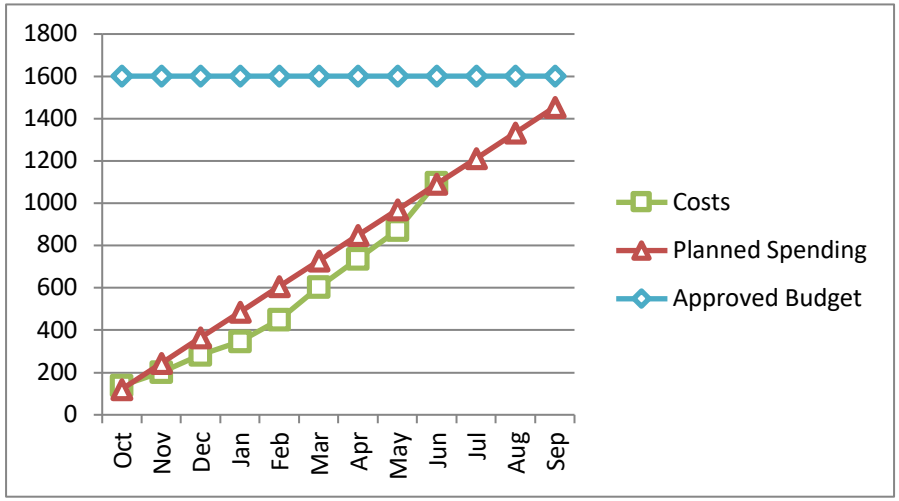
NUCLEAR CRITICALITY SAFTEY PROGRAM (NCSP)

FY2019 3RD QUARTER REPORTS

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: LANL AM1, AM2, AM4, AM5, AM6 Task Title: see last page M&O Contractor Name: LANL Point of Contact Name: Brian Bluhm / Bob Little Point of Contact Phone: 505-667-2440 / 505-665-3487	Reference: B&R DP0909010 Date of Report: July 26, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**



1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $1,601,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $283,516**
4. **Actual spending for 2nd Quarter FY 2019 = $321,123**
5. **Actual spending for 3rd Quarter FY 2019 = $493,582**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $146,000**

- **MCNP R&D Work, continued to investigate & develop (AM1)**
  - Fission matrix methods to diagnose & accelerate MC source convergence. Packaged for distribution to selected NCS early-adopters for testing. Initial distribution released to SNL, others planned in Q4.
    Milestone complete (AM1)
  - Update whisper to **whisper-1.2**, capabilities for multiple benchmark catalogs & new covariance data. Initial phase complete. Now have 2723 ICSBEP benchmarks. Converting new covariance data to ACE format.
  - Region-dependent sensitivity-uncertainty data for NCS validation
  - Machine learning studies to understand the bias in criticality calculations
  - Impact of correlated fission multiplicity models in criticality calculations
  - Studies into the validation for chlorine

- **MCNP Support & Maintenance (AM1)**
  - **Support MCNP6 users.** MCNP Forum, email, direct interactions, etc. **Milestone complete (AM1)**
  - Implemented Doppler Broadening Resonance Correction (DBRC) in MCNP6 free-gas scattering model. (Work funded

	by another DOE program, but has some significance to DOE NCSP.) - Code modernization effort - Efforts are in progress to improve SQA, implement some MCNP-2020 features, & upgrade portions of MCNP6. Includes more formal planning, design proposals, improved code review, SQA tools, and more. (Most of funding is non-NCSP.) • **Monte Carlo Education (AM1)** - MCNP6 Criticality training courses at LANL & SNL - 1/2 -day sensitivity-uncertainty seminar for LANL NCS - See separate report for full details of all Q3 MCNP classes. - Thesis advisor for UNM graduate student working in area of criticality calculations • **Comparison of Sensitivity-Uncertainty-based USL Methods (AM4)** - Comparison of results from LANL & ORNL is in progress. Awaiting results from IRSN. - Comparison of USLs found using LANL, SNL, & SRS benchmark suites, in progress. • **Comparison of ICSBEP Benchmark Results (AM5)** - Preliminary results were obtained from LANL, LLNL, ORNL, SNL, and IRSN. Detailed comparison of results is underway. • **Technical Data for the Pitzer Formulation of Solution Compositions (AM6)**

	- Participated in additional teleconference with ORNL and LLNL. Provided update to status of planned experiments at Los Alamos and proposed experiments at ORNL. • **NJOY Development and Support (AM2)** - An abstract was submitted to PHYSOR to report on the Doppler broadening implementation being done for NJOY21. This work is being completed and is schedule to be done by the end of the FY. - Work continues to implement the generation of fast neutron ACE files in NJOY21. The building of the ACE table is done and in final review. Taking the data from the PENDF file to the ACE builder is just beginning. - Much work was done in ENDFtk to support the work in ACER—including reading of MFs 4–8. - We continue to receive and respond to support requests for NJOY21. - Subgroup 43 – Code infrastructure to support a modern general nuclear database (GND) structure. Conlin and Haeck attended SG43 during the WPEC in June. Here is an excerpt from their NCSP trip report: Jeremy is the co-chair of Subgroup 43 with Caleb Mattoon of LLNL. We just completed the second (of three) year of the project. Reports were made by LLNL, ORNL, and LANL about the progress towards developing an implementation of GNDS and an Application Programming Interface (API) so that a user can access the GNDS data. We reported that LANL has ideas

on how to do this, but we don't have the resources (i.e., time, money, and people) to do so. We presented what we will do when we have the resources. LANL's approach was well received as a simple and understandable way to access the GNDS data without knowing the intimate details of the format.

- **Reports & Publications:**
  - F.B. Brown, "Doppler Broadening Resonance Correction for Free-gas Scattering in MCNP6.2", LA-UR-19-24824 (2019).
  - J.L. Alwin, F.B. Brown, M.E. Rising, "Verification of MCNP6.2 with ENDF/B-VIII.0 Nuclear Data for Nuclear Criticality Safety Applications", LA-UR-19-23348 (2019).
  - C.J. Josey, F.B. Brown, "Computing Alpha Eigenvalues Using the Fission Matrix", for MCD 2019, LA-UR-19-23543 (2019)
  - C.J. Josey, F.B. Brown, "Stabilizing the K-Alpha Iteration Algorithm in Very Subcritical Regimes", for MCD 2019, LA-UR-19-23527 (2019)
  - F.B. Brown, C.J. Josey, S.Henderson, W.R. Martin, "Automated Acceleration and Convergence Testing for Monte Carlo Criticality Calculations", for MCD 2019, LA-UR-19-23887 (2019)
  - F.B. Brown, C.J. Josey, S.Henderson, W.R. Martin, "Fission Matrix Application to Acceleration and Convergence Testing for Monte Carlo Criticality Calculations", for ICTT-26, LA-UR-19-24563 (2019)
  - F.B. Brown, C.J. Josey, S.Henderson, W.R. Martin, "Automated Acceleration and Convergence Testing for Monte Carlo NCS Calculations", for ICNC 2019, LA-UR-19-25170 (2019)
  - F.B. Brown, "Automated Acceleration and Convergence Testing for Monte Carlo Nuclear Criticality Safety Calculations", for ANS Winter 2019, LA-UR-19-25527 (2019)

