable

Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Jennifer L. Alwin, Jerawan Armstrong, Simon R. Bolding, Alexander R. Clark, Chelsea D’Angelo, Micky R. Dzur, Robert A. (Art) Forster III, Avery S. Grieve, Esteban Gonzalez, Wim Haeck, Colin Josey, Karen C. Kelley, Joel A. Kulesza, M. Robert MacQuigg, Vedant Mehta, Michael E. Rising, Div Sharma, Joshua B. Spencer, Holly Trelleue, and James R. Tutt, “A list of 2022 MCNP User Symposium Abstracts from XCP-3,” Los Alamos Report ( <b>LA-UR-22-30534</b> ).
Q1	Colin Josey, Avery S. Grieve, and Michael E. Rising, “Results and Responses for the 2022 User Forum Survey,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30614</b> ).
Q1	Alexander R. Clark, Michael E. Rising, Colin Josey, and Joel A. Kulesza, “Verification and validation testing and tools: comparison between MCNP code versions and nuclear data libraries,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30692</b> ).
Q1	Alexander R. Clark, “Easy PERT: a Python tool for writing PERT cards and parsing PERT card results,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30831</b> ).
Q1	Jennifer L. Alwin, M. Robert MacQuigg, Joshua B. Spencer, Wim Haeck, Joel A. Kulesza, and Michael E. Rising, “Critical Benchmarks Modeled with MCNP Unstructured Mesh,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30840</b> , Draft).
Q1	Michael E. Rising, “Multigroup Cross-section Generation in MCNP6.3,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30839</b> ).
Q1	Michael E. Rising, “MCNP6.3: A Year in Review,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30768</b> ).
Q1	Michael E. Rising and Simon R. Bolding, “Coincident Capture through Post-processing PTRAC,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30927</b> ).
Q1	Colin Josey, Avery S. Grieve, and Michael E. Rising, “MCNP6.3 Code and Nuclear Data Installation Guide,” presented at the 2022 MCNP User Symposium ( <b>LA-UR-22-30884</b> , Draft).
Q1	Robert C. Little, Michael E. Rising, Jennifer L. Alwin, Rian M. Bahran, Travis J. Grove, Alexander R. Clark, Jesson D. Hutchinson, M. Robert MacQuigg, Alexander T. McSpaden, Isaac J. Michaud, Bobbi Riedel, Travis A. Smith, and Nicholas W. Thompson, “Nuclear data covariances are critical input to determine upper sub-critical limits and to design experiments to increase it,” presented at the Nuclear Data Uncertainty Quantification Working Meeting (NDUQWM) ( <b>LA-UR-22-31233</b> ).
Q1	Nicholas W. Thompson, Jesson D. Hutchinson, Jennifer L. Alwin, Alexander R. Clark, Theresa E. Cutler, Michael J. Grosskopf, Wim Haeck, Michal W. Herman, Noah A. Kleedtke, Juliann R. Lamproe, Robert C. Little, Issac J. Michaud, Denise Neudecker, Michael E. Rising, Travis A. Smith, and Scott A. Vander Wiel, “Neutron Leakage Spectra Sensitivities for ICSBEP Benchmarks,” presented at the American Nuclear Society (ANS) Winter Meeting and Nuclear Technology Expo ( <b>LA-UR-22-32047</b> ).

## NCSP Quarterly Progress Report (FY-2023 Q4)

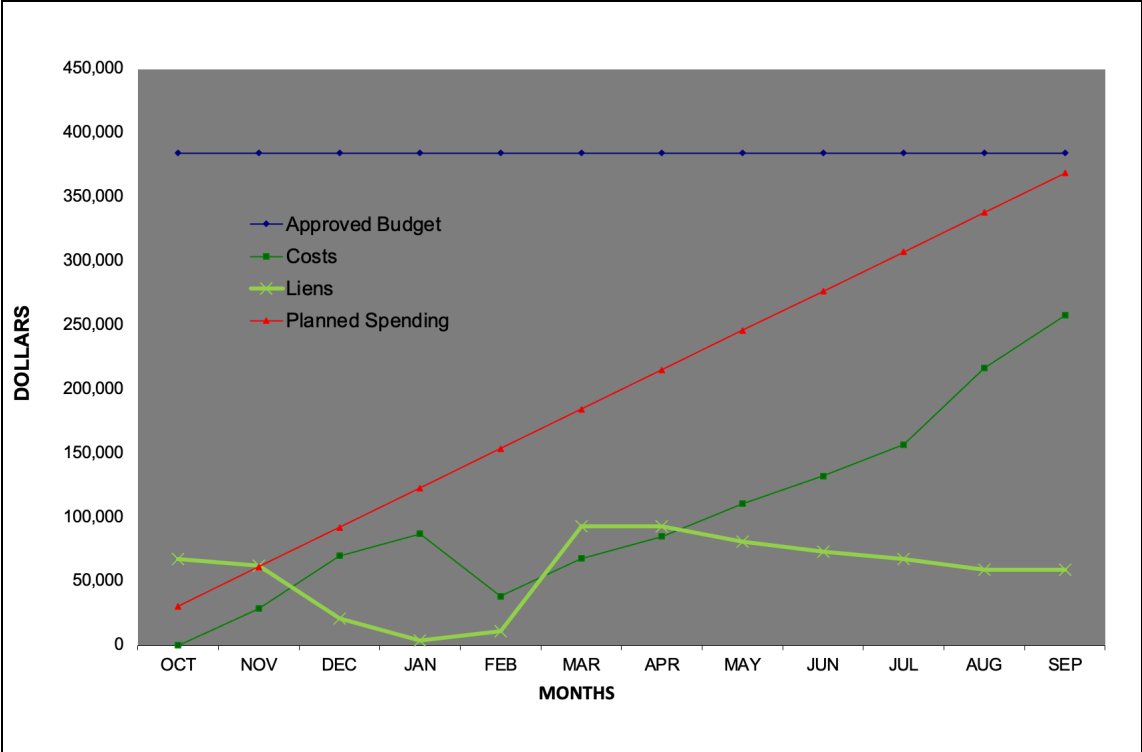
Q1	Jeffrey S. Bull, Colin Josey, Joel A. Kulesza, and Michael E. Rising, "MCNP® Code Version 6.3.0 Build Guide," Los Alamos Report ( <b>LA-UR-22-32851</b> , Rev. 1).
Q1	Colin Josey, Alexander R. Clark, Joel A. Kulesza, Eric J. Pearson, and Michael E. Rising, "MCNP® Code Version 6.3.0 Verification & Validation Testing," Los Alamos Report ( <b>LA-UR-22-32951</b> , Rev. 1).
Q1	Michael E. Rising, Jerawan C. Armstrong, Simon R. Bolding, Forrest B. Brown, Jeffrey S. Bull, Timothy P. Burke, Alexander R. Clark, David A. Dixon, Robert A. (Art) Forster III, Jesse F. Giron, Avery S. Grieve, H. Grady Hughes, Colin J. Josey, Joel A. Kulesza, Roger L. Martz, Austin P. McCartney, Gregg W. McKinney, Scott W. Mosher, Eric J. Pearson, Michael E. Rising, Clell J. (CJ) Solomon Jr., Sriram Swaminarayan, Jeremy E. Sweezy, Stephen C. Wilson, and Anthony J. Zukaitis, "MCNP® Code Version 6.3.0 Release Notes," Los Alamos Report ( <b>LA-UR-22-33103</b> , Draft).
Q1	Jennifer Alwin, "Nuclear Criticality Safety Needs for Validation of Chlorine", Los Alamos Report ( <b>LA-UR-22-30437</b> , Draft).
Q1	Tara Robertson, Jennifer Alwin, Christopher Perfetti, Rachael Bulso, "Application of an Empirical Density Law via Python for Aqueous Plutonium Nitrate Systems in MCNP6", Los Alamos Report ( <b>LA-UR-22-32993</b> ).
Q1	Riley Bulso, Jennifer Alwin, Christopher Perfetti, Tara Robertson, Kelly Aldrich, Theresa Cutler, David Kimball, James Bunsen, Laura Worl, "Application of an Empirical Density Law via Python for Aqueous Plutonium Chloride Systems in MCNP6", Los Alamos Report ( <b>LA-UR-22-20040</b> ).
Q2	Robert C. Little, Michael E. Rising, Joel A. Kulesza, Patrick Talou, Conny Egozi, Timothy Burke, Jill Gibson, and Angelique Johnson, "MCNP® Site Support Newsletter First Quarter 2023," Los Alamos Report ( <b>LA-UR-23-23122</b> ).
Q2	Michael E. Rising, Jerawan C. Armstrong, Simon R. Bolding, Forrest B. Brown, Jeffrey S. Bull, Timothy P. Burke, Alexander R. Clark, David A. Dixon, Robert A. (Art) Forster III, Jesse F. Giron, Avery S. Grieve, H. Grady Hughes, Colin J. Josey, Joel A. Kulesza, Roger L. Martz, Austin P. McCartney, Gregg W. McKinney, Scott W. Mosher, Eric J. Pearson, Michael E. Rising, Clell J. (CJ) Solomon Jr., Sriram Swaminarayan, Jeremy E. Sweezy, Stephen C. Wilson, and Anthony J. Zukaitis, "MCNP® Code Version 6.3.0 Release Notes," Los Alamos Report ( <b>LA-UR-22-33103</b> , Rev. 1).
Q2	Michael E. Rising, Alexander R. Clark, and Jennifer L. Alwin, "Verification and Validation of the New MCNP6.3 Criticality Features," Los Alamos Report ( <b>LA-UR-23-21142</b> ) submitted to ICNC 2023 conference.
Q2	Michael E. Rising, Nicholas H. Whitman, and Jesson D. Hutchinson, "Verification and Performance Impact of the New Parallel MCNP6.3 Particle Track Output Capability for Subcritical Multiplication Simulations," Los Alamos Report ( <b>LA-UR-23-21143</b> ) submitted to ICNC 2023 conference
Q3	Michael E. Rising, "Recent MCNP® Code Developments and Improvements for Nuclear Energy Applications," Los Alamos Report ( <b>LA-UR-23-23473</b> ) presented at a LANL Nuclear and Particle Futures Capability Review.
Q4	Michael E. Rising, Alexander R. Clark, and Jennifer L. Alwin, "Verification and Validation of the New MCNP6.3 Criticality Features," Los Alamos Report full paper ( <b>LA-UR-23-25883</b> ) and presentation ( <b>LA-UR-23-30811</b> ) submitted to and accepted at the ICNC 2023 conference.
Q4	Michael E. Rising, Nicholas H. Whitman, and Jesson D. Hutchinson, "Verification and Performance Impact of the New Parallel MCNP6.3 Particle Track Output Capability for Subcritical Multiplication Simulations," Los Alamos Report full paper ( <b>LA-UR-23-26336</b> ) and presentation ( <b>LA-UR-23-30891</b> ) submitted to and accepted at the ICNC 2023 conference.
Q4	Michael E. Rising, "MCNP6 Developments: A 2022-23 Year in Review," Los Alamos Report presentation ( <b>LA-UR-23-30362</b> ) at the 2023 MCNP User Symposium.
Q4	Michael E. Rising, Alexander R. Clark, Nicholas H. Whitman, and Jesson D. Hutchinson, "Validation of New MCNP6.3 Features for Critical and Subcritical Benchmark Simulations," Los Alamos Report presentation ( <b>LA-UR-23-30558</b> ) at the 2023 MCNP User Symposium.
Q4	Alexander R. Clark and Michael E. Rising, "Computing Upper Subcritical Limits via Whisper using ENDF/B-VIII.0 Nuclear Data," Los Alamos Report presentation ( <b>LA-UR-23-30432</b> ) at the 2023 MCNP User Symposium.

**NCSP Quarterly Progress Report (FY-2023 Q4)**

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> AM2, 3, 4, 5 <b>M&amp;O Contractor Name:</b> LLNL <b>Point of Contact Name:</b> Catherine Percher <b>Point of Contact Phone:</b> (925) 579-4226	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET













1. Carryover into FY 2023 = \$190,317
  2. Approved FY 2023 Budget = \$194,000
  3. Total FY23 budget w/Carryover = \$384,317
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$70,063
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = -\$2,144
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$64,356
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$125,456
  8. Carryover into FY 2024 = \$ 126,586
- NOTE:** Include commitments as part of spending
- Note for Q2: Strange behavior of cost line was due to a lien being inappropriately costed in November of 2022, and the funds were redeposited in February of 2023.

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on Multi-Physics methods for simulation of criticality excursions activities (AM2)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide a status report on slide rule application activities (AM3)		
Q1	Provide a status report on thermal scattering and self-shielding in GNDS/FUDGE activities. (AM4)		
Q1	Provide a status report on proposed intercomparison study activities. (AM5)		
Q2	Provide a status report on Multi-Physics methods for simulation of criticality excursions activities (AM2)		
Q2	Provide a status report on slide rule application activities (AM3)		
Q2	Provide a status report on thermal scattering and self-shielding in GNDS/FUDGE activities. (AM4)		
Q2	Provide a status report on proposed intercomparison study activities. (AM5)		
Q3	Provide a status report on Multi-Physics methods for simulation of criticality excursions activities (AM2)		
Q3	Provide a status report on slide rule application activities (AM3)		
Q3	Provide a status report on thermal scattering and self-shielding in GNDS/FUDGE activities. (AM4)		
Q3	Provide a status report on proposed intercomparison study activities. (AM5)		
Q4	Provide a status report on Multi-Physics methods for simulation of criticality excursions activities (AM2)		
Q4	Provide a status report on slide rule application activities (AM3)		
Q4	Provide a status report on thermal scattering and self-shielding in GNDS/FUDGE activities. (AM4)		
Q4	Provide a status report on proposed intercomparison study activities. (AM5)		

### ACCOMPLISHMENTS

- AM2 – Multi-Physics Methods for Simulation of Criticality Excursion

## NCSP Quarterly Progress Report (FY-2023 Q4)

- Project continues under different funding stream trying to match PDV results to Multiphysics Godiva model
- AM3 – Slide Rule Application
  - Slide Rule meeting in July where it was decided IRSN would provide a draft final report at the end of the FY, to be completed in FY24. All LLNL calculations have been completed and the final report is in preparation by IRSN. A decision on the final application has yet to be made.
- AM4 - Thermal Scattering and Self-Shielding in GNDS/FUDGE
  - Extensively tested the ENDF-VIII.1 beta-2 release, including processing the full library at several temperatures for use in both continuous energy and multigroup transport applications.
  - Improved ACE file generation capabilities in FUDGE, including an important patch to prevent memory issues when generating multi-temperature unresolved region probability tables and fixes to facilitate exporting multiple temperatures to ACE format.
  - Made progress on a tool to generate COG libraries directly from FUDGE. This should provide a faster alternative to the current approach of using ACE files as an intermediary format.
  - Investigated TNSL processing differences between FUDGE and other codes (effort continues in FY24)
- AM5 - Proposed Benchmark Intercomparison Study
  - Jeremy Bez is the new lead for IRSN, replacing Nicolas Leclaire, and he has solicited  $\beta$ -eff benchmarks from all labs for comparison this FY-LLNL provided 32 benchmark results
  - Shielding will be the focus of FY24 intercomparison and LLNL has provided preliminary results with more underway

## PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter
- AND
- Are publicly releasable

Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Heinrichs, D. et al, "COG Beta-Effective Benchmarks," LLNL-TR-843852, December 20, 2022
	Mattoon, C. "TNSL Support in GNDS 2.0 and Beyond," LLNL-PRES-842271, November 4, 2022
	Mattoon, C. "GNDS v2.0 Release and Future Developments," LLNL-PRES-842271, November 4, 2022
Q2	none
Q3	Heinrichs, D. and E. Lent, "Bramblett and Czirr Self-Shielded Fission Rates for <sup>235</sup> U Physical and Analytic Benchmark," LLNL-TR-851689, June 30, 2023.
Q4	none



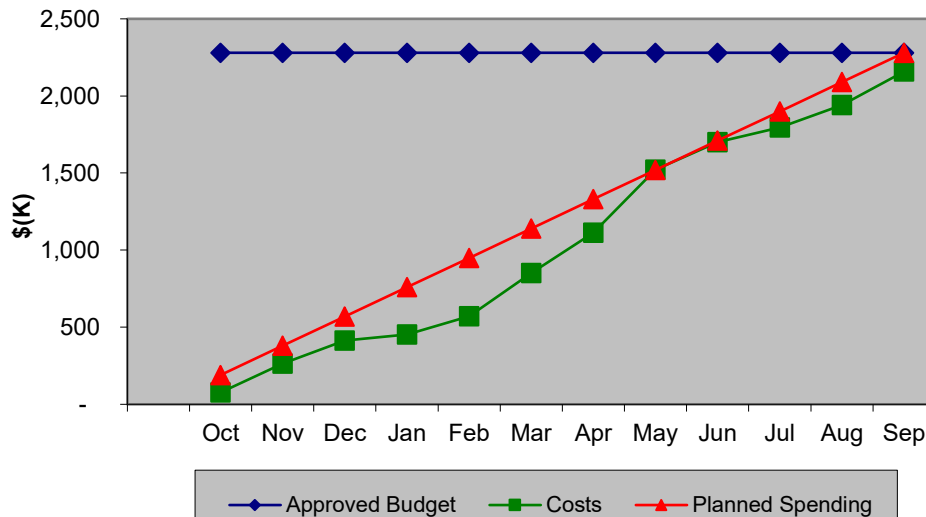
# NCSP Quarterly Progress Report (FY-2023 Q4)

**NCSP Element and Subtask:** AM1, 2, 3, 6, 10, 17, 18, 19  
**M&O Contractor Name:** ORNL  
**Point of Contact Name:** Doug Bowen  
**Point of Contact Phone:** (865) 576-0315

**Reference:** DP0909010  
**Date of Report:** November 6, 2023

## BUDGET

**FY23 Analytical Methods**



1. Carryover into FY 2023 = \$50K
  2. Approved FY 2023 Budget = \$ 2300K
  3. Total FY 2023 Budget w/Carryover = \$2280K
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$414K
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$438K
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$849K
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$457K
  8. Projected carryover into FY 2024 = \$122K
- NOTE:** Include commitments as part of spending





## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**




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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)	<span style="display: inline-block; width: 20px; height: 15px; background-color: blue;"></span>	
Q1	Provide status on RSICC activities (AM1)	<span style="display: inline-block; width: 20px; height: 15px; background-color: blue;"></span>	
Q1	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of	<span style="display: inline-block; width: 20px; height: 15px; background-color: green;"></span>	









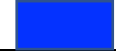




## NCSP Quarterly Progress Report (FY-2023 Q4)

	NCSP interest. (AM2)		
Q1	Provide status on TSUNAMI upgrades. (AM2)		
Q1	Provide status on VADER. (AM2)		
Q1	Provide status on Sampler improvements. (AM2)		
Q1	Provide status on CSAS improvements. (AM2)		
Q1	Provide status on SCALEHELP. (AM2)		
Q1	Provide status on SCALE 7.0 support. (AM2)		
Q1	Provide status on SCALE training (other than stats). (AM2)		
Q1	Publish a quarterly newsletter. (AM2)		Newsletter delayed coinciding with SCALE 6.3 release.
Q1	Provide status on AMPX maintenance and modernization activities (AM3)		
Q1	Provide status on Slide Rule application activities (AM6)		
Q1	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q1	Provide status on VALID activities (AM17)		
Q1	Provide status on determination of appropriate integral parameters for critical experiment activities. (AM18)		
Q1	Provide status on analysis of Sum-of-Fractions for Nuclide Mixtures activities. (AM19)		
Q2	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
Q2	Provide status on RSICC activities (AM1)		


















## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q2	Provide status on TSUNAMI upgrades. (AM2)		
Q2	Provide status on VADER. (AM2)		
Q2	Provide status on Sampler improvements. (AM2)		
Q2	Provide status on CSAS improvements. (AM2)		
Q2	Provide status on SCALEHELP. (AM2)		
Q2	Provide status on SCALE 7.0 support. (AM2)		
Q2	Provide status on SCALE training (other than stats). (AM2)		
Q2	Publish a quarterly newsletter. (AM2)		Newsletters will resume in Q3
Q2	Provide status on AMPX maintenance and modernization activities (AM3)		
Q2	Provide status on Slide Rule application activities (AM6)		
Q2	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q2	Provide status on VALID activities (AM17)		
Q2	Provide status on determination of appropriate integral parameters for critical experiment (AM18)		
Q2	Provide status on analysis of Sum-of-Fractions for Nuclide Mixtures (AM19)		
Q3	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
Q3	Provide status on RSICC activities (AM1)		
Q3	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide		

## NCSP Quarterly Progress Report (FY-2023 Q4)

	brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q3	Provide status on TSUNAMI upgrades. (AM2)		
Q3	Provide status on VADER. (AM2)		
Q3	Provide status on Sampler improvements. (AM2)		
Q3	Provide status on CSAS improvements. (AM2)		
Q3	Provide status on SCALEHELP. (AM2)		
Q3	Provide status on SCALE 7.0 support. (AM2)		
Q3	Provide status on SCALE training (other than stats). (AM2)		
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Q3	Provide status on Slide Rule application activities (AM6)		
Q3	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q3	Provide status on VALID activities (AM17)		
Q3	Provide status on determination of appropriate integral parameters for critical experiment (AM18)		
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## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
Q4	Provide status on RSICC activities (AM1)		
Q4	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q4	Provide status on TSUNAMI upgrades. (AM2)		
Q4	Provide status on VADER. (AM2)		
Q4	Provide status on Sampler improvements. (AM2)		
Q4	Provide status on CSAS improvements. (AM2)		
Q4	Provide status on SCALEHELP. (AM2)		
Q4	Provide status on SCALE 7.0 support. (AM2)		
Q4	Provide status on SCALE training (other than stats). (AM2)		
Q4	Publish a quarterly newsletter. (AM2)		
Q4	Document AMPX modernization and technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager. (AM3)		
Q4	Provide status on Slide Rule application activities (AM6)		
Q4	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q4	Provide status on VALID activities (AM17)		
Q4	Provide status on determination of appropriate integral parameters for critical experiment (AM18)		
Q4	Provide status on analysis of Sum-of-Fractions for Nuclide Mixtures (AM19)		
<b>ACCOMPLISHMENTS</b>			

## NCSP Quarterly Progress Report (FY-2023 Q4)

- AM1 - Radiation Safety Information Computational Center (RSICC)
  - § Distributed 1252 software packages.
  - § 270 SCALE, 603 MCNP®, and 1 COG packages distributed.
  - § RSICC quarterly report issued.

<u>Quarter</u>	<u>University Requests</u>	<u>NCSP Direct Requests</u>
1	405	28
2	373	40
3	217	61
4	469	55

FY2023 University Distributions		
Month	MCNP®	SCALE
October	105	26
November	56	28
December	58	33
January	26	26
February	85	34
March	54	25
April	24	19
May	22	29
June	18	20
July	97	94
August	137	85
September	369	91
Total	1051	510

- 
- AM2 - SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section Generation/Modernization
  - **Add capability to visualize fission source points in FULCRUM:**
    - The ability to plot an initial and final fission source onto a 2-D geometry in Fulcrum has been implemented and is planned for inclusion in the SCALE 6.3.2 release. This feature includes a new ability for KENO to dump initial fission source point information to disk (previously on the locations of the final generation were stored). All corresponding documentation related to this feature has been added to the SCALE manual. Below two figures demonstrate the new capability.

# NCSP Quarterly Progress Report (FY-2023 Q4)

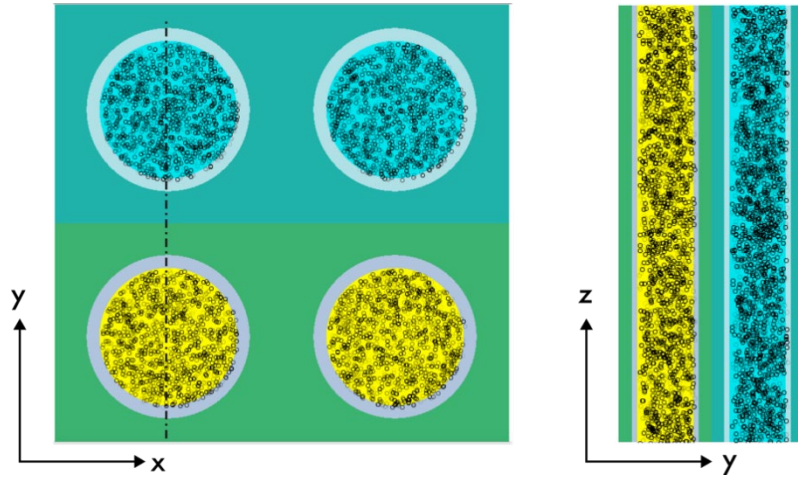


Fig.1. 2-D views of fission neutrons starting points overlaid on 2x2 mini assembly

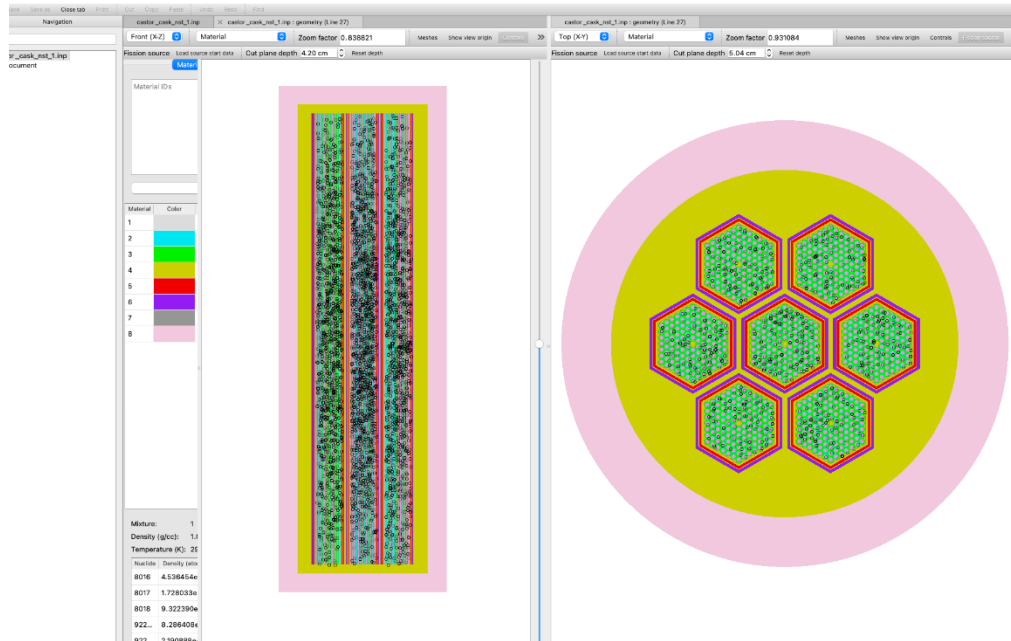


Fig.2. 2-D views of fission neutrons starting points overlaid on Castor Cask model

## NCSP Quarterly Progress Report (FY-2023 Q4)

- Capability to save fission neutron starting and collision location information to an on-disk HDF5 file has been implemented. This will be later used in FY24 development task which enables visualization of fission source starting points on a 3-D geometry and visualization of fission neutron tracks onto a 3-D geometry.
- **Provide status on MAVRIC upgrades:**
  - **CAAS calculation sequence with MAVRIC-Shift:**

MAVRIC-Shift code has been enhanced to enable simulation of CAAS systems. Capability added to the code base to import CSAS-Shift generated fission source (mesh-based) as either separable or non-separable sources to MAVRIC-Shift. V&V testing has been completed, CAAS modeling with variance reduction methods (CADIS & FW-CADIS) with parallel MC transport is operational and will be released in next SCALE beta.
- **Provide status on TSUNAMI upgrades:**
  - **Direct Perturbation Capability:**

Capability to apply user-defined perturbation to the cross section data for the given nuclide-reaction pair has been implemented in CE KENO. V&V testing for the new CE data perturbation capability is still progressing. CE data perturbation capability will be used in FY24 development task which implements automated/manual direct perturbation calculation capability to TSUNAMI sequences.
  - **Sensitivity tally data block in TSUNAMI sequences:**

A new input data block named sensitivity tally has been added into tallies data block in KENO and TSUNAMI to allow flexible definition and control of sensitivity tallies. In the first phase, CLUTCH method with the following  $F^*(r)$  map options have been enabled in sensitivity tally data block:

    - Read  $F^*(r)$  from an external mesh file (3dmap file),
    - Read mesh-averaged adjoint flux and birth spectrum of fission neutrons from external mesh files (3dmap files), then calculate  $F^*(r)$ ,
    - Compute  $F^*(r)$  using IFP-like approach currently available in KENO.
  - Sensitivity tally input block can be easily extendible; definitions for the existing sensitivity tally methods (IFP, GPT, etc.) will be enabled within this input block as well as the new methods like Direct Perturbation capability.
- **TSUNAMI Primer updates:**

Minor efforts.
- **TSUNAMI-IP new capabilities:**

The uncertainty and  $c(k)$  per nuclide and uncertainty plots vs. energy features have been added to TSUNAMI-IP.
- **Provide status on VADER:**

No major efforts.
- **Provide status on Sampler improvements:**
  - **Sampler Variable block enhancement:**

Capability to allow specification of user defined distributions has been added to Sampler. A new variable named “custom\_values” has also been added to the variable types in Sampler. The block requires “values” card to enter an array of values. This new variable type can also be used with geometry perturbations. When parametric study is not used, Sampler randomly selects a value



## NCSP Quarterly Progress Report (FY-2023 Q4)

from the user supplied list for perturbations.

- **Sampler Parametric Study Target Value Prediction:**

This capability allows user to set a “targets” card to search for parameter value that satisfies the target value for the “all “ the responses exist for that case. The current implementation allows multiple target values to be entered for all responses.

