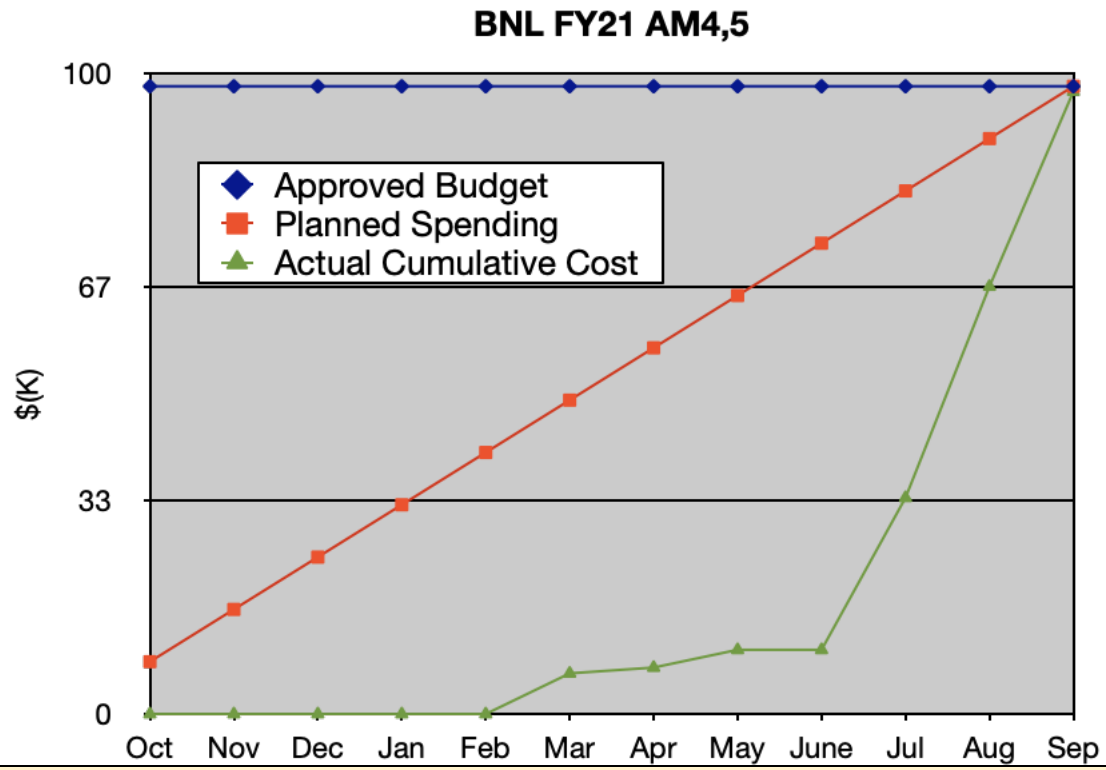
NUCLEAR CRITICALIY SAFETY PROGRAM (NCSP)

FY2021 4TH QUARTER REPORTS

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: AM4, 5 **M&O Contractor Name**: BNL **Point of Contact Name:** David Brown **Point of Contact Phone:** 631-344-2814	**Reference:** DP0909020 **Date of Report:** 20 Oct. 2021

BUDGET



1. Carryover into FY 2021 = $ 2.483
2. Approved FY 2021 Budget = $ 98,000
3. Actual spending for 1st Quarter FY 2021 = $0
4. Actual spending for 2nd Quarter FY 2021 = $6,347
5. Actual spending for 3rd Quarter FY 2021 = $3,679
6. Actual spending for 4th Quarter FY 2021 = $87,160
7. Projected carryover into FY 2022 = $3,297

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 generating a draft document defining the TNSL code or software interface. (AM4)		Drafting the GNDS-2.0 specifications is taking longer than expected; a TNSL covariance format is among the pending changes. Otherwise, the TNSL format has been created and is being tested at LLNL in FUDGE. Elements of this new format have been back-ported to the

			ENDF-6 format by NNL and several new evaluations using this new format have been proposed.
Q1	Provide status on completing an ENDF/B-VIII.0 library with FUDGE. (AM5)		Until FUDGE has "officially" implement GNDS-2.0, we cannot use it to generate ENDF/B-VIII.0 in the new format.
Q2	Provide status on generating a draft document defining the TNSL code or software interface. (AM4)		The GNDS-2.0 specifications are on track for approval at the 2021 WPEC Expert Group Meeting, including TNSL formats that support NCSP activities.
Q2	Provide status on completing an ENDF/B-VIII.0 library with FUDGE. (AM5)		Until FUDGE has "officially" implement GNDS-2.0, we cannot use it to generate ENDF/B-VIII.0 in the new format. This format should be approved in May.
Q3	Provide status on generating a draft document defining the TNSL code or software interface. (AM4)		Finalization of the GNDS-2.0 specifications is stalled and hopefully will get "unstalled" in Q4
Q3	Provide status on completing an ENDF/B-VIII.0 library with FUDGE. (AM5)		As the GNDS specifications are not yet complete, we cannot yet convert ENDF/B-VIII.0 into it.
Q4	Provide status on generating a draft document defining the TNSL code or software interface. (AM4)		See the LLNL AM 4,5 report
Q4	Provide status on completing an ENDF/B-VIII.0 library with FUDGE. (AM5)		See the LLNL AM 4,5 report
ACCOMPLISHMENTS			

- AM4 - Thermal Scattering and Self-Shielding in GNDS/FUDGE
  - David Brown, Matteo Vorabbi, Caleb Mattoon, Bret Beck, Godfree Gert and Paul Romano, "Consistent, Bayesian, Approach to the Cross Section Probability Distribution in the Unresolved Resonance Region", Brookhaven National Laboratory Report BNL-222203-2021-INRE (2021)
  - "Thermal Neutron Scattering Law (TNSL) Implementation and Testing in FUDGE" Lawrence Livermore National Laboratory Report (2021)

PUBLICATIONS

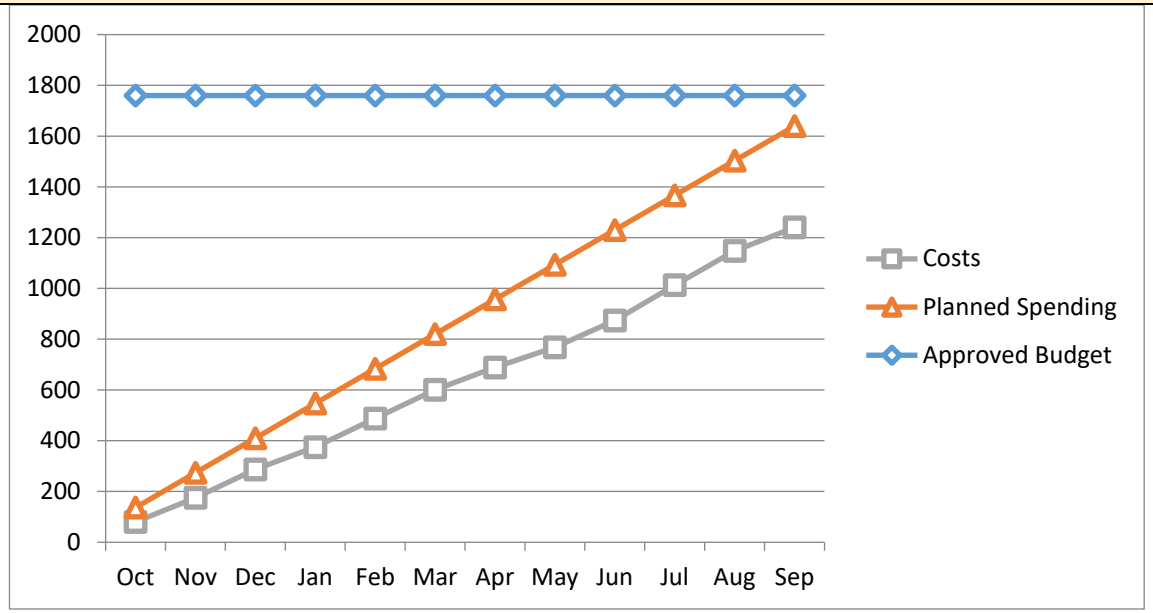
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	n/a		
Q2	n/a		
Q3	n/a		
Q4	David Brown, Matteo Vorabbi, Caleb Mattoon, Bret Beck, Godfree Gert and Paul Romano, "Consistent, Bayesian, Approach to the Cross Section Probability Distribution in the Unresolved Resonance Region", Brookhaven National Laboratory Report BNL-222203-2021-INRE (2021)	yes	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: AM1, 2, 3, 4, 5, 7 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda/Bob Little **Point of Contact Phone:** 505-667-2812/505-665-3487	**Reference:** DP0909020 **Date of Report:** October 21, 2021

BUDGET



1. Carryover into FY 2021 = $ 425,000.00
2. Approved FY 2021 Budget = $ 1,335,000.00
3. Actual spending for 1st Quarter FY 2021 = $287,054
4. Actual spending for 2nd Quarter FY 2021 = $313,672
5. Actual spending for 3rd Quarter FY 2021 = $272,779
6. Actual spending for 4th Quarter FY 2021 = $367,157
   (YTD = $ 1,240,661.65)
7. Projected carryover into FY 2022 = $0

(Note that $300k of FY21 funding from AM was moved to IE to allow AM to spend down carryover. Overall AM spend plan does not change.)

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	Continue to distribute MCNP6 with automated acceleration and convergence testing to NCSP early-adopters and collect feedback (AM1)		
Q1	Provide a status report on NJOY user support (AM2)		
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q1	Provide status in NCSP Quarterly Progress Reports (AM3)		RPI subcontract delayed
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM4)		
Q1	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)		
Q1	Provide status in NCSP Quarterly Progress Reports (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 MCNP6 Criticality training course (AM1)		Scheduled and completed in Q3
Q2	Provide a status report on NJOY user support (AM2)		
Q2	Release modernized and integrated versions of THERMR and LEAPR with documentation (AM2)		Modernized version of LEAPR has been incorporated and is part of the upcoming NJOY21 1.3.0 release. Modernized version of THERMR is nearly complete, waiting only for compatibility with ENDFtk. This is expected to be finalized early in Q4. Milestone completed during Q4.

Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q2	Provide status in NCSP Quarterly Progress Reports (AM3)		RPI subcontract delayed
Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM4)		
Q2	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)		
Q2	Provide status in NCSP Quarterly Progress Reports (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	Issue an MCNP V&V report, including MCNP6 automated acceleration and convergence (AM1)		Delayed to FY22 Q1 to be fully in sync with the release of MCNP6.3
Q3	Provide a status report on NJOY user support (AM2)		
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q3	Provide status in NCSP Quarterly Progress Reports (AM3)		RPI subcontract delayed
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM4)		
Q3	Provide status reports on LANL participation in US and International analytical methods collaborations (AM5)		
Q3	Provide status in NCSP Quarterly Progress Reports (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	Release MCNP 6.3 to RSICC (AM1)		MCNP6.3 code feature freeze. Development of features, improvements and bugfixes halted to focus on finalizing documentation, V&V, installation and more related to the RSICC release. Milestone will be completed late in Q1 or early in Q2 of FY22.
Q4	Provide MCNP6 Criticality training course (AM1)		Now scheduled for FY22. Also planned for FY22 is training requested by Savannah River and an MCNP tutorial at the NCSD Topical Meeting.
Q4	Develop and demonstrate long-term strategy for distributing all Los Alamos supported ACE files (AM1)		
Q4	Provide a status report on NJOY user support (AM2)		
Q4	Provide status reports on LANL participation in US and International analytical methods collaborations (AM2)		
Q4	Demonstrate modernized ACER capabilities for processing fast neutron files with NJOY21 (AM2)		
Q4	Provide status in NCSP Quarterly Progress Reports (AM3)		RPI subcontract delayed (but now in place)
Q4	Provide data files and report for h-h2o and graphite on-the-fly S(alpha,beta) temperature effects. (AM3)		RPI subcontract delayed (but now in place)
Q4	Provide status reports on LANL participation in US and International analytical methods collaborations (AM4)		
Q4	Issue report on detailed review, comparisons, and updates to the Sensitivity-Uncertainty Comparison Study (pending carryover funding). (AM4)		

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 in NCSP Quarterly Progress Reports (AM7)		
Q4	Deliver final modified version of Whisper to LANL with an ANS conference paper to disseminate the work (AM7)		An ANS conference paper (and TPR talk) were presented previously. The final modified version of Whisper will be delivered to LANL in FY22. The University of Michigan subcontract was finalized later than expected.

ACCOMPLISHMENTS

- AM1 - MCNP® Maintenance and Support, Uncertainty Analysis Development, and Modernization
  - Education
    - Online MCNP6 classes: See separate summary of MCNP classes.
    - Thesis committee member for UNM graduate student working in area of criticality calculations.
    - Mentorship of year-round graduate research assistant jointly between XCP-3 and XCP-7.
  - R&D Work, continued to investigate & develop:
    - Region-dependent sensitivity-uncertainty data for NCS validation (UNM).
    - Subcritical multiplication methods investigation and impact of correlated fission multiplicity models in criticality calculations (UNM).
    - Further investigation of nuclear data adjustment augmented by machine learning using Whisper benchmarks, sensitivities and covariance data (OSU).
    - MCNP6.3 code feature freeze. Development of features, improvements and bugfixes halted to focus on finalizing documentation, V&V, installation and more related to the RSICC release. **Milestone delayed**.
  - MCNP Support & Maintenance
    - Support MCNP6 users. MCNP Forum, website, email, direct interactions, etc. **Milestone complete.**
    - Continue to modernize MCNP coding and update the code manual.
    - Updating V&V testing framework for consistency, extensibility, and automation.
    - Hosted the virtual 2021 MCNP® User Symposium. Criticality and Reactors Session organized (see presentations listed in reports and publications section).
  - MCNP Data Libraries
    - We have developed and released a major upgrade to our website, https://nucleardata.lanl.gov. This site hosts all of our ACE data and allows anyone to download the data as needed. It has fast download speeds and a reasonable interface. Additional improvements are planned. **Milestone complete.**
  - Reports & Publications

- J.D. Hutchinson, N.A. Kleedtke, J.L. Alwin, A.R. Clark, T.E. Cutler, et al., "Investigation of Delayed Neutron Sensitivities for Several ICSBEP Benchmarks using MCNP", Prepared for 2021 ANS Winter Meeting, LA-UR-21-26405.
- W. Haeck, K.D. Spencer, J.L. Alwin, M.E. Rising, "LABS: Los Alamos Benchmark Suite - Current status and planning", Presented at 2021 Virtual Mini-CSEWG Meeting, LA-UR-21-28293.
- J.L. Alwin, N. Leclaire, and M.R. MacQuigg, "LANL Critical Benchmark Comparison Study and Subsequent Revision for Cases Involving LEU and MIX", Los Alamos Report LA-UR-21-29454.
- M.E. Rising, T.R. Adams, J.C. Armstrong, S.R. Bolding, F.B. Brown, et al., "2021 MCNP® User Symposium Developer Abstracts", Prepared for 2021 MCNP® User Symposium, LA-UR-21-25954.
- N.W. Thompson, M.E. Rising, D. Neudecker, J.D. Hutchinson, A.C. Kahler, et al., "Questionable Benchmarks", Presented at OECD/NEA WPNCS 2021 SG-8 meeting, LA-UR-21-26262.
- R.A. Forster, M.E. Rising, and A. Sood, "The History of Monte Carlo and MCNP at Los Alamos", Presented at 2021 MCNP® User Symposium, LA-UR-21-26274.
- M.E. Rising, T.R. Adams, J.C. Armstrong, S.R. Bolding, F.B. Brown, et al., "Upcoming MCNP6.3® Release: New Features and Improvements", Presented at 2021 MCNP® User Symposium, LA-UR-21-26276.
- M.E. Rising, C.J. Josey, and J.A. Kulesza, "Improved Verification and Validation Testing and Tools", Presented at 2021 MCNP® User Symposium, LA-UR-21-26448.
- M.E. Rising, "Whisper Use of Nuclear Data Covariances", Presented at 2021 Virtual Mini-CSEWG Meeting, LA-UR-21-28292.
- J.L. Alwin, "Comparison Study of Upper Subcritical Limits Derived Using Sensitivity/Uncertainty Tools: Case Studies of U233-SOL-THERM-001-001, MIX-COMP-THERM-001-001, IEU-MET-FAST-002-001, LEU-COMP-THERM-001-001, LEU-SOL-THERM-004-001", Los Alamos Report LA-UR-21-25804.
- J.L. Alwin and J.B. Spencer, "Utilizing Unstructured Mesh Geometry in Criticality Calculations and Criticality Accident Alarm System Analysis", Los Alamos Report LA-UR-21-25913.

- AM2 - NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization
  - NJOY2016
    - NJOY2016.65 is going to contain a number of major updates for NJOY in anticipation of the ENDF/B-VIII.1 library. The following updates have been implemented in this version over the course of FY21 (and Q4 of FY21 in particular):
      - LAW=61 is now allowed for photonuclear ACE libraries (the secondary angular distributions are now tabulated in all cases instead of being assumed isotropic when using LAW=1 LANG=1).
      - Some photonuclear libraries use MF6/MT18 but with a neutron multiplicity equal to 1 instead of nubar. A warning is now printed when this is encountered and the multiplicity is replaced with the appropriate nubar data.
      - Thermal scattering ACE files now support mixed mode elastic scattering (both coherent and incoherent elastic scattering are used), with appropriate updates to THERMR and MODER (the ACE format specifications have been updated accordingly).
      - The XSS array and its size is now set in the common acecm module. Writing out the ACE file and locator checking for photonuclear and thermal scattering files has been enabled as well (previously only available for incident neutron and charged particle ACE files).
      - In addition, several following minor issues were fixed as well.

        - We worked with the MCNP development team to make sure MCNP6.3 is capable of using the new ENDF/B-VIII.1 thermal scattering data and photonuclear data.
    - User Support
        - Questions on the ACE format
        - Various questions on the GitHub issues trackers
    - NJOY 21
        - To satisfy the Q2 Milestone for THERMR, the necessary changes were made in ENDFtk to solve the underlying issues (essentially having a simplified way to insert new data into an existing ENDF file). **Milestone complete.**
        - Extension of ENDFtk capability to MF23, MF26, MF27 and MF28 (photo and electro atomic data) and MF33 and MF34 (covariance data). These new features will go into ENDFtk v0.4.0 soon.
        - Significant progress has been made on ACEtk, the toolkit for reading, modifying and creating ACE files that is an essential part of the NJOY21 modernization. The capability is currently limited to continuous energy data for incident neutrons and charged particles (also known as fast data). Data that can be extracted from these types of ACE tables are everything up to and including cross section data and angular distribution data (secondary particle distribution data and unresolved probability tables are under development) and this can be done using both a C++ and Python interface. The capability also includes the necessary coding to format the XSS array in the ACE file "from scratch" and allows us to extract data from an existing ACE table, modify it and insert it back into a new ACE table (the internal locators are adjusted automatically). Once the secondary particle energy distributions are implemented, this version of ACEtk will be used to generate some analytical ACE data for MCNP V&V. Completion of the work on ACEtk is foreseen for FY22.
- AM3 - Development of an Adaptive-in-temperature Method for fast on-the-fly Sampling of Thermal Neutron Scattering Data in MCNP6
    - The subcontract with RPI was finally signed in mid-September. Instead of a FY21-22 task, this has turned in to a FY22-23 task.
- AM4 - Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits
    - Continued collaboration with IRSN and ORNL to study five cases within IEU, LEU, MIX, and U233. Completed LANL report with USL results, received IRSN results, awaiting ORNL results.
    - Drafted abstract for submission to ANS NCSD Topical Meeting in collaboration with IRSN and ORNL.
    - Revised report of LANL results to incorporate ORNL feedback, LA-UR-21-25804. **Milestone complete.**
- AM5 - Proposed Benchmark Intercomparison Study
    - Completed review and revision of specific benchmark files based upon feedback from IRSN. Issued report on LANL results and incorporated IRSN feedback, LA-UR-21-29454. **Milestone complete.**
- AM7 - Incorporation of Benchmark Experiment Correlations into the Whisper Nuclear Criticality Safety Software
    - Explored alternative method for similarity weighting with correlation based upon solving a minimization problem.
    - Cleaned up Whisper source code for decision tree algorithm to highlight modified and old code for easier integration.

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	F.B. Brown & M.E. Rising, "Guide for Using ENDF/B-VIII.0 Nuclear Data with MCNP", LA-UR-20-30460 (2020).	Yes, will send.	
Q1	F.B. Brown (Ed.), "Statistical Tests for Diagnosing Fission Source Convergence and Undersampling in Monte Carlo Criticality Calculations", final report for OECD-NEA-WPNCS Subgroup-6, to be published by OECD-NEA in 2021.	No, will send next quarter.	Sent with Q2 Report
Q1	J.L. Alwin, F.B. Brown, M.J. Lazaric, B.R. Murphy, K.D. Spencer, "Comparison Study of Upper Subcritical Limits Derived Using Sensitivity/Uncertainty Tools Case Studies of Benchmarks & Applications", LA-UR-20-28129.	Yes, submitted in Q4FY20	
Q1	J.L. Alwin, F.B. Brown, J. Clarity, I. Duhamel, F. Fernex, et al, "S/U Comparison Study with a Focus on USLs", ANS Winter meeting, LA-UR-20-24758, LA-UR-20-28222.	Yes, submitted in Q3FY20	
Q1	R.H. Mendleski, K.Y. Spencer, E. Moll, R.F. Sartor, J.L. Alwin, W. Haeck, "Validation of MCNP Critical Benchmark Models of PU-MET-FAST-016", ANS Winter Meeting, LA-UR-20-29300, LA-UR-20-25118.	Yes, will send.	
Q1	J.D. Hutchinson, T.A. Smith, N.A. Kleedtke, N.W. Thompson, R.C. Little, M.R. Rising, J.L. Alwin, T.J. Grove, I.J. Michaud, "Sensitivity Studies, Gap Analysis, and Benchmark Experiment Optimization", ANS Winter Meeting, LA-UR-20-29405, LA-UR-20-24750.	Yes, will send.	
Q1	C.M. Kostelac, N. Thompson, R.G. Sanchez, J.D. Hutchinson, K.Y. Spencer, W. Haeck, J.L. Alwin, "Validation and Independent Uncertainty Analysis of the MIX-SOL-THERM-003 ICSBEP Benchmark", ANS Winter Meeting, LA-UR-20-29459, LA-UR-20-24749.	Yes, will send.	
Q1	D.T. Wise, B. Madahar, K.Y. Spencer, J.L. Alwin, W. Haeck, "Validation of MCNP Critical Benchmark Models of Moderated Highly Enriched Uranium Slabs, ANS Winter Meeting, LA-UR-20-29255, LA-UR-20-24771.	Yes, will send.	
Q1	"Analytic Insights into the Neutronic Characteristics of Neutron Moderators from MCNP Calculations," D. Kent Parsons and Cecile Toccoli, LA-UR-20-24442.	Yes, submitted in Q3FY20	
Q1	"Verification of the Re-Released ENDF/B VIII.0 Based Thermal Scattering Libraries," D. Kent Parsons, Cecile Toccoli, and Jeremy L. Conlin, LA-UR-20-24679.	Yes, submitted in Q3FY20	
Q2	"Uniformly Ordered Binary Decision Algorithm for Benchmark Experiment Correlations in Whisper Validation," Brian Kiedrowski, presented at TPR.	TPR – You have	
Q2	"Verification of the Re-Released ENDF/B VIII.0 Based Thermal Scattering Libraries, D. Kent Parsons, Cécile Toccoli and Jeremy L. Conlin, presented at TPR.	TPR – You have	
Q2	"Physics Improvements for Criticality Calculations with MCNP6.3," F.B. Brown, presentation at NCSP TPR, LA-UR-21-21189.	TPR – You have	

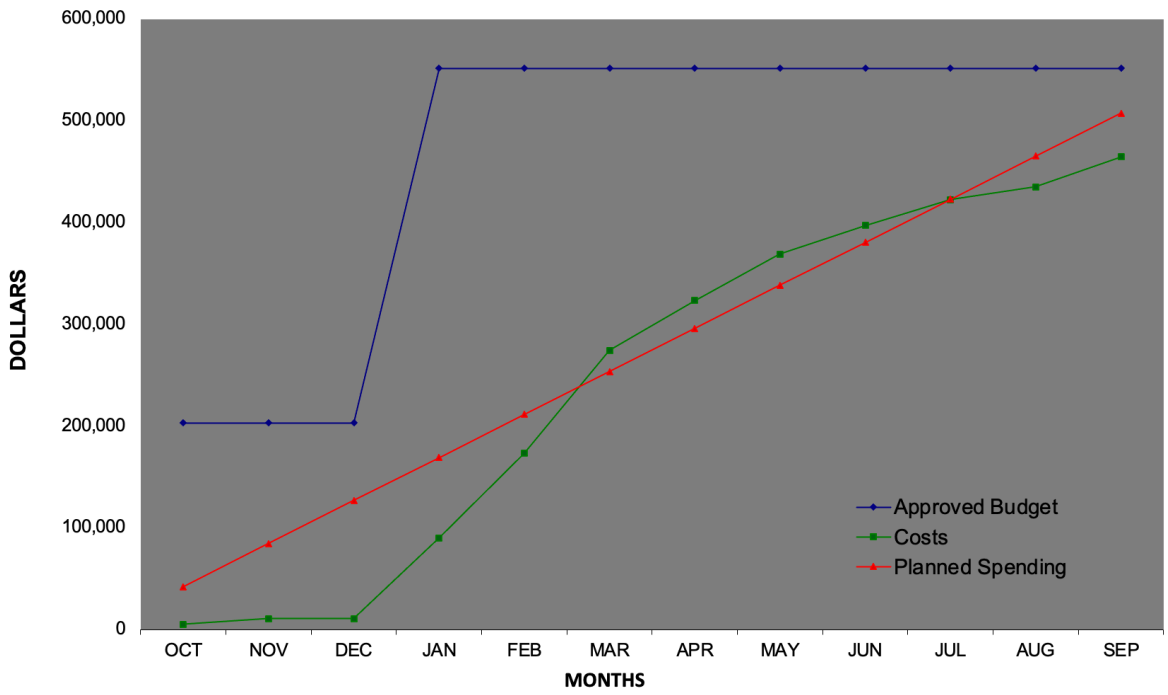
Q2	"Analytic Insights into the Neutronic Characteristics of Neutron Moderators from MCNP Calculations, D. Kent Parsons and Cécile Toccoli, presented at TPR.	TPR – You have	
Q2	"NJOY21 Release: RECONR, THERMR, and LEAPR," Jeremy Lloyd Conlin, Amelia Jo Trainer, Wim Haeck, and Nathan Gibson, presented at TPR.	TPR – You have	
Q2	"MCNP6 Recent Updates on Modernization, R&D, and Release Plans," M.E. Rising, J.L. Alwin, F.B. Brown, C.M. Perfetti, B. Riedel, et al., presentation for NCSP TPR, LA-UR-21-21534.	TPR – You have	
Q2	"Whisper Results of a PuCl 'Solution' System Using LLNL TEX Cl Benchmark Model," K.D. Spencer, J.L. Alwin, LA-UR-21-20156,	Yes	
Q2	"Application of Machine Learning Algorithms to Identify Problematic Nuclear Data," P.A. Grechanuk, M.E. Rising, T.S. Palmer, prepared for Nuclear Science and Engineering, LA-UR-21-20494.	Yes	
Q2	"Sensitivity Tool Needs for Modern Nuclear Data Validation," M.E. Rising, prepared for Workshop for Applied Nuclear Data Activities (WANDA 2021), LA-UR-21-20511.	Yes	
Q2	"Recent and Future Improvements to MCNP6 for Isotope Production Applications," M.E. Rising, prepared for Workshop for Applied Nuclear Data Activities (WANDA 2021), LA-UR-21-20515.	Yes	
Q2	"Development of MCNP Training Modules for Safeguards Practitioners," A.C. Trahan, M.E. Rising, M.M. Watson, prepared for Institute of Nuclear Materials Management, LA-UR-21-22485.	Yes	
Q2	"Uniformly Ordered Binary Decision Algorithm for Benchmark Experiment Correlations in Whisper Validation," Brian C. Kiedrowski, prepared for ANS Summer meeting.	Yes	
Q3	"Recent MCNP6 Code Developments and Improvements for Nuclear Engineering Applications", M.E. Rising, T.R. Adams, J.C. Armstrong, S.R. Bolding, F.B. Brown, et al., Presented at LANL Engineering Capability Review, LA-UR-21-25703.	Yes	
Q3	"MCNP® Particle Transport Code: Its History and Future", M.E. Rising, presented at UNM Student Seminar, LA-UR-21-23887.	Yes	
Q3	"Spring 2021 Update on the Los Alamos Benchmark Suite", K. Spencer, J.L. Alwin, and W. Haeck, presented at OECD/NEA WPEC meeting, LA-UR-21-24478.	Yes	
Q3	"Comparison Study of Upper Subcritical Limits Derived Using Sensitivity/Uncertainty Tools: Case Studies of U233-SOL-THERM-001-001, MIX-COMP-THERM-001-001, IEU-MET-FAST-002-001, LEU-COMP-THERM-001-001, LEU-SOL-THERM-004-001", J. L. Alwin, LANL report LA-UR-21-25804.	Yes	
Q4	J.D. Hutchinson, N.A. Kleedtke, J.L. Alwin, A.R. Clark, T.E. Cutler, et al., "Investigation of Delayed Neutron Sensitivities for Several ICSBEP Benchmarks using MCNP", Prepared for 2021 ANS Winter Meeting, LA-UR-21-26405.	Yes	