	- J.L. Alwin, F.B. Brown, "Excluding Benchmark Statistical Outliers in Nuclear Criticality Safety Validation", for ANS Minneapolis, LA-UR-19-25267 (2019) - J.L. Alwin, J.B. Spencer, "Critical Experiment Benchmark Results using UM and Mesh Quality Recommendations", LA-UR-19-26393 (2019) - J.L. Alwin, J.B. Spencer, G. Failla, "Criticality Accident Alarm System (CAAS) CSG-UM Hybrid Example", LA-UR-19-27007 (2019) - J.B. Spencer, J.L. Alwin, "Big Ten MCNP6 Unstructured Mesh Benchmark", LA-UR-19-25731 (2019) - J.L. Alwin, J.B. Spencer, G. Failla, "Criticality Accident Alarm System Analysis Using MCNP6.2 Constructive Solid Geometry/Unstructured Mesh Hybrid", for ICNC 2019, LA-UR-19-24892 (2019) - J.L. Alwin, "Sharing of Good Industry Practices and/or Lessons Learned in Nuclear Criticality Safety: Using Sensitivity-Uncertainty Methods to Improve Traditional Validation", ANS Minneapolis, LA-UR-19-25296 (2019) - A. Sood, M.E. Rising, "MCNP Modernization Execution Plan for 2019", LA-CP-19-20317 (2019) - A. Sood, M.E. Rising, "MCNP Modernization Plan", LA-CP-19-20318 (2019) - M.E. Rising, "Evaluating Sensitivity-Based Similarity Metrics Between Applications And Benchmarks", for ICNC 2019, LA-UR-19-25712 (2019) - P.A. Grechanuk, M.E. Rising, T.S. Palmer, "Identifying Sources of Bias from Nuclear Data in MCNP6 Calculations using Machine Learning Algorithms", for MCD 2019, LA-UR-19-20421 (2019)

	- M.E. Rising, et al., “Correlated Fission Physics, Transport and Applications”, for INMM Annual meeting, LA-UR-19-20757, LA-UR-19-25670 (2019)

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL AM Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Provide reports on summer intern work accomplished (AM1)		
Q2	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Issue an MCNP V&V report, including ENDF/B-VIII.0 (AM1)		
	Provide MCNP6 Criticality training course (AM1)		
	Provide status of R&D and modernization efforts at the NCSP Technical Program Review (AM1)		

	Implement the Doppler broadening capabilities into the NJOY21 framework (AM2)		**Now scheduled for delivery in Q4.**
Q3	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Release initial version of MCNP6 with automatic convergence testing & under-sampling diagnostics to several NCSP early-adopters for testing, issue report (AM1)		
Q4	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Implement ACER fast neutron capabilities into the NJOY21 framework (AM2)		
	Issue report on the Sensitivity-Uncertainty Comparison Study (AM4)		
	Issue report on the ICSBEP Benchmark Comparison Study (AM5)		
	Document and release beta versions of ENDF/B-VIII.1 evaluations in ACE format on LANL website (AM1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

Task Title:

AM1 MCNP Maintenance and Support, Uncertainty Analysis Development, and Modernization

AM2 NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization

AM4 Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits

AM5 Proposed Benchmark Intercomparison Study

AM6 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: AM2, 3, 5, 6, 7

Task Titles:

AM2 Multiphysics Methods for the Simulation of Criticality Accidents
AM3 Slide Rule Application
AM5 Proposed Benchmark Intercomparison Study
AM6 Proposed 1-D Multipoint Analytical Benchmark Comparison
AM7 Technical Data for the Pitzer Formulation of Solution Compositions

M&O Contractor Name: Lawrence Livermore National Laboratory

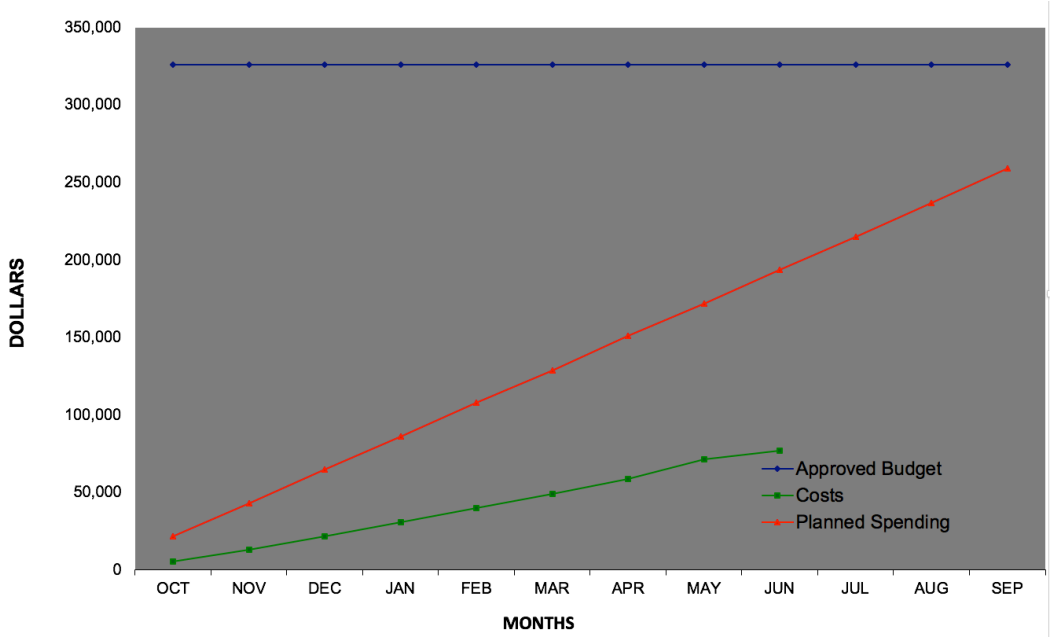
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: July 12, 2019

BUDGET



1. **Carryover into FY 2019** = $45,203
2. **Approved FY 2019 Budget** = $326,203 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $22,055
4. **Actual spending for 2nd Quarter FY 2019**= $27,204
5. **Actual spending for 3rd Quarter FY 2019** = $28,026 (not including $54,537 lien for AM6).
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $67,203 (21%)

MAJOR ACCOMPLISHMENTS

1. LLNL multiphysics methods development continues with the focus currently on implementation and testing of delayed neutrons in the sub-prompt super-critical regime based on a mechanically simplified model of Flattop (AM2).
2. Report IRSN/2019-00266, *Update of the Nuclear Criticality Slide Rule, Technical Basis,* was issued on May 9, 2019 (AM3).
3. Provided additional high-precision COG benchmark results using ENDF/B-VII.1, ENDF/B-VIII.0 and JEFF-3.3 to Isabelle Duhamel (IRSN) for a total of 2,286 ICSBEP benchmark cases for inclusion in the Benchmark Intercomparison Study (AM5) as follows:

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PU: 600     U233: 193     MIX: 124
HEU: 818    IEU:  188     LEU: 363
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4. Isabelle Duhamel (IRSN) submitted *International Criticality Benchmark Comparison for Nuclear Data Validation* to the ANS Winter Meeting, which includes COG results for PU and HEU cases using ENDF/B-VII.1, -VIII.0, and JEFF-3.3 (AM5).
5. Reviewed *Analytic One-Group S2 Slab Problem with Isotropic Scattering and Fission Applied to Leakage and Neutron Multiplicity Sensitivity* submitted by Jeff Favorite (LANL) to the ANS Winter Meeting (AM6).