Like max/min value implementation, the current implementation allows user to check the predicted parameter value for accuracy.

- **Provide status on CSAS improvements** - Minor efforts.

- **Provide status on SCALEHELP** - Minor efforts.

- **Provide status on SCALE7.0 support** - No major efforts.

- **Provide status on SCALE training (other than stats)** - No major efforts.

- **Publish a quarterly newsletter.**

- Newsletter will be posted in a new continuous feed of articles on the SCALE website in a new section, recently approved by ORNL. At the end of each quarter, a newsletter “digest” will be created from those collected over the quarter. The hope is that useful articles are easier to find and the cost and time of newsletter assembly can be reduced.

- **AM3 - AMPX Maintenance & Modernization**

- The ENDF/B-VIII.1 Beta 2 release was processed by members of the AMPX team, leading into multifaceted validation in criticality safety, reactor physics, and depletion benchmarks (to be continued in FY2024 Q1 and reported at the November CSEWG meeting).

- The PUFF sequence within AMPX was updated to handle lumped sums in the covariance files. This is under testing and subsequent code review.

- To maximize previous investment in modernizing components of AMPX, the Polident code for point data processing was organized to use only the more recently written code.

- For the accurate processing of cryogenic moderator thermal scattering libraries, a refined scheme for the grid in the cosine of the scattering angle ( $\mu$ ) had been developed in previous quarters. In Q4, this refined gridding scheme was revisited to improve runtime performance. This investigation will continue into FY2024 Q1, to be concluded with code included in the SCALE 6.3.2 bug fix release.

- Several thermal scattering libraries in ENDF/B-VIII.1 Beta 2 have many Bragg edges, which process into intractably large files in the current SCALE CE library format. Planning and scoping an enhanced SCALE CE library format to better accommodate these library files has begun.

- **AM6 – Slide Rule Application**

- Identified missing simulations for the sensitivity models of the uranium systems have been modeled, and simulations are completed by ORNL staff. Simulation results will be shared with IRSN and LLNL so that benchmark comparisons can be performed for the final report for this project. (Celik)

- **AM10 – Proposed Benchmark Intercomparison Study (Shaw)**

- Coordinated with IRSN and LLNL for benchmark selection and resolution of discovered model discrepancies.

- Developed ~15 new models in common with LLNL and IRSN for Beff intercomparison.

- Generated  $B_{eff}$  values for said models with ENDF/B-VII.1 and VIII.0 libraries.

- **AM17 – Expansion of the Verified, Archived, Library of Inputs and Data (VALID)**

- Lisa Reed has completed 25 models for LEU-SOL-THERM-016, -017, -018, and -019. All models have been reviewed and are currently in the sensitivity/uncertainty phase of the model addition process. Lisa is coordinating with Alex Lang for sensitivity review before final QAC

## NCSP Quarterly Progress Report (FY-2023 Q4)

- approval into VALID.
- Veronica Karriem has completed 28 models for LEU-COMP-THERM-060. These models are currently still in review due to their complexity. Alex Shaw will be coordinating the sensitivity of the models.
- LEU-COMP-THERM-096 and -097, originated by Alex Shaw, are in the final review stages before being ready for the Quality Assurance Coordinator review: 19 models in LCT-096 and 24 in LCT-097.
- U233 sensitivity calculations are currently in review with Alex Shaw to complete the keff/sensitivity suite for U233 models currently in VALID.
- Alex Lang is in the process of adding PU-MET-FAST-003, -004, -016, -017, and -037 and HEU-MET-FAST-002, -003, and -004 models to VALID.
- Alex Shaw is currently reviewing LEU-MET-THERM-007 models for addition to VALID.
- AM18 – Determination of Appropriate Integral Parameters for Critical Experiment
  - Expanded study to include recent U-233 evaluations in VALID, adding 188 cases to the assessment. The now 616 cases are assessed with respect to integral parameters  $k_{eff}$  and E. (Reed)
  - Incorporated preliminary trending analysis to distinguish which fissile system categories' computational bias predictions are most dependent upon integral parameter cutoff. (Reed)
  - The ANS paper submitted last quarter was accepted. (Reed)
  - Background, the methodology of the analysis, original findings (excluding the final additions and conclusions) – (Karriem)
- AM19 – Analysis of Sum-of-Fractions for Nuclide Mixtures
  - Teams meetings were held during this time to discuss the presentation of the results at the ICNC meeting in October in Japan.
  - Travis Greene completed the validation portion of the report and Travis Zipperer is working on incorporating this into the final report. This is currently a working draft available through Teams from PNNL.
  - Two conference papers detailing the validation efforts of ORNL were presented at the ICNC conference in Sendai, Japan in October.

### PUBLICATIONS

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Jordan McDonnell, BK Jeon, Kang Seog Kim, Dorothea Wiarda, Jesse Brown, Chris Chapman, Andrew Holcomb, "AMPX," CSWEG, Upton, NY, Nov 2022.
	William B.J. Marshall, Travis Greene, Alex Shaw, "Updated Gadolinium Validation in SCALE 6.3.0 using ENDF/B-VIII.0 Data," CSWEG, Upton, NY, Nov 2022.
	Alex Shaw, William B.J. Marshall, "Analysis of SCALE Criticality and Sensitivity Calculations for Reflected HEU Cylinders," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 666-674 (June 2022).
	Mathieu Dupont, "Evaluation of Oak Ridge National Laboratory Health Physics Research Reactor Operation Data for Critical Benchmark Creation," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 725-734 (June 2022)
	William B.J. Marshall, Alex Lang, "Multigroup Examination of Nickel-Reflected HEU System," Nuclear Criticality Safety Division Topical Meeting

## NCSP Quarterly Progress Report (FY-2023 Q4)

	(NCSD 2022), 784-791 (June 2022)
	William B.J. Marshall, Travis Greene, "Performance of the Initial Implementation of the Shift Monte Carlo Code in SCALE 6.3," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 754-763 (June 2022)
	Travis Greene, William B.J. Marshall, Justin Clarity, "Impact of Increased Latent Generations on Sensitivity Calculations with SCALE," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 744-753 (June 2022)
	Travis Greene, William B.J. Marshall, Justin Clarity, "Impact of Increased Latent Generations on Sensitivity Calculations with SCALE," submitted to 2022 American Nuclear Society Annual Meeting, June 2022.
	Alex Lang, William B.J. Marshall, "Multigroup Examination of Nickel-Reflected HEU System," submitted to 2022 American Nuclear Society Annual Meeting, June 2022.
Q2	Shane Hart, Justin Clarity, "Creation of the VADER Code in SCALE," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 385-391 (June 2022)
	Shane Hart, Justin Clarity, "Creation of the VADER Code in SCALE," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), Anaheim, CA, June 2022
	Douglas Bowen, "ISO TC85/SC5/WG8 "Nuclear Criticality Safety" Meeting, NRC public Workshop, Oak Ridge, TN, February 2023.
	Matthieu Duluc, Johann Herth, Tristan Adatte, D. Heinrichs, Soon Kim, Douglas Bowen, Cihangir Celik, Mathieu Dupont, "Update of the Nuclear Criticality Slide Rule: Review of the Estimation of the Number of Fissions," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 446-455 (June 2022)
	Johann Herth, Matthieu Duluc, Tristan Adatte, D. Heinrichs, Soon Kim, Douglas Bowen, Cihangir Celik, Mathieu Dupont, "Update of the Nuclear Criticality Slide Rule Calculations: Plutonium systems – Delayed Fission Gamma," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), 456-463 (June 2022)
	William B.J. Marshall, "Expansion of the Verified, Archived, Library of Inputs and Data (VALID)," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Jordan McDonnell, Jesse Brown, Chris Chapman, Bk Jeon, Kang Seog Kim, Dorothea Wiarda, "AMPX Developments in FY2022," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Douglas Bowen, "Nuclear Criticality Safety Repository, Radiation Safety Information Computational Center (RSICC), & NDA Program," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Lisa Reed, Veronica Karriem, William B.J. Marshall, "Assessing the Impact of Sensitivity/Uncertainty-Based Selection Criteria on Computational Bias Prediction," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	William Wieselquist, "SCALE Activities in FY22," Technical Program Review Meeting, Albuquerque, NM, February 2023.
Q3	Douglas Bowen, "American Nuclear Society ANS-8 Standards Forum," 2023 ANS Winter Meeting and Technology Expo, Indianapolis, IN, June 2023.
	Shane Hart, Seth Johnson, Robert Lefebvre, William Wieselquist, "Improvements of SCALE Infrastructure on Microsoft Windows," 2023 ANS Winter Meeting and Technology Expo, Indianapolis, IN, June 2023.
	Travis Greene, William B.J. Marshall, Alex Lang, Travis Zipperer, "Impact of Thermal Scattering Law on Similarity Assessment in Light-Water or Polyethylene-Moderated Systems," 2023 ANS Winter Meeting and Technology Expo, Indianapolis, IN, June 2023.
	Walid Metwally, Douglas Bowen, "Nuclear Criticality Safety Training: Needs and Efforts," 2023 ANS Winter Meeting and Technology Expo, Indianapolis, IN, June 2023.

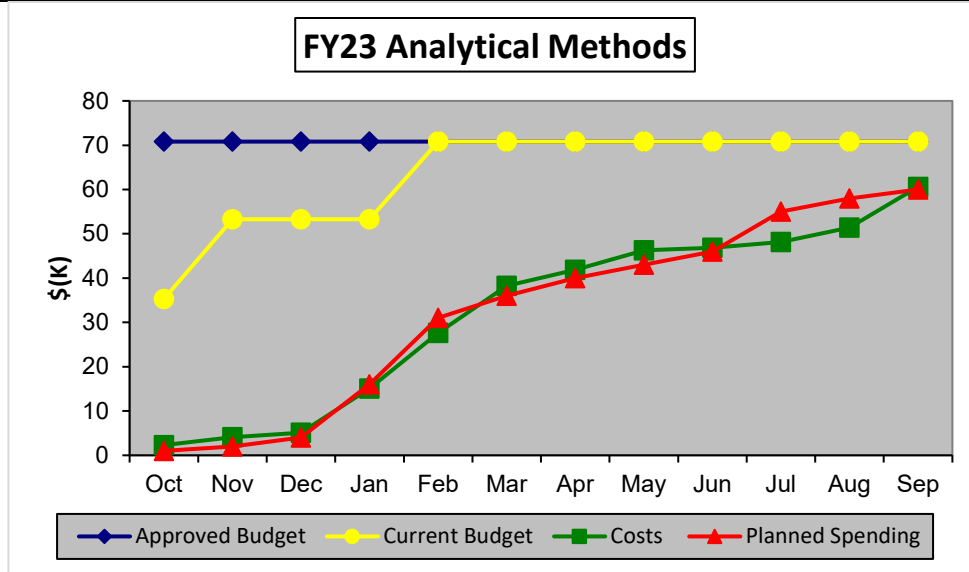
## NCSP Quarterly Progress Report (FY-2023 Q4)

	Alex Lang, Lisa Reed, "EM NCS Needs for TEX 2.0," TEX 2.0 Meeting, Livermore, CA, May 2023.
	William B.J. Marshall, Walid Metwally, "ORNL S/U Capabilities for Critical Experiment Design," TEX 2.0 Meeting, Livermore, CA, May 2023.
	William B.J. Marshall, Travis Greene, "Validation Progress and Plans for ENDF/B-VIII.1 $\beta$ 1 at ORNL," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	William B.J. Marshall, "Covariance Testing Progress for ENDF/B-VIII.1 $\beta$ 1 at ORNL," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	William B.J. Marshall, Shane Hart, "Vader in a Nutshell," 2023 SCALE Users' Group Workshop, Oak Ridge, TN, April 2023.
	Walid Metwally, Alex Lang, "ANS 2023 Nuclear Safety Workshop Presentation," 2023 ANS Student Conference, Knoxville, TN, May 2023.
	Travis Greene, Lisa Reed, "NCS Applications Using SCALE 6.3.0," 2023 SCALE Users' Group Workshop, Oak Ridge, TN, April 2023.
Q4	Hany Abdel-Khalik, Jeongwon Seo, Ugur Mertuyurek, Goran Arbanas, William (B.J.) Marshall, William Wieselquist, "Comparative Analysis of Confidence Metrics for Nuclear Criticality Safety," ORNL/TM-2022/2772, UT-Battelle, LLC, Oak Ridge National Laboratory (March 2023).
	Travis Greene, William (B.J.) Marshall, Alex Lang, Travis Zipperer, "Impact of Thermal Scattering Law on Similarity Assessment in Light-water or Polyethylene-Moderated Systems," Transactions of the American Nuclear Society, 482-485 (July 2023)
	Douglas Bowen, "Conduct of Operations and Nuclear Criticality Safety Standards," Transactions of the American Nuclear Society, 446-448 (June 2023)
	Kursat Bekar, William Wieselquist, "SCALE and NCSP," 2023 SCALE Users' Group Workshop, Oak Ridge, TN, April 2023.
	Ugur Mertuyurek, Hany Abdel-khalik, William (B.J.) Marshall, "Comparative Analysis of Standard and Advanced USL Methodologies," WPNCS Subgroup 13, Paris, France, June 2023.
	Mathieu Dupont, William (B.J.) Marshall, Justin Clarity, "Preliminary Design of Critical Experiments Involving Commercially Available B4C Neutron Absorber Plates with Low-Enriched UO2 Fuel," ANS Annual Meeting, Indianapolis, IN, June 2023.
	Seo, Jeongwon, Abdel-Khalik, Hany S., Mertuyurek, Ugur, Arbanas, Goran, Marshall, William, and Wieselquist, William. Comparative Analysis of Standard and Advanced USL Methodologies for Nuclear Criticality Safety. United States: N. p., 2023. Web. doi:10.1080/00295639.2023.2211202.

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> AM1 <b>M&amp;O Contractor Name:</b> PNNL <b>Point of Contact Name:</b> Travis Zipperer <b>Point of Contact Phone:</b> (206) 528-3474	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November, 2023
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## BUDGET



1. Carryover into FY 2023 = \$35,313
  2. Approved FY 2023 Budget = \$35,500
  3. Total FY2023 Budget w/Carryover = \$70,813
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$5,118
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$33,131
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$8,609
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$13,747
  8. Projected carryover into FY 2024 = \$10,208
- NOTE:** Include commitments as part of spending

## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="display: inline-block; width: 20px; height: 15px; background-color: blue; border: 1px solid black;"></span>	On Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: green; border: 1px solid black;"></span>	Behind Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: yellow; border: 1px solid black;"></span>	Missed Milestone <span style="display: inline-block; width: 20px; height: 15px; background-color: red; border: 1px solid black;"></span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status of Sum-of-Fractions analysis for nuclide mixtures (AM1)		
Q2	Provide a status of Sum-of-Fractions analysis for nuclide mixtures (AM1)		
Q3	Provide a status of Sum-of-Fractions analysis for nuclide mixtures (AM1)		
Q4	Provide a status of Sum-of-Fractions analysis for nuclide mixtures (AM1)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

### ACCOMPLISHMENTS

- AM1 – Analysis of Sum-of-Fractions for Nuclide Mixtures
  - Q1: Constructed case matrix for water and polyethylene reflected systems (around 1900 cases each); calculations to commence in Q2
  - Q1: Met with ORNL staff in December to discuss collaboration on the NCSP Technical Program Review Presentation and ICNC 2023 publications.
  - Q2: Submitted Abstract to ICNC 2023 on evaluation of Sum of Fractions for water and polyethylene moderated systems.
  - Q2: Presented at the NCSP TPR meeting in Albuquerque in February on Sum of Fractions methodology.
  - Q2: Completed case matrix for water and polyethylene reflected systems.
  - Q2: Developing draft report of SoF methodology.
  - Q3: Submitted Paper to ICNC 2023 on evaluation of Sum of Fractions for water and polyethylene moderated systems.
  - Q3: Continuing development of SoF report.
  - Q4: The SoF report draft completed and is awaiting a technical editor.

### PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter
- AND
- Are publicly releasable

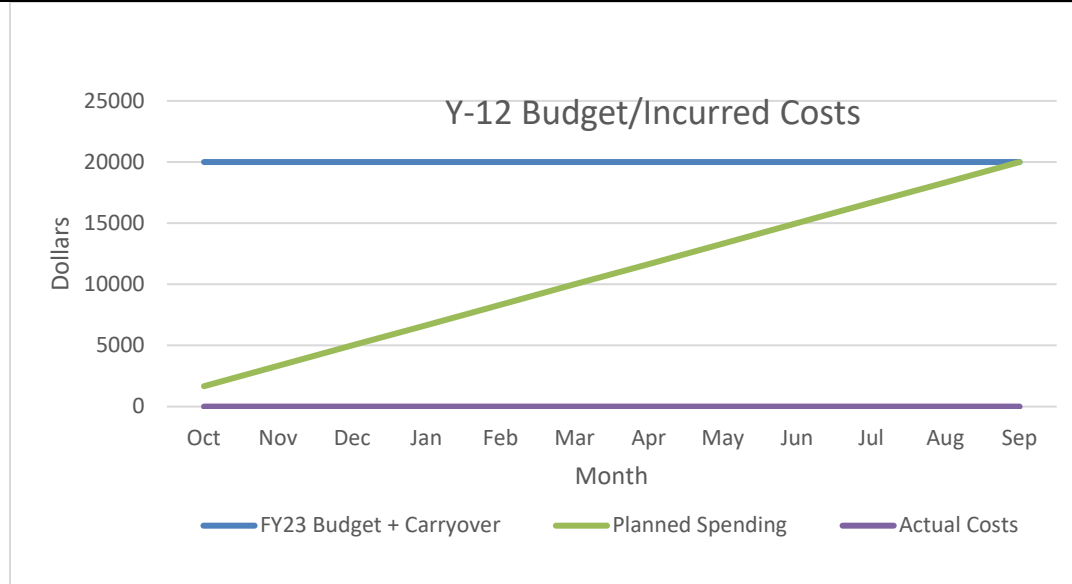
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	1) Travis Zipperer and Travis Greene, “Applicability of the Sum-of-Fractions for Moderated Systems”, PNNL-SA-182011, February 21, 2023. 2) Travis Zipperer, Andrew Prichard, Travis Greene, BJ Marshall, and Alex Lang, <b>Abstract:</b> “Evaluation of the Sum-of-Fractions Methodology for Water and Polyethylene Moderated Systems”, PNNL-SA-181534, January 31, 2023.
Q3	
Q4	

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> AM1 <b>M&amp;O Contractor Name:</b> Y12 <b>Point of Contact Name:</b> Kevin Reynolds <b>Point of Contact Phone:</b> (865) 241-9067	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 1, 2023
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## BUDGET



1. Carryover into FY 2023 = \$0.00
  2. Approved FY 2023 Budget = \$20,000.00
  3. Total FY 2023 Budget w/Carryover = \$20,000.00
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$0.00
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$0.00
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$0.00
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$0.00
  8. Projected carryover into FY 2024 = \$20,000.00
- NOTE:** Include commitments as part of spending

## MILESTONES

STATUS (copy color code and paste below in 'STATUS' field)			
Complete	<span style="background-color: blue; width: 20px; height: 15px; display: inline-block;"></span>	On Schedule	<span style="background-color: green; width: 20px; height: 15px; display: inline-block;"></span>
		Behind Schedule	<span style="background-color: yellow; width: 20px; height: 15px; display: inline-block;"></span>
		Missed Milestone	<span style="background-color: red; width: 20px; height: 15px; display: inline-block;"></span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status on Y12-AM1 activities in NCSP Quarterly Progress Reports. (AM1)	<span style="background-color: green; width: 20px; height: 15px; display: inline-block;"></span>	No activity this quarter to report.
Q2	Provide status on Y12-AM1 activities in NCSP Quarterly Progress Reports. (AM1)	<span style="background-color: green; width: 20px; height: 15px; display: inline-block;"></span>	No activity this quarter to report.
Q3	Provide status on Y12-AM1 activities in NCSP Quarterly Progress Reports. (AM1)	<span style="background-color: green; width: 20px; height: 15px; display: inline-block;"></span>	No activity this quarter to report.

## NCSP Quarterly Progress Report (FY-2023 Q4)

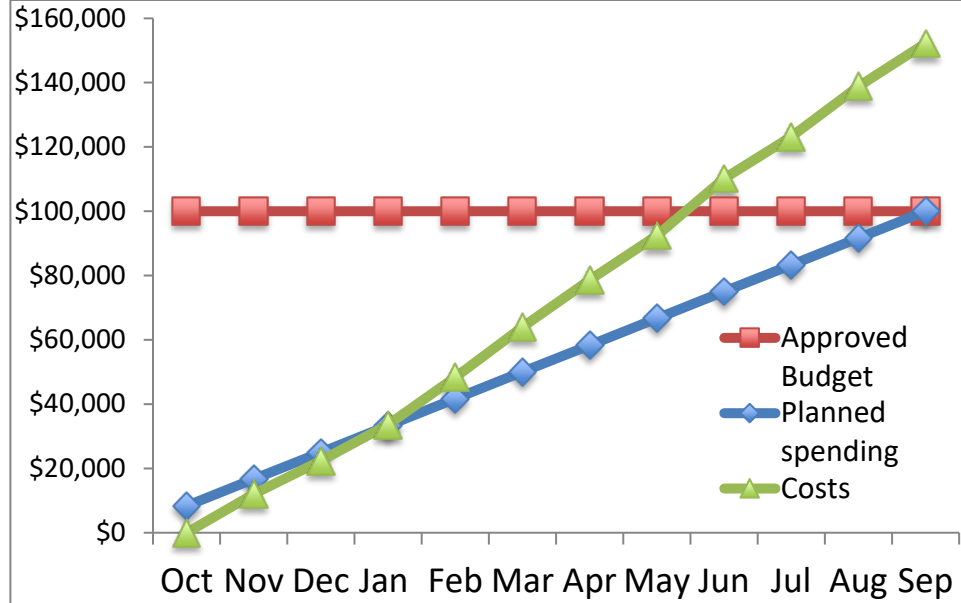
Q4	Provide status on Y12-AM1 activities in NCSP Quarterly Progress Reports. (AM1)		No activity this quarter to report.
<b>ACCOMPLISHMENTS</b>			
<ul style="list-style-type: none"> <li>• AM1 – Proposed Benchmark Intercomparison Study             <ul style="list-style-type: none"> <li>○</li> </ul> </li> </ul>			
<b>PUBLICATIONS</b>			
<p>Any publications that have</p> <ul style="list-style-type: none"> <li>• Completed your institution’s review cycle during the quarter</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Are publicly releasable</li> </ul> <p>Should be submitted to Marsha Henley, <a href="mailto:henleym@ornl.gov">henleym@ornl.gov</a> with your quarterly report.</p>			
<b>Quarter</b>	<b>Publication Reference</b> Example: Author, "Title", LA-UR-18-27731, October 1, 2019		
Q1			
Q2			
Q3			
Q4			



# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> IPD3 <b>M&amp;O Contractor Name:</b> LANL <b>Point of Contact Name:</b> Joetta Goda <b>Point of Contact Phone:</b> 505-667-2812/505-665-3487	<b>Reference:</b> DP0909010 <b>Date of Report:</b> October 30, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 0
2. Approved FY 2023 Budget = \$ 100,000
3. Total FY23 Budget w/Carryover = \$100,000

Q1	\$22,392	\$0	\$22,392
Q2	\$41,566	\$0	\$41,566
Q3	\$46,237	\$0	\$46,237
Q4	\$42,027	\$0	\$42,027

4. Projected carryover into FY 2024 = \$

**NOTE:** Include commitments as part of spending

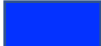
## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on IT support activities at NNSS (IPD3)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q2	Provide a status report on IT support activities at NNSS (IPD3)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q3	Provide a status report on IT support activities at NNSS (IPD3)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

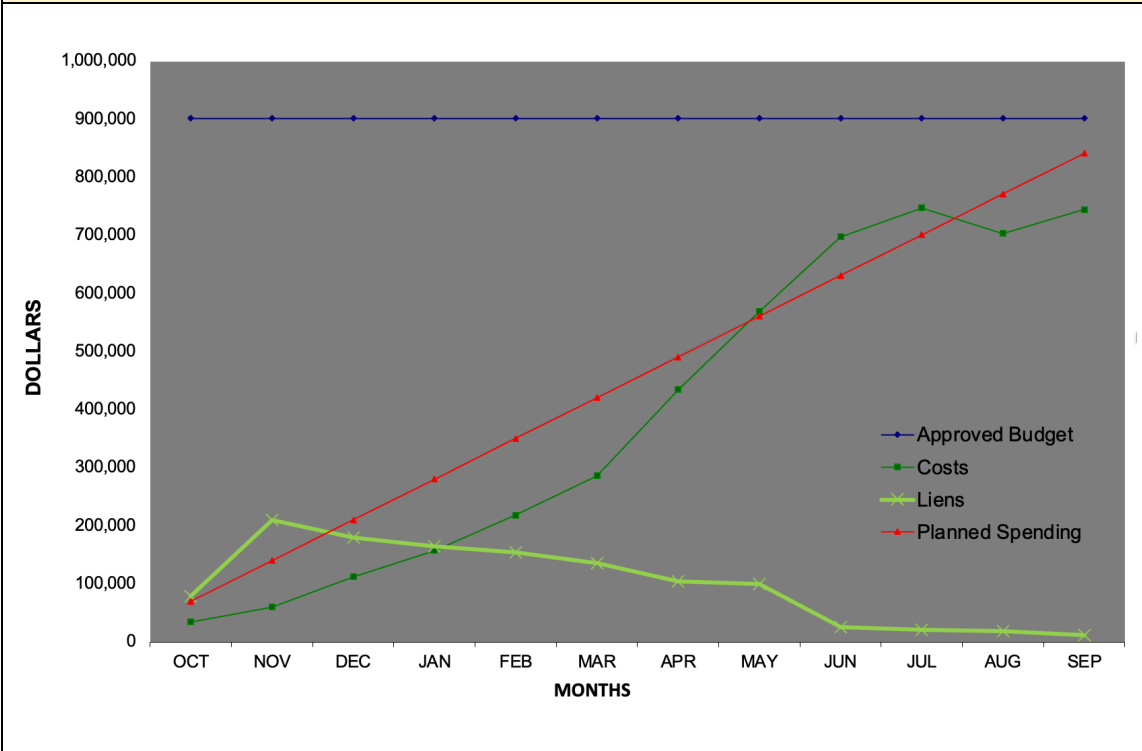
## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Provide a status report on IT support activities at NNSS (IPD3)		
<b>ACCOMPLISHMENTS</b>			
<ul style="list-style-type: none"> <li>• IPD3 – IT support at NNSS             <ul style="list-style-type: none"> <li>○ <i>JLON IT is in the process of making major upgrades to NTS SLAN, which should drastically improve access within the DAF.</i></li> <li>○ Continuing weekly visits to NCERC to troubleshoot issues.</li> <li>○ Replacing network switch to improve NCERC Count Room communication.</li> <li>○ Maintaining networks, security upgrades.</li> <li>○ Installing printer drivers, troubleshooting printer issues.</li> <li>○ Inspection of equipment for Control Room Upgrades.</li> <li>○ Laptop inspection.</li> </ul> </li> </ul>			
<b>PUBLICATIONS</b>			
<p>Any publications that have</p> <ul style="list-style-type: none"> <li>• Completed your institution’s review cycle during the quarter</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Are publicly releasable</li> </ul> <p>Should be submitted to Marsha Henley, <a href="mailto:henleym@ornl.gov">henleym@ornl.gov</a> with your quarterly report.</p>			
<b>Quarter</b>	<b>Publication Reference</b>		
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019		
Q1			
Q2			
Q3			
Q4			

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> IPD1, 2, 5, 6 <b>M&amp;O Contractor Name:</b> LLNL <b>Point of Contact Name:</b> Catherine Percher <b>Point of Contact Phone:</b> (925) 579-4226	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET



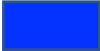















1. Carryover into FY 2023 = \$151,559
  2. Approved FY 2023 Budget = \$750,000
  3. Total FY23 Budget w/Carryover = \$901,559
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$112,918
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$112,665
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$411,339
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$46,928
  8. Carryover into FY 2024 = \$156,774
- NOTE:** Include commitments as part of spending
- NOTE: Q3 had some spurious charges (approximately \$105K of contract accruals that were not actually costed and should be returned to the IPD budget) which is why August and September saw a correction to spending.




## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="color: blue;">■</span>	On Schedule <span style="color: green;">■</span>	Behind Schedule <span style="color: yellow;">■</span>	Missed Milestone <span style="color: red;">■</span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)	<span style="color: blue;">■</span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP). (IPD1)		
Q1	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
Q1	Provide a status report on IT support at NNS (IPD5)		
Q1	Provide a status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		
Q2	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
Q2	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP). (IPD1)		
Q2	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
Q2	Provide a status report on IT support at NNS (IPD5)		
Q2	Provide a status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		
Q3	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
Q3	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP). (IPD1)		
Q3	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
Q3	Provide a status report on IT support at NNS (IPD5)		
Q3	Provide a status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		
Q4	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
Q4	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP). (IPD1)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
Q4	Provide a status report on IT support at NNSS (IPD5)		
Q4	Provide a status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		

### ACCOMPLISHMENTS

- **IPD1 - Conduct ICSBEP for Benchmarks of the 5-Year Plan and publish annual revision to the Handbook**
  - 2022 Version of the handbook was not finalized- will be combined with 2023 version for one handbook release
  - Review was finalized for three of four NCSP evaluations accepted at the April 2023 ICSBEP Meeting:
    - (1) LEU-COMP-THERM-111 (IER305): 7uPCX fuel with Mo sleeves (SNL)
    - (2) PU-MET-THERM-004 (IER480): TEX-Pu benchmark optimized for Polyethylene and Lucite thermal scattering, (LLNL)
    - (3) Chlorine Worth Study (LANL)
  - Review of final NCSP evaluation- HEU-MET-FAST-104 (IER488): MUSiC, HEU Critical and Subcritical Measurements (LANL)- expected Nov 2024
  - Review of additional LANL/JAEA collaboration experiment (HEU-MET-FAST-102) of Fast-Spectrum Critical Assemblies with a Pb-HEU Core Surrounded by a Copper Reflector expected Nov 2024
- **IPD2 - Maintain the NCSP Website and Systems**
  - Updated documents, links, calendars, taskings, newsletters, photos/portraits, created art for updated banners.
  - Maintained lists of email subscribers for various "group" emails used by NCSP management.
  - LFE: meetings and page build, still in development
  - Working on user survey questionnaire for NCSP site
  - Continue to update site to meet accessibility requirements
  - NCSP Primer to NCSP site (this is live)- *developer still has a few more things to address*
- **IPD5 - IT Support at NNSS**
  - Brian Musick retired in May 2023 - his replacement is currently uncleared, so classified IT support has been supplemented by LLNL main site personnel
  - Provided ISSM/ISSO and System Administrator support for Nevada IT including required weekly NTS-SLAN/NCERC system updates, monthly "authenticated" scans for NCERC network devices, and system upgrades as required. Created and renewed NTS-SLAN accounts throughout the quarter.
  - NTS-SLAN SharePoint site creation for user account creation/tracking (On-going)
  - Transitioning System Administrator role for NTS-LAN to LANL support team
  - Equipment inspection for NCERC transitioned to LANL support team
- **IPD6 - Benchmark Evaluation of LLNL 'Pulsed Spheres'**
  - S. Kim (retired, under Delphi contract) mentored A. Tamashiro to take over the pulsed sphere benchmark evaluation
  - A. Tamashiro presented first benchmark of LLNL pulsed spheres to SINBAD task force review at April 2023 meeting.

## NCSP Quarterly Progress Report (FY-2023 Q4)

### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter  
AND
- Are publicly releasable

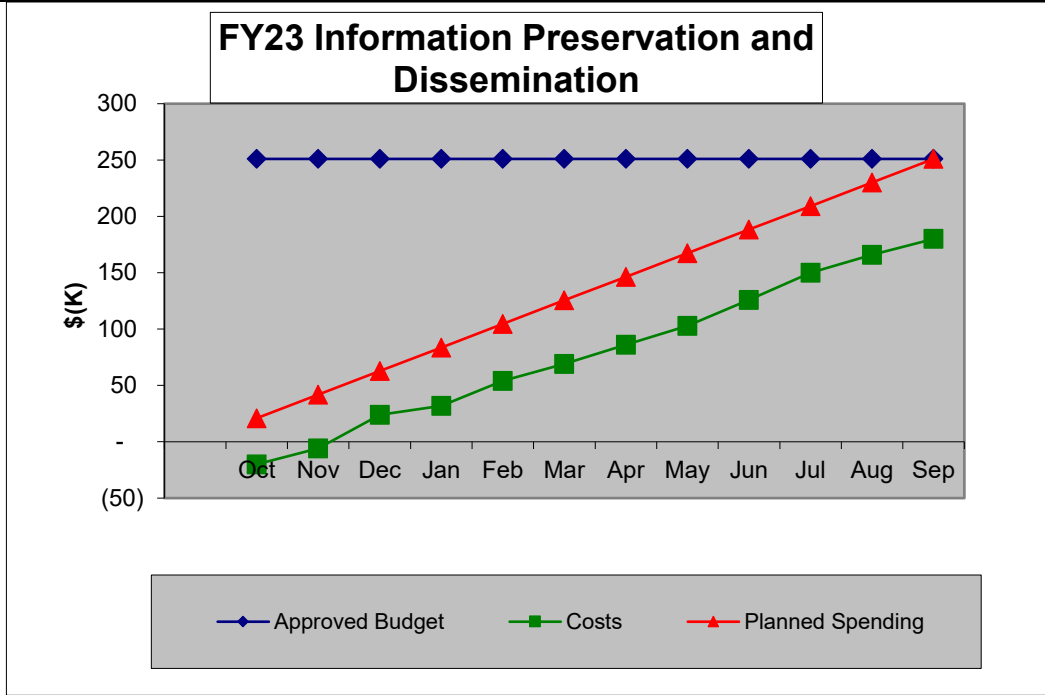
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	C. Percher, J. Bess, W. Marshall, et al, Abstract for "Status of the International Criticality Safety Benchmark Evaluation Project," LLNL-ABS-844502, International Conference on Nuclear Criticality Safety, Sendai, Japan (2023). J. Bess, C. Percher, W. Marshall, et al, "Engagement Opportunities in OECD NEA Benchmark Development," Frontiers in Energy Research: Nuclear Energy, February 2023. <a href="https://doi.org/10.3389/fenrg.2023.1085764">https://doi.org/10.3389/fenrg.2023.1085764</a>
	J. Bess, C. Percher, W. Marshall, et al, " Intrinsic value of the international benchmark projects, ICSBEP and IRPhEP, for Advanced Reactor Development," Frontiers in Energy Research: Nuclear Energy, March 2023. <a href="https://doi.org/10.3389/fenrg.2023.1085788">https://doi.org/10.3389/fenrg.2023.1085788</a>
Q3	None
Q4	none

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> IPD3, 4, 5 <b>M&amp;O Contractor Name:</b> ORNL <b>Point of Contact Name:</b> Doug Bowen <b>Point of Contact Phone:</b> (865) 576-0315	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 6, 2023
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## BUDGET



1. Carryover into FY 2023 = \$161K
2. Total Approved FY 2023 Budget w/Carryover = \$251K
3. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$24K
4. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$45K
5. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$57K
6. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$54K
7. Projected carryover into FY 2024 = \$26K (unallocated funding for IPD3/IPD4).

**NOTE:** Include commitments as part of spending




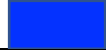






At the end of FY23, the following projects had commitments:

- OSTI Repository (IPD3) - \$20k commitment
- LFE Database (IPD4) - \$25.8k commitment

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on the development of the NCSP repository at OSTI.gov. (IPD3)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q1	Provide a status report on the development of the NCSP LFE database (IPD4)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide a status report about the progress on the HPRR benchmark. (IPD5)		
Q2	Provide a status report on the development of the NCSP repository at OSTI.gov. (IPD3)		
Q2	Provide a status report on the development of the NCSP LFE database (IPD4)		
Q2	Provide a status report about the progress on the HPRR benchmark (IPD5)		
Q3	Provide a status report on the development of the NCSP repository at OSTI.gov. (IPD3)		
Q3	Provide a status report on the development of the NCSP LFE database (IPD4)		
Q3	Provide a status report about the progress on the HPRR benchmark (IPD5)		
Q4	Provide a status report on the development of the NCSP repository at OSTI.gov. (IPD3)		
Q4	Provide a status report on the development of the NCSP LFE database (IPD4)		
Q4	Provide a status report about the progress on the HPRR benchmark (IPD5)		

### ACCOMPLISHMENTS

- IPD3 – Nuclear Criticality Safety Repository
  - Description of Project Services
    - OSTI.GOV will curate individual records associated with the Nuclear Criticality Safety Program (NCSP) to be made discoverable at OSTI.GOV.
  - Completed Work
    - In FY23 Q1-Q4, the NCSP project team analyzed 23,136 records, identified 13,313 useable records, and curated 2,960 existing or new records, including 813 technical reports, 2,033 conference products, 112 accepted manuscripts, one book, and one patent. In total, 3,134 records have been curated, including a small number during the end of FY22. This total also includes newer records not listed in the original bibliography, which the team has prioritized. During FYQ4 specifically, 250 technical reports, 909 Conference Products, and 43 Accepted Manuscripts were curated.



## NCSP Quarterly Progress Report (FY-2023 Q4)

- Future Work

- The analysis of the records listed on the bibliography to determine matches in the OSTI collection has been the most time-consuming aspect of the project thus far. With that completed, curation, or the completion of new records, is the focus going forward. The tables included below offer more detail from each quarter of FY23.

FY23Q4				
Product Type	Existing Curated	New Curated	FY23Q4 Totals	Project Cumulative
Tech Reports	247	3	250	829
Conference Products	858	51	909	2,191
Accepted Manuscripts	38	5	43	112
Patents	0	0	0	1
Books	0	0	0	1
<b>Totals</b>	<b>1,143</b>	<b>59</b>	<b>1,202</b>	<b>3,134</b>

- IPD4 – Learning from Experience (LFE) database

- In Q4, ORNL lead several meetings with the UK and IRSN collaborators to discuss the content of the Learning from Experience (LFE) Database based on our dedicated panel session at the Annual ANS meeting where Deb Hill (UK NNL), Doug Bowen (ORNL) and John Miller (SNL) provided information about the LFE database and requested feedback from the NCS community. Based on this feedback and subsequent discussions, the collaborators finalized the content of the LFE database and started working with LLNL website developer, Pam Williams, to provide a dedicated location off the IPD webpage on the NCSP website. We are currently reviewing test links from the NCSP website and are nearly ready to begin populating the tool with real event data from the domestic and international criticality safety community. The database should be implemented in late FY24Q1 or early Q2.

- IPD5 – Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation

- No further work on the HPRR benchmark evaluation translation to SINBAD during FY23 Q4. Funds are allocated for it to be completed during FY24 Q1 or Q2.

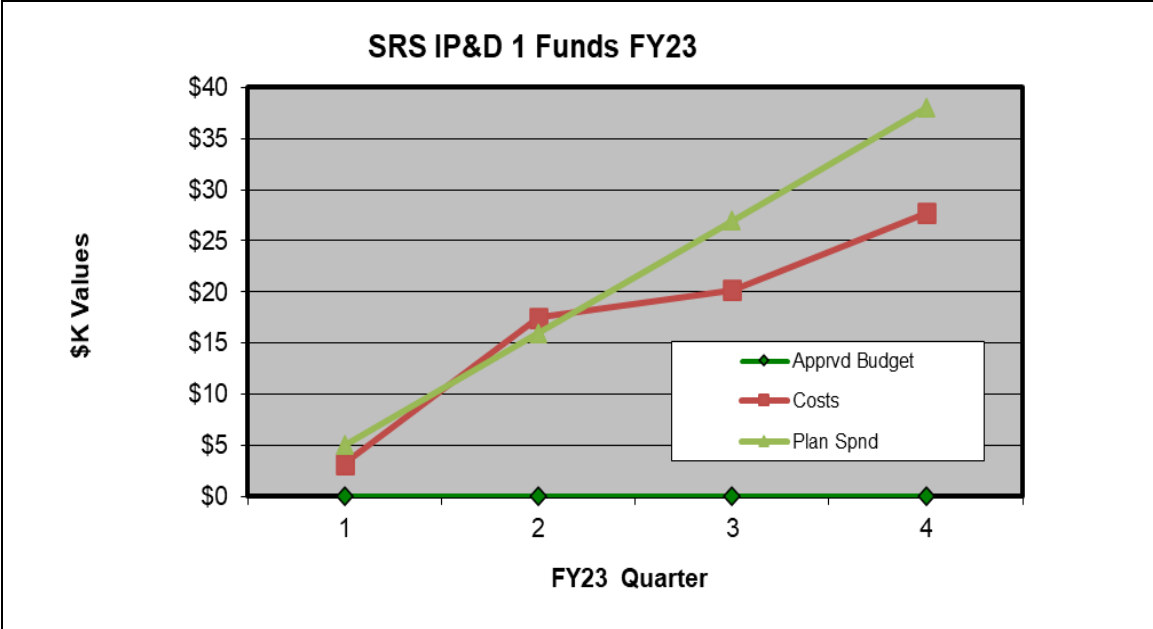
## PUBLICATIONS

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	None
Q2	John Mihalcz, Delayed Critical and Subcritical Experiments with Polyethylene Moderated Unreflected Thin 15 in. Diameter HEU Metal Plates, ORNL/TM-2022/2724, UT-Battelle, LLC, Oak Ridge National Laboratory (February 2023)
Q3	None
Q4	None

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> IPD1 <b>M&amp;O Contractor Name:</b> SRNS <b>Point of Contact Name:</b> Scott Finrock <b>Point of Contact Phone:</b> 803-557-1317	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November, 2023
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## BUDGET







1. Carryover into FY 2023 = \$ 40.5K
  2. Approved FY 2023 Budget = \$0K
  3. Total FY 2023 Budget w/Carryover = \$40.5K
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$3.2K
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$14.3K
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$2.7K
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$7.5K
  8. Projected carryover into FY 2024 = \$12.8
- NOTE:** Include commitments as part of spending

## MILESTONES

STATUS (copy color code and paste below in 'STATUS' field)			
Complete		On Schedule	
Behind Schedule		Missed Milestone	
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on progress with CritView. (IPD1)		More time has become available, so progress is being made.
Q1	NCSP Approved Scope for FY23. (IPD1)		Scope for FY22/FY23 has been approved
Q2	Provide status reports on progress with CritView. (IPD1)		No issues. Code work in progress.

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q3	Provide status reports on progress with CritView. (IPD1)		Code work in progress. Limited staff availability this quarter reduced spending. Still expect to meet goal in 4 <sup>th</sup> quarter.
Q4	Complete beta version of revised CritView code (IPD1)		Beta version is complete however limited staffing availability in September resulted in a somewhat reduced scope. This will be addressed during the testing period in FY2024 and covered by carry over.
Q4	Complete updated CritView database. (IPD1)		Database is complete and internal testing has started.
Q4	Provide status reports on progress with CritView. (IPD1)		Beta versions are complete and ready to begin testing in FY24.

### ACCOMPLISHMENTS

- IPD1 – ARH-600 Reissue (CritView)
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### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter
- AND
- Are publicly releasable

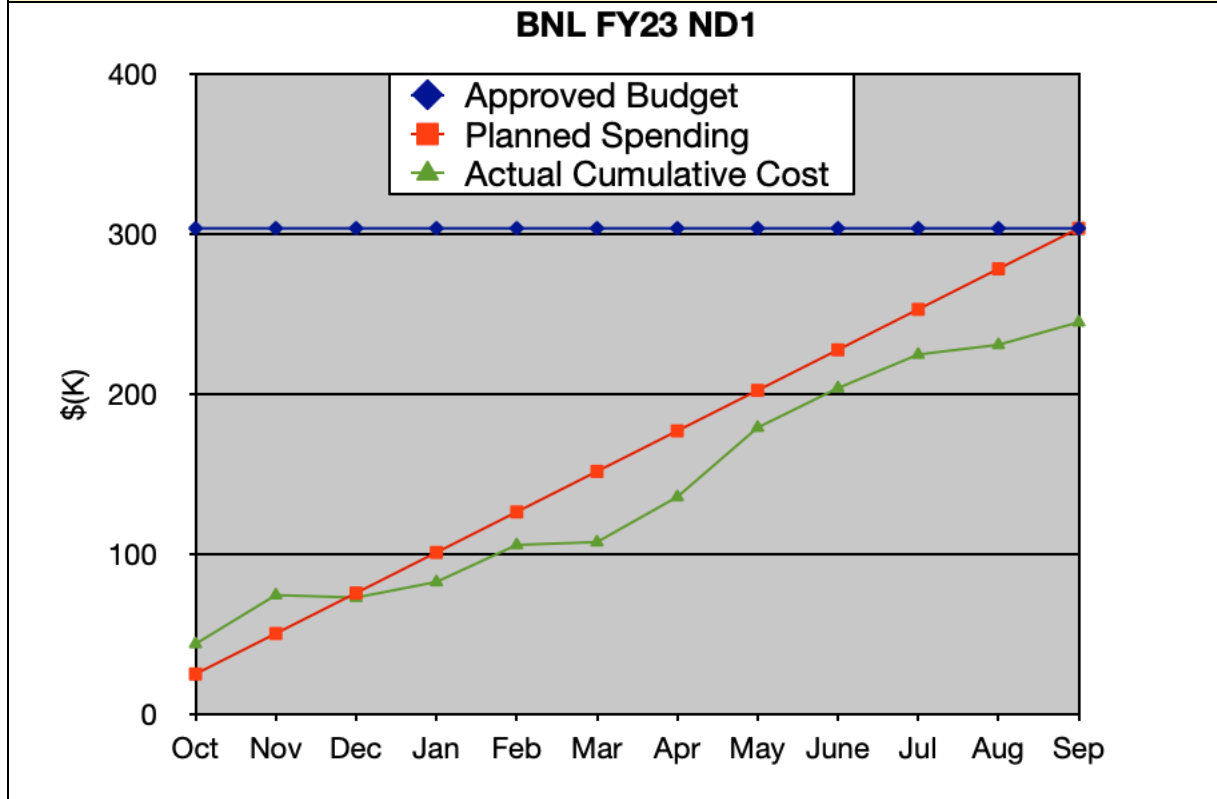
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	
Q3	
Q4	

# NCSP Quarterly Progress Report (FY-2023 Q4)






<b>NCSP Element and Subtask:</b> ND1 <b>M&amp;O Contractor Name:</b> BNL <b>Point of Contact Name:</b> Gustavo Nobre <b>Point of Contact Phone:</b> 631-344-5205	<b>Reference:</b> DP0909010 <b>Date of Report:</b> 2 November, 2023
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## BUDGET










1. Carryover into FY 2023 = \$ 13,754
  2. Approved FY 2023 Budget = \$ 290,000
  3. Total FY 2023 Budget w/Carryover = \$303,754
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$73,063
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$34,667
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$96,160
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$41,220
- Projected carryover into FY 2024 = \$58,644 **NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete 	On Schedule 	Behind Schedule 	Missed Milestone 
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	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		ADVANCE build reports simplified and condensed using Markdown format. Build reports are now generated on a per-commit basis to any ENDF development branch. The

## NCSP Quarterly Progress Report (FY-2023 Q4)

	on all nuclear data activities in the NCSP Quarterly Progress Reports. (ND1)		build reports contain information only on the changeset of a given commit. We are in final testing and should deploy in Q2.
<b>Q1</b>	If mandated by CSEWG, release new ENDF library. (ND1)		Released many versions of a preliminary ENDF/B-VIII.1-Beta0 for testing within the community. In parallel, refined and continued the review process aiming for a more comprehensive Beta1 release in the next quarter.
<b>Q2</b>	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 nuclear data activities in the NCSP Quarterly Progress Reports. (ND1)		The ADVANCE system has been successfully implemented in mirror repositories and should be fully deployed in Q3.
<b>Q2</b>	If mandated by CSEWG, release new ENDF library. (ND1)		Released Beta1 containing many updates for the neutron, FPY, alphas sublibraries. This was in the Make-It-Happen list. TSL could not get reviewed in time for Beta1, but should be released in Beta1.1 in the next quarter.
<b>Q3</b>	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 nuclear data activities in the NCSP Quarterly Progress Reports. (ND1)		Fully deployed ADVANCE and worked to significantly expand its capabilities.
<b>Q3</b>	If mandated by CSEWG, release new ENDF library. (ND1)		Released ENDF/B-VIII.1-Beta1.1 on April 18, including many TSL contributions and small fixes in the neutrons sublibrary. Continued the coordination, organization and review effort in preparation for a Beta 2 release.
<b>Q4</b>	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 nuclear data activities in the NCSP Quarterly Progress Reports. (ND1)		Fully-deployed ADVANCE collected feedback from the community and implemented improvements.
<b>Q4</b>	If mandated by CSEWG, release new ENDF library. (ND1)		Released ENDF/B-VIII.1-Beta2 on August 4, 2023, including all submitted contributions to neutrons sublibrary. Additionally, the Beta2 release included updates to TSL, alphas, electrons, gammas, fission yields, protons and tritons

## NCSP Quarterly Progress Report (FY-2023 Q4)

			sublibraries. Main challenges in the period were related to conflicting evaluations and review turnover times.
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### ACCOMPLISHMENTS

- Released and distributed ENDF/B-Beta2 on August 4, 2023. The release, which updated the neutrons, TSL, alphas, electrons, gammas, fission yields, protons and tritons sublibraries, contained many improvements among which we can highlight:
  - All files submitted to neutrons sublibrary were reviewed, fixed if needed, and incorporated into the release.
  - New version of 239,240,241Pu files recover performance in depletion benchmarks.
  - Pb evaluations were incorporated.
  - Work on missing distributions done by LLNL was incorporated.
  - Replaced specific reactions by dosimetry cross sections from IRDFF.
  - New TSL evaluation for polystyrene incorporated.
  - Format fix in all files of the electron-atomic sublibrary.
  - More than 200 evaluations from IAEA CRP for photonuclear sublibrary incorporated into release.
  - Fixes to fission yields, alphas, tritons, and protons sublibraries.
- Co-organized the Hackathon meeting hosted by LANL on August 6-8 to address and fix problems with the library.
- Special work was dedicated to conflict-handling of competing TSL evaluations. Organized an extraordinary meeting of the CSEWG Executive Committee with evaluators, experimentalist, data validators and specialists to assess the status and provide guidance for path forward,
- Coordinated the necessary post-Beta2 reviews, in preparation for Beta3.
- Organized contributions for the ENDF/B-VIII.1 accompanying paper.
- On the ADVANCE continuous integration system, we have implemented an automatic feature that provides users with an up-to-date catalog of ENDF artifacts on our repositories' Wikipedia pages. Additionally, we have addressed and rectified certain errors within ADVANCE that arose due to recent upgrades in various code runners.

### PUBLICATIONS

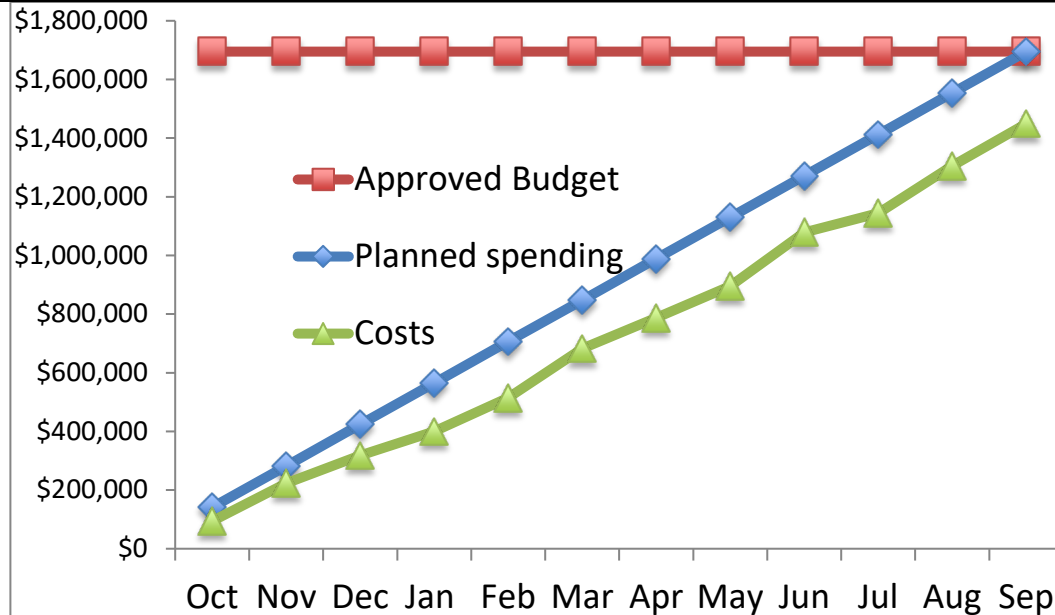
Any publications created during the quarter should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov).

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Minutes for the 2021 CSEWG Meeting - BNL-223530-2022-INRE	Yes	
Q2			
Q3	D. Brown, "CSEWG Meeting Minutes", BNL-224203-2023-INRE	Yes	
Q4			

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> ND1, 2, 2a, 2b <b>M&amp;O Contractor Name:</b> LANL <b>Point of Contact Name:</b> Joetta Goda/ Jen Alwin <b>Point of Contact Phone:</b> 505-667-2812/505-667-7252	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET


















1. Carryover into FY 2023 = \$ 145,000
  2. Approved FY 2023 Budget = \$ 1,550,000
  3. Total FY23 Budget w/Carryover = \$ 1,695,000
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$ 318,227 (\$0 commits)
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$ 364,505  
Sum = \$ 682,732 (\$0 commits)
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$ 395,729  
Sum = \$ 1,078,461 (\$0 commits)
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$ 370,703  
Sum = \$ 1,449,164 (\$0 commits)
  8. Projected carryover into FY 2024 = \$
- NOTE:** Include commitments as part of spending

## MILESTONES




STATUS (copy color code and paste below in 'STATUS' field)			
Complete	<span style="background-color: blue; color: white;">■</span>	On Schedule	<span style="background-color: green; color: white;">■</span>
		Behind Schedule	<span style="background-color: yellow; color: black;">■</span>
		Missed Milestone	<span style="background-color: red; color: white;">■</span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on LANL participation in US and International Nuclear Data collaborations. (ND1)	<span style="background-color: blue; color: white;">■</span>	
Q1	Conduct CSEWG Evaluation and Covariance sessions. (ND1)	<span style="background-color: blue; color: white;">■</span>	
Q1	Report data testing results with ENDF/B-VIII.0 and additional beta release cross sections at CSEWG. (ND1)	<span style="background-color: blue; color: white;">■</span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide a status report on Nuclear Data activities at LANSCE (ND2)		
Q1	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2a)		
Q1	Provide status report on Unresolved and Fast Measurements of Uranium-233 (n,gamma) (ND2b)		
Q2	Provide a status report on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q2	Provide a status report on Nuclear Data activities at LANSCE (ND2)		
Q2	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2a)		
Q2	Provide status report on Unresolved and Fast Measurements of Uranium-233 (n,gamma) (ND2b)		
Q3	Provide a status report on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q3	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2a)		
Q3	Provide a status report on Nuclear Data activities at LANSCE (ND2)		
Q3	Provide status report on Unresolved and Fast Measurements of Uranium-233 (n,gamma) (ND2b)		
Q4	Provide a status report on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q4	Deliver nuclear data evaluations as indicated in Appendix B of the Five-Year plan. (ND1)		
Q4	Provide a status report on Nuclear Data activities at LANSCE (ND2)		
Q4	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2a)		



## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Obtain final experimental results for Pu-240 PFNS at LANSCE, finalize data analysis, and deliver data to evaluators (ND2a)		
Q4	Provide status report on Unresolved and Fast Measurements of Uranium-233 (n,gamma) (ND2b)		
Q4	Finalize acquisition of U-233 thick target capture data, finalize data analysis, and deliver data to evaluators (ND2b)		

## ACCOMPLISHMENTS

- ND1 – Nuclear Data Evaluation and Testing
  - Light Nuclei
    - 6Li: work on covariances (ongoing)
    - 9Be: integral testing (Danon RPI, MMF, PMF, HMF) on our version ENDF/B-VIII.1-beta2 is in progress. The R-Matrix extension up to 10 MeV objective has been attained for elastic and total cross sections (and some angular distributions).
    - 16O: new publication in Phys. Rev. C (just accepted)
    - n+12C (most of the n+C cross section at almost all energies): The new analysis goes up to about 8 MeV and includes contributions from the alpha+9Be channel. It gives a good fit to almost all the data included, except for a region around 6.3 MeV where it disagrees with new 12C(n,n'gamma)12C\* data from the CoGNAC detector. The total cross section has come down by > 1% at energies below 1 MeV. (work relevant to but not funded by NCSP).
  - 35Cl evaluation (FY23 work funded by GAIN):
    - We produced a new evaluation of 35Cl, which includes recent experimental data of (n,p) reaction at LENZ/LANSCE. Since there was a large gap of the (n,p) cross section in the 500keV to 1MeV region between the experimental data and the ENDF/B-VIII.0 evaluation due to undetermined proton widths in the resolved resonance parameters, we provided a background (n,p) component to fill this gap. We confirmed that NJOY can process the new file.
  - Evaluation of 139La:
    - Created the file with the new evaluation in the fast region. The merger with the new evaluation of the resonance parameters has been postponed, as ORNL is still working on it. We expect to have a complete file in FY24 Q1. This will also include covariances for the fast region. In FY23 Q4 we have finished all the charged particle channels, describing available experimental data with the same or better accuracy, and extending the evaluation to 30 MeV incident neutron energies. In the figure below we show our proposal for charged-particle channel evaluation (denoted by CoH). These results have been included in Ionel Stetcu's presentation to ICNC 2023

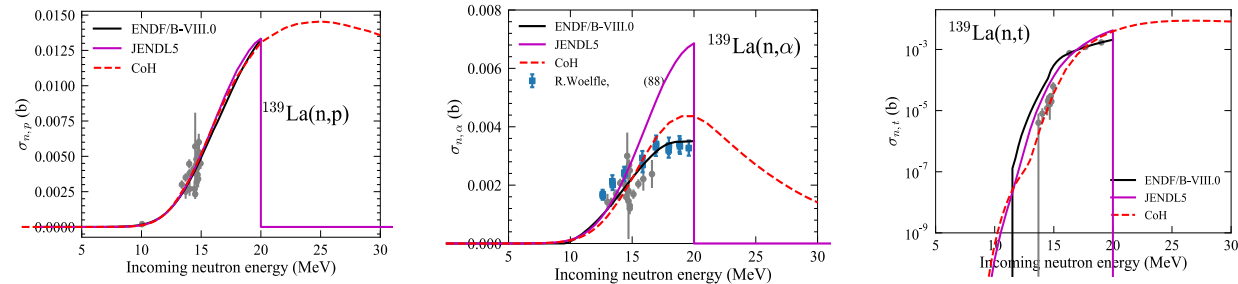
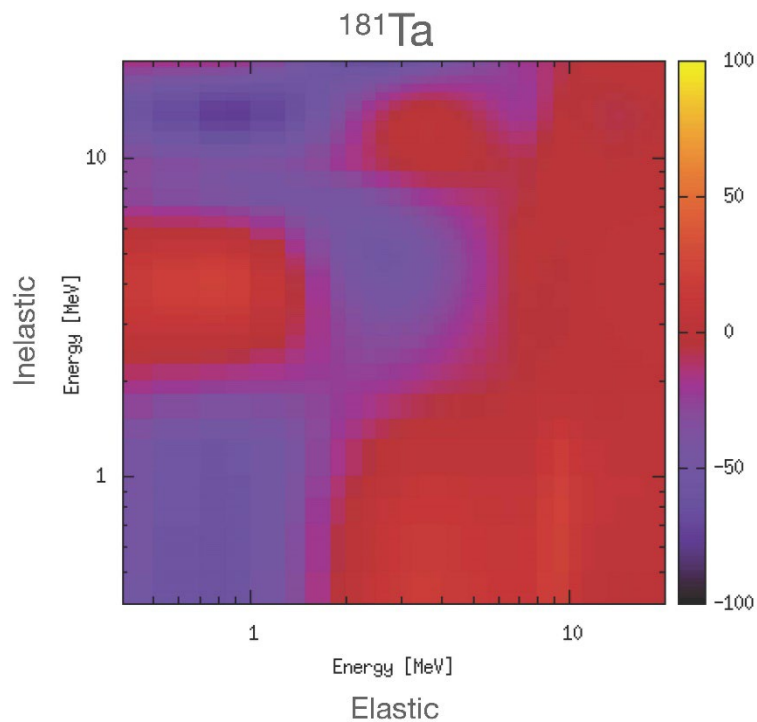


Figure 1: Neutron-induced reactions for  $^{139}\text{La}$ , charged-particle production channels. Comparison between existing evaluations (ENDF/B-VIII.0, and JENDL5) and our proposed evaluation (CoH).

