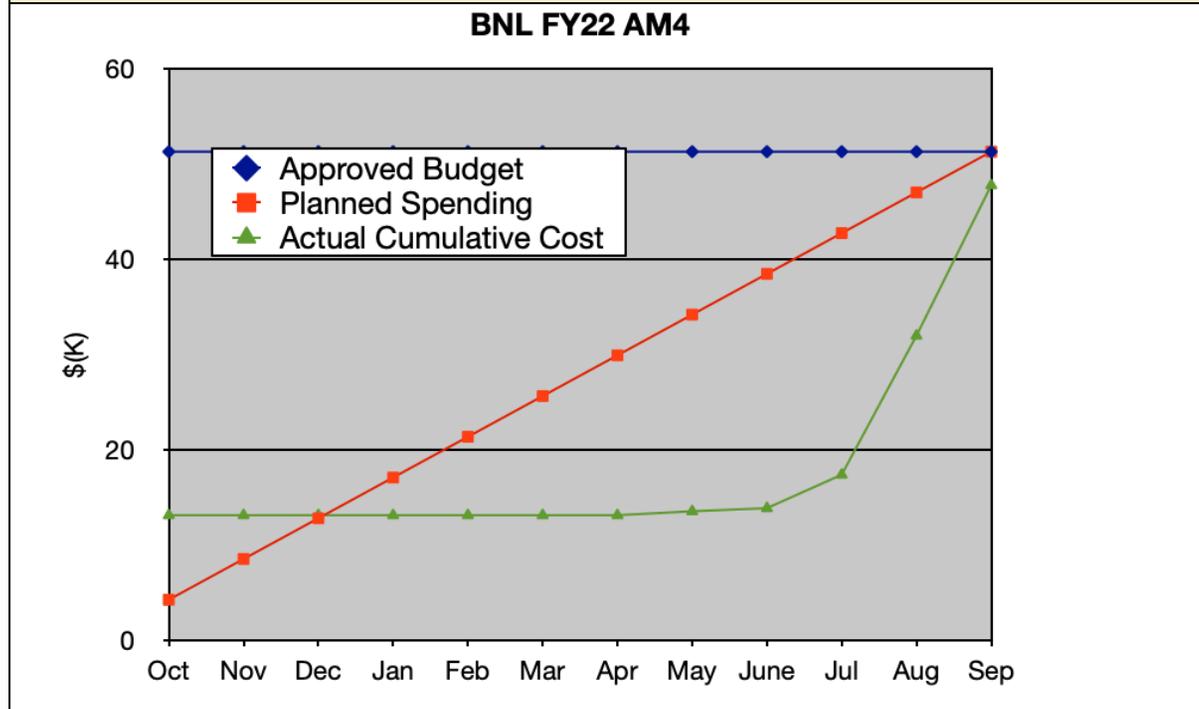# NUCLEAR CRITICALITY SAFETY PROGRAM (NCSP)

FY2022 4TH QUARTER REPORTS

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: AM4	Reference: DP0909010
M&O Contractor Name: BNL	Date of Report: 27 October, 2022
Point of Contact Name: Gustavo Nobre	
Point of Contact Phone: 631-344-5205	

BUDGET

BNL FY22 AM4

1. Carryover into FY 2022 = $ 3,298
2. Approved FY 2022 Budget = $ 48,000
3. Total FY 2022 Budget w/Carryover: $51,298
4. Actual spending for 1st Quarter FY 2022 = $13,144
5. Actual spending for 2nd Quarter FY 2022 = $0
6. Actual spending for 3rd Quarter FY 2022 = $737
7. Actual spending for 4th Quarter FY 2022 = $33,893
8. Projected carryover into FY 2023 = $6,822
   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 a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		In Q2, BNL will focus on finalizing the GNDS-2.0 specifications document for submission to WPEC in May 2022. At the CSEWG annual meeting during Nuclear Data Week, it was noted that the legacy ENDF/B format ran out of MAT numbers for TSL

			evaluations. CSEWG has adopted a format rule change as a work-around but BNL still needs to reassign numbers to support the large number of new TSL materials developed by the NCSP. This issue does NOT affect the new GNDS-2.0 format.
Q2	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		Work at BNL paused until students rejoin the NNDC during the summer
Q3	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		The intern M. McLaurin will work on the development of an algorithm for the smoothing of the PDF that, eventually, will be implemented in FUDGE. M. Vorabbi and D. Brown will continue to work on the definition of an analytical capture PDF which is well behaved at zero cross section.
Q4	Provide a status report on generating a draft document defining the TNSL code or software interface in NCSP Quarterly Progress Report. (AM4)		Postdoc Matteo Vorabbi left BNL to accept a position as lecturer in the UK. We are currently processing his results and conclusions. Work has been done mostly in coordination with LLNL. Had regular bi-weekly meetings with LLNL team.

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 developments of former postdoc M. Vorabbi who left BNL to take a lecturer position at the University of Surrey, UK.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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-2022 Q4)

NCSP Element and Subtask: AM1, 2, 3, 4, 5, 7 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda/Bob Little/Jen Alwin **Point of Contact Phone:** 505-667-2812/505-665-3487/505-667-7252	**Reference:** DP0909010 **Date of Report:** October 27, 2022
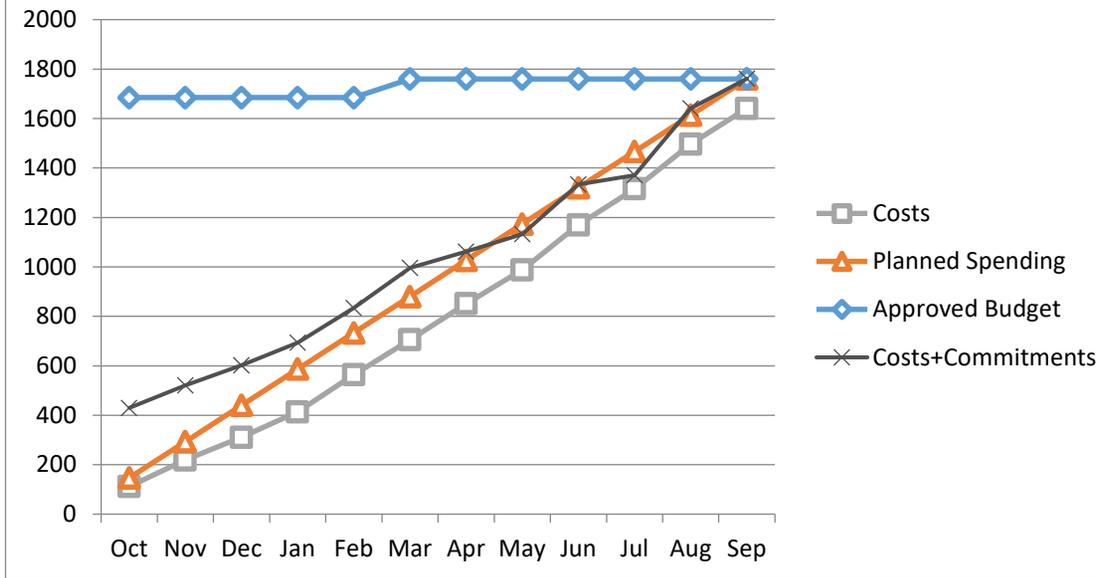
BUDGET

1. Carryover into FY 2022 = $125,000
2. Approved FY 2022 Budget = $ 1,635,000
3. Total FY 2022 Budget w/Carryover = $1,760,000
4. Actual spending for 1st Quarter FY 2022 = $310,627 (plus end of Q1 commitments of $291,167 for a total of $601,794)
5. Actual spending for 2nd Quarter FY 2022 = $394,636 for a total of $705,263 (plus end of Q2 commitments of $290,293 for a total of $995,556)
6. Actual spending for 3rd Quarter FY 2022 = $464,588 for a total of $1,169, 851 (plus end of Q3 commitments of $163,164 for a total of $1,333,015)
7. Actual spending for 4th Quarter FY 2022 = $471,419 (plus end of Q4 commitments of $120,046 for a total of $1,761,316)
8. Projected carryover into FY 2023 = $0
   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 a status report on MCNP6 user support (AM1)	🟦	
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1)	🟦	
Q1	Provide reports on summer intern work accomplished (AM1)	🟦	
Q1	Issue an MCNP V&V report, including MCNP6 automated acceleration and convergence (AM1)	🟦	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Provide a status report on NJOY maintenance and user support (AM2)		
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q1	Provide status on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 (AM3)		
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)		
Q1	Provide status on incorporation of benchmark Experiment Correlations into the Whisper NCS software (AM7)		
Q2	Provide a status report on MCNP6 user support (AM1)		
Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1)		
Q2	Provide status of all MCNP6 and Whisper progress at the NCSP Technical Program Review (AM1)		
Q2	Provide a status report on NJOY maintenance and user support (AM2)		
Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q2	Update NJOY2016 to process new ENDF/B formats for mixed coherent/incoherent elastic thermal scattering and to properly handle recent IAEA photo-nuclear libraries that specify anisotropic angular distributions (AM2)		Completed early in Q1
Q2	Provide status on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 (AM3)		
Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q2	Provide status on incorporation of benchmark Experiment Correlations into the Whisper NCS software (AM7)	■	
Q3	Provide a status report on MCNP6 user support (AM1)	■	
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1)	■	
Q3	Provide MCNP6 Criticality training course (AM1)	■	
Q3	Provide a status report on NJOY maintenance and user support (AM2)	■	
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)	■	
Q3	Provide status on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 (AM3)	■	
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)	■	
Q3	Provide status on incorporation of benchmark Experiment Correlations into the Whisper NCS software (AM7)	■	
Q4	Provide a status report on MCNP6 user support (AM1)	■	
Q4	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1)	■	
Q4	Issue an expanded MCNP V&V report, specifically targeting additional unstructured mesh models of criticality benchmarks (AM1)	▨	See below, completed tests w/ and w/o MCNP6.3 features, report is being drafted.
Q4	Create ENDF/B-VIII.0-based covariance data library for MCNP/Whisper (AM1)	▨	See below, started converting and testing NJOY-processed ENDF/B-VIII.0 into the ACE format for Whisper to use.
Q4	Obtain approval to open-source the Whisper code and release it on GitHub (AM1)	▨	See below, pending LANL Feynman Center for Innovation (FCI) approval, once approved will be made available on GitHub.

Q4	Provide a status report on NJOY maintenance and user support (AM2)	 	
Q4	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)	 	
Q4	Complete the GNDStk component of NJOY21 that will provide an interface (C++ and python) for GNDS 2.0 standard compliant files. (AM2)	 	
Q4	Provide status on Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6 (AM3)	 	
Q4	Provide data files and report for h-h2o and graphite on-the-fly S(alpha,beta) temperature effects. (AM3)	 	See below, overall delivery delayed by RPI subcontract delay. Subcontract modified to maintain project duration given initial delay.
Q4	Provide status reports 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)	 	
Q4	Provide status on incorporation of benchmark Experiment Correlations into the Whisper NCS software (AM7)	 	
Q4	Deliver final modified version of Whisper to LANL with an ANS conference paper to disseminate the work (AM7)	 	See below, the modifications to Whisper have been completed and are being delivered to the MCNP Development team.

ACCOMPLISHMENTS

- **AM1 - MCNP® Maintenance and Support, Uncertainty Analysis Development, and Modernization**

- **Education (AM1, TE4)**
  - One online and one in-person MCNP6 classes with 41 students: See separate summary of MCNP classes.
  - Presented another "MCNP6.3 Workshop" at the ICRS14/RPSD2022 (ANS RPSD Topical) Meeting with 30+ participants. This workshop was similar to the ANS NCSD MCNP6.3 Tutorial presented at the ANS NCSD Topical meeting, with a bit more focus on radiation shielding applications.
  - Thesis committee member for UNM graduate student working in area of criticality calculations. Dissertation defended and passed on July 1, 2022.
  - Mentorship of year-round graduate research assistant jointly between XCP-3 and XCP-7.
  - Research mentorship of two UNM graduate students working on plutonium solution density predictive capabilities

- **R&D Work (AM1)**
  - Region-dependent sensitivity-uncertainty data for NCS validation. A journal article submission is in progress (UNM).

- o Paper entitled, "Using an Adjoint-based Importance Map to Reduce Fission Multiplicity Tally", has been drafted for submission to a peer-reviewed journal (UNM).
- o MCNP6.3 code is frozen and has been made available to internal LANL users.
  - ▪ The final code package is completed with the installer scripts undergoing final updates/testing.
  - ▪ Code documentation is nearly complete. The MCNP6.3 Theory and User Manual has been finalized and is available on the mcnp.lanl.gov website here: https://mcnp.lanl.gov/pdf_files/TechReport_2022_LANL_LA-UR-22-30006Rev.1_KuleszaAdamsEtAl.pdf; the MCNP6.3 Build Guide, V&V Report, and Release Notes are in review and will be made available on website once review is completed.
  - ▪ All V&V benchmarks have been processed through the final production release versions of the MCNP6.3 code. The NCSP V&V report detailing all of the MCNP6.3 calculations is under construction.
- o Attended the NCERC Futures workshop at LANL and presented in a couple nuclear data sessions invited by Bob Little.
- o Worked with a summer student from RPI on nuclear data verification using ACEtk and MCNP.
- o The Whisper open-source release is pending LANL Feynman Center for Innovation (FCI) approval. Once approved the code will be made available on GitHub. Due to the delay from FCI in processing the open-source release request, the Whisper-1.1 code will be distributed with MCNP6.3.
- o Presented "Nuclear Criticality Safety Needs for Validation of Chlorine" at LANL Nuclear Data Working Group meeting September 2022.

- ▪ **MCNP Support and Maintenance**
  - o Support MCNP6 users. MCNP Forum, website, email, direct interactions, etc.
  - o MCNP public website re-designed and updated online. More improvements to come.
  - o Continue to update the release notes and code manual documentation.
  - o Updating V&V testing framework for consistency, extensibility, and automation.
  - o Consolidating and archiving past V&V results in repository
  - o Adding recent subcritical multiplication benchmarks to V&V testing framework
  - o Completed running and comparing V&V tests with and without MCNP6.3 features (Doppler Broadening Rejection Correction, Automated Acceleration and Convergence Testing). The NCSP V&V report with these results is being drafted.
  - o Added critical benchmark geometry models using Unstructured Mesh to Los Alamos Benchmark Suite (LABS). Completed MCNP6.3 calculations for 24 benchmarks and initial documentation. Completion of full report is delayed by formal process to review solid geometry (Parasolid files) and mesh (Abaqus files).
  - o Prepared for the 2022 MCNP User Symposium. Including administrative and logistical support, review of submitted papers, preparation of MCNP team presentations, session chairing, etc. The relevant presentations will be provided in the FY23 Q1 report.

- ▪ **MCNP Data (AM1)**
  - o Data downloading tools are finalized and ready for distribution with the MCNP6.3 release to help those needing to download and install the nuclear data libraries from the LANL nuclear data website.
  - o ENDF/B-VIII.0 Covariance Library
    - ▪ Work continues on the development of a processed covariance library.

- Two covariance testing tools have been prototyped independently and they are being combined into a single production tool, on track for a delivered library this FY.
- Started converting and testing the NJOY-processed ENDF/B-VIII.0 covariance data into the ACE format for Whisper to use. As these data are processed, they will begin to be tested within Whisper.

- **NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization (AM2)**
  - **NJOY2016**
    - 1 update to NJOY2016 was released: NJOY2016.68. This update fixes a number of minor issues:
      - there was an indexing error in the calculation of inelastic thermal scattering mubar in ACER for IFENG=2 ACE files. Test 74 was added to track this issue.
      - there was a division by zero that caused a segmentation fault in Debug mode, also for IFENG=2 ACE files.
      - removed an erroneously added FEND record in the PENDF file when no MF12 data gets added to the PENDF file (related to issue #250).
      - correction in ACER to fix issue #250. Previously it could happen that ACER picked the wrong temperature from a multi-temperature PENDF file when the materials in the PENDF only contained linearised MF3 data (no MF10, MF12 or MF23 data was added by RECONR).
      - fixed an indexing problem in CCCCR for delayed neutron data and added test 76.
      - there was a use of wrong memory addresses in CCCR not accounting for GROUPR's energy structure offset.

Note: the first ENDF/B-VIII.1 beta0 library has been processed with this version but no major issues were found. It should be noted that the beta0 only involved the incident neutron data (and not all ENDF/B-VIII.1 candidate files were in it, including the thermal scattering data). Future beta versions will include more sub-libraries. For the moment, beta0 has not revealed any major processing issues in NJOY.

  - **User support**
    - Various questions on the GitHub issues trackers
    - Support on ACE formats for photonuclear and electron files
    - Support on how to use ENDFtk and ACEtk at LANL (summer students and PhD students such as Bobbi Riedel and Kyle Bellings)
    - Installation support for Apple Mac M1 systems (it is difficult to install Fortran compilers)

  - **NJOY21**
    - ACEtk development progress:
      - Continued internal testing of ACEtk, users are providing feedback that help us correct and/or improve ACEtk (mainly interface improvements)
      - In particular, the thermal scattering ACE files have been rigurously tested by a summer student (Greg Siemers).
      - A prototype implementation for photoatomic and photonuclear ACE files is almost complete (testing is ongoing - this is an NCSP FY23 goal)
    - ENDFtk development progress:
      - support for MF31, MF35 and MF40 covariance data (we may revisit the interface at some point, but the current interface is now in production). This now allows for much more rich interaction with covariance data, not relying on NJOY's ERRORR module and processing

to identify deficiencies in covariance data. This capability is being folded into covariance checking tools, which is leading to improved understanding of the processed covariance library.
- dependency updates (updating to a more recent version of the hana library dependency to remove compiler warnings)
- we are looking into releasing ENDFtk v1.0 and are preparing a major publication on the toolkit

- Resonance reconstruction progress:
  - resurrecting the coding for the general R-matrix option in anticipation of incident charged particle resonances (in collaboration with T2)
- GNDStk development progress:
  - A limited interface to GNDS v2.0 was created. This proved to be quite a challenge, as the specifications include a vast amount of contradictory information, circular dependencies, and ambiguous references. The approach taken was to select the most important pieces of the GNDS standard for applications and created cleaned-up local specifications. This allows for the interface to be used for data relevant to current processing activities in NJOY. Observations and corrections to the specifications are being fed back to the curators of the GNDS format.

- **On-the-fly S(a,b) Temperature Dependence, RPI (AM3)**
  - A Python code has been developed to allow the automation of OTF data creation including the generation of cumulative distribution functions (CFS) of beta and alpha at different temperatures, and regression fitting of data over temperature ranges, for liquid and solid scatterers (H in H2O, and graphite).
  - A modular framework has been developed in the new Python code to facilitate the addition of new materials beyond light water (lwtr) and crystalline graphite.
  - A verification paradigm is being planned and developed to ensure that newly generated OTF data is in agreement with the established thermal data generated through NJOY.

- **S/U Comparison Study (AM4)**
  - Completed LANL results for HEU, LEU cases. Received results from IRSN, awaiting ORNL results.

- **Comparison of ICSBEP Benchmark Results (AM5)**
  - Completed report of all revisions for HEU, IEU, LEU, MIX and Pu. LA-UR-22-31333.

- **Whisper Improvements, Univ. of Michigan (AM7)**
  - The modifications to Whisper have been completed and are being delivered to the MCNP Development team.

<table>
<tr><td colspan="4" align="center">PUBLICATIONS</td></tr>
<tr><td colspan="4">Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.</td></tr>
<tr>
<th>Quarter</th>
<th>Publication Reference
Example:
Author, "Title", LA-UR-18-27731, October 1, 2019</th>
<th>Sent to NCSP? Yes/no</th>
<th>If no, status of submittal</th>
</tr>
<tr>
<td>Q1</td>
<td>M.E. Rising, C.J. Josey, J.A. Kulesza, A.R. Clark, D. Timmons, and J.L. Alwin, "Improved Verification and Validation Testing and Tools including Nuclear Criticality Safety Applications with the MCNP6.3(R) Code," submitted to Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), Los Alamos Report, LA-UR-21-30313 (2021).</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>J.L. Alwin, J. Clarity, F. Fernex, L. Leal, N. Leclaire, B.J. Marshall, M.E. Rising, K. Spencer, M.R. MacQuigg, and E. Saylor, "Sensitivity/Uncertainty Comparison Study Involving IRSN, LANL, and ORNL Tools to Support Validation," submitted to Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), Los Alamos Report, LA-UR-21-30153 (2021).</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>J.L. Alwin, J.D. Hutchinson, N.A. Kleedtke, A.R. Clark, T.E. Cutler, W. Haeck, R.C. Little, D. Neudecker, M.E. Rising, T.A. Smith, and N.W. Thompson, "Investigating Fission Reaction Rate Ratio Sensitivities," submitted to Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), Los Alamos Report, LA-UR-21-30259 (2021).</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>M.E. Rising and A.R. Clark, "Development of a New Fixed-source Sensitivity Tally Capability in the MCNP(R) Code," submitted 15th International Conference on Nuclear Data for Science and Technology (ND2022), Los Alamos Report, LA-UR-21-30306 (2021).</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>T.E. Cutler, J.D. Hutchinson, D. Neudecker, W. Haeck, A.R. Clark, and M.E. Rising, "Reactivity Coefficient Measurements and Sensitivity Studies," submitted to Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), Los Alamos Report, LA-UR-21-30075 (2021).</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>J.L. Alwin, R.C. Little, M.R. MacQuigg, M.E. Rising, N. Leclaire, F. Fernex, L. Leal, E. Saylor, J. Clarity, B. J. Marshall, and K.D. Spencer, "Sensitivity/Uncertainty Comparison Study Involving IRSN, LANL, and ORNL Tools to Support Validation," submitted to the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report LA-UR-22-20941.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>J.D. Hutchinson, A.R. Clark, N.A. Kleedtke, M.E. Rising, R.G. Sanchez, and R.A. Weldon, "Equivalent Fundamental-Mode Source Simulations for Spherical Uranium and Plutonium Systems," submitted to the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report LA-UR-22-20752.</td>
<td>Yes</td>
<td></td>
</tr>
</table>

| Q2	J.D. Hutchinson, J.L. Alwin, A.R. Clark, T.E. Cutler, M.J. Grosskopf, W. Haeck, M.W. Herman, N.A. Kleedtke, J.R. Lamproe, R.C. Little, I.J. Michaud, D. Neudecker, M.E. Rising, T.A. Smith, N.W. Thompson, and S.A. Vander Wiel, "EUCLID: Experiments Underpinned by Computational Learning for Improvements in Nuclear Data," presented at the NCSP Technical Program Review, Feb. 16, 2022, Los Alamos Report **LA-UR-22-21097**.	Yes	
Q2	M.E. Rising, J.L. Alwin, J.C. Armstrong, S.R. Bolding, F.B. Brown, J.S. Bull, A.R. Clark, R.A. Forster, T.S. Grieve, C.J. Josey, J.A. Kulesza, R.C. Little, M.R. MacQuigg, S. Swaminarayan, and J.E. Sweezy, "FY21 MCNP(R) Updates for the Nuclear Criticality Safety Program," presented at the NCSP Technical Program Review, Feb. 15, 2022, Los Alamos Report **LA-UR-22-21049**.	Yes	
Q2	M.E. Rising, C.J. Josey, and W. Haeck, "Thermal Neutron Scattering Improvements and Fixes for MCNP6.3," presented at the NCSP Technical Program Review Analytical Methods Working Group, Feb. 14, 2022, Los Alamos Report **LA-UR-22-21067**.	Yes	
Q2	M.E. Rising, J.L. Alwin, A.R. Clark, M.R. MacQuigg, B. Riedel, "Nuclear Data Adjustment with Whisper for Criticality Safety Applications," presented at the Workshop for Applied Nuclear Data Activities (WANDA 2022), Feb. 28 - Mar. 4, 2022, Los Alamos Report **LA-UR-22-21216**.	Yes	
Q2	N.N. Calhoun, K.W. Glover, A.S. Bowles Tomaszewski, J.A. Alwin, W.J. Crooks, C.M. Perfetti, "University Pipeline (with UNM) for Criticality Safety Professionals," presented at the NCSP Technical Program Review, February 15, 2022, Los Alamos Report **LA-UR-22-21051.**	Yes	
Q2	R. Bulso, J.L. Alwin, R. MacQuigg, R. Sartor, J. Arthur, W. Haeck, "Verification of MCNP Critical Benchmark Model of U233-COMP-THERM-004," submitted to the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting. Los Alamos Report **LA-UR-22-20686.**	Yes	
Q2	K.E. Aldrich, J.L. Alwin, D.M. Vu, L.A. Worl, J.N. Cross, et al. "Experimental Steps toward a Density Law for Chlorine-Crediting Criticality Models of Aqueous Plutonium solutions", submitted to the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report **LA-UR-22-20837**.	Yes	
Q2	D. Wise, K. D. Y. Spencer, B.J. Madahar, J.L. Alwin, W. Haeck, "Validation of MCNP Critical Benchmarks Models of Highly Enriched Uranium Cylinders", submitted to the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report **LA-UR-22-20245**.	Yes	
Q3	J. L. Alwin, R. C. Little, R. MacQuigg, M. E. Rising, N. Leclaire, F. Fernex, L. Leal, E. Saylor, J. Clarity, B.J. Marshall, K. Spencer, "Study Involving IRSN, LANL, & PRNL Sensitivity/Uncertainty Tools to Support Validation", presented at the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report **LA-UR-22-25262**	Yes	
Q3	J. L. Alwin, J. D. Hutchinson, A. R. Clark, T. E. Cutler, W. Haeck, N. A. Kleedtke, R. C. Little, D. N. Neudecker, M. E. Rising, T. A. Smith, N. W. Thompson, "Investigating Fission Reaction Rate	Yes	

	Ratio Sensitivities", presented at the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report, **LA-UR-22-25327**.		
Q3	R. Bulso, J. Alwin, M. R. Macquigg, R. F. Sartor, K. Spencer, "Verification of MCNP Critical Benchmark Model of U233-COMP-THERM-004, **LA-UR-22-25401**.	Yes	
Q3	B. Riedel, F. B. Brown, C. M. Perfetti, "Comparison Study of the Baseline USL Calculation Methods for Loosely-Coupled and Novel Neutronic Systems", presented at the American Nuclear Society (ANS) Nuclear Criticality Safety Division (NCSD) Topical Meeting, Los Alamos Report **LA-UR-22-25651.**	Yes	
Q3	M. E. Rising, B. Riedel, "Deterministic and Monte Carlo Nuclear Data Adjustment Methods", presented at OECD/NEA Working Party on Nuclear Criticality Safety (WPNCS), Los Alamos Report, **LA-UR-22-26383.**	Yes	
Q4	Alexander R. Clark, "How can a diverse set of integral and semi-integral measurements inform identification of discrepant nuclear data?", presented at ND2022 conference, Los Alamos Report, **LA-UR-22-26950.**	Yes	
Q4	Michael E. Rising, Patrick Talou, Ionel Stetcu, Patrick Jaffke, Amy Lovell, and Toshihiko Kawano, "Open-source release of CGMF 1.1 and Integration into the MCNP6.3(R) Code", presented at the ND2022 conference Los Alamos Report, **LA-UR-22-27410.**	Yes	
Q4	Michael E. Rising and Avery Grieve, "MCNP6.3 Workshop", presented at the ICRS14/RPSD2022 topical meeting, Los Alamos Report, **LA-UR-22-29859.**	Yes	
Q4	Michael E. Rising and Alexander R. Clark, "Development of a New Fixed-source Sensitivity Tally Capability in the MCNP(R) Code", presented at ND2022 conference, Los Alamos Report, **LA-UR-22-27323.**	Yes	
Q4	Gregory Siemers, Wim Haeck, and Michael E. Rising, "Verification and Validation of Nuclear Data Processing by NJOY Using ACEtk and MCNP", presented at LANL Nuclear Data Team meeting, Los Alamos Report, **LA-UR-22-29622.**	Yes	
Q4	Joel A. Kulesza, Terry R. Adams, Jerawan C. Armstrong, Simon R. Bolding, Forrest B. Brown, Jeffrey S. Bull, Timothy P. Burke, Alexander R. Clark, Robert A. (Art) Forster III, Jesse F. Giron, Avery S. Grieve, Colin J. Josey, Joel A. Kulesza, Roger L. Martz, Gregg W. McKinney, Eric J. Pearson, Michael E. Rising, Clell J. (CJ) Solomon Jr., Sriram Swaminarayan, Travis J. Trahan, Stephen C. Wilson, and Anthony J. Zukaitis, "MCNP® Code Version 6.3.0 Theory & User Manual", Los Alamos Report, **LA-UR-22-30006, Rev. 1.**	Yes	
Q4	J. L. Alwin, N. Leclaire, "Summary of LANL Critical Benchmark Comparison Study and Revisions for Cases Involving HEU, LEU, MIX, and Pu". Los Alamos Report, **LA-UR-22-31333.**	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: AM2, 3, 4, 5 **M&O Contractor Name:** LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909010 **Date of Report:** October 28, 2022
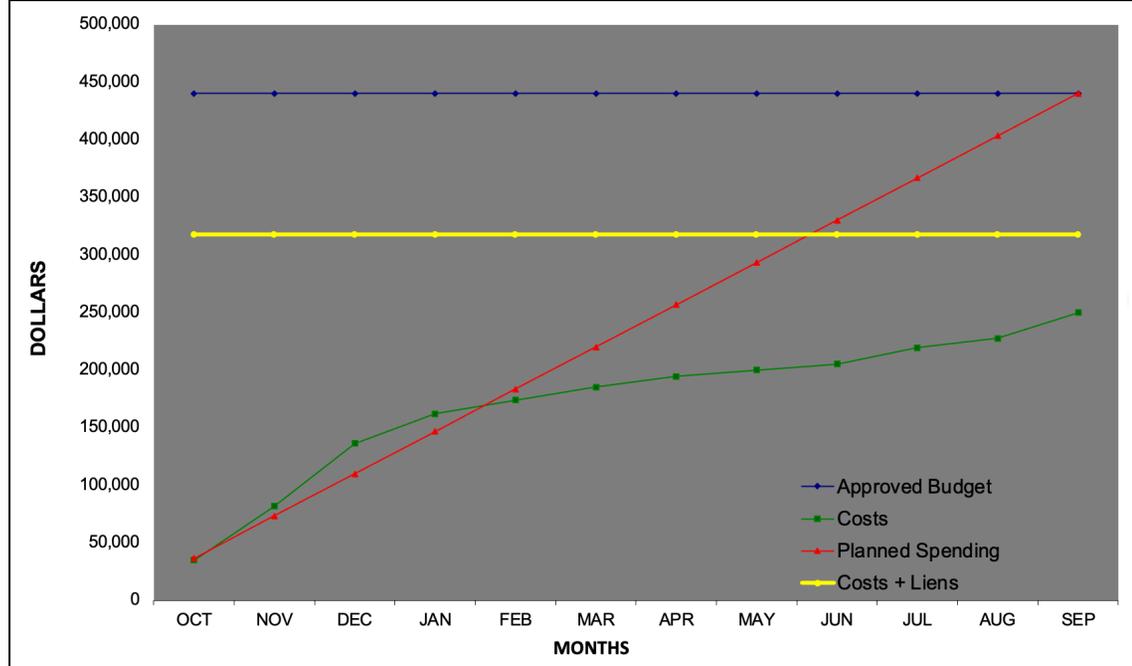
BUDGET