Q4	W. Haeck, K.D. Spencer, J.L. Alwin, M.E. Rising, "LABS: Los Alamos Benchmark Suite - Current status and planning", Presented at 2021 Virtual Mini-CSEWG Meeting, LA-UR-21-28293.	Yes	
Q4	J.L. Alwin, N. Leclaire, and M.R. MacQuigg, "LANL Critical Benchmark Comparison Study and Subsequent Revision for Cases Involving LEU and MIX", Los Alamos Report LA-UR-21-29454.	Yes	
Q4	M.E. Rising, T.R. Adams, J.C. Armstrong, S.R. Bolding, F.B. Brown, et al., "2021 MCNP® User Symposium Developer Abstracts", Prepared for 2021 MCNP® User Symposium, LA-UR-21-25954.	Yes	
Q4	N.W. Thompson, M.E. Rising, D. Neudecker, J.D. Hutchinson, A.C. Kahler, et al., "Questionable Benchmarks", Presented at OECD/NEA WPNCS 2021 SG-8 meeting, LA-UR-21-26262.	Yes	
Q4	R.A. Forster, M.E. Rising, and A. Sood, "The History of Monte Carlo and MCNP at Los Alamos", Presented at 2021 MCNP® User Symposium, LA-UR-21-26274.	Yes	
Q4	M.E. Rising, T.R. Adams, J.C. Armstrong, S.R. Bolding, F.B. Brown, et al., "Upcoming MCNP6.3® Release: New Features and Improvements", Presented at 2021 MCNP® User Symposium, LA-UR-21-26276.	Yes	
Q4	M.E. Rising, C.J. Josey, and J.A. Kulesza, "Improved Verification and Validation Testing and Tools", Presented at 2021 MCNP® User Symposium, LA-UR-21-26448.	Yes	
Q4	M.E. Rising, "Whisper Use of Nuclear Data Covariances", Presented at 2021 Virtual Mini-CSEWG Meeting, LA-UR-21-28292.	Yes	
Q4	J.L. Alwin, "Comparison Study of Upper Subcritical Limits Derived Using Sensitivity/Uncertainty Tools: Case Studies of U233-SOL-THERM-001-001, MIX-COMP-THERM-001-001, IEU-MET-FAST-002-001, LEU-COMP-THERM-001-001, LEU-SOL-THERM-004-001", Los Alamos Report LA-UR-21-25804 (Updated).	Yes	
Q4	J.L. Alwin and J.B. Spencer, "Utilizing Unstructured Mesh Geometry in Criticality Calculations and Criticality Accident Alarm System Analysis", Los Alamos Report LA-UR-21-25913.	Yes	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: AM2, 3, 4, 5, 6, 8 **M&O Contractor Name**: LLNL **Point of Contact Name:** David Heinrichs **Point of Contact Phone:** (925) 424-5679	**Reference:** DP0909020 **Date of Report:** October, 2021

BUDGET



1. Carryover into FY 2021 = $ 120,596
2. Approved FY 2021 Budget = $ 551,596
3. Actual spending for 1st Quarter FY 2021 = $ 10,752
4. Actual spending for 2nd Quarter FY 2021 = $ 263,847
5. Actual spending for 3rd Quarter FY 2021 = $ 122,679
6. Actual spending for 4th Quarter FY 2021 = $ 67,257
7. Projected carryover into FY 2022 = $ 87,061* (16%)

*Includes $47,525 lien for Prof. Ganapol.

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 in NCSP Quarterly Progress Report (AM2)		

NCSP Quarterly Progress Report (FY-2021 Q4)

Q1	Provide status in NCSP Quarterly Progress Report (AM3)		
Q1	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		
Q1	Provide status in NCSP Quarterly Progress Report (AM5)		
Q1	Provide status in NCSP Quarterly Progress Report (AM6)		
Q1	Provide status in NCSP Quarterly Progress Report (AM8)		
Q2	Provide status in NCSP Quarterly Progress Report (AM2)		Focus continues on analysis of IER268 (PDV) experimental results.
Q2	Provide status in NCSP Quarterly Progress Report (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)		
Q2	Provide status in NCSP Quarterly Progress Report (AM6)		
Q2	Provide status in NCSP Quarterly Progress Report (AM8)		
Q3	Provide status in NCSP Quarterly Progress Report (AM2)		
Q3	Provide status in NCSP Quarterly Progress Report (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)		
Q3	Provide status in NCSP Quarterly Progress Report (AM6)		

Q3	Provide status in NCSP Quarterly Progress Report (AM8)		
Q4	Provide status in NCSP Quarterly Progress Report (AM2)		
Q4	Provide status in NCSP Quarterly Progress Report (AM3)		
Q4	Provide a status report on generating a draft document defining the TNSL code or software interface. (AM4)		LLNL-TR-828141 (see publications)
Q4	Provide status in NCSP Quarterly Progress Report (AM5)		
Q4	Provide status in NCSP Quarterly Progress Report (AM6)		
Q4	Provide status in NCSP Quarterly Progress Report (AM8)		