(Sendai, Japan, October 1-6, 2023). The full paper published in the proceedings and the presentation are attached separately.

## NCSP Quarterly Progress Report (FY-2023 Q4)

- Ta181 evaluation updates:
  - Fine tuning of Ta181(n,2n) reaction, especially at energies above threshold where the new evaluation has been overestimating experimental data. Improvement has been achieved by 2% adjustment of two optical model parameters for emission of a second neutron. Thus, the entire fast Ta181 evaluation is still defined by the input to the reaction model code.
  - Adding discrete gamma transitions from (n,g), (n,n'), (n,p), (n,a), (n,d), (n,t) and (n,3He) reactions to the evaluation – an essential upgrade of the gamma spectra (previously discrete gammas were smeared over energy bins).
  - Slight modifications of covariances for Ta181 evaluation by allowing for scaling of absorption cross section.
  - Work advanced on new routine to format cross-reaction correlations produced by Kalman filter. See current results below for the correlation between elastic and inelastic scattering:



- Actinides
  - Pu-238, Pu-240, Pu-241, Pu-242 “Attempt a consistent nu-bar evaluation supported by a model code to provide better evaluated nu-bar for minor Pu-isotopes”

## NCSP Quarterly Progress Report (FY-2023 Q4)

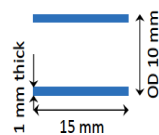
- Using the sensitivities from CGMF calculated in Q3, a consistent evaluation for 238-242Pu was performed. The CGMF parameter values were run through CGMF and other prompt observables were compared to experimental data where available.
- The multi-chance fission probabilities were further investigated using updated CoH calculations. Baseline calculations were run with these new probabilities, but the evaluated nubar values changed only negligibly.
- Additional parameter sensitivities were calculated using CGMF to take into account compound mass dependence for the pre-fission mass distribution and spin cut off parametrization.
- These sensitivities, baseline nubar, and baseline parameter values were used for another evaluation that is slightly improved. We performed a detailed UQ of all experimental data and extended the evaluation algorithm in the code ARIADNE to cover multiple isotopes. Evaluated nu-bar with the consistent modeling are close for Pu-239-241 to experimental data and ENDF/B-VIII.0 up to third chance fission.
- Larger differences to ENDF/B-VIII.0 are observed for Pu-238 and Pu-242 but it is unclear which evaluation is more realistic given the scarcity of differential data. Benchmarking studies in the next fiscal year will help us assess whether proposed changes are acceptable and the impact of cross-isotope covariances are going to be explored for a FY24 milestone.
- Our references this quarter include two reports that have been written about 1) the updates to CGMF for the consistent calculation of the Pu isotopes and 2) the evaluation effort.
  - 238U “Finalize prompt fission neutron spectra based on LANSCE Chi-Nu Data”
    - We finished experimental data uncertainty quantification. Model calculations were executed and model parameter uncertainties were quantified. All input needed for the evaluation has been created and the evaluation is underway.
    - Attached publication: Presentation by D. Neudecker, “238U PFNS evaluation Update” (LA-UR-23-30805).
- Validation: Nuclear Data Evaluation and Testing
  - Continued validation of ENDF/B-VIII.1beta2 with LLNL pulsed sphere neutron leakage spectra.
  - Attached publication: D. Neudecker, Validating ENDF/B-VIII.1beta2 with LLNL pulsed-sphere neutron-leakage spectra (LA-UR-23-30377).
- ND2 – Nuclear Data Measurements at LANSCE
  - Work Towards Fabricating a <sup>239</sup>Pu Sample for Measurements with DICER
    - Two batches of highly enriched 239Pu in plutonium chloride chemical format (PuCl3) referred to as “Clinton Pu” have been chemically purified. The two batches contain 3x10<sup>-4</sup> and 6x10<sup>-4</sup> atoms/barn. The 239Pu material was dissolved in deuterated hydrochloric acid (DCI). Currently the material is purified, chemically stable and dehydrated. Once the neutron beams is delivered, the material will go in solution again and dispensed in Teflon canisters that were designed for this specific experiment. The canisters are shown below.

## NCSP Quarterly Progress Report (FY-2023 Q4)

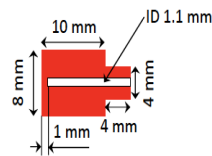
DICER canister



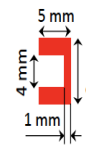
aluminum tube



teflon canister



teflon cup



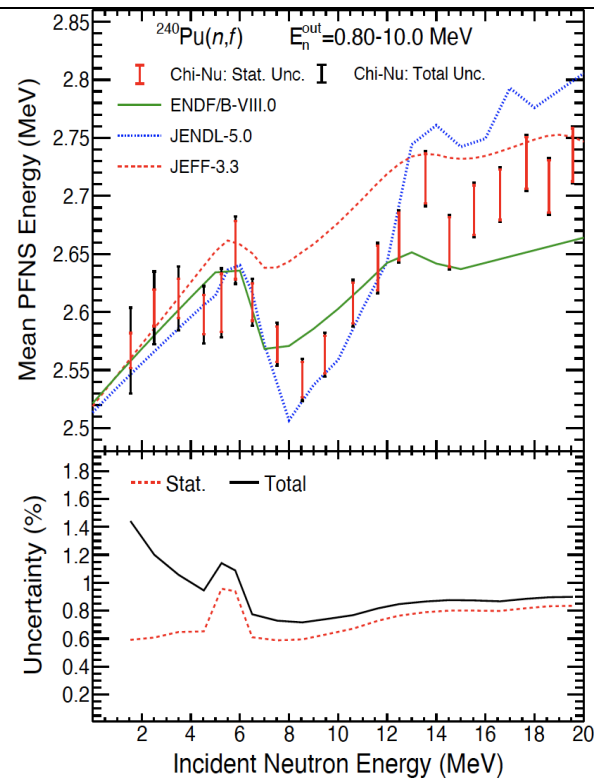
- Analysis of  $^{143}\text{Nd}(n,\gamma)$  Cross Sections from DANCE
  - The R-Matrix analysis of the  $^{143}\text{Nd}(n,\gamma)$  data measured with DANCE at LANSCE (LANL) and other previous transmission and capture measurements from has been finalized. A total number of 98 resonances were observed in this work in the energy region from 10 eV up to 3.5 keV, while 77 resonances were reported in ENDF/B-VIII.0 and in JEFF-3.3 in the same region, and 73 resonances were reported in JENDL-5.0. The spin separation method used to produce capture cross section data for the two spins allows a clear identification of the correct spin of the resonances, improving the information given in the evaluations where the spin of resonances was randomly assigned. From the 98 resonances observed in this work, 51 resonances have  $J = 3$  and 46 have  $J = 4$ . Compared to this work, ENDF/B-VIII.0 reports a different spin on 23 resonances, JEFF-3.3 does it in 25, and JENDL-5.0 provides a different spin on 26 resonances. The data have been corrected for the missing levels using the method from Fuketa and Harvey.
- Analysis of  $^{149}\text{Sm}(n,\gamma)$  Cross Sections from DANCE and  $^{149}\text{Sm}(n,\text{tot})$  Cross Sections from DICER
  - $^{149}\text{Sm}$  has a thermal capture cross section of 40 kb and is an important stable fission product (FP) for burnup credit.  $^{149}\text{Sm}$  builds up in power reactor fuel but does not decay out of spent nuclear fuel. Total and capture cross sections,  $\sigma_{\gamma}$  and  $\sigma_{\text{tot}}$  respectively, have been identified as inadequate for burnup credit applications. With regard to benchmark performance, critical experiment model calculations indicate an under-prediction of the  $^{149}\text{Sm}$  worth and reactivity worth measurements indicate that the calculated  $^{149}\text{Sm}$  capture rate underestimates measured capture rates for Pressurized Water Reactor (PWR) experiments by 4.8%. Based on the assessment, total and capture  $^{149}\text{Sm}$  cross-section measurements are needed from 10–5 eV and extending through the resonance region. The DANCE (Detector for Advances Neutron Capture Experiments) and DICER (Device for Indirect Capture Experiments on Radionuclides) instruments were used previously at the Los Alamos Neutron Science Center (LANSCE) to measure spin separated  $\sigma_{\gamma}$  and neutron transmission, respectively using the time-of-flight technique. A combined R-Matrix analysis has been performed to extract resonance parameters. Data have been collected and analyzed from 8 – 520 eV for capture and 0.8 meV - 1.5 keV for

## NCSP Quarterly Progress Report (FY-2023 Q4)

transmission. Resonance parameters have been extracted up to 520 eV. Significant discrepancies have been observed with evaluation libraries.

- Perform PFNS Measurements of U-233 at Chi-Nu
  - We have caused a small amount of funding to be sent to LLNL this FY to begin procurement of parts for the PPAC, which will be completed during FY24.
  - We have obtained a quote to purchase the U-233 material and a procurement is in process at Los Alamos. The material we were quoted is 99.98% U-233. The order was placed early in FY24.
- ND2a – Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium 240
  - The data analysis for the  $^{240}\text{Pu}(n,f)$  PFNS was finalized and delivered to Denise Neudecker and Amy Lovell for evaluation. A spectrum of the average PFNS energy over the measured range as a function of incident neutron energy is shown below.
  - As was previously evident from the preliminary analysis, these results show the first-ever measurement of multi-chance fission and pre-equilibrium neutron emission preceding fission. Experimenter - evaluator communication and iteration will continue as the evaluation milestone work progresses.

## NCSP Quarterly Progress Report (FY-2023 Q4)



- ND2b - Unresolved and Fast Measurements of U233 (n, gamma)
  - Task complete.
- Additional Publications and International Collaborations
  - D. Neudecker et al.: “Contributions for ENDF/B-VIII.1 Paper” (LA-UR-23-28517, NDS). Describes NCSP evaluations and validation.
  - D. Neudecker et al.: “Templates of expected measurement uncertainties” (LA-UR-23-23484, accepted EPJ-N). U-235 nu-bar UQ for NCSP.

## PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter
- AND
- Are publicly releasable

Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

## NCSP Quarterly Progress Report (FY-2023 Q4)

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	D. Neudecker, " <sup>239</sup> Pu and <sup>235</sup> U PFNS and nu-bar covariances", <b>LA-UR-22-31319</b> , Presented at CSEWG meeting November 2022.
Q1	D. Neudecker, "New nuclear data proposed for the <sup>238</sup> U nu-bar, <sup>235</sup> U nu-bar and PFNS", <b>LA-UR-22-31314</b> , Presented at CSEWG meeting November 2022.
Q1	D. Neudecker, "ENDFB/VIII.1beta0 testing with LLNL Pulsed Spheres", <b>LA-UR-22-31317</b> , Presented at CSEWG meeting October 31, 2022.
Q1	N. Kleedtke, S. Kahler, W. Haeck, D. Neudecker, "Validation of ENDF/B-VIII.1-β0-based Continuous Energy Data Tables", <b>LA-UR-22-31596</b> , Presented at CSEWG meeting November 2022.
Q2	D. Neudecker, A. Lovell, K. Parsons, N. Gibson, P. Talou, "Release of 239Pu and 235U PFNS and nu-bar Covariances" <b>LA-UR-23-20728</b> .
Q3	Denise Neudecker, "Covariance testing and update on 239Pu and 235U PFNS covariances," <b>LA-UR-23-24329</b> , Presented at April 2023 Mini-CSEWG meeting.
Q3	Denise Neudecker, "Validating ENDF/B-VIII.1beta1 with LLNL pulsed-sphere neutron-leakage spectra," <b>LA-UR-23-24085</b> , Presented at April 2023 Mini-CSEWG meeting.
Q3	Athanasios Stamatopoulos, Paul E. Koehler, Esther Leal Cidoncha, Aaron Joseph Couture, Gencho Y. Rusev, and John Leonard Ullmann, " Study of 149Sm capture and total cross sections for burnup credit applications," <b>LA-UR-23-25695</b> , Presented at International Workshop On Nuclear Data Evaluation for Reactor Applications (WONDER) (Aix-En-Provence, France).
Q3	Esther Leal Cidoncha, Athanasios Stamatopoulos and Paul Koehler, " R-Matrix analysis of the neutron-induced cross sections on 143Nd and 147,149Sm measured at LANSCE," <b>LA-UR-23-26588</b> , Presented at 2023 R-matrix Workshop on Methods and Applications.
Q3	E. Leal-Cidoncha , A. Couture, E. M. Bond, T. A. Bredeweg , C. Fry , T. Kawano , A. E. Lovell , G. Rusev, I. Stetcu , J. L. Ullmann, L. Leal, and M. T. Pigni, " Measurement of the neutron-induced capture-to-fission cross section ratio in 233U at LANSCE," <b>LA-UR-23-20578</b> (also Phys. Rev. C 108, 014608 (2023)).
Q4	Denise Neudecker, "238U PFNS evaluation update," Los Alamos National Laboratory report <b>LA-UR-23-30805</b> .
Q4	Denise Neudecker, "Validating ENDF/B-VIII.1beta2 with LLNL pulsed-sphere neutron-leakage spectra," Los Alamos National Laboratory report <b>LA-UR-23-30377</b> .
Q4	Ionel Stetcu, T. Kawano, A. E. Lovell, M. Herman, M. R. Mumpower, E. Leal-Cidoncha, and A. Couture, "Consistent Nuclear Data Evaluations for Criticality Safety," <b>LA-UR-23-25362</b> , full paper submitted to ICNC2023.
Q4	Ionel Stetcu, T. Kawano, A. E. Lovell, M. Herman, M. R. Mumpower, E. Leal-Cidoncha, and A. Couture, "Consistent Nuclear Data Evaluations for Criticality Safety," <b>LA-UR-23-30829</b> , presentation at ICNC2023.
Q4	D. Neudecker, et al., "Templates of Expected Measurement Uncertainties," <b>LA-UR-23-23484</b> , accepted in EPJ Nuclear Sciences & Technologies.
Q4	D. Neudecker, R.J. Casperson, A. Lovell, N. Gibson, W.J. Marshall, K. Parsons, and P. Talou, "Contributions for ENDF/B-VIII.1 Paper," Los Alamos National Laboratory report <b>LA-UR-23-28517</b> .
Q4	Amy Lovell and Denise Neudecker, "Fitting nu-bar for minor Pu isotopes," Los Alamos National Laboratory report LA-UR-23-31009.



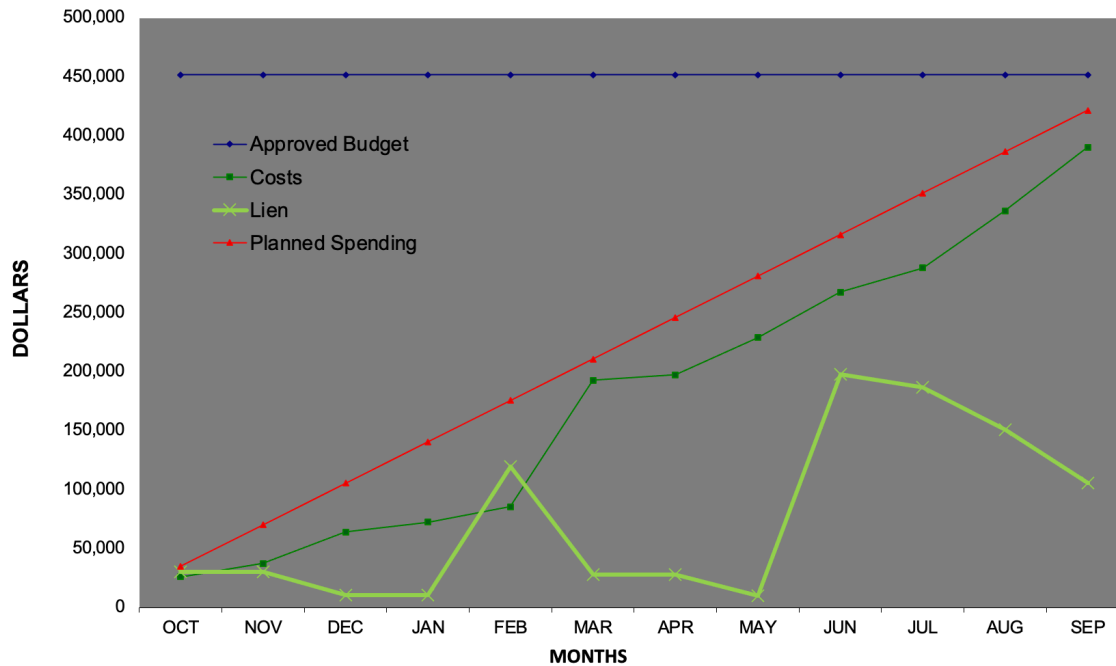
# NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Amy Lovell, Ionel Stetcu, Patrick Talou, and Toshihiko Kawano, "Baseline CGMF calculations for Pu isotopes," Los Alamos National Laboratory report LA-UR-23-31012.
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# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> ND9, 12 <b>M&amp;O Contractor Name:</b> LLNL <b>Point of Contact Name:</b> Catherine Percher <b>Point of Contact Phone:</b> (925) 579-4226	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET



1. Carryover into FY 2023 = \$76,734
  2. Approved FY 2023 Budget = \$375,000
  3. Total FY23 Budget w/Carryover = \$421,734
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$64,059
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$128,739
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$74,844
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$122,728
  8. Carryover into FY 2024 = \$61,363
- NOTE:** Include commitments as part of spending







## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="background-color: blue; color: white; padding: 2px 5px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px 5px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px 5px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px 5px;"> </span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on Li-Doped Liquid Scintillator Array for Fission Correlations (ND9)	<span style="background-color: blue; color: white; padding: 2px 5px;"> </span>	
Q1	Provide a status report on thermal scattering law evaluations and methods development (ND12)	<span style="background-color: blue; color: white; padding: 2px 5px;"> </span>	NCSU had to delay work in December because we could not fund the contract due to funding timing.

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide a status report on Li-Doped Liquid Scintillator Array for Fission Correlations (ND9)		
Q2	Provide a status report on thermal scattering law evaluations and methods development (ND12)		
Q3	Provide a status report on Li-Doped Liquid Scintillator Array for Fission Correlations (ND9)		
Q3	Provide a status report on thermal scattering law evaluations and methods development (ND12)		
Q4	Provide a status report on Li-Doped Liquid Scintillator Array for Fission Correlations (ND9)		
Q4	Provide a status report on thermal scattering law evaluations and methods development (ND12)		

### ACCOMPLISHMENTS

- **ND9 – Scoping Study: Li-6 Doped Liquid Scintillator Array for Fission Correlations**

- Adjusted detector configuration model to improve the gamma energy containment, which helps considerably in discriminating the fission reaction channel from the scatter channels. The analysis can identify fissions correctly 98% of the time and reject scatters 95% of the time currently and a separate machine learning analysis performs similarly. Study has examined tripling the 6Li content of the detector to the theoretical limit of a new scintillator developed at LLNL which greatly increases the accuracy of the nubar measurement based on captures only. Completed neutron energy, angle, and nubar analyses based on the fast neutron signatures in the detector as well. All studies for 5 energy incident neutrons between 1 and 5 MeV incident on <sup>239</sup>Pu. The report is being drafted and expected in November 2024.

- **ND12 – Thermal Scattering Law Evaluations and Methods Development**

*Generation and Benchmarking of Thermal Neutron Scattering Cross Sections in Support of Advanced Nuclear Reactor Concepts*

- NCSU completed evaluation of TSL evaluation of paraffin (NCSP's Appendix B material for FY 2022 and 2023) for both amorphous and crystalline microstructures. At this stage, validation is ongoing and related cross sections are being examined.
- NCSU continued work on the TSL evaluations that will be part of ENDF/B-VIII.1 release (see past QPRs for a listing of the specific evaluations). The PuO<sub>2</sub> TSL evaluation was submitted to NNDC. Initial work for uranium silicide is underway.

*Development and Implementation of a Modern Doppler Broadening Approach Including Atomic Binding Effects*

- NCSU continued integration of the Doppler broadening operation into FLASSH. The FLASSH GUI was updated to allow the user to perform this operation while using FLASSH evaluated TSL data.

*Development and Implementation of Machine Learning Methods for Thermal Scattering Law Evaluations*

- NCSU initiated testing and linked the CDFs of the NeTS modules to the Serpent Monte Carlo simulation tool. The generated NeTS cross section data is consistent with ACE data. The logistics and speed of executing Serpent-NeTS analysis are being optimized.

### PUBLICATIONS

## NCSP Quarterly Progress Report (FY-2023 Q4)

<p>Any publications that have</p> <ul style="list-style-type: none"> <li>Completed your institution's review cycle during the quarter</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Are publicly releasable</li> </ul> <p>Should be submitted to Marsha Henley, <a href="mailto:henleym@ornl.gov">henleym@ornl.gov</a> with your quarterly report.</p>	
Quarter	Publication Reference
	<p><b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019</p>
Q1	Laramee, B.K., N.C. Fleming, and A.I. Hawari, "Implementation of TSL Evaluations Beyond the Incoherent Approximation," Presentation to CSEWG, November 1, 2022
	Fleming, N.C., J. P. W. Crozier, B. K. Laramee, and A. I. Hawari, "TSL Nuclear Fuel Evaluations and Capabilities at NC State University," Presentation to CSEWG, November 1, 2022
	Crozier, J.P.W. and A.I. Hawari, "Neural Thermal Scattering (NeTS) Modules for Graphite & Beryllium," Presentation to CSEWG, November 1, 2022
Q2	E. Lee, N. C. Fleming, Ayman I Hawari, "Benchmark of Neutron Thermalization in Graphite Using a Pulsed Slowing-Down-Time Experiment," <i>Nuclear Science and Engineering</i> , <a href="https://doi.org/10.1080/00295639.2022.2162789">https://doi.org/10.1080/00295639.2022.2162789</a> , 2023
	N. C. Fleming, ..., Ayman I. Hawari, "FLASSH 1.0: Thermal Scattering Law Evaluation and Cross Section Generation for Reactor Physics Applications," <i>Nuclear Science and Engineering</i> , 2023. <b>(Accepted)</b> .
Q3	J. P. W. Crozier, A. I. Hawari, "Ab Initio Evaluation of Plutonium Dioxide $S(\alpha, \beta)$ and Thermal Neutron Cross Sections," <i>Transactions of the American Nuclear Society</i> , 2023.
Q4	J. Gil, A.I Hawari, "Evaluation of Thermal Neutron Scattering Cross Section of Uranium Silicide with Ab Initio Lattice Dynamics," <i>Transactions of the American Nuclear Society</i> , 2023.
	J. P. W. Crozier, A. I. Hawari, "Phonon-informed Neural Thermal Scattering (NeTS) Optimization for Crystalline Graphite and Beryllium Metal ," <i>Transactions of the American Nuclear Society</i> , 2023.
	T. Ahmed, B.K. Laramee, A. I. Hawari, "Thermal Scattering Law Data Development for Paraffin Wax," <i>Transactions of the American Nuclear Society</i> , 2023.

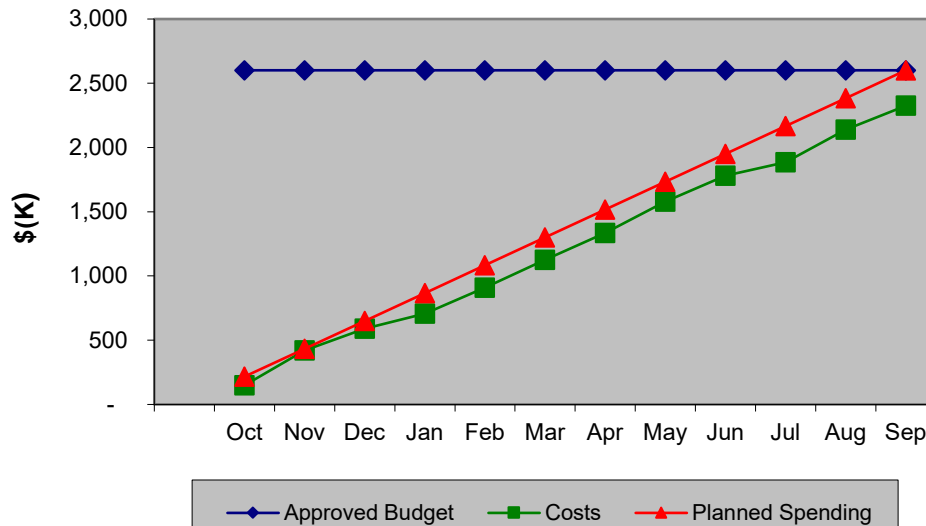
J. P. W.  
Nuclea

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> ND1, 2, 3, 4, 6, 9, 11 <b>M&amp;O Contractor Name:</b> ORNL <b>Point of Contact Name:</b> Doug Bowen <b>Point of Contact Phone:</b> (865) 576-0315	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 6, 2023
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## BUDGET

**FY23 Nuclear Data**



1. Carryover into FY 2023 = \$89K
  2. Approved FY 2023 Budget = \$ 2,601K (includes carryover)
  3. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$591K
  4. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$534K
  5. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$656K
  6. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$544K
  7. Projected carryover into FY 2024 = \$286K
- NOTE:** No funds committed for ND.




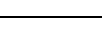









## MILESTONES

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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on all Nuclear Data measurement activities (ND1)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q1	Provide a status report 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 (ND1)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

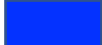



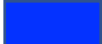
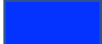







## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		
Q1	Provide a status report on all Nuclear Data evaluation and testing activities (ND2)		
Q1	Provide a status report 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 (ND2)		
Q1	Complete cross-section evaluation deliverables per the nuclear data schedule in Appendix B (ND2)		
Q1	Provide a status report on all isotopic sample lease activities (ND3)		
Q1	Provide a status report on all thermal neutron scattering measurement and analysis activities (ND4)		
Q1	Provide a status report on all SAMMY nuclear data evaluation code modernization activities (ND6)		
Q1	Provide a status report on evaluation of thermal and resolved resonance ranges of UO2 and PUO2 activities (ND9)		
Q1	Provide a status report on thermal neutron scattering measurements and evaluations for DHS applications at temperature activities (ND11)		
Q2	Provide a status report on all Nuclear Data measurement activities (ND1)		
Q2	Provide a status report 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 (ND1)		
Q2	Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		
Q2	Provide a status report on all Nuclear Data evaluation and testing activities (ND2)		

## NCSP Quarterly Progress Report (FY-2023 Q4)



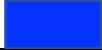

Q2	Provide a status report on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
Q2	Complete cross-section evaluation deliverables per the nuclear data schedule in Appendix B (ND2)		
Q2	Provide a status report on all isotopic sample lease activities (ND3)		
Q2	Provide a status report on all thermal neutron scattering measurement and analysis activities (ND4)		
Q2	Provide a status report on all SAMMY nuclear data evaluation code modernization activities (ND6)		
Q2	Provide a status report on evaluation of thermal and resolved resonance ranges of UO2 and PUO2 activities (ND9)		
Q2	Provide a status report on thermal neutron scattering measurements and evaluations for DHS applications at temperature activities (ND11)		
Q3	Provide a status report on all Nuclear Data measurement activities (ND1)		
Q3	Provide a status report 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 (ND1)		
Q3	Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		
Q3	Provide a status report on all Nuclear Data evaluation and testing activities (ND2)		
Q3	Provide a status report 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 (ND2)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q3	Complete cross-section evaluation deliverables per the nuclear data schedule in Appendix B (ND2)		
Q3	Provide a status report on all isotopic sample lease activities (ND3)		
Q3	Provide a status report on all thermal neutron scattering measurement and analysis activities (ND4)		
Q3	Provide a status report on all SAMMY nuclear data evaluation code modernization activities (ND6)		
Q3	Provide a status report on evaluation of thermal and resolved resonance ranges of UO2 and PUO2 activities (ND9)		
Q3	Provide a status report on thermal neutron scattering measurements and evaluations for DHS applications at temperature activities (ND11)		
Q4	Provide a status report on all Nuclear Data measurement activities (ND1)		
Q4	Provide a status report 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 (ND1)		
Q4	Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		Resume experiments in 2024 after GELINA repair.
Q4	Provide a status report on all Nuclear Data evaluation and testing activities (ND2)		
Q4	Provide a status report 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 (ND2)		
Q4	Complete cross-section evaluation deliverables per the nuclear data schedule in Appendix B (ND2)		
Q4	Provide a status report on all isotopic sample lease activities (ND3)		



## NCSP Quarterly Progress Report (FY-2023 Q4)

Q4	Provide a status report on all thermal neutron scattering measurement and analysis activities (ND4)		
Q4	Provide a status report on all SAMMY nuclear data evaluation code modernization activities (ND6)		
Q4	Provide a status report on evaluation of thermal and resolved resonance ranges of UO2 and PUO2 activities (ND9)		
Q4	Provide a status report on thermal neutron scattering measurements and evaluations for DHS applications at temperature activities (ND11)		

### ACCOMPLISHMENTS

- **Status report on all nuclear data support activities.**
  - Attendance of INDEN meeting on light evaluations (Vienna)
  - ORNL contributions to new **ENDF/B-VIII.1 library paper** have been written up.
  - ORNL testing and processing of the new **ENDF/B-VIII.1 library**.
- ND1 - Nuclear Data Measurements: Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.
  - No **Zr-92** experiments performed due to budget constrains to operate GELINA, summer break, and performance issue of the GELINA electron gun. Upon start up after summer break RF window broke, no replacement, new windows are on order, expect to be delivered next year. No operation of GELINA is anticipated for the rest of the year.
  - Travel to JRC-Geel for data reduction on **Zr-91**. Malfunction of the flux ion chamber for **Zr-91** capture experiment. Evaluation was performed to use different flux shape from previous experiments.
  - **Transmission** factors for **Zr-91** have been produced. Data is tested and ready for analysis.
- ND2 – Nuclear Data Evaluations and Testing
  - Weekly meetings to discuss status of evaluation work for RRR, URR and TSL at ORNL.
  - **V** capture and transmission data analysis and evaluation for data using various sample thickness have been finalized. Data file for EDNF library was produced for testing.
  - **<sup>239</sup>Pu evaluation:** Test of the criticality benchmarks and related discussion. Independent analyses are showing comparable performance to ENDF/B-VIII.0 in addition to the constraint on depletion calculations in the attempt to resolve the loss of criticality at high burn-up of the ENDF/B-VIII.0 library. Therefore, the proposed file is indeed a compromise between PST criticality and depletion constraints. An additional confirmation is the reactivity as a function of temperature. The achieved slope in mistral experiments (CEA proprietary benchmarks) is another important constraint for <sup>239</sup>Pu RRR, that we only managed to solve with <sup>239</sup>Pu RRR in the previous quarter.