1. Carryover into FY 2022 = $ 88,109
2. Approved FY 2022 Budget = $327,000
3. Total FY 2022 budget w/Carryover = $ 415,109
4. Actual spending for 1st Quarter FY 2022 = $136,190
5. Actual spending for 2nd Quarter FY 2022 = $ 49,049 ($65,128 liens)
6. Actual spending for 3rd Quarter FY 2022 = $ 20,071 ($13,118 liens)
7. Actual spending for 4th Quarter FY 2022 = $44,685 ($67,625 liens)
8. Carryover into FY 2023 (including liens) = $ 190,317

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 on Multi-Physics methods for simulation of criticality excursions (AM2)		
Q1	Provide status on slide rule application (AM3)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		
Q1	Provide status on proposed intercomparison study (AM5)		
Q2	Provide status on Multi-Physics methods for simulation of criticality excursions (AM2)		
Q2	Provide status on slide rule application (AM3)		
Q2	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		
Q2	Provide status in NCSP Quarterly Progress Report (AM5)		
Q3	Provide status on Multi-Physics methods for simulation of criticality excursions (AM2)		
Q3	Provide status on slide rule application (AM3)		
Q3	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		
Q3	Provide status in NCSP Quarterly Progress Report (AM5)		
Q4	Provide status on Multi-Physics methods for simulation of criticality excursions (AM2)		
Q4	Provide status on slide rule application (AM3)		
Q4	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		
Q4	Provide status in NCSP Quarterly Progress Report (AM5)		
ACCOMPLISHMENTS			
• AM2 – Multi-Physics Methods for Simulation of Criticality Excursion			

- o A 2D planar symmetric model has been extended to a full 3D model with no planes of symmetry. The zone count has increased to over 4M.
- o The 3D model allows for realistic modelling of the control rods including the 5 cases described in HEU-MET-FAST-086.
- o Recent excursion simulations have uncovered a thermal contact problem. The code development team is working on this. A recent alpha settling problem has a work-around, and the code development team is working on a proper fix.
- AM3 – Slide Rule Application
  - o All LLNL calculations were completed in previous quarters and the final report is in preparation by IRSN.
- AM4 - Thermal Scattering and Self-Shielding in GNDS/FUDGE
  - o The comparison of unresolved resonance processing results from FUDGE with results from NJOY and FRENDY continued, and several remaining discrepancies were resolved. The GIDI+ library was extended to support sampling GNDS URR cross sections both from cross section probability distributions and from probability tables. The Monte Carlo code Mercury was updated to the latest GIDI+ and used to simulate critical assemblies using various strategies in the unresolved region: mean cross sections only, drawing from cross section pdfs, drawing from probability tables, and using single random realizations of resonance parameters. Comparing results showed that for some simulations the probability table approach agrees better with benchmarks. FUDGE supports exporting probability tables (along with other processed Monte Carlo data) to ACE format, but some testing on the resulting ACE files is still required. URR processing and testing results were presented at the ND2022 conference in July 2022.
  - o Testing of Thermal Scattering data in GNDS has continued. Users pointed out that some TNSL files are not clear enough about how to combine TNSL with fast neutron evaluations. A proposed extension to the GNDS specification to better support this transition is under development.
- AM5 - Proposed Benchmark Intercomparison Study
  - o A total to 3,393 high-precision COG (k-eff) ICSBEP benchmark results, and 21 beta-eff benchmark results, using ENDF/B-VII.1, ENDF/B-VIII.0 and JEFF-3.3 have been provided to Nicolas Leclaire (IRSN) for inclusion in the study as follows:

Pu	U233	MIX	HEU	LEU	SPEC	$\beta-\text{eff}$
766	193	356	1054	807	10	21

- o 30 β-eff benchmarks models were completed and run with ENDF/B-VIII.0. The β-eff runs using JEFF-3.3 are in progress.
- o Shielding benchmarks are in preparation.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

| Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	C. M. Mattoon et al., "Thermal Neutron Scattering Law (TNSL) Implementation and Testing in FUDGE," LLNL-TR-828141, October 15, 2021	Yes	
	C. M. Mattoon, "TNSL improvements in FUDGE," LLNL-PRES-828123, October 19, 2021	Yes	
	M. Vorabbi, "Unifying the URR PT approaches and covariance work in a consistent framework," November 15, 2021	No	BNL to provide.
Q2	Dave Heinrichs et al., "LLNL Analytical Methods Update," LLNL-PRES-831683, February 15, 2022.	Yes	
	C. M. Mattoon, "TNSL improvements in FUDGE," LLNL-PRES-828123, February 15, 2022.	Yes	
	J. Herth et al., "Status of the Slide Rule Update," February 16, 2022.	Yes	Provided by IRSN

Q3	Matthieu Duluc et al., "Update of the Nuclear Criticality Slide Rule: Review of the Estimation of the Number of Fissions," Proceedings of the Nuclear Criticality Safety Division Topical Meeting, NCSD 2022, Anaheim, California, June 13-16, 2022.	Yes	Provided by IRSN
	Johann Herth et al., "Update of the Nuclear Criticality Slide Rule Calculations: Plutonium Systems – Delayed Fission Gamma," Proceedings of the Nuclear Criticality Safety Division Topical Meeting, NCSD 2022, Anaheim, California, June 13-16, 2022.	Yes	Provided by IRSN
Q4	M.-A. Descalle, "Comparison of URR Implementations in GNDS Format," LLNL-PRES-838053, July 28, 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: AM1, 2, 3, 6, 10, 15, 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:** October 31, 2022

BUDGET

FY22 Analytical Methods
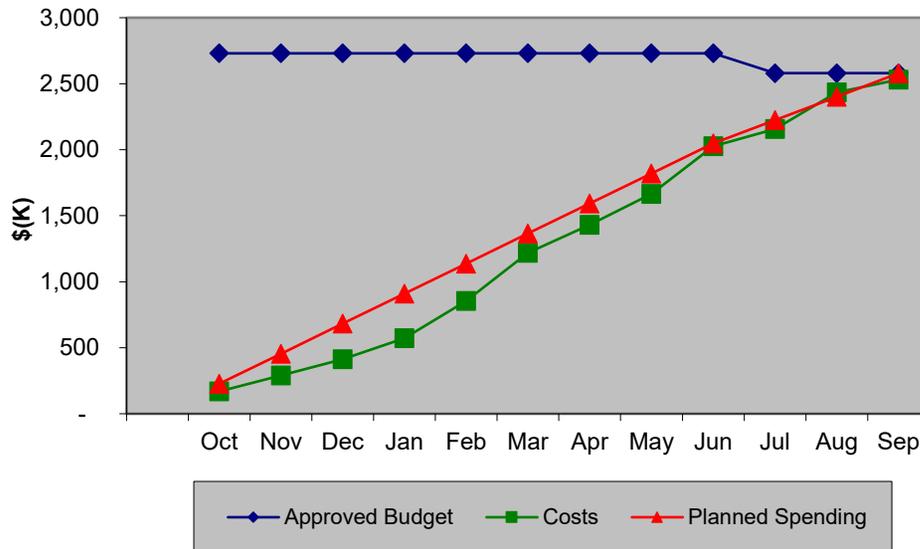
1. Carryover into FY 2022 = $235K
2. Approved FY 2022 Budget = $ 2,345
3. Total FY 2022 Budget w/Carryover = $2,580K
4. Actual spending for 1st Quarter FY 2022 = $413K
5. Actual spending for 2nd Quarter FY 2022 = $806K
6. Actual spending for 3rd Quarter FY 2022 = $807K
7. Actual spending for 4th Quarter FY 2022 = $505K
8. Projected carryover into FY 2023 = $50K

NOTE: Include commitments as part of spending

In Q4, $150K was transferred in G2 from AM to ND.

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	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)		
Q1	Provide status on RSICC activities (AM1)		
Q1	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and		

NCSP Quarterly Progress Report (FY-2022 Q4)

	provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q1	Provide status on SCALE/KENO/TSUNAMI maintenance and support activities (AM2)	🟦	
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 effects of temperature on propagation of nuclear data uncertainty in calculations (AM15)	🟦	
Q1	Provide status on VALID activities (AM17)	🟦	
Q1	Provide status on determination of appropriate integral parameters for critical experiment (AM18)	🟦	
Q1	Provide status on analysis of Sum-of-Fractions for Nuclide Mixtures (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)	🟦	
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 SCALE/KENO/TSUNAMI maintenance and support activities (AM2)	🟦	
Q2	Issue an annual SCALE maintenance report to the NCSP Manager. (AM2)	🟨	
Q2	Provide status on AMPX maintenance and modernization activities (AM3)	🟦	
Q2	Provide status on Slide Rule application activities (AM6)	🟦	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q2	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q2	Provide status on effects of temperature on propagation of nuclear data uncertainty in calculations (AM15)		
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 brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q3	Provide status on SCALE/KENO/TSUNAMI maintenance and support activities (AM2)		
Q3	Provide status on AMPX maintenance and modernization activities (AM3)		
Q3	Provide status on Slide Rule application activities (AM6)		
Q3	Provide status on proposed benchmark intercomparison study activities (AM10)		
Q3	Provide status on effects of temperature on propagation of nuclear data uncertainty in calculations (AM15)		
Q3	Provide status on VALID activities (AM17)		
Q3	Provide status on determination of appropriate integral parameters for critical experiment (AM18)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q3	Provide status on analysis of Sum-of-Fractions for Nuclide Mixtures (AM19)	🟦	
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 SCALE/KENO/TSUNAMI maintenance and support activities (AM2)	🟦	
Q4	Publish annual newsletter to users to communicate software updates, user notices, generic technical advice, and training course announcements. (AM2)	🟨	
Q4	Document AMPX modernization and technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager. (AM3)	🟨	To be delivered in FY23 Q1
Q4	Provide status on AMPX maintenance and modernization activities (AM3)	🟦	
Q4	Provide status on Slide Rule application activities (AM6)	🟦	
Q4	Provide status on proposed benchmark intercomparison study activities (AM10)	🟦	
Q4	Provide status on effects of temperature on propagation of nuclear data uncertainty in calculations (AM15)		Completed in FY22 Q3
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)	🟦	

ACCOMPLISHMENTS

- AM1 - Radiation Safety Information Computational Center (RSICC)
  - Distributed 1087 software packages.
  - 224 SCALE, 502 MCNP®, and 0 COG packages distributed.
  - RSICC quarterly report issued.
  - Quarter 1: University Requests 406; NCSP Direct Requests 14
  - Quarter 2: University Requests – 391; NCSP Direct Requests 31
  - Quarter 3: University Requests – 179; NCSP Direct Requests 22
  - Quarter 4: University Requests – 480; NCSP Direct Requests 36

FY2022 University Distributions		
Month	MCNP®	SCALE
October	89	24
November	59	41
December	36	16
January	102	74
February	161	75
March	112	52
April	23	10
May	15	9
June	32	21
July	23	13
August	37	21
September	154	52
Total	843	408

- AM2 - SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section Generation/Modernization/etc.
  - Coordination
    - Focusing on additional responsibility delegation after losing Ben Betzler to Radiant Energy.
    - No additional communication or final decision regarding SCALE 6.3.0 export control review.
    - SCALE 7 beta3 released internally with new features described below
    - Closed contract with Dr. Abdel-Khalik of Purdue on comparison of methods for criticality safety validation (Parametric, Nonparametric, Whisper, TSURFER). ORNL report should be released in early FY23 Q1.
  - Infrastructure and Modernization
    - Completed code test turnaround time updates, reducing to ~2 hours (from 8) through extensive use of virtual machines on the Gitlab CI framework.
    - Completed move for main source code to modern CMake for configuring SCALE on all major platforms. Only need to complete the "bundle" generation which generates self-installer .exe on Windows and .dmg on Mac.

- Scoped out a vritual machine option for downloading/running SCALE where one can have a parallel build of SCALE running on Linux within a Windows machine.
- Created snapshot of AMPX and dependencies on public repository: https://code.ornl.gov/scale/code/scale-public, can be used to build AMPX or SAMMY.
  - Development
    - Completed development on Sampler-based search for max/min, initial grid search followed by detailed adaptive search to determine e.g. moderator density that maximizes keff (replaces CSAS-based maximum criticality condition search and can be valid for any single parameter)
    - Started Fulcrum and CSAS development activities focusing on
      - source convergence assessment capabilities,
      - additional k-eff estimators in Shift,
      - visualizations for starting sources and particle tracks,
      - a new start type which guarantees at least one neutron starts in each fissile region,
      - a better automatic mesh for calculating Shannon Entropy tallies,
  - The SCALE Annual report should be released soon in this quarter.

- AM3 - AMPX Maintenance & Modernization
  - Attended the International Conference on Nuclear Data for Science and Technology, hosted virtually by Lawrence Livermore National Laboratory. A presentation was given on the status and new developments in AMPX.
  - Mixed-elastic thermal neutron scattering processing capability implementation continued in AMPX. Testing continued to ensure mixed-elastic format produces same results as previous format.
  - In coordination with SCALE development and maintenance tasks, the upgrade of the build system to one based on modern CMake was completed.
  - AMPX has been released in the open source subset of SCALE, available at https://code.ornl.gov/scale/code/scale-public.

- AM6 – Slide Rule Application
  - No tasks were completed. Awaiting information from Matthieu Duluc, IRSN

- AM10 – Proposed Benchmark Intercomparison Study
  - Limited work supporting investigation of discrepancies in reported SCALE results

- AM15 – The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculations
  - Completed in FY22 Q3

- AM17 – Expansion of the Verified, Archived, Library of Inputs and Data (VALID)
  - Work developing TSUNAMI models for uranium-fueled benchmarks generated in the summer of 2021

- o Work finishing and documenting TSUNAMI models for ^{233}U-fueled benchmarks
- o Limited work performing reviews of VALID cases in progress, staff availability challenges

- AM18 – Determination of Appropriate Integral Parameters for Critical Experiment
  - o Developed a python tool that determines the bias and bias uncertainty for validation sets based on multiple different ck criteria
  - o Used C/E data based on results from AM-20 task
  - o Used c_k values based on SCALE 6.2.2 validation report
  - o Started verification of python tool results

- AM19 – Analysis of Sum-of-Fractions for Nuclide Mixtures
  - o Teams' meetings were held during this time to discuss changes or questions encountered during the validation and analysis portion of the project. Several discussions were held to review validation results and how they can be used to justify the mass contents for the Sum of Fractions calculations.
  - o PNNL is currently working on a draft report given the results from the validation portion of the project supplied by ORNL. Once this draft is completed, it will be sent to ORNL so that the validation/sensitivity portion of the report can be added to complete the final draft.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	Pulled from ORNL RES system	yes	
Q2	William B.J. Marshall, Travis Greene, "Cumulative χ2 Metric for VALID for ENDF/B-VII.1 and ENDF/B-VIII.0 in SCALE 6.3b9," Transactions of the American Nuclear Society, 125, 696-699, (December 2021)	yes	
Q2	William B.J. Marshall, Travis Greene, "Cumulative χ2 Metric for VALID for ENDF/B-VII.1 and ENDF/B-VIII.0 in SCALE 6.3b9," ANS Winter Meeting (virtual), November 2021	Yes	
Q3	W.J. Marshall, "Sensitivity/Uncertainty Analysis for Nuclear Criticality Safety Validation," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	Alex Shaw, "Illustration of Neutronic Decoupling in Fresh Fuel Storage Environments," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	Alex Shaw, "Impacts of LEU+ and ATF on Fresh Fuel Storage Criticality Safety," 2022 SCALE Users' Group Workshop, April 2022.	Yes	

| Q3	W.J. Marshall and C. Celik, "Criticality and Radiation Shielding Impacts of ENDF/B-VIII.0," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	Jordan McDonnell, Will Wieselquist, "SCALE Sensitivity Tutorial," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	W. Wieselquist, "SCALE 6.3," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	Nicholas Kucinski, Peter Stefanovic, Will Wieselquist, "Calculation of SFP Time-to-Boil using Polaris/ORIGAMI," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	Nicholas Kucinski, "Polaris Depletion Calculations: Selected Best Practices," 2022 SCALE Users' Group Workshop, April 2022.	Yes	
Q3	William (B.J.) Marshall, "Challenges for Data Adjustment and Bias Quantification," Virtual, Workshop for Applied Nuclear Data Activities (WANDA), March 2022.	Yes	
Q3	Andrew Holcomb, Doro Wiarda, G. Arbanas, J. Brown, C. Chapman, K. Guber, J. McDonnell, M. Pigni, "AMPX Developments," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	Alex Shaw, William Marshall, "Analysis of SCALE Criticality and Sensitivity Calculations for Reflected HEU Cylinders," submitted to 2022 American Nuclear Society Annual Meeting, June 2022.	Yes	
Q3	Ryan P. O'Mara, Will Wieselquist, Cihangir Celi, "Monte Carlo Uncertainty Quantification in UF6 Cylinder Neutron Emissions", 2019 ANS Winter Meeting and Nuclear Technology Expo, 121, 1492-1495, November 2019.	Yes	
Q3	W.J. Marshall, O.M. Belcher, N.H. Bynre, L.E. de Leon, M.N. Solis, T.M. Greene, S.R. Blair, "Expanded Validation of Uranium Systems with the KENO Monte Carlo Codes and SCALE 6.2.4," PHYSOR 2022, May 2022	Yes	
Q3	Shane W.D. Hart, Justin Clarity, "Creation of the VADER Code in SCALE, " ANS Winter Meeting (virtual), November 2021.	Yes	
Q4	Ugur Mertyurek, William B.J. Marshall, William Wieselquist, "Overview of the Tolerance Limit Calculations with Application to TSURFER," Energies, Web. doi:10.3390/en14217092.	Yes	
Q4	William B.J. Marshall, Olivia Belcher, Noah Byrne, Lauren de Leon, Maya Solis, Travis Greene, Stu Blair, "Expanded Validation of Uranium Systems with the KENO Monte Carlo Codes and SCALE 6.2.4," PHYSOR 2022: International Conference on Physics of Reactors, Web, Pages 2664-2673, May 2022	Yes	
Q4	Travis Greene, William B.J. Marshall, Justin Clarity, "Latent Generations," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Alex Lang, William B.J. Marshall, "Multi-group Examination of Nickel-Reflected HEU System," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	

Q4	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), June 2022.	Yes	
Q4	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), June 2022.	Yes	
Q4	William B.J. Marshall, Mathieu Dupont, Travis Greene, Alex Lang, Alex Shaw, Justin Clarity, Ellen Saylor, "Expansion of the ORNL VALID Library," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	William B.J. Marshall, Travis Greene, "Applicability of ORCEF UF4/CF2 Experiments to Validation of 30" UF6 Cylinders," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, Mathieu Dupont, Alex Lang, Andrew Holcomb, Shane Hart, "A SUBCRITICAL ASSEMBLY FOR TRAINING AND EDUCATION USE AT THE OAK RIDGE NATIONAL LABORATORY," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, Mathieu Dupont, Alex Lang, Andrew Holcomb, Shane Hart, "A Subcritical Assembly for Training and Education Use at the Oak Ridge National Laboratory," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	William B.J. Marshall, Mathieu Dupont, "Critical Experiments in Support of Current Reactors and Advanced Reactor Deployment," NCERC Futures Meeting, Los Alamos, NM, September 2022.	Yes	
Q4	Cihangir Celik, "Advanced Reactors Campaign and NCERC: Friend or Foe?," NCERC Futures Meeting, Los Alamos, NM, September 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: AM1 **M&O Contractor Name**: PNNL **Point of Contact Name:** Travis Zipperer **Point of Contact Phone:** (206) 528-3474	**Reference:** DP0909010 **Date of Report:** October, 2022
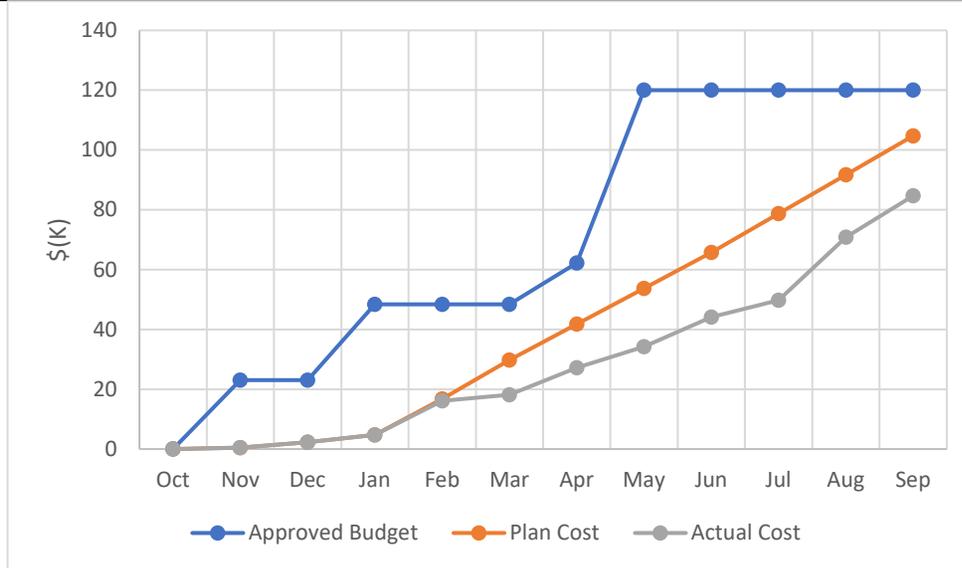
BUDGET

1. Carryover into FY 2022 = $ 0
2. Approved FY 2022 Budget = $120,000
3. Total FY2022 Budget w/Carryover = $120,000
4. Actual spending for 1st Quarter FY 2022 = $2,286
5. Actual spending for 2nd Quarter FY 2022 = $18,151
6. Actual spending for 3rd Quarter FY 2022 = $44,121
7. Actual spending for 4th Quarter FY 2022 = $84,687
8. Projected carryover into FY 2023 = $31,445

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 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)		

ACCOMPLISHMENTS

- AM1 – Analysis of Sum-of-Fractions for Nuclide Mixtures
    - Q1-Q2: Computed critical mass curves for actinides: U-232, U-233, U-234, U-235, Np-237, Pu-236, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, Am-242m, Am-243, Cm-242, Cm-243, Cm-244, Cm-245, Cm-246, Cm-247, Cf-249, Cf-251.
    - Q1-Q2: Developed tool to compute critical mass curves of actinide mixtures.
    - Q1-Q3: Held monthly meetings between PNNL and ORNL teams to discuss progress, share information, and maintain engagement.
    - Q3: Submitted cases to ORNL to develop the USL values for the water moderated/reflected and poly moderated/reflected mixed U-233, U-235, and Pu-239 systems.
    - Q3: ORNL completed assessment of USL values for the water moderated/reflected mixed U-233, U-235, and Pu-239 systems.
    - Q4: Completed method development and tested on a subset of cases.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: IPD1, 2, 5, 6, 7 **M&O Contractor Name**: LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909010 **Date of Report:** October 28, 2022
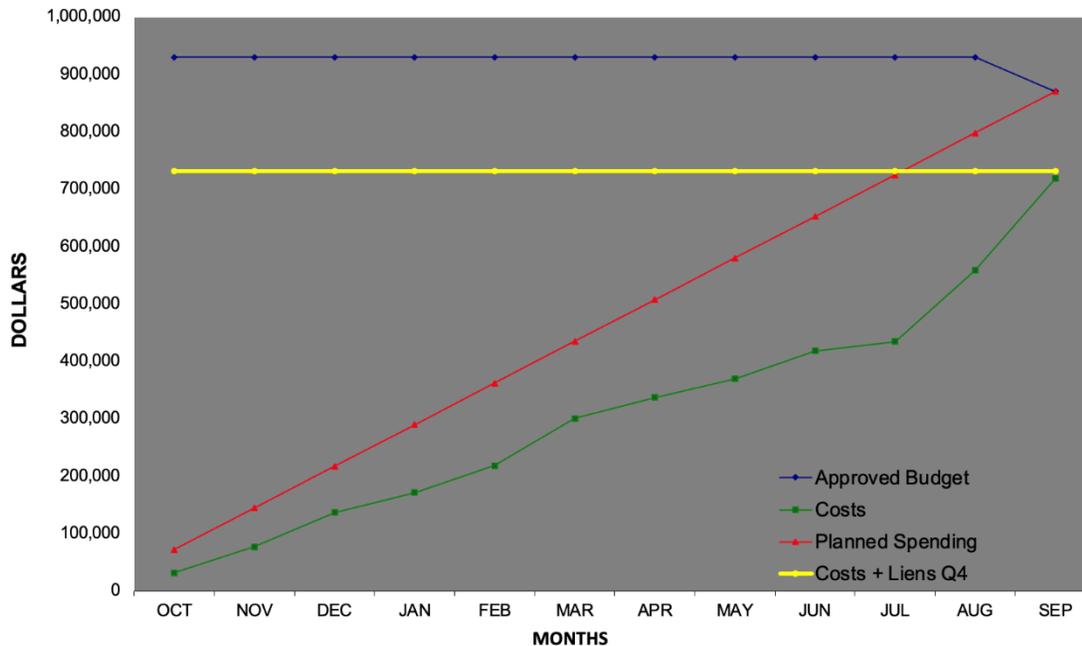
BUDGET

1. Carryover into FY 2022 = $51,366
2. Approved FY 2022 Budget = $879,000 - $60,000* = $819,000
3. Total FY 2022 Budget w/Carryover = $ 870,366
4. Actual spending for 1st Quarter FY 2022 = $ 136,905
5. Actual spending for 2nd Quarter FY 2022= $ 164,319 ($13,128 liens)
6. Actual spending for 3rd Quarter FY 2022 = $117,317 ($13,118 liens)
7. Actual spending for 4th Quarter FY 2022 = $300,265 ($13,118 liens)
8. Carryover into FY 2023 = $ 151,559

*$60,000K transferred from IPD at FY22 Year End to cover shortfall in TE

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	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)	🟦	The 2020 edition of the ICSBEP Handbook will be published by February 2022.