NCSP Quarterly Progress Report (FY-2019 Q3)

LLNL AM Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q2	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q3	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q4	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		

Task Titles:

AM2 Multi-Physics Methods for Simulation of Criticality Excursions

AM3 Slide Rule Application

AM5 Proposed Benchmark Intercomparison Study

AM6 Proposed 1-D Multipoint Analytical Benchmark Comparison

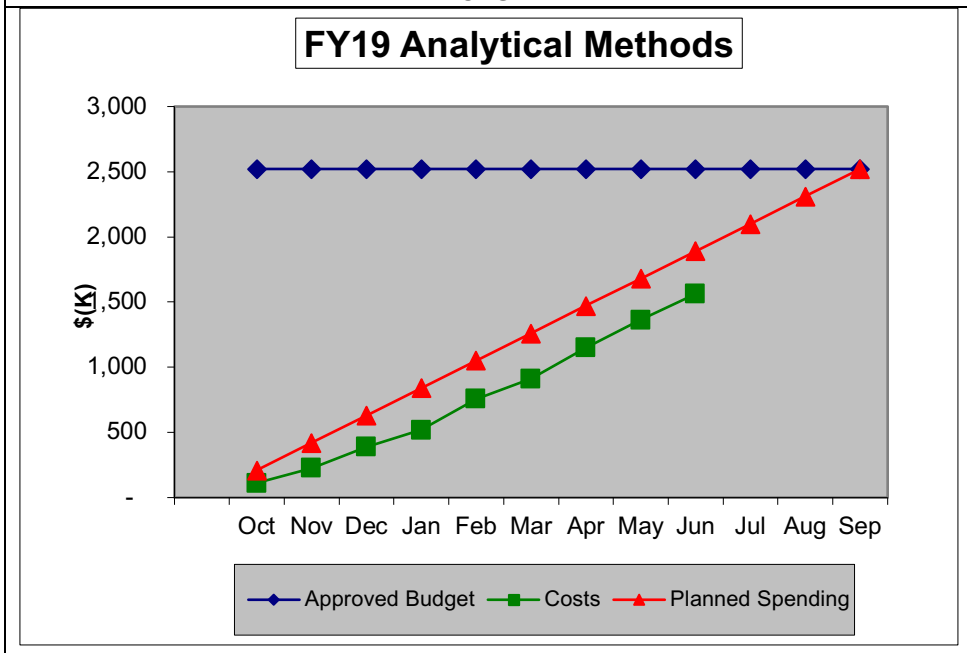
AM7 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ORNL – AM1, 2, 3, 6, 9, 10, 11, 13, 14, 15, 16
Task Titles: See last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: July 23, 2019

BUDGET



1. **Carryover into FY 2019** = $301K
2. **Approved FY 2019 Budget** = $2521k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $388K
4. **Actual spending for 2nd Quarter FY 2019** = $523
5. **Actual spending for 3rd Quarter FY 2019** = $651
6. **Actual spending for 4rd Quarter FY 2019** = $0
7. **Projected carryover into FY 2020 = ~$250K**

MAJOR ACCOMPLISHMENTS

AM1 – Distribution of available and newly packaged software

- Distributed 611 software packages and updated 1 software package.
- 104 SCALE, 250 MCNP®, and 0 COG packages distributed.
- RSICC quarterly report issued.

AM2 - SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section and Generation/Modernization

- Released FY2018 SCALE Annual Report.
- Contributed Winter ANS Summary Paper on SCALE for NCSP.
- Discovered "Significant Software Error" for handling of isotopic distributions for non-naturally occurring elements. Notified sponsors within 48 hours and SCALE users within 4 days.
- Released SCALE 6.3 beta3 and beta4 internally to ORNL users. Delivered beta4 to a small group of external users.
- Beta3 and Beta 4 updates.
  - Infrastructure/Maintenance
    - Combined packages and removed deprecated packages from SCALE repository including a duplicate of "EXSITE", the AMPX GUI.
    - Merged projects with the Exnihilo Shift team to manage development within one system.
    - Developed new scheme for managing testing different data versions in SCALE automated testing. Used for ENDF/B-VIII data below.
    - Refined software quality assurance templates with better checklists.
    - Automated testing now returns all result files from fails for quicker debugging.
  - CSAS-Shift criticality safety analysis sequence
    - Initial version of new Shift continuous energy processing package (Robus) deployed.
    - Energy and region-dependent flux and fission density edits
    - Additional error checking for geometry robustness
    - New thermal cutoff parameter for upscattering
- Nuclear data

	○ Updated ENDF/B-VII.1 data with new p-tables for better fast spectrum calculations. ○ Deployed ENDF/B-VIII data in beta4 for external testing. ○ Arbitrary data parameter ranking capability in Sampler (top 5 contributors to uncertainty) **AM3 - AMPX Maintenance and Modernization** ○ The ENDF/B-VIII.0 data were prepared, bundled and released with the current SCALE beta release. ○ The AMPX participated in the WPEC meeting in PARIS and presented the current status of GNDS support in AMPX. **AM6 – SlideRule Application** ○ ORNL is awaiting tasks, if any, to be assigned by IRSN. IRSN is possibly investigating "fission yield estimation" and ORNL has been on standby in case help is needed. **AM9 - Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits** ○ Awaiting results from IRSN in order to begin comparisons between all participants. **AM10 - Proposed Benchmark Inter-Comparison Study** ○ Work begun on adding requested experiment to other results that ORNL has submitted to IRSN. ORNL also provided supporting details on other experiments already in VALID. Work has begun on generating results using ENDF/B-VIII.0 to comparison. **AM11 – Proposed 1-D Multipoint Analytical Benchmark Inter-Comparison** ○ This task is pending information from LLNL to proceed. **AM13 - Nuclear Data and Cross Section Testing Using ENDF/B-VIII.0** ○ Contract has been cancelled. **AM14 - Development and Addition of Continuous-Energy Sensitivity Data Files to SCALE's VALID Library** ○ Sensitivity data files were completed for all 19 low-enriched uranium solutions in Q2. All cases have generated sensitivity data files for both IFP and CLUTCH with optimum parameters identified, except for LEU-SOL-THERM-003-002:005. In LST-003-002:004 the 1H sensitivities are just outside of a