## NCSP Quarterly Progress Report (FY-2023 Q4)

- <sup>88</sup>Sr evaluation: this milestone in APPENDIX B was completed and submitted to the beta ENDF repository. The work performed is documented in the ORNL letter report (ORNL/LTR-2023/3004).
- <sup>140</sup><sup>142</sup>Ce covariance estimates for ENDF/B-VIII.1 release: the uncertainty quantification of the resonance parameters was performed with a retroactive methodology to generate covariance matrices compatible with experimental uncertainty guidelines. The generated uncertainty and related correlations for both isotopes and all available reaction channel in the resolved resonance region were estimated following the resonance structure of the reconstructed cross sections.
- <sup>181</sup>Ta evaluation in collaboration with NNL: Review of the paper about the RRR evaluation including virtual meetings to discuss updates to the paper.
- **63,65Cu**: The copper evaluation has been submitted in its present form, including resonance parameter covariance analysis, to the ENDF/B-VIII.1 library. The issue with the angular distributions has been resolved by demonstrating that SAMMY is producing correct calculations, and that comparison with experimental data requires more knowledge of the experimental conditions than is available in the reports associated with that data.
- The <sup>139</sup>La evaluation has progressed, with an extension of the resolved resonance range from 20 keV up to 40 keV. The newly introduced resonances follow good statistical metrics and improve agreement between the evaluated cross section and experimental transmission and capture data.
- ND3 - Isotopic Sample Leases to Support ND1 ND Measurements
  - Obtained Zr94 lease approval from DOE. Material and sample dimension identified Order put on hold due to end of FY23 funding issues.
- ND6 – SAMMY Nuclear Data Evaluation Code Modernization
  - Development and testing of the SAMMY code for the multiple incident channel module. This is of great importance for light nuclei evaluations. Test cases for the <sup>7</sup>Be compound nucleus were generated to be included in the next code release. Review of the updated version and documentations is ongoing and is expected to be concluded before the CSEWG meeting.
  - Currently SAMMY relies on the fact that the index of all adjustable parameters into the covariance matrix is strictly monotonically increasing as determined by an initial ordering of resonance, broadening, normalization, and resolution parameters. With the update of multiple incident channels module, the need for this order in the resonance parameters was taken out. The same will be done for all the other parameters and work on this is currently in progress. This will enable to add additional parameters more easily to SAMMY.
- ND9 – Evaluation of Thermal and Resolved Resonance Ranges of UO<sub>2</sub> and PUO<sub>2</sub>
  - Two independent methods for simultaneously calculating thermal and resolved resonance effects in the thermal range have been implemented in a series of Python scripts. Differential and total scattering results calculated by the scripts have been compared against source publications and were found to be in good agreement, ensuring that the theory was correctly employed. Testing is currently underway to determine the efficacy of the two methods, as well as the pros-and-cons of each.
- ND11 –Thermal neutron scattering measurements and evaluations for DHS applications at temperature.

## NCSP Quarterly Progress Report (FY-2023 Q4)

- No work performed, task on hold due to funding issues. The measurements for concrete would need completion.

### PUBLICATIONS

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Chris Chapman, "Thermal Neutron Scattering Research and Development at Oak Ridge National Laboratory", 242nd ECS Meeting, Atlanta, GA, Oct 2022.
	Dorothea Wiarda, Jesse Brown, Goran Arbanas, Marco Pigni, Jordan McDonnell, Chris Chapman, "SAMMY Modernization Efforts," CSWEG, Upton, NY, Nov 2022.
	Chris Chapman, Kemal Ramic, Goran Arbanas, Jesse Brown, Alexander Kolesnikov, Matthew Stone, Luke Daemen, Yongqiang Cheng, Anibal Ramirez Cuesta, Yaron Danon, Dominik Fritz, "Proposed Methodology for Evaluating and Validating TSLs," CSWEG, Upton, NY, Nov 2022.
	Marco Pigni, "On the Uranium and Plutonium Nuclear Data Evaluations," CSWEG, Upton, NY, Nov 2022.
	Jordan McDonnell, Marco Pigni, " Evaluation and Validation of the n+63,65Cu Cross Sections," CSWEG, Upton, NY, Nov 2022.
	Marco Pigni, "Theoretical and calculable dependent variables and their covariance in nuclear data libraries," Nuclear Data Uncertainty Quantification Working Meeting, Virtual Los Alamos, NM, Sep 2022.
	Marco Pigni, Jordan McDonnell, "Brief Update for Evaluation of Neutron Reactions on 63,65Cu," INDEN consultants' meeting, Vienna, Austria, Aug 2022.
	Marco Pigni, R. Capote, "Status of fissile and light nuclei evaluations towards ENDF/B-VIII.1 neutron sub-library release," INDEN consultants' meeting, Vienna, Austria, Aug 2022.
	Klaus Guber, Jesse Brown, Carlos Paradela Dobarro, Stefan Kopecky, Jan Heyse, Peter Schillebeeckx, "ORNL Neutron Cross Section Measurements of 90Zr," Transactions of the American Nuclear Society, Vol 127, 662-665 (Nov 2022).
	Chris Chapman, Dorothea Wiarda, "Proposed Generalized Header File for TSLs," CSWEG, Upton, NY, Nov 2022.
Q2	Marco Pigni, "Quantification of the 35Cl (n,p) reaction channel," Progress in Nuclear Energy, Vol 157, March 2023, <a href="https://doi.org/10.1016/j.pnucene.2022.104551">https://doi.org/10.1016/j.pnucene.2022.104551</a>
	Chris Chapman, Goran Arbanas, Jesse Brown, Douglas Abernathy, Alexander Kolesnikov, Luke Daemen, Yongqiang Cheng, Anibal Ramirez Cuesta, Garrett Granroth, Yaron Danon, Dominik Fritz, Daniel Siefman, "Status of ORNL TSL evaluations," CSWEG, Upton, NY, Nov 2022.
	Dorothea Wiarda, Jesse Brown, "Covariance Data in Unresolved Range," CSWEG, Upton, NY, Nov 2022.
	Dorothea Wiarda, Jordan McDonnell, Jesse Brown, Chris Chapman, Bk Jeon, Kang Seog Kim, Andrew Holcomb, "RECENT AMPX developments," IAEA Technical Meeting on Nuclear Data Processing, Vienna, Austria, Nov 2022.
	Chris Chapman, Kemal Ramic, Goran Arbanas, Jesse Brown, Alexander Kolesnikov, Matthew Stone, Luke Daemen, Yongqiang Cheng, Anibal Ramirez Cuesta, Yaron Danon, Dominik Fritz, "Applying Methodology for Evaluating and Validating TSLs to Materials of Interest to NCSP," Technical Program Review, Albuquerque, NM, February 2023.

## NCSP Quarterly Progress Report (FY-2023 Q4)

	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, Luke Daemen, Klaus Guber, Douglas Bowen, Douglas Abernathy, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Daniel Siefman, Yaron Danon, Dominik Fritz, "Status of ORNL TSL evaluations - TPR2023," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Marco Pigni, "FY22 NCSP accomplishments for U and Pu Evaluations," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Jordan McDonnell, Jesse Brown, Chris Chapman, Marco Pigni, "ORNL R-matrix Analyses for Non-Fissile Materials within NCSP," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Goran Arbanas, Jesse Brown, Dorothea Wiarda, Andrew Holcomb, "Bayesian Evaluation Framework for Imperfect Differential and Integral Data or Models," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Dominik Fritz, Y. Danon, Kemal Ramic, Chris Chapman, Jesse Brown, Goran Arbanas, M Rapp, Tim Trumbull, Michael Zerkle, Jesse Holmes, Peter Brain, Adam Ney, Sukhjinder Singh, Katelyn Cook, Benjamin Wang, "Total thermal neutron cross section measurements of hydrogen dense polymers from 0.0005–20 eV," Annals of Nuclear Energy, Vol 183, Issue 1, April 2023.
	Douglas Bowen, "NCSP Nuclear Data Program," WANDA, Washington DC, March 2023.
	Jordan McDonnell, Jesse Brown, Chris Chapman, Bk Jeon, Kang Seog Kim, Dorothea Wiarda, William Wieselquist, Rike Bostelmann, "AMPX and SCALE Nuclear Data Libraries for Depletion," WANDA, Washington DC, March 2023.
Q3	Paraskevi Dimitriou, Zhenpeng Chen, R deBoer, G. Hale, Satoshi Kunieda, H. Leeb, M. W. Paris, Marco Pigni, Thomas Srdinko, Pierre Tamagno, I. Thompson, "Evaluation of light-element reactions in the resolved resonance region," 15th International Conference on Nuclear Data for Science and Technology (ND2022), 284, (May 2023).
	Marco Pigni, Dorothea Wiarda, Goran Arbanas, Jesse Brown, Jordan McDonnell, Chris Chapman, Kemal Ramic, Klaus Guber, "Nuclear Data Evaluations in the Resolved Resonance Region and Proposed Updates to R-matrix Modeling in the SAMMY Code," 2023 R-matrix Workshop on Methods and Applications, Athens, OH, June 2023.
	Marco Pigni, R deBoer, Paraskevi Dimitriou, "International Nuclear Data Evaluation Network (INDEN) on the Evaluation of Light Elements (4)," Summary Report of the IAEA Consultants Meeting, June 2022, IAEA Headquarters, Vienna, Austria
	Goran Arbanas, Jesse Brown, Dorothea Wiarda, "Advancing the Theory of Nuclear Data Evaluations," 6th edition of the International Workshop On Nuclear Data Evaluation for Reactor Applications (WONDER-2023), Aix-en-Provence, France, June 2023.
	deBoer, R. J., Gula, A., Febraro, Michael T., Brandenburg, K., Brune, C. R., Görres, J., Gyürky, Gy, Kelmar, R., Manukyan, K., Meisel, Z., Odell, D., Pigni, Marco T., Shahina, None, Stech, E., Tan, W., and Wiescher, M. First near-threshold measurements of the C13( $\alpha$ ,n1)O16 reaction for low-background-environment characterization. United States: N. p., 2022. Web. doi:10.1103/physrevc.106.055808
	Chris Chapman, "Protecting Against Potential Issues in Thermal Neutron Scattering," WPEC SG48, Paris, France, May 2023.
	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, William B.J. Marshall, Luke Daemen, Douglas Abernathy, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Daniel Siefman, Yaron Danon, Dominik Fritz, "ORNL's continuing efforts in evaluating and validating TSLs," WPEC SG48, Paris, France, May 2023.
	Jordan McDonnell, Jesse Brown, Chris Chapman, Dorothea Wiarda, Andrew Holcomb, "Status of GNDS Support in AMPX," WPEC SG48, Paris, France, May 2023.
	Goran Arbanas, Jesse Brown, Dorothea Wiarda, "Advancing the theory of nuclear data evaluations," International Workshop On Nuclear Data Evaluation for Reactor Applications (WONDER-2023), Aix-en-Provence, France, June 2023.

## NCSP Quarterly Progress Report (FY-2023 Q4)

	Jesse Brown, Goran Arbanas, Hany Abdel-khalik, Ugur Mertyurek, William B.J. Marshall, William Wieselquist, "Generalized Bayesian Framework for Evaluation of Integral Benchmark Experiments," ANS Winter Meeting and Technology Expo (2022), 732-735 (Nov 2022).
	Marco Pigni, R-MATRIX ANALYSIS AND STATISTICAL PROPERTIES OF DYSPROSIUM ISOTOPES IN THE NEUTRON ENERGY RANGES UP TO A FEW KEV, ORNL/TM-2023/2925, UT-Battelle, LLC, Oak Ridge National Laboratory (June 2023).
	Jordan McDonnell, Jesse Brown, Chris Chapman, Bk Jeon, Kang Seog Kim, Dorothea Wiarda, "AMPX and ENDF/B-VIII.1 Thermal Scattering Library," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, William B.J. Marshall, Luke Daemen, Douglas Abernathy, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Daniel Siefman, Yaron Danon, Dominik Fritz, "On integral benchmarks for resolving TSL conflicts for ENDF/B-VIII.1 release," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	Chris Chapman, Dorothea Wiarda, "Format Proposal for Isotopic Distribution in TSL Files for ENDF/B-VIII.1," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	Marco Pigni, "Proposed updates to Pu evaluation for ENDF/B-VIII.0 $\beta$ 2," mini-CSEWG, Lawrence Livermore National Laboratory, Livermore, CA, April 2023.
	Jordan McDonnell, Jesse Brown, "ENDF/B-VIII.1 and AMPX," 2023 SCALE Users' Group Workshop, Oak Ridge, TN, April 2023.
	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, Luke Daemen, Douglas Abernathy, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Daniel Siefman, Yaron Danon, Dominik Fritz, "Advancements in Validation of TSLs through Inelastic Neutron Scattering and Transmission Measurements," International Workshop On Nuclear Data Evaluation for Reactor Applications (WONDER-2023), Aix-en-Provence, France, June 2023.
	Jesse Brown, William Wieselquist, Steve Skutnik, Rike Bostelmann, Jordan McDonnell, Germina Ilas, "Fission Product Yields: SCALE/ORNL Perspective," WANDA, Washington DC, March 2023.
	Jesse Brown, Goran Arbanas, Ugur Mertyurek, William B.J. Marshall, William Wieselquist, Hany Abdel-khalik, "Generalized Bayesian Framework for Evaluation of Integral Benchmark Experiments," American Nuclear Society Winter Meeting, Phoenix, AZ, November 2022
	Goran Arbanas, Jesse Brown, Dorothea Wiarda, Andrew Holcomb, Peter Brain, Devin Barry, Yaron Danon, "Parameterization of Direct and Doorway Processes in R-Matrix Formalism," 15th International Conference on Nuclear Data for Science and Technology (ND2022). 284, (May 2023).
	Chris Chapman, Goran Arbanas, Jesse Brown, Kemal Ramic, Yongqiang Cheng, Douglas Abernathy, Alexander Kolesnikov, Matthew Stone, Luke Daemen, Anibal Ramirez Cuesta, Xunxiang Hu, Jiao Lin, "Advanced Modeling and Simulation Methods for Evaluation of Thermal Neutron Scattering Materials," 15th International Conference on Nuclear Data for Science and Technology (ND2022). 284, (May 2023).
	Chris Chapman, Marco Pigni, Klaus Guber, Goran Arbanas, "140,142Ce Neutron Cross Section Resolved Resonance Region Evaluation," 15th International Conference on Nuclear Data for Science and Technology (ND2022). 284, 08003, (May 2023).
	Jesse Brown, Klaus Guber, Carlos Paradela, Peter Schillebeeckx, Stefan Kopecky, "Zirconium Nuclear Data Campaign: Measurement of 90Zr (n, $\gamma$ ) cross section," 15th International Conference on Nuclear Data for Science and Technology (ND2022). 284, 1-3, (May 2023).
	Jesse Brown, Goran Arbanas, Dorothea Wiarda, Klaus Guber, Andrew Holcomb, Vladimir Sobes, "Bayesian Monte Carlo Evaluation of Imperfect (n, 233U) Data and Model," 15th International Conference on Nuclear Data for Science and Technology (ND2022). 284, 1-3, (May 2023).
Q4	Jesse Brown, "Research in Nuclear Data," University of Tennessee, October 2022.
	Jesse Brown, Klaus Guber, Carlos Paradela, Peter Schillebeeckx, Stefan Kopecky, "Improving Zr Cross Sections: Zr-90(n,g)," 2022 ANS Winter Meeting, Upton, NY, November 2022.

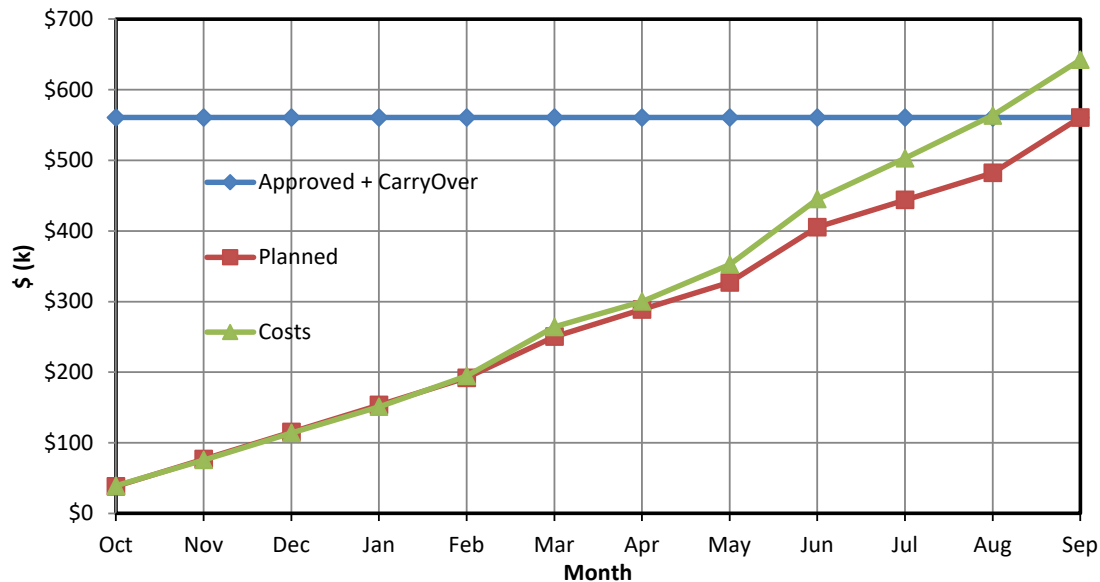
## NCSP Quarterly Progress Report (FY-2023 Q4)

	Jesse Brown, Klaus Guber, Peter Schillebeeckx, Stefan Kopecky, Carlos Paradela, "ORNL FY22 NCSP Time-of-Flight Measurements," NCSP Technical Program Review, Albuquerque, NM, Feb 2023.
	Dorothea Wiarda, Goran Arbanas, Jesse Brown, Marco Pigni, Jordan McDonnell, Chris Chapman, "Recent Developments in the R-Matrix Code SAMMY," NCSP Technical Program Review, Albuquerque, NM, Feb 2023.
	Jesse Brown, Dorothea Wiarda, Jordan McDonnell, "ENDF/B-VIII.1 Validation: Covariance," Meeting at Livermore, CA, May 2023.
	Jesse Brown, "SG 51 Proposal: Unresolved Evaluations," WPEC, Paris, France, May 2023.
	Klaus Guber, "Action Sheet 66: Neutron Induced Nuclear Data Cross Section Measurements at JRC-Geel," US-Euratom Coordination Meeting, June 2023, Luxembourg.
	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, William (B.J.) Marshall, Luke Daemen, Douglas Abernathy, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Daniel Siefman, Yaron Danon, Dominik Fritz, "Advancements in Validation of TSLs through Inelastic Neutron Scattering and Transmission Measurements," WONDER-2023, Aix-en-Provence, June 2023.
	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, Luke Daemen, Alexander Kolesnikov, Yongqiang Cheng, Anibal Ramirez Cuesta, Yaron Danon, Dominik Fritz, "Development of transmission measurements capability at VISION spectrometer," 6th Tri-Lab Chemistry Workshop, Oak Ridge, TN, June 2023.
	E Leal-Cidoncha, Aaron Couture, E. M. Bond, Todd Bredeweg, C Fry, T. Kawano, A. E. Lovell, G Rusev, I. Stetcu, J. Ullmann, Luiz Leal, Marco Pigni, "Measurement of the neutron-induced capture-to-fission cross section ratio in $^{233}\text{U}$ at LANSCE," Physcial Review C, 108, 1 (July 2023).
	Marco Pigni, "Evaluated Nuclear Data Requirements in Support of Fission and Fusion Applications," OCED-NEA Nuclear Data Stakeholder Event, Paris, September 2023.

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> ND 1, 3 <b>M&amp;O Contractor Name:</b> RPI <b>Point of Contact Name:</b> Yaron Danon <b>Point of Contact Phone:</b> 518-276-4008	<b>Reference:</b> DP0909010 <b>Date of Report:</b> October, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 100,591 (ND1)
  2. Approved FY 2023 Budget = \$ 360K(ND1)+100K(ND2)
  3. Total FY 2023 Budget w/Carryover = \$560,591
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$113,888
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$150,152
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$180,976
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$197,327
  8. Projected carryover into FY 2024 = \$ -81,752
- NOTE:** Include commitments as part of spending

## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete	On Schedule	Behind Schedule	Missed Milestone
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all resonance region nuclear data measurement activities. (ND1)		
Q1	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. (ND1)		
Q1	Complete analysis of measurement from previous year (ND1)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide status report on all LINAC refurbishment activities (ND3)		
Q1	Complete condition and qualification of one set of high-power Radio frequency (RF) windows to support SOL 1 Accelerator Section site acceptance testing. (ND3)		
Q2	Provide status reports on all resonance region nuclear data measurement activities. (ND1)		
Q2	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. (ND1)		
Q2	Provide status report on all LINAC refurbishment activities (ND3)		
Q2	Complete condition and qualification of one set of high-power Radio-frequency (RF) windows to support TPV Accelerator Section site acceptance testing. (ND3)		Windows for TPV have lower priority than SOL section test.
Q3	Provide status reports on all resonance region nuclear data measurement activities. (ND1)		
Q3	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. (ND1)		WPEC meeting
Q3	Complete nuclear data measurements (transmission/capture or scattering) per the nuclear data schedule in Appendix B of the 5 year plan. (ND1)		
Q3	Provide status report on all LINAC refurbishment activities (ND3)		
Q3	Complete SOL #1 Accelerator Section Site acceptance testing. (ND3)		
Q3	Start fabrication of 2nd batch of speed of light structures 2, 3 and 4 (ND3)		Deferred, until funds are identified.
Q4	Provide status reports on all resonance region nuclear data measurement activities. (ND1)		
Q4	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for		



## NCSP Quarterly Progress Report (FY-2023 Q4)

	foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
Q4	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 of the 5 year plan (ND1)		
Q4	Provide status report on all LINAC refurbishment activities (ND3)		
Q4	Complete delivery of solenoids and quadrupoles components (ND3)		
Q4	Complete TPV Accelerator Section Site acceptance testing. (ND3)		Deferred, until funds are identified.

### ACCOMPLISHMENTS

- **ND1 – Resonance Region Nuclear Data Measurement Capability at RPI**

- **Fe-54**

- Finished capture data covariance matrix generation.
- Started work on an automated IDC-generation tool for LINAC TOF experiments with additional tests and validation.
- Performed TOF experiments using the neutron beam imager and confirmed conceptual system performance.
- Started resonance parameter fitting w/ and w/o IDCs.

- **URR improvements to SAMMY**

- Began work on uncertainty quantification for transmission self-shielding correction factor implemented in SAMMY.
- Transmission correction derivative methods validated.

- **Zr evaluation**

- Obtained final resonance parameters for <sup>90</sup>Zr evaluation to 200 keV and preliminary evaluation to 500 keV

- **Fast Neutron Scattering**

- Validated performance of upgrades to RPI high energy neutron scattering system with series of preliminary LINAC measurements and EJ-301 detector efficiency measurements
- Completed high energy quasi-differential neutron emission measurements of <sup>181</sup>Ta and Teflon.
- Extracted preliminary results from <sup>181</sup>Ta and Teflon high energy quasi-differential measurements for validation of ENDF/B-VIII.I beta 2 <sup>181</sup>Ta and <sup>19</sup>F evaluations.

- **Pb evaluation**

- Identified potentially problematic cross sections in new Pb evaluations from LLNL Pulse Sphere.
- Investigated potential causes for LCT benchmarks calculating higher C/E compared to ENDF/B-VIII.0, concluded most LCT benchmarks, with exception of LCT-74, have geometry issues which are not considered fully. Advise revisions or new experiments.
- Final documentation completed: DOE-NEUP Final report, Thesis, Journal paper.

## NCSP Quarterly Progress Report (FY-2023 Q4)

- **ND3 – RPI/ORNL: LINAC 2020 Nuclear Data Capabilities Maintenance Plan**
  - SOL modulator was tested up to 30% of full power (to be continued after cross section experiments).
  - Site acceptance test of modulator one was completed.