ACCOMPLISHMENTS

- AM3 – Slide Rule Application
  - Provided LLNL calculated DFG multiplicity and spectra and limited experimental validation for Pu to IRSN and ORNL for comparison to IRSN (VESTA) and ORNL (ORIGEN) "source term" calculations. Completed all Phase 4 Pu DFG COG calculations for discussion in the next viseoconference scheduled for October 1, 2021.
- AM4 - Thermal Scattering and Self-Shielding in GNDS/FUDGE
  - ENDF-VIII.0 thermal scattering library was processed with FUDGE into "LLNL" format, then tested using 'broomstick' simulations. LLNL codes Mercury and COG were compared with each other, and to COG using TSL data in ENDF-6 File 7 format, and with MCNP using TSL data in ACE format. COG and MERCURY are in excellent agreement, and good agreement was observed with MCNP except at extreme scattering angles (near μ =+1 or –1). COG testing of TSL data in ACE format continues.
  - URR capabilities in FUDGE were updated to generate legacy-compatible probability tables. Differences with NJOY and FRENDY are being investigated.
- AM5 - Proposed Benchmark Intercomparison Study
  - A total of 3,382 high-precision COG (k-eff) ICSBEP 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:  766     U233: 193     MIX: 356
HEU: 1054     IEU:  206     LEU: 807
```

    COG input files were also provided to Scott McKinley (LLNL) and 3,366 cases have been translated into MERCURY input for additional LLNL participation in the study. Assisted Scott with Mercury translation of triangular lattices in COG.
- AM6 - Proposed 1D Multipoint Analytical Benchmark Intercomparison

- Professor Barry Ganapol is the chair of the scientific committee for the 27th International Conference on Transport Theory (ICTT27) currently scheduled to convene December 12-18, 2021, at the Conference Center of the University of Bologna in Bertinoro, Italy. For details, see https://events.unibo.it/ictt-27.

- AM8 - FUDGE Generation of a Complete ENDF/B-VIII.0 Library for Testing in Production Codes
  - FUDGE URR probability table generator tested for several ENDF-VIII.0 evaluations, now testing on full library.

PUBLICATIONS

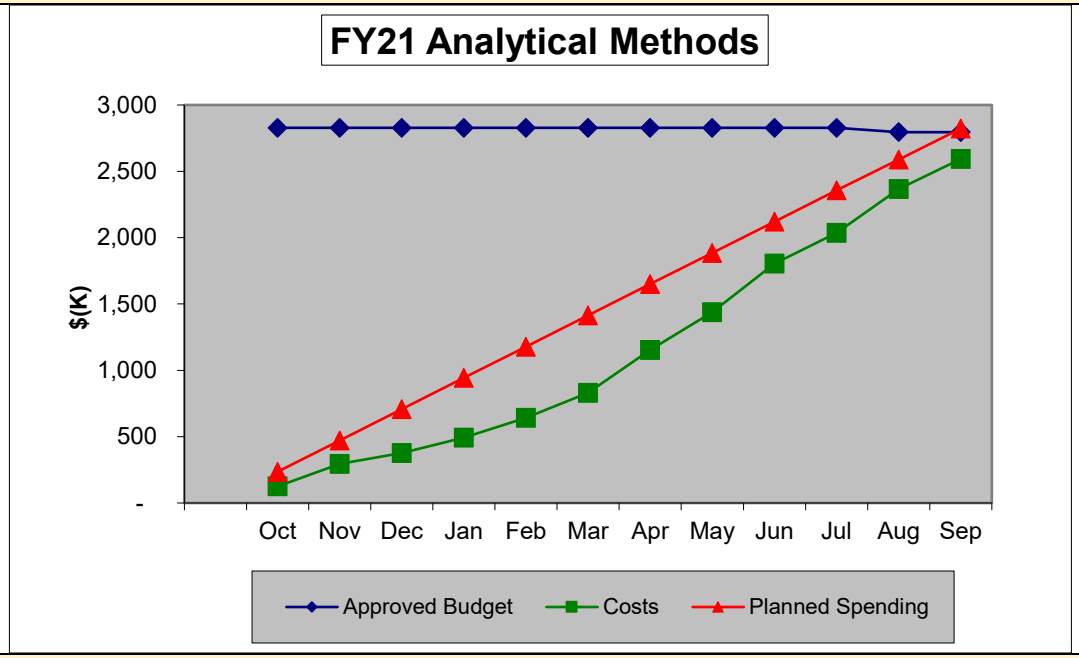
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	C. M. Mattoon, "Status of Fudge, November 30, 2020: CSEWG," LLNL-PRES-816458.	Yes	
Q1	B. Ganapol, "Solution of the Monoenergetic Neutron Transport Equation in a Half Space via Singular Eigenfunction Expansion," Transactions of the American Nuclear Society, Vol. 123, pp. 685-689, 2020 ANS Virtual Winter Meeting, November 16-19, 2020	No	Copyrighted material
Q2	D. Heinrichs et al., "LLNL Analytical Methods Update," LLNL-PRES-819569, February 22, 2021.	Yes	
	M. Vorabbi, "Alternate approach for Calculating URR PDFs," December 3, 2020.	No	To be provided by BNL.
Q3	N/A	N/A	
Q4	C. M. Mattoon et al., "Thermal Neutron Scattering Law (TNSL) Implementation and Testing in Fudge," LLNL-TR-828141, October 15, 2021.	N/A	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: AM1, 2, 3, 6, 9, 10, 15, 17 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October, 2021

BUDGET



1. Carryover into FY 2021 = $ 418K
2. Approved FY 2021 Budget = $ 2,795 (includes carryover)
3. Actual spending for 1st Quarter FY 2021 = $378K
4. Actual spending for 2nd Quarter FY 2021 = $452K
5. Actual spending for 3rd Quarter FY 2021 = $974K
6. Actual spending for 4th Quarter FY 2021 = $789K
7. Projected carryover into FY 2022 = ~$202K

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 in NCSP Quarterly Progress Reports. (AM1)		

Q1	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM2)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM3)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM6)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM9)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM10)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM11)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM15)		
Q1	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM17)		
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 in NCSP Quarterly Progress Reports. (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 ORNL activities in NCSP Quarterly Progress Report (AM2)		
Q2	Issue an annual SCALE maintenance report to the NCSP Manager. (AM2)		

Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM3)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM6)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM9)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM10)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM11)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM15)		
Q2	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM17)		
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 in NCSP Quarterly Progress Reports. (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 ORNL activities in NCSP Quarterly Progress Report (AM2)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM3)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM6)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM9)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM10)		

Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM11)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM15)		
Q3	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM17)		
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 in NCSP Quarterly Progress Reports. (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 ORNL activities in NCSP Quarterly Progress Report (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)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM3)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM6)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM9)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM10)		

Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM11)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM15)		
Q4	Provide status on ORNL activities in NCSP Quarterly Progress Report (AM17)		

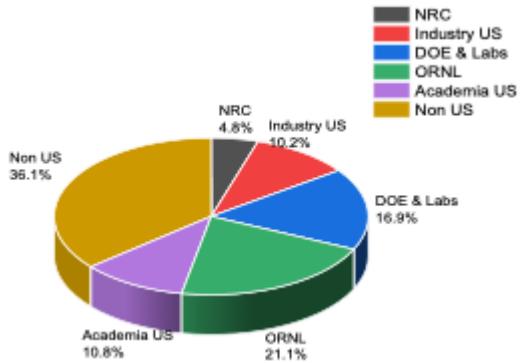
ACCOMPLISHMENTS

- AM1 - Radiation Safety Information Computational Center (RSICC)
  - Distributed 980 software packages
  - 234 SCALE, 426 MCNP®, and 0 COG package distributed.
  - RSICC quarterly report issued.
  - Quarter 1 – University Requests – 384; NCSP Direct Requests – 17
  - Quarter 2 - University Requests – 421; NCSP Direct Requests – 14
  - Quarter 3 – University Requests – 196; NCSP Direct Requests – 5
  - Quarter 4 - University Requests – 602; NCSP Direct Requests – 22
  - Note: Slightly more than half of the distributions of MCNP® and SCALE are to U.S. university students in nuclear engineering department or programs. The month of September was very busy for RSICC as the team distributed over 600 packages that included a total of 496 packages to US universities.

FY2021 University Distributions		
Month	MCNP®	SCALE
October	100	39
November	26	14
December	36	20
January	20	11
February	111	44
March	65	26
April	88	45
May	74	39
June	98	44
July	25	13
August	24	7
September	226	114
Total	893	416

- AM2 - SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section Generation/Modernization/etc.
  - Developed final benchmark feedback form for WPNCS SG-8, leading "Preservation of Expert Knowledge and Judgement Applied to Criticality Benchmarks (SG-8)" (https://code.ornl.gov/ww5/wpncs-sg8-feedback-form)

- Held 5th Annual SCALE Users' Group Workshop (August 4-6, 2021). A total of 173 participants from 94 organizations in 29 countries attended the meeting, with 138 of them external to ORNL (see Fig. 1 contributed to NCSP newsletter)



- Ported all of scalehelp@ornl.gov services to Jira Helpdesk (previous Fogbugz system no longer supported by company and could not be patched—cybersecurity risk)
- Significant Shift geometry improvements deployed in Oak Ridge Advanced Nested Geometry Engine (ORANGE)
  - designed to handle both MCNP-style surface-based geometry definitions and volume-based KENO-style geometry definitions, including "holes" which are very useful for making local geometry substitutions
  - CPU and GPU tracking support
  - Open-source component also released within Exascale Computing Project (ECP)
  - 3D geometry renders complex geometry up to 5x faster
- Corrections to AMPX and SCALE 6.3.0 bound libraries for thermal scattering
- VADER trending code development
  - Histogram and Q-Q plot for graphical normality assessment
  - Extreme value theorem methods
  - Correlated trending and non-trending methods
- TSUNAMI sensitivity analysis code developments
  - Confidence bounds for USL in TSURFER
  - Initiated subcontract with Purdue for comparison of MCNP/Whisper, SCALE/TSUNAMI, and a new Physics-based Coverage Mapping (PCM) method for bias assessment
- VALID validation suite expansion
- Continued to expand testing infrastructure. Full test suite wall time reduced from 8 hours to 4 hours. All tests on Mac, Windows, Linux must pass for developers to merge changes into the central repo. Our goal for FY22 is 1 hour turnaround time which requires 12 concurrent "testing jobs" on each of 12 virtual test machines with 16 cores each. Each testing job may represent a different platform/compiler/group of tests. Each "testing job" contains hundreds to thousands of individual tests across all modules of SCALE.
- Miscellaneous maintenance efforts for CSAS, TSUNAMI, and AMPX

- AM3 - AMPX Maintenance & Modernization

- Finalized improved angular gridding routine for more accurate TSL processing of low-temperature moderators.
- Continued work on implementing new mixed-elastic format.
- Identified and patched issues in SCALE 6.3 cross sections with threshold reactions, as well as some TSL data.
- Attended and presented at mini-CSEWG.

- AM6 – Slide Rule Application
  - Attended different meetings in the quarter to discuss the progress on the plutonium cases and to assess the discrepancies between ORNL, IRSN and LLNL results
  - ORNL and IRSN agree well for Cases 1,2, not well for cases 3,4,5. Ongoing investigation to find the reason of the discrepancies.
  - Ongoing refined analysis of specific plutonium cases, "Case 1,3,4,5: Unreflected Plutonium System with H/Pu ratio of 0 ,100,900,2000", and case 4 with different spatial discretizations (20 regions equal volume, 100 regions)
  - The next meeting will be on Thursday November 18, 2021 to discuss the results of the discrepancy investigation with other participants.

- AM9 - Sensitivity / Uncertainty Comparison Study with a Focus on Upper Subcritical Limits
  - Communication between all involved (LANL/IRSN/ORNL) on adding additional experiments and agreeing to look at IMF-002-001, LCT-001-001, LST-004-001, MCT-001-001, and UST-001-001, with summary papers/reports to be submitted/presented at ND2022 Meeting (led by IRSN) and ANS NCSD2022 Topical Meeting (led by LANL).
  - ORNL analysis on additional experiments to be finished in October, with group review of all results to follow thereafter.

- AM10 – Proposed Benchmark Intercomparison Study
  - No work done in Q4.

- AM11 – Proposed 1D Multipoint Analytical Benchmark Intercomparison
  - This task has been cancelled.

- AM15 – The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculations
  - Established evaluation of integral parameter uncertainty from coverx files produced using new temperature methods. This is done in TSUNAMI-IP and can use any sensitivity information available in ICSBEP
  - Added a user argument for Doppler width parameter used in broadening of cross section derivative with respect to resonance parameters
  - In pursuit of debugging issues with large evaluations, split up computing steps and now performing unmodified steps in stable versions of AMPX

- AM17 – Expansion of the Verified, Archived, Library of Inputs and Data (VALID)
  A significant investment has been made in using AM-2 and AM-17 funds to expand the contents of the VALID Library.
  - Over 80 deuterium-moderated benchmarks that were generated as part of Travis Greene's master's thesis were submitted for review in Q1. Review of and updates to these submissions continues.

- LCT-079 has been entered for review, and iteration and comment resolution is underway.
- KENO models of the TEX Pu baselines, PMM-002, have been generated and reviews are complete.
- Work is progressing on a number of fast Pu metal benchmarks including PMF-003, PMF-004, PMF-016, PMF-017, PMF-024, PMF-035, PMF-037, and PMF-040. Most of these benchmarks are in the review process, and some are completed.
- Updated PMF-001 models based on the recent significantly more detailed Jezebel models have been submitted and are under review.
- ZEUS models (HMI-006, HMF-072, and JMF-073) have been generated and review of these models is complete.
- A number of HEU benchmarks including HMF-002, HMF-003, HMF-004, HMF-028, HMF-084, and HMF-085 have been generated and are in various stages of the review process.
- Models for LST-007, LST-008, LST-009, LST-010, and MST-003 have been submitted and review is on-going.

Funding from the US NRC is also being leveraged to expand the VALID Library, largely focused on better coverage for LEU+/HALEU systems.

- Models are being generated for the LCT-060 evaluation. Review is expected to begin in Q4.
- The IST-002 and IST-003 evaluations have been submitted and reviews are complete.
- Models for the LCT-025 evaluation have been built and submitted. Reviews are complete.
- LCT-096 and LCT-097 (SNL experiments) have new models that have been submitted for review. Review is under way.

In summary, over 300 cases are in the process of being added to the VALID library. This represents an expansion of 50% or more over the library as it existed at the end of FY20. The more expansive set of benchmarks will be used in the SCALE 6.3 validation report.

The AM-17 funds also supported ORNL staff mentoring 4 interns from the United States Naval Academy building new benchmark models over the summer. The midshipmen generated over 350 benchmark models, and these results were used to generate a PHYSOR paper on validation of uranium-fueled systems. The paper should be presented at PHYSOR in May, 2022. Many of the models have been reviewed and a number of issues have been identified and fixed. No detailed plan currently exists to finalize reviews and add the files to VALID. These plans will be developed in FY22 with available funding in hopes of maximizing the number of these models that can be incorporated into VALID. The new models include LCT, LST, IST, HST, ICT, ICM, and ICI benchmarks.

AM-2 funds were also used periodically in FY21 to draft a new VALID procedure revision (Revision 3) to support migration from Fogbugz to GitLab for work tracking and to the GitLab repository for file management. Migration to GitLab should facilitate mirroring the internal VALID library to the external code.ornl.gov site so that external users can have on-demand open access to the repository. The new revision of the VALID procedure has been drafted, and reviews within the VALID project have started. SCALE project and ORNL QA program reviews should come early in FY22 with adoption of the revision 3 procedure following the successful completion of those reviews.

PUBLICATIONS

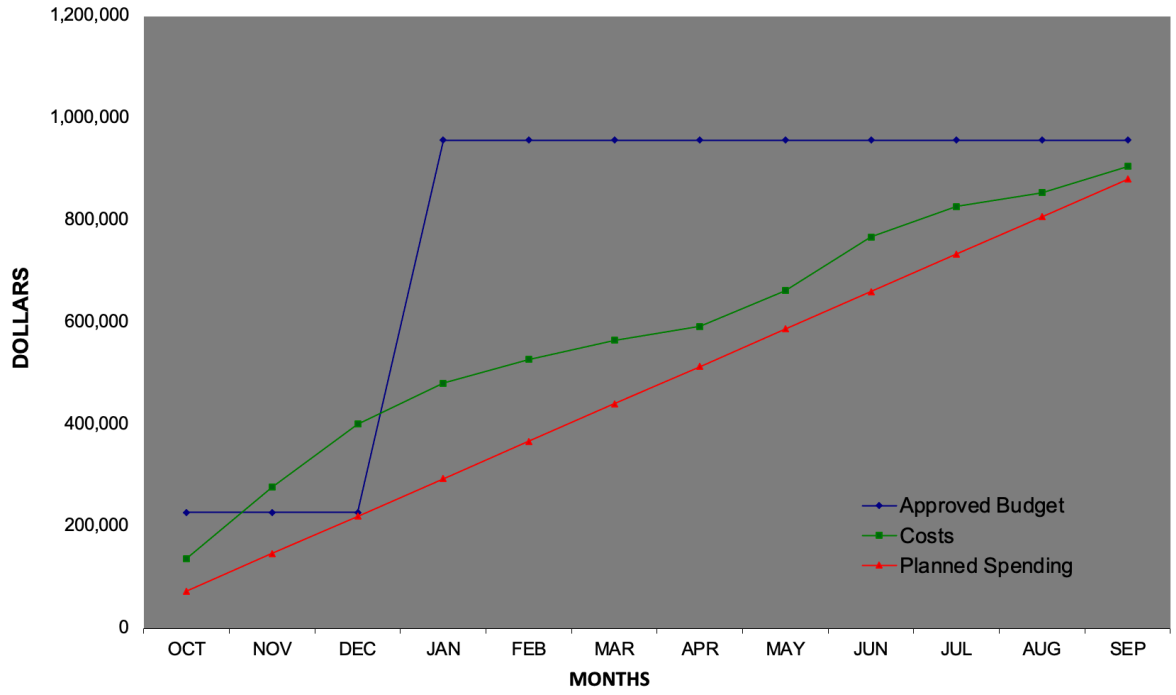
NCSP Quarterly Progress Report (FY-2021 Q4)

Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.			
Quarter	**Publication Reference** **Example:** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	**Sent to NCSP? Yes/no**	**If no, status of submittal**
Q1	Pulled from ORNL RES publication tracking system	Yes	
Q2	Pulled from ORNL RES publication tracking system	Yes	
Q3	Pulled from ORNL RES publication tracking system	Yes	
Q4	Pulled from ORNL RES publication tracking system	Yes	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: IPD1, 2, 4, 5, 6, 7 **M&O Contractor Name**: LLNL **Point of Contact Name:** David Heinrichs **Point of Contact Phone:** (925) 424-5679	**Reference:** DP0909020 **Date of Report:** October, 2021

BUDGET



1. Carryover into FY 2021 = $ 54,942
2. Approved FY 2021 Budget = $ 956,942
3. Actual spending for 1st Quarter FY 2021 = $ 400,994
4. Actual spending for 2nd Quarter FY 2021= $ 164,210
5. Actual spending for 3rd Quarter FY 2021 = $ 202,353
6. Actual spending for 4th Quarter FY 2021 = $ 138,019
7. Projected carryover into FY 2022 = $ 51,366 (5%)

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)		OECD NEA has approved the 2019 edition of the ICSBEP Handbook and plans to ship ISO files to the DVD manufacturer the week of January 11, 2021. DVDs should be available for distribution to NCSP users in late January or early February 2021.
Q1	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide a brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		
Q1	Maintain, operate, and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
Q1	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		
Q1	Provide status report on progress (IPD5)		
Q1	Provide status report on progress (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) and provide brief summary report to NCSP Manager on items of NCSP interest. (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 progress (IPD5)		
Q2	Provide status report on progress (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)		
Q3	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (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 progress (IPD5)		
Q3	Provide status report on progress (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)		2021 edition of the ICSBEP Handbook undergoing final editing.
Q4	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (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 progress (IPD5)		
Q4	Provide status report on progress (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
  - All NCSP evaluations from the 2020 ICSBEP TRG have completed final editing and are ready for publication in the 2021 edition of the Handbook.
  - NCSP evaluations in progress for the 2021 ICSBEP TRG Meetings in October 11-15 and December 13-17, 2021, are:
    - (a) IER489, U235 URR IE (LANL) – LLNL external review in progress by Norris (Sections 1-2) and Heinrichs (Sections 3-4). Five independent COG detailed models and five simplified models were completed this quarter. The detailed model results have been provided to the evaluator (J. Favorite) and the simplified model results will be available next quarter.
    - (b) IER297, TEX-HEU Baselines (LLNL) – NNL external review in progress by Zerkle.
    - (c) Graphite Slowing Down Benchmark (NCSU) – LLNL external review in progress by Heinrichs.
    - (d) HPRR Sulfur Fluence Benchmark (ORNL) – LLNL external review in progress by Heinrichs.
  - Non-NCSP evaluations in progress include:
    - (e) LCT110 – MIRTE arrays in copper and steel sleeves in water or in an aluminum block – LLNL external review comments provided by Heinrichs including development of six independent benchmark models in COG. High precision results will be available next quarter.
    - (f) FNG Cu Block (14 MeV neutron deep penetration SINBAD benchmark) – external review in progress by Haverkamp (NNL) and Heinrichs.
    - (g) Rež Cf-252 Cu Block transmission benchmarks – external review comments completed by Heinrichs including independent confirmatory COG benchmark model results.
  - The NCSP evaluation, IER441, 7uPCX with Tantalum Rods (SNL), is deferred to 2022.
- IPD2 - Maintain the NCSP Website and Systems
  - Maintained https://ncsp.llnl.gov updating documents, links, calendars, taskings, newsletters, photos/portraits, and created art for/updated banners.
  - Maintained list of email subscribers for the different "group" emails used by the NCSP Management Team.
  - Ran and provided analytics reports on site traffic to the NCSP Management Team.
  - Added and updated available T&E courses and foreign trip reports.
  - Converting the site to the Drupal platform. This will help with accessibility, 504 compliance, site navigation, and "spam bot" with forms.
  - Updated contacts information and portraits.
- IPD4 - Benchmark Evaluation of Hot Box, LLNL Historical Critical Configurations at High Temperature
  - A summary of progress to date was presented in LLNL-PRES-819574, page 10, at the NCSP TPR on Feb. 23, 2021.
- IPD5 - IT Support at NNSS

- Supported NCERC with equipment inspections and approvals including: NCERC Consortia Measurements (IER 543), NCERC RTO CA (IER 554), and NCERC Crown Jewels (IER 553).
- Provided OISSO and ISSO support for Nevada IT including required weekly NTS-SLAN/NCERC system updates, monthly "authenticated" scans for NCERC network devices, and system upgrades as required. Renewed NTS-SLAN accounts. Submitted NTS-SLAN Contingency Test to OCIO.

- IPD6 - Benchmark Evaluation of LLNL 'Pulsed Spheres'
  - A SINBAD evaluation is in preparation as described in LLNL-ABS-820246, "Evaluation of Polyethylene and Blank Pulsed Sphere Experiments Using Deuteron Transport Feature in COG," submitted to the ANS Winter Meeting, November 30 – December 4, 2021, Washington, DC.
- IPD7 - LLNL - NDA Website Support
  - Maintained https://nda.llnl.gov and made minor updates.

PUBLICATIONS

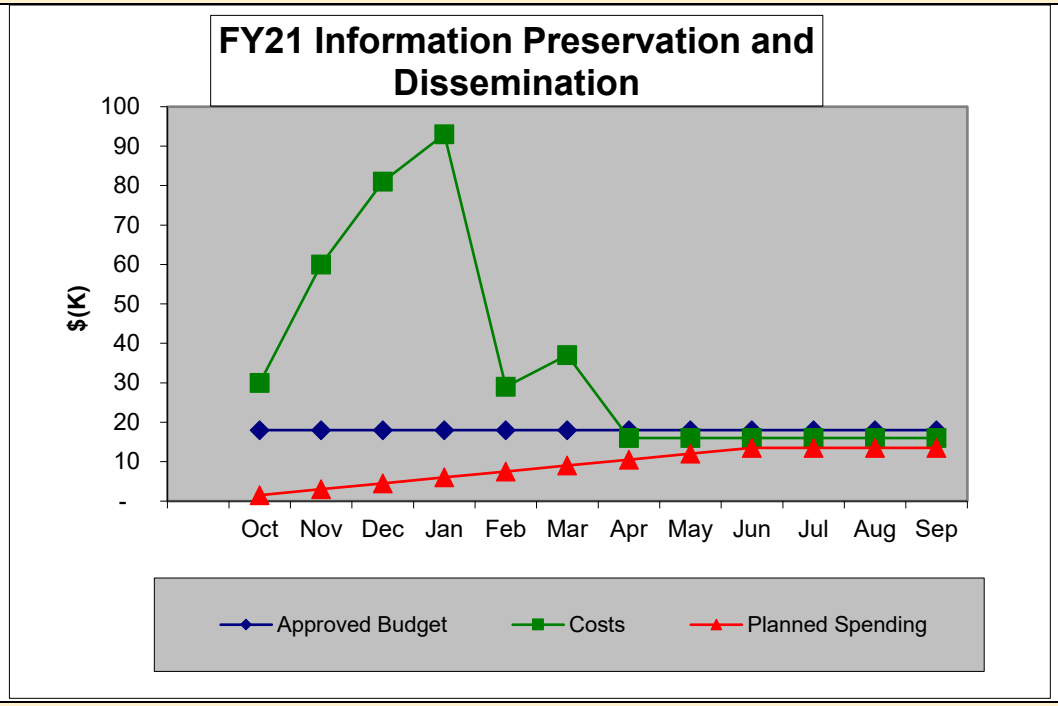
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Soon S. Kim et al., "Application of COG to Deuteron Transport Problems," Transactions of the American Nuclear Society, Vol. 123, pp. 1189-1191, ANS Virtual Winter Meeting, November 16-19, 2020.	No	Copyrighted material.
	David P. Heinrichs, "Report on the (on-line) 2020 ICSBEP Technical Review Group (WebEx) Meeting," LLNL-MI-816976, October 31, 2020.	Yes	
Q2	Dave Heinrichs, "LLNL Task Highlights and Budget," LLNL-PRES-819574, February 23-24, 2021.	Yes	
	Soon S. Kim et al., "Evaluation of Polyethylene and Blank Pulsed Sphere Experiments Using Deuteron Transport Feature in COG," LLNL-ABS-820246, March 5, 2021.	Yes	
Q3	N/A	N/A	
Q4	N/A	N/A	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: IPD5, 7 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $ -8K
2. Approved FY 2021 Budget = $18K (includes carryover)
3. Actual spending for 1st Quarter FY 2021 = $81K
4. Actual spending for 2nd Quarter FY 2021 = $-44K (Negative due to cost corrections for HPRR benchmark work)
5. Actual spending for 3rd Quarter FY 2021 = $-21K
6. Actual spending for 4th Quarter FY 2021 = $0k
7. Projected carryover into FY 2022 = ~$1.7K

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 progress made. (IPD5)		
Q1	Provide a status report on progress made. (IPD7)		

Q2	Provide a status report on progress made. (IPD5)		
Q2	Provide a status report on progress made. (IPD7)		
Q3	Provide a status report on progress made. (IPD5)		
Q3	Provide a status report on progress made. (IPD7)		
Q4	Provide a status report on progress made. (IPD5)		
Q4	Provide a status report on progress made. (IPD7)		

ACCOMPLISHMENTS

- IPD5 – Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation
  - An ICSBEP evaluation for this work has been submitted by Mathieu Dupont for the October 11, 2021 ICSBEP TRP for review and comment.