	designated parameter level, R2 of 0.98, and for LST-003-005, the 1H sensitivity is outside of two standard deviations when comparing CE TSUNAMI-CLUTCH results with direct perturbations. VALID paperwork will be generated in Q4, and the review process will be started at that time. ○ All 140 low-enriched uranium pin array cases have been run in CE TSUNAMI-IFP generating sensitivity data files with direct perturbation calculations performed on case number four for each experiment to confirm that the sensitivity data were accurate: for example, LEU-COMP-THERM-0XX-004 (nine cases total). All direct perturbation calculations with these selected cases provide results similar to those found in CE TSUNAMI, with the exception of individual nuclides that would need further optimization to develop specific sensitivity parameters. These selected cases can then be used to generalize the remaining cases within an experiment with expected similar results; however, more calculations are need for the remaining 131 cases. VALID paperwork will also need to be generated and reviewed. Depending on qualification and staff availability, the VALID review would be completed in Q4 or potentially FY20. ○ The paper for the deuterium-moderated experiments was completed in Q3 and submitted to ICNC and is currently awaiting edits from the committee. The paper will be presented at ICNC in during Q4. **AM15 - The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculation** ○ A toy model using the Single-Level Breit-Wigner formalism was developed to analyze the uncertainty propagation of resonance parameters to continuous energy cross section uncertainty as well as a multi-group cross section uncertainty ○ The work on this model was submitted as an abstract to ICNC 2019 and accepted for the presentation track. The full paper submission is under review. ○ Remote access for the student to the cluster containing AMPX development files was established so that work could begin on developing temperature dependent processing of resonance parameter uncertainty in the AMPX code **AM16 - Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers** ○ We continue to search for old data that may fill gaps in fissile solution density measurements, which includes inquiries to Y-12, Savannah River, and IRSN. In addition, we are making plans to wrap up the work and issue a final report at the end of FY19. ORNL staff have located the old codes that were

	used to process data and perform calculations (dating from the era 2003-2005). These will be modified and used to evaluate the additional data that has been identified.

NCSP Quarterly Progress Report (FY-2019 Q3)

ORNL AM Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	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)		
	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, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		**See above**
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)		
	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, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
	Issue an annual SCALE maintenance report to the NCSP Manager. (AM2)		**This report will be completed by the end of Q3.**
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)		

	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, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
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)		
	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, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
	Publish annual newsletter to users to communicate software updates, user notices, generic technical advice, and training course announcements. (AM2)		
	Document AMPX modernization and technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager. (AM3)		

NCSP Quarterly Progress Report (FY-2019 Q3)

Task Titles:

AM1 Radiation Safety Information Computational Center (RSICC)

AM2 SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section and Generation/Modernization

AM3 AMPX Maintenance and Modernization

AM6 Slide Rule Application

AM9 Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits

AM10 Proposed Benchmark Intercomparison Study

AM11 Proposed 1-D Multipoint Analytical Benchmark Intercomparison

AM13 Nuclear Data and Cross Section Testing Using ENDF/B-VIII.0

AM14 Development and Addition of Continuous-Energy Sensitivity Data Files to SCALE's VALID Library

AM15 The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculations

AM16 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: IPD1, 2, 4

Task Titles:

IPD1 Conduct ICSBEP for Benchmarks listed in Appendix C of the 5-Year Plan and publish annual revision to the Handbook

IPD2 Maintain the NCSP Website and Systems

IPD4 Benchmark Evaluation of Hot Box, LLNL Historical Critical Configurations at High Temperature

M&O Contractor Name: Lawrence Livermore National Laboratory

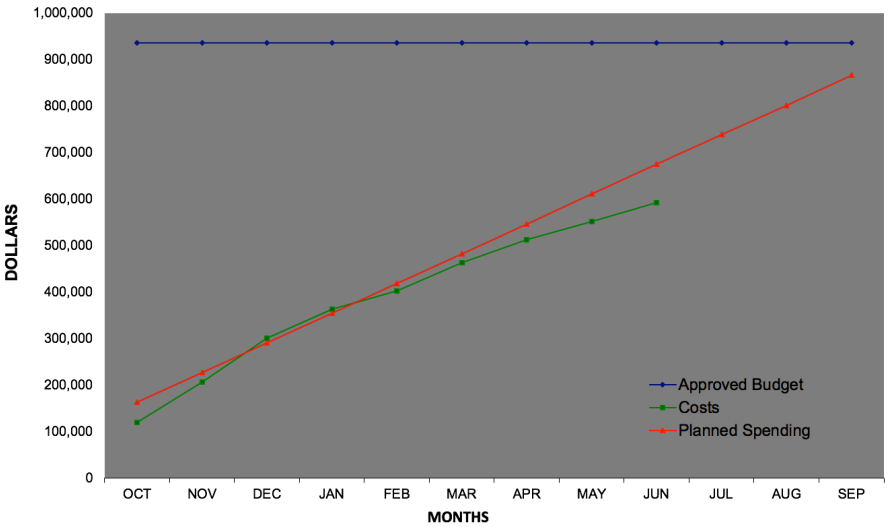
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: July 12, 2019

BUDGET



1. **Carryover into FY 2019** = $102,907
2. **Approved FY 2019 Budget** = $935,907 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $301,469
4. **Actual spending for 2nd Quarter FY 2019**= $161,932
5. **Actual spending for 3rd Quarter FY 2019** = $128,720
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $69,907 (8%)

MAJOR ACCOMPLISHMENTS

1. ICSBEP (IPD1).

   Reviewed and provided comments on the draft evaluation for **IER-209**, LCT101, 7uPCX, 0.855 cm pitch, variable water height (Harms, SNL), and signed the CEdT webpage as completing CED-3b. Other evaluations due prior to October 2019 include:

   - **IER-184**, TEX baseline experiments with PANN plates moderated by polyethylene (LLNL)
   - **IER-299**, KRUSTY cold/warm critical experiments (LANL)

   Note that **IER-407**, FUND-LLNL-ALPHAN-U235-MULT-001, ISSA Subcritical Multiplicity Benchmark, was selected for DVD cover art for the next edition of the ICSBEP Handbook.

   Note also that LANL has delayed completion of **IER-192**, Class foils moderated and reflected by Lucite, and delayed revision of **HMF086**, Godiva-IV (corrections). LANL/JAEA is planning on submitting 3 non-NCSP evaluations: Jupiter-ZPPR/Pb, Zeus HEU/Pb, and Zeus LEU/Pb.

2. Website and Systems (IPD2).

   - Provided NCSP website updates as requested by NCSP Management and deployed new webpages for the NCSP TPR.
   - Maintained and updated NTS-SLAN/NCERC classified network.
   - Upgraded all classified network switches.
   - Completed ESNet 10GB dedicated fiber connection upgrade, awaiting new 10GB VPN router for LANL connectivity.

   Provided equipment inspections, certifications and data transfers (IPD2) supporting:

   - IER-462: NCSP T&E Hands-On Training (LANL)
   - IER-466: LANL IE1 – Provide NCERC Operational Support at the DAF
   - IER-506: Non-NCSP ER Class May 2019 (LANL)
   - IER-511: Non-NCSP Falcon DPF (LANL)

3. Hot Box (IPD4).

   Formal evaluation of "Hot Box" continued this quarter including the description of the experiment (Section 1) and progress towards development of the benchmark model (Section 3).