### PUBLICATIONS

Any publications that have  
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	<ul style="list-style-type: none"> <li>• D. Fritz, Y. Danon, K. Ramic, C. W. Chapman, J. M. Brown, G. Arbanas, M. Rapp, T. H. Trumbull, M. Zerkle, J. Holmes, P. Brain, A. Ney, S. Singh, K. Cook and B. Wang, "Total thermal neutron cross section measurements of hydrogen dense polymers from 0.0005–20 eV", <i>Annals of Nuclear Energy</i>, vol. 183, pp. 109651, 2023, DOI:10.1016/j.anucene.2022.109651.</li> <li>• D. Fritz, Y. Danon, M. Rapp, T. H. Trumbull, M. Zerkle, J. Holmes, C. W. Chapman, G. Arbanas, J. M. Brown, K. Ramic, X. Hu, S. Singh, A. Ney, P. Brain, K. Cook and B. Wang, "Total thermal neutron cross section measurements of yttrium hydride from 0.0005 - 3 eV", <i>Annals of Nuclear Energy</i>, vol. 181, pp. 109475, 2023, DOI:10.1016/j.anucene.2022.109475.</li> <li>• Y. Danon, R. Block, K. Cook, S. Singh, B. Wang, "Overview of Nuclear Data Measurement and Analysis at RPI", CSEWG meeting, November 2022.</li> <li>• P. Brain, Y. Danon, D. Brown, D. Barry, A. Lewis, T. Kawano, "Fast Region Evaluations of Pb-206 and Pb-208", CSEWG meeting, November 2022.</li> <li>• Y. Danon, "RPI - Nuclear Data for structural materials", International Nuclear Data Evaluation Network (INDEN) Evaluated Nuclear Data of the Structural Materials, IAEA, December 6-9, 2022.</li> </ul>
Q2	
Q3	<ul style="list-style-type: none"> <li>• Singh, Sukhjinder, Danon, Yaron, Ney, Adam, Cook, Katelyn, Fritz, Dominik, Wang, Benjamin, Brain, Peter, Daskalakis, Adam and Rapp, Michael, "Neutron Capture and Transmission Measurements of <sup>54</sup>Fe at the RPI LINAC", <i>EPJ Web of Conf.</i>, vol. 284, pp. 01039, 2023, <a href="https://doi.org/10.1051/epjconf/202328401039">https://doi.org/10.1051/epjconf/202328401039</a></li> <li>• Fritz, Dominik, Danon, Yaron, Rapp, Michael, Trumbull, Timothy, Zerkle, Michael, Holmes, Jesse, Chapman, Chris, Arbanas, Goran, Brown, Jesse, Ramic, Kemal, Hu, Xunxiang, Ney, Adam, Brain, Peter, Singh, Sukhjinder, Cook, Katelyn and Wang, Benjamin, "Thermal Cross Section Measurements At The RPI LINAC", <i>EPJ Web of Conf.</i>, vol. 284, pp. 01020, 2023, <a href="https://doi.org/10.1051/epjconf/202328401020">https://doi.org/10.1051/epjconf/202328401020</a></li> <li>• Danon, Yaron, Fritz, Dominik, Wang, Benjamin, Cook, Katelyn, Singh, Sukhjinder, Ney, Adam, Brain, Peter, Blain, Ezekiel, Rapp, Michael, Daskalakis, Adam, Barry, Devin, Trumbull, Timothy, Chapman, Chris and Arbanas, Goran, "Experimental validation of thermal scattering evaluations", <i>EPJ Web of Conf.</i>, vol. 284, pp. 17001, 2023, <a href="https://doi.org/10.1051/epjconf/202328417001">https://doi.org/10.1051/epjconf/202328417001</a></li> </ul>

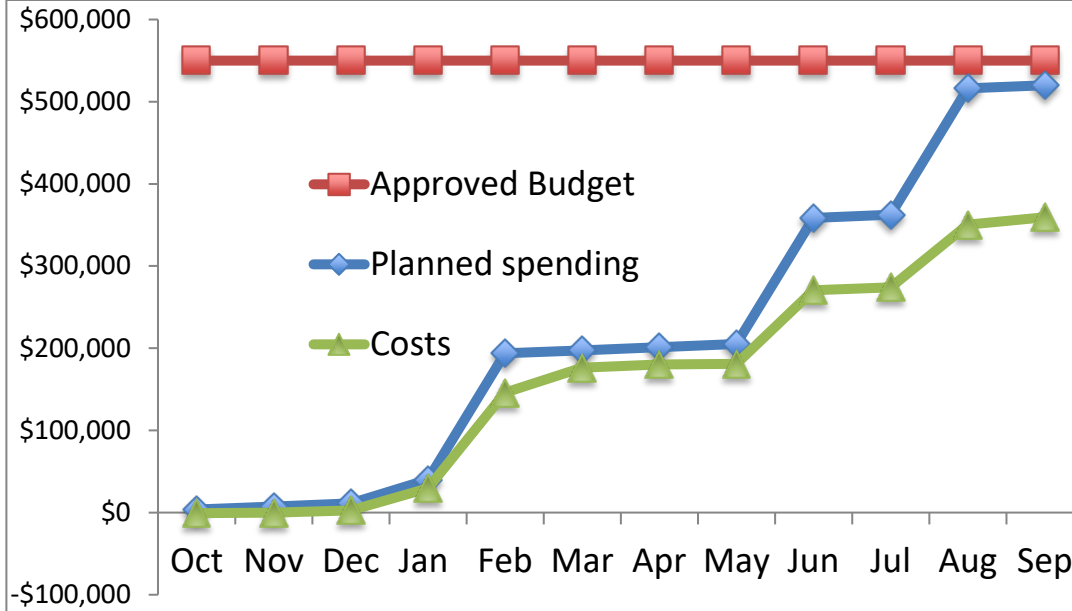
## NCSP Quarterly Progress Report (FY-2023 Q4)

	<ul style="list-style-type: none"><li>• Brain, Peter, Danon, Yaron, Brown, Dave and Barry, Devin, “Resolved resonance region analysis of 206Pb, 207Pb, and 208Pb for next generation lead-cooled fast systems”, EPJ Web of Conf., vol. 284, pp. 14005, 2023, <a href="https://doi.org/10.1051/epjconf/202328414005">https://doi.org/10.1051/epjconf/202328414005</a></li><li>• Peter Brain, Yaron Danon, Dave Brown, Devin Barry, “Isotopic Lead Neutron Evaluations for Future Fast Spectrum Systems”, Submitted to ANS Annual Meeting, June 10-14, Indianapolis, IN, 2023.</li><li>• Y. Danon, P. Brain, K. Cook, D. Fritz, A. Golas, G. Siemers, S. Singh, B. Wang<sup>1</sup>, A. Lewis, A. Daskalakis, M. Rapp, D. Barry, and T. Trumbull, “Recent Nuclear Data Activity at the RPI Gaertner LINAC Center”, WONDER 2023, 6th International Workshop on Nuclear Data Evaluation for Reactor Applications, June 5-9, Aix-en-Provence, France, 2023.</li></ul>
Q4	<ul style="list-style-type: none"><li>• Gregory Siemers, S. Singh, Y. Danon, A. Daskalakis, K. Cook, B. Wang, P. Brain, M. Rapp, “Quasi-Differential Neutron Scattering Measurements of <sup>181</sup>Ta and Teflon from 1.75 to 20 MeV”, WINS 2023, October 2023. <a href="https://indico.cern.ch/event/1201892">https://indico.cern.ch/event/1201892</a></li><li>• Gregory Siemers, Y. Danon, A. Daskalakis, J. Hutchinson, N. Thompson, “Zirconium Scattering Sensitivity in Neutron Transport Calculations of Multiplying Systems”, WINS 2023, October 2023. <a href="https://indico.cern.ch/event/1201892">https://indico.cern.ch/event/1201892</a></li><li>• Peter Brain, Yaron Danon, D. Brown, D. Barry, A. Lewis, T. Trumbull, T. Kawano, “Validation and Evaluation Uses of Quasi-Differential High-Energy Scattering Data”, WINS 2023, October 2023. <a href="https://indico.cern.ch/event/1201892">https://indico.cern.ch/event/1201892</a></li><li>• Peter Brain, Yaron Danon, A. Daskalakis, “Deployment of Gaussian Surrogate Model for Ad-Hoc Adjustments to Elastic Scattering Angular Distributions”, WINS 2023, October 2023. <a href="https://indico.cern.ch/event/1201892">https://indico.cern.ch/event/1201892</a></li></ul>

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TE3, 6, 8 <b>M&amp;O Contractor Name:</b> LANL <b>Point of Contact Name:</b> Joetta Goda <b>Point of Contact Phone:</b> 505-667-2812	<b>Reference:</b> DP0909010 <b>Date of Report:</b> October 30, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 0
2. Approved FY 2023 Budget = \$550,000
3. Total FY 2023 Budget w/Carryover = \$

	Spending	Commitments	Total
Q1	\$2,467	\$91,520	\$93,987
Q2	\$174,015	\$31,275	\$205,289
Q3	\$94,016	\$22,329	\$116,344
Q4	\$88,874.98	\$22,329	\$111,204

8. Projected carryover into FY 2024 = \$

**NOTE:** Include commitments as part of spending










## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="color: blue;">■</span>	On Schedule <span style="color: green;">■</span>	Behind Schedule <span style="color: yellow;">■</span>	Missed Milestone <span style="color: red;">■</span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on all hands-on criticality safety training activities (TE3)	<span style="color: blue;">■</span>	
Q1	Provide a status report on the development of a university pipeline for CS professionals (TE6)	<span style="color: blue;">■</span>	
Q1	Provide a status report on all reactivity simulation aids activities (TE8)	<span style="color: blue;">■</span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide a status report on all hands-on criticality safety training activities (TE3)		
Q2	Provide a status report on the development of a university pipeline for CS professionals (TE6)		
Q2	Provide a status report on all reactivity simulation aids activities (TE8)		
Q3	Provide a status report on all hands-on criticality safety training activities (TE3)		
Q3	Provide a status report on the development of a university pipeline for CS professionals (TE6)		
Q3	Provide a status report on all reactivity simulation aids activities (TE8)		
Q4	Provide a status report on all hands-on criticality safety training activities (TE3)		
Q4	Provide a status report on the development of a university pipeline for CS professionals (TE6)		
Q4	Provide a status report on all reactivity simulation aids activities (TE8)		

### ACCOMPLISHMENTS

- TE3 – Conduct Hands-On Criticality Safety Training Course at NCERC
  - Conducted January NCSP Class
  - Conducted June NCSP CSO/Manager’s Class
  - Conducted August NCSP Class
  - Nancy Watts at NCERC-FO supports DAF access for students.
- TE6 – Development of University Pipeline for Criticality Safety Professionals
  - Commitment is UNM contract
- TE8 – Reactivity Simulation Aids
  - No update

### PUBLICATIONS

## NCSP Quarterly Progress Report (FY-2023 Q4)

Any publications that have

- Completed your institution's review cycle during the quarter
- AND
- Are publicly releasable

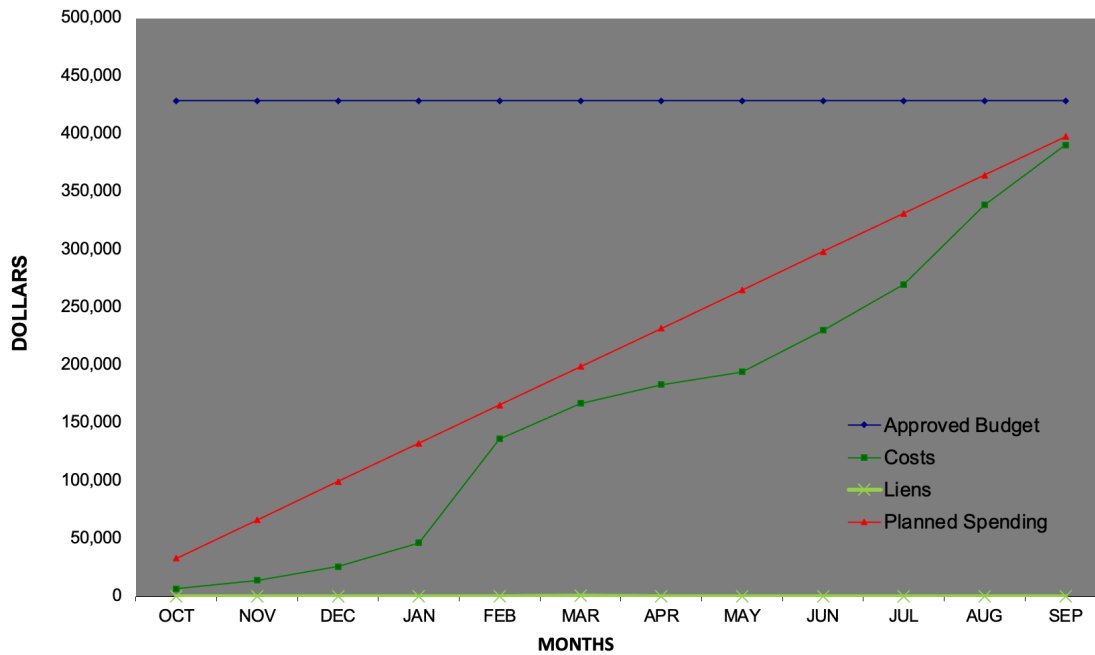
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
Example:	Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	
Q3	
Q4	See Tara Robertson's paper listed in IE report.

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TE1, 3, 8 <b>M&amp;O Contractor Name:</b> LLNL <b>Point of Contact Name:</b> Catherine Percher <b>Point of Contact Phone:</b> (925) 579-4226	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET














1. Carryover into FY 2023 = \$38,730
2. Approved FY 2023 Budget = \$390,000
3. Total FY23 Budget w/Carryover = \$428,730
4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$28,798
5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$141,111
6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$63,220
7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$160,164
8. Carryover into FY 2024 = \$ 38,294
9. **NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete	On Schedule	Behind Schedule	Missed Milestone
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on hands-on training at the DAF (TE1)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q1	Provide a status report classroom criticality safety training (TE3)		
Q1	Provide a status report on development of university pipeline for CS professionals. (TE8)		
Q2	Provide a status report on hands-on training at the DAF (TE1)		
Q2	Provide a status report classroom criticality safety training (TE3)		
Q2	Provide a status report on development of university pipeline for CS professionals. (TE8)		
Q3	Provide a status report on hands-on training at the DAF (TE1)		
Q3	Provide a status report classroom criticality safety training (TE3)		
Q3	Provide a status report on development of university pipeline for CS professionals. (TE8)		
Q4	Provide a status report on hands-on training at the DAF (TE1)		
Q4	Provide a status report classroom criticality safety training (TE3)		
Q4	Provide a status report on development of university pipeline for CS professionals. (TE8)		

### ACCOMPLISHMENTS

- TE1 – Conduct Hands-on Training at the DAF (TACS)
  - Participated in all T&E telecons
  - Provided lectures and TACS instruction for August 2-week training course
- TE3 – Classroom Criticality Safety Training
  - Provided first week lectures during August 2-week training course
- TE8 - Development of University Pipeline for Criticality Safety Professionals
  - No activity this period- course is taught in the Fall

### PUBLICATIONS



## NCSP Quarterly Progress Report (FY-2023 Q4)

Any publications that have

- Completed your institution's review cycle during the quarter
- AND
- Are publicly releasable

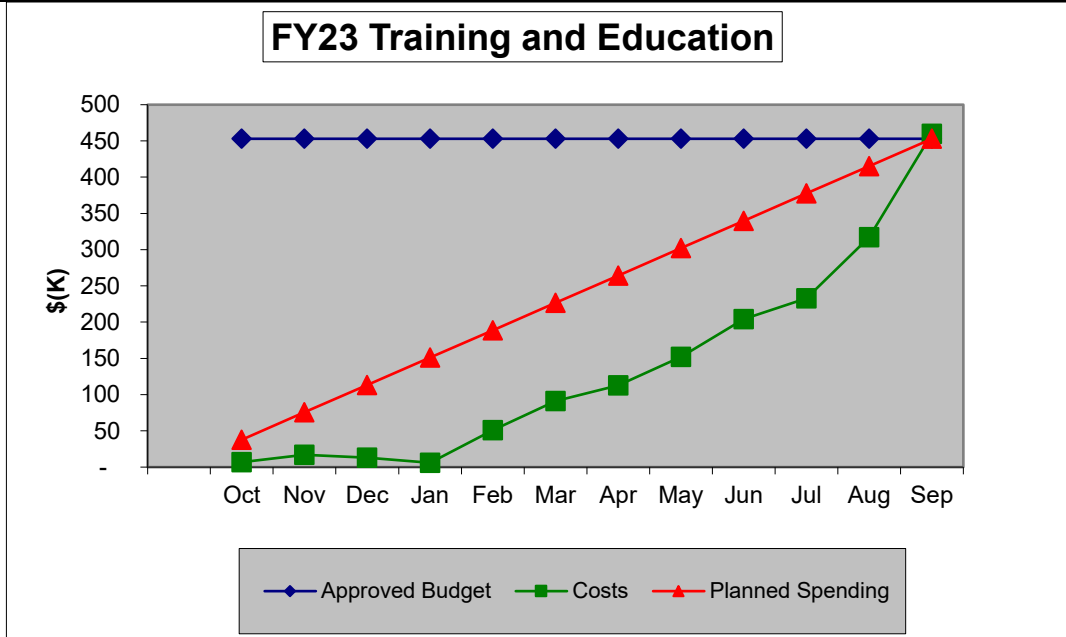
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	none
Q2	Coleman, S. and M. Fratoni, "Nuclear Criticality Safety Pipeline Course with Hands-On Experimental Training at Lawrence Livermore's Inherently Safe Subcritical Assembly Training Center," Presented at the Conference on Nuclear Training and Education (CONTE 2023), Amelia Island, FL, February 2023, LLNL-ABS-841056.
Q3	Coleman, S., "Nuclear Criticality Safety Pipeline Course- LLNL," Presented at the 2023 EFCOG Nuclear Facility Safety Annual Workshop, March 14, 2023, LLNL-PRES-819441.
Q4	Coleman, S., "Criticality Safety Evaluation Project Development for University of California, Berkeley Nuclear Criticality Safety Pipeline Course." Presented at the International Conference on Nuclear Criticality, October 4, 2023, LLNL-CONF-849310.

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TE1, 11, 14 <b>M&amp;O Contractor Name:</b> ORNL <b>Point of Contact Name:</b> Doug Bowen <b>Point of Contact Phone:</b> (865) 576-0315	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 6, 2023
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## BUDGET



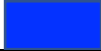








1. Carryover into FY 2023 = \$113K
  2. Approved FY 2023 Budget = \$340K
  3. Total FY 2023 Budget w/Carryover = \$453K
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$13K
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$78K
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$113K
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$256K
  8. Projected carryover into FY 2024 = -\$14k
- NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="background-color: blue; color: black;">█</span>	On Schedule <span style="background-color: green; color: black;">█</span>	Behind Schedule <span style="background-color: yellow; color: black;">█</span>	Missed Milestone <span style="background-color: red; color: black;">█</span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on implementation of the NCS training program (TE1)	<span style="background-color: blue; color: black;">█</span>	
Q1	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)	<span style="background-color: blue; color: black;">█</span>	
Q1	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)	<span style="background-color: blue; color: black;">█</span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide a status report on implementation of the NCS training program (TE1)		
Q2	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)		
Q2	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)		
Q3	Provide a status report on implementation of the NCS training program (TE1)		
Q3	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)		
Q3	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)		
Q4	Provide a status report on implementation of the NCS training program (TE1)		
Q4	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)		
Q4	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)		

### ACCOMPLISHMENTS

- TE1 - Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program
  - Bowen/Henley worked to solidify the rosters for the December 1-week and January/February 2-week courses working with NCSP Manager and T&E coordinators at Sandia and NCERC.
  - Bowen working with NCERC POC and LANL T&E POC for AWE Rad Worker 2 requirements. MSTs has tightened up the requirements, so ORNL/LANL are working to resolve outstanding issues.
  - Successfully completed the August 2-week hands-on course at NATM, Sandia and NCERC. This was the largest class held by the NCSP so far – 29 students.
  - Held a 2-week lecture improvement session with lecture week instructors.
  - Began to start planning efforts for a Y-12 special course (2-week version)
  - Archived all FY23 course materials per course procedure.
- TE11 - Revision of the LA-12808 Nuclear Criticality Safety Guide

## NCSP Quarterly Progress Report (FY-2023 Q4)

- Bowen is drafting this document and is making steady progress. The content is aligned with ANS-8 standards content and will include subcritical and critical data as in previous drafts. Carryover funding is being used to complete this document.
- TE14 - Nuclear Criticality Safety Training and Pipeline Development
  - Bi-weekly conference calls with the team continued. For ORNL, Walid Metwally and Doug Bowen are supporting this task. Progress in Q4 was steady. Walid supported in a lead role for ORNL, and Doug provided input on various aspects of the work. The following tasks were completed:
    - 20 of the 27 presentations are prepared.
    - 12 of the 27 presentations are peer reviewed.
    - 12 of the 27 videos are recorded.

### PUBLICATIONS

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Mathieu Dupont, "Health Physics Research Reactor Criticality Accident Alarm System Benchmark Overview," Transactions of the 14th International Conference on Radiation Shielding and 21st Topical Meeting of the Radiation Protection and Shielding Division (ICRS 14/RPSD 2022), Vol II, 406-409 (Sep 2022).
	Mathieu Dupont, Alex Lang, Douglas Bowen, "Current Progress of the Final Design of a Subcritical Assembly at the Oak Ridge National Laboratory," Transactions of the American Nuclear Society, Vol 127, 717-720 (Nov 2022).
	Mathieu Dupont, "Health Physics Research Reactor Criticality Accident Alarm System Benchmark Overview," 14th International Conference on Radiation Shielding (ICRS 14/RPSD 2022), Seattle, WA, Sep 2022.
	Alex Lang, Mathieu Dupont, Douglas Bowen, "Subcritical Assembly at ORNL," Oak Ridge, TN, Sep 2022.
Q2	Douglas Bowen, Mathieu Dupont, Alex Lang, Shane Hart, Andrew Holcomb, Proposed Subcritical Assembly for Nuclear Criticality Safety Training at the Oak Ridge National Laboratory, ORNL/TM-2022/2748, UT-Battelle, LLC, Oak Ridge National Laboratory (January 2023).
	Douglas Bowen, "ORNL NCSP Training and Education Support for FY2022," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Douglas Bowen, "DOE/NNSA Nuclear Criticality Safety Program NCS Engineer Resource Pipeline Activities," EFCOG N&FS Workshop, Albuquerque, NM, March 2023.
Q3	Douglas Bowen, Mathieu Dupont, "Current Progress of the Final Design of a Subcritical Assembly at Oak Ridge National Laboratory," 2022 ANS Winter Meeting and Technology Expo, Phoenix, AZ, Nov 2022.
	Alex Lang, Mathieu Dupont, Douglas Bowen, "Oak Ridge Subcritical Assembly Final Design and Current Progress," 2023 Annual NCSP Technical Program Review, Albuquerque, NM, Feb 2023.
Q4	Douglas Bowen, Robert Busch, "Hand Calculation Methods for Nuclear Criticality Safety," ORNL/TM-2022/2747, UT-Battelle, LLC, Oak Ridge National Laboratory (May 2023).
	Douglas Bowen, "Overview and Current Progress of the DOE/NNSA Nuclear Criticality Safety Program Training and Education Program," ICNC 2023 – The 12 <sup>th</sup> International Conference on Nuclear Criticality Safety," October 1-6, 2023, Sendai, Japan.

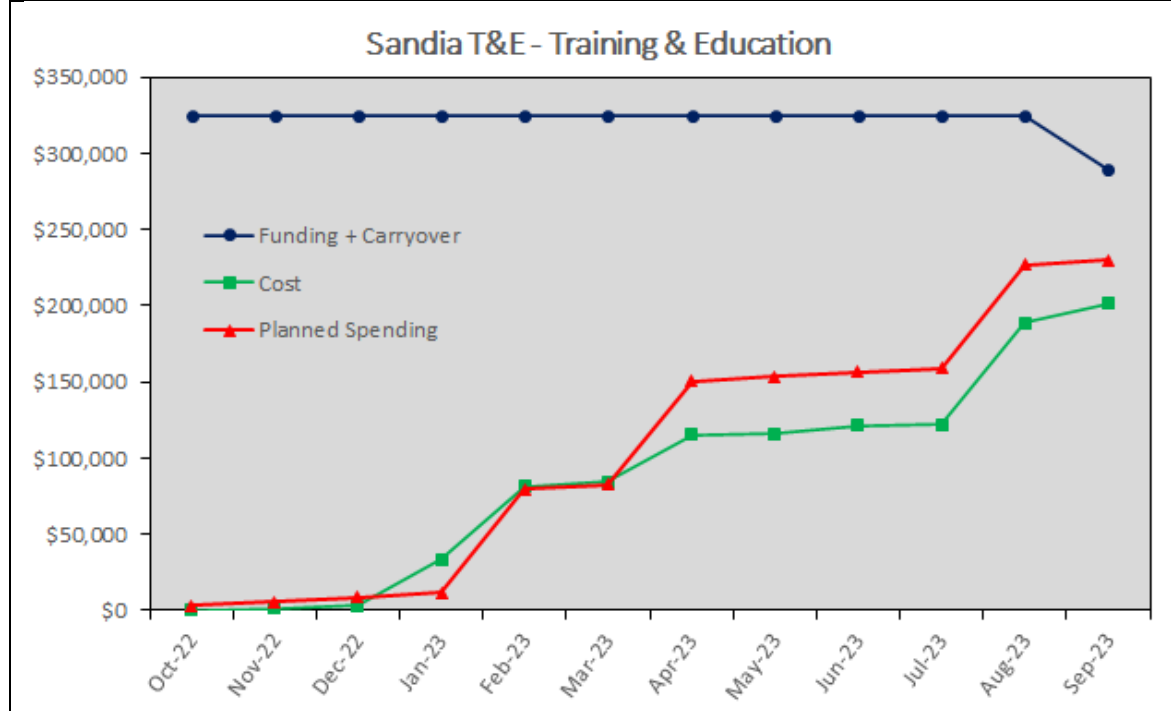
# NCSP Quarterly Progress Report (FY-2023 Q4)

	Walid Metwally, Douglas Bowen, "Nuclear Criticality Safety Training: Needs and Efforts," Transactions for the 2023 ANS Annual Meeting,, 51-52 (June 2023).
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# NCSP Quarterly Progress Report (FY-2023 Q4)






<b>NCSP Element and Subtask:</b> TE1 <b>M&amp;O Contractor Name:</b> Sandia National Laboratories (SNL) <b>Point of Contact Name:</b> David Ames <b>Point of Contact Phone:</b> (505)844-4697	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November, 2023
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## BUDGET






1. Carryover into FY 2023 = \$95,119
  2. Approved FY 2023 Budget = \$230,000
  3. Total FY 2023 Budget w/Carryover = \$325,119
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$2,870
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$81,226
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$37,183
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$80,009
  8. Projected carryover into FY 2024 = \$88,831
- NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete 	On Schedule 	Behind Schedule 	Missed Milestone 
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

<b>Q2</b>	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
<b>Q3</b>	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
<b>Q4</b>	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		

### ACCOMPLISHMENTS

- TE1 - Prepare for and Conduct Hands-on Criticality Safety Training at SNL
  - The Sandia Hands-on portion of the training course for NCS professionals was delivered Jan. 30 – Feb. 4.
  - The Sandia Hands-on course for Managers/CSOs was delivered April 3 – 7.
  - Preparations are underway for a Hands-On criticality safety class for NCS professionals to be presented in August.
  - Adjustments made to replace a long-standing instructor that recently retired from SNL and is no longer involved with the Sandia portion of the training course.
  - Preparations are underway for a Hands-On criticality safety class for NCS professionals to be presented in January 2024.

### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter
- AND
- Are publicly releasable

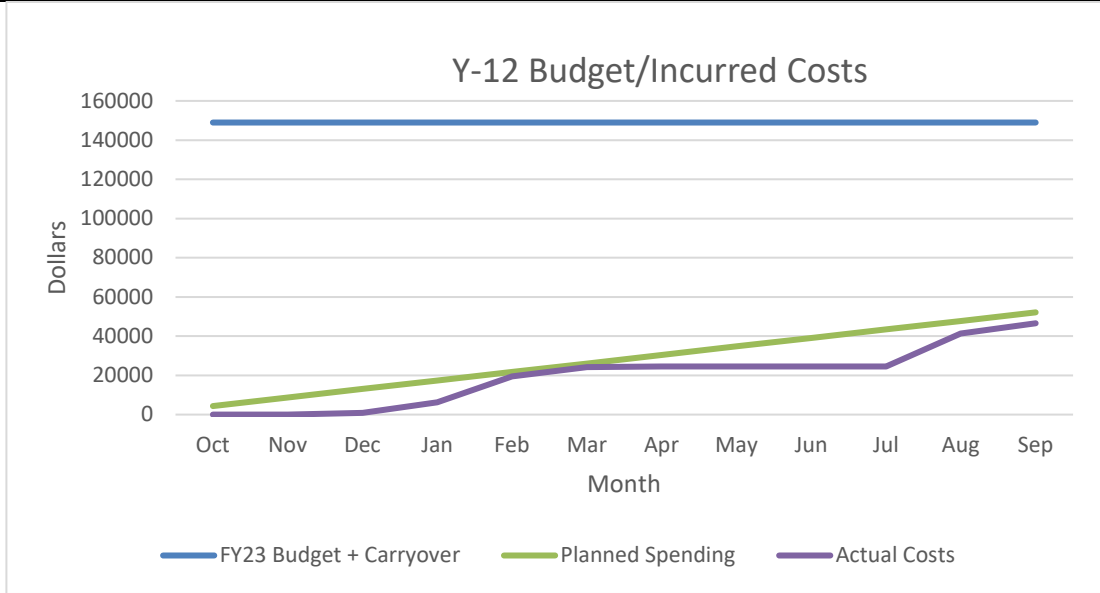
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

<b>Quarter</b>	<b>Publication Reference</b>
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TE1 <b>M&amp;O Contractor Name:</b> Y12 <b>Point of Contact Name:</b> Kevin Reynolds <b>Point of Contact Phone:</b> (865) 241-9067	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 1, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 148,968.58
  2. Approved FY 2023 Budget = \$0.00
  3. Total FY 2023 Budget w/Carryover = \$148,968.58
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$813.62
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$23,324.86
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$ 328.49
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$22,102.07
  8. Projected carryover into FY 2024 = \$102,399.54
- NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="color: blue;">■</span>	On Schedule <span style="color: green;">■</span>	Behind Schedule <span style="color: yellow;">■</span>	Missed Milestone <span style="color: red;">■</span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report of Y-12 activities to support the hands-on training courses. (TE1)		No travel
Q2	Provide a status report of Y-12 activities to support the hands-on training courses. (TE1)		
Q3	Provide a status report of Y-12 activities to support the hands-on training courses. (TE1)		No travel
Q4	Provide a status report of Y-12 activities to support the hands-on training courses. (TE1)		



## NCSP Quarterly Progress Report (FY-2023 Q4)

### ACCOMPLISHMENTS

- TE1 - Conduct Hands-On Criticality Safety Training Course
  -

### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter  
AND
- Are publicly releasable

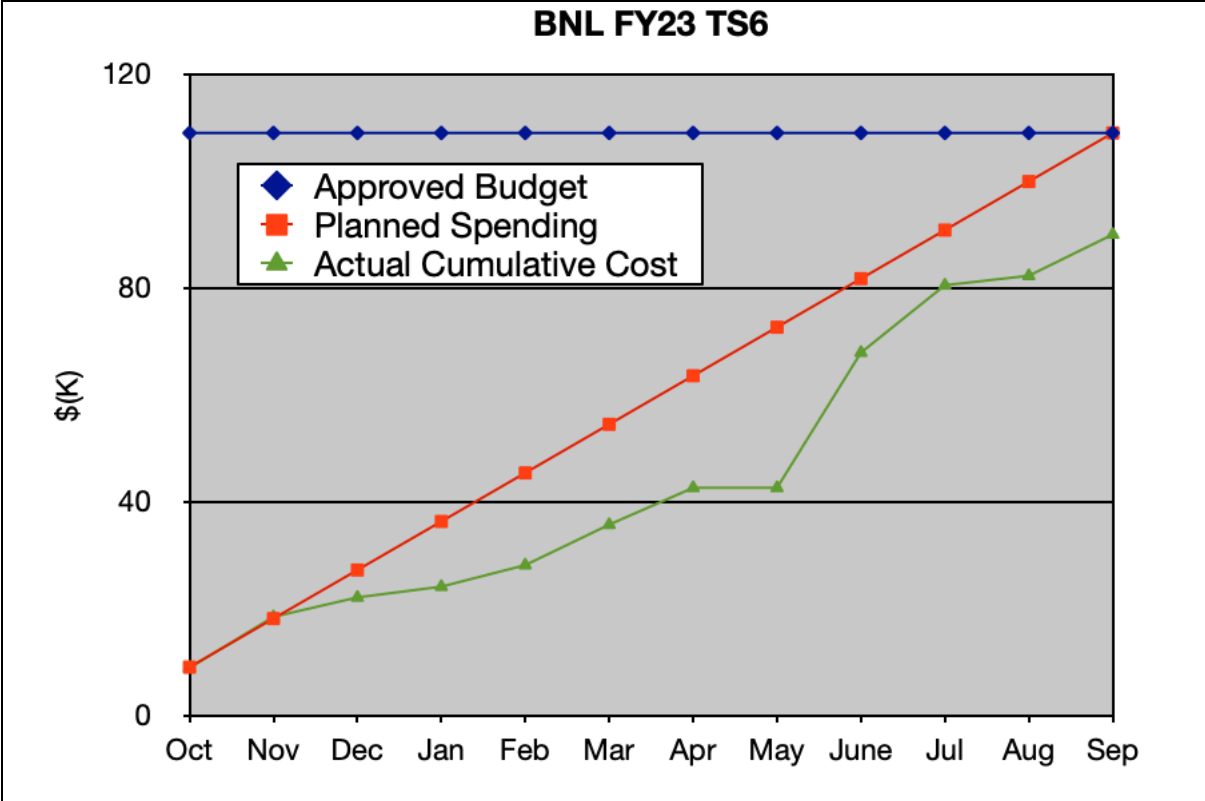
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	
Q3	
Q4	

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS6 <b>M&amp;O Contractor Name:</b> BNL <b>Point of Contact Name:</b> Gustavo Nobre <b>Point of Contact Phone:</b> 631-344-5205	<b>Reference:</b> DP0909010 <b>Date of Report:</b> 2 November, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 9,027
  2. Approved FY 2023 Budget = \$100,00
  3. Total FY 2022 Budget w/Carryover = \$109,027
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$22,135
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$13,609
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$32,189
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$22.101
  8. Projected carryover into FY 2024 = \$18.993
- NOTE:** Include commitments as part of spending





## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="color: blue;">■</span>	On Schedule <span style="color: green;">■</span>	Behind Schedule <span style="color: yellow;">■</span>	Missed Milestone <span style="color: red;">■</span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
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## NCSP Quarterly Progress Report (FY-2023 Q4)

<b>Q1</b>	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Mentored two students who started working on the successor of the manuscript submitted last quarter (arXiv: 2209.14403). This work will use and make predictions on real 238U data instead of synthetic data.
<b>Q2</b>	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Mentored one student to work on final calculations for a second paper on resonance spin classification with machine learning. Planning for three more students for 2023 Summer program from SULI (DOE).
<b>Q3</b>	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Finalized work with Spring intern and started working with 3 interns through the DOE SULI and BNL SURP Summer programs.
<b>Q4</b>	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Finalized work with the 3 Summer interns.