NCSP Quarterly Progress Report (FY-2022 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 status report on IT support at NNSS (IPD5)		
Q1	Provide status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		
Q1	Provide the NCSP manager an update of NDA website support. (IPD7)		
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 for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		
Q2	Provide status report on IT support at NNSS (IPD5)		
Q2	Provide status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)		
Q2	Provide the NCSP manager an update of NDA website support. (IPD7)		
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)		Official comments from 2021 ICSBEP meetings delayed- not received until June 22, 2022
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 for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)	 	
Q3	Provide status report on IT support at NNSS (IPD5)	 	
Q3	Provide status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)	 	
Q3	Provide the NCSP manager an update of NDA website support. (IPD7)	 	
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)	 	
Q4	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)	 	
Q4	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)	 	
Q4	Provide status report on IT support at NNSS (IPD5)	 	
Q4	Provide status report on benchmark evaluation of LLNL 'Pulsed Spheres' (IPD6)	 	
Q4	Provide the NCSP manager an update of NDA website support. (IPD7)	 	

ACCOMPLISHMENTS

- IPD1 - Conduct ICSBEP for Benchmarks of the 5-Year Plan and publish annual revision to the Handbook
  - Three <u>new</u> NCSP evaluations approved at the 2021 ICSBEP meetings are working to address TRG comments (received comments June 22, 2022):
    (a) HEU-MET-INTER-011, CURIE: 235U Unresolved Resonance Region Experiment, Jeff Favorite (LANL), **Review Complete**
    (b) HEU-MET-MIX-021, TEX-HEU Baseline Assemblies: HEU Plates with Polyethylene Moderator and Polyethylene Reflector, Jesse Norris (LLNL), **Comment resolution ongoing**
    (c) FUND-ORELA-ACC-GRAPH-PNSDT-001, Benchmark of Neutron Thermalization in Graphite Using the Slowing-Down-Time ORELA Experiment, Ayman Hawari (NCSU), **Review Complete**

- Five <u>new</u> and one legacy NCSP evaluations are in preparation for the 2023 ICSBEP meeting:
  (d) ALARM-REAC-SST-SHIELD-001, Neutron Fluence and Element 57 Dose Responses to a Bare and Steel-Reflected Pulse of the ORNL HPRR, M. Dupont (ORNL)
  (e) IER305, 7uPCX fuel with Mo sleeves (SNL)
  (f) IER441, Epithermal 7uPCX lattices
  (g) IER480, Pu ZPPR benchmark optimized for Polyethylene and Lucite thermal scattering, Catherine Percher (LLNL)
  (h) IER488, HEU Critical and Subcritical Measurements (LANL)
  (i) Chlorine Worth Study (LANL)
  - An additional evaluation of Libby Johnson U(5) metal rod arrays in water by Robert McBroom (ORO) is also in preparation for the 2023 ICSBEP meeting.
  - OECD NEA selected Catherine Percher (LLNL) and B. J. Marshall (ORNL) as ICSBEP Chair and Vice-Chair, respectively.
- 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.
  - Added and updated foreign trip reports.
  - Maintained list of available T&E courses.
  - Ran and provided various analytics reports.
  - Create waitlist for all NCSP T&E courses – in progress.
  - Create annual TPR Cvent registration page – complete but waiting for approval to go live
  - Migrating NCSP Primer to NCSP site (this is live)
    - Web team developer to work with consultant to make some adjustments
- IPD5 - IT Support at NNSS
  - 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, system upgrades and user accounts as required. Created NTS-SLAN SharePoint for user account tracking.
  - Completed the data call and annual system risk assessment for NTS-SLAN.
  - Performed equipment and camera inspections for NCERC and NAD Lab activities (IER-153, 466, 569, 565, 538, and 573).
  - Virtual machine setup for LANL Network performance.
- IPD6 - Benchmark Evaluation of LLNL 'Pulsed Spheres'
  - The official SINBAD "kick off" meeting was convened by OECD NEA on September 9, 2022. LLNL provided LLNL-TR-840032-DRAFT, "Pulsed Sphere Time of Flight Neutron Spectrum Measurements: Blank Run and 1.8 Mean-Free-Path thick Polyethylene Moderating Sphere," directly to the SINBAD Subgroup 10 external reviewers on September 20, 2022, which is also available on https://git.oecd-nea.org/science/wprs/sinbad/evaluations/llnl-spheres/-/tree/maintenance_period_01/00_Evaluation_Report/40_Document.
- IPD7 - LLNL - NDA Website Support
  - Maintenance and minor updates to site.
  - Area of growing focus for LLNL, LANL, and AWE due to regulatory interest.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

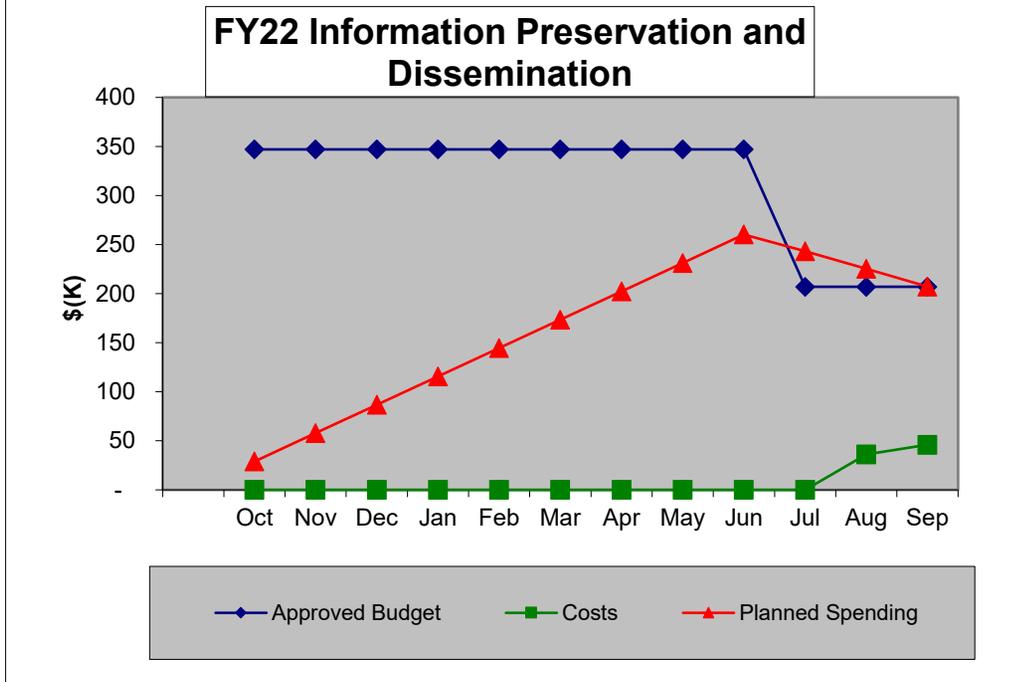| Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Dave Heinrichs et al., "Report on the 2021 ICSBEP and SINBAD Technical Review Group (ZOOM) Meeting," LLNL-MI-829200, October 31, 2021.	Yes	
	Soon S. Kim et al., "Evaluation of Polyethylene and Blank Pulsed Sphere Experiments Using Deuteron Transport Feature in COG," 2021 ANS Winter Meeting, December 1, 2021.	Yes	
	Dave Heinrichs et al., "Report on the Second 2021 ICSBEP/IRPhE Technical Review Group (ZOOM) Meeting," LLNL-MI-830264, December 31, 2021.	Yes	
Q2	None		
Q3	None		
Q4	Soon S. Kim, "Pulsed Sphere Time of Flight Neutron Spectrum Measurements: Blank Run and 1.8 Mean-Free-Path thick Polyethylene Moderating Sphere," LLNL-TR-840032-DRAFT, September 12, 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: IPD3, 5 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 28, 2022

BUDGET

FY22 Information Preservation and Dissemination

Legend: Approved Budget, Costs, Planned Spending

1. Carryover into FY 2022 = $2K
2. Approved FY 2022 Budget = $205K
3. Total Approved FY 2022 Budget w/Carryover = $207K
4. Actual spending for 1st Quarter FY 2022 = $0K
5. Actual spending for 2nd Quarter FY 2022 = $0K
6. Actual spending for 3rd Quarter FY 2022 = $0K
7. Actual spending for 4th Quarter FY 2022 = $46K
8. Projected carryover into FY 2023 = $161K

NOTE: Include commitments as part of spending

In Q4, $140K was returned to DOE Headquarters

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 a status report on development of NCSP repository at OSTI.gov. (IPD3)		
Q1	Provide a status report on completion of the HPRR benchmark. (IPD5)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q2	Provide a status report on development of NCSP repository at OSTI.gov. (IPD3)	▮	Two OSTI meetings have been conducted to get this back on track. The significant issue is the late arrival of FY22 funding at ORNL. OSTI also needed to update the scope statement and update labor rates in the proposal.
Q2	Provide a status report on completion of the HPRR benchmark. (IPD5)	▮	
Q3	Provide a status report on development of NCSP repository at OSTI.gov. (IPD3)	▮	
Q3	Provide a status report on completion of the HPRR benchmark. (IPD5)	▮	
Q4	Provide a status report on development of NCSP repository at OSTI.gov. (IPD3)	▮	
Q4	Provide a status report on completion of the HPRR benchmark. (IPD5)	▮	

ACCOMPLISHMENTS

- IPD3 – Nuclear Criticality Safety Repository
  - In FY22 Q4, dedicated NCSP staff were trained in curation standards by members of the OSTI Information Science Team. Detailed guidance for records in the NCSP collection was developed and outstanding questions were compiled. Per customer direction, the initial focus was on the newest records, FY22 Q1-Q3. Staff performed record search and confirmation to determine if entries for these NCSP records already existed in OSTI.GOV. When found, existing records were curated according to established collection standards. New records were created and curated for those not already existing in OSTI.GOV. Staff also developed search instructions for retrieving this set of records at OSTI.GOV.

Product Type	Existing Curated	New Curated	Totals
Tech Reports	8	8	16
Conferences	21	138	159
Totals	**29**	**146**	**175**

    Additional product types will be included on report as they are encountered.
    All records curated in Q4 were pending Subject Category Code assignment. This work is ongoing.
  - The NCSP team will continue to prioritize most recent records as they are made available, starting with FY22 Q4 and FY21. Team members will confirm matches for these records in the current collection, create needed records, and perform full curation of all records in these document sets. Work is ongoing, a meeting will be scheduled with NSCP POCs to discuss several records related questions.

- IPD5 – HPRR Benchmark
  - The update of the shielding evaluation presented at the ICSBEP TRG meeting in 2021 is still ongoing. The evaluation will be sent to the internal and independent reviewers by December 2022, on track with the ICSBEP guidelines for the next TRG meeting in April 2023.
  - The task was presented at the RPSD/ICRS 2022 conference in September 2022. The audience was really interested in the subject. A short, associated summary is also being published on this topic.
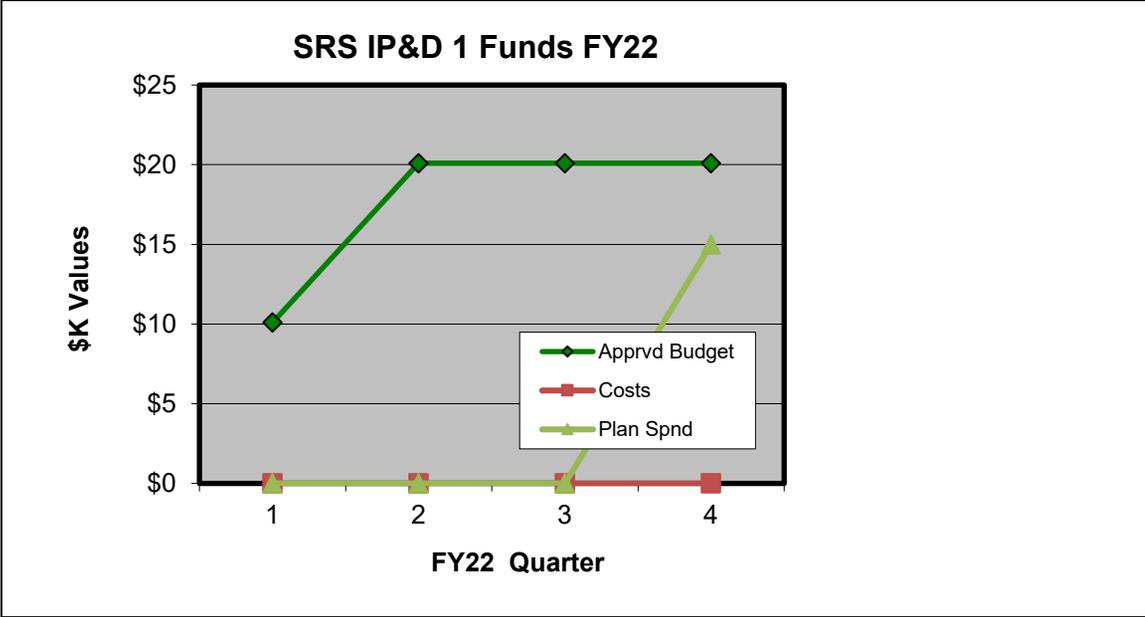
PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	List pulled from RESolution	Yes	
Q2	None have completed ORNL's review process. Will be sent next quarter.		
Q3	Mathieu Dupont, "FY21 Progress of the Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	Evaluation of Oak Ridge National Laboratory Health Physics Research Reactor Operation Data for Critical Benchmark Creation	Yes	
Q4	John Mihalczo, Delayed Critical Enriched Uranium Metal, 7-in.-diam. Cylinder with Thin Stainless-Steel Top and Bottom Reflectors, ORNL/TM-2022/2481, UT-Battelle, LLC, Oak Ridge National Laboratory (July 2022)	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: IPD1 **M&O Contractor Name:** SRNS **Point of Contact Name:** David Erickson **Point of Contact Phone:** 803-557-1315	**Reference:** DP0909010 **Date of Report:** OCtober, 2022

BUDGET

SRS IP&D 1 Funds FY22

Chart: $K Values vs FY22 Quarter

Legend:
- Apprvd Budget
- Costs
- Plan Spnd

1. Carryover into FY 2022 = $95
2. Approved FY 2022 Budget = $10,000 + $10K transfer from CSSG funds
3. Total FY 2022 Budget w/Carryover = $20,500
4. Actual spending for 1st Quarter FY 2022 = $0
5. Actual spending for 2nd Quarter FY 2022 = $0
6. Actual spending for 3rd Quarter FY 2022 = $0
7. Actual spending for 4th Quarter FY 2022 = $0
8. Projected carryover into FY 2023 = $20,500

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	
	(blue)		(green)		(yellow)		(red)

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on progress with CritView. (IPD1)	(blue)	Work in FY21 included generating 2 documents. The first documents the digitization of curves from LA-10860. The second documents new SCALE calculations. These documents are both in the review/approval stage. Once completed they will be reviewed for public release and made available to the NCSP. The information from these documents will be incorporated into an upcoming revision to the CritView database and code.

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	NCSP Approved Scope for FY21. (IPD1)	■	The Scope for FY22 is not finalized.
Q2	Provide status reports on progress with CritView. (IPD1)	■	These documents are both approved and have been reviewed for public release. They will be made available to the NCSP. Site/facility project priorities have made it difficult to identify time to work on database and code updates.
Q2	TBD based on Approved Scope. (IPD1)	■	The Scope for FY22 is not finalized.
Q3	Provide status reports on progress with CritView. (IPD1)	■	No progress since last quarter
Q3	TBD based on Approved Scope. (IPD1)	■	Draft SCOPE in progress. Will send to NCSP management for approval.
Q4	Provide status reports on progress with CritView. (IPD1)	■	Scope for FY22/FY23 has been approved. Minimal other progress
Q4	Provide updated CritView database for user testing. (IPD1)	■	Due to site/facility priorities, minimal progress has been made. This effort will continue in FY23.

ACCOMPLISHMENTS

- IPD1 – ARH-600 Reissue (CritView)
    - Completion of Documentation for SCALE Calculations related to ARH-600
    - Completion of Documentation for Digitizing Curves from LA-10860 for CritView

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

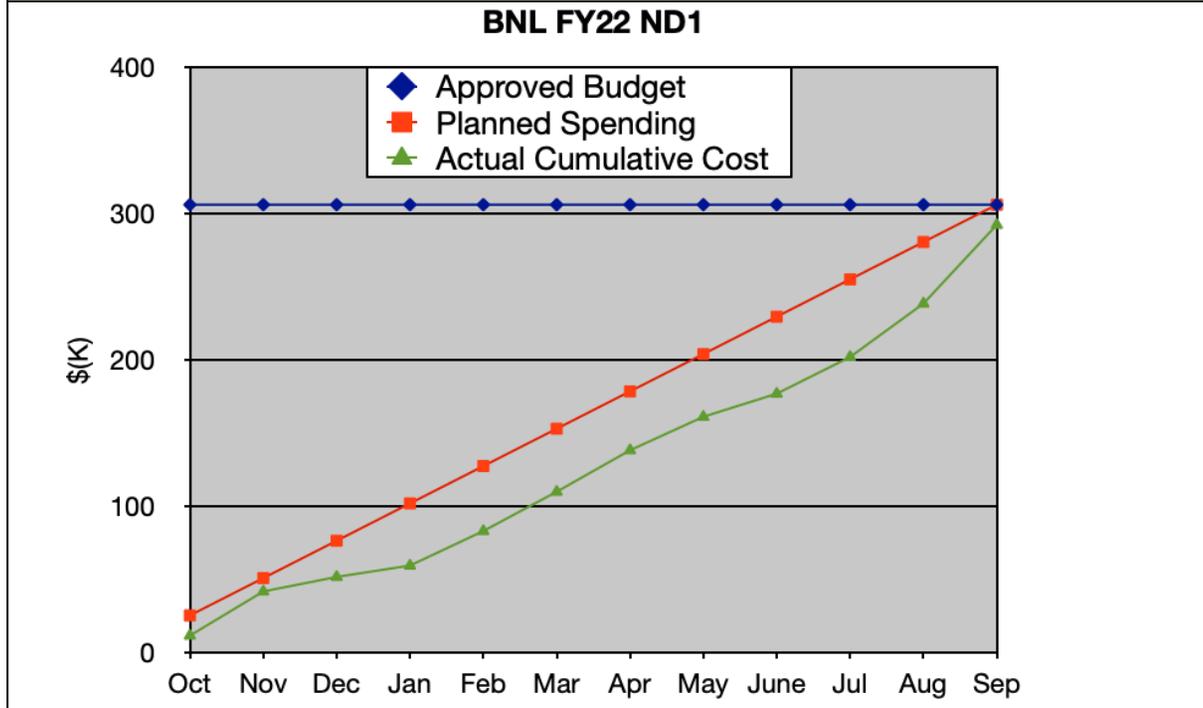| Quarter	Publication Reference **Example:** Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	A.N. Rodgers, N.R. Coon, S.H. Finfrock, "SCALE Calculations Replicating ARH-600 Data", N-NCS-G-00191, Rev. 0, February, 2022	No	Will be sent in Q3
Q2	N. Coon, A. Rodgers, D. Erickson, "Digitizing Curves from LA-10860 to be Used in CritView", N-NCS-G-00192, Rev. 0, July, 2021	No	Will be sent in Q3
Q3	Copies of public releasable documents have been transmitted to NCSP	Yes	

Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: ND1 **M&O Contractor Name**: BNL **Point of Contact Name:** Gustavo Nobre **Point of Contact Phone:** 631-344-5205	**Reference:** DP0909010 **Date of Report: 2**7 October, 2022

BUDGET

BNL FY22 ND1

1. Carryover into FY 2022 = $ 39,209
2. Approved FY 2022 Budget = $ 267,000
3. Total FY 2022 Budget w/Carryover = $306,209
4. Actual spending for 1st Quarter FY 2022 = $51,837
5. Actual spending for 2nd Quarter FY 2022 = $58,200
6. Actual spending for 3rd Quarter FY 2022 = $67,019
7. Actual spending for 4th Quarter FY 2022 = $115,403
   Projected carryover into FY 2023 = $5,413
   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	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)		Due to revised BNL cybersecurity posture, the next major upgrade to ADVANCE is delayed. In short, we are finding it difficult to connect the NNDC GitLab instance (outside of the BNL firewall) to the Kubernetes cluster (inside the firewall). As a result, ADVANCE must be run "by hand", defeating the

			purpose of a continuous integration system. Nevertheless, build reports are being forwarded to evaluation reviewers.
Q1	If mandated by CSEWG, release new ENDF library. (ND1)	🟨	The next ENDF/B library release is postponed until 2024. However, ENDF/B beta releases were also delayed by lack of evaluation review system. An evaluation review system being piloted in Q2. Once evaluations pass this review and enter the "Phase II" branch, then validation of new evaluations can begin.
Q2	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 review system and interface has been now officially deployed in this quarter. Merge requests for the decay sublibrary (~520 files) have been created, being that about 13 reviews have already been concluded and successfully merged. Reviewers for the alphas, atomic relaxation, and electrons sublibraries have already been identified and agree to review the evaluated contributions. Steps were given also in the process of reviewing the impactful evaluations related to the major actinides in the neutron sublibrary: the review interface has been set up and is awaiting confirmation of the potential reviewers.
Q2	If mandated by CSEWG, release new ENDF library. (ND1)	🟨	13 reviews have been completed.
Q3	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)	🟩	Kubernetes and gitlab are communicating and we are refactoring ADVANCE to use the simplified and more powerful system. We aim to have ADVANCE fully functional by the end of Q4.
Q3	If mandated by CSEWG, release new ENDF library. (ND1)	🟨	The review process of the submitted evaluated files, aiming for ENDF/B-VIII.1, continues with substantial progress, in particular related to the proposed ^{239}Pu files. More than 30 files have been reviewed and approved while many other reviews are in progress.
Q4	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	🟨	Refactoring of the ADVANCE CI/CD system is progressing. We have converted 90% of the build reports to simpler PDFs that can be easily distributed through gitlab. We

	on all nuclear data activities in the NCSP Quarterly Progress Reports. (ND1)		anticipate converting the remaining build report in FY23 Q1. Final deployment is stalled because the gitlab code base was not designed to work with a Kubernetes cluster behind a firewall. This is a non-negotiable cybersecurity requirement. Gitlab.com engineers promise a solution in FY23 Q1.
Q4	If mandated by CSEWG, release new ENDF library. (ND1)		The review process for VIII.1 has continued in Q4 with significant progress. BNL has helped coordinate reviews for 239Pu and TSL. Planned and organized for Beta0 releases which happened just after Q4.

ACCOMPLISHMENTS

- The review process of the submitted evaluated files, aiming for ENDF/B-VIII.1, continues with substantial progress. The review of most the impactful component of the future release, ^{239}Pu, is advancing well with review reports from subject matter experts returned and discussed among evaluators and reviewers. BNL helped coordinate the review process and is archiving and disseminating the files and reports.
- Successfully organized and held a Hackathon meeting at BNL on September 19th – 23rd, 2022, with about 10 in-person participants and about 5 remote attendees. During the week, many old and new issues with the library files were addressed, while others were found and logged.
- Developed a timeline of milestones and Beta releases leading to the release of ENDF/B-VIII.1, which was approved by the CSEWG Executive Committee

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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-2022 Q4)

NCSP Element and Subtask: ND1, 2, 3 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda/Bob Little/ Jen Alwin **Point of Contact Phone:** 505-667-2812/505-665-3487/505-667-7252	**Reference:** DP0909010 **Date of Report:** October 26, 2022

BUDGET
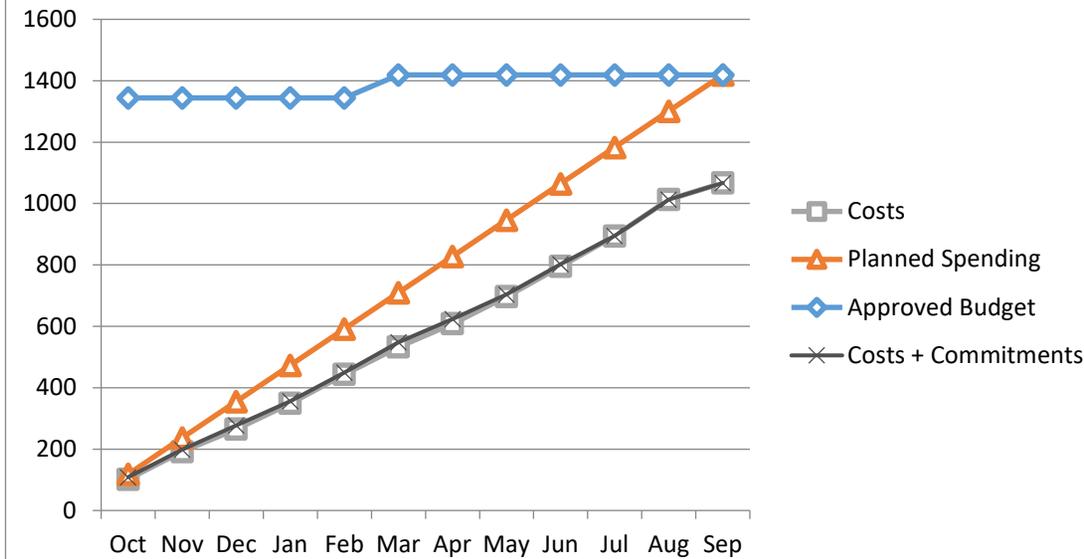
1. Carryover into FY 2022 = $100,000
2. Approved FY 2022 Budget = $ 1,319,000
3. Total FY22 Budget w/Carryover = $1,419,000
4. Actual spending for 1st Quarter FY 2022 = $265,403 (plus end of Q1 commitments of $12,188 for a total of $277,591)
5. Actual spending for 2nd Quarter FY 2022 = $267,214 for a total of $532,617 (plus end of Q2 commitments of $15,620 for a total of $548,237)
6. Actual spending for 3rd Quarter FY 2022 = $262,718 for a total of $795,335 (plus end of Q3 commitments of $6,611) for a total of $801,947
7. Actual spending for 4th Quarter FY 2022 = $$271,723 (no Q4 commitments)
8. Projected carryover into FY 2023 = $145,000
   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 report on LANL participation in US and International Nuclear Data collaborations. (ND1)	🟦	
Q1	Conduct CSEWG Evaluation and Covariance sessions. (ND1)	🟦	

NCSP Quarterly Progress Report (FY-2022 Q4)

|			
Q1	Report data testing results with ENDF/B-VIII.0 and additional beta release cross sections at CSEWG. (ND1)		
Q1	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2)		
Q1	Provide status report on Unresolved and Fast Measurements of Uraunium-233 (n,gamma) (ND3)		
Q2	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q2	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2)		
Q2	Provide status report on Unresolved and Fast Measurements of Uraunium-233 (n,gamma) (ND3)		
Q3	Provide status reports 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 (ND2)		
Q3	Provide status report on Unresolved and Fast Measurements of Uraunium-233 (n,gamma) (ND3)		
Q4	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
	Deliver nuclear data evaluations as indicated in Appendix B of the Five Year plan. (ND1)		Almost all of the dozen or so FY22 milestones in Appendix B were delivered successfully. One milestone for extending the O-16 evaluation to 10 MeV is delayed until FY23.
Q4	Provide status report on Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240 (ND2)		
Q4	Obtain final experimental results for Pu-240 PFNS at LANSCE, finalize data analysis, and deliver data to evaluators (ND2)		As discussed previously, the measurement was delayed, and this milestone was moved to FY23 Q2. It is on track for completion then as described below.
Q4	Provide status report on Unresolved and Fast Measurements of Uraunium-233 (n,gamma) (ND3)		
Q4	Finalize acquisition of U-233 thick target capture data, finalize data analysis, and deliver data to evaluators (ND3)		

ACCOMPLISHMENTS

- ND1 – Nuclear Data Evaluation and Testing
  - Actinides
    - We developed the methodology to evaluate nubar for Pu isotopes consistently with CGMF (leading into a FY23 milestone) and wrote a report (LA-UR-22-29570).
    - We revisited the ^{234}U and ^{236}U evaluations to include the collective enhancement adopted for ^{239}Pu evaluations. New files have been prepared and are retested so we can resubmit the new versions to NNDC.
    - As reported last quarter, a simultaneous evaluation of U-235 PFNS at incident-neutron energy of thermal, 1.5, 6.5 and 14 MeV was undertaken using CGMF satisfying the milestone requirements. When fitting just the fission-fragment initial conditions the resulting PFNS did not change significantly. The methodology to evaluate across incident energies is now in place for when improvements to the model are implemented. This work was documented in LA-UR-22-29989.
    - The outstanding issue reported last quarter for nu-bar near second-chance threshold for U-238 was fixed and an evaluation has been completed with CGMF (LA-UR-22-29906). Testing is waiting for PFNS from ChiNu to be delivered and evaluated.
    - A journal article was submitted to Frontiers of Physics on the fission source terms for Pu-239 (LA-UR-22-27724).
  - Light Nuclei
    - n+16O: fit to new data under En = 7 MeV
    - n+6Li: inelastic state contributions up to 8 MeV
    - resonance parameters (MF=2, LRF=7, KRM=4) for 5He, 16O, 6Li
    - work on n+^{12}C (^{13}C system) that improved the fit to the inelastic angular distributions measured by Vanhoy at energies up to 7 MeV.
  - Ta181
    - Uncertainties generated by Kalman filter were examined towards understanding the reason for their tendency to be excessively small. The problem has been related to weighting of measurements with large number of points and to influence of discrepant experiments. The methodology has been worked out to overcome these difficulties and it was applied to generation of a set of covariances for the new Ta-181 evaluation (including cross-reaction correlations).
- ND2 – Prompt Fission and Neutron Spectra (PFNS) Measurement of Plutonium-240
  - The ^{240}Pu(n,f) prompt fission neutron spectra (PFNS) measurements were completed during Q4 of FY22.
  - The experiment strategy was somewhat different than for previous PFNS measurements. The LLNL-fabricated PPAC has roughly 20 mg of Pu-240, compared to typical amounts of about 100 mg. This was done consciously to mitigate backgrounds from the α decay of Pu-240. The small sample size made the typical use of a Li-glass array for low-energy PFNS neutrons and a liquid scintillator array for high-energy PFNS neutrons infeasible due to the required beam time. Therefore, we split the liquid scintillator signals into high- and lo-gain inputs on the digital data acquisition to facilitate extension of the data to lower outgoing neutron energies.
  - Thirty-two days of beam time were available for the experiment instead of the roughly 50 desired. However, a preliminary uncertainty analysis of the results obtained led to the conclusion that an additional 60 days would be required to reduce the uncertainty on the highest

precision data points by an additional 1%. This is because the systematic uncertainty of the random-coincidence background dominates the total uncertainty. The determination was made that the experiment was complete with the current amount of data.