NCSP Quarterly Progress Report (FY-2019 Q3)

LLNL IP&D Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
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)		
	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)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		
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)		
	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)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		
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)		
	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)		
	Maintain, operate and modernize the NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		

NCSP Quarterly Progress Report (FY-2019 Q3)

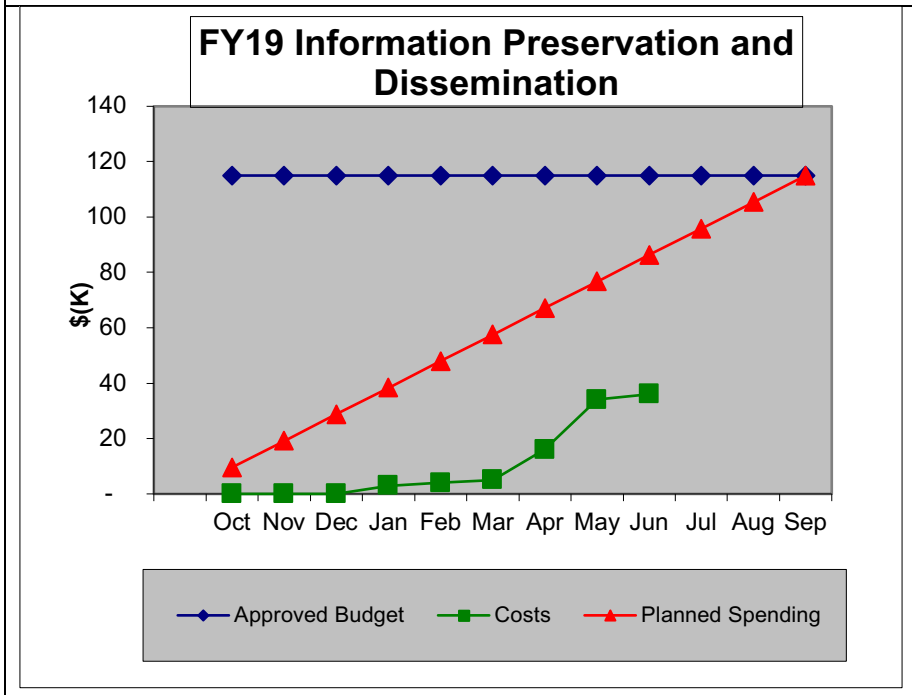
Q4	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL “Hot Box” for inclusion in the ICSBEP Handbook. (IPD4)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ORNL – IPD5, 6
Task Titles:
IPD5-Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation
IPD6- Preservation and Dissemination of Unpublished Critical Experiments by Mihalczo
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: July 23, 2019

BUDGET



1. **Carryover into FY 2019** = $0K
2. **Approved FY 2019 Budget** = $115K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0K
4. **Actual spending for 2nd Quarter FY 2019** = $5K
5. **Actual spending for 3rd Quarter FY 2019** = $31K
6. **Actual spending for 4rd Quarter FY 2019** = $0
7. **Projected carryover into FY 2020 = $50K**

MAJOR ACCOMPLISHMENTS

IPD5 – Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation

- Based on a review of the first set of retrieved data, additional information was sought. This is time consuming due to the fact that the documentation is located throughout files located in 50 boxes stored at OSTI. A record is being compiled of potentially important information in each box for future reference.
- Several shielding experimental reports have been recovered for analysis. There were over 20 annual shielding experiments, most of which were documented. These documents are being reviewed and usable data compiled. Missing experimental reports will be requested from OSTI.
- A walk-through of the facility was conducted to gain perspective and understand the types of construction information that would be most helpful.
- New data was found for the building materials and concrete specifications, as well as detailed drawings and photos of the positioning assembly.
- Another look through log books for specific dates may provide any missing details for selected experiments.
- All important documents are being cataloged, and data is being compiled into usable format for benchmark models.
- Preliminary benchmark models should be able to be started by the end of FY19.

IPD6 – Preservation and Dissemination of Unpublished Critical Experiments by Mihalczo

- Mihalczo has submitted a draft report of experiments with sufficient information and data to potentially be applicable for a benchmark evaluation along with a list of reference reports.
- The experiments have been prioritized, supporting documents collected, and data examined.
- It was found that several experiments used the same critical material and this material is well documented. Some of these experiments are already benchmarks.
- Based on NCSP priorities, the thick graphite reflected and infinite polyethylene reflected critical experiments were determined to be the top priority for benchmark development.
- Mihalczo is providing information on the experiments on the list free of charge in an effort to preserve some of the information. Perhaps this additional information, beyond the scope of this task, will be sufficient for ANS summaries or reports in the future.

NCSP Quarterly Progress Report (FY-2019 Q3)

ORNL IPD Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

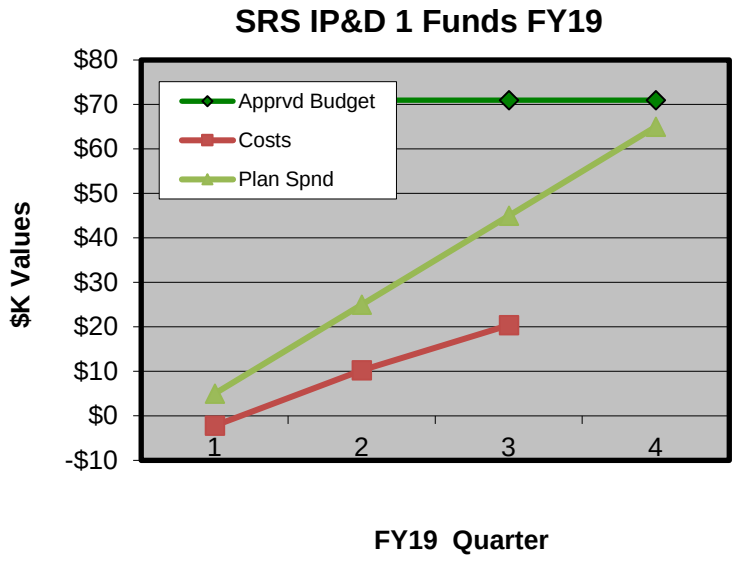
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	Complete documentation of data needed for an ICSBEP benchmark based on the ORNL HPRR (IPD5)		We are engaging HPRR facility management to obtain the data archives and logbooks. More progress was made in Q3.
Q3	Perform initial evaluation of HPRR data and determine if this task should continue (IPD5)		This project was started late in the year due to the departure of Thomas Miller. This task will be delayed into FY20. There were also some delays being able to access HPRR facilities to access logbooks and personnel.
Q4	Perform some initial benchmark simulations to evaluate the quality of the data collect in IPD5 and the ability to simulate the measured data (IPD5)		
	Report on progress made with the review of 25 critical experiments and their potential applicability and quality for generating ICSBEP evaluations in an FY20 NCSP proposal (IPD6)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: SRS IPD1
Task Title: ARH-600 Reissue
M&O Contractor Name(s): SRNS
Point of Contact Name: David Erickson
Point of Contact Phone: 803-557-9445

Reference: B&R DP 0909010
Date of Report: July 16, 2019

BUDGET



1. **Carryover into FY 2019** = $1.9K
2. **Approved FY 2019 Budget** = $ 70.9K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $-2.2K
4. **Actual spending for 2nd Quarter FY 2019** = $12.4K
5. **Actual spending for 3rd Quarter FY 2019** = $10.2K
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020** = $

MAJOR ACCOMPLISHMENTS

The updated user manual, and local testing is complete. Working on approvals for export control release. The release is needed to post/distribute via the NCSP website.