- IPD7 - Preserving the "Howard Dyer" Library at ORNL
  - This task is complete. Ready to work with OSTI to add to the NCSP repository next year.

PUBLICATIONS

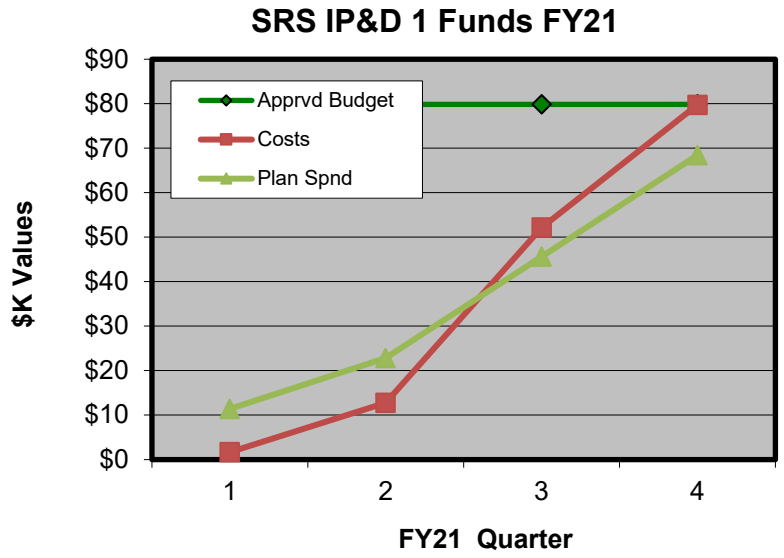
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference **example)** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	None		
Q2	None		
Q3	None		
Q4	None		

NCSP Quarterly Progress Report (FY-2021 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:** DP09090100 **Date of Report:** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $79.8K
2. Approved FY 2021 Budget = $ 0K
3. Actual spending for 1st Quarter FY 2021 = $1.7K
4. Actual spending for 2nd Quarter FY 2021 = $11.1K
5. Actual spending for 3rd Quarter FY 2021 = $39.4K
6. Actual spending for 4th Quarter FY 2021 = $27.6K
7. Projected carryover into FY 2022 = $0

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 SRS progress with CritView. (IPD1)		
Q1	NCSP Approved Scope for FY21. (IPD1)		Did not complete in Q1. In Q2 the scope was defined and approved.
Q2	Provide status reports on SRS progress with CritView. (IPD1)		

Q2	TBD based on Approved Scope. (IPD1)		Identified two interns to support FY-21 activities.
Q3	Provide status reports on SRS progress with CritView. (IPD1)		Per the approved FY-21 scope, curves from LA-10860 have been digitized and parametric calculations with SCALE are in progress.
Q3	TBD based on Approved Scope. (IPD1)		Interns are working to complete approved scope. At this stage it looks like they should about wrap up their tasks by the end of July. Effort has begun on updating the database.
Q4	Provide status reports on SRS progress with CritView. (IPD1)		Inters completed all assigned tasks. Database has been updated and documents written describing what was accomplished.
Q4	Provide updated CritView database for user testing. (IPD1)		While the database is mostly complete, there are a few more adjustments that need to be made. Also, the corresponding document, while drafted, is still in the review/approval stage. These documents should be issued in FY22 Q1.

ACCOMPLISHMENTS

- IPD1 – ARH-600 Reissue (CritView)
  See Q4 status, above.

PUBLICATIONS

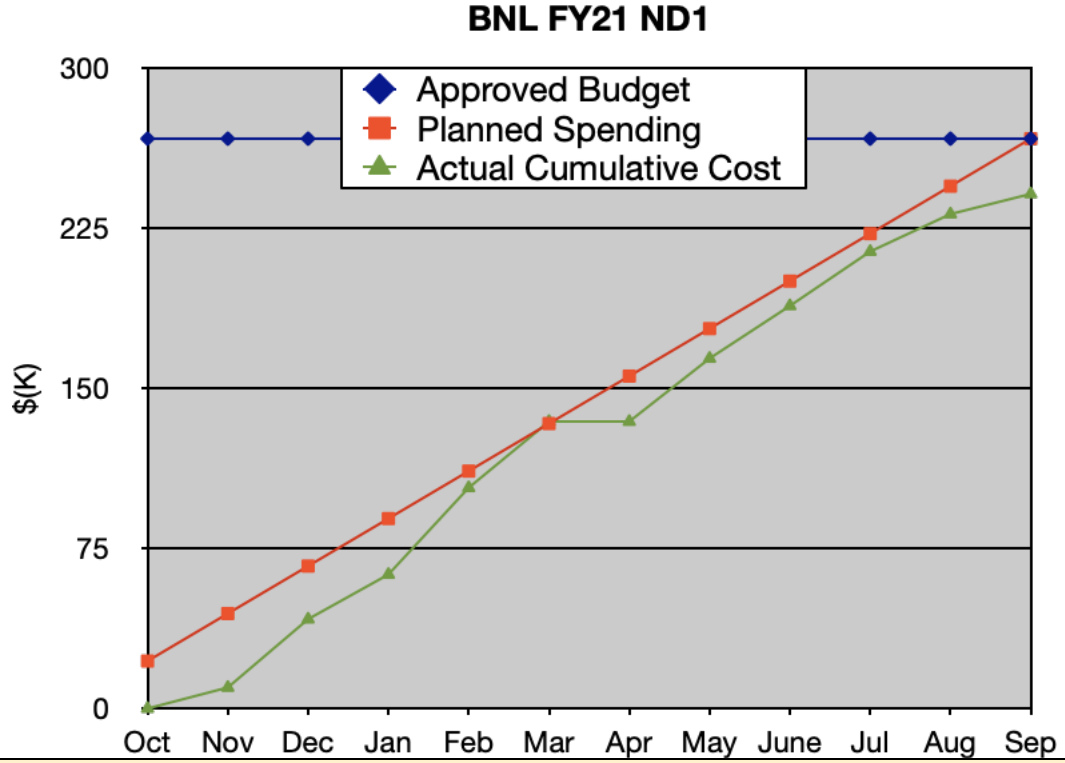
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference **example)** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	N/A		
Q2	N/A		
Q3	N/A		
Q4	N/A		

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: ND1 **M&O Contractor Name**: BNL **Point of Contact Name:** David Brown **Point of Contact Phone:** 631-344-2814	**Reference:** DP0909020 **Date of Report:** 20 Oct. 2021

BUDGET



1. Carryover into FY 2021 = $ 13,325
2. Approved FY 2021 Budget = $ 267,000
3. Actual spending for 1st Quarter FY 2021 = $42,871
4. Actual spending for 2nd Quarter FY 2021 = $92,602
5. Actual spending for 3rd Quarter FY 2021 = $54,186
6. Actual spending for 4th Quarter FY 2021 = $52,459
7. Projected carryover into FY 2022 = $39,207

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 and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		CSEWG is deciding on a review process for all ENDF evaluations. Currently, all submitted evaluations are stored in the `phase1' branch and this branch is checked by ADVANCE. To move to the `phase2' branch for integral validation, evaluations must pass through an as-yet-undefined peer review process. We had planned to work this

			process out at the 2020 mini-CSEWG which was postponed due to COVID-19.
Q1	If mandated by CSEWG, release new ENDF library. (ND1)		Release of a beta version of the next ENDF library (ENDF/B-VIII.1) was discussed and approved by the CSEWG Executive Committee. A timeline for this beta release has not been decided. CSEWG has set a target date of February 2023 for the final release of ENDF/B-VIII.1.
Q2	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		Working on updating ADVANCE to use latest FUDGE and NJOY21. Addition of A. Cuadra and A. Varuttamaseni to project will temporarily slow updates as they come up to speed.
Q2	If mandated by CSEWG, release new ENDF library. (ND1)		No change since last quarter
Q3	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		A change to BNL cybersecurity posture is forcing a change to the communication between ADVANCE and the NNDC gitlab server. We hope to have this resolved by mini-CSEWG, to be held Aug. 16-19, 2021. We have upgraded our gitlab server to GitLab Premium edition to accommodate the needed cybersecurity changes.
Q3	If mandated by CSEWG, release new ENDF library. (ND1)		No change since last quarter
Q4	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		No change since last quarter
Q4	If mandated by CSEWG, release new ENDF library. (ND1)		No change since last quarter

ACCOMPLISHMENTS

- ND1 - National Nuclear Data Center (NNDC) Support to the NCSP
  - Mini-CSEWG Meeting was held 16-19 August 2021 (virtually). This meeting took place over 4 days with 8 sessions and 94 registered attendees. This meeting covered the planned implementation of DOI's for ENDF files, plans for an ENDF evaluation peer review system, summaries of new evaluations, development of benchmarks for TSL data and a discussion of cross section adjustment.

PUBLICATIONS

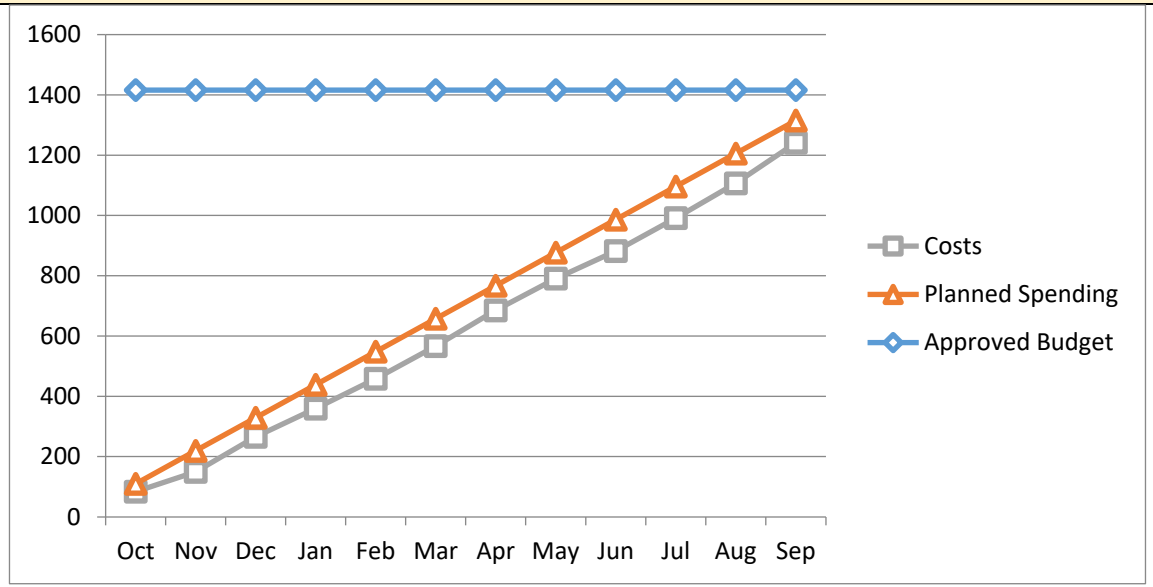
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

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

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: ND1, 2, 3, 4 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda/Bob Little **Point of Contact Phone:** 505-667-2812/505-665-3487	**Reference:** DP0909020 **Date of Report:** October 21, 2021

BUDGET



1. Carryover into FY 2021 = $ 30,000.00
2. Approved FY 2021 Budget = $ 1,386,000.00
3. Actual spending for 1st Quarter FY 2021 = $265,680
4. Actual spending for 2nd Quarter FY 2021 = $301,006
5. Actual spending for 3rd Quarter FY 2021 = $315,272
6. Actual spending for 4th Quarter FY 2021 = $359,317 (YTD = $1,241,274.51)
7. Projected carryover into FY 2022 = $0

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 LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q1	Conduct CSEWG Evaluation and Covariance sessions. (ND1)		
Q1	Report data testing results with ENDF/B-VIII.0 and additional beta release cross sections at CSEWG. (ND1)		

NCSP Quarterly Progress Report (FY-2021 Q4)

Q1	Provide status report on progress (ND2)		
Q1	Provide status report on progress (ND3)		
Q1	Complete review of previous “thin” target U233 measurements and finalize specifications for new “thick” U233 target (ND3)		Completed early during FY20 – see Q3 ND report.
Q1	Provide status report on progress (ND4)		
Q2	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q2	Provide status report on progress (ND2)		
Q2	Provide status report on progress (ND3)		
Q2	Provide status report on progress (ND4)		
Q3	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q3	Provide status report on progress (ND2)		
Q3	Provide status report on progress (ND3)		
Q3	Complete fabrication of new “thick” U233 target (ND3)		Completed early – see Q1 ND report.
Q3	Provide status report on progress (ND4)		
Q4	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q4	Deliver nuclear data evaluations as indicated in Appendix B of the Five Year plan. (ND1)		
Q4	Provide status report on progress (ND2)		
Q4	Start taking Pu240 PFNS data (ND2)		Delayed due to late delivery of Pu240 PPAC from LLNL, a result of Covid.

Q4	Provide status report on progress (ND3)		
Q4	Acquire initial U233 thick-target data (ND3)		
Q4	Provide status report on progress (ND4)		
Q4	Finalize the analysis, submit the results for publication, and make the data available to IRSN and EXFOR. (ND4)		

ACCOMPLISHMENTS

- ND1 – Nuclear Data Evaluation and Testing
  - Light nuclei:
    - Light-element work has been focused almost exclusively on the 17O (n+16O) system with some checking and review of the 7Li system fit.
    - 17O system (n + 16O)
      - Comprehensive review of available integrated and differential (unpolarized and polarized) data in the region 0< En < 15 MeV including new (2021) data from Notre Dame, Ohio University and LUNA
        - 16O(n,tot); 16O(n,el); 16O(n,alpha_0); 16O(n,inl)
        - 13C(alpha,el); 13C(alpha,n0); 13C(alpha, nx)
      - Preliminary fit complete to 0 < En < 7.5 MeV (ENDF/B-VIII.0 goes to 7.0 MeV)
    - 7Li system (n + 6Li)
      - Graphical rendering (using ENDFtk and NVIZ codes) of the 7Li system fit and data
  - Actinide Fission Evaluations:
    - Fission Cross Sections
      - Our Q4 fission cross section milestones were completed and documented in the Q3 Progress Report
    - Fission Nu-bar
      - We were able to show that we can produce ENDF/B-quality nu-bar data with CGMF. We did from scratch an evaluation of the Pu-239(n,f) nu-bar using CGMF. This evaluation is being considered as a candidate for ENDF/B-VIII.1. The U-235(n,f) nu-bar evaluation is close to be finished. This was documented in D. Neudecker, A. Lovell, P. Talou: "Producing ENDF/B-quality Evaluations of 239Pu(n,f) and 235U(n,f) Average Prompt Neutron Multiplicities using the CGMF Model," LA-UR-21-29906 (2021).
    - Fission Neutron Spectrum (PFNS)
      - Significant work was also done to improve the predictive power of CGMF for the PFNS and a first evaluation of the U-235(n,f) PFNS induced by thermal neutrons was undertaken. We are preparing a report on this: A. Lovell, D. Neudecker: "Correcting the PFNS for more consistent fission modeling," to be finalized in FY22 Q1.
      - We performed a first-pass Kalman filter optimization for the CGMF PFNS to experimental data for U235 at thermal; the Kalman filter results showed a hardening in the tail due to a combination of parameters for Y(A), TKE, and the spin

distribution. The parameters still need to be run through CGMF and compared to the Kalman filter results, but parameter changes are mostly within 5% of the baseline values. These results will also be included in the report mentioned in the previous bullet.

- Consistent Modeling of Three Fission Observables (Nu-bar, PFNS, FY Distribution)
  - BeoH was updated to calculate all three observables consistently up to 20 MeV (Lovell, et al., PRC 103, 014615 (2021)) and optimization is underway starting with first-chance fission (Okumura, et al., accepted by JNST, LA-UR-21-20820); more targeted optimization for the FY's is being performed, leveraging NA-22 funding.
  - This work included results described in a paper on PFNS improvements with BeoH (Kawano, et al., PRC 104, 014611 (2021)) due to Y(A), spin of the discrete levels, and width of the spin distribution.
  - A comparison between CGMF and BeoH was performed for the prompt fission observables in the first-chance energy range, to ensure that we can connect the input space of both - and correlations in CGMF to the delayed observables from BeoH.
- Additional Reports, Publications, and Presentations:
  - D. Neudecker, A. Lovell: "239Pu(n,f) Neutron Multiplicity Evaluation with CGMF-Very First Release Candidate," LA-UR-21-26869 (2021).
  - D. Neudecker et al.: "Informing nuclear physics via machine learning methods with differential and integral experiments," Phys. Rev. C 104, 034611 (2021). <https://doi.org/10.1103/PhysRevC.104.034611>
  - D. Neudecker, M. Mumpower: "Proposed updates for the 239Pu file in the fast range," LA-UR-21-28115 (2021), presented at mini-CSEWG.
  - D. Neudecker: "Which nuclear data can be validated with LLNL pulsed-sphere experiments?" LA-UR-21-25334 (2021), presented at WPEC SG-47 on June 16, 2021.

- Ta181 evaluation
  - Evaluation of Ta181 in the fast neutron range was provisionally merged with the resolved resonance and unresolved resonance ranges recently evaluated by ORNL/RPI/KAPL in the framework of the NCSP. Although the two evaluation match each other within 2% at the end of the unresolved resonance range we are working with ORNL/RPI/KAPL evaluators to produce the most consistent file. Meantime the provisional version has been tested with the CRATER/FAUST code against the PMF-045 series of benchmarks. Generally, the reactivity has been lowered by 50 to 90 pcm. This benefitted 6 out of 7 benchmarks which were considerably improved. Only the first PMF-045-001 benchmark, which was already under calculated by 388 pcm got worse. Work on the more Ta181-sensitive TEX benchmarks is scheduled.
- Np237
  - For a number of years, Appendix B of the NCSP 5-year plan has carried an out-year placeholder for Np-237 measurements (focus on fission) at LANSCE. To complete a FY21 milestone, the Los Alamos theory and experimental communities discussed the value, relative to existing data, of such a measurement. The consensus is that while additional data is always useful, we should wait for a detector under development to mature and demonstrate capability. In particular, the Spatially Resolved Fission Tracker TPC (SREFT TPC) is intended to be a smaller, cheaper, easier detector v/v the current TPC instrument.

- ND2 – Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240

- As described in the LLNL progress report, the 240Pu PPAC was completed and shipped to Los Alamos. It arrived at LANSCE in mid-September. The total 240Pu content of the PPAC is about 18 mg, slightly less than the 20-25 mg we hoped for.
- Late in September, a major item of equipment at LANSCE suffered an irreparable failure. A transformer that fed electrical power to the injector region of the accelerator failed, and without that power, the accelerator cannot operate.
  - Prior to the transformer failure, the PPAC had been installed in the Chi-Nu liquid scintillator array in order to measure the neutron-induced Prompt Fission Neutron Spectrum. As the in-beam measurement was then delayed, we have begun a measurement of the spontaneous fission PFNS, which is not well-measured and is needed as a background to the eventual in-beam PFNS measurement.
  - As of the time of this report, beam is back on at LANSCE, and schedules for various experiments are being re-assessed. The possibility of extending the current run cycle is also under discussion. We are hopeful, but not 100% guaranteed, of getting sufficient beam time during the current run cycle to gather all data required.

- ND3 – Unresolved and Fast Measurements of U233 (n, gamma)
  - Production Experiment
    - The production measurement was performed over 10 days during June / July 2021 with the 20 mg sample, and the 10 mg sample was placed in the beam for 1 day. The rest of the beam time was used to measure radioactive γ sources for energy calibration, and for background measurements and tests to define the 233U windows required during the data taking.
  - Data Analysis
    - After calibrating the DANCE and NEUANCE detectors for this new measurement, the analysis code has been modified to search for coincidences between the DANCE and NEUANCE channels. First, a time window of 5ns has been used to look for γ coincidences between the DANCE crystals to identify γ cascades. Then, a time window of 25ns has been used to look for coincidences between the γ's from DANCE and the neutrons from NEUANCE. The events from DANCE found in coincidence with NEUANCE have been tagged as fission events and the rest of the DANCE events have been left untagged. The purpose of tagging is to define the shape of the fission γ-ray spectrum that can be subtracted from the untagged spectrum.
  - Next steps
    - The fission tagging efficiency will be improved for final analysis. The data analysis will continue in FY22.
- ND4 – 95-Mo Neutron Capture and Transmission Measurements
  - A paper ("Improved 95Mo neutron resonance parameters" by P. E. Koehler, LA-UR-21-28567) describing the results of this work was submitted to Phys. Rev. C. Also, the data and SAMMY files were transmitted to Luiz Leal (IRSN) during September.

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

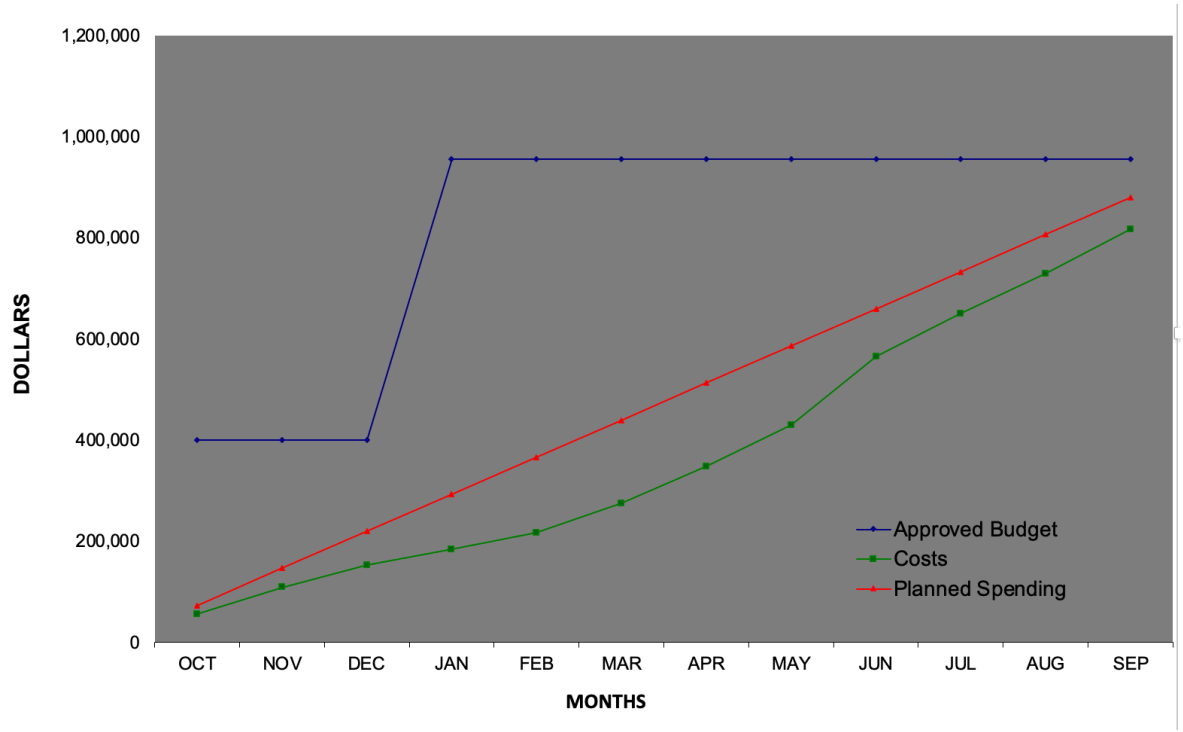
Q1	"Which nuclear data can be validated with LLNL pulsed-sphere experiments?", Denise Neudecker, Oscar Cabellos, Alexander R. Clark, Wim Haeck, Robert Capote, Andrej Trkov, Morgan C. White, and Michael E. Rising, submitted to Annals of Nuclear Energy, 2021, LA-UR-20-28636.	Yes – will send.	
Q1	J.L. Alwin, F.B. Brown, W. Haeck, M.E. Rising, K.D. Spencer, "Procedure for Creating, Reviewing, & Submitting Input Files into Benchmark Library", LA-UR-20-29183	Yes - will send.	
Q1	W. Haeck, K.Y. Spencer, J.L. Alwin, "Benched: Upgrading and Updating the Los Alamos Benchmark Suite for the 21st Century", ANS Winter Meeting, LA-UR-20-29471, LA-UR-20-24777.	Yes – will send.	
Q1	P.A. Grechanuk, M.E. Rising, T.S. Palmer, "Application of Machine Learning to Identify Problematic Nuclear Data", to be submitted to *Nucl. Sci. Eng*. (2021).	No – will send in Q2.	Sent with Q2 report.
Q1	Amy Lovell, "Towards a Consistent Evaluation of Fission Observables: Status, Challenges, and Plans for Consistent Modeling and Evaluation of Fission Data: Nubar, PFNS, and FPY," presented at NDAG, LA-UR-20-29811.	Yes - will send.	
Q1	Denise Neudecker, "Additional information to CSEWG talk on Average Prompt-fission Neutron Multiplicity and PFNS Evaluations for 239Pu, "LA-UR-20-29720.	Yes - will send	
Q2	Mark Paris & Gerry Hale, "EDA R-Matrix Evaluations, Report on n+9Be, n+16O," International Nuclear Data Evaluation Network on Light Elements (INDEN-LE), online meeting hosted by the IAEA, 3/17/21.	Yes	
Q2	T. Kawano, S. Okumura, A. E. Lovell, I. Stetcu, and P. Talou, "Influence of non-statistical properties in nuclear structure on emission of prompt fission neutrons", arXiv:2104.00879 [nucl-th] (2021). Submitted to Phys. Rev. C. (https://arxiv.org/pdf/2104.00879).	Yes	
Q2	"Which nuclear data can be validated with LLNL pulsed-sphere experiments?", Denise Neudecker, Oscar Cabellos, Alexander R. Clark, Wim Haeck, Robert Capote, Andrej Trkov, Morgan C. White, and Michael E. Rising, Annals of Nuclear Energy, 2021 (First revised version).	Yes	
Q2	"Optimal Experiment Design and Nuclear Data Validation with Diverse Benchmarks," Alex Clark, presented at TPR.	TPR – You have	
Q2	"Towards a Consistent Evaluation of Fission Observables," Amy Lovell, presented at TPR.	TPR – You have	
Q2	"Evaluations of the 239Pu fission source term," Denise Neudecker, presented at TPR.	TPR – You have	
Q2	"Measurements of 233U(n,g) with DANCE," Esther Leal Cidoncha, presented at TPR.	TPR – You have	
Q2	"LANL Evaluation Progress in FY 2020," Ionel Stetcu and Mark Paris, presented at TPR.	TPR – You have	
Q2	"R-Matrix Evaluation and Benchmarking of n+^{9}Be," Mark Paris, presented at NDAG during TPR week.	TPR – You have	
Q2	"EMPIRE-3.2 Nuclear Reaction Code System," Mike Herman, presented at WANDA 2021.	Yes	

Q2	"HPC for Fission Modeling in Support of Nuclear Data," Ionel Stetcu, presented at WANDA 2021.	Yes	
Q2	"Example on how to (intelligently) augment the nuclear-data pipeline with machine learning," Denise Neudecker, presented at WANDA 2021.	Yes	
Q2	"Evaluation of Energy Dependent Fission Product Yields," Toshihiko Kawano, presented at WANDA 2021.	Yes	
Q3	"Including 238U(n,f)/235U(n,f) and 239Pu(n,f)/235U(n,f) NIFFTE fissionTPC Cross-sections into the Neutron Data Standards Database," Denise Neudecker, Vladimir G. Pronyaev, and Luke Snyder, LA-UR-21-24093.	Yes	
Q4	D. Neudecker, A. Lovell, P. Talou: "Producing ENDF/B-quality Evaluations of 239Pu(n,f) and 235U(n,f) Average Prompt Neutron Multiplicities using the CGMF Model," LA-UR-21-29906 (2021).	Yes	
Q4	Lovell, et al., "Extension of the Hauser-Feshbach fission fragment decay model to multichance fission," PRC 103, 014615 (2021).	Yes	
Q4	Okumura, et al., "Energy Dependent Calculations of Fission Product, Prompt, and Delayed Neutron Yields for Neutron Induced Fission on 235U, 238U, and 239Pu," accepted by JNST, LA-UR-21-20820.	Yes	
Q4	Kawano, et al., "Influence of nonstatistical properties in nuclear structure on emission of prompt fission neutrons," PRC 104, 014611 (2021).	Yes	
Q4	D. Neudecker, A. Lovell: "239Pu(n,f) Neutron Multiplicity Evaluation with CGMF-Very First Release Candidate," LA-UR-21-26869 (2021).	Yes	
Q4	D. Neudecker et al.: "Informing nuclear physics via machine learning methods with differential and integral experiments," Phys. Rev. C 104, 034611 (2021). <https://doi.org/10.1103/PhysRevC.104.034611>	Yes	
Q4	D. Neudecker, M. Mumpower: "Proposed updates for the 239Pu file in the fast range," LA-UR-21-28115 (2021), presented at mini-CSEWG.	Yes	
Q4	D. Neudecker: "Which nuclear data can be validated with LLNL pulsed-sphere experiments," LA-UR-21-25334 (2021), presented at WPEC SG-47 on June 16, 2021.	Yes	
Q4	"Improved 95Mo neutron resonance parameters" by P. E. Koehler, LA-UR-21-28567, submitted to Phys. Rev. C.	Yes	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: ND1a, 1b, 2, 3, 5, 6, 7, 8, 9, 10, 11 **M&O Contractor Name**: LLNL **Point of Contact Name:** David Heinrichs **Point of Contact Phone:** (925) 424-5679	**Reference:** DP0909020 **Date of Report:** October, 2021

BUDGET



1. Carryover into FY 2021 = $ 268,257
2. Approved FY 2021 Budget = $ 956,257
3. Actual spending for 1st Quarter FY 2021 = $ 153,005
4. Actual spending for 2nd Quarter FY 2021= $ 122,912
5. Actual spending for 3rd Quarter FY 2021 = $ 290,288
6. Actual spending for 4th Quarter FY 2021 = $ 251,204
7. Projected carryover into FY 2022 = $ 138,848 (14%)

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 nuclear data activities to NCSP Manager (ND1a, 1b)		On hold pending restart of Criticality Slide Rule project for plutonium systems

Q1	Provide status on nuclear data activities to NCSP Manager (ND2)		
Q1	Provide status on nuclear data activities to NCSP Manager (ND3)		
Q1	Provide status on nuclear data activities to NCSP Manager (ND5)		
Q1	Provide status on nuclear data activities to NCSP Manager (ND6)		Task complete.
Q1	Provide status on nuclear data activities to NCSP Manager (ND7)		
Q1	Provide status on nuclear data activities to NCSP manager (ND8)		
Q1	Provide status on nuclear data activities to NCSP manager (ND9)		
Q1	Provide status on nuclear activities to NCSP manager (ND10)		
Q1	Provide status report PPAC target fabrication progress (ND11)		
Q1	Fabricate the Pu240 PPAC targets and fission detector components (ND11)		
Q2	Provide status on nuclear data activities to NCSP Manager (ND1a, 1b)		
Q2	Provide status on nuclear data activities to NCSP Manager (ND2)		
Q2	Provide status on nuclear data activities to NCSP Manager (ND3)		
Q2	Provide status on nuclear data activities to NCSP Manager (ND5)		
Q2	Provide status on nuclear data activities to NCSP Manager (ND6)		Task complete.
Q2	Provide status on nuclear data activities to NCSP Manager (ND7)		
Q2	Provide status on nuclear data activities to NCSP manager (ND8)		

Q2	Provide status on nuclear data activities to NCSP manager (ND9)		
Q2	Provide status on nuclear data activities to NCSP manager (ND10)		
Q2	Provide status report PPAC target fabrication progress (ND11)		