### ACCOMPLISHMENTS

- Finalized mentoring the three Summer interns, two of whom are URM, for the summer internship program on projects related to the Bayesian Resonance Reclassifier:
  - Investigation of different machine-learning metrics.
  - Implementation of an iterative approach.
  - Using experimental capture widths to improve re-classification, applied to 206Pb evaluation.
- Two of the interns submitted an abstract to CEU undergraduate program and were accepted, with partial support, to present their work at the upcoming DNP (Division of Nuclear Physics) meeting organized by APS (American Physical Society)

### PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov).

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1			
Q2	G. P. A. Nobre et al., "Novel machine-learning method for spin classification of neutron resonances", Physical Review C 107, 034612 (2023)	Yes	

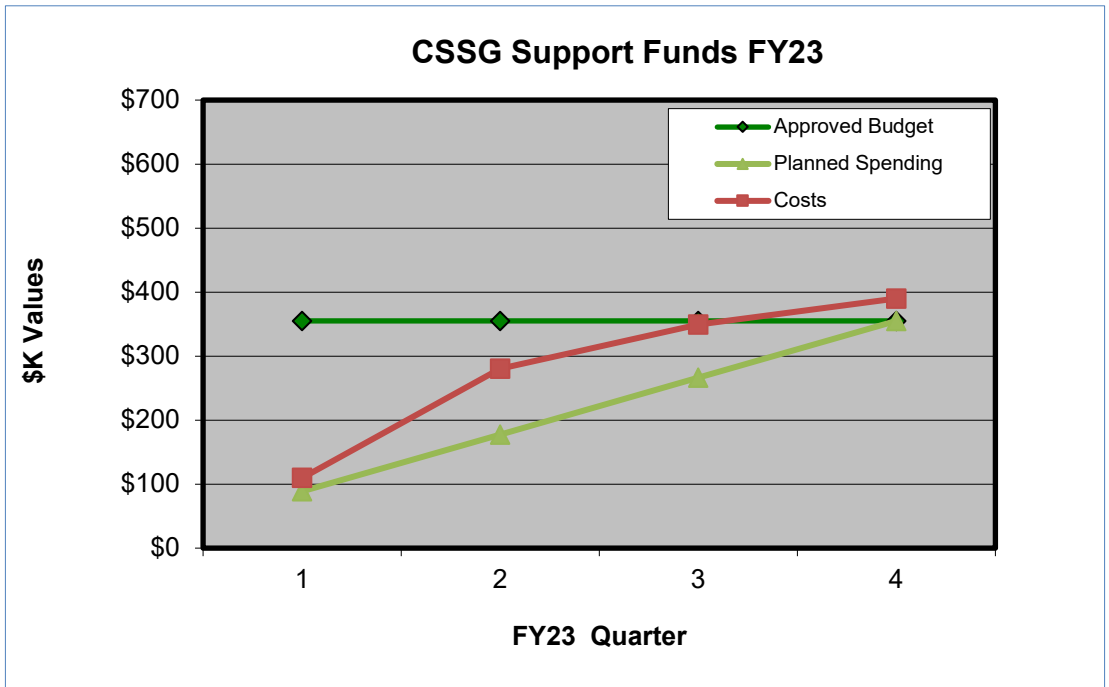
**NCSP Quarterly Progress Report (FY-2023 Q4)**

Q3			
Q4			

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS1 <b>Task Title:</b> CSSG Support <b>Point of Contact Name:</b> David Hayes <b>Point of Contact Phone:</b> 505-667-4523	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 0
  2. Approved FY 2023 Budget = \$ 355,000
  3. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$109,061
  4. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$170,889
  5. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$68,649
  6. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$40,840
  7. Projected carryover into FY 2024 = \$132,760
- NOTE:** Include commitments as part of spending

## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager report of activities. (TS1)		Jim Morman will likely run out of budget early second quarter. Plus up?
Q2	Provide NCSP Manager report of activities. (TS1)		None
Q3	Provide NCSP Manager report of activities. (TS1)		None
Q4	Provide NCSP Manager report of activities. (TS1)		None. Resolve carryover.

## NCSP Quarterly Progress Report (FY-2023 Q4)

### ACCOMPLISHMENTS

- TS1 – CSSG – Support for the Criticality Safety Support Group
  - Regularly scheduled Teams Meetings
  - Nominations for Deputy Chair and New Member out for vote
  - Completed draft response for Tasking 2023-02, *Role of CSSG Emeritus Members*

### PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter  
AND
- Are publicly releasable

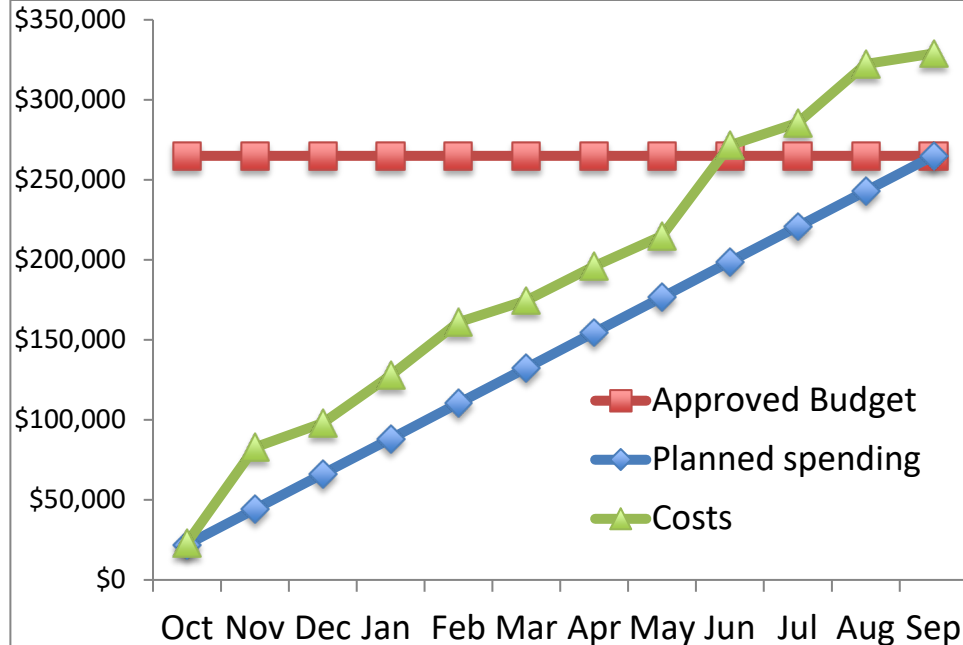
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	
Q2	
Q3	
Q4	

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS4 <b>M&amp;O Contractor Name:</b> LANL <b>Point of Contact Name:</b> Joetta Goda <b>Point of Contact Phone:</b> 505-667-2812	<b>Reference:</b> DP0909010 <b>Date of Report:</b> October 30, 2023
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## BUDGET



1. Carryover into FY 2023 = \$ 100,000
2. Approved FY 2023 Budget = \$ 110,000
3. Total FY23 Budget w/Carryover = \$ 210,000

Quarter	Approved Budget	Carryover	Total Budget
Q1	\$97,985	\$0	\$97,985
Q2	\$76,632	\$0	\$76,632
Q3	\$96,924	\$0	\$96,924
Q4	\$57,423	\$0	\$57,423

8. Projected carryover into FY 2024 = \$0

**NOTE:** Include commitments as part of spending

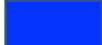
## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager report on succession planning efforts. (TS4)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q2	Provide NCSP Manager report on succession planning efforts. (TS4)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q3	Provide NCSP Manager report on succession planning efforts. (TS4)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

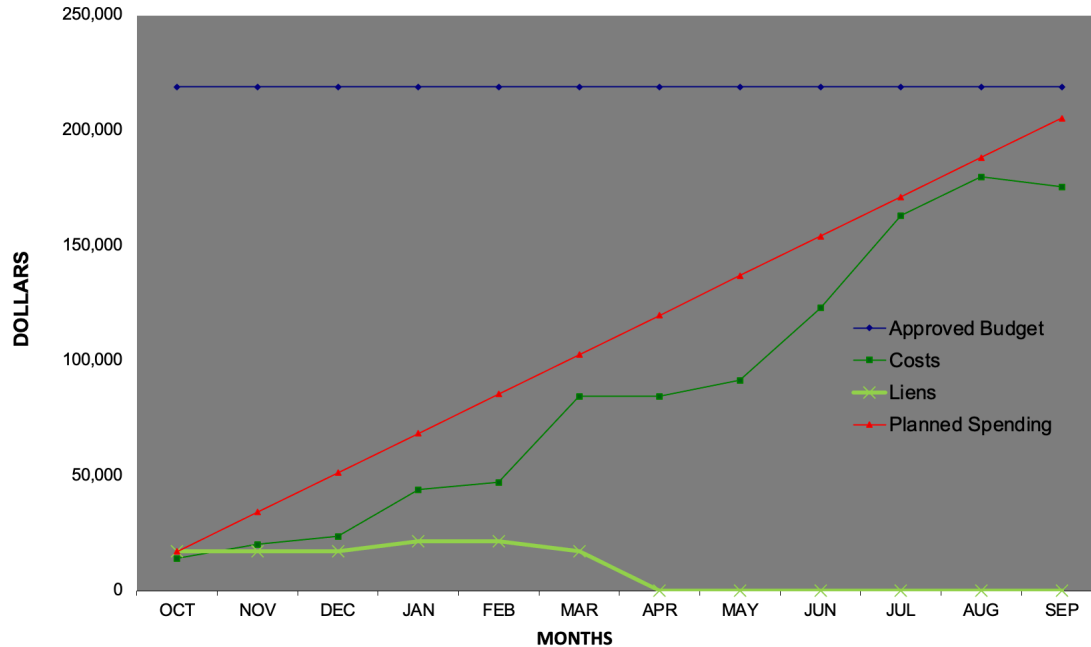
Q4	Provide NCSP Manager report on succession planning efforts. (TS4)		
<b>ACCOMPLISHMENTS</b>			
<ul style="list-style-type: none"> <li>• TS4 – AM, IE, ND Succession Planning             <ul style="list-style-type: none"> <li>○ Students working in person during summer, some continued into fall.</li> </ul> </li> </ul>			
<b>PUBLICATIONS</b>			
<p>Any publications that have</p> <ul style="list-style-type: none"> <li>• Completed your institution’s review cycle during the quarter AND</li> <li>• Are publicly releasable</li> </ul> <p>Should be submitted to Marsha Henley, <a href="mailto:henleym@ornl.gov">henleym@ornl.gov</a> with your quarterly report.</p>			
<b>Quarter</b>	<b>Publication Reference</b> Example: Author, "Title", LA-UR-18-27731, October 1, 2019		
Q1			
Q2			
Q3			
Q4			



# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS5 <b>M&amp;O Contractor Name:</b> LLNL <b>Point of Contact Name:</b> Catherine Percher <b>Point of Contact Phone:</b> (925) 579-4226	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 2, 2023
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## BUDGET





1. Carryover into FY 2023 = \$48,922
  2. Approved FY 2023 Budget = \$120,000 + \$50,000 (CSSG)
  3. Total FY23 budget w/Carryover = \$218,922
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$23,643
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$60,802
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$38,512
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$52,525
  8. Carryover into FY 2024 = \$43,441
- NOTE:** Include commitments as part of spending



## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete 	On Schedule 	Behind Schedule 	Missed Milestone 
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on succession planning efforts. (TS5)		
Q2	Provide a status report on succession planning efforts. (TS5)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

<b>Q3</b>	Provide a status report on succession planning efforts. (TS5)		
<b>Q4</b>	Provide a status report on succession planning efforts. (TS5)		

### ACCOMPLISHMENTS

- TS5 - AM, IE, ND Succession Planning
  - R. Rahman and E. Hudec- summer students hired in June 2023- both are planning to work with the division during the academic years on IE benchmarking as part of their degree programs
  - J. Norris attended Budget Execution Meeting
  - J. Norris, D. Siefman, E. Aboud, A. Tamashiro, R. Araj reviewed 5YP and IE Plan inputs

### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter  
AND
- Are publicly releasable

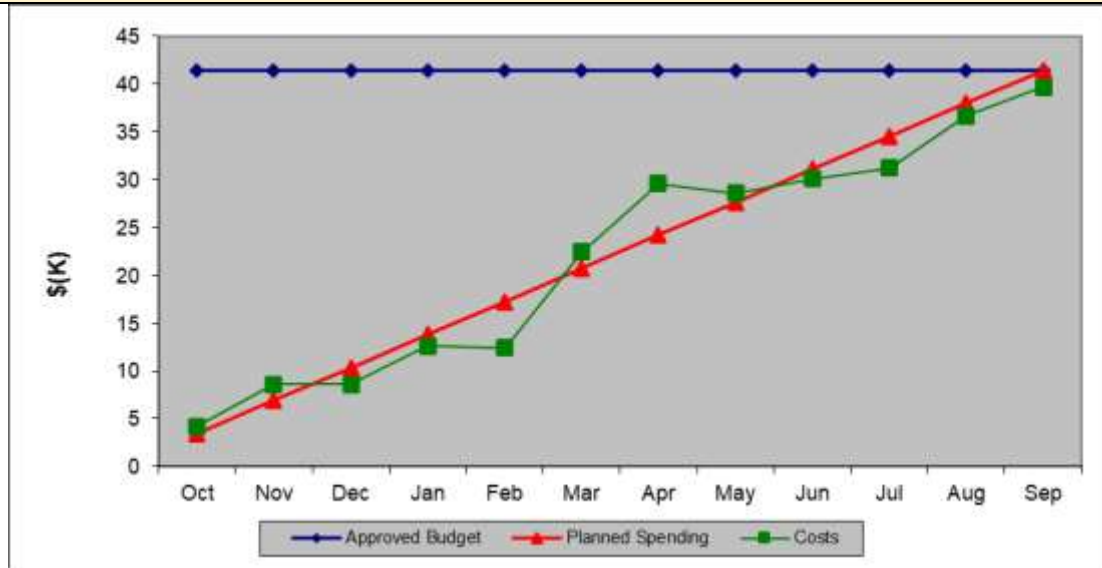
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

<b>Quarter</b>	<b>Publication Reference</b> Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	None
Q2	None
Q3	None
Q4	None

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS9 <b>M&amp;O Contractor Name:</b> NNL <b>Point of Contact Name:</b> Mike Zerkle <b>Point of Contact Phone:</b> (412) 476-6188	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 6, 2023
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## BUDGET



1. Carryover into FY 2023 = \$26K
  2. Approved FY 2023 Budget = \$15K
  3. Total FY 2023 Budget with Carryover = \$41K
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$9K
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$13k
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$8k
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$10k
  8. Projected carryover into FY 2024 = \$2k
- NOTE:** Include commitments as part of spending

## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete <span style="display: inline-block; width: 20px; height: 15px; background-color: blue; vertical-align: middle;"></span>	On Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: green; vertical-align: middle;"></span>	Behind Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: yellow; vertical-align: middle;"></span>	Missed Milestone <span style="display: inline-block; width: 20px; height: 15px; background-color: red; vertical-align: middle;"></span>
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status report on all NDAG chair activities (TS9)		
Q2	Provide status report on all NDAG chair activities (TS9)		
Q3	Provide status report on all NDAG chair activities (TS9)		
Q4	Provide status report on all NDAG chair activities (TS9)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

### ACCOMPLISHMENTS

- TS9 – Support for NDAG Chair activities
  - Participate in NCSP Budget Execution Meeting (Jul 18-20, 2023)
  - Finalized Appendix B for FY2024-FY2028
  - Participate in monthly IE meetings
  - Participate in CSSG meetings
  - Perform reviews of draft ICSBEP benchmark evaluations (ongoing)
  - Serve on CSEWG Executive Committee (ongoing)
  - Support CSEWG phase2 TSL evaluation reviews for ENDF/B-VIII.1 (ongoing)
  - Participate on several IER teams
  - Travel to Japan for ICNC2023

### PUBLICATIONS

Any publications that have

- Completed your institution’s review cycle during the quarter  
AND
- Are publicly releasable

Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	D. Fritz, et al., “Total thermal neutron cross section measurements of yttrium hydride from 0.0005 - 3 eV,” <i>Annals of Nuclear Energy</i> , 181, 109475 (2023). <a href="https://doi.org/10.1016/j.anucene.2022.109475">https://doi.org/10.1016/j.anucene.2022.109475</a>
	D. Fritz, et al., “Total thermal neutron cross section measurements of hydrogen dense polymers from 0.0005–20 eV,” <i>Annals of Nuclear Energy</i> , 183, 109651 (2023). <a href="https://doi.org/10.1016/j.anucene.2022.109651">https://doi.org/10.1016/j.anucene.2022.109651</a>
Q2	
Q3	
Q4	

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS2, 7, 8, 13 <b>M&amp;O Contractor Name:</b> ORNL <b>Point of Contact Name:</b> Doug Bowen <b>Point of Contact Phone:</b> (865) 576-0315	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November 6, 2023
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## BUDGET

**FY23 NCSP Technical Support**

Month	Approved Budget (\$K)	Costs (\$K)	Planned Spending (\$K)
Oct	975	100	100
Nov	975	200	180
Dec	975	250	230
Jan	975	280	300
Feb	975	350	400
Mar	975	450	500
Apr	975	550	600
May	975	650	700
Jun	975	750	800
Jul	975	850	900
Aug	975	900	950
Sep	975	950	950












1. Carryover into FY 2023 = \$391K
2. Total FY 2023 Budget w/Carryover = \$975K
3. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$258K
4. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$196K
5. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$216K
6. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$282K
7. Projected carryover into FY 2024 = \$23K
8. TS budget decreased by \$130k in 12/2023 - \$30K recalled to HQ for G2 IER database work and \$100K transferred to NNSS to cover over-spending.

**NOTE:** Include commitments as part of spending







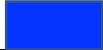
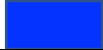


## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="display: inline-block; width: 20px; height: 15px; background-color: blue; vertical-align: middle;"></span>	On Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: green; vertical-align: middle;"></span>	Behind Schedule <span style="display: inline-block; width: 20px; height: 15px; background-color: yellow; vertical-align: middle;"></span>	Missed Milestone <span style="display: inline-block; width: 20px; height: 15px; background-color: red; vertical-align: middle;"></span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	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. (TS2)	<span style="display: inline-block; width: 20px; height: 15px; background-color: blue;"></span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

<b>Q1</b>	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)		
<b>Q1</b>	Provide NCSP Manager annual report of succession planning efforts (TS7)		
<b>Q1</b>	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
<b>Q1</b>	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
<b>Q2</b>	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. (TS2)		
<b>Q2</b>	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)		
<b>Q2</b>	Provide NCSP Manager annual report of succession planning efforts (TS7)		
<b>Q2</b>	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
<b>Q2</b>	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
<b>Q3</b>	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. (TS2)		
<b>Q3</b>	Manage 5-year plan development and maintenance and oversee the CEDT process		

## NCSP Quarterly Progress Report (FY-2023 Q4)

	and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)		
Q3	Provide NCSP Manager annual report of succession planning efforts (TS7)		
Q3	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
Q3	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
Q4	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. (TS2)		
Q4	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)		
Q4	Organize and lead the Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY (TS2)		
Q4	Publish final Five-Year Plan. (TS2)		
Q4	Provide NCSP Manager annual report of succession planning efforts (TS7)		
Q4	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
Q4	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
<b>ACCOMPLISHMENTS</b>			

## NCSP Quarterly Progress Report (FY-2023 Q4)

- TS2 - Support for Lead Lab to Execute the NCSP
  - FY2023 NCSP Budget Execution Meeting was conducted successfully July 18-20, 2023, at the National Atomic Testing Museum and at the Nevada National Security Site. Bowen worked with Eloura Phelps at LANL to arrange tours of the NNSS and DAF per requests from the NCSP manager.
  - FY23 Five-Year Plan:
    - Final addendum was completed to reflect changes to the NCSP funding profiles. Marsha Henley provided a significant amount of support to this effort in FY23Q4 to keep track of funding transfers between sites, as necessary.
    - Main 5-year plan was finalized by Bowen/Henley and approved by Angela Chambers August 21, 2023.
    - Integral experiment section of the 5-year plan was drafted and updated because of the status of IER work at the end of the fiscal year. Due to be published in Nov. 2023 once the final status of FY23 integral experiment work is known.
  - CSCT Scribe – took minutes for the monthly meetings in July, August, and September.
  - Summer Newsletter generated and published. Fall newsletter drafted and sent to Angela Chambers for approval to publish.
  - FY2023 Quarter 4 Reports:
    - Sent requests to each TM for their Q4 reports.
    - Posted non-IE version of the Q3 report on the website for NCSP accomplishments.
    - Requested foreign trip reports based on Appendix C. Updated the website with the reports/information received.
  - Access Database:
    - FY23 budget changes were made so that reports and Excel spreadsheets can be generated.
    - Quarterly publications – each quarter Henley is adding the publications to the Access database for easy search and extract of records. A spreadsheet of all the quarterly publications is created and provided to OSTI along with the publications themselves.
    - Pulled FY23 tasks from my database including information about which are ongoing and when tasks should end. Sent this information to Doug for our FY24 5YP planning.
    - Pulled proposals that haven't been accepted from Marsha's database. Sent this information to Doug for our FY24 5YP planning.
      - Marsha received an Excel file from Jake Nicholls with all the BCR detailed data that he created from 2014 – 2023 of BCR PDFs. I added new records and updated data I had with more information Jake provided in the Excel file. We now have all BCR data in Access. This can be related to the IERs for showing changes in deliverables over the years. was missing into my Access table.
    - Added Mission and Vision data to support revision.
    - Appendix B – began task of creating tables to update with FY23 Appendix B data.
  - CSSG Support:
    - Supported meetings as necessary; attended virtual meetings and in-person meeting at the June ANS meeting.
  - Lead FY23 Q3 quarterly report video teleconference and summarized NCSP accomplishments. Posted accomplishments to the NCSP website, sans IE data.
  - Supported Mission and Vision meetings as necessary to support the revised document.
  - MGT Team (Miller) led IE status update meetings, as necessary. Bowen and Henley assisted with this effort as needed.
  - Conducted NCSP Management Team meetings to discuss the status of NCSP execution work.



## NCSP Quarterly Progress Report (FY-2023 Q4)

- TS7 - AM, ND Succession Planning
  - Utilized succession planning funding for new staff development for AM and ND ORNL NCSP tasks.
  - Iyad Al-Qasir has started in the ND group and will utilize this funding to train into his ND task roles.
- TS8 - NCSP Program Management Tools Development
  - No work to support this effort in Q3. No significant updates to G2 have been completed by ORNL G2 staff in Q3. Late in Q3 more bugs were found for Bowen/Miller to find. Meetings with NNSA and ORNL were supported to talk about FY24 G2 IER database priorities.
- TS13 - NDA Technical Support Group and NDA Technical Infrastructure Project
  - Angie Lousteau's NDA group worked with Bowen and the NCS group to successfully execute the 2<sup>nd</sup> NCSP-funded hold up workshop in Q4 at ORNL. Henley/Bowen worked with LLNL on NDA website updates to reflect new training and education activities for the NDA program. More courses are planned in FY24.

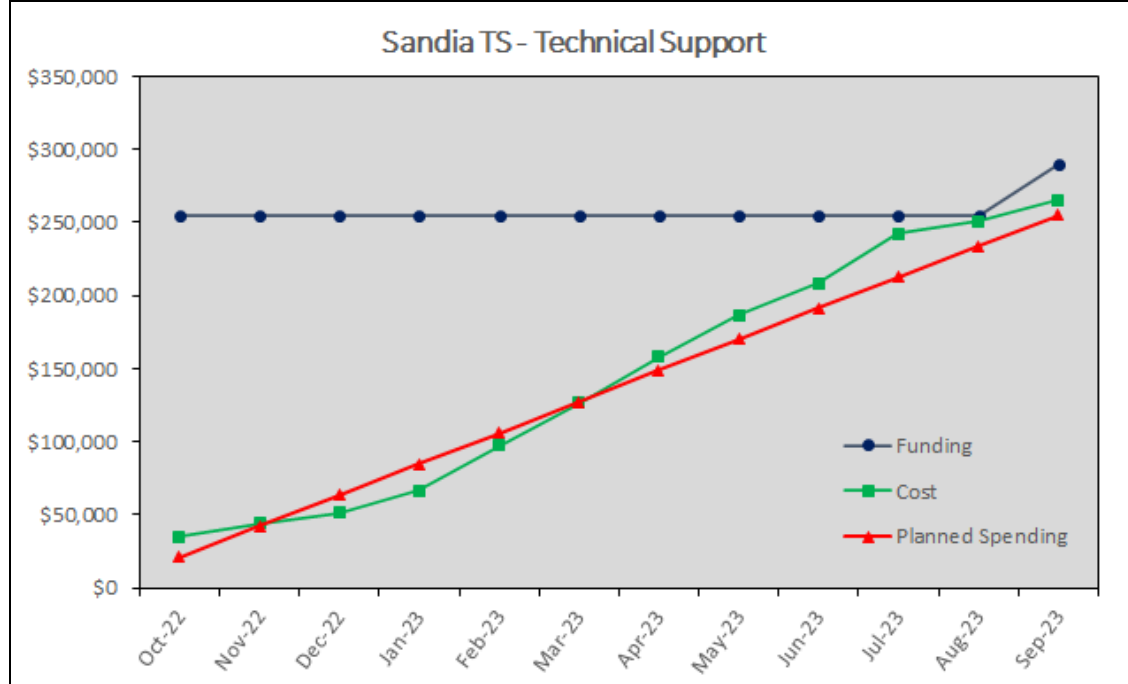
### PUBLICATIONS

Quarter	Publication Reference
	<b>Example:</b> Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	Douglas Bowen, "Brief Overview of the DOE/NNSA Nuclear Criticality Safety Program", 2022 ANS Winter Meeting and Technology Expo, Phoenix, AZ, Nov 2022.
Q2	Douglas Bowen, "The meaning of the Terms "Credible" and "Unlikely" for Nuclear Criticality Safety Purposes," LANL Nuclear Criticality Safety Division Discussion, Los Alamos, NM, June 2022
	Douglas Bowen, "ORNL NCSP FY 2022 Budget Summary and Highlights," Technical Program Review Meeting, Albuquerque, NM, February 2023.
	Douglas Bowen, "The Purpose of the DOE/NNSA Nuclear Criticality Safety Program Technical Program Review," Technical Program Review Meeting, Albuquerque, NM, February 2023.
Q3	None
Q4	Douglas Bowen, "Formality of Operations and Nuclear Criticality Safety Standards," ANS Annual Meeting, Indianapolis, IN, June 2023.
	Douglas Bowen, "Sharing of Good Practices & Lessons Learned," ANS Annual Meeting, Indianapolis, IN, June 2023.
	Douglas Bowen, "Status of ANS-8 and TC85/SC5/WG8 NCS Consensus Standards," 29th Meeting of the Working Party on Nuclear Criticality Safety (WPNCS), June 2023.