o   A preliminary analysis of the data leveraging MCNP simulations and experience from previous PFNS measurements was carried out. The first figure below shows the preliminary results for 1.0 – 2.0 MeV incident energy where only first-chance fission is possible. In this range both ENDF/B-VIII.0 and JEFF-3.3 evaluations agree well with the data, while JENDL-5.0 shows a markedly different shape and does not agree well with the data. The second figure is for incident neutron energies between 7.0 and 8.0 MeV where second-chance fission is possible. Here, the shape of the JENDL-5.0 evaluation is in much better agreement with the data than either ENDF/B-VIII.0 or JEFF-3.3. The average emitted energy as a function of incident energy has also been compared with evaluations up to 20 MeV incident energy. These first-ever observations will provide valuable information for future evaluators.

o   Remaining analysis tasks include:
   ▪   Detailed MCNP parametrizations of the Pu-240 data
   ▪   Analysis of spontaneous fission data for both Li-glass and liquid scintillator data
   ▪   Extension of the liquid scintillator data down to lower outgoing energies of the PFNS
   ▪   Subtraction of the spontaneous fission PFNS background from the in-beam results
   ▪   Minimization of total uncertainty on the random-coincidence background

o   This project is on track to be completed by Q2 of FY23 as planned.
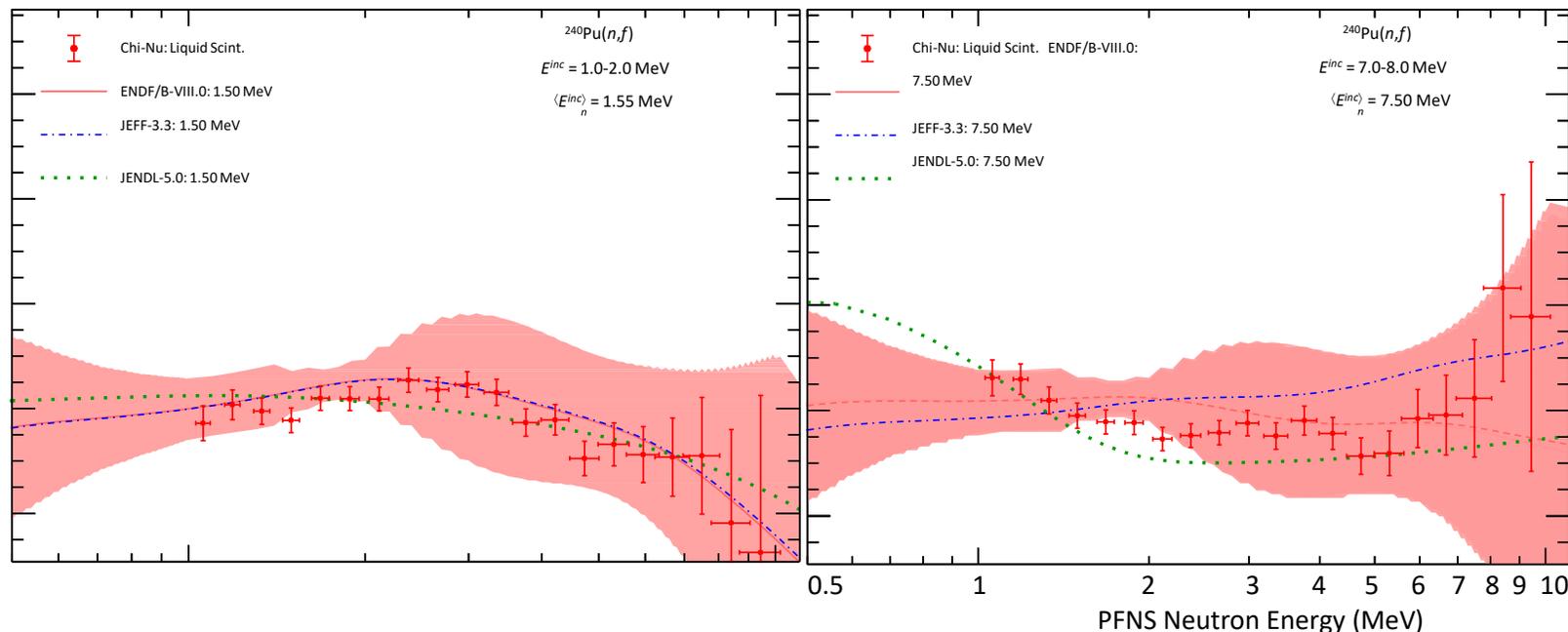
- ND3 – Unresolved and Fast Measurements of U-233 (n,gamma)
    - The complete set of experimental data has been analyzed. The capture-to-fission ratio of U-233 has been determined from 0.7 eV to 250 keV. The data have been normalized to the broadened ENDF/B-VIII.0 capture to fission ratio in the energy range between 8.1 and 14.7 eV as recommended by the evaluators.
    - The results have been compared with ENDF/B-VIII.0 and previous measurements. The current work provides higher resolution in the resolved resonance region and extends measured data above 2 keV up to 250 keV. Our results indicate a lower capture to fission ratio in the unresolved resonance range above 5 keV than found in the ENDF/B-VIII.0 evaluation.
    - The data have been provided to evaluators at ORNL and IRSN. Further discussion is planned in order to finalize the format to upload the data to EXFOR. The data analysis and results will be sent for publication.
- ND5 – Improved 239Pu neutron total cross section data and evaluation at low energies
    - We have located what we believe is about 100 mg of "Clinton" 239Pu (~99.9% enriched) at TA-48. The material is in several containers and will need chemical purification but appears to be enough for DICER measurements. We have begun chemical purification tests with this material. To ensure the thin samples needed are uniform, we plan to use liquid samples, most likely Pu dissolved in deuterated hydrochloric acid. To this end, we also have begun solubility tests.
- Presentations
    - Many presentations were made at the 15th International Conference on Nuclear Data for Science and Technology, Sacramento, Jul 24 – 29, 2022.
    - Many presentations were made at the 5th International Workshop on Nuclear Data Covariances - CW2022, Tokyo, September 26 - 30, 2022.
    - Several presentations were made at the recent INDEN nuclear data collaboration meeting at the IAEA in Vienna.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	Amy Lovell and Denise Neudecker, "Correcting the PFNS for more consistent fission modeling," LA-UR-21-30882, November 1, 2021.	Yes	
Q1	Matthew Mumpower and Denise Neudecker, "LANL Update to Pu-239 in the fast energy range,"LA-UR-21-31243, presented at CSEWG, November 2021.	Yes	
Q1	Denise Neudecker, "Updates from the Covariance Session Committee," LA-UR-21-31165, presented at CSEWG, November 2021.	Yes	
Q1	Denise Neudecker, "Validating the LANL versus INDEN Pu-239 file in the fast range," LA-UR-21-31248, presented at CSEWG, November 2021.	Yes	

Q1	Ester Leal Cidoncha, Aaron Couture, and Gencho Rusev, "U-233 (n,γ) measurements at LANSCE," LA-UR-21-31520, presented at NDAG, November 2021.	Yes	
Q1	Paul E. Koehler et al., "149Sm Results from DICER Plus DANCE," LA-UR-21-31180, presented at NDAG, November 2021.	Yes	
Q1	M. Herman and T. Kawano, "Ta-181 – fast neutron evaluation," LA-UR-21-31368, presented at CSEWG, November 2021.	Yes	
Q1	G. Hale and M. Paris, "Progress on Light Element Standard Cross Sections at Los Alamos," LA-UR-21-31976, presented at Technical Meeting on Neutron Data Standards 2021 (on-line), IAEA Vienna, Austria, December 8, 2021.	Yes	
Q1	G. Hale and M. Paris, "TN update plans and advances for O-16 and Be-9," LA-UR-21-31398, presented at CSEWG, November 2021.	Yes	
Q2	Amy Lovell and Denise Neudecker, "Modeling and evaluating 239Pu and 235U PFNS and average prompt-neutron multiplicity," Presented at NCSP TPR, **LA-UR-22-20933**, February 16, 2021.	Yes	
Q2	Denise Neudecker and Kegan Kelly, "Including Chi-Nu 235U PFNS Experimental Data into an ENDF/B-VIII.1 Release Candidate Evaluation," **LA-UR-22-22220**, March 8, 2021.	Yes	
Q2	D. Neudecker, A. Lovell, K. Kelly, P. Talou "235U(n,f) PFNS and nu-bar evaluations: first release candidate including validation," **LA-UR-22-21516**, February 15, 2021.	Yes	
Q2	Amy Lovell, "Compare v-bar parameterizations for 235U(n,f) with fitted fission barriers", **LA-UR-22-23270**, April 4, 2022	Yes	
Q3	A.E. Lovell, D. Neudecker, P. Talou, "Release of Evaluated 235U(n,f) Average Prompt Fission Neutron Multiplicities Including the CGMF Model," **LA-UR-22-23475**, April 13, 2022.	Yes	
Q3	Denise Neudecker, "Validation testing of 239Pu IAEA INDEN, LANL, and LLNL 239Pu files from May 2022," **LA-UR-22-24485**, June 13, 2022.	Yes	
Q4	Amy Lovell and Denise Neudecker, "Fitting ν for minor Pu isotopes," **LA-UR-22-29570**, September 21, 2022.	Yes	
Q4	Amy E. Lovell and Denise Neudecker, "Energy-dependent optimization of the prompt fission neutron spectrum with CGMF," **LA-UR-22-29989**, September 28, 2022.	Yes	
Q4	D. Neudecker, A.E. Lovell, T. Kawano, and P. Talou, "Evaluated U-238 Average Prompt Fission Neutron Multiplicities Including the CGMF Model," **LA-UR-22-29906**, September 28, 2022.	Yes	
Q4	D. Neudecker, A.E. Lovell, K.J. Kelly, P. Marini, L. Snyder, M.C. White, P. Talou, M. Devlin, J. Taieb, M.B. Chadwick, "Shedding Light on the 239Pu Fission Source Term with New High-precision Experiments and Advanced Fission Modeling," submitted to *Frontiers of Physics*, **LA-UR-22-28832**, September 19, 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: ND2, 5, 7, 8, 10, 11 **M&O Contractor Name**: LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909010 **Date of Report:** October 28, 2022
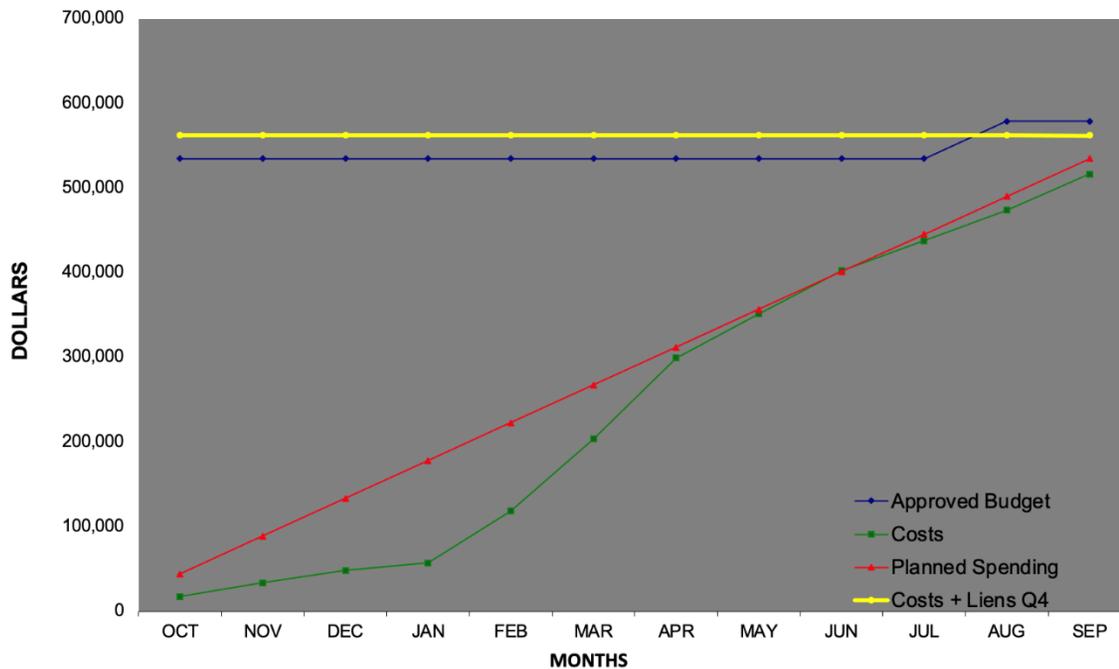
BUDGET

1. Carryover into FY 2022 = $ 138,848
2. Approved FY 2022 Budget = $396,000 + $44,000 (transfer from TS*) = $440,000
3. Total FY 2022 Budget w/Carryover = $ 578,848
4. Actual spending for 1st Quarter FY 2022 = $ 33,897
5. Actual spending for 2nd Quarter FY 2022 = $155,537 ($71,969 liens)
6. Actual spending for 3rd Quarter FY 2022 = $198,679 ($76,495 liens)
7. Actual spending for 4th Quarter FY 2022 = $114,000 ($45,813 liens)
8. Carryover into FY 2023 = $76,734

*Due to our large lien for NCSU (ND2, ND5, and ND10), we had to transfer $44,000K in August from the TS element as our available funds ran low.

MILESTONES

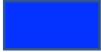**STATUS (copy color code and paste below in 'STATUS' field)**

Complete		On Schedule		Behind Schedule		Missed Milestone	

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status on LLNL/NCSU nuclear data activities on generation and benchmarking of thermal neutron scattering sections (ND2)		
Q1	Provide status on LLNL/NCSU nuclear data activities on development and implementation		

	of modern doppler broadening approach (ND5)		
Q1	Provide status on 'Alpha-N' benchmark measurements (ND7)		
Q1	Provide status on fission TPC measurement study (ND8)		
Q1	Provide status on development and implementation of machine learning methods for thermal scattering law evaluations (ND10)		
Q1	Provide status report PPAC target fabrication progress (ND11)		Task complete.
Q1	Fabricate the Pu240 PPAC targets and fission detector components (ND11)		Task complete.
Q2	Provide status on LLNL/NCSU nuclear data activities on generation and benchmarking of thermal neutron scattering sections (ND2)		
Q2	Provide status on LLNL/NCSU nuclear data activities on development and implementation of modern doppler broadening approach (ND5)		
Q2	Provide status on 'Alpha-N' benchmark measurements (ND7)		
Q2	Provide status on fission TPC measurement study (ND8)		
Q2	Provide status on development and implementation of machine learning methods for thermal scattering law evaluations (ND10)		
Q2	Provide status report PPAC target fabrication progress (ND11)		Task complete.
Q2	Assemble and test the Pu240 fission detector (ND11)		Task complete.
Q3	Provide status on LLNL/NCSU nuclear data activities on generation and benchmarking of thermal neutron scattering sections (ND2)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q3	Provide status on LLNL/NCSU nuclear data activities on development and implementation of modern doppler broadening approach (ND5)		
Q3	Provide status on 'Alpha-N' benchmark measurements (ND7)		
Q3	Provide status on fission TPC measurement study (ND8)		
Q3	Provide status on development and implementation of machine learning methods for thermal scattering law evaluations (ND10)		
Q3	Provide status report PPAC target fabrication progress (ND11)		Task complete.
Q4	Deliver thermal neutron scattering data evaluations as indicated in Appendix B of the 5-Year Plan. (ND2)		
Q4	Provide status on LLNL/NCSU nuclear data activities on generation and benchmarking of thermal neutron scattering sections (ND2)		
Q4	Provide status on LLNL/NCSU nuclear data activities on development and implementation of modern doppler broadening approach (ND5)		
Q4	Provide status on 'Alpha-N' benchmark measurements (ND7)		
Q4	Provide status on fission TPC measurement study (ND8)		Task complete
Q4	Provide status on development and implementation of machine learning methods for thermal scattering law evaluations (ND10)		
Q4	Provide an update on the development and testing of NeTS modules for selected materials such as light water, graphite, etc. (ND10)		
Q4	Provide status report PPAC target fabrication progress (ND11)		Task complete

NCSP Quarterly Progress Report (FY-2022 Q4)

ACCOMPLISHMENTS

- ND2 - Generation and Benchmarking of Thermal Neutron Scattering Cross Sections in Support of Advanced Nuclear Reactor Concepts
  - NCSU continued the TSL evaluation of paraffin (NCSP's Appendix B material for FY 2022 and 2023). Classical molecular dynamics models with hundreds of polymer chains (i.e., thousands of atoms) have been created to test different levels of the carbon content. At this stage, the parametrization of the COMPASS force field is completed. The CMD models in combination with COMPASS potential are reproducing the published characteristics of paraffin to reasonable agreement at 300 K and 1 atm. Based on that, a preliminary density of excitation states has been produced and is currently being tested in TSL generation.
  - A TSL package was prepared for release to NNDC to include in ENDF/B-VIII+ library. The package presents new TSL evaluations (UC, U-metal, and enrichment dependent UC, U-metal, and UO2 libraries) and also updates existing materials (BeO, SiC, and SiO2) to enhance uniformity of the applied methodology and basic input.
- ND5 - Development and Implementation of a Modern Doppler Broadening Approach Including Atomic Binding Effects
  - NCSU created a comprehensive update to the *FLASSH* code that includes all modifications to date. This includes incorporating the latest version of the Doppler broadening module, an improved SCT module, an expansion of the material database, and an upgraded GUI reflecting the updates and including improved error checks. This version of *FLASSH* is tested in evaluating all materials that are currently ready for release to NNDC.
- ND7 - 'Alpha-N' Benchmark Measurements
  - The new frame for the expanded detector system has been constructed. New and old detector modules have been placed in a calibration configuration to allow for simultaneous calibration and characterization. Work has begun to add the new 16 detector configuration into the simulation.
- ND8 - Study: Fission TPC Measurement of the U-233/U-235 (n,f) Cross Section Ratio
  - The fissionTPC and all support equipment has been fully returned from LANL to LLNL. The detector was assembled and is operational though several items have been tagged for repair and replacement that would be required for an experimental campaign. The report, LLNL-TR-840571, "Study of a Proposed fissionTPC Measurement of 233U(n,f)/235U(n,f) Cross Section Ratio," describing motivations and options for measuring the 233U(n,f)/235U(n,f) cross section ratio has been provided to NCSP completing this milestone.
- ND10 – Development and Implementation of Machine Learning Methods for Thermal Scattering Law Evaluations
  - NCSU continued development of NeTS modules for producing the TSL of graphite and beryllium moderators. 1-D and 2-D training of the associated feed forward neural network (FFN) have been completed and 3-D training is underway. Results show clear dependence of the FFN architecture on the details of the material microstructure.
- ND11 - Fabricate the Pu240 PPAC targets and fission detector components
  - A detailed progress report, LA-UR-22-31150, LANL/LLNL 240Pu(n,f) Prompt Fission Neutron Spectrum Measurement: Q4FY22 Progress Report," has been completed and provided to NCSP Management – see publications.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

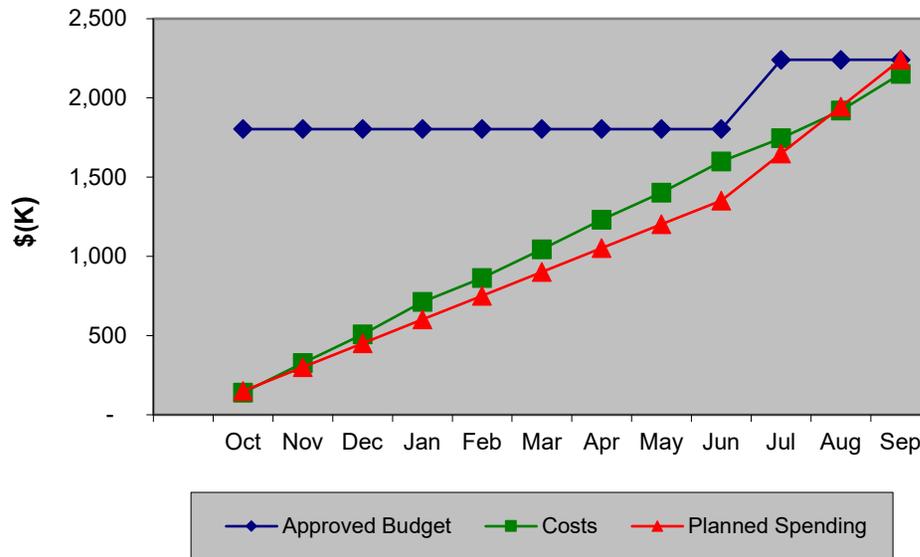| Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Jonathan Crozier, "Uranium Carbide and Uranium-Metal TSL Evaluation and Cross Sections," CSEWG Meeting, November 17, 2021.	Yes	

	Nina C. Fleming et al., "*FLASSH* 1.0: Full Law Analysis Scattering System Hub," 2021 ANS Winter Meeting and Technology Expo, December 3, 2021.	Yes	
	Lucas Snyder et al., "*Measurement of the $^{239}Pu(n,f)/^{235}U(n,f)$ Cross-Section Ratio with the NIFFTE fission Time Projection Chamber*" Nuclear Data Sheets 178 (2021) 1-40.	Yes	
Q2	M. Devlin, C. Y. Wu et al., "*Measurement of the $^{240}Pu(n,f)$ Prompt Fission Neutron Spectra with Chi-Nu,*" no date.	Yes	
	Chin-Yen Wu, Roger A. Henderson, "*Parallel-plate avalanche counter (PPAC) fabrication for 240Pu PFNS measurement,*" LLNL-PRES-831600, February 16, 2022.	Yes	
	Ayman I. Hawari, "*Accomplishments of Thermal Scattering Research at North Carolina State University,*" February 17, 2022.	Yes	
	Mateusz Monterial et al., "*Measurement of the material isotopics and atom number ratio with α-particle spectroscopy for a NIFFTE fission Time Projection Chamber actinide target*" NIM A 1021 (2022) 165864.	Yes	
Q3	J.P.W. Crozier, N.C. Fleming, A.I. Hawari, "Thermal Scattering Law for Structure-Dependent-Doppler Broadening in FLASSH," PHYSOR 2022.	Yes	
	N.C. Fleming, C.A. Manring, B.K. Laramee, J.P.W. Crozier, E. Lee, A.I. Hawari, "*FLASSH* 1.0: Thermal Scattering Law," PHYSOR 2022.	Yes	
	E. Lee, N.C. Fleming, A.I. Hawari, " Benchmark of Neutron Thermalization in Graphite Using a Pulsed Slowing-Down-Time Experiment," PHYSOR 2022.	Yes	
	C.A. Manring, A.I. Hawari, "Design of a Neural Thermal Scattering (NeTS) Module for Hydrogen in Light Water," PHYSOR 2022.	Yes	
	T. Ahmed, N.C. Fleming, A.I. Hawari, "Thermal Neutron Scattering Cross Sections for Amorphous Carbon," PHYSOR 2022.	Yes	
Q4	J.P.W. Crozier, A.I. Hawari, "Ab Initio Evaluation of Uranium Carbide S(α,β) and Thermal Neutron Cross Sections," ND 2022.	Yes	
	T. Ahmed, N.C. Fleming, A.I. Hawari "Effects of Hydrogen Bonding on Nuclear Data Development of Liquid Anhydrous HF," ND 2022.	Yes	
	B.K. Laramee, A.I. Hawari, Evaluation of Thermal Neutron Scattering Law and Cross Sections for Calcium Hydride," ND 2022.	Yes	
	N.C. Fleming, C.A. Manring, B.K. Laramee, J.P.W. Crozier, E. Lee, A.I. Hawari, "*FLASSH* 1.0: Thermal Scattering Law Evaluation and Cross Section Generation," ND 2022.	Yes	
	Lucas Snyder, "Study of a Proposed fissionTPC Measurement of 233U(n,f)/235U(n,f) Cross Section Ratio," LLNL-TR-840571, October 4, 2022.	Yes	
	K. J. Kelly *et al.*, "LANL/LLNL 240Pu(n,f) Prompt Fission Neutron Spectrum Measurement: Q4FY22 Progress Report," LA-UR-22-31150, October 21, 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: ND1, 3, 4, 6, 10 **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 28, 2022

BUDGET

FY22 Nuclear Data

Chart legend: Approved Budget, Costs, Planned Spending. Y-axis: $(K) from - to 2,500. X-axis: Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

1. Carryover into FY 2022 = $221K
2. Approved FY 2022 Budget = $2,020K
3. Total FY 2022 Budget w/Carryover = $2,241K
4. Actual spending for 1st Quarter FY 2022 = $508K
5. Actual spending for 2nd Quarter FY 2022 = $537K
6. Actual spending for 3rd Quarter FY 2022 = $553K
7. Actual spending for 4th Quarter FY 2022 = $554K
8. Projected carryover into FY 2023 = $89K

NOTE: Include commitments as part of spending

In Q4, $107K was added by the NCSP Manager for use with ND (SAMMY and ND evaluation work). $150K was transferred from AM1 (RSICC) to ND1 (Evaluation and Measurement). $180K was transferred from TS1 ($100K, CSSG) and TS2 ($80K, Subcontract Support) to ND4 (Thermal Neutron Total Cross Section)

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 all activities in NCSP Quarterly Progress Reports (ND1)	🟩	
Q1	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1)	🟩	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		COVID-19 has delayed cross section measurements at GELINA by 12 months, that is all experiments are about 12 months behind original schedule. Appendix B will be adjusted
Q1	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND3)		
Q1	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND3)		
Q1	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND3)		
Q1	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND4)		
Q1	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND6)		
Q1	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND10)		
Q2	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND1)		
Q2	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1)		
Q2	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		
Q2	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND3)		
Q2	Provide status reports on ORNL participation in US and International Nuclear Data		

	collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND3)		
Q2	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND3)	🟩	
Q2	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND4)	🟦	
Q2	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND6)	🟦	
Q2	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND10)	🟦	
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1)	🟦	
Q3	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1)	🟦	
Q3	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)	🟩	
Q3	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND3)	🟦	
Q3	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND3)	🟦	
Q3	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND3)	🟦	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q3	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND4)		
Q3	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND6)		
Q3	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND10)		Final report included in publications submitted to NCSP. Title of the report is Bayesian Optimization Framework for Imperfect Data or Models
Q3	Provide status reports on all activities in NCSP Quarterly Progress Reports (ND11)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1)		
Q4	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1)		
Q4	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND1)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND3)		
Q4	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND3)		
Q4	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5 Year Plan (ND3)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND4)		

Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND6)		
Q4	Document SAMMY modernization progress and report status annually to the NCSP Manager (ND6)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND10)		No activity. Completed in Q3.
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND11)		

ACCOMPLISHMENTS

- **ND1** - Nuclear Data Measurement and Evaluation
  - **Status report on all nuclear data support activities.**
    - Attendance of the ND group members at the **International Conference on Nuclear Data for Science and Technology** (ND2022) with several presentations.
    - **Technical Meeting on Long Term International Collaboration to Improve Nuclear Data Evaluation** held from 29-31 August 2022
    - **Consultancy Meeting on the Evaluation of Light Elements** held from 1-2 September 2022
    - Lecture at the **ND summer school at UC Davis** organized by the NSSC.
    - Continue to work and mentor new staff and PhD students for data analysis of experimental data.
  - **Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.**
    - Travel to JRC-Geel in July 2022 but only 5-day visit due to change in JRC policy for working extended period at JRC-Geel. Problem seems to be resolved. A letter between ORNL and JRC was exchanged as require per DOE/EURATOM agreement for extended visit. Next visit approved.
    - **Zr-90** capture data were sorted into TOF spectra at JRC-Geel. Data reduction for capture underway. Preliminary results were presented at ND2022.
    - **Zr-91** capture experiments finished at JRC-Geel.
    - **Natural Zr** capture data reduction continued. Transmission for 4-, 1- and 0.5-mm sample available.
    - V capture and transmission data analysis and evaluation for data using various sample thickness continued.
    - The evaluation of **139-La** and the fitting of resonance parameters continued.
    - **140,142Ce** –Error in the ENDF file for Cerium was corrected and new file submitted to NNDC. Report of the evaluation is finalizing.
    - **Hf** –The URR data measured at Karlsruhe in 2006 were not included in ENDF or JEFF evaluations, no further action until new cross section data is available.