Q2	Assemble and test the Pu240 fission detector (ND11)		Task delayed – see accomplishments.
Q3	Provide status on nuclear data activities to NCSP Manager (ND1a, 1b)		
Q3	Provide status on nuclear data activities to NCSP Manager (ND2)		
Q3	Provide status on nuclear data activities to NCSP Manager (ND3)		
Q3	Provide status on nuclear data activities to NCSP Manager (ND5)		
Q3	Provide status on nuclear data activities to NCSP Manager (ND6)		
Q3	Provide status on nuclear data activities to NCSP Manager (ND7)		
Q3	Provide status on nuclear data activities to NCSP manager (ND8)		
Q3	Provide status on nuclear data activities to NCSP manager (ND9)		
Q3	Provide status on nuclear data activities to NCSP manager (ND10)		
Q3	Provide status report PPAC target fabrication progress (ND11)		Task delayed – see accomplishments.
Q4	Provide status on nuclear data activities to NCSP Manager (ND1a, 1b)		
Q4	Provide status on nuclear data activities to NCSP Manager (ND2)		
Q4	Deliver thermal neutron scattering data evaluations as indicated in Appendix B of the 5-Year Plan. (ND2)		

Q4	Provide status on nuclear data activities to NCSP Manager (ND3)		
Q4	Provide status on nuclear data activities to NCSP Manager (ND5)		
Q4	Provide status on nuclear data activities to NCSP Manager (ND6)		
Q4	Provide status on nuclear data activities to NCSP Manager (ND7)		
Q4	Provide status on nuclear data activities to NCSP manager (ND8)		
Q4	Provide status on nuclear data activities to NCSP manager (ND9)		
Q4	Provide status on nuclear data activities to NCSP manager (ND10)		
Q4	Provide status report PPAC target fabrication progress (ND11)		PPAC target fabrication and testing was completed in August 2021. PPAC received at LANL on September 15, 2021.
Q4	Provide an update on the development and testing of NeTS modules for selected materials such as light water, graphite, etc. (ND10)		

ACCOMPLISHMENTS

- ND1 - Delayed Fission Gamma Multiplicity and Spectra
  - COG Pu DFG multiplicity, spectra and dose calculations were discussed and compared to IRSN (VESTA), CCFE (FISPACT-II) and ORNL (ORIGEN) “source term” calculations. COG is in excellent agreement with MCNP/FISPACT-II and MCNP/VESTA.
- ND2 - Generation and Benchmarking of Thermal Neutron Scattering Cross Sections in Support of Advanced Nuclear Reactor Concepts
  - NCSU completed TSL evaluations for uranium metal and calcium hydride. The evaluations are in the process of being submitted to NNDC for inclusion in the ENDF/B-VIII TSL database.
- ND3 - Development and Implementation of an Advanced and Rigorous Computational Platform for Thermal Neutron Scattering Analysis
  - NCSU continued updating the FLASSH code based on the feedback of various users. Advanced features have been completed and included in the code that remove all major approximations such as the incoherent assumption. In addition, ACE capability has been completed and is currently being tested using the TSL data of various materials. The GUI has been modified to include the new modifications. Currently, work is ongoing to investigate adding a Doppler capability to FLASSH based on the outcomes of the ND5 task.
- ND5 - Development and Implementation of a Modern Doppler Broadening Approach Including Atomic Binding Effects
  - NCSU continued the development of the utilization of the TSL in Doppler broadening. The test material, uranium metal, has been converted for modeling using ab initio MD. This proved to be. Testing using this TSL is underway and shows significant improvement when broadening is performed using the TSL vs the free gas model. The data also shows that using the TSL in broadening may motivate reevaluating the parameters for a given resonance.
- ND6 - Evaluate Neutron Radiative Capture Gamma Production in Cadmium

- This task is complete as reported in the Q2 QPR.
- ND7 - 'Alpha-N' Benchmark Measurements
  - The first measurement of a Am-Be source was completed in the low scatter LLNL B255 Calibration Facility. Analysis of these results are in progress and appear very promising. The LLNL institution is investing in expanding the hnTOF scintillator array for improved statistics and finer energy resolution. Procurements of all components except the scintillators were initiated late in this quarter.
- ND8 - Study: Fission TPC Measurement of the U-233/U-235 (n,f) Cross Section Ratio
  - If additional funding is available, LLNL estimates U-233/U-235 target fabrication to cost $60,000 and is ready to begin. Pu-239/U-235 "Fission TPC cross section ratio results," are summarized in INDC(NDS)-0820, "Neutron Data Standards Summary Report of the IAEA Consultants' Meeting," June 2021 – see publications.
- ND9 - Scoping Study: Li-6 Doped Liquid Scintillator Array for Fission Correlations
  - On hold pending carry-over constraints.
- ND10 - Development and Implementation of Machine Learning Methods for Thermal Scattering Law Evaluations
  - NCSU continued work on the development of a feedforward neural network (FNN) representation of the TSL of H in H2O. Using the generated TSL data, the 1-D and 2-D training of the FFN was completed. The training for addressing temperature effects is in advanced stages and expected to be completed during the upcoming quarter. Subsequently the NeTS FFN will be tested for generating TSL data for arbitrary values of α, β and temperature.
- ND11 - Fabricate the Pu240 PPAC targets and fission detector components
  - Fabrication and testing of the Pu240 PPAC was completed in August. The Pu240 PPAC was packaged for shipment and received at LANL on 9/15/2021.
- ND2022 – LLNL will host the International Conference on Nuclear Data for Science and Technology, ND2022, at the SAFE Credit Union Convention Center in Sacramento, CA, on July 24-29, 2022. Sponsorship opportunities are still available – see https://indico.bnl.gov/event/9462/page/343-sponsors-and-exhibitors.

PUBLICATIONS

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

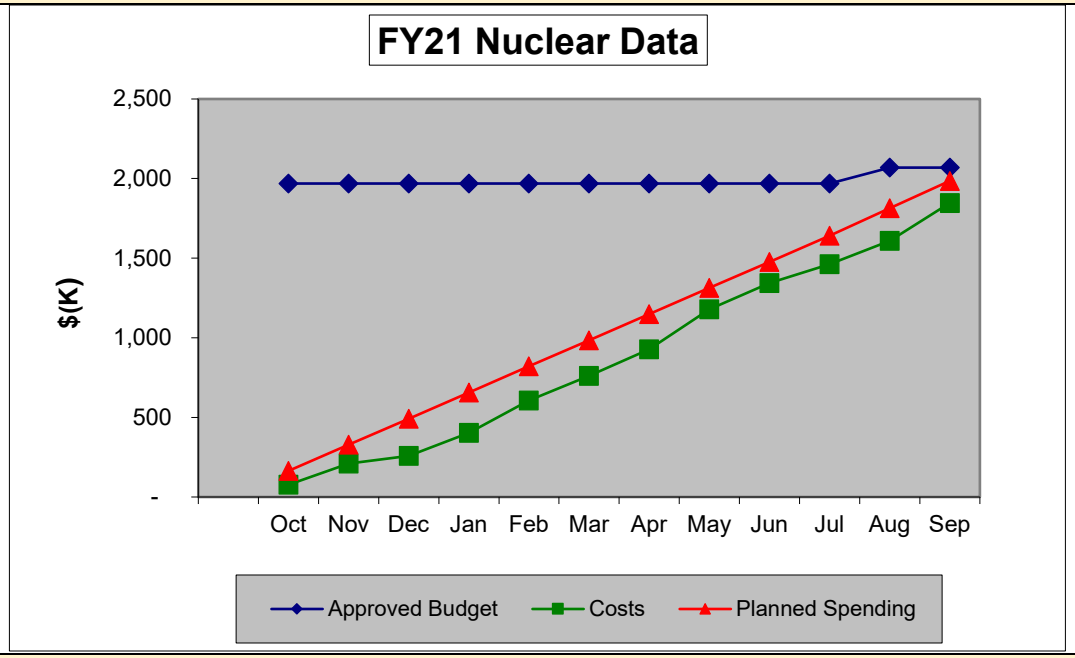
Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Bret Beck et al., "LLNL Report: Presented (on-line) to the Nuclear Data Advisory Group on December 3, 2020," LLNL-PRES-817232.	Yes	
	A. I. Hawari et al., "Thermal Neutron Scattering Law Benchmark and Validation at NCSU."	Yes	
	A. I. Hawari et al., "Thermal Scattering Law Evaluations and Progress at NCSU."	Yes	
Q2	Dave Heinrichs and Catherine Percher, "LLNL Task Highlights and Budget," LLNL-PRES-819574, February 23-24, 2021.	Yes	
	Ayman Hawari, "Accomplishments of Thermal Neutron Scattering Research at NCSU."	Yes	
	N. C. Fleming, A. I. Hawari, "Structure-Dependent Doppler Broadening Using a Generalized Thermal Scattering Law," Journal of Nuclear Engineering, April 8, 2021.	Yes	
Q3	E. Lee, N. C. Fleming, A. I. Hawari, "Development of a Pulsed Slowing-Down-Time Benchmark of Neutron Thermalization in Graphite," Transactions of the American Nuclear Society, June 2021.	Yes	

	B. K. Laramee, A. I. Hawari, "Evaluation of Thermal Neutron Scattering Cross Sections for CaH_2," Transactions of the American Nuclear Society, June 2021.	Yes	
	N. C. Fleming, A. I. Hawari, "Structure-Dependent Doppler Broadening Using a Generalized Thermal Scattering Law," Journal of Nuclear Engineering, April 8, 2021. **(selected for JNE issue cover)**	Yes	
	Lucas Snyder, "Fission TPC cross section ratio results," page 11, INDC(NDS)-0820, "Nuclear Data Standards Summary Report of the IAEA Consultants' Meeting", June 2021, including the presentation in Appendix III with an embedded link to LLNL-PRES-815345, "Fission TPC cross section ratio results."	Yes	
Q4	Ayman Hawari, "NCSU TSL Validation Update," August 19, 2021. (**presented at mini-CSEWG**)	Yes	

NCSP Quarterly Progress Report (FY-2021 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, 2021

BUDGET



1. Carryover into FY 2021 = $91K
2. Approved FY 2021 Budget = $ 2,069K (includes carryover)
3. Actual spending for 1st Quarter FY 2021 = $258K
4. Actual spending for 2nd Quarter FY 2021 = $502K
5. Actual spending for 3rd Quarter FY 2021 = $584K
6. Actual spending for 4th Quarter FY 2021 = $503K
7. Projected carryover into FY 2022 = ~$221K

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-2021 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.
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)		COVID-19 has delayed cross section measurements at GELINA.
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)		

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)		
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)		Zr-90 measurements complete; Zr-91 isotope leasing in progress. Cu, Ce evaluations in late stages.
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)		

ACCOMPLISHMENTS

- ND1 - Nuclear Data Measurement and Evaluation
  - **Status report on all nuclear data support activities.**
    - Attendance of the mini-CSEWG with several presentation.
    - Attendance of the meeting for planning WANDA2022: new chair election, discussion on topic sessions, virtual or on-site venues, etc.
    - Continue to work and mentor new staff for data analysis of experimental data.
    - Participated in DOE/EURATOM meeting and reported on progress on action sheet 66.
    - Submitted several ND2022 Conference abstracts
  - **Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.**
    - Travel to JRC-Geel is canceled due to COVID-19.
    - **Zr-90** capture and transmission experiments started Q3 have been finished before the summer break of GELINA. Data is in list mode available for sorting into TOF spectra
    - Natural Zr capture data reduction has been resumed.
    - Regular meetings to discuss progress on cerium and copper evaluations. Work on the **copper** angular distributions, covariances, and thermal values continues. **Cerium** evaluation is in final stages, i.e. adjustment of external levels to describe thermal values.
    - Sponsor report on progress on copper evaluations released. The report described the status of the **63,65Cu** evaluation with particular emphasis on the strategy needed to achieve comparable results with ENDF/VIII.0 performance.
    - Journal paper on **n+233U** published. The paper focused on work devoted to improving the agreement with a set of benchmarks by including newly evaluated PFNS, thermal constants, and updates to the RRR parametrization.
    - Journal paper published on TSL measurements and modeling of **yttrium-hydrides** for high temperature moderator applications
    - Work in progress on the URR evaluation of **233-U** and **235-U**: analysis of available measured data and related fitting with the SAMMY/FITACS code. Preliminary analysis of measured data and related fitting.
    - Work in progress on the **239-Pu** evaluation including fluctuations in the neutron multiplicities. The coupling between RRR and neutron multiplicities is relevant in the quantification of the (n,gf) reaction channels.
    - The evaluation of **139-La** and the fitting of resonance parameters has been started.

- **Hafnium** –Analysis of ENDF vs. JEFF libraries underway to determine whether new transmission measurements might be required. Previously used samples used for capture measurements could be suitable for possible transmission measurements (if needed), analysis of viability of these samples is ongoing.

- **Y12 ND1** – GELINA depleted Uranium target cost estimate and construction
  - MSC Inc. assembled the GELINA target; the target passed quality inspection. Shipment of the target is coordinated with JRC-Geel.

- **ND3** - Isotopic Sample Leases to Support ND1 ND Measurements
  - Contract for Zr-91 sample lease has been issued and signed.
  - Lease for Zr-90 sample has been extended for 6 months to investigate possible activation

- **ND4** - Thermal Neutron Total Cross Section Measurements for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties
  - Analysis of RPI-measured total cross section data for polyethylene & polystyrene is ongoing.
  - Methodology for generating scattering kernel uncertainties for polyethylene & polystyrene is being tested.

- **ND6** – SAMMY Nuclear Data Evaluation Code Modernization
  - Finished the integration of the use of the AMPX external R-Matrix parameters in SAMMY. External R-Matrix parameters and relevant fit flags are stored in the in-memory C++ object for resonance parameters. SAMMY internal arrays for this have been erased.
  - A new C++ class has been added that greatly simplifies the handling of the fit flags for the radius parameters. The resonance reconstruction code can query the fit flag and values for the radius for each spin group and channel, while internally the fit flags are saved in a more concise format. Any existing SAMMY internal arrays have been deleted.
  - We are in the process to create a framework for all 0K cross section reconstruction from RR, which will eliminate a lot of duplicate code in SAMMY. This is currently operational for Multi-level Breit-Wigner, and the framework for the reconstruction and de-duplication of the code is done. Presently this is being extended to the Reich-Moore formalism, the existing code for the formalism itself will be reused but all SAMMY global parameters will be eliminated in favor of local variables. In the future this will allow more flexibility in parallelizing the code. We also took the opportunity to add additional comments to the code.
  - A new R-matrix parameterization of direct and doorway processes, as well as the corresponding Reich-Moore approximation of eliminated capture processes, has been derived for potential implementation into the modernized SAMMY code in the future. This new R-matrix parameterization is expected to improve nuclear data evaluations because it accounts for currently neglected processes and the quantum interference among them.

- **ND10** - Monte Carlo Evaluation of Differential and Integral Data

- Improved SAMMY API to obtain improved Bayesian Monte Carlo nuclear data evaluations of the U-233 test case.
- Various comparisons to the extant evaluation methods reveal the flexibility made available by removing the assumption of perfect data inherent in all extant nuclear data and integral benchmark evaluations.
- ORNL ND10 work performed in collaboration with ORNL ND1, ND4, ND6, to maximize the gain to the NCSP
- A comprehensive ORNL-TM Report documenting ND10 progress is under review.
- ORNL ND10 activities continue to be closely coordinated with NCSP ORNL Tasks ND1, ND4, ND6, to maximize synergies among them.

PUBLICATIONS

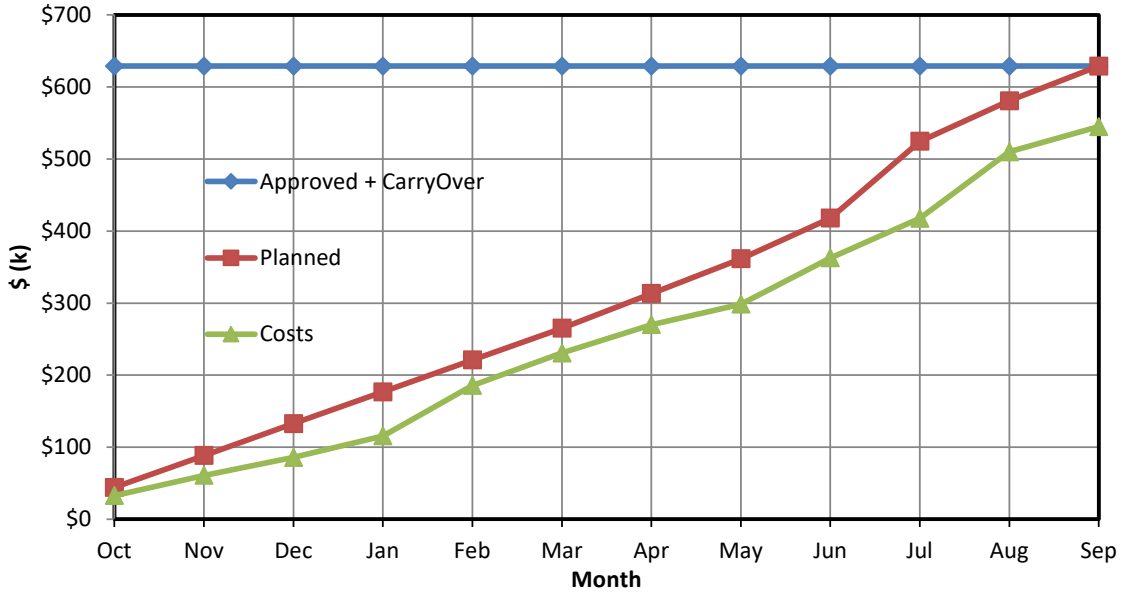
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference **Example:** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Received and sent separately	yes	
Q2	Pulled from RES	yes	
Q3	Pulled from RES	yes	
Q4	Marco Pigni, Roberto Capote, Andrej Trkov, "Progress on the reevaluation and validation of the n+ 233 U neutron cross sections," *Annals of Nuclear Energy,* Vol 163, Aug 2021	yes	
Q4	Marco Pigni, Roberto Capote, Andrej Trkov, "Progress on the reevaluation and validation of the n+ 233 U neutron cross sections," *Annals of Nuclear Energy,* Vol 163, Aug 2021	yes	
Q4	Chris Chapman, Xunxiang Hu, Jesse Brown, Goran Arbanas, Alexander Kolesnikov, Douglas Abernathy, Luke Daemen, Anibal Ramirez Cuesta, Matthew Stone, Yongqiang Cheng, Kemal Ramic, Li Liu, Yaron Danon, "Thermal neutron scattering measurements and modeling of yttrium-hydrides for high temperature moderator applications," *Annals of Nuclear Energy,* Vol 157, Jul 2021	yes	

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: ND 1, 2, 3 **M&O Contractor Name**: RPI **Point of Contact Name:** Yaron Danon **Point of Contact Phone:** 518-276-4008	**Reference:** DP1013021 **Date of Report:** 10/13/2021

BUDGET



1. Carryover into FY 2021 = $ 183,029
2. Approved FY 2021 Budget = $ 446,000
3. Actual spending for 1st Quarter FY 2021 = $85,716
4. Actual spending for 2nd Quarter FY 2021 = $144,978
5. Actual spending for 3rd Quarter FY 2021 = $132,038
6. Actual spending for 4th Quarter FY 2021 = $182,201
7. Projected carryover into FY 2022 = $84K

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 nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
Q1	Provide status reports on NNL 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-2021 Q4)

Q1	Complete analysis of measurement from FY-20 (ND1)		Completed analysis of preliminary Cr-nat capture experiment
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
Q1	Provide status reports on NNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND2)		No travel using NCSP funds
Q1	Complete neutron output testing (ND2)		Demonstrated a working cold moderator
Q1	Provide status report LINAC refurbishment activities in NCSP Quarterly Progress Reports (ND3)		
Q1	Complete RF window qualification (ND3)		Delayed from Q1, test completed in Q2 but one of the RF windows failed during the test and the vendor is working on resolving the problem for production of the rest. RF windows qualification will resume once this issue is resolved. Expected FY22 - Q1
Q1	Complete of SOL 1 Accelerator Section RF Conditioning. (ND3)		Delayed to FY22 - Q1 - need to resolve the issue with the RF windows first.
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
Q2	Provide status reports on NNL 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 reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
Q2	Provide status reports on NNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide		

	a brief trip summary report to NCSP Manager on items of NCSP interest. (ND2)		
Q2	Perform thermal cross section measurements for moderators (ND2)		Completed measurements on both polyethylene and polystyrene
Q2	Provide status report LINAC refurbishment activities in NCSP Quarterly Progress Reports (ND3)		
Q2	Complete TPV Accelerator Section RF Conditioning. (ND3)		Delayed to FY22 Q1
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
Q3	Provide status reports on NNL 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)		Completed Fe-54 capture measurements
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
Q3	Provide status reports on NNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND2)		
Q3	Complete thermal cross section measurements (ND2)		
Q3	Provide status report LINAC refurbishment activities in NCSP Quarterly Progress Reports (ND3)		

Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
Q4	Provide status reports on NNL 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 effort 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. (ND2)		
Q4	Provide status reports on NNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND2)		
Q4	Complete documentation (PhD thesis) and publication (ND2)		Paper was published, thesis in progress
Q4	Provide status report LINAC refurbishment activities in NCSP Quarterly Progress Reports (ND3)		
Q4	Complete Medium Voltage Electrical Distribution Upgrade (ND3)		Moved to FY22-Q1 and 2

ACCOMPLISHMENTS

- ND1 – Resonance Region Nuclear Data Measurement Capability at RPI
  - Completed normalization experiment using Au and Ta samples for Fe-54 capture data.
  - Reduced raw capture data into capture yield.
  - Started evaluation of RPI Fe-54 capture data and comparison to other evaluations/experiments using SAMMY.
- ND2 – Thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties
  - Completed final cross section data reduction for all total thermal cross section measurements

- Completed preliminary uncertainty quantification for all total thermal cross measurements.
- ND3 - LINAC 2020 Nuclear Data Capabilities Maintenance Plan
  - New RF windows test setup was designed and is fabrication at the RF windows vendor (ETA 11/2021)

PUBLICATIONS

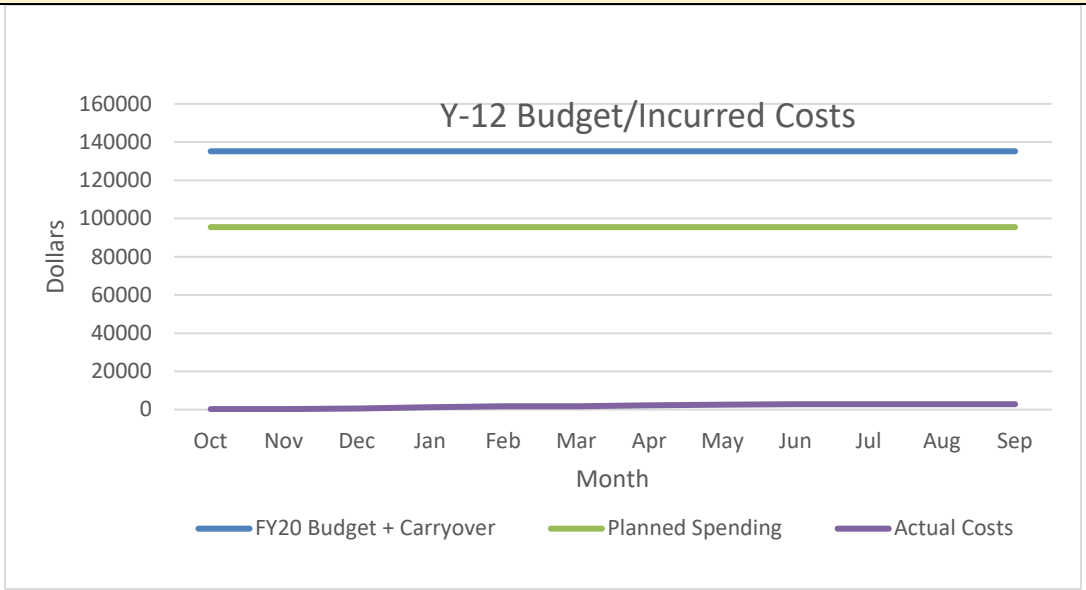
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference **example)** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	D. Fritz, Y. Danon, “A Cold Moderator For Sub-Thermal Neutron Flux Enhancement At The RPI-LINAC”, Transactions of the American Nuclear Society, Vol. 123, 2020 ANS Virtual Winter Meeting, November 16-19, (2020).	Yes (in Q1)	
Q2	D. Fritz, Y. Danon and E. Liu, “Enhancement of Sub-thermal Neutron Flux through Cold Polyethylene”, Journal of Neutron Research, vol. 23, pp. 179-184, 2021, DOI:10.3233/JNR-210010.	Yes	Included with Q4 report
Q3	E. Blain, Y. Danon, D. P. Barry, B. E. Epping, A. Youmans, M. J. Rapp, A. M. Daskalakis and R. C. Block, “Measurements of Neutron Scattering from a Copper Sample Using a Quasi-Differential Method in the Region from 2 keV to 20 MeV”, Nuclear Science and Engineering, vol. 0, no. 0, pp. 1-12, 2021, DOI:10.1080/00295639.2021.1961542 .	Yes	Included with Q4 report
Q4			

NCSP Quarterly Progress Report (FY-2021 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 22, 2021

BUDGET



1. Carryover into FY 2021 = $ 105,193.05
2. Approved FY 2021 Budget = $ 30,000
3. Actual spending for 1st Quarter FY 2021 = $512.90 ($95,500 commit from GELINA work still outstanding)
4. Actual spending for 2nd Quarter FY 2021 = $1,282.23 ($95,500 commit from GELINA work still outstanding)
5. Actual spending for 3rd Quarter FY 2021 = $1,025.79 ($95,500 commit from GELINA work still outstanding)
6. Actual spending for 4th Quarter FY 2021 = $0.00
7. Projected carryover into FY 2022 = $132,372.13 ($95,500 commit from GELINA work still outstanding)

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	As necessary, provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Part manufacturing proceeding. Partial delivery of parts received and they fit up well. Still awaiting final shipment but no issues expected. Photos sent in separate e-mail update.
Q2	As necessary, provide a status report of the fabrication of a depleted uranium/molybdenum target per		Still awaiting final delivery of parts for final fit up and assembly. (COVID impacts)

	IRMM/GELINA specifications to the NCSP Manager. (ND1)		
Q3	As necessary, provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Still awaiting final delivery of parts for final fit up and assembly. (COVID impacts)
Q4	As necessary, provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		All done except final delivery

ACCOMPLISHMENTS

- ND1 - Y-12 Fabrication of New Uranium Target for IRMM/GELINA for Cross-section Measurements

PUBLICATIONS

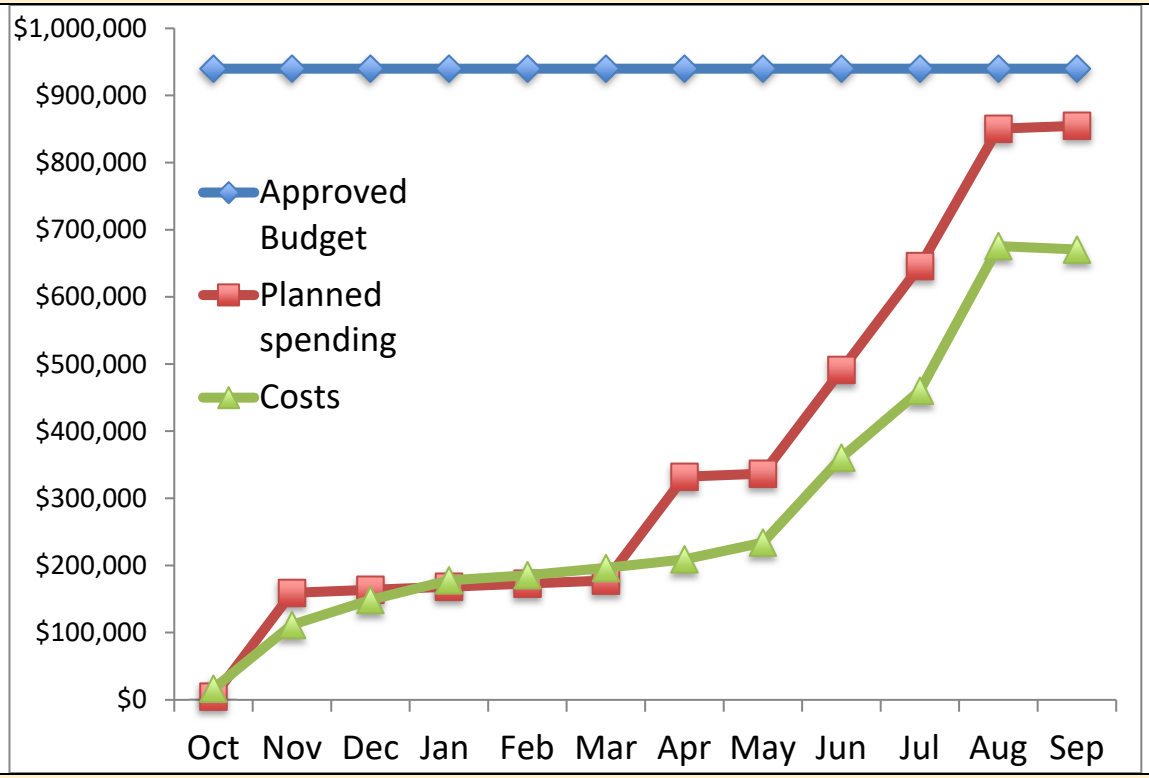
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

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

NCSP Quarterly Progress Report (FY-2021 Q3)

NCSP Element and Subtask: TE3, 4, 6 **M&O Contractor Name**: LANL **Point of Contact Name:** Joetta Goda **Point of Contact Phone:** 505-667-2812	**Reference:** DP0909020 **Date of Report:** July 14, 2021

BUDGET



1. Carryover into FY 2021 = $ 400,000
2. Approved FY 2021 Budget = $ 540,000
3. Actual spending for 1st Quarter FY 2021 = $148,617
4. Actual spending for 2nd Quarter FY 2021 = $47,729
5. Actual spending for 3rd Quarter FY 2021 = $164,354
6. Actual spending for 4th Quarter FY 2021 = $309,793
7. Projected carryover into FY 2022 = $200,000