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> TS3, 12 <b>M&amp;O Contractor Name:</b> Sandia National Laboratories (SNL) <b>Point of Contact Name:</b> David Ames <b>Point of Contact Phone:</b> (505)844-4697	<b>Reference:</b> DP0909010 <b>Date of Report:</b> November, 2023
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## BUDGET









1. Carryover into FY 2023 = \$11,226
  2. Approved FY 2023 Budget = \$ 255,000
  3. Total FY 2023 Budget w/Carryover = \$266.226
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023 = \$51,463
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$74,828
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$82,298
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$56,588
  8. Projected carryover into FY 2024 = \$36,049
- NOTE:** Include commitments as part of spending

## MILESTONES

<b>STATUS (copy color code and paste below in 'STATUS' field)</b>			
Complete <span style="background-color: blue; color: white; padding: 2px;"> </span>	On Schedule <span style="background-color: green; color: white; padding: 2px;"> </span>	Behind Schedule <span style="background-color: yellow; color: black; padding: 2px;"> </span>	Missed Milestone <span style="background-color: red; color: white; padding: 2px;"> </span>
QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager with report of succession planning efforts. (TS3)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	
Q1	Provide the NCSP manager with a summary of NCSP CEEdT support (TS12)	<span style="background-color: blue; color: white; padding: 2px;"> </span>	

## NCSP Quarterly Progress Report (FY-2023 Q4)

Q2	Provide NCSP Manager with report of succession planning efforts. (TS3)		
Q2	Provide the NCSP manager with a summary of NCSP CEdT support (TS12)		
Q3	Provide NCSP Manager with report of succession planning efforts. (TS3)		
Q3	Provide the NCSP manager with a summary of NCSP CEdT support (TS12)		
Q4	Provide NCSP Manager with report of succession planning efforts. (TS3)		
Q4	Provide the NCSP manager with a summary of NCSP CEdT support (TS12)		

### ACCOMPLISHMENTS

#### TS3 – Support for Experimentalist Succession Planning

- The Year-round Ph.D. student intern that has been supporting the critical experiment team has transitioned to a SNL staff member.
- Matrixed employee performing as an experimenter.
- Actively participating in the NCS community by attending conferences and publishing papers.

#### TS12 - NCSP IE Manager Support

- Performed duties as the IE Manager in support of the IE program element.
  - Interacted with the site task mangers to track and assist progress on various IER milestones and MIHLs:
  - Interacted with NCSP Management Team, provided technical advice, and assisted on a broad scope of items (e.g., 5 year plans, TEX-2.0 meeting, IE priorities, MIHL lists items).
  - Run monthly IE meetings, distribute agenda and notes.
  - Participate in various IER team meetings and assisted IER team members with requested items.
  - Project and report final milestone completions as well as IERs moved out to future or into the current FY.
  - Process BCR submissions.
  - Reviewed reports and processed through approval in IER database (team members and NCSP manager) or ensured BCR submission.
  - Track Non-NCSP IERs and work with site and NCSP management team to initiate new ones, as added.
  - Updated team memberships per site leads direction.
  - Facilitated discussions between LANL, LLNL and NCSP management team on use of NCSP materials for non-NCSP IERs.
  - Worked in the IER database, assisted others with issues using database, work with G2 developers on database improvement items.
- Minor progress on NCSP IE Manual Revision.

## NCSP Quarterly Progress Report (FY-2023 Q4)

### PUBLICATIONS

Any publications that have

- Completed your institution's review cycle during the quarter  
AND
- Are publicly releasable

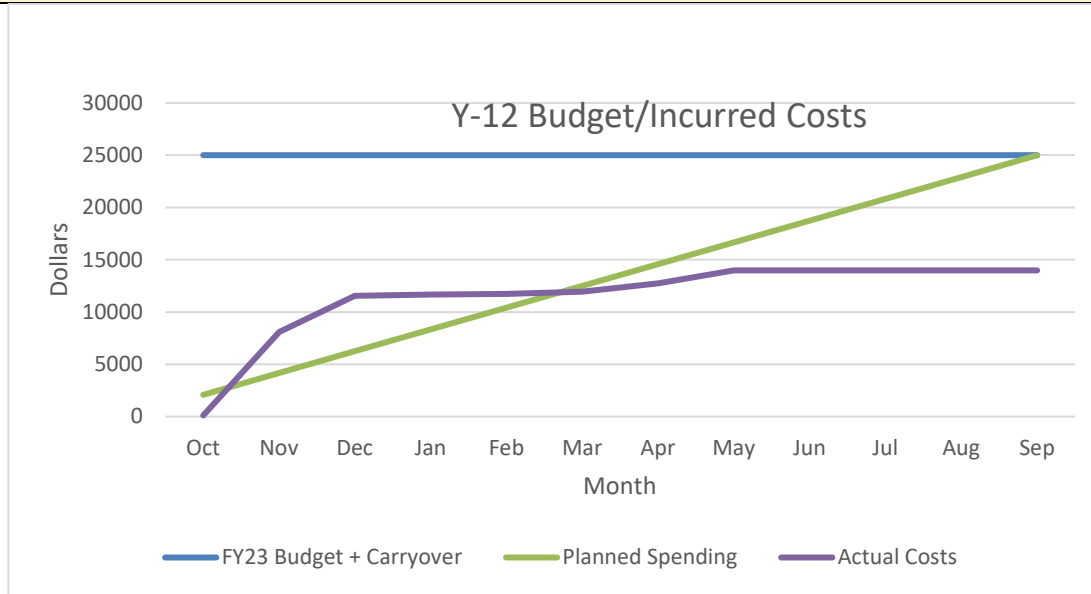
Should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov) with your quarterly report.

Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019
Q1	D.E. Ames, G.A. Harms and E.C. Lutz, "Design of Critical Experiments Targeting Epithermal Cross Sections of Tantalum," SAND2022-8816C, ANS Winter Meeting, ANS-2022, Phoenix, AZ (Nov. 2022).
Q2	D.E. Ames, M. Dupont, G. Harms, A. Chapa, and E. Lutz, "IER 441: Experiments to Measure the Effect of Tantalum on Critical Systems (SNL/ORNL)," SAND2023-12567PE, presented at the NCSP TPR, Feb. 21-23, 2023.
Q2	W. Cook, E. Lutz, D. Ames, A. Raster, J. Cole, G. Harms, and J Miller, "IER-523: Design of a UO <sub>2</sub> -BeO Critical experiment at Sandia," SAND2023-12611PE, presented at the NCSP TPR, Feb. 21-23, 2023.
Q4	D. Ames, G. Harms, E. Lutz and M. Dupont, "Experiments to Measure the Effect of Tantalum on Critical Systems," SAND2023-07341C, ICNC-2023, Full Paper, Sendai, Japan (2023).
Q4	W. Cook, E. Lutz, D. Ames, A. Raster, G. Harms, J. Miller and J. Cole, "Design of UO <sub>2</sub> -BeO Critical Experiment at Sandia," SAND2023-09380D, ICNC-2023, Poster, Sendai, Japan (2023).
Q4	D. Ames, G. Harms, E. Lutz, and M. Dupont, "Critical Experiments Targeting the Epithermal/Intermediate Cross Sections of Tantalum," SAND2023-0733C, ANS Winter Meeting, ANS-2023, Accepted Summary Paper, Washington DC (2023).

# NCSP Quarterly Progress Report (FY-2023 Q4)

<b>NCSP Element and Subtask:</b> Technical Support & CSSG (TS) <b>M&amp;O Contractor Name:</b> Y12 <b>Point of Contact Name:</b> Kevin Reynolds <b>Point of Contact Phone:</b> (865) 241-9067	<b>Reference:</b> DP0909020 <b>Date of Report:</b> November 1, 2023
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## BUDGET







1. Carryover into FY 2023 = \$0.0
  2. Approved FY 2023 Budget = \$25,000.00
  3. Total FY 2023 Budget w/Carryover = \$25,000.00
  4. Actual spending for 1<sup>st</sup> Quarter FY 2023=\$11,545.61
  5. Actual spending for 2<sup>nd</sup> Quarter FY 2023 = \$403.82
  6. Actual spending for 3<sup>rd</sup> Quarter FY 2023 = \$2,253.81
  7. Actual spending for 4<sup>th</sup> Quarter FY 2023 = \$0.00
  8. Projected carryover into FY 2024= \$11,017.03
- NOTE:** Include commitments as part of spending

## MILESTONES

**STATUS (copy color code and paste below in 'STATUS' field)**

Complete 	On Schedule 	Behind Schedule 	Missed Milestone 
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QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager an update of Program activities (including CSSG)		
Q2	Provide the NCSP manager an update of Program activities (including CSSG)		
Q3	Provide the NCSP manager an update of Program activities (including CSSG)		
Q4	Provide the NCSP manager an update of Program activities (including CSSG)		

## NCSP Quarterly Progress Report (FY-2023 Q4)

### ACCOMPLISHMENTS

- Travel to BEM and NCERC Futures Meeting
- Attendance at several CSSG meetings (virtual or email votes).

### PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, [henleym@ornl.gov](mailto:henleym@ornl.gov).

Quarter	Publication Reference (example)	Sent to NCSP? Yes/no	If no, status of submittal
Q1			
Q2			
Q3			
Q4			

## Summary of MCNP Classes in FY 2023 – Q4

M.E. Rising<sup>1</sup>, A.R. Clark<sup>1</sup>

<sup>1</sup>Monte Carlo Codes (XCP-3), LANL

**FY2023 – Q4 classes are highlighted in red.**

### Total Students

- FY2023 – Q1            82 students        (Intro, Intermediate, Criticality)
- FY2023 – Q2:        34 students        (Intermediate, Advanced)
- FY2023 – Q3:        73 students        (Intro, Criticality, Safeguards)
- **FY2023 – Q4:        14 students        (Intro)**
- FY2023 – TOTAL:    203 students

In FY23, a balanced mix of in-person and online classes are offered.

### Classes sponsored by DOE-NNSA-NCSP

- **Criticality Calculations with MCNP6 (LANL-AM1)**
  - November 7-10, 2022        in-person @ Y12        15 students
  - June 19-23, 2023            in-person @ LANL        15 students

MCNP criticality class for NCS & reactor physics practitioners, with focus on best practices. Includes 1 day on NCS validation using MCNP6-Whisper. NCS participants at DOE sites do not pay registration fees.

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation (LANL-TE4; not funded in FY23)**
  - TBD                                TBD                                TBD students

Joint LANL & ORNL effort, covering background material and specific usage of MCNP6-Whisper and SCALE-KENO-TSUNAMI-TSURFER. D. Bowen coordinates scheduling at DOE sites.

### Other Classes - supported by student registration fees.

- **Introduction to MCNP6** (includes 1/2 day on criticality calculations, without NCS validation & Whisper)
  - Oct 24 – 28, 2022            online                    41 students
  - Jun 5 – 9, 2023                online                    44 students
  - **Aug 21 – 25, 2023**            in-person @ LANL        14 students
- **Intermediate MCNP6**
  - Oct 3 – 7, 2022                online                    26 students
  - Feb 27 – Mar 3, 2023        in-person @ OECD-NEA    20 students
- **Advanced MCNP6 Features & Utilities**
  - Mar 6 – 11, 2023            in-person @ OECD-NEA    14 students
- **MCNP6 for Nuclear Safeguards Practitioners**
  - June 26 – 30, 2023        in-person @ LANL        14 students

# STATUS REPORT

## on the

### International Collaboration with the Atomic Weapons Establishment (AWE)

Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2023 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
<b>Analytical Methods</b>						
AWE-AM1	Slide rule update	ORNL-AM6 LLNL-AM3 IRSN-AM5	Perform calculations; attend meetings; review analysis and reports	C. HODKINSON	D. BOWEN C. PERCHER	ORNL LLNL
AWE effort currently on hold due to lack of resource.						
<b>INTEGRAL EXPERIMENTS</b>						
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
Passive Neutron Spectrometer has been developed and deployed alongside LLNL sphere et al at the Godiva intercomparison in both gold and TLD configurations. Discussions have now been recently held regarding the SPECTRA-UF unfolding code and access for international labs.						
AWE-IE3 <b>IER 406</b>	Cf-252 CAAS benchmark	LLNL-IE1	Perform/support PNS(TLD) measurements with a shadow cone	P. ANGUS	D. HEINRICHS F. TROMPIER	LLNL IRSN
Dependent on completion of IE2.						
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 IRSN
Dependent on completion of IE2 (unfolding tools for directionality). Linked with IE11 (International inter-comparison)						
AWE-IE6	ICSBEP shielding benchmark for shipping containers	Proposal FY20-25 (Low priority Experiment for FY2022)	Participate in experiment design; PNS(TLD) could be deployed as primary measurement device AWE to do some preliminary design	P. ANGUS	S. KIM	LLNL
Not started due to long lead time (2023) and dependence on PNS availability (see IE2). Scope definition required.						
AWE-IE7 <b>IER 153</b>	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	LANL
Discussions being held with UKAEA to set up a session to discuss the code and our applications. US will share measurement data with the UK, enabling analysis using UK unfolding tools and comparison with US codes.						



Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2023 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
AWE-IE8	Diagnostic development for measurement of correlated leakage radiations	LLNL-IE1	A feasibility study is being developed at AWE to ascertain suitable counting scenarios and methods. An experimental design will then be produced in the following years based upon the outcomes of this study	N. KELSALL	W. ZYWIEC	LLNL
AWE experiments suggest that further measurements on bulk metal and oxide systems are worthwhile. A measurement campaign at DAF is therefore planned for the last quarter of 2023.						
AWE-IE9	AWE/LLNL NCT 5 year measurement campaign	LLNL-IE1	Participate in experiment design, measurements and reporting	N. KELSALL	W. ZYWIEC	LLNL
DAF measurement campaign undertaken on bulk metal systems during November 2022, with the next campaign planned for the first quarter of 2024.						
AWE-IE10	NAD Research & Development	LLNL-IE1	Develop prototypes, participate in design, execution and reporting of dosimetry experiments	P. ANGUS	F. TROMPIER	LLNL
No progress to date. Potentially use IE11 as an opportunity to compare & test any new instrumentation.						
AWE-IE11 (IER 538)	NAD Exercise	LLNL-IE1	Produce experiment design; participate in exercise; produce final report. Repeat even years.	P. ANGUS	P. MAGGI	LLNL
Next international inter-comparison is anticipated in June 2024.						
AWE-IE12	CIDAAS testing	Proposal FY19-20	Deploy AWE CIDAAS for test irradiation. Repeat odd years as needed	T. BIRKETT S. GARBETT	D. HEINRICHS P. MAGGI J. GODA	LLNL LLNL LANL
Next test planned for March 2024, using Godiva.						
AWE-IE13	Characterization of AFRR1 TRIGA reactor radiation field AWE will provide onsite measurement	LLNL-IE1 SNL-IE1ST2	Provide support to experiment design	P. ANGUS	A. ROMANYUKHA G. HARMS	LLNL SNL
AFRR1 visit undertaken in February 2023 to discuss experimental plan with participants. UK involvement in the characterization (August 2023) was cancelled at very late notice due to UK/US clearance issues. However, US will share their measurement data with the UK, enabling analysis using UK unfolding tools and comparison with US codes.						
<b>INFORMATION PRESERVATION AND DISSEMINATION</b>						
AWE-IPD1	Conduct benchmark evaluations of legacy IEU integral experiments.	LLNL-IPD1	Assess feasibility of sponsoring PhD; determine availability of data.	C. HODKINSON	C. PERCHER	LLNL
Considered unlikely to make any material progress.						
<b>TRAINING AND EDUCATION</b>						
AWE-TE1	Hands-on criticality safety training	ORNL-TE1	AWE personnel to attend training course	C. HODKINSON	D. BOWEN B. MYERS D. HEINRICHS	ORNL LANL LLNL

Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2023 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
					G. HARMS	SNL
Four criticality assessors attended courses during Q2. Three assessors expected to attend course planned for Q2 of next financial year.						

## APPENDIX E: International Collaboration with the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) for FY2023

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.

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<b>ANALYTICAL METHODS</b>						
IRSN-AM5	Update of the slide rule	ORNL-AM6 LLNL-AM3 AWE-AM1	Contribution to final report	J. HERTH	D. BOWEN D. HEINRICHS R. JONES	ORNL LLNL AWE
<p><b>Q1 status</b></p> <p>A meeting is going to be scheduled to identify work to be done this year to close the action.</p> <p><b>Q2 status</b></p> <p>In line with IRSN's goal to provide a final report on the Slide Rule project on Q4 FY2023, a doll has been proposed for a meeting in order to make progress on the next steps (end of May or beginning of June).</p> <p><b>Q3 status</b></p> <p>As discussed during June 8 meeting, IRSN is updating the former technical report (IRSN 2019-00266), which combines results for phase 1 and 2. New version will include results of phases 3 (shielding materials) and 4 (Pu DFG). Draft version will be sent to ORNL and LLNL in September.</p> <p><b>Q4 status</b></p> <p>Delay due to ICNC, draft version now ready for ORNL and LLNL review, to be sent before end of November.</p>						
IRSN-AM8	Analytical Methods Working Group	LANL-AM1 ORNL-AM2 LLNL-AM3	IRSN participation to NCSP Analytical Methods Working Group, NDAG meeting, and TPR meeting	S. PIGNET	J. ALWIN B.J. MARSHALL D. HEINRICHS	NCSP

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q1 status</b></p> <p>Participation of IRSN to TPR meeting. Needs to set up an intercomparison between MACSENS and TSUNAMI/TSURFER for bias estimation.</p> <p><b>Q2 status</b></p> <p>No update</p> <p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p> <p>No update</p>						
IRSN-AM9	Cross sections processing validation	ORNL-AM3	AMPX training - Development of an interface between GAIA and AMPX and test interface capabilities.	V. JAISWAL	A. HOLCOMB D. BOWEN	ORNL
<p><b>Q1 status</b></p> <p>First tests of covariance matrixes generation with in-house code GAIA, comparison with AMPX to be done.</p> <p><b>Q2 status</b></p> <p>Benchmark of NJOY/AMPX/GAIA(IRSN) covariances matrixes using SERPENT code (in progress).</p> <p><b>Q3 status</b></p> <p>Benchmark NJOY/AMPX/GAIA(IRSN) covariances matrixes using SERPENT code completed and published at Wonder 2023 (6-9 June, France)</p> <p><b>Q4 status</b></p>						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
No update						
IRSN-AM13	Benchmark intercomparison study	(FY21 5 YP) LLNL-AM5 ORNL-AM10 LANL-AM5 Y12-AM1 FY22-02	Definition of common set of developed benchmark models. Extension 2022-2024	J. BEZ	D. HEINRICHS B.J. MARSHALL J. ALWIN	LLNL ORNL LANL
<p><b>Q1 status</b></p> <p>The report on the intercomparison study on keff has been sent on January 19<sup>th</sup> to the NCSP partners.</p> <p><b>Q2 status</b></p> <p>Presentation has been held during TPR meeting. Waiting for review/feedback from LLNL, LANL, ORNL.</p> <p><b>Q3 status</b></p> <p>ORNL remarks received and included in the report. Waiting until end of August for other comments from LANL and LLNL. Final report to be released in September.</p> <p><b>Q4 status</b></p> <p><a href="#">k-eff report under IRSN reviewing. Publication expected for the end of November</a></p> <p>Report for Beta-eff benchmarks has been delayed (end of civil year) due to update in calculations. Shielding Benchmarks list to be set up at the beginning of next civil year.</p>						
<b>INTEGRAL EXPERIMENTS</b>						
IRSN-IE25 IER 296	TEX-MOX	LLNL-IE1	Leading the design, supplying materials if needed. In 2023, working on CED2	M. BROVCHENKO	C. PERCHER	LLNL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
	<p><b>Q1 status</b></p> <p>CED-1 report sent to CED Team.  Mechanical/thermal mock-up to demonstrate the heat removal design shared with the CED Team during the meeting on 12<sup>th</sup> January 2023.  Inputs from LANL calculations. New meeting scheduled during TPR week.</p> <p><b>Q2 status</b></p> <p>Regular CED team (LALN, LLNL, Sandia) meeting to progress on the thermal design of the experiments. Comparison of LANL and IRSN thermal calculations. Plates analysis foreseen in Q3 with IRSN staff participation. CED-1 report uploaded to G2.  Completion of thermal design scheduled mid-May  Final Neutronics optimization to be launched after measurements.</p> <p>On track to provide a draft of CED2 for review in September.</p> <p><b>Q3 status</b></p> <p>Jeremy Bez participated to measurements campaign in May, Joetta transmitted a draft report, IRSN comments sent to Joetta July 21<sup>st</sup>.</p> <p><i>CED2 progress:</i>  Passive cooling design enough to meet safety requirements. Active cooling system foreseen for better physical results. Neutronics optimization of design in progress, completion of calculations scheduled for mid-August. Writing of report has started. Still on track for a draft sent to LANL and LLNL mid-September.</p> <p><b>Q4 status</b></p> <p>CED2 report : LANL's comments have been received and incorporated in the draft report  Additional calculation results are currently being included, a new version will be sent to LANL and LLNL end of November  Final version is expected for end of December.</p>					

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<b>IRSN-IE30 IER 538</b>	Full dosimetry exercise around GODIVA	LLNL-IE1	Participation to the experiment in 2022. Provide support for CED4a in 2023.	F. TROMPIER	D. HEINRICHS	LLNL AWE
<p><b>Q1 status</b></p> <p>IRSN’s results from the last exercise (Godiva IV, august 2022) have been sent on time. Note that this exercise was not a “full exercise”. Depending on the visit at AFFRI, it could be also foreseen to organize it at AFFRI and to advantage of the cytogenetic laboratory available at AFFRI.</p> <p><b>Q2 status</b></p> <p>CED4A report published by ORNL and received.</p> <p><b>Q3 status</b></p> <p>No update – action completed</p> <p><b>Q4 status</b></p> <p>Action completed</p>						
<b>IRSN-IE30 IER 484</b>	Dosimetry collaboration with Armed Forces Radiobiology Research Institute (AFRRI)	LLNL-IE1 AWE IE13	Participation to the characterization work in 2023.	F. TROMPIER	D. HEINRICHS	LLNL AWE
<p><b>Q1 status</b></p> <p>IRSN participation to visit AFFRI facility (scheduled early 2023) in order to participate to preliminary measurements and discussions on the organization of the next national US exercise.</p> <p><b>Q2 status</b></p> <p>IRSN participation to visit the facility in February Dosimetry Characterization scheduled in August, IRSN will participate</p>						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p> <p>Dosimetry Characterization performed in August, IRSN colleagues François TROMPIER and Yoann RISTIC participated.</p>						
<b>IRSN-IE46 IER 518</b>	High Multiplication Subcritical (Multiplicity) Benchmark Experiments	LLNL-IE1 SNL-IE1 LANL-IE3	Review of CED4a.	W. MONANGE	G. HARMS/C. PERCHER	SNL/LLNL
<p><b>Q1 status</b></p> <p>Discussion about the submission of an abstract at ICNC</p> <p><b>Q2 status</b></p> <p>CED3B draft received, IRSN inputs in progress</p> <p><b>Q3 status</b></p> <p>CED3B finalized. Meeting to be scheduled</p> <p><b>Q4 status</b></p> <p>CED4 completed for IRSN part. IRSN will be external reviewers, report to be reviewed expected in December, deadline for IRSN to be discussed.</p>						
<b>IRSN-IE51 IER 479</b>	TEX HEU with poly at very low temperatures	LLNL-IE1	Contribution to design, supplying materials if needed, participation to the experiment	J. BEZ	C. PERCHER	LLNL



	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q1 status</b></p> <p>Discussion about LLNL's abstracts for ICNC and about the technical delays for thermal surrogate testings</p> <p><b>Q2 status</b></p> <p>Visit of LLNL staff at IRSN March 31<sup>st</sup> Status on surrogate testing discussed.</p> <p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p> <p>No update for Q4, one IRSN-ORANO paper at the ICNC showing the needs for low temperature experiments.</p>						
<b>IRSN-IE53 IER 551</b>	True Intermediate Energy System with Pu-239 and Pu-240	LANL IE3 (Funded as low priority IER for FY2022)	Contribution to design and CED-1 report	M. BROVCHENKO	J. GODA D. BOWEN	LANL ORNL
<p><b>Q1 status</b></p> <p>No update</p> <p><b>Q2 status</b></p> <p>No update</p> <p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p>						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
No update						
<b>IRSN-IE7 IER 305</b>	Critical Experiments with UO2 Rods and Molybdenum foils	SNL-IE1	Contribution to ICSBEP evaluation of baseline experiments.	J. BEZ	G. HARMS D. AMES	SNL
<p><b>Q1 status</b></p> <p>IRSN started reviewing of parts of CED-4 report (ICSBEP evaluation). To be continued as soon as new parts are available.</p> <p><b>Q2 status</b></p> <p>IRSN external review of ICSBEP benchmark done, participation to ICSBEP subgroup scheduled.</p> <p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p> <p>List of all remarks from ICSBEP subgroup has been grouped and sent to SNL.</p>						
<b>IRSN-IE11 IER 532</b>	TEX-Hf experiments	LLNL-IE1	Contribution to the analysis of the experiments (CED-4)	M. BROVCHENKO	C. PERCHER	LLNL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q1 status</b> No update</p> <p><b>Q2 status</b> No update</p> <p><b>Q3 status</b> No update</p> <p><b>Q4 status</b> No update</p>						
<b>IRSN-IE27 IER 498</b>	GODIVA CAAS benchmark	ORNL-IE1	Participation to the experiments in 2024	F. TROMPIER	D. BOWEN R. CUMBERLAND	ORNL

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q1 status</b> No update</p> <p><b>Q2 status</b> No update</p> <p><b>Q3 status</b> No update</p> <p><b>Q4 status</b> No update</p>						
<b>IRSN-IE45 IER 517</b>	Integral Experiments for Validation of Molybdenum Neutron Cross Sections on the whole energy spectrum	LANL-IE3	Participation in experiments design, external review of CED1	J. BEZ	N. THOMSON	LANL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q1 status</b></p> <p>CED1 External review CED1 completed in October 2022</p> <p><b>Q2 status</b></p> <p>No update Due to Nicolas Leclaire position change, please include Jérémy Bez in futures exchanges.</p> <p><b>Q3 status</b></p> <p>No update</p> <p><b>Q4 status</b></p> <p>No update</p>						
<b>IRSN-IE41 IER 499</b>	Thermal/Epithermal Experiments (TEX) with Chlorine	LLNL-IE1	Participation to the experiments.	M. BROVCHENKO	C. PERCHER	LLNL
<p><b>Q1 status</b></p> <p>LLNL shared the CED 2 report with IRSN.</p> <p><b>Q2 status</b></p> <p>No update</p> <p><b>Q3 status</b></p> <p>Technical exchanges with LLNL in June.</p> <p><b>Q4 status</b></p> <p>No update</p>						

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-IE34 IER 488	MUSIC (HEU) critical and Subcritical measurements.	LANL-IE3	Analysis of results, contribution to CED4	J-B. CLAVEL	J. HUTCHINSON	LANL
<p><b>Q1 status</b></p> <p>ICSBEP benchmark received from LANL early January. External review in progress, to be completed for February 15<sup>th</sup>, schedule is very tight.</p> <p><b>Q2 status</b></p> <p>IRSN External review of critical experiment completed, participation to subgroup work scheduled</p> <p><b>Q3 status</b></p> <p>The main geometrical simplifications have been received for critical configurations. IRSN will performed new calculations for the new geometry beginning of August. Waiting for updated ICSBEP benchmark.</p> <p><b>Q4 status</b></p> <p>No update</p>						
IRSN-IE47 IER 537	Copper Critical Experiment	LANL-IE3	Participation to the experiments	J-B. CLAVEL	T. CUTLER K. AMUNDSON	LANL
<p><b>Q1 status</b></p> <p>No update</p> <p><b>Q2 status</b></p> <p>No update</p> <p><b>Q3 status</b></p> <p>No update</p>						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<b>Q4 status</b> No update						
<b>IRSN-IE56 IER 578</b>	Jupiter ZPPR high 240 plates benchmark report	LANL-IE3	Independent review of the ICSBEP evaluation.	M. BROVCHENKO	J. GODA	LANL
<b>Q1 status</b> No update, waiting for LANL inputs <b>Q2 status</b> No update, waiting for LANL inputs <b>Q3 status</b> No update <b>Q4 status</b> No update						
<b>INFORMATION PRESERVATION AND DISSEMINATION</b>						
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
<b>Q1 status</b> ICNC Abstract on IRSN LFE database to be submitted.						

REFERENCE		IRSN Contribution / POC				
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
<p><b>Q2 status</b></p> <p>ICNC 2023 paper on IRSN criticality safety assessment methodology (including in-house LFE database use) to be submitted</p> <p><b>Q3 status</b></p> <p>ICNC paper submitted and accepted</p> <p><b>Q4 status</b></p> <p>ICNC presentation</p>						
<b>NUCLEAR DATA</b>						
<b>TRAINING AND EDUCATION</b>						
IRSN-TE1	Hands-on criticality safety training	ORNL-TE1 LANL-TE3 LLNL-TE1 SNL-TE1	IRSN attendance to NCSP classes. Possible lectures by IRSN working with NCSP training and education coordinator.	S. PIGNET	D. BOWEN	NCSP
<p><b>Q1 status</b></p> <p>Participation of 2 IRSN staff on August session.</p> <p><b>Q2 status</b></p> <p>Registrations to be done very soon for Aurélie Bardelay and Raphaëlle Ichou.</p> <p><b>Q3 status</b></p> <p>IRSN participants refused due to lack of availability.</p> <p><b>Q4 status</b></p>						



	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
NO update						