- Investigated on how to extract the **35Cl(n,p)** reaction channel in the region of interest form total cross section and preliminary high energy data form LANL. A paper on 35Cl(n,p) reaction channel results was submitted to Progress of Nuclear Energy.
- **233U RRR evaluation**: Currently waiting for newly measured capture data from LANL. Capture to fission ratio was send from LANL, currently investigating on how to incorporate into the analysis/evaluation.
- **239Pu RRR evaluation**: Proceeding with the 239Pu evaluation in extending the experimental database to include Mosby's capture data set.
- **63,65Cu**: The benchmark analysis questions that were raised earlier this year have been resolved – the differences in previous conclusions were driven by differences in benchmark model rather than nuclear data. The resolved resonance region parameters are under finalization, and the evaluation will be submitted to the ENDF/B-VIII.1 library for testing in Q1 FY2023. The progress in the copper evaluation was presented at ND2022.
- **Ta-181** is under review in the NNDC GitLab.
- **Polystyrene** – ENDF file submitted to NNDC for inclusion in ENDF8.1.
- Created a preliminary TSL library for **Teflon.**

- **ND3** - Isotopic Sample Leases to Support ND1 ND Measurements
  - Zr92 has been ordered form ORNL Isotopes.
- **ND4** - Thermal Neutron Total Cross Section Measurements for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties
  - Total cross sections of polystyrene, polyethylene, and yttrium hydride measured at RPI were used to create ENDF-format thermal neutron scattering files along with the inelastic neutron scattering measurement at Spallation Neutron Source at ONRL
  - **Polystyrene**– ENDF file submitted to NNDC for potential revision of existing ENDF Polyethylene TSL file; temperature dependence of the phonon spectra will be investigated as part of ND11.
  - **Teflon** - created a preliminary TSL library for Teflon
- **ND6** – SAMMY Nuclear Data Evaluation Code Modernization
  - With a publicly available subset of AMPX and SCALE (https://code.ornl.gov/scale/code/scale-public), we updated the SAMMY build system by simplifying it. The updated version was made available on https://code.ornl.gov/RNSD/SAMMY. Before the CSEWG meeting in November appropriate tags will be applied to the public facing repository for external users to refer to the correct version.
  - Work continued to modularize the resolution function, mainly focusing on the DEX module. As previously, this has been made harder as the adjustable parameters for this resolution function can be input by the user in the block for Doppler broadened parameters as well as in the block for miscellaneous parameters.
  - Work continued in converting the SAMMY manual into LaTeX to allow version control and for easier maintainability.
  - A new option to write out the covariance information in HDF5 file format was further refined. The output is now only done upon user request (to avoid writing large files if not desired by the user) and encompasses prior as well as posterior covariance information.

- o   A SAMMY overview was presented at the ND-2022 conference and a paper for the proceedings was prepared. R-matrix parameterization of previously neglected direct as well as doorway processes intended for implementation in SAMMY has been presented at the ND-2022 and the paper for the proceedings was prepared.
- **ND10** - Monte Carlo Evaluation of Differential and Integral Data
  - o   No activity. Completed in Q3
- **ND11** - Thermal neutron scattering measurements and evaluations for DHS applications at different temperature
  - o   Concrete sample preparation started for the measurements at SNS and RPI
  - o   Measurements for proposal for SNS submitted, and in tandem with instrument scientist scheduled for measurements sometime in January, using internal beam time
  - o   Modeling of components of dry cement (Portland cement completed): Tricalcium aluminate, Tetracalcium aluminoferrite, Belite, Alite, Sodium oxide, Potassium oxide and Gypsum were modeled
  - o   Modeling of cement paste (hydrated cement) as calcium silicate hydrate has started

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference Example:	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Received and sent separately	yes	
Q2	Jesse Brown, Goran Arbanas, Andrew Holcomb, Dorothea Wiarda, "Bayesian Monte Carlo Evaluation Framework for Imperfect Nuclear Data," Transactions of the American Nuclear Society, 125,691-694 (December 2021)	Yes	
Q2	D.H. Moon, Carlos Paradela, Gery Alaerts, V. Chavan, Klaus Guber, Jan Heyse, S.W. Hong, S. Kopecky, P. Schillebeeckx, R. Wynants, "Results of time-of-flight transmission measurements for 142Ce at a 50 m station of GELINA," INDC International Nuclear Data Committee, March 2021	Yes	
Q2	Klaus Guber, Jesse Brown, "ORNL Neutron Cross Section Measurements of 90Zr," Nuclear Data Week, CSEWG Evaluation Session (Virtual), Brookhaven, NY, November 2021	Yes	
Q2	Chris Chapman, Andrew Holcomb, Dorothea Wiarda, "Isotope Effects in Thermal Neutron Scattering," Nuclear Data Week, CSEWG Evaluation Session (Virtual), Brookhaven, NY, November 2021	Yes	
Q2	Jesse Brown, Goran Arbanas, Dorothea Wiarda, Andrew Holcomb, "Bayesian Monte-Carlo Evaluation Framework for Imperfect Nuclear Data," ANS Winter Meeting (virtual), November 2021	Yes	

Q2	Jesse Brown, Goran Arbanas, Andrew Holcomb, Dorothea Wiarda, "Bayesian Monte-Carlo Framework: New Methods for Resonance Parameter Evaluation," NCSP Technical Program Review (virtual), February 2022	Yes	
Q2	Jordan McDonnell, "Updates to the n+63,65Cu Angular Distributions for Critical Experiments," NCSP Technical Program Review (virtual), February 2022	Yes	
Q2	K. Guber, J. Brown, "ORNL Neutron Cross Section Measurements of 90 Zr NCSP ND-1 Task, " NCSP Technical Program Review (virtual), February 2022	Yes	
Q2	Goran Arbanas, Jesse Brown, Chris Chapman, Klaus Guber, Andrew Holcomb, Jordan McDonnell, Marco Pigni, Dorothea Wiarda, Kemal Ramic, "Advances in Nuclear Data Evaluation Theory for NCSP," NCSP Technical Program Review (virtual), February 2022	Yes	
Q2	Chris Chapman, Marco Pigni, Klaus Guber, Goran Arbanas, "Resolved Resonance Region Evaluation of n+140,142Ce," NCSP Technical Program Review (virtual), February 2022	Yes	
Q2	Chris Chapman, Kemal Ramic, Goran Arbanas, Jesse Brown, Yongqiang Cheng, Yaron Danon, Dominik Fritz, "Thermal Neutron Scattering Research at ORNL – ENDF File Validation," NCSP Technical Program Review (virtual), February 2022	Yes	
Q3	Chris W. Chapman, Andrew Holcomb, Doro Wiarda, "Isotope Effects in Thermal Neutron Scattering," 34th WPEC Subgroup Meetings, May 2022.	Yes	
Q3	Marco T. Pigni, Travis Greene, Kang Seog Kim, Roberto Capote, Andrej Trkov, "Progress on Fissile Actinides Evaluations: 233,235U and 239Pu," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	D. Wiarda, A. Holcomb, G. Arbanas, J. Brown, M. Pigni, "SAMMY Modernization Efforts," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	Jesse Brown, Marco Pigni, "Ta-181 Evaluation in the Unresolved Resonance Region," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	K. Guber, J. Brown, "ORNL Neutron Cross Section Measurements of 90Zr NCSP ND-1 Task," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	J. D. McDonnell, M.T. Pigni, "Updates to the n+63,65 RRR and Angular Distributions," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	Andrew Holcomb, Doro Wiarda, G. Arbanas, J. Brown, C. Chapman, K. Guber, J. McDonnell, M. Pigni, AMPX and SAMMY Status Report," Virtual, CSEWG Workshop - Nuclear Data Week, November 2021.	Yes	
Q3	Marco T. Pigni, Roberto Capote, Andre Trkov, "Low-Energy Reactions of the n+233U Nuclear Compound System and Its Initial Validation," 2021 ANS Winter Meeting and Technology Expo, 125, 581-584, November 2021.	Yes	
Q3	Klaus Guber, "Action Sheet 66: Neutron Induced Nuclear Data Cross Section Measurements at JRC-Geel," US-Euratom Coordination Meeting, June 2022.	Yes	

Q3	Jesse M. Brown, Goran Arbanas, Hany Abdel-Khalik, Ugur Mertyurek, William B. Marshall, William A. Wieselquist, "Generalized Bayesian Framework for Evaluation of Integral Benchmark Experiments," submitted to ANS Winter Meeting, November 2022	Yes	
Q3	Jesse M. Brown, Goran Arbanas, Dorothea Wiarda, Andrew Holcomb, "Bayesian Optimization Framework for Imperfect Data or Models," ORNL/TM-2022/2448, UT-Battelle, LLC, Oak Ridge National Laboratory (April 2022)	Yes	
Q4	Jesse Brown, Goran Arbanas, Dorothea Wiarda, Andrew Holcomb, Klaus Guber, "Bayesian Monte Carlo Evaluation Framework for Imperfect Data and Models," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Goran Arbanas, Jesse Brown, Andrew Holcomb, Dorothea Wiarda, Peter Brain, Devin Barry, Yaron Danon, "Phenomenological R-Matrix parameterization of direct, doorway, and compound nuclear resonant scattering matrix," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Dominik Fritz, Yaron Danon, Benjamin Wang, Katelyn Cook, Sukhjinder Singh, Adam Ney, Peter Brain, M. Rapp, Chris Chapman, Goran Arbanas, Jesse Brown, Xunxiang Hu, "Thermal cross section measurements at the RPI LINAC," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Jordan McDonnell, Marco Pigni, "Updates and Validation for the Neutron Reactions on 63,65Cu *," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	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, July 2022.	Yes	
Q4	Dorothea Wiarda, Goran Arbanas, Jesse Brown, Andrew Holcomb, Marco Pigni, "Modernization efforts for the R-Matrix code SAMMY," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Chris Chapman, Goran Arbanas, Jesse Brown, Kemal Ramic, Yongqiang Cheng, Jiao Lin, Douglas Abernathy, Alexander Kolesnikov, Matthew Stone, Luke Daemen, Anibal Ramirez Cuesta, Xunxiang Hu, "Advanced Modeling and Simulations for Evaluation of Thermal Neutron Scattering Materials," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Jesse Brown, Klaus Guber, "Zr Nuclear Data Campaign: Measurement of Zr-90(n,g) cross section," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Marco Pigni, R. Capote, A. Trkov, "Evaluated Data for Fissile Actinides in the Resolved and Unresolved Resonance Region and their Coupling to Neutron Multiplicities," Technical	Yes	

|			
	Meeting of the INDEN on Actinide Evaluations in the Resonance Region, IAEA, Vienna, Austria, November 2021.		
Q4	Kemal Ramic, Chris Chapman, Goran Arbanas, Jesse Brown, Yongqiang Cheng, Yaron Danon, Dominik Fritz, "The importance of phonon spectrum measurements for accurate prediction of thermal scattering laws," 34th WPEC Subgroup Meetings, Paris, France, May 2022.	Yes	
Q4	Jesse Brown, "Preliminary API design to access SG-50 database," 34th WPEC Subgroup Meetings, Paris, France, May 2022.	Yes	
Q4	Dorothea Wiarda, Chris Chapman, Jesse Brown, Jordan McDonnell, "Status of GNDS support in AMPX," Working Party on International Nuclear Data Evaluation Co-operation (WPEC) Meeting, May 2022.	Yes	
Q4	Marco Pigni, "Including inverse channel in n+16O R-matrix evaluation and analysis on the 35Cl(n,p) reaction channel," Consultancy Meeting of the INDEN on Light Elements, IAEA, Vienna, Austria, June 2022.	Yes	
Q4	Dorothea Wiarda, Goran Arbanas, Jesse Brown, Marco Pigni, Jordan McDonnell, Chris Chapman, Andrew Holcomb, "Modernization efforts for the R-Matrix code SAMMY," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Goran Arbanas, Jesse Brown, Andrew Holcomb, Dorothea Wiarda, Peter Brain, Devin Barry, Yaron Danon, "Phenomenological R-Matrix parameterization of direct, doorway, and compound nuclear reactions," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Marco Pigni, "239Pu R-matrix Analysis and Neutron Fission Multiplicities in the Neutron Energy Region up to 5 keV," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Chris Chapman, Marco Pigni, Klaus Guber, Goran Arbanas, "140,142Ce Neutron Cross Section Resolved Resonance Region Evaluation," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Jordan McDonnell, Marco Pigni, "Updates and Validation for the Neutron Reactions on 63,65Cu," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Marco Pigni, "239Pu R-matrix Analysis and Neutron Multiplicities in the Neutron Energy Region up to a few keVs," submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 2022.	Yes	
Q4	Jesse Brown, Goran Arbanas, Dorothea Wiarda, Generalized Bayesian Monte Carlo Evaluation," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	

Q4	Jesse Brown, Klaus Guber, Peter Schillebeeckx, Carlos Paradela, Stefan Kopecky, "Zr Nuclear Data Campaign: Measurement of Zr-90(n,g) cross section," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Jordan McDonnell, Jesse Brown, Chris Chapman, Dorothea Wiarda, Andrew Holcomb, "Recent Developments in the Nuclear Data Processing Code AMPX," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Dominik Fritz, Y. Danon, Adam Ney, Peter Brain, Sukhjinder Singh, Katelyn Cook, Benjamin Wang, M. Rapp, T Trumbull, Michael Zerkle, Jesse Holmes, Chris Chapman, Goran Arbanas, Jesse Brown, Kemal Ramic, "Thermal Cross Section Measurements At The RPI LINAC," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Y. Danon, Dominik Fritz, Benjamin Wang, Katelyn Cook, Sukhjinder Singh, Adam Ney, Peter Brain, M. Rapp, A. Daskalakis, Devin Barry, T Trumbull, Chris Chapman, Goran Arbanas, "Experiments for validation of TSL evaluations," 15th International Conference on Nuclear Data for Science and Technology, July 2022.	Yes	
Q4	Marco Pigni, Michael Zerkle, "Nuclear Criticality Safety Program (NA-ESH)," Nuclear Data Working Group Annual Meeting, Livermore, CA, August 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: ND1, 3 **M&O Contractor Name:** RPI **Point of Contact Name:** Yaron Danon **Point of Contact Phone:** 518-276-4008	**Reference:** DP0909010 **Date of Report:** October 21, 2022

BUDGET
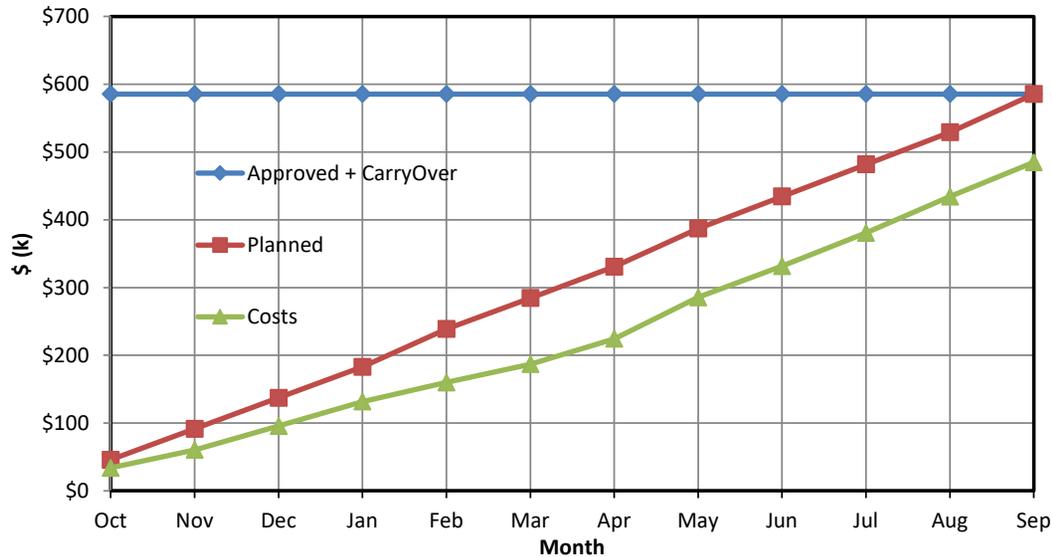
1. Carryover into FY 2022 = $114,524 (ND 1,2,3)
2. Approved FY 2022 Budget = $471,000
3. Total FY 2022 Budget w/Carryover = $585,524
4. Actual spending for 1st Quarter FY 2022 = $95,594
5. Actual spending for 2nd Quarter FY 2022 = $91,323
6. Actual spending for 3rd Quarter FY 2022 = $144,715
7. Actual spending for 4th Quarter FY 2022 = $153,301
8. Projected carryover into FY 2023 = $100.6K

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 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-2022 Q4)

Q1	Provide status report on all LINAC refurbishment activities (ND3)	🟦	Provided a report during ANS meeting
Q1	Complete SOL 1 Accelerator Section RF Conditioning. (ND3)	🟨	RF windows test finally in progress. This is the next step
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 TPV Accelerator Section RF Conditioning. (ND3)	🟨	RF windows is in progress.
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)	🟦	
Q3	Complete nuclear data measurements (transmission/capture or scattering) per the nuclear data schedule in Appendix B of the 5 year plan. (ND1)	🟩	Working on completion of data analysis and evaluation of Fe-54
Q3	Provide status report on all LINAC refurbishment activities (ND3)	🟦	
Q3	Start fabrication of 2nd batch of speed of light structures 2, 3 and 4 (ND3)	🟨	Delayed until RF windows testing will be completed
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 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	🟦	Fe-54 measurements completed evaluation in progress, thermal cross sections were delivered to ORNL

	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)		

ACCOMPLISHMENTS

- ND1 – Resonance Region Nuclear Data Measurement Capability at RPI
  - **Fe-54**
    - Normalization of nTOF data resolve major differences with RPI Fe-54 capture experiment.
    - Relevant (other) transmission experiments were added to resonance parameter evaluation.
    - Critical and non-critical benchmarks were identified for validation of the evaluation.
  - **Zr isotopes**
    - Performed extensive pre-evaluation of existing differential and integral Zr nuclear data
    - Preliminary evaluation of Zr-90 features resonance parameters to 500 keV, a 300 keV extension from the current EDF/B-VIII.0 evaluation.
  - **Pb isotopes**
    - Pb-208 evaluation completed including resonance and fast region (from LANL).
    - Pb-206 and 207 evaluations in progress.
  - **SAMMY improvement in the URR**
    - Completed validation of SESH for transmission
    - verification of SESH for capture is in progress
- ND3 – RPI/ORNL: LINAC 2020 Nuclear Data Capabilities Maintenance Plan
  - Windows testing finally started.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

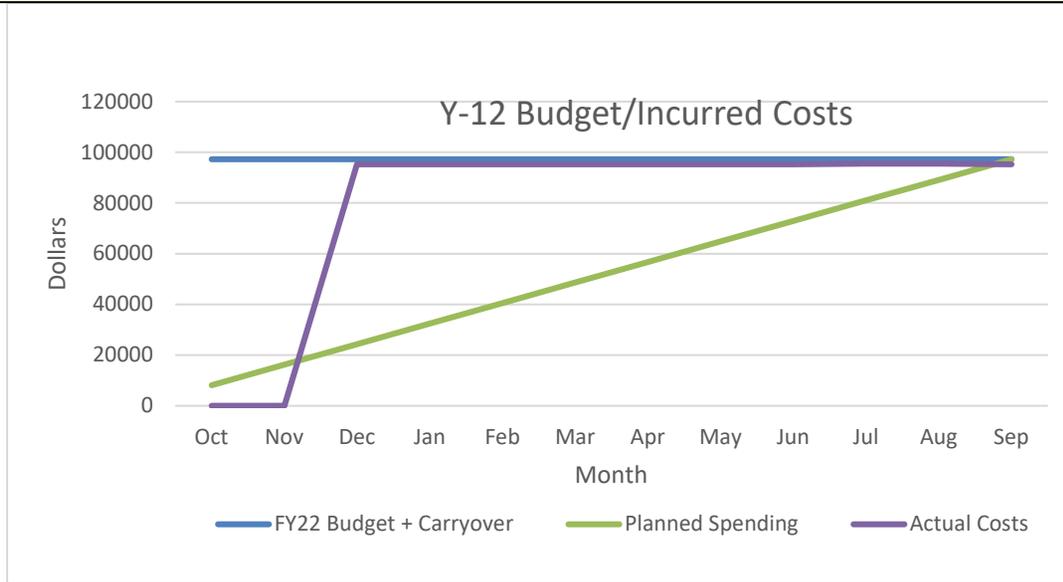| Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Yaron Danon, Peter Brand, Michael Bretti, Brian Epping, and Timothy Trumbull, "RPI LINAC refurbishment and upgrade project", Transactions of the American Nuclear Society, Volume 125, 2021	Yes	

Q2			
Q3	Dominik Fritz et al., "Thermal cross section measurements at the RPI LINAC", submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 24-29, 2022, in Sacramento, California, USA.	No	Will be submitted to NCSP after final conference papers are submitted.
	Sukhjinder Singh et al., "Radiative capture cross section measurements of Fe-54 at the RPI LINAC,", submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 24-29, 2022, in Sacramento, California, USA.	No	
	Y. Danon et al., " Experimental validation of thermal scattering evaluations", submitted to 15th International Conference on Nuclear Data for Science and Technology (ND2022), July 24-29, 2022 in Sacramento, California, USA.	No	
Q4	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, B.Wang, "Total thermal neutron cross section measurements of yttrium hydride from 0.0005 - 3 eV", Annals of Nuclear Energy, Volume 181, February 2023. https://doi.org/10.1016/j.anucene.2022.109475	No	Link to full text is provide
	Peter Brain, Yaron Danon , Dave Brown, and Devin Barry, "Resolved Resonance Region Analysis of Pb-206, Pb-207, and Pb-108 For Next Generation Lead-Cooled Fast Systems", Submitted to ND2022, August 2022.	No	Not published yet
	Sukhjinder Singh, Yaron Danon, Adam Ney, Katelyn Cook, Dominik Fritz, Benjamin Wang, Peter Brain, Adam Daskalakis, and Michael Rapp, "Neutron Capture and Transmission Measurements of Fe-54 at the RPI LINAC", Submitted to ND2022, August 2022	No	
	Yaron Danon, Dominik Fritz, Benjamin Wang, Katelyn Cook, Sukhjinder Singh, Adam Ney, Peter Brain, Ezekiel Blain, Michael Rapp, Adam Daskalakis, Devin Barry, Timothy Trumbull, Chris Chapman, and Goran Arbanas, "Experimental validation of thermal scattering evaluations" , Submitted to ND2022, August 2022.	No	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: ND1 **M&O Contractor Name:** Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference:** DP0909020 **Date of Report:** October 31, 2022

BUDGET

1. Carryover into FY 2022 = $ 97,266.06
2. Approved FY 2022 Budget = $0K
3. Total FY 2022 Budget w/Carryover = $97,266.06
4. Actual spending for 1st Quarter FY 2022=$95,316.16 ($95k commit from GELINA work costed)
5. Actual spending for 2nd Quarter FY 2022 = $0.00
6. Actual spending for 3rd Quarter FY 2022 = $0.00
7. Actual spending for 4th Quarter FY 2022 = +$38.81
8. Projected carryover into FY 2023 = $ 1988.71

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	
	(blue)		(green)		(yellow)		(red)

| QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	As necessary, provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)	(blue)	GELINA Delivered. Project Complete.
Q2			
Q3			

NCSP Quarterly Progress Report (FY-2022 Q4)

Q4			

ACCOMPLISHMENTS
• ND1 - Y-12 Fabrication of New Uranium Target for IRMM/GELINA for Cross-section Measurements – delivered; project complete.

| PUBLICATIONS |
|---|
| Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov. |

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

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TE3, 6 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda **Point of Contact Phone:** 505-667-2812	**Reference:** DP0909010 **Date of Report:** October 27, 2022
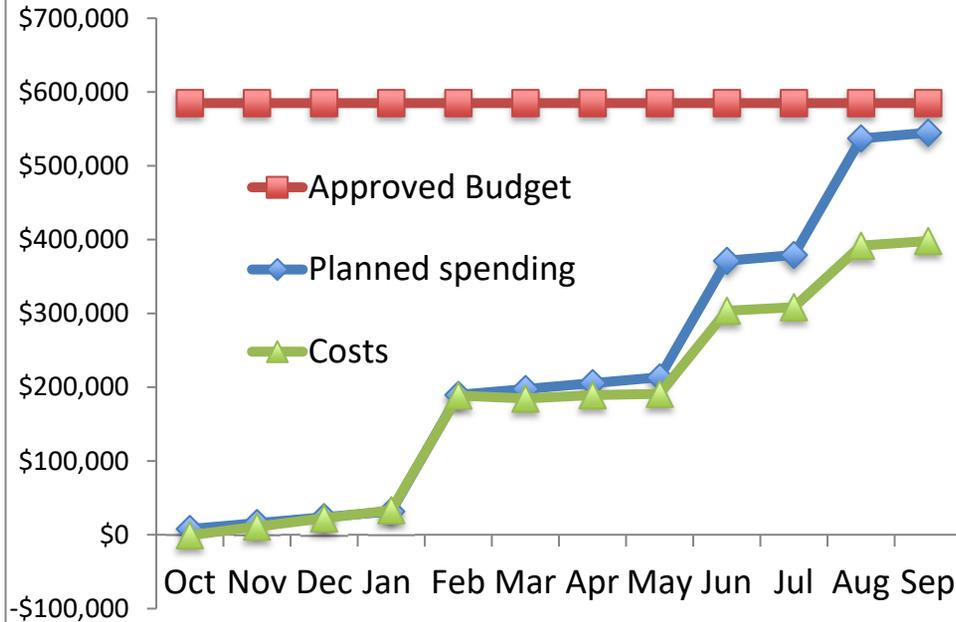
BUDGET

1. Carryover into FY 2022 = $45,000
2. Approved FY 2022 Budget = $540,000
3. Total FY 2022 Budget w/Carryover = $585,000
4. Actual spending for 1st Quarter FY 2022 = $22,365 +$18,314 committed = $40,679
5. Actual spending for 2nd Quarter FY 2022 = $162,316 + $2,913 committed = $165,229
6. Actual spending for 3rd Quarter FY 2022 = $119,011 (no commitments)
7. Actual spending for 4th Quarter FY 2022 = $94,608 (no commitments)
8. Projected carryover into FY 2023 = $145,000
   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	
	(blue)		(green)			(yellow)		(red)

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager (TE3)	(blue)	
Q1	Provide status reports on development of university pipeline for CS professionals (TE6)	(blue)	
Q2	Provide status reports on all training activities to the NCSP Manager (TE3)	(blue)	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q2	Provide status reports on development of university pipeline for CS professionals (TE6)	■	
Q3	Provide status reports on all training activities to the NCSP Manager (TE3)	■	
Q3	Provide status reports on development of university pipeline for CS professionals (TE6)	■	
Q4	Provide status reports on all training activities to the NCSP Manager (TE3)	■	
Q4	Provide status reports on development of university pipeline for CS professionals (TE6)	■	

ACCOMPLISHMENTS

- TE3 – Conduct Hands-On Criticality Safety Training Course at NCERC
  - August CSE Class
- TE6 – Development of University Pipeline for Criticality Safety Professionals
  - Working on contract with UNM.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TE1, 3, 8 **M&O Contractor Name**: LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909010 **Date of Report:** October 14, 2022

BUDGET
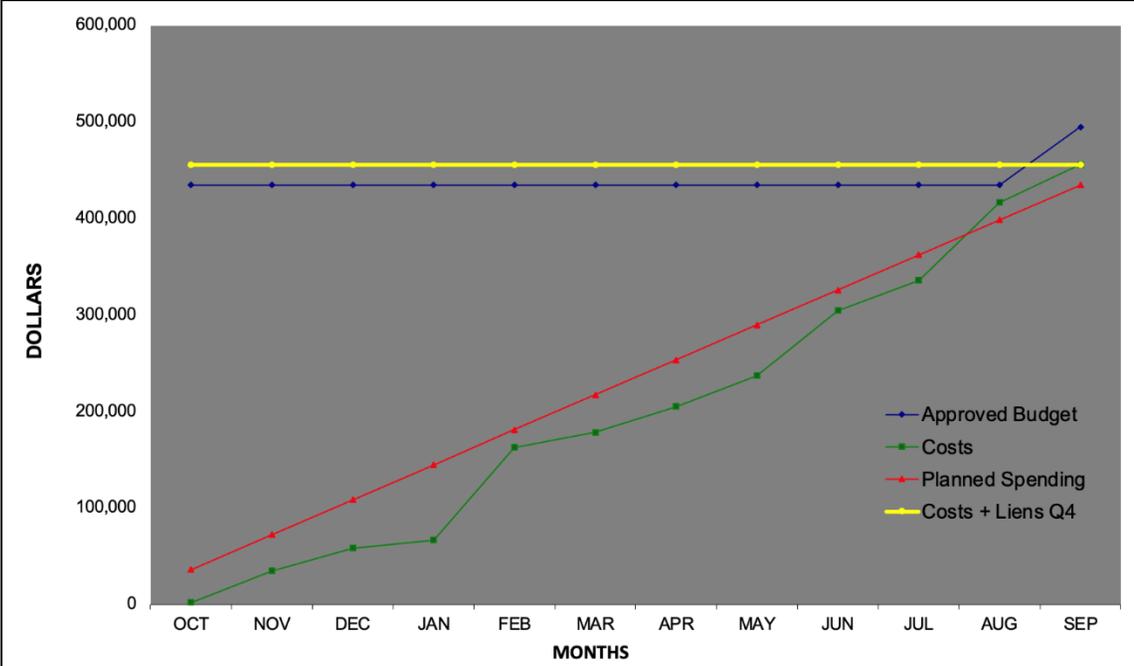
1. Carryover into FY 2022 = $44,699
2. Approved FY 2022 Budget = $390,000 +$60,000 transferred from IPD in Q4
3. Total FY 2022 Budget w/Carryover = $494,699
4. Actual spending for 1st Quarter FY 2022 = $58,417
5. Actual spending for 2nd Quarter FY 2022 = $120,181 ($10,599 liens)
6. Actual spending for 3rd Quarter FY 2022 = $126,252 ($0 liens)
7. Actual spending for 4th Quarter FY 2022 = $151,119 ($0 Liens)
8. Carryover into FY 2023 = $ 38,730
9. **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 report on hands-on training at the DAF (TE1)		
Q1	Provide status report classroom criticality safety training (TE3)		
Q1	Provide status report on development of university pipeline for CS professionals. (TE8)		

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

ACCOMPLISHMENTS

- TE1 – Conduct Hands-on Training at the DAF (TACS)
  - Participated in all telecons for preparations for the FY22 courses
  - Provided lectures and hands-on training with the TACS assembly for August NCS Practitioner's 2-week course
- TE3 – Classroom Criticality Safety Training
  - Participated in all telecons for preparations for the FY22 courses
  - Provided week of lecture instruction for August NCS Practitioner's 2-week course
- TE8 - Development of University Pipeline for Criticality Safety Professionals
  - Met with LANL and UC-B to start planning for the UC Berkeley Fall 2022 course. Updated lecture materials to reduce lengthy handouts on hand calculations, standards and the evaluation process replacing them with lectures focused on these topics. Additional lectures were developed to address shipping and receiving under CSI control as well as near misses and lessons learned. Three options for student projects were also prepared. LLNL has processed 10 students for attending the hands-on portion of the class with ISSA this November.
  - LLNL hired a graduate of the University Pipeline, Samuel Varghese, as a full-time employee starting in October. LLNL is preparing him to teach the upcoming ISSA experimental class.