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 training activities to the NCSP Manager (TE3)		

NCSP Quarterly Progress Report (FY-2021 Q3)

Q1	Provide status reports on all training activities to the NCSP Manager (TE4)		
Q1	Provide status reports on all training activities to the NCSP Manager, to include photos and content for the quarterly newsletter (TE6)		
Q2	Provide status reports on all training activities to the NCSP Manager (TE3)		Due to a Covid positive and required isolation of the remainder of the crew, the Feb 1 Hand's-On Week for the CSE Course was cancelled. Make-up course has been scheduled.
Q2	Provide status reports on all training activities to the NCSP Manager (TE4)		
Q2	Provide status reports on all training activities to the NCSP Manager, to include photos and content for the quarterly newsletter (TE6)		
Q3	Provide status reports on all training activities to the NCSP Manager (TE3)		
Q3	Provide status reports on all training activities to the NCSP Manager (TE4)		
Q3	Provide status reports on all training activities to the NCSP Manager, to include photos and content for the quarterly newsletter (TE6)		
Q4	Provide status reports on all training activities to the NCSP Manager (TE3)		
Q4	Provide status reports on all training activities to the NCSP Manager (TE4)		
Q4	In collaboration with ORNL, provide introductory 1-day S/U workshop training to one or more DOE sites in FY21. (TE4)		Completed in Q3.
Q4	Provide status reports on all training activities to the NCSP Manager, to include photos and content for the quarterly newsletter (TE6)		

ACCOMPLISHMENTS

- TE3 – Conduct Hands-On Criticality Safety Training Course at NCERC
  - Three courses conducted this quarter
  - Hand's On portion of Criticality Safety Courses week of July 12 and week of Aug 9 as make-up sessions (Q4).

- NCSP 2-week CSE Hand's-On Course week of Aug 16 (Q4).
- TE4 – On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools
  - Course was conducted as scheduled, Tuesday and Wednesday, April 27 and 28
  - The classes were virtual, one held at Eastern time geared toward participants from BWXT and Nuclear Fuel Services and one class held at Mountain time geared toward participants from INL.
  - There were 22 students and feedback was positive.
- TE6 – Development of University Pipeline for Criticality Safety Professionals
  - The Fall semester for UNM is now in full swing. Mandy Bowles-Tomaszewski, Kaelin Glover, and Norann Calhoun attended Dr. Perfetti's NCS class at UNM on Aug. 24th (first day of class). We met with the students in Dr. Perfetti's class, as well as the students in Dr. Cassiano's Senior Design class. We have been attending the NCS class lectures through Zoom on Tuesday and Thursday each week. The students are asking tons of questions, and seem very interested in the subject. We have been able to help Dr. Perfetti answer questions that the students ask, as well as provide additional information about the topics he covers during his lectures. We will continue to support the class through Zoom throughout the semester, with another in person visit scheduled for December.

PUBLICATIONS

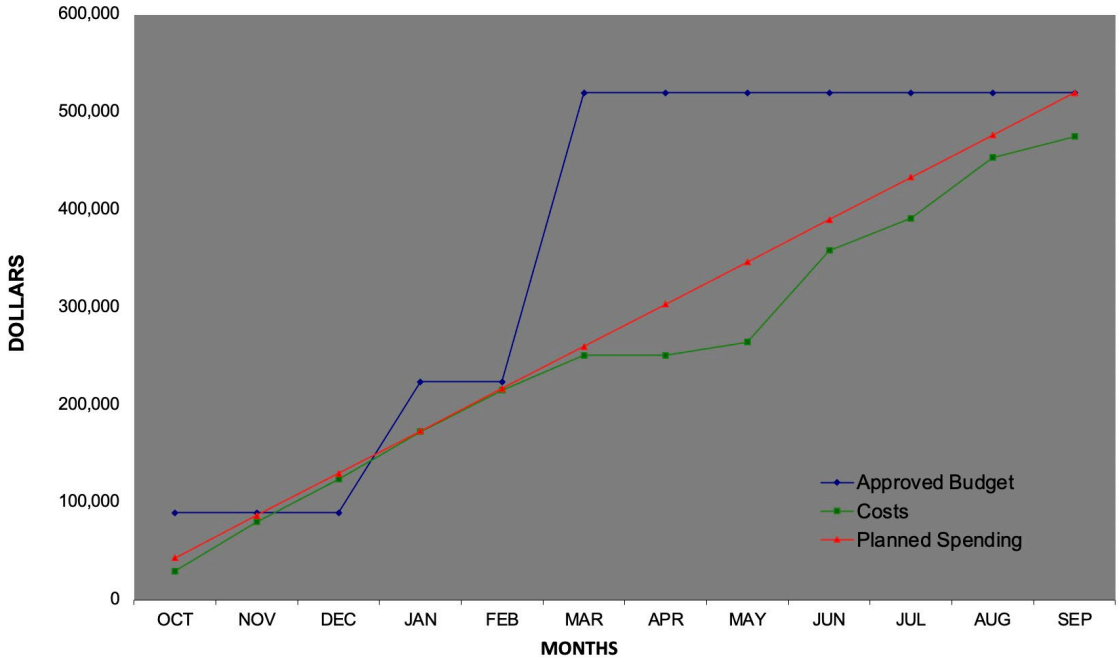
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", 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-2021 Q4)

NCSP Element and Subtask: TE1, 3, 6, 8 **M&O Contractor Name**: LLNL **Point of Contact Name:** Catherine Percher **Point of Contact Phone:** (925) 579-4226	**Reference:** DP0909020 **Date of Report:** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $ 89,634+296,221* =$385,855
2. Approved FY 2021 Budget = $ 134,000 ($519,855 with carryover)
3. Actual spending for 1st Quarter FY 2021 = $ 123,883
4. Actual spending for 2nd Quarter FY 2021 =$ 126,773
5. Actual spending for 3rd Quarter FY 2021 = $107,542
6. Actual spending for 4th Quarter FY 2021 = $116,959
7. Projected carryover into FY 2022 = $ 44,698 (8.6%)

*Added $296K from carryover at the direction of the NCSP Manager, as TE1 was cut to $1K in the 5YP and to accommodate an extra class.

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 the activities to the NCSP manager (TE1)		
Q1	Provide status report on the activities to the NCSP manager (TE3)		

NCSP Quarterly Progress Report (FY-2021 Q4)

Q1	Provide status report on the activities to the NCSP manager (TE6)		
Q1	Provide status report on all training activities to the NCSP manager, to include photos and content for the quarterly newsletter. (TE8)		
Q2	Provide status report on the activities to the NCSP manager (TE1)		
Q2	Provide status report on the activities to the NCSP manager (TE3)		
Q2	Provide status report on the activities to the NCSP manager (TE6)		
Q2	Provide status report on all training activities to the NCSP manager, to include photos and content for the quarterly newsletter. (TE8)		
Q3	Provide status report on the activities to the NCSP manager (TE1)		
Q3	Provide status report on the activities to the NCSP manager (TE3)		
Q3	Provide status report on the activities to the NCSP manager (TE6)		
Q3	Provide status report on all training activities to the NCSP manager, to include photos and content for the quarterly newsletter. (TE8)		
Q4	Provide status report on the activities to the NCSP manager (TE1)		
Q4	Provide status report on the activities to the NCSP manager (TE3)		
Q4	Provide status report on the activities to the NCSP manager (TE6)		
Q4	Provide status report on all training activities to the NCSP manager, to include photos and content for the quarterly newsletter. (TE8)		

ACCOMPLISHMENTS

- TE1 – Conduct Hands-on Training at the DAF (TACS)
  - Conducted two hands-on training classes for practitioners, providing lectures and TACS experiments, August 2021
  - Instructed during first lecture week for practitioners, August 2021
  - Coordinated registration for all NCSP classes
- TE3 – Classroom Criticality Safety Training
  - Participated in all telecons for preparations for the August 2021 practitioner's course
  - Provided instruction for August lecture week for practitioners, August 2021
- TE6 - Mobile (CAT III or IV material) Hands on Critical or Near Critical Demonstration Capability
  - No activity this period
- TE8 - Development of University Pipeline for Criticality Safety Professionals
  - Coordinated with UCBerkeley to teach Fall 2021 NCS Pipeline Course

PUBLICATIONS

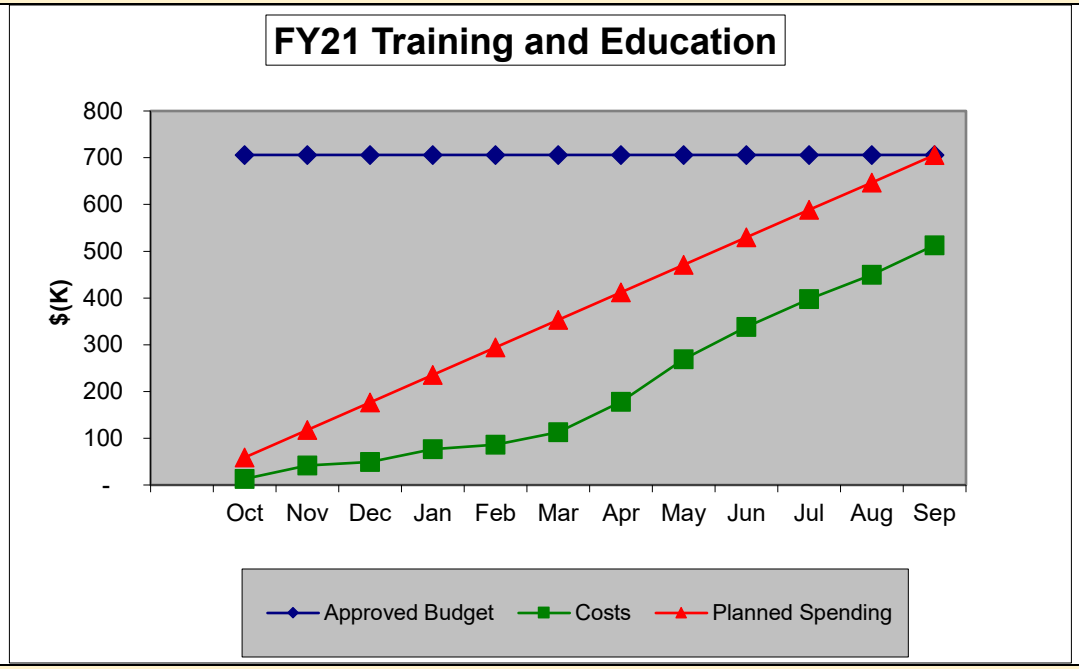
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

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

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: TE1, 3, 5, 11, 12 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $236K; FY2021 budget $470k
2. Approved FY 2021 Budget = $706K (includes carryover)
3. Actual spending for 1st Quarter FY 2021 = $49K
4. Actual spending for 2nd Quarter FY 2021 = $64K
5. Actual spending for 3rd Quarter FY 2021 = $225K
6. Actual spending for 4th Quarter FY 2021 = $175K
7. Projected carryover into FY 2022 = ~$174K

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 in NCSP Quarterly Progress Reports on implementation of the NCS training program (TE1)		
Q1	Provide a status report to the NCSP manager. (TE3)		

NCSP Quarterly Progress Report (FY-2021 Q4)

Q1	Provide a status report to the NCSP manager. (TE5)		
Q1	Provide a status report to the NCSP manager. (TE11)		
Q1	Provide a status report to the NCSP manager. (TE12)		
Q2	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program (TE1)		
Q2	Provide a status report to the NCSP manager. (TE3)		
Q2	Provide a status report to the NCSP manager. (TE5)		
Q2	Provide a status report to the NCSP manager. (TE11)		
Q2	Provide a status report to the NCSP manager. (TE12)		
Q3	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program (TE1)		
Q3	Provide a status report to the NCSP manager. (TE3)		
Q3	Provide a status report to the NCSP manager. (TE5)		
Q3	Provide a status report to the NCSP manager. (TE11)		
Q3	Provide a status report to the NCSP manager. (TE12)		
Q4	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program (TE1)		
Q4	Provide a status report to the NCSP manager. (TE3)		
Q4	Provide a status report to the NCSP manager. (TE5)		

Q4	Provide a status report to the NCSP manager. (TE11)		
Q4	Provide a status report to the NCSP manager. (TE12)		

ACCOMPLISHMENTS

- TE1 - Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program
  - In Q4, three make up courses for the Sandia and NCERC hands-on courses, one 2-week hands-on course, and two Sandia manager makeup courses were successfully executed in Q4. This is unprecedented and required all staff and points-of-contact to complete these courses this year (despite extreme challenges toward the end of the quarter due to the delta variant of COVID-19). WebEx preparatory meetings were held for each course at least one month out. New course dates were added to the NCSP website so students could register for courses through FY22. Other efforts included archiving course materials, course planning, telecons, binder QA/printing, and course execution.

2-week Hands-on Courses	
SANDIA PORTION – Makeup Course #2	Make-up session 2 - September 27-October 1, 2021
NCERC PORTION – Makeup Course #1	Make-up session 1 - July 12-16, 2021
NCERC PORTION – Makeup Course #2	Make-up session 2 - August 9-13, 2021
2-Week Hands-on Course – August 9-20, 2021	Regularly scheduled
1-Week Manager Courses	
Sandia Manager Course – July 12-16, 2021	Make-up session - July 12-16, 2021
Sandia Manager Course – August 30-Sept. 4, 2021	Make-up session - August 30 - September 4, 2021

- TE3 - Hand-calculation Primer Expansion, LA-14244-M
  - In Q4, Bob Busch and Doug Bowen continued work on the new Primer draft (about 75% complete). The website programmer has generated a portion of a website to assist students with the Primer example problems, which will be added to the NCSP website when completed. The programmer had made significant progress on webpages to assist with Primer example problems. This task didn't start until June 2021 due to FY21 funding arrive late in the year (Feb) and subcontractor support still needed to be procured to support the task. This work will be completed on or before the NCSD 2022 Topical.
- TE5 - On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools
  - No activity in Q4.
- TE11 - Revision of the LA-12808 Nuclear Criticality Safety Guide
  - Steady progress has been made on this revision of the nuclear safety guide, which is being rewritten with modern references. This task will be completed by the end of FY22 and is delayed due to a late start due to FY21 funding.
- TE12 - Design of a Subcritical/Critical Assembly at ORNL for Use with the CSO/FMH Courses
  - In Q4, final design calculations were completed, and four site locations were identified at ORNL. The final report has been delayed due to late cost estimates from Y-12 for fuel location and transportation to ORNL. This report will be completed near the end of the calendar year.

PUBLICATIONS

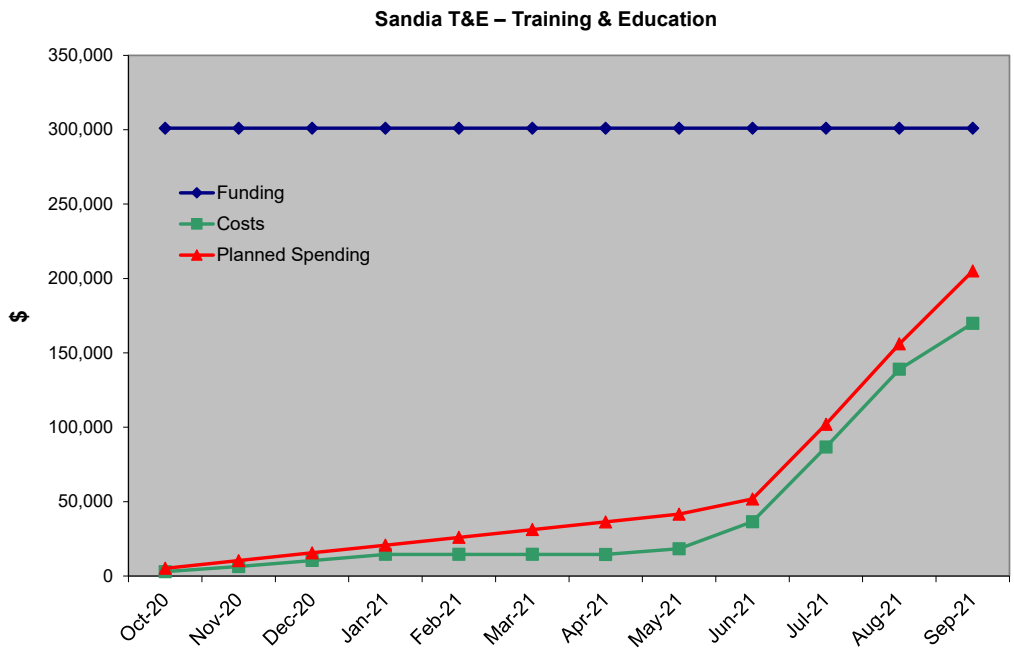
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	None		
Q2	None		
Q3	None		
Q4	None		

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP 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:** DP0909020 **Date of Report:** September, 2021

BUDGET



1. Carryover into FY 2021 = $301,011
2. Approved FY 2021 Budget = $301,011
3. Actual spending for 1st Quarter FY 2021 = $10,437
4. Actual spending for 2nd Quarter FY 2021 = $4,151
5. Actual spending for 3rd Quarter FY 2021 = $21,917
6. Actual spending for 4th Quarter FY 2021 = $133,355
7. Projected carryover into FY 2022 = $131,151

All spending is from FY20 carryover.

February and April classes were postponed. The August NCSE class was presented as scheduled.

Make-up classes for managers were delivered in July and September.

A make-up class for NCSEs was delivered immediately after the close of the FY. FY22 costs for the class were about $44k

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)		Make-up sessions for classes postponed during COVID are: NCSE class: Aug. 16, 2020 (regular class), Sept. 13, Sept 27 (costs in FY22) Managers class: July 12, Aug. 30
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)		Due to low student numbers, the make-up NCSE class scheduled for Sept. 13 was combined with the class scheduled for Sept. 27. All remaining classes were presented as scheduled.

ACCOMPLISHMENTS

- TE1 - Prepare for and Conduct Hands-on Criticality Safety Training at SNL
  - Preparations were made for the January-February class for NCS professionals
  - The Sandia portion of the class was postponed by Sandia due to COVID-19 concerns
  - Sandia supported the HFER portion of the virtual classroom presentations for the January-February and August classes for NCS professionals
  - The April Hands-On criticality safety class for managers was postponed by Sandia due to COVID-19 concerns
  - The August Hands-On criticality safety class for NCS professionals was delivered as scheduled
  - Make-up Hands-On criticality safety classes for managers were delivered on July 12-16 and August 30 – September 3.
  - A make-up Hands-On criticality safety class for NCS professionals was delivered September 27 – October 1 in early FY22

PUBLICATIONS

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

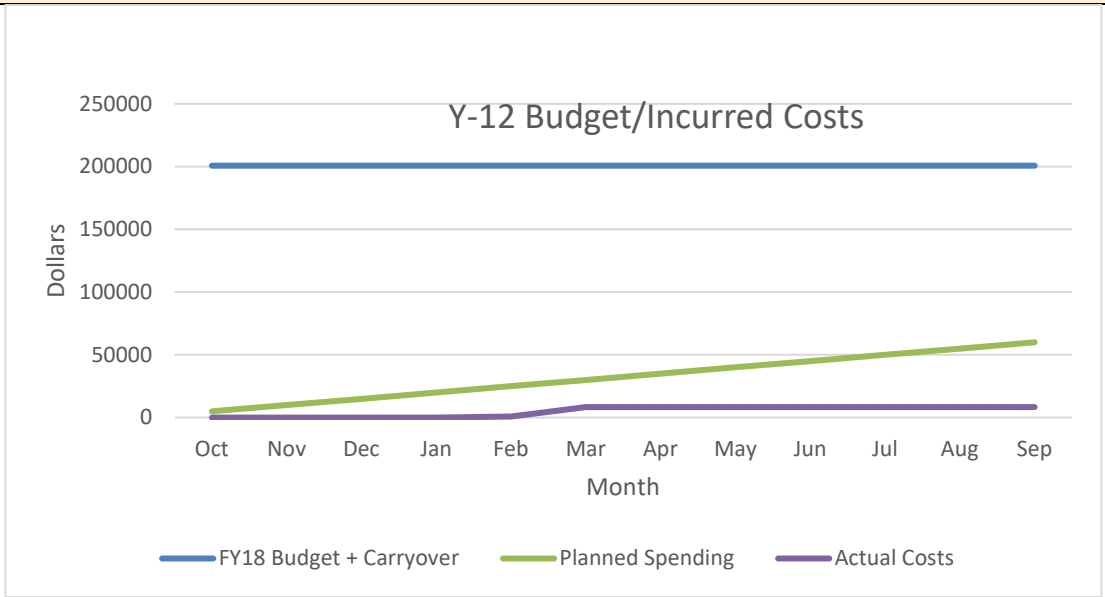
Quarter	Publication Reference **example)** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1			
Q2			
Q3			

Q4			

NCSP Quarterly Progress Report (FY-2021 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 22, 2021

BUDGET



1. Carryover into FY 2021 = $200,759.84
2. Approved FY 2021 Budget = $ 0.00
3. Actual spending for 1st Quarter FY 2021 = $0.00
4. Actual spending for 2nd Quarter FY 2021 = $8,375.01
5. Actual spending for 3rd Quarter FY 2021 = $0.00
6. Actual spending for 4th Quarter FY 2021 = $0.00
7. Projected carryover into FY 2022 = $192,384.83

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)		No travel.

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)		No travel

ACCOMPLISHMENTS

- TE1 - Conduct Hands-On Criticality Safety Training Course (Lecture support week 1 of 2-week hands-on course and course material development)

PUBLICATIONS

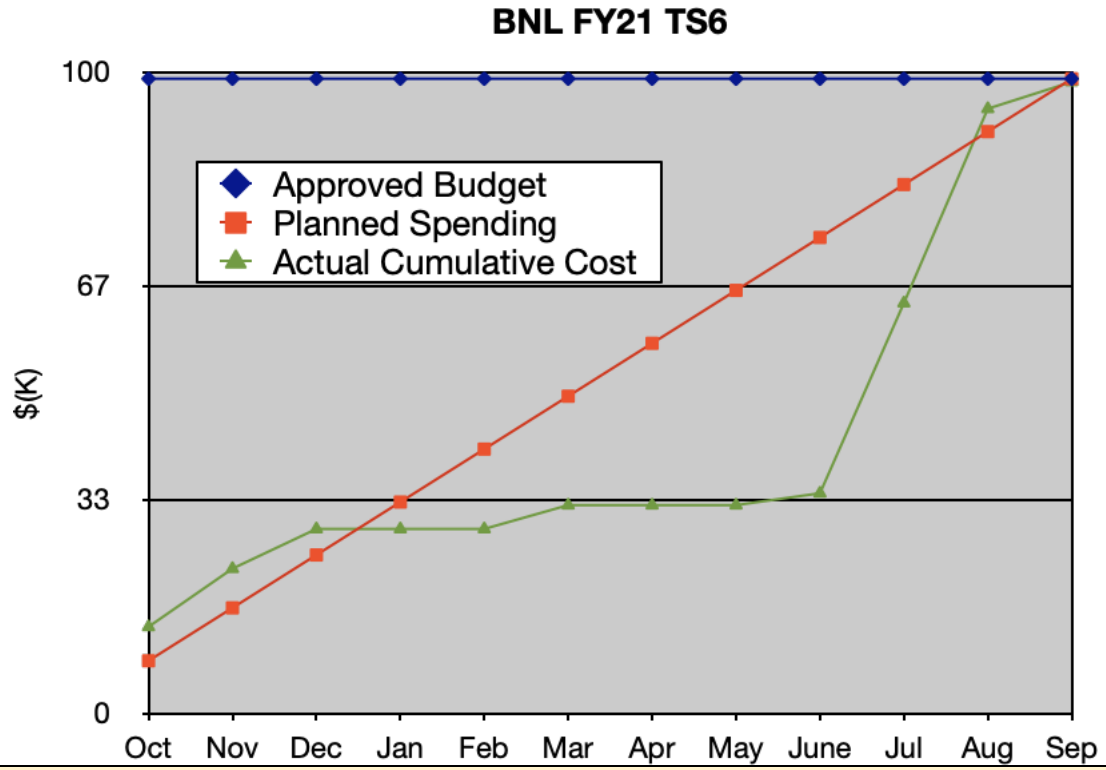
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

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

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: TS6 **M&O Contractor Name**: BNL **Point of Contact Name:** David Brown **Point of Contact Phone:** 631-344-2814	**Reference:** DP0909020 **Date of Report:** 20 Oct. 2021

BUDGET



1. Carryover into FY 2021 = $ 5,413
2. Approved FY 2021 Budget = $ 99,000
3. Actual spending for 1st Quarter FY 2021 = $28,805
4. Actual spending for 2nd Quarter FY 2021 = $3,712
5. Actual spending for 3rd Quarter FY 2021 = $1,854
6. Actual spending for 4th Quarter FY 2021 = $64,131
7. Projected carryover into FY 2022 = $5,912

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 of succession planning efforts. (TS6)		We are writing up the project now and are aiming for submission this quarter.
Q2	Provide NCSP Manager report of succession planning efforts. (TS6)		

Q3	Provide NCSP Manager report of succession planning efforts. (TS6)		Summer students arrived on 7 June, 2021, including 3 SULI students (funded by Office of Science), 1 SURP (funded by NCSP) and a NP Traineeship student (separate Office of Science program)
Q4	Provide NCSP Manager report of succession planning efforts. (TS6)		One student stayed on for the Fall term (M. Fucci), focusing on classifier optimization. She is funded by NCSP.

ACCOMPLISHMENTS

- TS6 – ND Succession Planning
  - G.P.A. Nobre, D.A. Brown, S. Scoville, M. Fucci, S. Ruiz, R. Crawford, A. Coles, and M. Vorabbi, "Expansion of Machine-Learning Method for Classifying Neutron Resonances", Brookhaven National Laboratory Report BNL-222202-2021-INRE (2021).

PUBLICATIONS

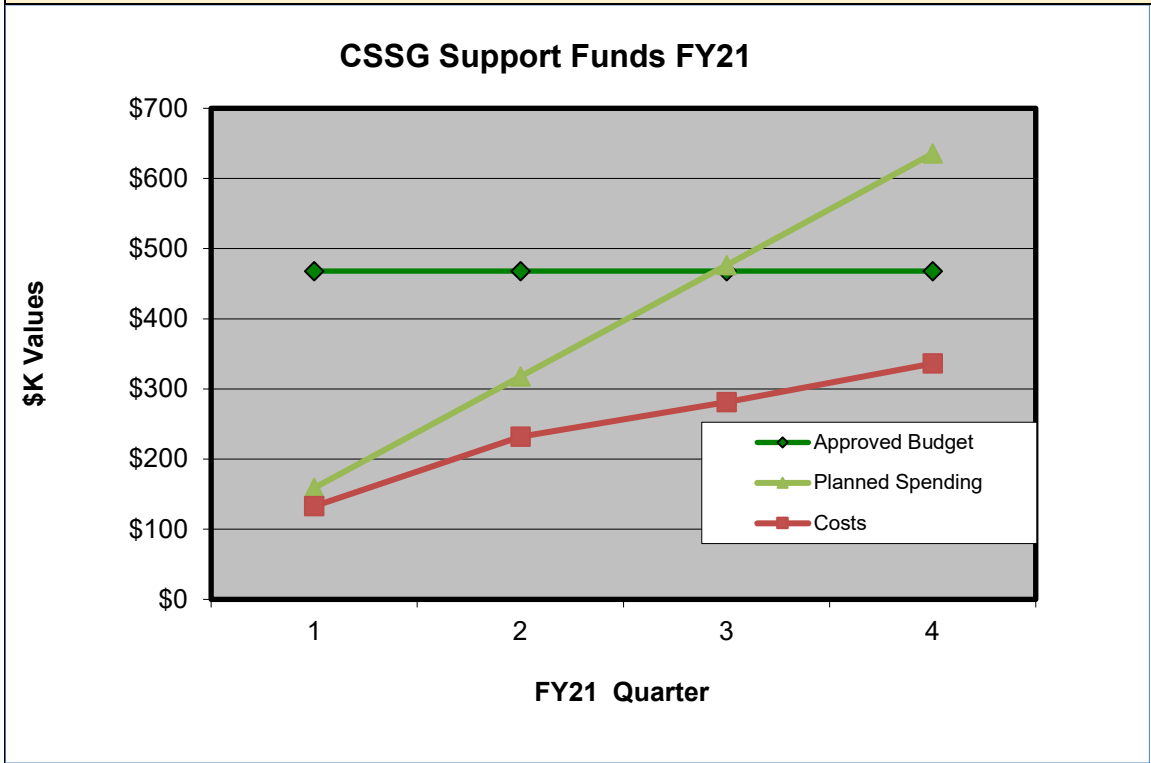
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	n/a		
Q2	n/a		
Q3	n/a		
Q4	G.P.A. Nobre, D.A. Brown, S. Scoville, M. Fucci, S. Ruiz, R. Crawford, A. Coles, and M. Vorabbi, "Expansion of Machine-Learning Method for Classifying Neutron Resonances", Brookhaven National Laboratory Report BNL-222202-2021-INRE (2021).	yes	

NCSP Quarterly Progress Report (FY-2021 Q3)

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 2021

BUDGET



1. Carryover into FY 2021 = $ 167,524
2. Approved FY 2021 Budget = $ 468,000
3. Actual spending for 1st Quarter FY 2021 = $132,752
4. Actual spending for 2nd Quarter FY 2021 = $99,414
5. Actual spending for 3rd Quarter FY 2021 = $49,135
6. Actual spending for 4th Quarter FY 2021 = $54,880
7. Projected carryover into FY 2022 = $299,344

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 of activities. (TS1)		None
Q2	Provide NCSP Manager report of activities. (TS1)		None
Q3	Provide NCSP Manager report of activities. (TS1)		None
Q4	Provide NCSP Manager report of activities. (TS1)		None

ACCOMPLISHMENTS

- TS1 – Activities
  - CSSG Telecons
  - Review of CSSG Charter and Work Instructions
  - Transition to new Cahir and Deputy Chair

PUBLICATIONS

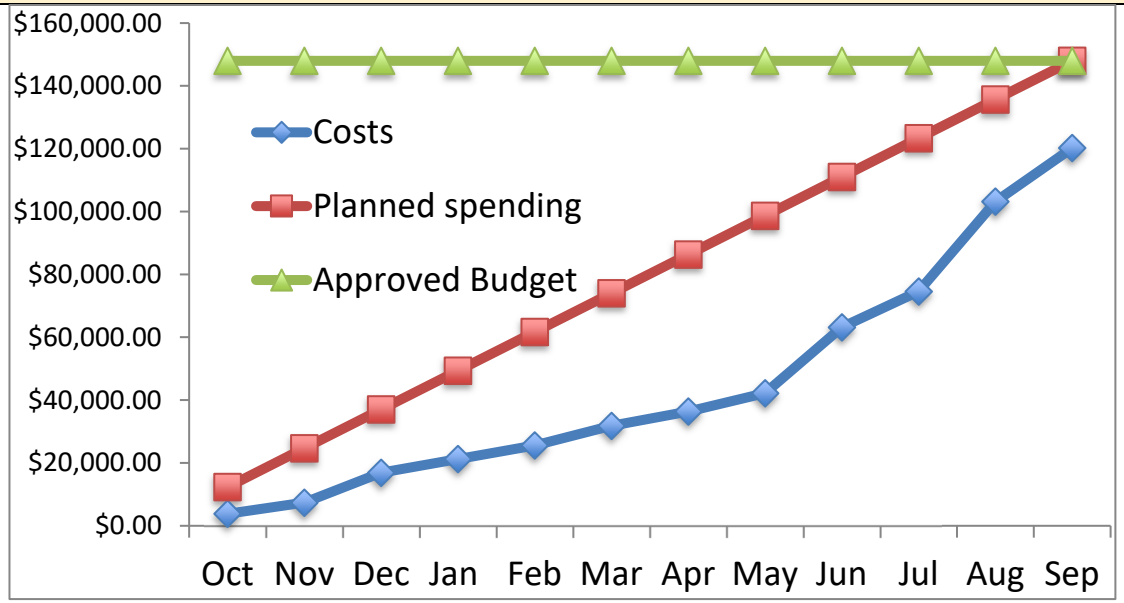
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	N/A		
Q2	N/A		
Q3	N/A		
Q4			

NCSP Quarterly Progress Report (FY-2021 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:** DP0909020 **Date of Report:** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $ 0
2. Approved FY 2021 Budget = $ 148,000
3. Actual spending for 1st Quarter FY 2021 = $16,875
4. Actual spending for 2nd Quarter FY 2021 = $14,062
5. Actual spending for 3rd Quarter FY 2021 = $31,361
6. Actual spending for 4th Quarter FY 2021 = $57,102
7. Projected carryover into FY 2022 = $10,000 (about $15k used to cover CSSG overages)

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. (TS4)		
Q2	Provide NCSP Manager report on succession planning efforts. (TS4)		
Q3	Provide NCSP Manager report on succession planning efforts. (TS4)		
Q4	Provide NCSP Manager report on succession planning efforts. (TS4)		

ACCOMPLISHMENTS

- TS4 – AM, IE, ND Succession Planning
  - Spend rate increased as students returned.

PUBLICATIONS

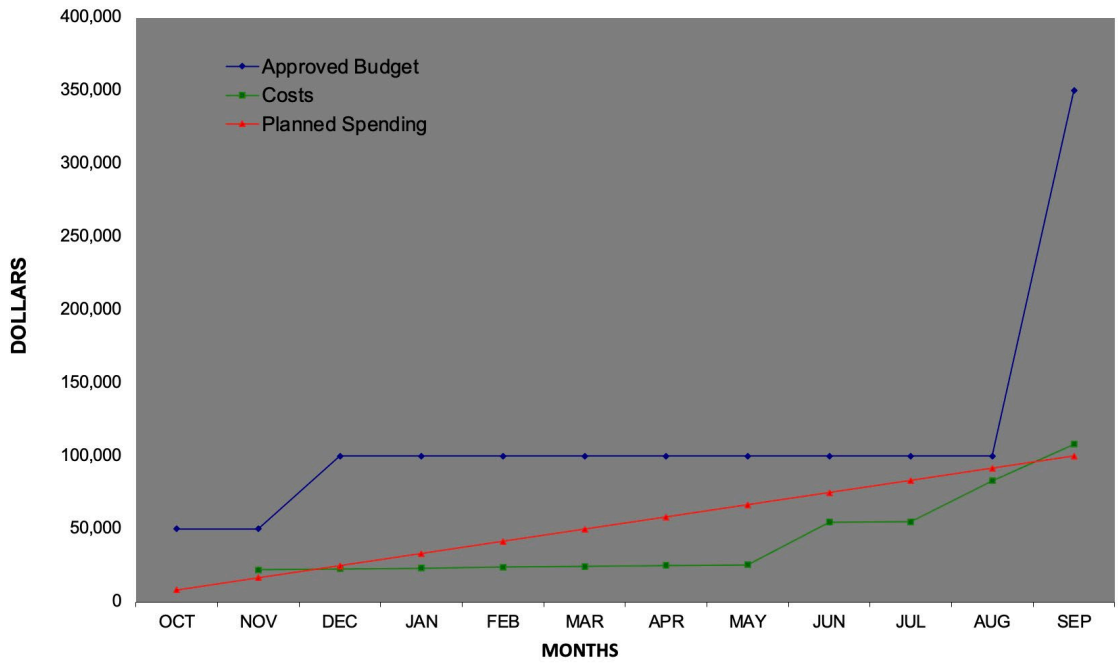
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", 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-2021 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:** DP0909020 **Date of Report:** October 27, 2021

BUDGET



1. Carryover into FY 2021 = $ 50039.18
2. Approved FY 2021 Budget = $ 50000* + $250203**
3. Actual spending for 1st Quarter FY 2021 = $ 20,108
4. Actual spending for 2nd Quarter FY 2021 =$ 0
5. Actual spending for 3rd Quarter FY 2021 = $ 32,160
6. Actual spending for 4th Quarter FY 2021 = $ 53,269
7. Projected carryover into FY 2022 = $243,658

*CSSG Funds for D. Heinrichs
**Transferred $250K from IE in Sept 2021 to fund mandatory LLNL 6% reserve account

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)		TS5 carryover exhausted in Q1. Succession planning activities to be funded in subsequent quarters by carryover in other elements.
Q2	Provide NCSP manager report on succession planning efforts. (TS5)		TS5 carryover exhausted in Q1. Succession planning activities to be funded in subsequent quarters by carryover in other elements.
Q3	Provide NCSP manager report on succession planning efforts. (TS5)		TS5 carryover exhausted in Q1. Succession planning activities to be funded in subsequent quarters by carryover in other elements.

Q4	Provide NCSP manager report on succession planning efforts. (TS5)		

ACCOMPLISHMENTS

- TS5 - AM, IE, ND Succession Planning
  - Percher succeeds Heinrichs as NCSP Task Manager for LLNL effective March 14, 2021.

PUBLICATIONS

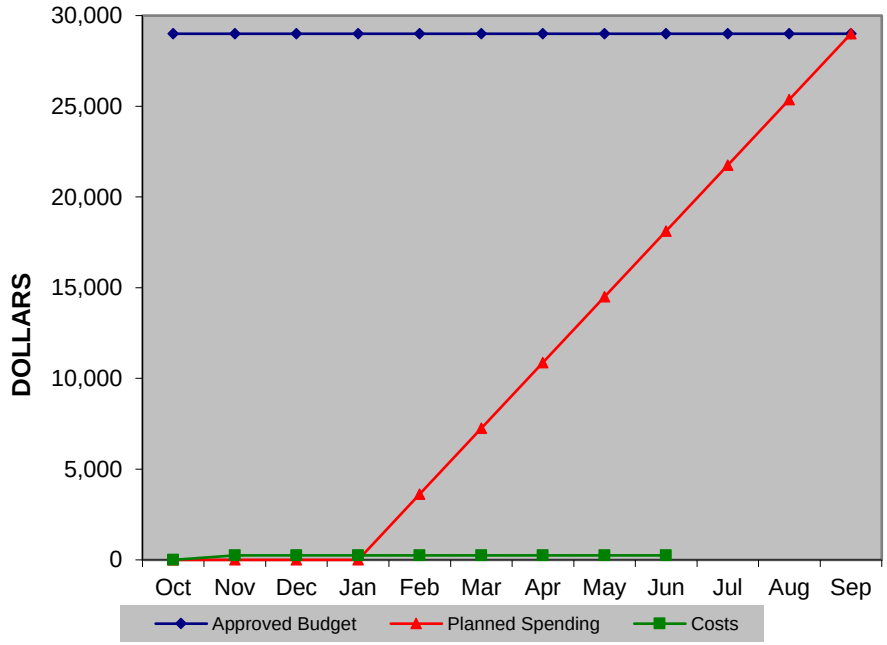
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference	Sent to NCSP? Yes/no	If no, status of submittal
Q1	Daniel Siefman, "Constrained Bayesian Optimization of Criticality Experiments: Presented to WPEC Subgroup 46," LLNL-PRES-816559, November 12, 2020.	Yes	
Q1	Daniel Siefman, "Constrained Bayesian Optimization of Criticality Experiments at LLNL" Presented to IEAE Consultancy Meeting on Machine Learning for Nuclear Data, LLNL-PRES-817545, December 10, 2020	Yes	
Q2			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2021 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:** DP0909020 **Date of Report:** October 21, 2021

BUDGET



1. Carryover into FY 2021 = $ 0*
2. Approved FY 2021 Budget = $ 29,000
3. Actual spending for 1st Quarter FY 2021 = $249
4. Actual spending for 2nd Quarter FY 2021 = $0
5. Actual spending for 3rd Quarter FY 2021 = $0
6. Actual spending for 4th Quarter FY 2021 = $
7. Projected carryover into FY 2022 = $28,751

*FY2020 carryover ($18k) transferred to the RPI LINAC Upgrade Project.

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 in NCSP Quarterly Progress Reports (TS9)		None.
Q2	Provide status report on all NDAG chair activities in NCSP Quarterly Progress Reports (TS9)		None.

Q3	Provide status report on all NDAG chair activities in NCSP Quarterly Progress Reports (TS9)		None.
Q4	Provide status report on all NDAG chair activities in NCSP Quarterly Progress Reports (TS9)		

ACCOMPLISHMENTS

- TS9 – Support for NDAG Chair activities
  - Participated in 2021 WPNCS Meeting
    - Participated in SG8 meeting on "Preservation of Expert Knowledge and Judgement Applied to Criticality Benchmarks"
    - Participated in 1st SFCOMPO TRG meeting
  - Coordinated update to Appendix B of NCSP FY22-FY26 5YP
  - Participated in NCSP BEM as NDAG Chair
  - Mini-CSEWG Meeting
    - Coordinated Validation Committee session
  - ICSBEP Benchmark Evaluation support
    - Independent Reviewer for HMM021 (TEX HEU)
  - Final pre-publication review of WANDA2021 review article
  - CeDT support for several IERs

PUBLICATIONS

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

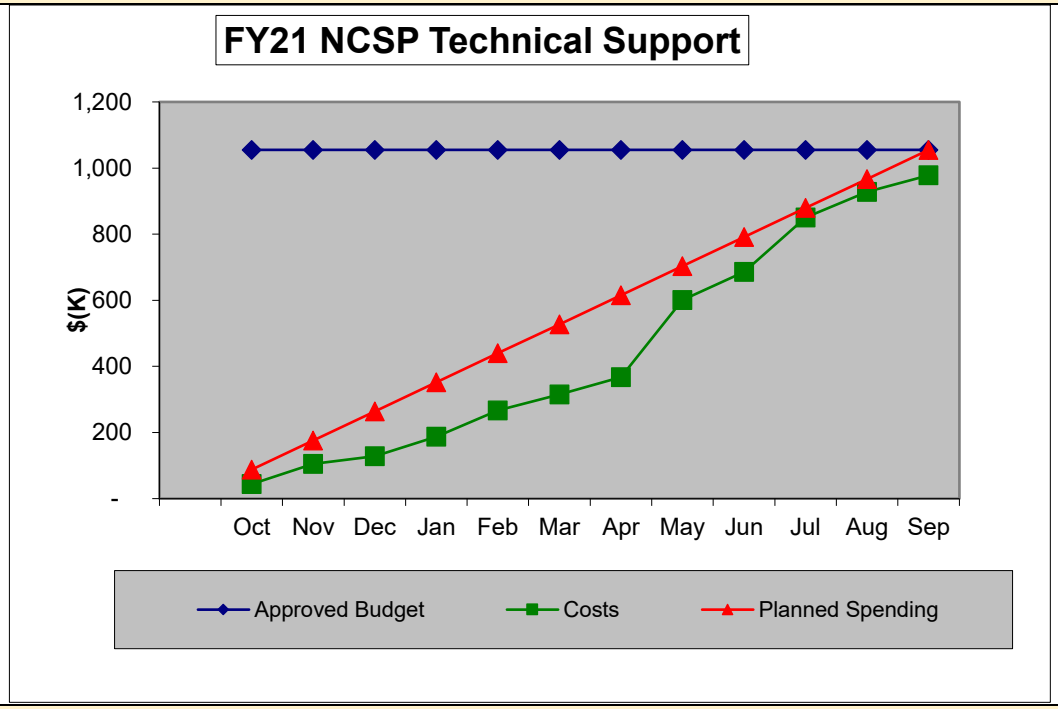
Quarter	Publication Reference example)	Sent to NCSP? Yes/no	If no, status of submittal
Q1			
Q2	1. M. Zerkle, C. Percher and J. Hutchinson, "Expended Benchmarks for Nuclear Data Validation," Proceedings of WANDA2021 (virtual), January 25 – February 3, 2021. 2. J. L. Wormald , N. C. Fleming , A. I. Hawari and M. L. Zerkle, "Generation of the Thermal Scattering Law of Uranium Dioxide with Ab Initio Lattice Dynamics to Capture Crystal Binding Effects on Neutron Interactions," *Nuclear Science and Engineering*, **195**:3, 227-238 (2021). https://doi.org/10.1080/00295639.2020.1820826 3. J. Wormald, M. Zerkle, and J. Holmes, "Generation of the TSL for Zirconium Hydrides from Ab Initio Methods." *J. Nucl. Eng.,* **2,** 105-113 (2021). https://doi.org/10.3390/jne2020011	Yes Yes Yes	