NCSP Quarterly Progress Report (FY-2019 Q3)

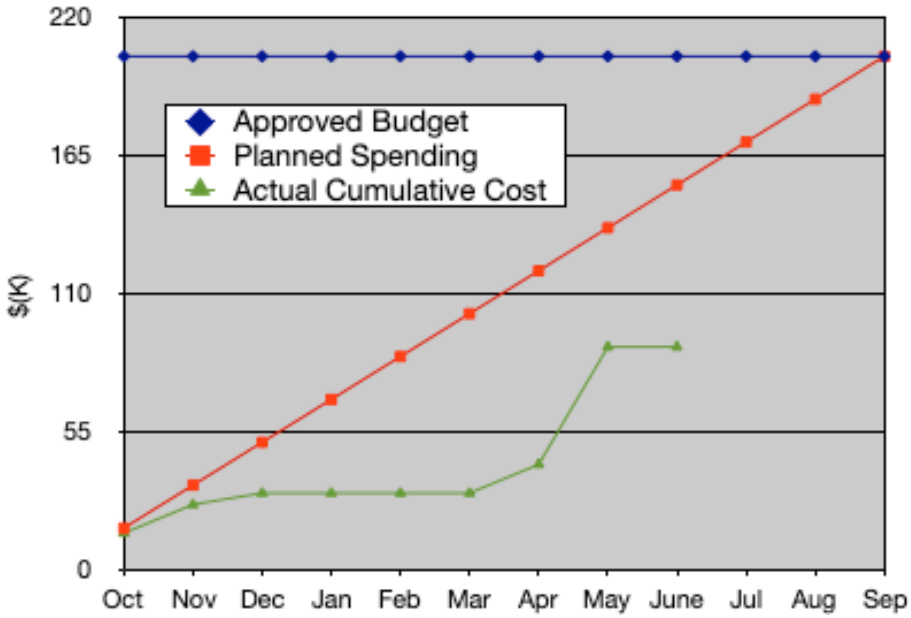
SRS IP&D Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status reports on SRS progress. (IPD1)		
Q2	Provide status reports on SRS progress. (IPD1) Develop QA documents for current version to meet current SRS/DOE requirements. (IPD1)		
Q3	Provide status reports on SRS progress. (IPD1)		**Local Export Control Release is moving very slowly.**
Q4	Provide status reports on SRS progress. (IPD1)		
	Issue Preliminary (updated) CritView version for internal testing. (IPD1)		
	Issue Preliminary User Guide to support internal testing. (IPD1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: Nuclear Data ND1 Task Title: National Nuclear Data Center (NNDC) Support to the NCSP M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: DP0909010 Date of Report: July 12, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
 1. **Carryover into FY 2019** = $24,444 2. **Approved FY 2019 Budget** = $224,444 (includes carryover) 3. **Actual spending for 1st Quarter FY 2019** = $31,019 4. **Actual spending for 2nd Quarter FY 2019** = $0 5. **Actual spending for 3rd Quarter FY 2019** = $58,172 6. **Actual spending for 4rd Quarter FY 2019** = $ 7. **Projected carryover into FY 2020 =** $24,000	First deployments of ADVANCE testing reports successful! New NCSP TSL evaluations look good!

NCSP Quarterly Progress Report (FY-2019 Q3)

BNL ND Milestones:

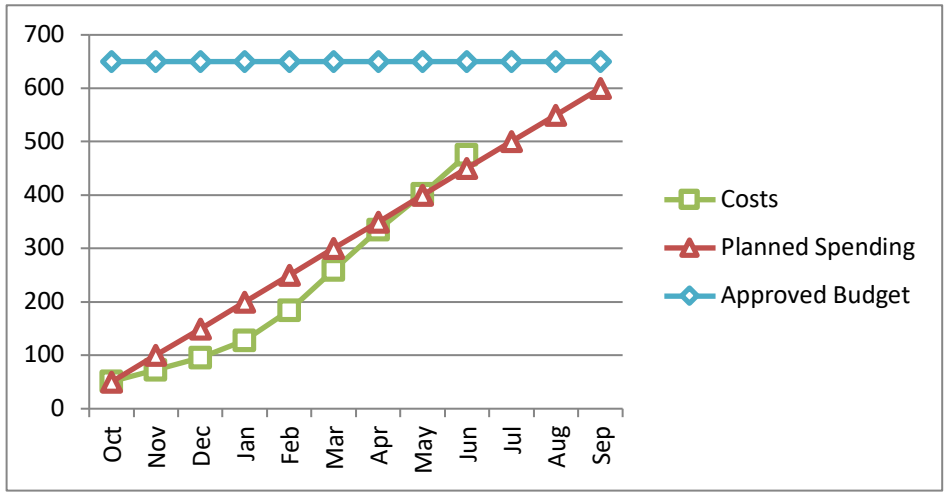
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	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)		Porting ADVANCE (and all of its dependencies) to Python3 is taking longer than anticipated. Also, actively interviewing for potential NCSP post-doc.
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)		**ADVANCE is ported to Python3 and Buildbot 2.1. Still interviewing for potential post-doc.**
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)		ADVANCE turned on and we have deployed the first build reports. ADVANCE is not yet operating autonomously.
	If mandated by CSEWG, release new ENDF library. (ND1)		**n/a**
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)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: LANL ND1 Task Title: Nuclear Data Evaluation and Testing M&O Contractor Name: LANL Point of Contact Name: Brian Bluhm / Bob Little Point of Contact Phone: 505-667-2440 / 505-665-3487	Reference: DP0909010 Date of Report: July 26, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**



1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $650,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $96,044**
4. **Actual spending for 2nd Quarter FY 2019 = $163,795**
5. **Actual spending for 3rd Quarter FY 2019 = $216.096**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $50,000**

- Generated new evaluation for n+208Pb, which was sent for benchmark testing. Details on evaluation changes have been provided in previous quarterly reports Benchmark testing will occur during Q4.

- Generated new evaluation for n+236U, and performed the preliminary tests. Details on evaluation changes have been provided in previous quarterly reports.

- n+9Be analysis: The ENDF/B-VIII.0 evaluation for 9Be left a less-than-satisfactory inconsistency between the 9Be(n,n) elastic angular distributions and integrated cross sections. We have restarted the n+9Be (10Be system) R-matrix analysis at energies up to 10-14 MeV with the goal of achieving this consistency. During this quarter, a solution was found with a better simultaneous fit to the total, elastic, (n, alpha) and (n,2n) integrated cross sections than has ever been achieved before, with an overall chi-squared per degree of freedom of 1.23. This fit overcomes the vexing problem we had before of not enough absorption coming out of the elastic cross section and going into the (n,2n) cross section, by employing a different representation of the four-body (2n,2 alpha) breakup channel in the R-matrix analysis. We are preparing to add information about the elastic scattering angular distributions and polarizations to this analysis during the last quarter of FY19, which should put us in a good position to submit a much-improved and more consistent 9Be ENDF evaluation in FY20.

- Continued our involvement in two IAEA nuclear data projects, one on benchmarking R-matrix codes for charged-particle reactions, and the other on R-matrix analyses of specific systems such as n+14N (15N), n+9Be (10Be), and n+23Na (24Na). Gerry Hale is chairing the second effort, and has reported recent progress on LANL analyses of reactions in the 7Be and 15N systems at a meeting in Vienna in May, 2019.

- An abstract was submitted to PHYSOR testing the covariance data for O-16 in ENDF/B-VIII.0 for mu-bar. Early indications are that for high leakage systems, the P1 (mubar) uncertainties can cause more overall uncertainty than the elastic scattering cross section uncertainties.