## PUBLICATIONS

NCSP Quarterly Progress Report (FY-2022 Q4)

	Any publications created during the quarter should be submitted to Marsha Henley, 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	none		
Q2	Coleman, S. NCS Pipeline UC Berkeley Course Overview. Presented at the NCSP Technical Program Review. February 16, 2022.	Yes	
Q3	Coleman, S., "UC Berkeley University Pipeline," NCSP Newsletter Summer 2022, pp. 6-7, June 15, 2022. https://ncsp.llnl.gov/sites/ncsp/files/202206/ncsp_newsletter_summer_2022_rev1.pdf.	Yes	
Q4	none		

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TE1, 3, 11, 12, 14 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 28, 2022

BUDGET

FY22 Training and Education
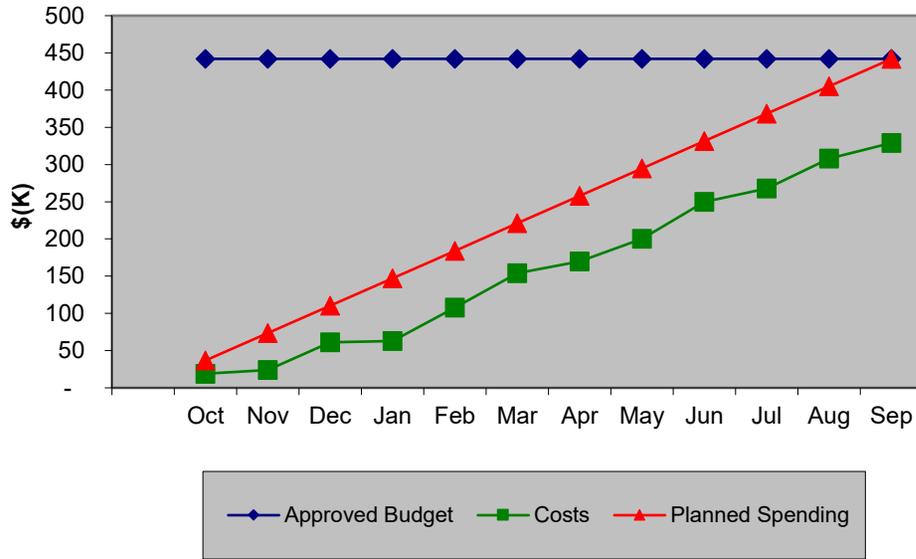
1. Carryover into FY 2022 = $193K
2. Approved FY 2022 Budget = $249K
3. Total FY 2022 Budget w/Carryover = $442K
4. Actual spending for 1st Quarter FY 2022 = $61K
5. Actual spending for 2nd Quarter FY 2022 = $93K
6. Actual spending for 3rd Quarter FY 2022 = $96K
7. Actual spending for 4th Quarter FY 2022 = $79K
8. Projected carryover into FY 2023 = $113K

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	
	(blue)		(green)		(yellow)		(red)

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report on implementation of the NCS training program (TE1)	(green)	
Q1	Provide a status report on hand-calculation primer expansion, LA-14244-M (TE3)	(yellow)	Continue working at current pace until project is complete. Subcontractor used for work is retired and is limited to how much time that can be spent on the project.

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)	🟨	Limited resources to direct to this task due to attrition. Anticipate completing this by the end of the FY.
Q1	Provide a status report on design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses. (TE12)	🟨	Y-12 delays for shipping costs in FY21Q4 and ORNL issues with finalizing the list of ORNL sites to house the assembly, this task is delayed. Anticipate completion of final report by FY22Q3.
Q1	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)	🟨	Awaiting sufficient funding from NNSA to set up a subcontract with all parties to begin work. Only CR1 funds have been available to date (01-20-2022).
Q2	Provide a status report on implementation of the NCS training program (TE1)	🟩	2-week hands-on course completed on schedule.
Q2	Provide a status report on hand-calculation primer expansion, LA-14244-M (TE3)	🟨	Hand calc primer progress is delayed from FY21 due to resource issues; however, the primer will be completed by Q4.
Q2	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)	🟨	LA-12808 progress is delayed from FY21 due to resource issues; however, the primer will be completed by Q4.
Q2	Provide a status report on design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses. (TE12)	🟨	Resource issues and delays from Y-12 in FY21 has delayed this task but it is due to be completed by Q4.
Q2	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)	🟨	The delay in obtaining FY22 funding and delays in the ORNL contracts organization have delayed the start of two subcontracts to initiate this work. Contracts in progress.
Q3	Provide a status report on implementation of the NCS training program (TE1)	🟩	Both NCERC and SNL CSO/Manager courses have been completed on schedule.
Q3	Provide a status report on hand-calculation primer expansion, LA-14244-M (TE3)	🟨	In final review – final draft of the report is complete, and the website complement in being implemented on the NCSP website.
Q3	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)	🟩	Draft is proceeding now that resources are now available.
Q3	Provide a status report on design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses. (TE12)	🟩	Report on track for the end of Q4.
Q3	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)	🟨	Late arrival of FY22 funds delayed contract development with GA Tech and Texas A&M Univ. Contracts nearly complete as of the end of Q3.
Q4	Provide a status report on implementation of the NCS training program (TE1)	🟩	

Q4	Provide a status report on hand-calculation primer expansion, LA-14244-M (TE3)	🟨	
Q4	Provide a status report on revision of LA-12808 Nuclear Criticality Safety Guide. (TE11)	🟨	
Q4	Provide a status report on design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses. (TE12)	🟩	
Q4	Provide a status report on nuclear criticality safety training and pipeline development (TE 14)	🟨	ORNL contracts took more than 4 months to complete due to the ORNL inefficiencies in the ORNL subcontracts organization and slow progress at GA Tech and TAMU. The receipt of NCSP funding delayed this task as well. Work was kicked off in September 2022.

ACCOMPLISHMENTS

- TE1 - Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program
  - Bowen and Henley coordinated the 2-week hands-on course that was successfully executed in August 2022. This involved 6-weeks of planning working with all the course logistical contacts and instructors. Nancy Watts (LANL NEN-2) replaced Becka Hudson (LLNL) for the DAF approval process – DAF access went well and Nancy will support the course from this point forward with help from MSTS. This was the largest NCSP 2-week course since 2011 with 26 total students. We conducted the lecture portion for the first time at the Desert Research Institute adjacent to the National Atomic testing museum. Marshall, Lousteau, and Bowen provided instructor support for the course. Bowen/Henley started working on logistics and registration tasks for the FY23 courses to include working with LLNL on course registration issues with CVENT and course rosters, working with NCS managers from across the DOE complex to fill the courses in FY23, and to ensure supplies and classrooms for FY23 were reserved.
- TE3 - Hand-calculation Primer Expansion, LA-14244-M
  - The new version of the Hand Calculation Primer was drafted in May 2022 and has been in the ORNL RES process for the review and unlimited release process (ORNL/TM-2022/2747, PUB ID: 186853) since then. There is an indication that this will be fully released by the end of the calendar year. The website complement to assist students with Primer example problems was completed in May and sent to LLNL for inclusion on the NCSP website (under NCSET module 9, where the ORNL/TM-2022/2747 will also reside). There were technical issues on the LLNL side that were being addressed to make the website complement easier to use within the LLNL website but were not yet complete as of this writing.
- TE11 - Revision of the LA-12808 Nuclear Criticality Safety Guide
  - This task is in progress and progress has been slow due to lack of applicable resources. This task should be completed by mid-2023 and published by the end of the fiscal year.
- TE12 - Design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses
  - A final design report has been completed by ORNL in August 2022 and it has been working its way through the ORNL RES system (ORNL/TM-2022/2748, PUB ID 186860. This report provides the final design details, fabrication requirements, ORNL site location and plan for fuel transport from Y-12 to ORNL. This report has been declared an OUO report. Alex Lang and Mathieu Dupont are the lead staff for this project

with assistance from Doug Bowen as needed. Bowen proposed to Angela Chambers that this project be considered for an NCSP budget over target request in FY24.

- TE14 - Nuclear Criticality Safety Training and Pipeline Development
  - In Q4, ORNL has set up subcontracts with GA Tech and TAMU to begin work on the new graduate certificate program for graduate and undergraduate students. In September, the project was kicked-off and each site has provided course materials and references that will be used as input for a skeleton outline for the certificate program content. Course materials will then be developed. Biweekly meetings are in progress and meetings are planned at the ANS meeting to discuss the project. Bowen and Metwally are the leads at ORNL; Steven Biegalski is our POC at GA Tech and Pavel Tsvetkov is our POC at Texas A&M University.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

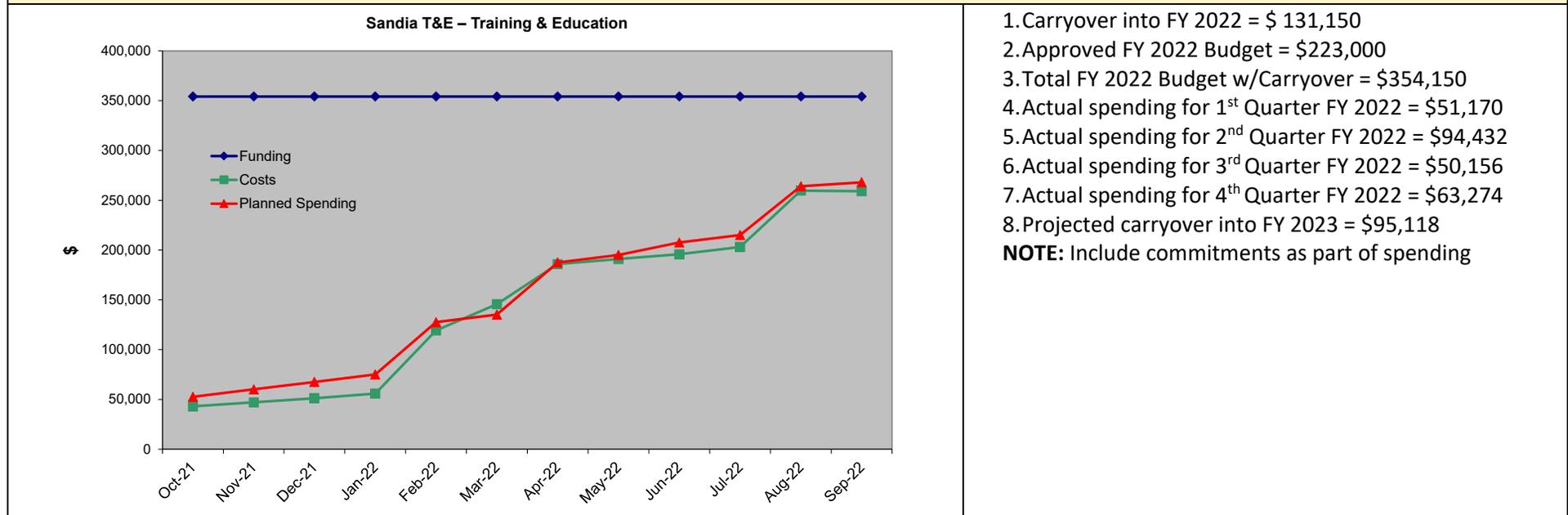| Quarter	Publication Reference Example: Author, "Title", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	None	No	
Q2	Douglas Bowen, "American Nuclear Society ANS-8 Standards Forum," ANS Winter Meeting (virtual), November 2021	Yes	
Q2	Douglas Bowen, "CURRENT STATUS OF THE DOE/NNSA NUCLEAR CRITICALITY SAFE-TY PROGRAM HANDS-ON CRITICALITY SAFETY TRAINING COURSES," submitted ANS Nuclear Criticality Safety Meeting, June 2022	Yes	
Q2	Douglas Bowen, Mathieu Dupont, Alex Lang, Andrew Holcomb, Shane Hart, "A SUBCRITICAL ASSEMBLY FOR TRAINING AND EDUCATION USE AT THE OAK RIDGE NATIONAL LABORATORY," submitted ANS Nuclear Criticality Safety Meeting, June 2022	Yes	
Q2	Douglas Bowen, "DOMESTIC AND INTERNATIONAL STANDARDS FOR NUCLEAR CRITICALITY SAFETY – OVERVIEW & STATUS," submitted ANS Nuclear Criticality Safety Meeting, June 2022	Yes	
Q2	Douglas Bowen, Robert Busch, "HAND CALCULATIONS FOR NUCLEAR CRITICALITY SAFETY – PRIMER REVISION," submitted ANS Nuclear Criticality Safety Meeting, June 2022	Yes	
Q3	Douglas Bowen, "ORNL NCSP Training and Education Support for FY2021," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q4	Douglas Bowen, Robert Busch, Tristan Lotivio, "HAND CALCULATIONS FOR NUCLEAR CRITICALITY SAFETY – PRIMER REVISION," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	

Q4	Douglas Bowen, "CURRENT STATUS OF THE DOE/NNSA NUCLEAR CRITICALITY SAFETY PROGRAM HANDS-ON CRITICALITY SAFETY TRAINING COURSES," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, Robert Busch, Tristan Lotivio, "HAND CALCULATIONS FOR NUCLEAR CRITICALITY SAFETY – PRIMER REVISION," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, "Domestic and International Standards for Nuclear Criticality Safety -- Overview and Status," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, "CURRENT STATUS OF THE DOE/NNSA NUCLEAR CRITICALITY SAFETY PROGRAM HANDS-ON CRITICALITY SAFETY," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

51NCSP Element and Subtask: TE1 **M&O Contractor Name**: Sandia National Laboratories (SNL) **Point of Contact Name:** Gary A. Harms **Point of Contact Phone:** (505)845-3244	**Reference:** DP0909010 **Date of Report:** September, 2022

BUDGET

Sandia T&E – Training & Education

Legend: Funding, Costs, Planned Spending

1. Carryover into FY 2022 = $ 131,150
2. Approved FY 2022 Budget = $223,000
3. Total FY 2022 Budget w/Carryover = $354,150
4. Actual spending for 1st Quarter FY 2022 = $51,170
5. Actual spending for 2nd Quarter FY 2022 = $94,432
6. Actual spending for 3rd Quarter FY 2022 = $50,156
7. Actual spending for 4th Quarter FY 2022 = $63,274
8. Projected carryover into FY 2023 = $95,118
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	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)		

Q2	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)	▮	
Q3	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)	▮	
Q4	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 portion of a make-up Hands-On criticality safety class for NCS professionals was delivered September 27 – October 1 that costed this FY.
    - The HFER module of the classroom portion Hands-On criticality safety class for NCS professionals was delivered January 31 – February 4.
    - The Sandia experimental portion of a Hands-On criticality safety class for NCS professionals was delivered February 7 – 11.
    - The modules for the Sandia Managers Hands-On criticality safety class were adjusted to include new material for CSOs.
    - Individual modules for the Managers class were submitted to Sandia's R&A system are approved for release to the public.
    - The Hands-On criticality safety class for Managers and CSOs was delivered April 4 – 8.
    - The HFER module of the classroom portion Hands-On criticality safety class for NCS professionals was delivered August 8 – 12.
    - The Sandia experimental portion of a Hands-On criticality safety class for NCS professionals was delivered August 15 – 19.
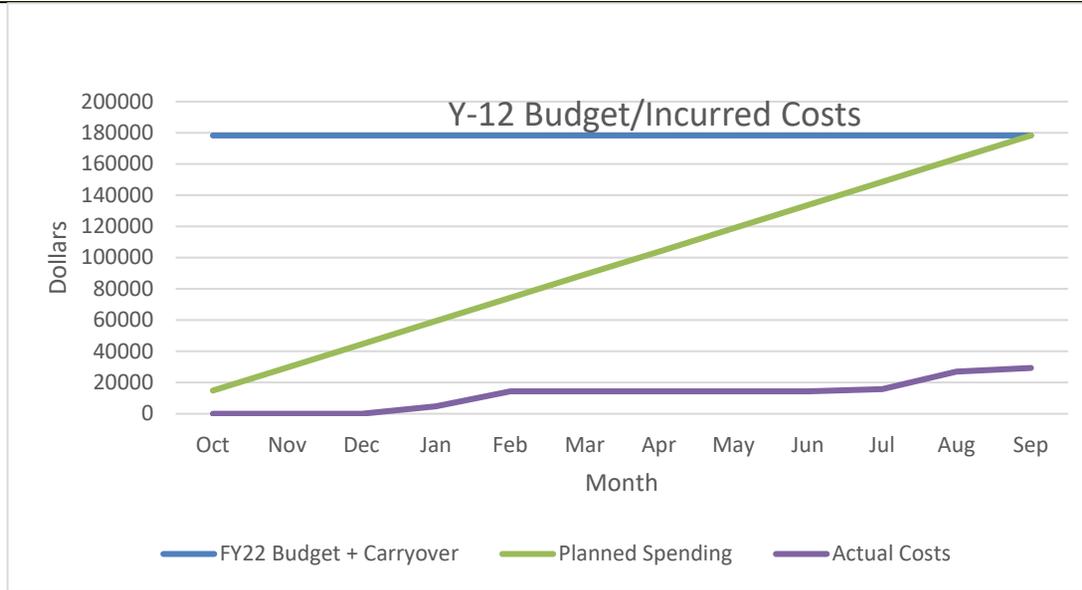
PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TE1 **M&O Contractor Name**: Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference:** DP0909020 **Date of Report:** October 31, 2022

BUDGET

Y-12 Budget/Incurred Costs

Legend: FY22 Budget + Carryover — Planned Spending — Actual Costs

1. Carryover into FY 2022 = $178,302.73
2. Approved FY 2022 Budget = $ 0.00
3. Total FY 2022 Budget w/Carryover = $178,302.73
4. Actual spending for 1st Quarter FY 2022 = $0.00
5. Actual spending for 2nd Quarter FY 2022 = $14,338.88
6. Actual spending for 3rd Quarter FY 2022= $0.00
7. Actual spending for 4th Quarter FY 2022 = $14,995.27
8. Projected carryover into FY 2023 = $148,968.58

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	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1)		No travel.
Q2	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q3	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1)	■	No Travel
Q4	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1)	■	

ACCOMPLISHMENTS

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

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

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS6 **M&O Contractor Name:** BNL **Point of Contact Name:** Gustavo Nobre **Point of Contact Phone:** 631-344-5205	**Reference:** DP0909010 **Date of Report:** 27 October, 2022

BUDGET

BNL FY22 TS6

Legend:
- Approved Budget
- Planned Spending
- Actual Cumulative Cost
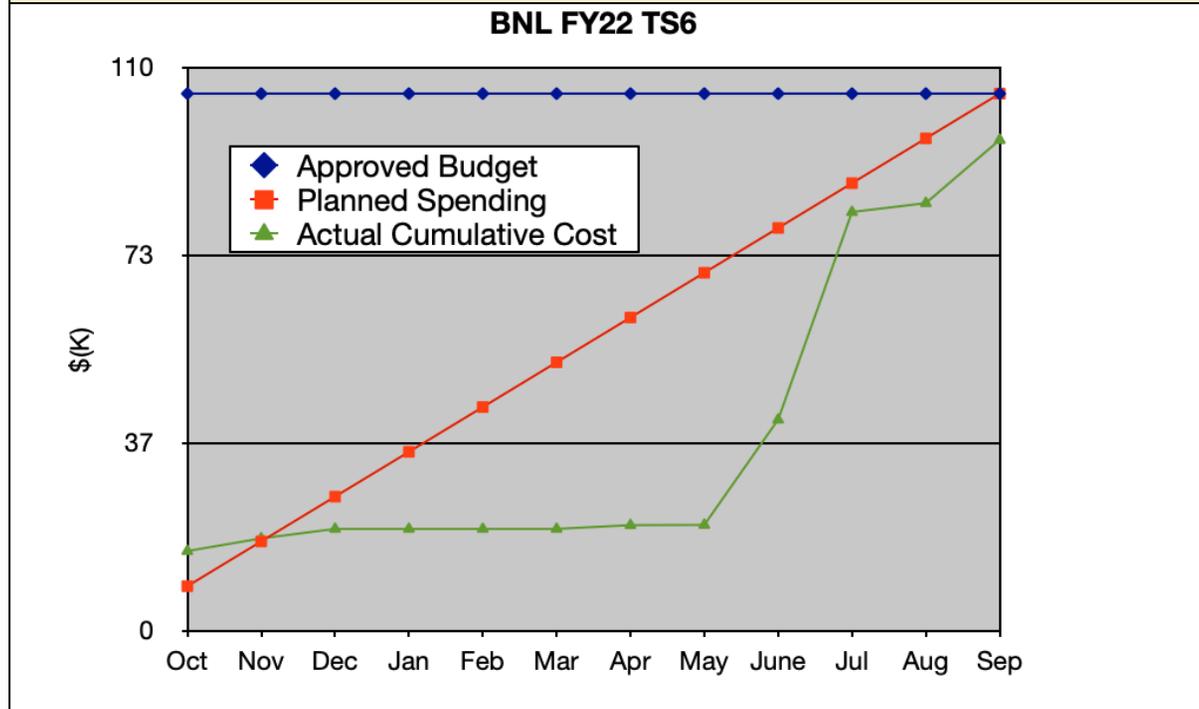
1. Carryover into FY 2022 = $ 5,915
2. Approved FY 2022 Budget = $99,000
3. Total FY 2022 Budget w/Carryover = $104,915
4. Actual spending for 1st Quarter FY 2022 = $19,925
5. Actual spending for 2nd Quarter FY 2022 = $0
6. Actual spending for 3rd Quarter FY 2022 = $21,335
7. Actual spending for 4th Quarter FY 2022 = $54,630
8. Projected carryover into FY 2023 = $14,940

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	
Complete	[blue]	On Schedule	[green]	Behind Schedule	[yellow]	Missed Milestone	[red]

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager annual report of succession planning efforts. (TS6)	[green]	K. Mbacke (NPT student) will continue to develop codes to extract resonance parameter averages from the *Atlas of Neutron Resonances* through Spring 2022.

			Work on the resonance quantum number reclassification project will resume in earnest in summer with SULI students. In the meantime, BNL will submit first group of resonance quantum number classification papers (we hope!) in Q2.
Q2	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Funds are being reserved to support student Sergey Scoville who is scheduled to collaborate on this project during the upcoming Summer internship
Q3	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Sergey Scoville ultimately chose a different internship, so funds are being used to partially fund Gustavo Nobre's time to mentor two undergrad students in the resonance reclassification project during the SULI Summer internship.
Q4	Provide NCSP Manager annual report of succession planning efforts. (TS6)		Mentored one student on project about resonance spin reclassification using Machine Learning and finalized and submitted manuscript to Physical Review C. This manuscript (arXiv: 2209.14403) will serve as the NCSP report

ACCOMPLISHMENTS

- Journal manuscript "A novel Machine-Learning method for spin classification of neutron resonances" (arXiv: 2209.14403v1) was finalized and submitted to Physical Review C and is currently being reviewed by referees. It is the first peer-reviewed publication on this project, detailing the whole method and applicability. Expectation is that this paper will be published in FY23Q1. Another paper is expected to be submitted within the first two quarters of FY23.
- Mentoring one intern in project related to resonance spin reclassification:
  - Extrapolating the method so the machine-learning classifier can be trained with real 238U data instead of synthetic data like previous projects.
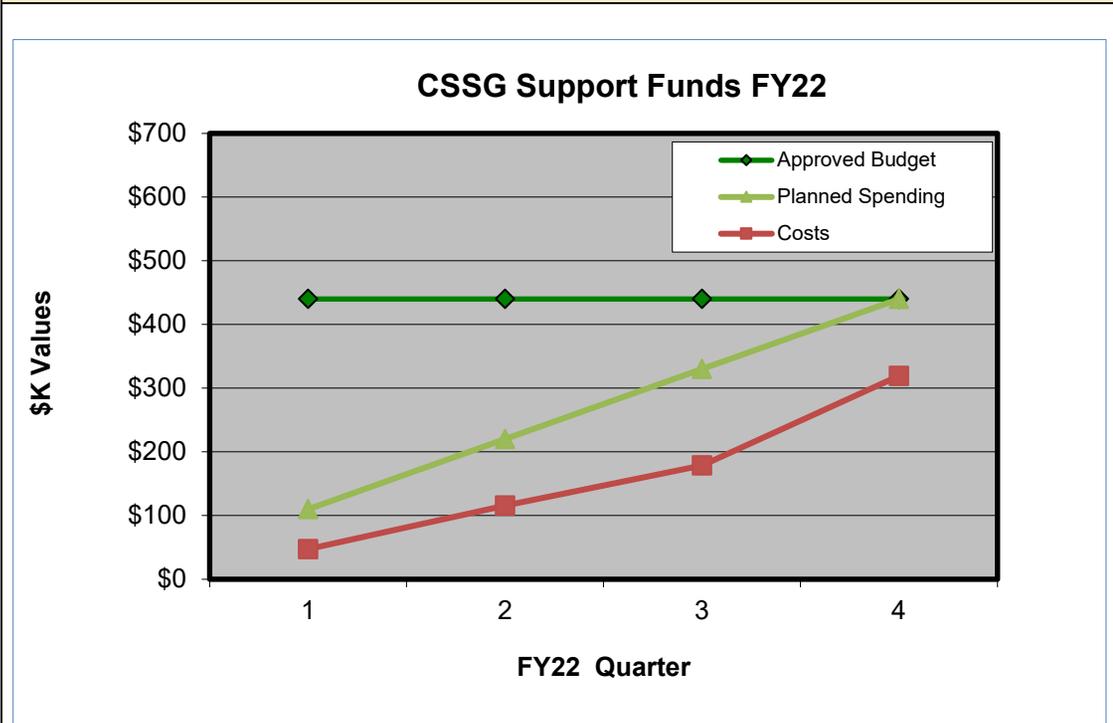
PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

`NCSP Element and Subtask:** TS1 **Task Title**: CSSG Support **Point of Contact Name:** David Hayes **Point of Contact Phone:** 505-667-4523	**Reference:** DP0909010 **Date of Report:** October 28, 2022

BUDGET

CSSG Support Funds FY22

Chart legend: Approved Budget, Planned Spending, Costs. Y-axis: $K Values ($0–$700). X-axis: FY22 Quarter (1–4).

1. Carryover into FY 2022 = $ 0
2. Approved FY 2022 Budget = $ 440,000
3. Actual spending for 1st Quarter FY 2022 = $47,376
4. Actual spending for 2nd Quarter FY 2022 = $68,250
5. Actual spending for 3rd Quarter FY 2022 = $62,913
6. Actual spending for 4th Quarter FY 2022 = $140,828
7. Projected carryover into FY 2023 = $120,633

NOTE: Include commitments as part of spending

MILESTONES

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

Complete	[blue]	On Schedule	[green]	Behind Schedule	[yellow]	Missed Milestone	[red]

QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager report of activities. (TS1)	[blue]	No issues.
Q2	Provide NCSP Manager report of activities. (TS1)	[blue]	No Issues.
Q3	Provide NCSP Manager report of activities. (TS1)	[blue]	No Issues.
Q4	Provide NCSP Manager report of activities. (TS1)	[blue]	No Issues.