Q3	1. On Behalf of CSEWG: Tim Trumbull, Mike Zerkle, Tom Sutton and Dave Brown, "Dr. Cecil Lubitz (1925–2021)," *Nuclear Data Sheets*, **173**, iii-iv (March–April 2021). https://doi.org/10.1016/j.nds.2021.04.001 2. M. L. Zerkle, "Nuclear Data Needs from Nuclear Criticality Safety Program's Perspective and Beyond," LANSCE Futures Spring Workshop, May 10, 2021. 3. M. L. Zerkle, "Update on ENDF-6 Mixed Elastic Scattering Format," WPEC SG48, May 12, 2021. 4. M. L. Zerkle, J. C. Holmes, J. L. Wormald, "Update on NNL TSL Evaluations and Validation," WPEC SG48, May 12, 2021.	Yes Yes Yes Yes	
Q4			

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: TS2, 7, 8, 11, 13 **M&O Contractor Name**: ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010 **Date of Report:** Oct. 14, 2021

BUDGET



1. Carryover into FY 2021 = $155K
2. Approved FY 2021 Budget = $1,477K
3. Actual spending for 1st Quarter FY 2021 = $128K
4. Actual spending for 2nd Quarter FY 2021 = $187K
5. Actual spending for 3rd Quarter FY 2021 = $371K
6. Actual spending for 4th Quarter FY 2021 = $292K
7. Projected carryover into FY 2022 = ~$168

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-2021 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 a status report support provided to manage the CEdT process and assist CEDT manager as necessary to support IE 5-year plan objectives. (TS11)		
Q1	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
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 a status report support provided to manage the CEdT process and assist CEDT manager as necessary to support IE 5-year plan objectives. (TS11)		
Q2	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		

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 annual report of succession planning efforts (TS7)		
Q3	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
Q3	Provide the NCSP Manager a status report support provided to manage the CEdT process and assist CEDT manager as necessary to support IE 5-year plan objectives. (TS11)		
Q3	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		
Q4	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		
Q4	Manage 5-year plan development and maintenance and oversee the CEDT process and manage main 5-year plan and Integral Experiment Request Milestones. (TS2)		
Q4	Organize and lead the Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY (TS2)		
Q4	Publish final Five-Year Plan. (TS2)		
Q4	Provide NCSP Manager annual report of succession planning efforts (TS7)		

Q4	Provide NCSP Manager a status report of progress on the new IER system in G2 (TS8)		
Q4	Provide the NCSP Manager a status report support provided to manage the CEdT process and assist CEDT manager as necessary to support IE 5-year plan objectives. (TS11)		
Q4	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS13)		

ACCOMPLISHMENTS

- TS2 - Support for Lead Lab to Execute the NCSP
  - Prepare and maintain elements of NCSP Plan and associated activities:
    - Monitor Five-Year Plan progress
    - Schedule/participate in meetings and teleconferences with NCSP manager and task managers
    - Manage and provide oversight/coordinate efforts for the NCSP Information, Preservation, and Dissemination task element.
    - Manage and provide oversight/coordinate efforts for the NCSP Training and Education Program task element.
  - Participated in NCSP management team and other NCSP-related meetings, as required by the NCSP Manager.
  - Prepared Q3 QPRs into a single bookmarked PDF file for use in QPR. Conducted Q3 WebEx meeting.
  - Henley completed work on the FY21 Fall Newsletter
  - Henley worked with LLNL to maintain and update the NCSP website as necessary. In Q4, the NCSP website was updated to Drupal, which delayed website updates until mid-October. Henley worked with LLNL to generate a waiting list NCSP T&E registration.
  - Participated in CSSG telecons and assisted with CSSG tasks as necessary.
  - Led and participated telecons and WebEx meetings as necessary to track NCSP MGT team actions and deliverables.
  - Working on NCSP website enhancements and fixes and updates for accomplishments, foreign travel reports, and planning calendars.
  - Henley worked to uploaded foreign travel reports to the NCSP website as needed.
  - Bowen/Henley completed the FY22-FY26 main 5-year plan and obtained NCSP manager approval one week early (Aug. 6, 2021). The Integral Experiment section of the NCSP 5-year plan (draft 1) was completed in late August about 2 weeks after the budget execution meeting.
  - A Memo of Understanding (MOU) for NR/RPI/NCSP has been completed. Eight drafts of the MOU were developed and reviewed by NR and the NCSP and the final version will be signed at the RPI/NR/NCSP LINAC program review in October.
  - Proposal call delayed 1 year, so preparations ceased in Q4.
    - Next proposal call scheduled for October 2022
  - Accepted FY21 proposals were added to a list for publication on the NCSP website.

- TS7 - AM, ND Succession Planning
  - Chris Chapman, Jordan McDonnell, Alex Shaw, and Alex Lang worked on NCSP nuclear data and analytical methods tasks using TS7 funding. All support focused on nuclear data and NCS tasks in the 5-year plan.

- TS8 - NCSP Program Management Tools Development
  - All funds exhausted by Q4. John Miller and Doug Bowen compiling a list of new requests for IER database programmers for FY2022.

- TS11 - NCSP C_EdT Manager Support
  - Miller lead and Bowen supported C_EDT tasks as needed (IER approvals, milestone tracking, and meeting execution support)
  - Supported monthly IE calls in Q4 and associated BCR approvals and IER milestone tracking
  - The C_EDT manager tracked IER products and Baseline Change Reviews and worked with the NCSP manager to approve tasks, as required.

- TS13 - NDA Technical Support Group and NDA Technical Infrastructure Project
  - Efforts continue the TSG efforts to generate the new ANSI/ANS-8.28 standard for NDA administrative requirements in NCS programs. A second ANS-8 ballot has been completed and comments are being resolved. Bowen and Berg have not been able to coordinate the structure of the NDA program based on Larry's vision (many repeated attempts made). The NCSP Mission and Vision has been published and has been uploaded on the NCSP NDA website. Proposal call cancelled due to lack of engagement with assigned NDA federal project director. $400K of funding from this task and others sent to LLNL for use for IE tasks.

PUBLICATIONS

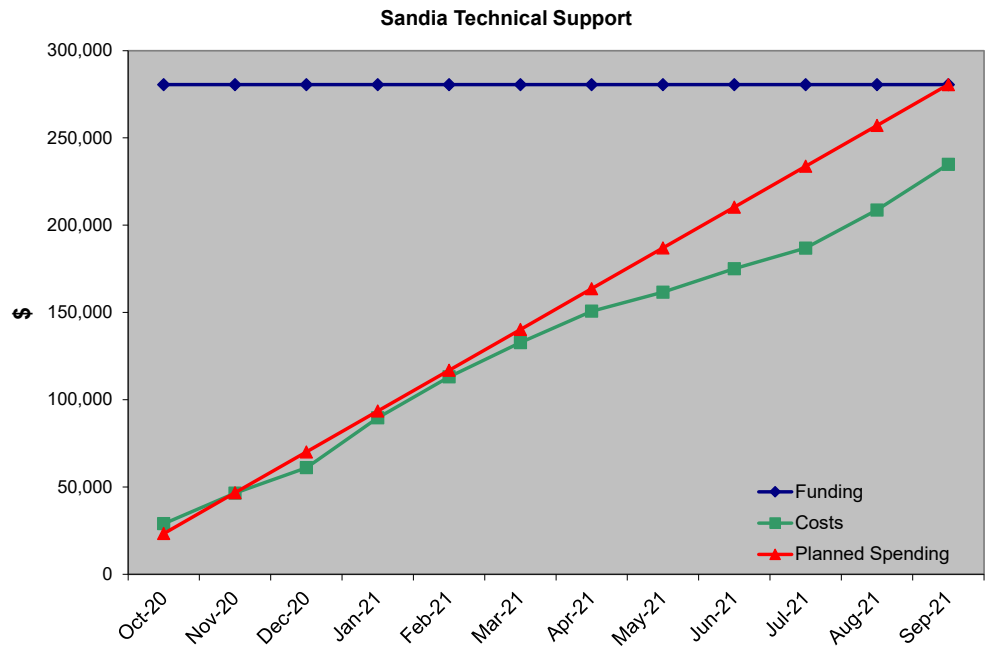
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	Publication Reference example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	Sent to NCSP? Yes/no	If no, status of submittal
Q1	N/A	N/A	
Q2	N/A	N/A	
Q3	D. Bowen & E. Saylor, "Nondestructive Assay Technical Infrastructure Program Mission and Vision," ORNL/TM-2021/2009, June 2021.	Yes	
Q4	Main section of the 5-year plan, published and sent to NA-50 on August 6, 2021	Yes	

NCSP Quarterly Progress Report (FY-2021 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:** DP0909020 **Date of Report:** September, 2021

BUDGET



1. Carryover into FY 2021 = $32,488
2. Approved FY 2021 Budget = $280,488
3. Actual spending for 1st Quarter FY 2021 = $61,119
4. Actual spending for 2nd Quarter FY 2021 = $71,628
5. Actual spending for 3rd Quarter FY 2021 = $42,353
6. Actual spending for 4th Quarter FY 2021 = $59,786
7. Projected carryover into FY 2022 = $45,602

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
  - We have a matrixed employee who is performing as an experimenter.
  - The new experimenter completed IER-230 and is now focusing on IER-441.
  - The new experimenter has been actively participating in the NCS community by attending conferences and publishing papers.
  - The student intern earned an MS Degree in Nuclear Engineering from Missouri S&T. Thesis title, "Development of Complex Lattice Cell in Benchmark Model of Particle Bed Critical System."
  - The student intern relocated to Albuquerque to continue working with the critical experiments program while pursuing a PhD degree.
- TS12 - NCSP C_EdT Manager Support
  - Performed duties as the C_EdT Manager in support of the IE program element.
    - Interacted with the various C_EdT Leads, NCSP Management Team, and other NCSP members.
    - Facilitated IE update meetings and issued meeting agenda and minutes.
    - Assisted the DOE NCS Program Management Team on a broad scope of items.
    - Tracked progress on BCRs and IER milestones/action items.
    - Reported projected final milestone completions and IERs moved out to future FYs.
    - Worked in the IER database and assisted others in gaining access to the database.

PUBLICATIONS

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

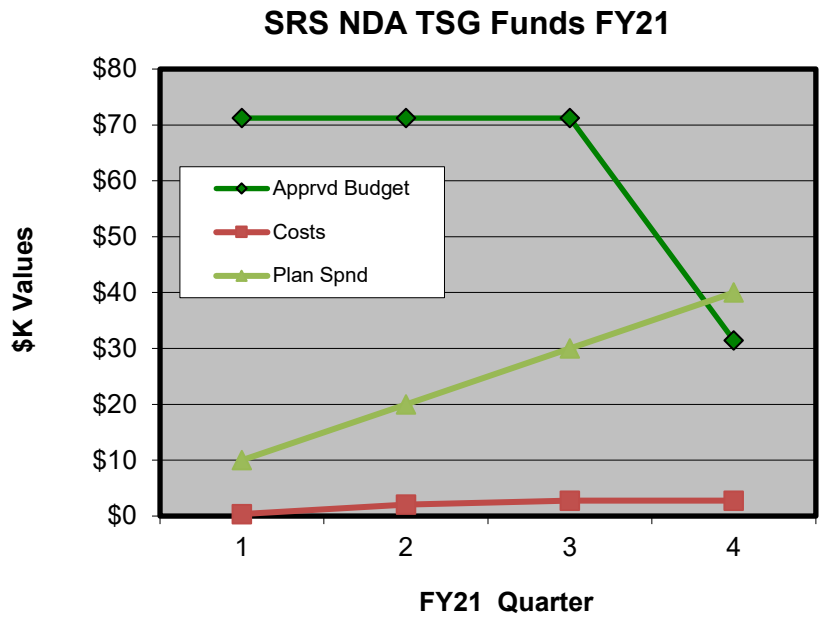
Quarter	Publication Reference	Sent to NCSP?	If no, status of submittal

	example) J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	**Yes/no**	
Q1			
Q2			
Q3			
Q4			

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: TS15 **M&O Contractor Name**: SRNS **Point of Contact Name:** David Erickson **Point of Contact Phone:** 803-557-1315	**Reference:** DP09090200 **Date of Report** October 14, 2021

BUDGET



1. Carryover into FY 2021 = $ 41,223
2. Approved FY 2021 Budget = $ 30,000*
3. Actual spending for 1st Quarter FY 2021 = $362
4. Actual spending for 2nd Quarter FY 2021 = $1,673
5. Actual spending for 3rd Quarter FY 2021 = $730
6. Actual spending for 4th Quarter FY 2021 = $0
7. Projected carryover into FY 2022 = $31.4K

* To be returned to NCSP – $39.8K has been returned (not sure if went to NCSP or other NNSA organization)

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 NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS15)		
Q2	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS15)		

Q3	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS15)		The NDA TSG has not been doing much this FY. Primary support has been responding to emails.
Q4	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS15)		No funds expended this quarter.

ACCOMPLISHMENTS

- TS15 - NDA Technical Support Group and NDA Technical Infrastructure Project

PUBLICATIONS

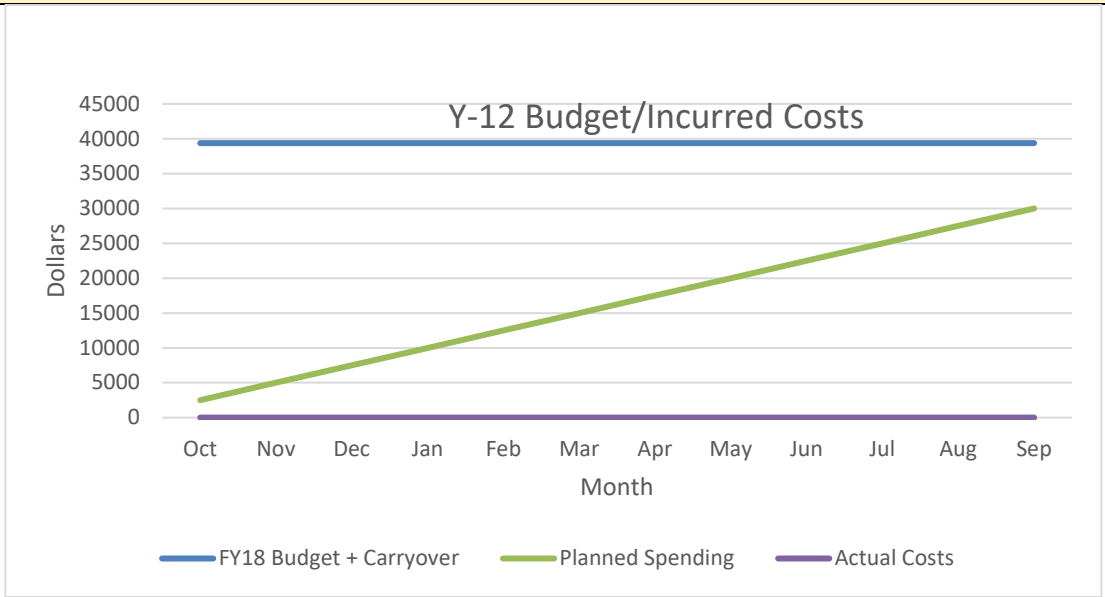
Any publications created during the quarter should be submitted to Marsha Henley, henleym@ornl.gov.

Quarter	**Publication Reference** **example)** J., "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation: A Comparison Study of Upper Subcritical Limits for Plutonium Systems using Whisper-1.1", LA-UR-18-27731, October 1, 2019	**Sent to NCSP? Yes/no**	**If no, status of submittal**
Q1	N/A		
Q2	N/A		
Q3	N/A		
Q4	N/A		

NCSP Quarterly Progress Report (FY-2021 Q4)

NCSP Element and Subtask: TS14 **M&O Contractor Name**: Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference:** DP0909020 **Date of Report:** October 22, 2021

BUDGET



1. Carryover into FY 2021 = $ 9,371.48
2. Approved FY 2021 Budget = $ 30,000
3. Actual spending for 1st Quarter FY 2021 = $0 (there is a $14,886.80 commit for CSSG support carried over that has not yet posted)
4. Actual spending for 2nd Quarter FY 2021 = $0.00 (there is a $14,886.80 commit for CSSG support carried over that has not yet posted)
5. Actual spending for 3rd Quarter FY 2021 = $0.00
6. Actual spending for 4th Quarter FY 2021 = $0.00
7. Projected carryover into FY 2022 = $39,371.48 (minus the $14,886.80 commit for CSSG support that still has not posted)

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 NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS14)		No activity this quarter.
Q2	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS14)		No activity this quarter.

Q3	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS14)		No activity this quarter
Q4	Provide the NCSP manager an update of NDA Technical Support Group and NDA Technical Infrastructure Project activities. (TS14)		No activity this quarter

ACCOMPLISHMENTS

- TS14 - NDA Technical Support Group and NDA Technical Infrastructure Project

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			

2021-10-21

Summary of LANL Classes in FY 2021 – Q4

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

FY2021 – Q4 classes are highlighted in red.

Total Students

- **FY2021 – Q1: 89 students (UNM, Intro, Intermediate, VR, UM)**
- **FY2021 – Q2: 106 students (Intro classes)**
- **FY2021 – Q3: 129 students (Intro, Intermediate, Criticality, S/U)**
- **FY2021 – Q4: 67 students (Intro, NJOY)**
- **FY2021 – TOTAL: 391 students**

Due to COVID-19 & travel restrictions, in-person classes & site visits were cancelled. 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 7-9, 2021 online 21 students**

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

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation (LANL-TE4)**
  - **April 27 & 28, 2021 online 22 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.

- **Monte Carlo Techniques for Nuclear Systems (LANL-AM1)**
  - **Aug 21 – Dec 4, 2020 UNM+online 13 students**
  - **Aug 27 – Dec 10, 2021 UNM+online**

  This is a 1-semester class for senior undergrads & graduate students at the University of New Mexico. Includes Monte Carlo theory & practical use of MCNP6. Partially supported by NCSP, ASC, and other programs.

- **Advanced Monte Carlo Methods (LANL-AM1)**
  - **TBD UNM+online**

  This is a 1-semester UNM graduate class covering details of transport theory, Monte Carlo, advanced computing, & codes. This course is also used to teach LANL staff members. Partially supported by NCSP, ASC, and other programs.

Other Classes - supported by student registration fees.

- **Introduction to MCNP6** (includes 1/2 day on criticality calculations, without NCS validation & Whisper)
  - **Nov 30 - Dec 4, 2020 online 35 students**
  - **Jan 25-29, 2021 online, OECD-NEA 28 students**
  - **May 24-28, 2021 online 47 students**
  - **Aug 16-20, 2021 online 44 students**
- **Intermediate MCNP6**
  - **Feb 1-5, 2021 online, OECD-NEA 39 students**
  - **Apr 5-9, 2021 online 39 students**
- **Advanced MCNP6 Features & Utilities**
  - **Feb 8-12, 2021 online, OECD-NEA 39 students**
- **Unstructured Mesh with Attila4MC**
  - **Nov 2-6, 2020 online 18 students**
- **Variance Reduction**
  - **Dec 14-16, 2020 online 23 students**
- **NJOY**
  - **Aug 30 – Sept 1, 2021 online 23 students**

2021 Q4 – SCALE Training Courses Report for the Nuclear Criticality Safety Program

Class Name	Frequent Fulcrum Functions: The Basics of SCALE's Graphical User Interface
Class Dates	August 4, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	20
Short Description	This tutorial will introduce the Fulcrum graphical user interface and the basic functions that enhance the common activities of creating, editing, navigating, executing, and visualizing SCALE input files. This tutorial will help attendees become familiar with the Fulcrum input file text editor and the integrated input development environment features of autocompletion, automatic checking, cursor context, and input navigation. In addition, the Fulcrum and SCALE runtime environment will be reviewed to improve understanding of job execution workflow. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.2.4 or SCALE 6.3.0 (beta14 or later).

Class Name	Sensitivity Uncertainty Analysis of HALEU/HBU Fuel using SAMPLER
Class Dates	August 4, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	15
Short Description	This tutorial will introduce the application of the Sampler sequence to perform sensitivity and uncertainty analysis for high-assay low-enriched uranium (HALEU)/high burnup (HBU) and accident tolerant fuel (ATF) concepts. Participants will learn how to use recent features in Sampler to identify similarities and differences in decay heat and k-eff trends, as well as the major contributors to the identified differences, for light water reactor (LWR) fuel. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.3.0 (beta14 or later).

Class Name	SCALE Modeling of the Fast Spectrum Heat Pipe Reactor
Class Dates	August 4, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	17
Short Description	This tutorial will demonstrate how to model fast spectrum heat pipe reactors using SCALE. Specifically, the INL Design A reactor based on the LANL Megapower reactor will be discussed. Demonstrations will show how to create a heat pipe reactor input with KENO and how to generate reactivity coefficients, power profiles, reactivity worths, and perform depletion calculations. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.2.4 or SCALE 6.3.0 (beta14 or later).

Class Name	Polaris Lattice Physics Modeling for ATF Designs
Class Dates	August 5, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	11
Short Description	This tutorial will walk through the use of Polaris for two-dimensional LWR depletion analysis. Polaris provides an easy-to-use input for defining lattice geometries, material compositions, and reactor state conditions. Attendees will learn how to model a standard pressurized water reactor lattice, with user-defined

	time-dependent state conditions, such as control rod insertion and removal and how to visualize the burnt fuel inventories in Fulcrum. A quick run-through will be provided of lead test rod or lead test assembly analysis using advanced technologies such as doped fuel or coated cladding. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.3.0 (beta14 or later).

Class Name	Source Term Generations for TRISO Fuel Systems
Class Dates	August 5, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	16
Short Description	Pebble-based TRISO fuel is drawing renewed interest across a number of different advanced reactor concepts, including high-temperature gas reactors and the fluoride-cooled high-temperature reactor. In this tutorial, SCALE experts will guide users through the existing set of SCALE capabilities for modeling TRISO-based fuel systems, including resonance self-shielding options in CENTRM and share various best practice observations from their experience in modeling full-scale reactor systems. Prior experience with TRITON is highly recommended. Attendees can follow along using SCALE 6.2.4 or SCALE 6.3.0 (beta14 or later).

Class Name	Criticality Safety Validation using VADER
Class Dates	August 5, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	18
Short Description	This tutorial will demonstrate criticality safety validation exercises using the VADER sequence in SCALE 6.3. This tutorial will use VADER in the Fulcrum user interface to develop upper subcritical limits (USLs) for hypothetical criticality safety applications based on critical experiment data. Several statistical tests and USL determination methods will be demonstrated. No prior experience with SCALE is needed for this tutorial. Attendees can follow along using SCALE 6.3.0 (beta14 or later).

Class Name	Activation Analysis with ORIGEN/MAVRIC for Advanced Reactors
Class Dates	August 5, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	19
Short Description	This tutorial will demonstrate the application of ORIGEN and MAVRIC for activation analysis for an advanced reactor concept. ORIGEN will be used to generate the activation source terms and MAVRIC will be employed to calculate dose rates due to activated materials. **N**o prior experience with SCALE is required. Attendees can follow along using SCALE 6.2.4 or SCALE 6.3.0 (beta14 or later).

Class Name	SCALE Utilities for Nuclear Data Interrogation, Comparison, and Visualization
Class Dates	August 6, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	16
Short Description	This tutorial is an introduction to the tools available to interrogate, compare, and visualize the SCALE nuclear data. We will use Fulcrum to plot continuous energy and multigroup cross section data, multigroup scattering matrices, covariance matrices, and correlation matrices. We will also demonstrate how to use Fulcrum

	to compare cross section and uncertainty data from different evaluated nuclear data releases. Users will get the chance to use a new tool, OBIWAN to view/patch/diff/convert data found on F33 and F71 files. Lastly, a variety of AMPX tools will be used to compare covariance libraries, compare working and master libraries, and print/manipulate the data stored on a multigroup library. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.2.4 or SCALE 6.3.0 (beta14 or later).

Class Name	LWR Decay Heat Analysis with SCALE
Class Dates	August 6, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	20
Short Description	This tutorial will walk users through different approaches for decay heat analysis in LWR spent fuel using fuel depletion and decay capabilities in SCALE. Attendees will learn how to determine decay heat based on fast simulations with ORIGEN under the ORIGAMI graphical user interface for LWRs, how to use ft71 files obtained with different SCALE depletion sequences as input for standalone ORIGEN simulations to determine decay heat as function of burnup and cooling time, and how to visualize the results with Fulcrum. No prior experience with SCALE is required. Attendees can follow along using SCALE 6.2.4.

Class Name	From SCALE to Source Term: Exporting SCALE Inventories to MELCOR
Class Dates	August 6, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	12
Short Description	This tutorial will walk users through the process of generating MELCOR-ready fission product inventories from ORIGEN concentration files, based on the new ORIGEN Inventory Interface File (IIF) format. Using the multi-functional OBIWAN utility, users will learn how to generate the JavaScript Object Notation-based IIFs, how to use these IIFs as standalone “databases” for follow-on calculations, as well as how to use other capabilities of the OBIWAN utility. Prior experience with ORIGEN and command-line interfaces is recommended. Attendees can follow along using SCALE 6.3.0 (beta14 or later).

Class Name	SCALE Modelling & Simulations for Nuclide Inventories and Source Terms in Spent Nuclear Fuel
Class Dates	September 13 – 16, 20 – 23, 2021
Location	Virtual - Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	11
Short Description	This was a hands-on training course focused on SCALE’s capabilities to determine nuclear inventories and source terms in spent nuclear fuel, with specific focus on aspects relevant for detection systems and nuclear safeguards applications of interest to IAEA staff. The course covered the use of ORIGEN for depletion and decay simulations and featured the use of the Fulcrum consolidated SCALE graphical interface and its capabilities for generating input files and inspecting and displaying nuclear data and calculated results. Participants learned how to generate ORIGEN libraries with the TRITON depletion sequence and how to use the ORIGAMI interface for convenient characterization with ORIGEN of LWR spent nuclear fuel with radially and axially varying burnup.

SCALE Users' Group Workshop – Information about attendance:

Total number of attendees – 173

Attendee Stats	Count of Attendees
NRC Attendees	8
ORNL Attendees	35
US Govt/Govt Contractors Attendees (Not ORNL, Not NRC)	15
Non-US Govt/Govt Contractor Attendees	13