- Subgroup 45—Validation of Nuclear Data Libraries (VaNDaL) Project: Jeremy Conlin and Wim Haeck attended the SG45 meeting as part of the June WPEC Meeting. The following summary is extracted from their NCSP trip report:

  The WPEC SG45 subgroup or VaNDaL (Validation of Nuclear Data Libraries) is working on providing Quality Assured benchmark input files for different calculation codes (e.g. MCNP, COG, etc.) for nuclear data library validation. During this year's meeting, a number of topics were discussed, such as licensing and reuse of the input files, the python coding developed at LANL for doing the output processing for different codes and the JSON format for exchanging results between different codes.

  Morgan White proposed the licensing for the resulting input files, essentially allowing for non-commercial use of the input files and requiring users to provide changes and corrections that have been made to them.

  Wim Haeck presented the python coding and the JSON format proposed for exchanging results between users and

	applications. The rationale behind this approach is that while every calculation code gives its result in its own format, the results we are interested in are however the same. As a result, calculation results can be split into two components: attributes (or metadata) that give information about the result (what type of result is it, what nuclide and reaction is it for if it is a reaction rate, etc.) and the actual calculation result (values for the result, optional uncertainties, the structure of the result and optional units for the values and uncertainties). The attributes are what we will search and filter on while the actual results are what we will want to compare, store, exchange, plot, etc.

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL ND Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
	Conduct CSEWG Data Evaluation Committee session. (ND1)		
	Report data testing results with ENDF/B-VIII.0 and additional beta release cross sections. (ND1)		
Q2	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q3	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q4	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
	Report on development of machine learning tools, in particular decision trees, for criticality-safety applications and sensitivity to nuclear data. (ND1)		
	Deliver nuclear data evaluations as indicated in Appendix B of this document. (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ND1, 2, 3, 5, 6

Task Titles: See last page for full task titles

ND1 Delayed fission gammas
ND2 Generation and testing of thermal scattering laws
ND3 FLASSH (modern code)
ND5 Advanced Doppler Broadening
ND6 Cadmium radiative capture gammas

M&O Contractor Name: Lawrence Livermore National Laboratory

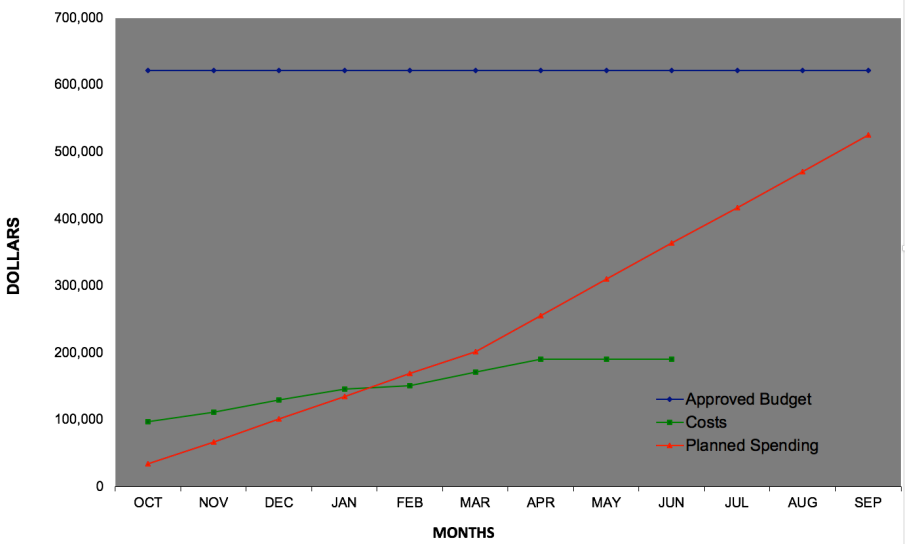
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: July 12, 2019

BUDGET



1. **Carryover into FY 2019** = $181,360
2. **Approved FY 2019 Budget** = $621,360 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $130,142
4. **Actual spending for 2nd Quarter FY 2019**= $ 41,306
5. **Actual spending for 3rd Quarter FY 2019** = $ 18,885*
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $96,360 (15%)

*This amount reflects actual invoices received by LLNL to date. NCSU reports a total of $35,371 actually spent in Q3.

MAJOR ACCOMPLISHMENTS

1. LLNL's Fission Reaction Yield Algorithm (FREYA) version 2.4 was implemented into COG11.3 for SOURCE and CRITICALITY calculations. (ND1)
2. (a) NCSU completed testing of the hydrogen in **heavy oil** thermal scattering law (TSL) library and submitted it to the National Nuclear Data Center (NNDC) for inclusion in the ENDF/B-VIII database. (b) Investigation of molecular dynamics (MD) modeling of **hydrofluoric acid (HF)** continued during this period. Current focus is on the possible implementation of the simulations either using classical MD or ab initio MD. Initial classical MD models composed of nearly 1000 HF molecules have been constructed. Further testing is underway to finalize the simulation methodology. (ND2)
3. NCSU continued the development of the *FLASSH* code. Integration of the liquid physics and the generalized (non-cubic) TSL analysis modules is near completion. As a result, *FLASSH* is now capable of producing ENDF File 7 TSL libraries for various liquid and solid materials. In addition, testing continues using the LLNL FUDGE code with *FLASSH* to generate TSL files in GNDS format and to produce TSL cross section libraries. (ND3)
4. NCSU continued the development of algorithms using a generalized treatment in the calculation of the TSL and its utilization in Doppler analysis. This formulation removes both the cubic and atom site approximations and is dependent on the polarization vectors and associated frequencies thereby including exact lattice information within the calculation. The formulation for the self TSL was tested using beryllium metal and crystalline graphite, both materials which have varying degrees of non-cubicity. The results for beryllium demonstrated agreement between the cubic and generalized treatments which is expected for materials exhibiting reasonable symmetry. Graphite shows deviations up to 12% difference between the generalized formulation and traditional calculation methods. (ND5)
5. Tamás Belgya (Center for Energy Research, Budapest, Hungary) completed prompt gamma radiative capture measurements for cadmium using a natural cadmium metal sample and an enriched ^{113}Cd powder sample in 2017. Preliminary results for the ^{113}Cd (n,g) gamma emission spectra shows good agreement between the unfolded experimental spectrum and calculated spectrum. LLNL has requested this data directly from the author for further evaluation and testing. (ND6)

NCSP Quarterly Progress Report (FY-2019 Q3)

LLNL ND Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q2	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q3	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q4	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
	Deliver thermal neutron scattering data evaluations as indicated in Appendix B of the 5-Year Plan. (ND2)		**Evaluations completed one or more years in advance of schedule.**

Task Titles:

ND1 Subtask 1 – Delayed Fission Gamma Multiplicity and Spectra – Data testing
ND1 Subtask 2 – Delayed Fission Gamma Multiplicity and Spectra – Document the technical basis of the method and data testing results

ND2 Generation and Benchmarking of Thermal Neutron Scattering Cross Sections in Support of Advanced Nuclear Reactor Concepts

ND3 Development and Implementation of an Advanced and Rigorous Computational Platform for Thermal Neutron Scattering Analysis

ND5 Development and Implementation of a Modern Doppler Broadening Approach Including Atomic Binding Effects