NCSP Quarterly Progress Report (FY-2022 Q4)

ACCOMPLISHMENTS

- TS1 – Activities
  - CSSG Telecons
  - CSSG Tasking 2022-02 Response
 - CSSG Tasking 2022-03 In Progress

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS4 **M&O Contractor Name:** LANL **Point of Contact Name:** Joetta Goda **Point of Contact Phone:** 505-667-2812	**Reference:** DP0909010 **Date of Report:** October 7, 2022

BUDGET
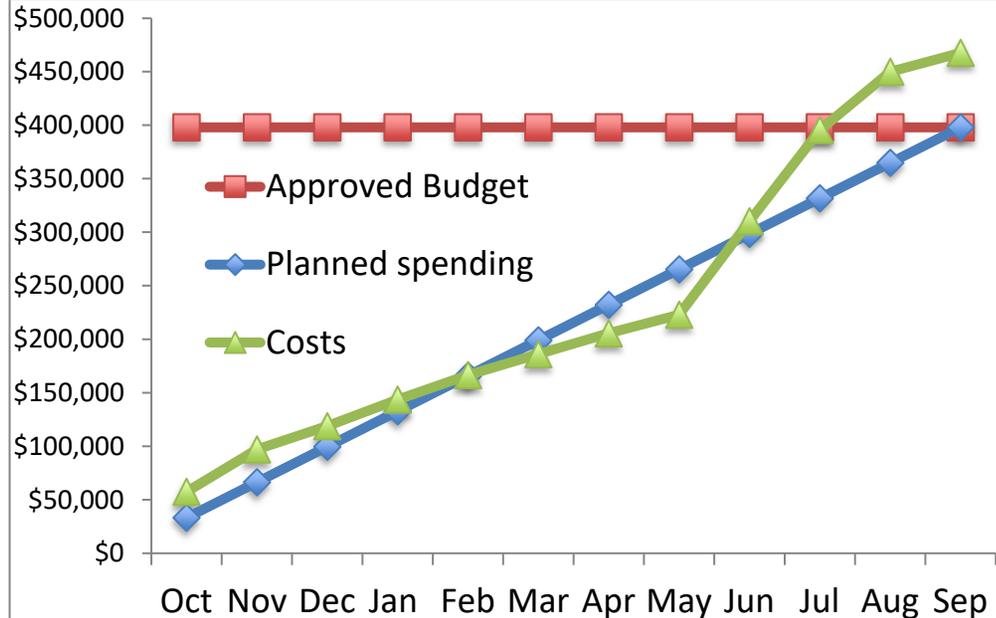
1. Carryover into FY 2022 = $ 250,000
2. Approved FY 2022 Budget = $148,000
3. Total Budget w/Carryover = $398,000
4. Actual spending for 1st Quarter FY 2022 = $118,813 (no commitments)
5. Actual spending for 2nd Quarter FY 2022 = $67,233 (no commitments)
6. Actual spending for 3rd Quarter FY 2022 = $124,179 (no commitments)
7. Actual spending for 4th Quarter FY 2022 = $157,421 (no commitments)
8. Projected carryover into FY 2023 = $0

   NOTE: Include commitments as part of spending

MILESTONES

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

Complete	▮ (blue)	On Schedule	▮ (green)	Behind Schedule	▮ (yellow)	Missed Milestone	▮ (red)

| QUARTER	TASK	STATUS	ISSUES/PATH FORWARD
Q1	Provide NCSP Manager report on succession planning efforts. (TS4)	▮ (blue)	
Q2	Provide NCSP Manager report on succession planning efforts. (TS4)	▮ (blue)	
Q3	Provide NCSP Manager report on succession planning efforts. (TS4)	▮ (blue)	

NCSP Quarterly Progress Report (FY-2022 Q4)

Q4	Provide NCSP Manager report on succession planning efforts. (TS4)		

ACCOMPLISHMENTS

- TS4 – AM, IE, ND Succession Planning
  - Some students continued working past the end of the summer.
  - Succession planning successes include several conversions who will support NCSP projects and train as FMHs and Crew Members.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS5 **M&O Contractor Name**: LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909010 **Date of Report:** October 28, 2022
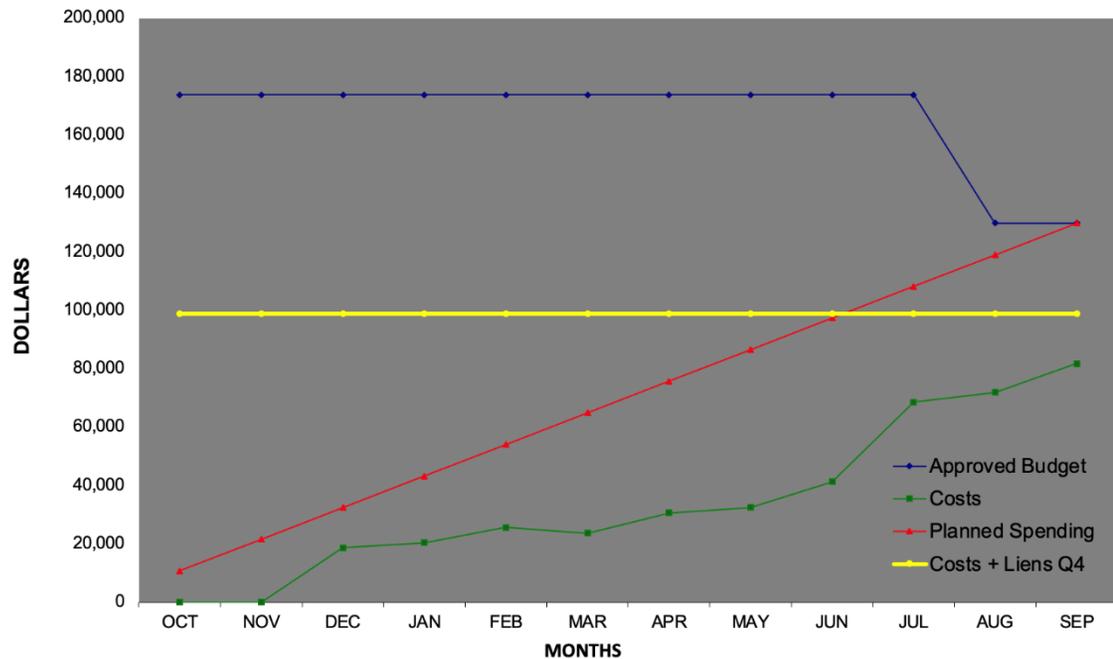
BUDGET

1. Carryover into FY 2022 = $24,797
2. Approved FY 2022 Budget = $149,000 - $44,000 (Transferred to ND Element) = $105,000
3. Total FY 2022 budget w/Carryover = $130,665
4. Actual spending for 1st Quarter FY 2022 = $18,751
5. Actual spending for 2nd Quarter FY 2022 =$4,966 ($20,354 liens)
6. Actual spending for 3rd Quarter FY 2022 = $17,564 ($17,409 liens)
7. Actual spending for 4th Quarter FY 2022 = $40,462 ($17,409 liens)
8. Carryover into FY 2023 = $31,799

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 NCSP manager report on succession planning efforts. (TS5)		Hired new PostDoc starting Jan 2022, mainly to support IE projects
Q2	Provide NCSP manager report on succession planning efforts. (TS5)		New PostDoc started January 2022, hired second PostDoc to start in June 2022, both will mainly support IE projects
Q3	Provide NCSP manager report on succession planning efforts. (TS5)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q4	Provide NCSP manager report on succession planning efforts. (TS5)		Second PostDoc start date delayed to October 2022 due to thesis project delays

ACCOMPLISHMENTS

- TS5 - AM, IE, ND Succession Planning
  - J. Norris and D. Siefman participated in IE telecons
  - D. Siefman and S. Mitchell (B. Hudson replacement) attended NCSP Budget Execution Meeting
  - New Postdoc (E. Aboud) started in January of 2022, mainly assisting on IE projects
  - Hired new Postdoc (A. Tamashiro) to start in October of 2022, mainly to assist on IE and interface with dosimetry
  - R. Araj returned from academic leave after her first year as a PhD student at UC Berkeley on July 1, will work on IE and IPD tasks

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS9 **M&O Contractor Name**: NNL **Point of Contact Name:** Mike Zerkle **Point of Contact Phone:** (412) 476-6188	**Reference:** DP0909010 **Date of Report:** November 28, 2022

BUDGET
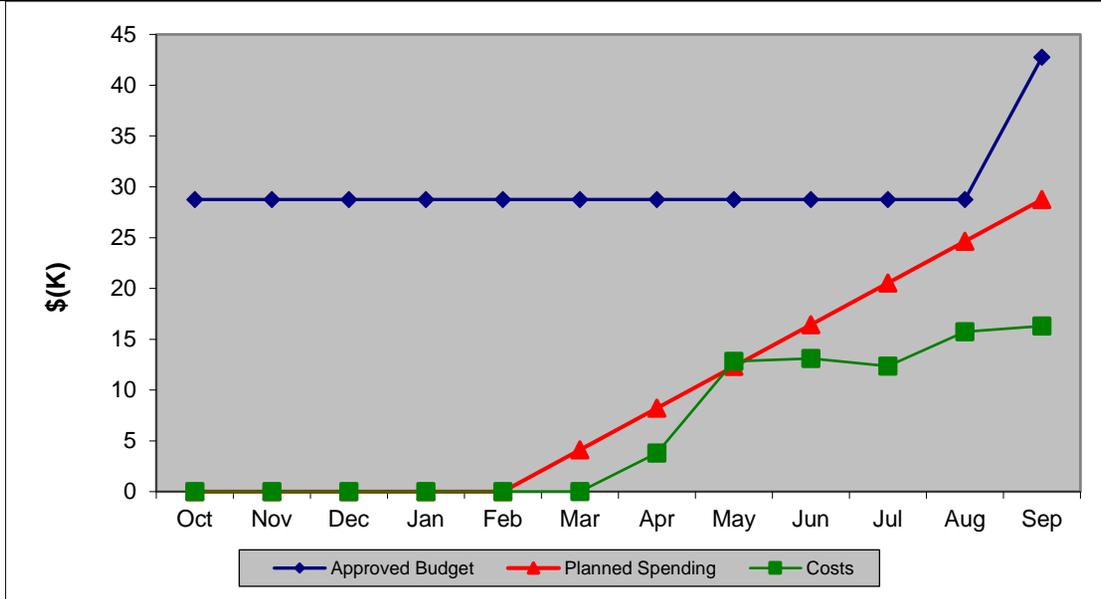
1. Carryover into FY 2022 = $29k
2. Approved FY 2022 Budget = $14k
3. Total FY 2022 Budget with Carryover = $43k
4. Actual spending for 1st Quarter FY 2022 = $0k
5. Actual spending for 2nd Quarter FY 2022 = $0K
6. Actual spending for 3rd Quarter FY 2022 = $13k
7. Actual spending for 4th Quarter FY 2022 = $3k
8. Projected carryover into FY 2023 = $26k

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 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-2022 Q4)

ACCOMPLISHMENTS

- TS9 – Support for NDAG Chair activities
  - Participated in NCSP FY2023 Budget Execution Meeting.
  - Participated in 2022 NDWG Meeting.
    - Provided NCSP Overview presentation
  - Participated in NCERC Futures Workshop
    - Provided Nuclear Data Needs presentation
  - Participated in Week 1 of the TEX HEU-Hf critical experiment (IER-532).
  - Supported several CEdTs.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	J. L. Wormald, J. C. Holmes, M. L. Zerkle, "Comparative Critical Mass Calculations for NNL and ENDF/B-VIII.0 Zirconium Hydride Thermal Neutron Scattering Laws," International Conference on Physics of Reactors 2022 (PHYSOR 2022), American Nuclear Society, Pittsburgh, PA, May 15-20, 2022. (paper)	Yes	
	J. L. Wormald, J. C. Holmes, M. L. Zerkle, "Thermal Neutron Scattering Law Evaluation for Zirconium Carbide and Critical Mass Calculations International Conference on Physics of Reactors 2022 (PHYSOR 2022), American Nuclear Society, Pittsburgh, PA, May 15-20, 2022. (paper).	Yes	
Q2	M. L. Zerkle, J. L. Wormald, and J. C. Holmes, "Thermal Neutron Scattering Law for Beryllium Hydride and Critical Mass Calculations," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), American Nuclear Society, Anaheim, CA, June 12-16, 2022. (paper)	Yes	
Q3	M. L. Zerkle, J. L. Wormald, J. C. Holmes, M. Rapp, A. Daskalakis, D. Barry, "Update on NNL TSL Validation Efforts," 2022 WPEC Meeting, SG48, Paris, France, May 11, 2022. (presentation)	Yes	
	J. L. Wormald, J. C. Holmes, M. L. Zerkle, "Comparative Critical Mass Calculations for NNL and ENDF/B-VIII.0 Zirconium Hydride Thermal Neutron Scattering Laws," International Conference on Physics of Reactors 2022 (PHYSOR 2022), American Nuclear Society, Pittsburgh, PA, May 15-20, 2022. (presentation)	Yes	

		Yes	
	J. L. Wormald, J. C. Holmes, M. L. Zerkle, "Thermal Neutron Scattering Law Evaluation for Zirconium Carbide and Critical Mass Calculations International Conference on Physics of Reactors 2022 (PHYSOR 2022), American Nuclear Society, Pittsburgh, PA, May 15-20, 2022. (presentation).	Yes	
	M. L. Zerkle, J. L. Wormald, and J. C. Holmes, "Thermal Neutron Scattering Law for Beryllium Hydride and Critical Mass Calculations," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), American Nuclear Society, Anaheim, CA, June 12-16, 2022. (presentation)	Yes	
Q4	M. L. Zerkle, "Nuclear Criticality Safety Program (NA-ESH)", Program Overview Presentation, 2022 Nuclear Data Working Group Meeting, Livermore, CA, August 2-4, 2022. (presentation)	Yes	
	M. L. Zerkle, "Perspectives on Nuclear Data on Nuclear Criticality Safety Needs," NCERC Futures Workshop, Los Alamos, NM, September 7-9, 2022. (presentation)	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS2, 7, 8, 13 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 28, 2022

BUDGET

FY22 NCSP Technical Support

Legend: Approved Budget, Costs, Planned Spending
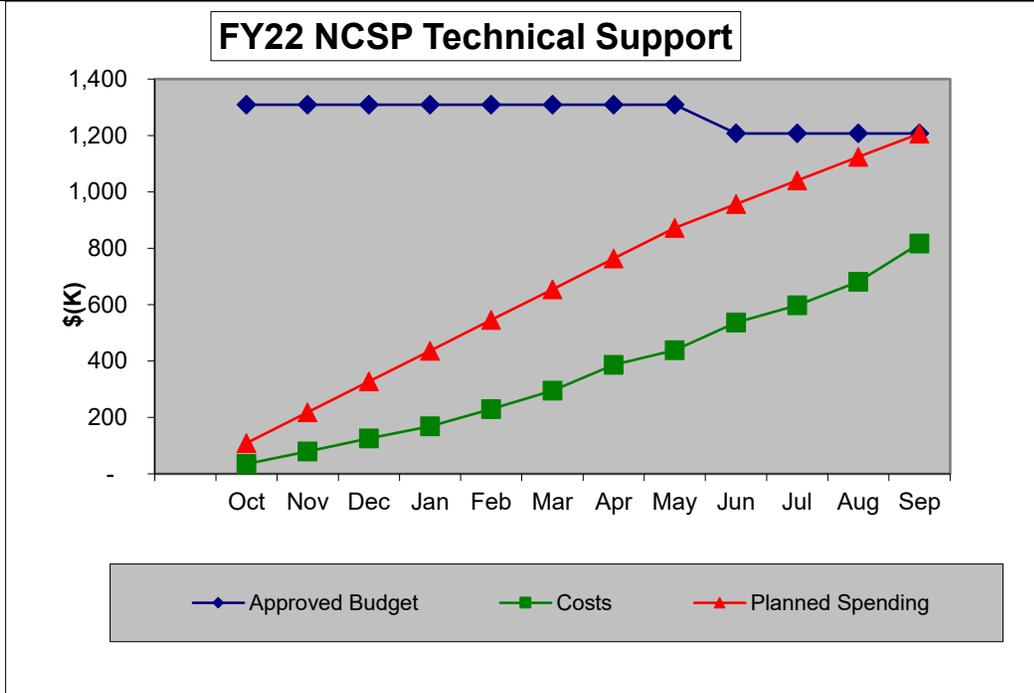
1. Carryover into FY 2022 = $78K
2. Approved FY 2022 Budget = $1,129K
3. Total FY 2022 Budget w/Carryover = $1,207K
4. Actual spending for 1st Quarter FY 2022 = $126K
5. Actual spending for 2nd Quarter FY 2022 = $169K
6. Actual spending for 3rd Quarter FY 2022 = $242K
7. Actual spending for 4th Quarter FY 2022 = $280K
8. Projected carryover into FY 2023 (minus CSSG carryover $55.5K) = $391K

NOTE: Included 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	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)		

NCSP Quarterly Progress Report (FY-2022 Q4)

Q1	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)	🟦	
Q1	Provide NCSP Manager annual report of succession planning efforts (TS7)	🟦	
Q1	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)	🟦	
Q1	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)	🟨	Lack of engagement of Federal Project Manager of the NDA program. No work performed in Q1. Mission and vision completed in FY21Q2: https://nda.llnl.gov/docs/ORNL_TM-2021_2009_NDA_Mission_and_Vision-FINAL.pdf
Q2	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)	🟩	
Q2	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)	🟩	
Q2	Provide NCSP Manager annual report of succession planning efforts (TS7)	🟩	
Q2	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)	🟩	
Q2	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)	🟨	Lack of engagement of Federal Project Manager of the NDA program. No work performed in Q1. Mission and vision completed in FY21Q2: https://nda.llnl.gov/docs/ORNL_TM-2021_2009_NDA_Mission_and_Vision-FINAL.pdf
Q3	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)	🟩	
Q3	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-	🟩	

	year plan and Integral Experiment Request Milestones. (TS2)		
Q3	Provide NCSP Manager status 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)	🟩	The lack of NDA program support from a program manager has delayed work for this task. A plan has been discussed with Angela Chambers to support NDA work for NCS purposes. Spending is now on track.
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)	🟩	
ACCOMPLISHMENTS			

NCSP Quarterly Progress Report (FY-2022 Q4)

- TS2 - Support for Lead Lab to Execute the NCSP
  - Planned and executed the FY22 NCSP Budget Execution Meeting in Las Vegas, NV in July 2022
  - Completed the main 5-year plan on time by August 8, 2022
  - Working with LLNL, updated and maintained the content of the NCSP website
  - Monitor Five-Year Plan progress and completed Q3 quarterly reporting process working with site task managers
  - Coordinate student registrants, facility logistics, and instructor personnel for the NCSP training and education program (Aug. 2022 2-week hands-on course)
  - Discuss/prioritize NCSP Nuclear Data work identified in the NCSP 5-year plan working with the NCSP manager and NDAG chair/members
  - Support telecons for task planning and execution, monthly integral experiment meetings, standing weekly meetings with the NCSP manager, and coordinate/execute meetings needed to execute the NCSP program.
  - Attend virtually and in-person, meetings to support the NCSP as needed
- TS7 - AM, ND Succession Planning
  - Succession planning funds were used in Q4 to mentor/training new staff in the NCS and ND groups at ORNL. These staff are new to the NCSP and funding was used specifically to support training in the area of Analytical methods and nuclear data evaluation work (Brown, Chapman, Remic)
- TS8 - NCSP Program Management Tools Development
  - Bowen/Miller worked with ORNL and Federal project managers supporting the NNSA G2 system to update and maintain the IER G2 database to support execution work for the integral experiments in progress at Sandia and NCERC. Bowen/Miller in Q4 worked with NNSA to prioritize work related to bug fixes and modest enhancements to the G2 IER system based on input from those using the IER database system. Some of this work is redo work, meaning that bugs are introduced into the IER database via G2 system modifications to other, non-NCSP modules.
- TS13 - NDA Technical Support Group and NDA Technical Infrastructure Project
  - D. Bowen worked with Cary Crawford, Nuclear Nonproliferation Division Director, and Angie Lousteau, Nondestructive Measurement S&T Group Leader, to plan, organize and execute a Uranium Holdup Measurements Course at ORNL, September 12-15, 2022. The report from A. Lousteau:

    ORNL provided a hands-on Generalized Geometry Holdup Measurement Fundamentals Course on Sept 19-22, 2022. The class was attended by 7 NCS staff, one NNSA oversight federal employee, and one NNSA NDA staff member representing LLNL, NNSS, BWXT, Centrus Energy, NPO, and ORNL. The course was designed to describe the parameters with associated uncertainties needed to determine the mass of holdup deposits based on the GGH methodology. Other empirical methods were also demonstrated. During the course, participants were given opportunities to characterize process equipment, make necessary assumptions, and determine mass deposits. Discussions on the importance of assumptions and their impact on measurement results were also had. Evaluations for the course were positive with many declarations that the hands-on exercises helped drive home the point that holdup measurements are complex and that there is now a better understanding of why uncertainties are high for many holdup measurements. There were also a few requests for a more in-depth uncertainty analysis. Additional SNAPSHOT funding was used to finalize the total grams report for SNAPSHOT and support software testing to support NCS NDA measurements throughout the DOE complex.

Uranium Holdup Measurements Course
September 12-15, 2022

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	None	Yes	
Q2	Douglas Bowen, "American Nuclear Society Standards Committee Subcommittee 8 Meeting," ANS Winter Meeting (virutal), November 2021	Yes	
Q2	Douglas Bowen, "Brief Overview of the NCSP," ANS Winter Meeting (Virtual), November 2021	Yes	
Q3	Douglas Bowen, "The DOE/NNSA Nuclear Criticality Safety Program and the Purpose of the Technical Program Review," Virtual, NCSP Technical Program Review, February 2022.	Yes	
Q3	Douglas Bowen, "ORNL NCSP FY 2021 Budget Summary and Highlights," Virtual, NCSP Technical Program Review, February 2022.	Yes	

Q4	Douglas Bowen, "Nuclear Criticality Safety Program @ ORNL," Nuclear Criticality Safety Program Technical Program Review, Virtual, February 2022.	Yes	
Q4	Douglas Bowen, "Overview of the NCSP Nuclear Data Program," Workshop for Applied Nuclear Data Activities (WANDA), Virtual, February 2022 .	Yes	
Q4	Douglas Bowen, "DOMESTIC AND INTERNATIONAL STANDARDS FOR NUCLEAR CRITICALITY SAFETY – OVERVIEW & STATUS," Nuclear Criticality Safety Division Topical Meeting (NCSD 2022), June 2022.	Yes	
Q4	Douglas Bowen, "Overview of the DOE/NNSA Nuclear Criticality Safety Program," Working Party on Nuclear Criticality Safety, Virtual, Paris, France, June 2022.	Yes	

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: TS3, 12 **M&O Contractor Name**: Sandia National Laboratories (SNL) **Point of Contact Name:** Gary A. Harms **Point of Contact Phone:** (505)845-3244	**Reference:** DP0909010 **Date of Report:** September, 2022

BUDGET

Sandia Technical Support
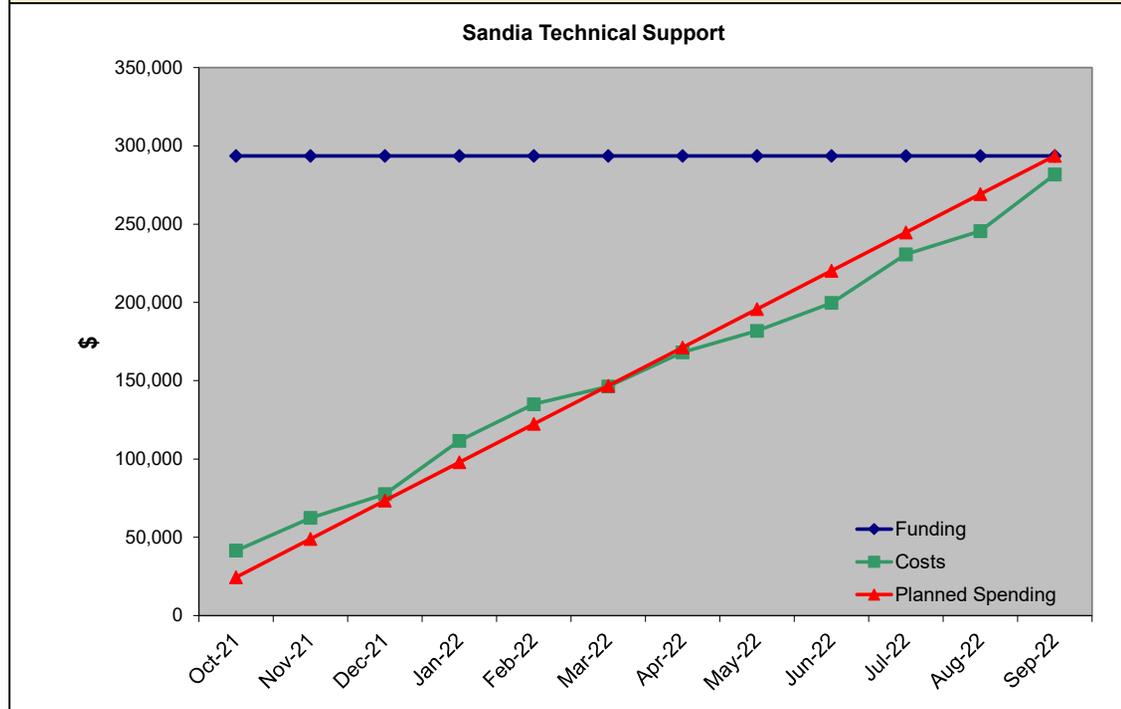
1. Carryover into FY 2022 = $ 45,602
2. Approved FY 2022 Budget = $ 248,000
3. Total FY 2022 Budget w/Carryover = $293,602
4. Actual spending for 1st Quarter FY 2022 = $77,535
5. Actual spending for 2nd Quarter FY 2022 = $68,746
6. Actual spending for 3rd Quarter FY 2022 = $53,380
7. Actual spending for 4th Quarter FY 2022 = $82,056
8. Projected carryover into FY 2023 = $11,885

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 NCSP Manager with report of succession planning efforts. (TS3)		
Q1	Provide the NCSP manager with a summary of NCSP CEdT support (TS12)		

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
  - Matrixed employee performing as an experimenter.
  - Year-round Ph.D. student intern supporting the critical experiment team.
  - Both are actively participating in the NCS community by attending conferences and publishing papers.
- TS12 - NCSP C$_E$dT Manager Support

Performed duties as the C$_E$dT (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:
  - Processed BCR submissions (~15).
  - Tracking progress/updates on Hf experiment.
  - Reviewed ~15 end of FY reports and processed through approval in IER database (team members and NCSP manager) or moved to ensure BCR submission.
  - Additional Non-NCSP IERs added.
  - Updated several team memberships per site leads direction
- Assisted IER team members with requested items, and participated in several different IER team meetings:
- Interacted with NCSP Management Team, provided technical advice, and assisted on a broad scope of items (e.g., 5 year plans, BEM meeting, NCERC futures meeting, IE priorities, MIHL lists items, end of year reporting).
- Facilitated IE meetings with all sites: issuing meeting agenda and minutes.
  - Reported projected final milestone completions and IERs moved out to future FYs.
- Worked in the IER database, assisted others with issues using database, work with G2 developers on database improvement items and issue resolution (sign off signature not recording in system)

- Worked on TPR planning items.
- Started arrangement for in-person meeting and tour at SNL.
- Progress on NCSP IE Manual Revision.

PUBLICATIONS

Any publications created during the quarter should be submitted to Marsha Henley, 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	E. C. Lutz and D. E. Ames, "Space Nuclear Thermal Propulsion Critical Assembly Boron Worth Experiments," SAND2021-8245 C, presented at the 2021 ANS Winter Meeting, Nov. 30 – Dec. 3, 2021.	Yes	
Q2			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2022 Q4)

NCSP Element and Subtask: Technical Support & CSSG (TS) **M&O Contractor Name**: Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference:** DP0909020 **Date of Report:** October 31, 2022

BUDGET

Y-12 Budget/Incurred Costs

Legend: FY22 Budget + Carryover — Planned Spending — Actual Costs

1. Carryover into FY 2022 = $ 11,519.47
2. Approved FY 2022 Budget = $0
3. Total FY 2022 Budget w/Carryover = $11,519.47
4. Actual spending for 1st Quarter FY 2022 = $ 0.00
5. Actual spending for 2nd Quarter FY 2022 = $0.00
6. Actual spending for 3rd Quarter FY 2022 = $4,967.26
7. Actual spending for 4th Quarter FY 2022 = $4,595.59
8. Projected carryover into FY 2023 = $-2,711.49

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 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)		Slightly over budget for the year – NCERC Futures trip put me over.

NCSP Quarterly Progress Report (FY-2022 Q4)

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

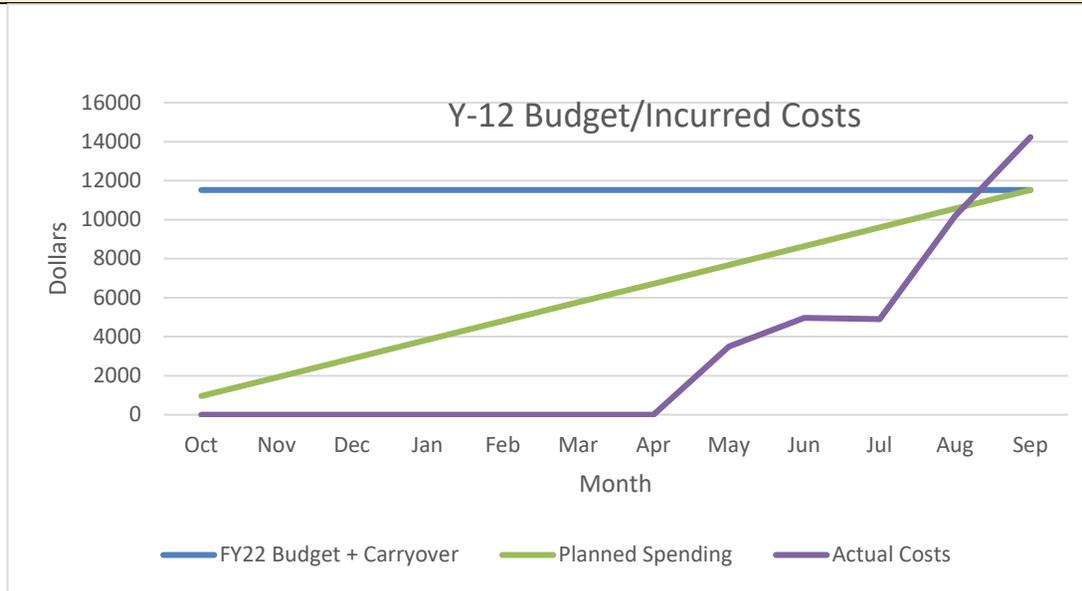| PUBLICATIONS |
|---|
| Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov. |

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

Summary of MCNP Classes in FY 2022 – Q4

M.E. Rising[1], J.L. Alwin[2]
[1] Monte Carlo Codes (XCP-3), [2] Radiation Transport Applications (XCP-7), LANL

FY2022 – Q4 classes are highlighted in red.