Academia Attendees (US universities, US citizens)	12
Academia Attendees (US universities, Non-US citizens)	6
Academia Attendees (Non-US Universities)	20
Industry Attendees (US companies, US citizens)	24
Industry Attendees (US companies, Non-US citizens)	0
Industry Attendees (Non-US Companies, US citizens)	3
Industry Attendees (Non-US Companies, Non-US citizens)	37

Organization Stats	Count of Organizations
US Govt/Govt Contractors	9
Non-US Govt/Govt Contractor Attendees	10
Academia (US universities)	11
Academia (Non-US Universities)	14
Industry (US companies)	17
Industry (Non-US companies)	33
Total Organizations Represented	94

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

Reference			AWE Contributions and POCs			
AWE Reference	**Task Description**	**NCSP Reference**	**FY2018 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. Next inter-comparison exercise anticipated to be 2021.						
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 (2021 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**	**FY2018 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 on hold during the COVID-19 pandemic.						
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. In addition to the ongoing travel limitations imposed by COVID, funding for AWE staff to attend the DAF during the forthcoming UK Financial Year (April 2021 to March 2022) has yet to be approved by MOD, but AWE is actively seeking to secure this funding.						
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 scheduled for 2021.						
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.						

Reference			AWE Contributions and POCs			
AWE Reference	**Task Description**	**NCSP Reference**	**FY2018 AWE Contribution**	**AWE Technical POC**	**Collaborator POC**	**DOE Lab**
AWE-IE13	Characterization of AFRRI TRIGA reactor radiation field AWE will provide onsite measurement	LLNL-IE18 SNL-IE4	Provide support to experiment design	P. ANGUS	A. ROMANYUKHA	LLNL
AWE was fully prepared for July 2019 trial, prior to the regulatory shut-down of TRIGA. If trial is re-scheduled for 2021 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 the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) for FY2021

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Analytical Methods						
IRSN-AM1	Validation and qualification methods	ORNL-AM2 ORNL-IPD4	Determination of the experimental correlations of Valduc experiments. To be discussed with ORNL.	N. LECLAIRE	B.J. MARSHAL	ORNL
Q1 status No progress **Q2 status** No progress **Q3 status** No progress **Q4 status** No progress						
IRSN-AM5	Update of the slide rules	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 The document about the specifications for delayed gamma calculations for plutonium systems was sent on 27th November to all collaborators (ORNL, LLNL, NNL, AWE). It was discussed during a meeting on 8th January and partners decided to make first calculations for April 2021. The next meeting is planned on 13th April. **Q2 status** During the 13th April meeting, first results were discussed. Additional calculations are necessary to understand discrepancies between participants' results. The section about the estimation of the number of fissions was also discussed. The next meeting is planned on 26th May. **Q3 status** Two meetings: May 26 and June 29 with participants from IRSN, ORNL and LLNL Analysis of inconsistency between results from 3 out of 5 cases. Results on two last cases to be discussed during next meeting (August 3, 2021) **Q4 status** Final results were discussed at the October 1th meeting. IRSN further comparison with VESTA/MCNP and FISPACT/MCNP showed a very good agreement with LLNL COG calculations of the Pu DFG dose. There still appear to be some discrepancies with ORIGEN/MCNP, which must be investigated. Next meeting is planned on November 18th. NCSD 2022 abstract on this collaborative work has been submitted for review.						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-AM8	Analytical Methods Working Group	NCSP-TS2	IRSN participation to NCSP analytical methods Working Group, NDAG meeting, and TPR meeting	S. PIGNET	F. BROWN D. BOWEN D. HEINRICHS	NCSP

Q1 status
IRSN will participate in the NDAG meeting. Luiz LEAL will make a presentation on ND needs. Presentations are scheduled to be delivered in next TPR meeting.

Q2 status
IRSN has participated to the AM WG, NDAG and TPR meetings on February 22-23. IRSN work activities were presented by Nicolas LECLAIRE Luiz LEAL and Sophie PIGNET.

Q3 status
No progress

Q4 status
No meeting during Q4

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

Q1 status
Nicolas LECLAIRE and Frederic FERNEX participated in AMPX training on October 2020. Due to the COVID-19 situation other planned activities were delayed.

Q2 status
A comparison was made between the PUFF module of AMPX and the ERRORR module of NJOY, with the use of several weighting fluxes, on U235 and Gd155 and Gd157, in the frame of a five months intern ship. Moreover, PUFF was used to generate covariances from the JEFF 3.3 library for internal use at IRSN.

Q3 status
Exchanges between IRSN and ORNL on AMPX training for data covariances generation. (extension of IRSN AMPX user group)

Q4 status
AMPX training postponed due to delay on the IRSN security clearance request.

IRSN-AM13	Benchmark intercomparison study	LLNL-AM5 ORNL-AM10 LANL-AM5	Definition of common set of developed benchmark models Calculations for Pu and HEU systems. LEU, MIX, U233 and SPEC systems will be included in FY 2021.	N. LECLAIRE	D. HEINRICHS D. BOWEN F. BROWN	LLNL ORNL LANL

Q1 status
Analysis of inconsistencies on LEU systems, MIX and U233 calculations. Conclusions transmitted to LANL (Jennifer ALWYN). Next action: Proposal of additional cases to be modelled with the MORET code in 2021 for U233 systems. A status of results will be presented at the next TPR meeting.

Q2 status
Additional experiments for U233 and MIX were identified and are being modelled this year. The analysis of the results will follow.

Q3 status
IRSN has implemented new U233, MIX results with MORET 5 for the inter-comparison exercise**.** Results shared with other participants.

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Q4 status IRSN has received results from LLNL and ORNL concerning cases for which discrepancies were observed (TSL of CH2 amongst others). IRSN also transmitted to LLNL a list of cases for which large discrepancies between the MORET and COG results were observed for the JEFF-3.3 and ENDF/B-VIII.0 nuclear data libraries. The analysis of the discrepancies is in progress. IRSN contribute to LANL report presenting the correction of MCNP input decks following the intercomparison analysis (thanks to 2019-2020 feedback).						
IRSN-AM14	Sensitivity/Uncertainty comparison study with a focus on Upper Subcritical Limits	ORNL-AM9 LANL-AM4	Definition of test cases Calculations and intercomparison Technical report	A. BARDELAY	F. BROWN D. BOWEN	LANL ORNL
Q1 status No progress **Q2 status** No progress **Q3 status** Selection of 5 cases proposed in common with J. Alwin and determination of bias and bias uncertainty using the MACSENS code with covariance based on ENDF/B-VII.0 (SCALE)on going at IRSN. **Q4 status** Transmission of IRSN MACSENS results for the 5 selected cases to J. Alwin end of July.						
IRSN-AM15	MCNP Maintenance and Support / Uncertainty Analysis Development / Modernization / etc.	LANL-AM1	Interest for uncertainty analysis, source convergence development and modernization strategy	W. MONANGE	F. BROWN	LANL
Q1 status No progress. **Q2 status** No progress **Q3 status** No progress **Q4 status** No progress						
Integral Experiments						
IRSN-IE6 **IER 306**	Rh experiment	SNL-IE1	CED-2 report	N. LECLAIRE	G. HARMS	SNL
Q1 status The CED-2 report is in progress. It takes into account the last results of a subcontract for the design optimization. The report should be submitted to the NCSP review team mid-2021.						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Q2 status The CED-2 report is almost finished. It considers the last results of a subcontract for the design optimization. The report should be submitted to the NCSP review by end of June. A preliminary study for rhodium supply was initiated. The cost of rhodium seems to have hugely increased and could constitute a limitation for the pursuit of the IER. **Q3 status** CED-2 report completed under IRSN review. Draft version to be sent to SNL by the end of July. **Q4 status** CED-2 report completed is under IRSN review. Draft version to be sent to SNL by the end of October.						
IRSN-IE7 **IER 305**	Mo experiment	SNL-IE1	Leading the CED-3a report; Supplying the Mo rods for the experiment. Participation to the experiments	N. LECLAIRE	G. HARMS	SNL
Q1 status The technical specifications report was written and submitted along with other documents to various companies through a public tender. Tender process in progress. The manufacturing of sleeves, measurement campaign (chemical and dimensions) and analysis of the results should be done beginning of May 2021. The CED-3a will need to be written when an estimate of the sleeves manufacturing is available. **Q2 status** The technical specifications report was written and submitted along with other documents to various companies for public bids. The PLANSEE company had the best offer. The order has been done after discussing the specification values with Gary Harms and David Ames and adjusting some dimensions to ease the experimental realization. The manufacturing of sleeves, measurement campaign (chemical and dimensions) and analysis of the results should be achieved beginning of July 2021. The CED-3a will be written shortly since the cost for Mo sleeves is now available. **Q3 status** Mo sleeves are being manufactured by PLANSEE company. Draft of contract sent by IRSN to Sandia for the Mo sleeves property transfer. Waiting for SNL feedback. **Q4 status** Mo sleeves have been manufactured. A first lot of 210 sleeves has been sent to the US on the 23rd of September. The remaining lot which presented deviations from the specification has been re-manufactured following the specifications are about to be sent. Documents related to measurements and to the chemical analyses of the first lot were sent to Gary Harms. IRSN is waiting for Gary's approval to launch payment.						
IRSN-IE11 **IER 297**	TEX - Hf baseline experiments (HEU)	LLNL-IE4	Contribution to ICSBEP evaluation of the baselines experiments	M. BROVCHENKO	C. PERCHER	LLNL
Q1 status Activity is on hold. The ICSBEP evaluation is under preparation by LLNL. **Q2 status** Activity is on hold. The ICSBEP evaluation is under preparation by LLNL. **Q3 status** Activity is on hold. The ICSBEP evaluation is under preparation by LLNL.						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Q4 status Activity is on hold. The ICSBEP evaluation is under preparation by LLNL.						
IRSN-IE11 **IER 532**	TEX-Hf experiments	LLNL-IE4	Participation to experiments and analysis of results	M. BROVCHENKO	C. PERCHER	LLNL
Q1 status Activity is on hold. Experiments foreseen to be performed summer 2021. **Q2 status** Activity is on hold. Experiments foreseen to be performed summer 2021. **Q3 status** Activity is on hold. Experiments foreseen to be performed autumn 2021. **Q4 status** Activity is on hold and waiting for experiment schedule.						
IRSN-IE27 **IER 498**	GODIVA CAAS benchmark	ORNL-IE4	Participation in the design (CED2 FY2021) Provide IRSN materials for irradiation	F. TROMPIER	D. BOWEN	ORNL
Q1 status Discussion in progress on the design. **Q2 status** Discussion in progress on the design. **Q3 status** Agreement on devices type and dosimeters to be provided by IRSN to help in the definition of dosimetry references. **Q4 status** Waiting for experiments schedule.						
IRSN-IE28 **IER 406**	Cf-252 CAAS benchmark	LLNL-IE1	Participation to the experiments. Provide IRSN materials for irradiation	F. TROMPIER	D. HEINRICHS	LLNL
Q1 status Stand by - waiting for experiments to be planned **Q2 status** Stand by - waiting for experiments to be planned						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Q3 status Stand by - waiting for experiments planning when the COVID-19 situation clears up. **Q4 status** Stand by - waiting for experiments planning when the COVID-19 situation clears up.						
IRSN-IE30	Full dosimetry exercise around GODIVA	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	F. TROMPIER	D. HEINRICHS	LLNL AWE
Q1 status No progress **Q2 status** No progress (discussion HEINRICHS and TROMPIER) **Q3 status** Exchanges between IRSN and LLNL: the first full exercise may be held in AFFRI in Bethesda instead of NTS, because of the ability of AFFRI to manage real blood samples for cytogenetic analysis. Experiments could be planned when radiation field characterization would be achieved. No schedule yet for the field characterization. **Q4 status** Waiting for update on the field characterization schedule of the TRIGA reactor at AFFRI						
IRSN-IE34 **IER 488**	MUSIC (HEU) critical and Subcritical measurements.	LANL-IE23	Participation to the experiments, analysis of results	W. MONANGE	J. HUTCHINSON	LANL
Q1 status The experiment should be carried out the second week of February. Team discussions for preparation of the experiment. Decision made early January due to the COVID-19 situation: IRSN team is not allowed to travel. **Q2 status** The experiments have been carried out mid-February. IRSN is waiting for the results. **Q3 status** Meeting with LLNL April 28. IRSN received results from experiments. Waiting for information regarding the experiments to start the benchmark modeling. **Q4 status** The information regarding the experiments have been received by IRSN in early October. IRSN will start working on the benchmark in October.						
IRSN-IE36 **IER 514**	ICSBEP/SINBAD Shielding benchmarks for shipping containers	LLNL-IE1 AWE-IE8	Participation in the design and to the experiments	M. BROVCHENKO	D. HEINRICHS R. JONES	LLNL AWE
Q1 status Activity is on hold waiting for LLNL input **Q2 status** Activity is on hold waiting for LLNL input **Q3 status**						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Activity is on hold waiting for LLNL input **Q4 status** Activity is on hold waiting for LLNL input						
IRSN-IE41 **IER 499**	Thermal/Epithermal Experiments (TEX) with Chlorine and Lithium	LLNL-IE23	Participation in experiments design and CED reports.	M. BROVCHENKO	D. HEINRICHS	LLNL
Q1 status Technical exchanges between LLNL and IRSN. **Q2 status** Technical exchanges between LLNL and IRSN. **Q3 status** Meeting June 25, IRSN has been kept informed on the design evolution by LLNL; Comparison with the French MIRTE Chlorine experiment to be done when LLNL sensitivity available. **Q4 status** Activity is on hold waiting for LLNL input						
IRSN-IE42 **IER 121**	Neptunium Subcritical Observations (NeSO) experiment	LANL-IE3	Independent review of the ICSBEP evaluation.	W. MONANGE	J. HUTCHINSON	LANL
Q1 status Activity is on hold; Evaluation is under preparation by LANL **Q2 status** Activity is on hold waiting for LANL input **Q3 status** Activity is on hold waiting for LANL input **Q4 status** Activity is on hold waiting for LANL input						
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.	N. LECLAIRE W. MONANGE	N. THOMPSON	LANL
Q1 status No progress. **Q2 status** The proposal was submitted. Both critical and sub-critical experiments are scheduled. Discussion between IRSN and LANL on IER design.						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Q3 status No progress (no news from LANL). Waiting for inputs from LANL. **Q4 status** No progress (no news from LANL). Waiting for inputs from LANL.						
IRSN-IE46 **IER 518**	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 No progress. **Q2 status** No progress. **Q3 status** No progress. **Q4 status** No progress.						
IRSN-IE47	Copper Critical Experiment	LANL-IE3	Participation in experiments design and CED reports. IRSN interest to understand results of various experiments (ZEUS experiments result and IRSN-IE48)	J-B. CLAVEL	J. HUTCHINSON	LANL
Q1 status No progress **Q2 status** No progress **Q3 status** Discussions with LANL. IRSN comments on the CED 1 to be sent in July. IRSN has interest on these experiments **Q4 status** LANL has sent to IRSN the last CED-1 version. IRSN will participate in the CED-2 kickoff meeting planned for November.						
IRSN-IE49	Iron/Steel/Chromium Critical Experiment Series	LANL-IE3	Participation in experiments design and CED reports. High interest for IRSN.	J-B. CLAVEL	J. HUTCHINSON	LANL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	Task Title	DOE Reference	FY 2021 IRSN Contribution	IRSN Technical POC	DOE Technical POC	DOE LAB
Q1 status No progress **Q2 status** No progress. **Q3 status** Discussions with LANL. **Q4 status** No progress.						
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 MIRTE 2 experiments evaluation approved. Few modifications in progress. To be published in 2021 handbook. **Q2 status** Last comments on MIRTE 2 experiments evaluation received and included in the benchmark. Evaluation to be published in 2021 handbook. **Q3 status** **Q4 status** Participation of IRSN in the ICSBEP meeting						
Nuclear Data						
IRSN-ND1	Contribution to new evaluations	ORNL-ND1 NNL-ND1 RPI	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 the evaluation of Mo and Pb isotopes are in progress; Evaluation of F19, Fe54, Fe56, Pu239 in progress; Rh103 evaluation completed and available for testing; **Q2 status** IRSN/NNL completed the Rh103 RR and URR evaluations. The library will be sent to NNDC. Work on the Mo and Pb isotope evaluation is under way. Fruitful exchanges with NNL/RPI. ANS paper on the Hf data assessment (shared with ORNL) accepted for presentation. Discussion on the RR Hf evaluation coordination (IRSN/ORNL/NNL) has been initiated. Fe56 evaluation shared with LLNL for testing. **Q3 status**						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
ANS paper on the RH103 RR completed; RR evaluation work start: resonance parameter selection and SAMMY input data defined. O16 RR evaluation revised using new (n, alpha) measurements. RR Mo95 evaluation with LANL data will start as soon as the data become available; RR for F19 revised; Contact with LANL to retrieve F19 inelastic data taken at GEANIE Fe56 evaluation sent to LLNL **Q4 status** RR Mo95 transmission and capture data provided to IRSN by LANL. IRSN Fe56 evaluation sent to BNL for testing Burnup issue with Pu239 has been investigated and addressed; ND abstract on the O16 evaluation submitted.						
IRSN-ND2	Nuclear data Evaluation and Testing	LANL-ND1 LANL-ND2	Contribution to new evaluations and validation in accordance with the milestone schedule in Appendix B Contribution to Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240	L. LEAL	B. BLUHM	LANL
Q1 status No progress **Q2 status** No progress **Q3 status** No progress **Q4 status** No progress						
IRSN-ND3	Nuclear data Evaluation and Testing	LLNL-ND8 ORNL-ND1	Resonance evaluation of ^{233}U	L. LEAL	D. HEINRICHS D. BOWEN	LLNL ORNL
Q1 status Work underway. Resolved resonance evaluation nearly completion; focus on the unresolved resonance evaluation: **Q2 status** Resolved resonance parameters from low to 2 keV and unresolved resonance parameter from 2 keV to 40 keV revised according to benchmark results. **Q3 status** URR work is underway. **Q4 status** Thermal benchmark calculations done at IRSN have shown substantial improvement. Testing of RR and URR RP covariance;						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2021 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-ND4	Delayed fission gamma multiplicity and spectra	LLNL-ND1 (a and b)	Data testing as new experimental data becomes available from foil activation measurements and dosimetry testing using GODIVA, FLATTOP, and other assemblies	M. BROVCHENKO	D. HEINRICHS	LLNL
Q1 status Activity is on hold waiting for LLNL input **Q2 status** Activity is on hold waiting for LLNL input **Q3 status** Activity is on hold waiting for LLNL input **Q4 status** Activity is on hold waiting for LLNL input						
Training and Education						
IRSN-TE1	Hands-on criticality safety training	ORNL-TE1 LANL-TE3 LLNL-TE1 SNL-TE1	IRSN attendance to NCSP classes. Possible lectures by IRSN working with NCSP training and education coordinator.	S. PIGNET	D. BOWEN	NCSP
Q1 status Activity delayed due to COVID. IRSN would like to send 2 participants to August 2021 session (if possible to travel) **Q2 status** Activity delayed due to COVID. IRSN would like to send 2 participants to August 2021 session (if possible to travel) **Q3 status** IRSN participation on the August 2021 session cancelled due to travel restrictions. **Q4 status** Proposal for participation of 2 people from IRSN in the August Hands-on training is under discussion at IRSN. A decision is excepted by the end of October.						

Additional information:

- **Q1:**

- **IER 513** Blind NAD Intercomparison with Godiva: exchanges (F. TROMPIER) with LLNL in November 2020 about the next dose blind intercomparison exercise plan at NCERC using the Godiva reactor. IRSN plans to participate to the exercise in 2021.

- **IER 520** TEX-Pu240 on the Planet machine: exchanges between LLNL and IRSN on the possible designs

- **IER 479** TEX low temperature: exchanges between LLNL and IRSN on the possible designs.

- **IER 519** TEX with absorbers Fe and Mn: technical exchanges between LLNL and IRSN on the nuclear data validation needs.

- **Q2:**

  - **IER 520** TEX-Pu240 on the Planet machine: exchanges between LLNL and IRSN on the possible designs

  - **IER 479** TEX low temperature: exchanges between LLNL and IRSN on the possibility to had materials of interest for transport (steel, Al, resin, …). Discussion on IRSN CH_2 Sab evaluations at different temperatures.

  - **IER 519** TEX with absorbers Fe and Mn: technical exchanges between LLNL and IRSN.

  - **IER 296**: comments from NCSP team on TEX MOX CED 1 received by IRSN.

  - **IER 184**: TEX Ta – contribution to TEX Ta review (PMM003)

- **Q3:**
  - IER 520 TEX-Pu240 on the Planet machine: exchanges between LLNL and IRSN on possible designs

  - IER 479 TEX low temperature: Discussions between IRSN and LLNL. IRSN is waiting for the LLNL design to propose additional experiments with materials of interest for criticality safety. Waiting for LLNL design.
    In addition, there are discussions on IRSN CH2 Sab evaluations at different temperatures. IRSN will provide results with the IRSN evaluation. Discussion on the thermal scattering experiments (PNDA -IER 501) proposed by LLNL. High interest for IRSN.

  - IER 519 TEX with absorbers Fe and Mn: technical exchanges between LLNL and IRSN
- **Q4:**
- IER 479 TEX low temperature: IRSN is waiting for the LLNL design to propose additional experiments with materials of interest for criticality safety.