Total Students

- **FY2022 – Q1**   **118 students**   (Intro, Intermediate, VR, UM)
- **FY2022 – Q2:**   **63 students**   (Intermediate, Advanced, Safeguards)
- **FY2022 – Q3:**   **139 students**   (Intro, Intermediate, Criticality, Safeguards)
- **FY2022 – Q4:**   **41 students**   (Intro, ~~NJOY~~, Criticality)
- **FY2022 – TOTAL:**   **461 students**

Due to COVID-19 and travel restrictions, in-person classes and site visits were canceled. All classes are currently being conducted online. Importantly, offering online classes has significantly increased class enrollment.

Classes sponsored by DOE-NNSA-NCSP

- **Criticality Calculations with MCNP6   (LANL-AM1)**
    - **June 20-23, 2022**   **online**   **14 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.

- **"Criticality Calculations using MCNP6.3" Tutorial presented at ANS NCSD Topical Meeting   (LANL-AM1)**
    - **June 12, 2022**   **in-person**   **40 students**

    Tutorial focused on advances in MCNP6.3 for criticality calculations including fission matrix, accelerated convergence, automation and testing, nuclear data advances, verification and validation framework, and plotting/visualization.

- **Criticality Calculations with MCNP6   (LANL-AM1)**
    - **August 8-12, 2022**   **in-person @ Sandia**   **11 Students**

    MCNP criticality class for NCS & reactor physics practitioners, with focus on best practices. Includes 1 day on NCS validation using MCNP6-Whisper.

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation (LANL-TE4)**
    - **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)
    - **Nov 15 – 19, 2021**   online   36 students
    - **Jun 6 – 10, 2022**   online   33 students
    - **Aug 22 – 26, 2022**   **online**   **30 students**
- **Intermediate MCNP6**
    - **Oct 4 – 8, 2021**   online   39 students
    - **Jan 31 – Feb 4, 2022**   online, OECD-NEA   28 students
    - **Apr 11–15, 2022**   online   25 students
- **Advanced MCNP6 Features & Utilities**
    - **Feb 7 – 11, 2022**   online, OECD-NEA   27 students
- **Unstructured Mesh with Attila4MC**
    - **Oct 18 – 22, 2021**   online   20 students
- **Variance Reduction**
    - **Nov 29 – Dec 1, 2021**   online   23 students
- **Nuclear Safeguards**
    - **Mar 21 – Mar 25, 2022**   in-person, pilot   8 students
    - **May 23 – May 27, 2022**   online   27 students
- **NJOY**
    - **Aug 29 – 31, 2022**   **canceled**   **0 students**

2022 Q4 – SCALE Training Courses Report for the Nuclear Criticality Safety Program

Class Name	IFE SCALE Training Part I: SCALE Overview
Class Dates	August 23–24,2022
Location	Virtual – Oak Ridge National Laboratory, Oak Ridge, TN
Number of Attendees	12
Short Description	This training provided an overview of the SCALE code system, its major analysis capabilities, and associated data resources. Shared tools and components were discussed, including the following: • SCALE installation and verification of installation • Available SCALE sequences and analyses • SCALE input structure and syntax • The Fulcrum graphical user interface (GUI) to SCALE • Visualization of SCALE models and data • SCALE sources of nuclear data This training included hands-on exercises introducing the Fulcrum GUI and its capabilities. No prior experience with SCALE was required for this training. Attendees followed along using SCALE 6.2

Class Name	IFE SCALE Training Part II: Criticality Safety and Sensitivity/Uncertainty-Based Validation
Class Dates	September 13–16, 20–21, 26-29, 2022
Location	Virtual –Oak Ridge National Laboratory, Oak Ridge, TN
Number of Attendees	9
Short Description	This training included parts IIA and IIB, as detailed below and provided instruction on performing criticality safety analyses using generic models representative of the systems encountered at the IFE facilities. Part IIA included the following topics: • SCALE material input • Basic geometry description • Convenient, efficient methods for modeling repeated and nested geometry configurations such as lattices • Monte Carlo (MC) theory and application to iterated-source k_{eff} eigenvalue calculations • Continuous-energy (CE) and multigroup (MG) criticality calculations, including resonance self-shielding capabilities • Inspection of the text and the easy-to-navigate HTML output • Model and calculation review and checking • Uncertainty quantification and parametric studies Part IIB focused on sensitivity and uncertainty (S/U) analysis, followed by application of these methods to criticality safety validation. S/U analysis methods provide advanced techniques for code and data validation, including identification of appropriate experiments, detailed quantification of bias and bias uncertainty, and identification of gaps in available experiments. Part IIB included the following topics: • Generation of k_{eff} sensitivity data with both MG and CE physics • SCALE's comprehensive cross section covariance data library • Application of the covariance data combined with the sensitivity coefficients to estimate the data-induced k_{eff} uncertainty • Similarity assessment determining the correlation between benchmark and application systems • Assessment of bias and bias uncertainty using trending and non-trending statistical techniques No prior experience with SCALE was required for this training. Attendees followed along using SCALE 6.2

STATUS REPORT
on the
International Collaboration with the Atomic Weapons Establishment (AWE)

Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2022 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
Analytical Methods						
AWE-AM1	Slide rule update	ORNL-AM6 LLNL-AM3 IRSN-AM5	Perform calculations; attend meetings; review analysis and reports	R. JONES	M. DULUC	ORNL
AWE effort currently on hold due to lack of resource.						
INTEGRAL EXPERIMENTS						
AWE-IE1	Inaugural international inter-comparison of nuclear accident dosimetry using Flattop	LLNL-IE1 IRSN-IE15	Co-author final report (CED-4b)	P. ANGUS	D. STONE	LLNL
Report completed and issued by C. Wilson before his departure in 2019.						
AWE-IE2	Development of Passive Neutron Spectrometer (PNS)		Fully commission TLD version of the PNS; Perform validation irradiations at NPL; develop unfolding tools for directionality	P. ANGUS	D. STONE	LLNL
3x PNS developed and built. Irradiations at NPL, planned for March 2020 (with potential involvement from US community), impacted by COVID-19 pandemic.						
AWE-IE3 **IER 406**	Cf-252 CAAS benchmark	LLNL-IE1 IRSN-IE28	Perform/support PNS(TLD) measurements with a shadow cone	P. ANGUS	D. HEINRICHS	LLNL
Dependent on completion of IE2.						
AWE-IE4 **IER 175**	Godiva-IV CAAS benchmark	ORNL-IE4 IRSN-IE27	Review of experiment design. Provide measurement capability as required	T. BIRKETT	J. SCORBY	ORNL
AWE involvement complete. Any further work dependent on future ORNL programme.						
AWE-IE5	Correction factor for dosimetry linked to orientation of the victim	LLNL-IE1 IRSN-IE29	Participate in experiment design; use PNS data to determine directional components of neutron fields (Godiva, Flattop, LLNL RCL)	P. ANGUS	D. HEINRICHS	LLNL
Dependent on completion of IE2 (unfolding tools for directionality). Linked with IE11 (International inter-comparison)						
AWE-IE6	ICSBEP shielding benchmark for shipping containers	LLNL-IE13 IRSN-IE36	Participate in experiment design; PNS(TLD) could be deployed as primary measurement device AWE to do some preliminary design	P. ANGUS	S. KIM	LLNL

Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2022 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
Not started due to long lead time (2023) and dependence on PNS availability (see IE2). Scope definition required.						
AWE-IE7 **IER 153**	Measure fission neutron spectrum shape using threshold activation detectors	LANL-IE3	Provide input into foil selection; use AWE unfolding codes to provide independent analysis. TBC AWE to provide foil suggestions per MYERS	P. ANGUS	T. CUTLER B. MYERS	LANL
Awaiting LANL to advise on the extent of AWE involvement.						
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	D. HEINRICHS	LLNL
An internal AWE report has been issued summarizing the outcome of the fast neutron liquid scintillation trials conducted at the DAF in 2019. This will inform future measurement aspirations but the schedule for measurement campaigns is currently on hold.						
AWE-IE9	(Neutron multiplicity experiments) AWE/LLNL NCT 5 year measurement campaign	LLNL-PROPOSAL 18	Participate in experiment design, measurements and reporting	N. KELSALL	D. HEINRICHS	LLNL
AWE has issued an internal report summarizing the results from analysis of bulk material measurements. Modified version of this report has been shared with the NCSP. DAF measurement campaign will be undertaken on bulk metal systems during October/November 2022.						
AWE-IE10	Enhanced methods of criticality accident dosimetry.	LLNL-IE1 IRSN-30 IRSN-33 Naval Dosimetry Center	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	International inter-comparison of nuclear accident dosimetry AWE to assist in preliminary design FY19 and FY20	LLNL-IE18 SNL-IE4	Produce experiment design; participate in exercise; produce final report. Repeat 2 - 3 years	P. ANGUS	D. STONE	LLNL
Next international inter-comparison is anticipated in 2022.						
AWE-IE12	CIDAAS testing	Proposal 20	Deploy AWE CIDAAS for test irradiation. Repeat 2 - 3 years	T. BIRKETT	J. SCORBY	LLNL
AWE successfully tested CIDAAS in May 2018 and provided support to CED-4. Technical report detailing the results has been issued. New design of visual alarm procured, which will be evaluated during the next available Testing Visit, planned for October 2022 onwards.						
AWE-IE13	Characterization of AFRRI TRIGA reactor radiation field	LLNL-IE18 SNL-IE4	Provide support to experiment design	P. ANGUS	A. ROMANYUKHA	LLNL

Reference			AWE Contributions and POCs			
AWE Reference	Task Description	NCSP Reference	FY2022 AWE Contribution	AWE Technical POC	Collaborator POC	DOE Lab
	AWE will provide onsite measurement					
AWE was fully prepared for July 2019 trial, prior to the regulatory shut-down of TRIGA. If trial is re-scheduled for 2022 AWE will be able to support it, provided sufficient notice is given.						
INFORMATION PRESERVATION AND DISSEMINATION						
AWE-IPD1	Conduct benchmark evaluations of legacy IEU integral experiments Requires no NCSP funding	LLNL-IPD1	Assess feasibility of sponsoring PhD; determine availability of data	R. JONES	D. HEINRICHS	LLNL
Considered unlikely to make any material progress.						
TRAINING AND EDUCATION						
AWE-TE1	Hands-on criticality safety training	ORNL-TE1 LANL-TE1 LLNL-TE1 LLNL-TE3 SNL-TE1 IRSN-TE1	AWE personnel to attend training course	R. JONES	D. BOWEN B. MYERS D. HEINRICHS G. HARMS S. EVO (IRSN)	ORNL
No AWE personnel attended courses during the reporting period. Currently no AWE personnel are expected to attend courses in the next quarter.						

Status report of international collaboration with IRSN for FY2022

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
ANALYTICAL METHODS						
IRSN-AM5	Update of the slide rule	ORNL-AM6 LLNL-AM3 AWE-AM1	Contribution to doses computation benchmarks, comparison with COG and SCALE results	M. DULUC	D. BOWEN D. HEINRICHS R. JONES	ORNL LLNL AWE

Q1 Status

Meeting on 11/18 with UK AEA/IAEA/LLNL: use of FISPACT for the DFG dose rate estimation. Presentation of IRSN results.

Sent SCALE IRSN data sets and results to ORNL. ORNL has identified the origin of the results inconsistencies: the neutron cross-section library used (302 energy groups) lacked accuracy at low energy. Using a 1597-group structure solved the problem. There is one case left (H/Pu=10) that requires further analysis. Meeting on 01/13/2022 with IRSN/ORNL/LLNL.

Two NSCD full papers expected on February 1st.

Q2 Status

Two full papers accepted for presentation at NCSD.

Johann HERTH did a presentation at the TPR meeting (invited for presentation to the ANS Winter Meeting).

Q3 Status

Two papers successfully presented at NCSD (Duluc & Herth).

Q4 Status

No progress

| IRSN Reference | REFERENCE | | | IRSN Contribution / POC | | |
	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
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

Q1 Status

IRSN will make presentations at the Analytical Methods Working group meeting (February 2022).

Q2 Status

A presentation from Nicolas LECLAIRE to the last meeting (on February 14th) on k-eff intercomparison benchmark. IRSN work has also been included in J. Alwin presentation on bias estimation.

Q3 Status

As a result of the MACSENS NCSD presentations (S&U computations), technical exchanges started between ORNL and IRSN on differences on bias estimation between TSURFER (ORNL) and MACSENS (IRSN).

Q4 Status

Meeting with ORNL on the MACSENS and TSURFER comparisons (August 30, 2022). Following the meeting, IRSN TSURFER input decks and results were shared with ORNL. ORNL is investigating the issue to find an explanation on the biase/uncertainties differences estimation.

IRSN-AM9	Cross sections processing validation	ORNL-AM3	AMPX training - Development of an interface between GAIA and AMPX and test interface capabilities.	R. ICHOU	A. HOLCOMB D. BOWEN	ORNL

Q1 Status

AMPX workshop to be organized. IRSN waiting for clearance approval.

Q2 Status

Clearance formality in progress.

New ORNL task point of contact to be defined.

	REFERENCE			IRSN Contribution / POC		
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB

Q3 Status

Proposed date for an ORNL-IRSN AMPX workshop in September.

Q4 Status

No progress

IRSN-AM13	Benchmark intercomparison study	LLNL-AM5 ORNL-AM10 LANL-AM5 FY22-02	Definition of common set of developed benchmark models. Extension 2022-2024	N. LECLAIRE	D. HEINRICHS B.J. MARSHALL J. ALWIN	LLNL ORNL LANL

Q1 Status

Analysis of the results for U233 and MCT series after extension of the number of common cases (FY2021) was done. Analysis of inconsistencies between results on all series is still ongoing.

IRSN is waiting for LANL MCNP results with ENDF/B-VIII.0 library.

Report concerning previous achievements (criticality benchmarks) is underway. No progress concerning the extension to other types of benchmarks (TSL, shielding) (Extension FY22-02)

Q2 Status

Presentation made at the TPR meeting on extended suite of U233 results.

LANL sent MCNP results using ENDF/B-VIII.0 library to IRSN for all benchmarks shared with IRSN.

SMF series from ICSBEP (Neptunium spheres) has been completed by IRSN and will be calculated by LLNL (Dave Heinrichs).

Report concerning previous achievements (criticality benchmarks) is underway.

Beta-eff were evaluated for a list of benchmarks provided by Dave Heinrichs; this list has been expanded by Nicolas Leclaire. IRSN MORET computations in progress, will be provided in Q3.

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB

Q3 Status

A paper on the intercomparison work (LECLAIRE & al) and its benefits to nuclear data has been written and will be presented at the ND2022.About new cases, Beta-eff IRSN MORET 5 computations results were sent to Dave Heinrichs.

First phase draft report to be sent for review Q1 FY2023.

Q4 Status

Progress was done on the intercomparison report (first phase of the intercomparison). A draft report is expected for reviewing Q1 FY2023.

INTEGRAL EXPERIMENTS						
IRSN-IE6 **IER 306**	Rh experiment	SNL-IE1	IRSN is leading the design. In 2022, design optimization to accommodate Rh cost	N. LECLAIRE	G. HARMS	SNL

Q1 Status

CED-2 report was sent to NCSP review team mid-0ctober. Comments from BJ Marshall received by IRSN. Waiting for further comments.

Q2 Status

Comments from BJ Marshall received and included by IRSN. Waiting for other reviewers comments.

Q3 Status

No progress. IRSN waiting for reviewers' comments.

Q4 Status

The CED-2 report has been reviewed by SNL. Action on hold due to Rh costs.

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2022 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-IE7 IER 305	Mo experiment	SNL-IE1	IRSN has led the design. Participation in the experiments. Analysis of results.	N. LECLAIRE	G. HARMS	SNL

Q1 Status

All sleeves were sent to Sandia. New grids are being manufactured to adapt the assembly pitch. SNL will write the CED-3a report. Waiting for opportunity to make experiments in 2022.

Full NCSD paper (IRSN-SNL) will be presented (June 2022).

Q2 Status

Discussions took place with Gary Harms in February in order to define the date of the experiments. This could happen from June to August depending on the platform availability. Access clearance procedures for IRSN employees in progress.

Q3 Status

Experiments are scheduled to take place from September 12 to September 16 pending the delivery of new grids at the end of July. Nicolas LECLAIRE and Jeremy BEZ will participate in the experiments.

Q4 Status

N. Leclaire and J. Bez participated in the first experiments at Sandia from September 12 to September 16. The experiment with 397 Mo sleeves has been realized at that time as well as the one with 208 molybdenum sleeves. Reproducibility experiments were also performed. An experiment with alternated rows of sleeved rods and un-sleeved rods is ongoing.

IRSN-IE11 IER 297	TEX - Hf baseline experiments (HEU)	LLNL-IE4	Contribution to ICSBEP evaluation of the baseline experiments	M. BROVCHENKO	C. PERCHER	LLNL

Q1 Status

IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
	REFERENCE		**IRSN Contribution / POC**			

LLNL submitted an ICSBEP evaluation of the experiments. IRSN did a review of the document and will proceed in 2022 to model the benchmarks with MORET.

Q2 Status

No update.

Benchmark modeling planned for Q3.

Q3 Status

No update.

Benchmark modeling planned for Q4 (MORET5).

Q4 Status

Benchmark modeling with MORET5 is in progress.

IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-IE11 **IER 532**	TEX-Hf experiments	LLNL-IE4	Participation to experiments Contribution to the analysis of the experiments (CED-4)	M. BROVCHENKO	C. PERCHER	LLNL

Q1 Status

No update.

Q2 Status

No information on experiment schedule.

Q3 Status

No update.

Q4 Status

	REFERENCE			IRSN Contribution / POC		
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
Experiments are in progress.						
IRSN-IE27 **IER 498**	GODIVA CAAS benchmark	ORNL-IE1	Participation in the design. IRSN can provide technical support and instrumentation	F. TROMPIER	D. BOWEN R. CUMBERLAND	ORNL

Q1 Status:

Waiting for information on schedule and type of instrumentations requested.

Q2 Status

No progress

Q3 Status

No update.

Q4 Status

No update

IRSN-IE30 **IER 538**	Intercomparison of criticality dosimetry around GODIVA	LLNL-IE1	Participation to the experiment. Provide IRSN NAD for irradiation, reading of dosimeters analysis of results on site	F. TROMPIER	D. HEINRICHS	LLNL AWE

Q1 Status:

Experiments planned for the spring 2022. IRSN will participate as standard participant. Experiment is scheduled in May 2022.

Q2 Status

Experiments planned in August 2022 (22nd-25th). IRSN will participate as standard participant. Formalities and devices shipment in progress.

Q3 Status

IRSN Reference	REFERENCE			IRSN Contribution / POC			
	Task Title	DOE Reference		FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB

Experiments planned for August 2022 (22nd-25th). IRSN participants : François TROMPIER, Yohann RISTIC, Johann HERTH, Sophie PIGNET.

Q4 Status

Experiments performed in August. IRSN report transmitted to ORNL on September 23, 2022. Final report gathering all participants results to be transmitted by LLNL very soon (delay due to the size of the report, investigation in progress to find a specific electronic transfer process)

IRSN-IE34 **IER 488**	MUSIC (HEU) critical and Subcritical measurements.	LANL-IE3	Analysis of results, contribution to CED4	W. MONANGE	J. HUTCHINSON	LANL

Q1 Status

Experiment has been performed in 2021 February. IRSN is currently doing the data analysis and the simulations. Status will be discussed during the IRSN_LANL meeting planned on 01/21.

Q2 Status

Receipt of the Section 1 (experiment description) of the MUSIC benchmark for review. Review planned for September 2022.

Q3 Status

 Accurate experiment modelling with MORET6 in progress.

IRSN plans to review the critical benchmark for ICSBEP (waiting for the draft).

Q4 Status

Accurate experiment modelling with MORET6 nearly completion.

Waiting for complete version of the ICSBEP benchmark, for the external review.

	REFERENCE			IRSN Contribution / POC		
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-IE41 **IER 499**	Thermal/Epithermal Experiments (TEX) with Chlorine and Lithium	LLNL-IE1	Participation in experiments design.	M. BROVCHENKO	D. HEINRICHS	LLNL

Q1 Status

No update.

Q2 Status

No update.

Q3 Status

No update.

Q4 Status

No update.

IRSN-IE42 **IER 121**	Neptunium Subcritical Observations (NeSO) experiment	LANL-IE3	Independent review of the ICSBEP evaluation.	W. MONANGE	J. HUTCHINSON	LANL

Q1 Status

Experiment has been performed. IRSN is waiting for preliminary analysis from LANL. Status will be discussed during the IRSN_LANL meeting planned 01/21.

Q2 Status

No update

Q3 Status

No update

Q4 Status

	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-IE45 **IER 517**	Integral Experiments for Validation of Molybdenum Neutron Cross Sections on the whole energy spectrum	LANL-IE3	Participation in experiments design and CED reports. In 2022, participation to CED1 review	N. LECLAIRE	D. HAYES T. CUTLER	LANL

Q1 Status

ANS winter meeting (Dec 2021) paper presenting the results of the CED-1 report was sent by J. Goda to IRSN. Discussions with IRSN on the collaboration will take place end of January 2022. Comparison of sensitivity profiles for configurations in thermal energy spectrum (MIRTE experiments) is proposed by IRSN.

Q2 Status

No update

Q3 Status

IRSN will participate in the CED Team.

Q4 Status

The CED-1 report has been sent to IRSN on September 27. N. Leclaire and L. Leal made the review. Comments were sent to Los Alamos on October 12, 2022.

IRSN-IE46 **IER 518** **FY20-29**	High Multiplication Subcritical (Multiplicity) Benchmark Experiments	LLNL-IE1 SNL-IE1 LANL-IE3	Participation in experiments. IRSN will provide detectors for comparison.	W. MONANGE	D. HEINRICHS G. HARMS J. HUTCHINSON	LLNL SNL LANL

Q1 Status

Experiment is planned for this year (2022). IRSN is waiting for experiments schedule. IRSN will use its detectors.

Q2 Status

IRSN Reference	REFERENCE			IRSN Contribution / POC		
	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB

Detector supports and detectors wells have been manufactured and received by IRSN. Device is ready. Shipment procedure to be started as soon as the dates of experiment are validated. Clearance procedures for IRSN employees in progress.

Q3 Status

IRSN participation in the experiments in June. IRSN used its He3 detectors in the SNL reactor, data analysis in progress.

Q4 Status

Due to issues with IRSN detectors during the experiments few IRSN measurements are available. IRSN propose to contribute with benchmark simulation. **Special thanks to the SANDIA staff for their support on detectors shipping**.

| IRSN-IE47 **IER 537** | Copper Critical Experiment | LANL-IE3 | Participation in CED reports. IRSN is interested to understand results of various experiments including ZEUS experiments results
Contribution to CED2 review | J-B. CLAVEL | J. HUTCHINSON | LANL |

Q1 Status

Status on LANL progress will be done during IRSN_LANL meeting planned 01/21

Q2 Status

No meeting during Q2

Q3 Status

No progress.

Q4 Status

No update

	REFERENCE			IRSN Contribution / POC		
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
IRSN-IE49 **IER 547**	TEX U with poly at very low temperatures - Surrogate measurement support	LLNL-IE1	Contribution to analysis of results for optimization of IER 479 design	J. BEZ	C. PERCHER	LLNL

Q1 Status

First calculations started. IRSN has sent questions on information received at the end of 2021 (email requesting data sent 01/05/2022). Some data updates are necessary from LLNL.

Q2 Status

Some configurations have been identified as interesting. A technical point will be set up to discuss differences between IRSN and LLNL results and experimental questions.

Q3 Status

Progress meeting between LLNL-IRSN in June 28th. Following this meeting, LLNL sent the updates on CED2. IRSN plans to continue design studies for new materials in Q4.

Q4 Status

A technical meeting has been set up on October 6th. IRSN has presented calculation results in order to optimize sensitivities on structural materials (Fe, Al, CH2). LLNL suggested to investigate the use of Teflon, graphite or even alumina as moderator to, maybe, get an epithermal configuration. These new configurations will be investigated in 2023. IRSN's pre-design results will be presented at the ICNC 2023 in collaboration with LLNL.

IRSN-IE50	Pulse Neutron Experiments for Resonance Parameter Evaluation of Absorbing Materials	FY22-15	Evaluation and support for experiments	L. LEAL	C. PERCHER/D. SIEFMAN	LLNL

Q1 Status

Ongoing activity: LLNL has carried out investigation of historical experiments employing measurement technique that are envisioned in this task.

Q2 Status

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

Q3 Status

Task discussed during NCSD and LLNL-IRSN meeting in June 28th. IRSN expressed interest in reviewing this benchmark.

Q4 Status

No update

IRSN-IE51	Thermal/Epithermal Experiments (TEX)-Plutonium Additional Mixed Spectrum Configurations	FY22-16	Contribution to CED1 report.	M. BROVCHENKO	C. PERCHER	LLNL

Q1 Status

No update.

Q2 Status

No update.

Q3 Status

IRSN ready to review the future ICSBEP benchmark.

Q4 Status

No update.

INFORMATION PRESERVATION AND DISSEMINATION						
IRSN-IPD1	ICSBEP reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks are reported in the IE tasks	S. PIGNET	D. HEINRICHS	LLNL
Q1 Status						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2022 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**

Participation to the December 2021 status meeting.

Q2 Status

IRSN will work on the reevaluation of PU-SOL-THERM-030 ICSBEP series involving solutions of plutonium nitrate (1.5 % ^{240}Pu) in annular cylinders along with a reevaluation of MIRTE experiments in order to make consistent the treatment of uncertainties for LCT-074, LCT-106 with LCT-110 series approved at the last TRG meeting.

Q3 Status

 LCT 110 benchmark (MIRTE 2.3) : reviewers' comments have been taken into account

IRSN plans to review the TEX-Pu(FY22-16) and MUSIC (critical) benchmarks in 2023.

Q4 Status

No progress due to meeting delayed in April.

NUCLEAR DATA						
IRSN-ND1	Contribution to new evaluations	ORNL-ND1 NNL-ND1 RPI-ND1	Contribution to new evaluations and validation in accordance with the milestone schedule in Appendix B	L. LEAL	D. BOWEN T. TRUMBULL	ORNL NNL RPI

Q1 Status

Work on Mo-95 resonance evaluation from LANL, benchmark testing and RP improvements

Finished U233 RR evaluation + RPC. Work on the URR underway;

Work with ORNL on Hf sample preparation for new measurements;

Work on the RR + URR for Pu239 underway;

Rh103 completed and delivered to BNL;

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB

Work on the URR for Gd155 and Gd157;

Work on the Fe54 and Fe56 RR evaluation;

Work on the F19 resonance evaluation.

Q2 Status

Benchmark calculations for systems with Mo have been done. Results indicate an improvement on the Mo-95 evaluation

Benchmark results shows improvement on the Pu-239 resonance evaluation for burnup calculations;

Progress has been made on the U-233 URR evaluation;

NEA/data bank offered to contact INRNE, Sofia/Bulgaria to obtain Hf enriched samples;

Q3 Status

Work on the molybdenum evaluation for isotopes other than Mo-95. Assessment of existing evaluation were done.

Paper presented at NCSD and a paper on validation of O16 evaluation on benchmark calculations to be presented at ND2022.

Q4 Status

Paper with RPI/NNL on the URR for Rh103 completed and submitted to ANE;

Work on the Mo isotopes evaluation continue;

Work on the RR for Hf-177 using existing data is underway;

Working RR of U233 with new alpha (capture/fission) from LANL.

TRAINING AND EDUCATION						
IRSN-TE1	Hands-on criticality safety training	ORNL-TE1	IRSN attendance to NCSP classes. Possible lectures by IRSN working with NCSP training and education coordinator.	S. PIGNET	D. BOWEN	NCSP

	REFERENCE			IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2022 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
		LANL-TE3 LLNL-TE1 SNL-TE1				

Q1 Status

Waiting for visibility on travel. (Travel plans contingent upon the sanitary situation.)

Q2 Status

2 IRSN employees will participate on August session.

Q3 Status

Two IRSN employees will participate in the August session: Johann HERTH and Gabriel FRONTIER, formalities in progress.

Q4 Status

Gabriel FRONTIER and Johann HERTH have participated in the August Training.

Additional information:

- TEX-MOX (IER 296): final CED-1 report will be published in Q1 FY2023. Thermal and mechanical mock-up tests are planned to take place at IRSN in Q2-Q3 2023. The definition of tests is ongoing. Technical exchanges with LANL and LLNL on the mock-up tests planned for Q1 2023.