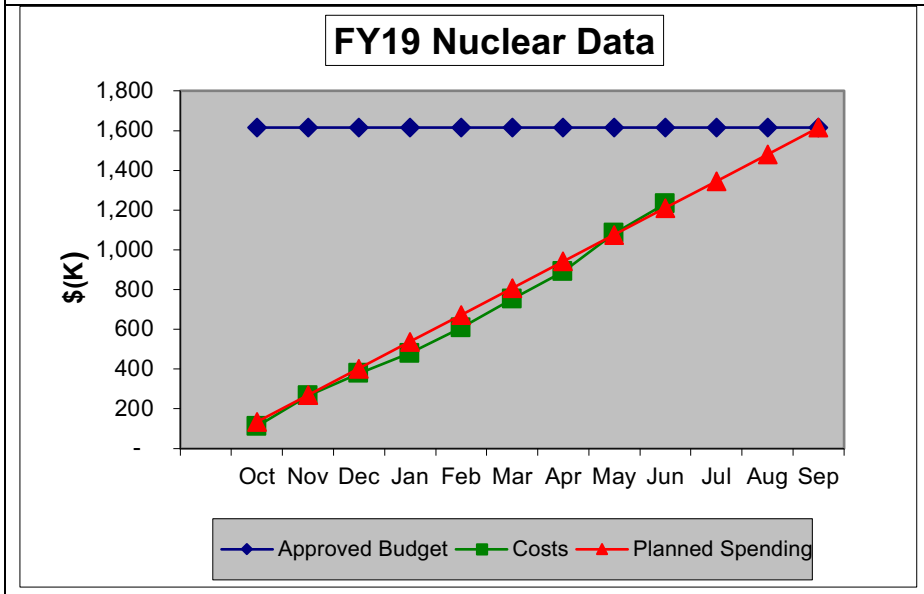
ND6 Evaluate Neutron Radiative Capture Gamma Production in Cadmium

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10
Task Title: see last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: July 23, 2019

BUDGET



Carryover into FY 2019 = $124K

1. **Approved FY 2019 Budget** = $1,615K (includes carryover)
2. **Actual spending for 1st Quarter FY 2019** = $379K
3. **Actual spending for 2nd Quarter FY 2019** = $374
4. **Actual spending for 3rd Quarter FY 2019** = $479
5. **Actual spending for 4rd Quarter FY 2019Y** = $0
6. **Projected carryover into FY 2020 = $0**

MAJOR ACCOMPLISHMENTS

ND1 – Evaluations and Measurements

- **Status report on all nuclear data support activities.**
  - Gd-156,158,160 (On Schedule)
    Resolved resonance region evaluation nearing completion. Collaboration visit to IRSN completed to update and synchronize with IRSN collaborators for isotopes 155 and 157.
  - Pb-204,206,207,208 (On Schedule)
    Collaboration visit to IRSN completed to map out the joint evaluation of the isotopes of lead.
    Additional experimental measurement needs were identified and prioritized.
    Initial identification of integral experiments sensitive to lead we conducted.
  - Work on Cr data for re-evaluation.
  - Support of post-doc for Ce data analysis.
  - Support of post-doc for V data analysis.
  - Plutonium evaluation: The evaluation work was devoted to improve the benchmark performance coupled to the new Prompt Fission Neutron Spectrum evaluation. This work was presented at ND2019 (in RESolution ID 126649) and RNSD highlight was also requested. This work is still on going since other improvements (related to the cross section temperature dependence) in the benchmark performance are still needed.
  - Cerium evaluation: Evaluation work on the cerium isotopes is progress. A proceeding paper for the ICNC19 conference was submitted. The evaluation work will be completed as soon as the newly measured data on 142Ce will be available.
  - Vanadium evaluation: Preliminary evaluation work on 51V was initiated: sorting available experimental data, checking status of the cross section in ENDF/B-VIII.0 library.
  - Uranium evaluation: work on the fit of the nTOF capture data and thermal constants is still in progress.
  - Chromium isotopes: Due to the poor performance of the chromium isotopes in the ENDF/B-VIII.0, the resonance parameters of 50,53Cr were revisited. The performance of the ENDF files was improved by fitting the natural data and introducing normalization factors for the two sets of

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 Task Title: see last page M&O Contractor Name: ORNL Point of Contact Name: Doug Bowen Point of Contact Phone: (865) 576-0315	Reference: DP090010/ORNL Date of Report: July 23, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	measured and discrepant capture data for 53Cr (Guber and Stieglitz). Additional work is needed to improve the experimental technique in measuring these isotopes in addition to the treatment of the multiple scattering corrections in SAMMY. ○ Tantalum evaluation: in collaboration with RPI, meetings (every two weeks) were scheduled to discuss progress on the RRR evaluation and possible extension to the URR. • **Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.** ○ Travel to JRC-Geel to continue Ce-142 capture experiments (green) ○ Start of data sorting at JRC-Geel to for Ce-142 capture experiments. The list mode data are sorted into TOF spectra. (green) ○ Start data reduction for La capture experiment for analysis. (green). ○ Path forward: continue working on La and V capture data. Continue data sorting for Ce-142 experiments. ○ Enriched Zr experiments are delayed, due to problems obtaining samples for lease. (behind schedule). However, this issue seems to be resolved. Path forward: After finalizing the Ce-142 experiments, enriched Zr neutron capture experiments will be started. **Y12 ND1 – GELINA depleted Uranium target cost estimate and construction** ○ No action. **ND3 – Isotopic Sample Lease to Support ND1 ND Measurements** ○ Ce-142 sample was leased in early fall from ORNL for neutron induced cross section experiments at JRC and is on site for experiments. (green) ○ Preparation for lease of Zr samples: preparing for activation experiments and calculation. **ND6 - Sammy Modernization** ○ In the previous quarter SAMMY was moved to a new repository and an initial continuous integration pipeline was set up. While the pipelines for systems

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 Task Title: see last page M&O Contractor Name: ORNL Point of Contact Name: Doug Bowen Point of Contact Phone: (865) 576-0315	Reference: DP090010/ORNL Date of Report: July 23, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	other than Linux and GCC have not yet been added, improvements for better error detection have been added to the pipeline. ○ Since SAMMY was originally written in F77, it still uses an old memory management system based on a "container" array, i.e. one large array that is used in the entire code for individual smaller arrays. This "container" array makes it difficult to use modern software tools to check for code errors. Work started to eliminate the use of the container array. This task is made more difficult as the same part of the container array may be used for different data. This ongoing change already uncovered one error in the code that might lead to subtle errors in fitting procedure. The extend of the error is being investigated, but is expected to be small. ○ In order to be able to share code between AMPX and SAMMY, resonance parameters information needs to be stored in-memory in a structure accessible by both codes. AMPX has a C++ in-memory structure for resonance parameters, but no Fortran bindings to it. Once the bindings are created SAMMY can access this structure. We added the binding and started work on additional code that should allow SAMMY to store and access resonance parameter in the C++ structure. Currently SAMMY has been changed to use the number of spin groups and isotope information from the C++ in-memory structure. In the next quarter more of the resonance information will be moved to the C++ in-memory structure. ○ Fixed an error in writing the parameter information in reduced format, which caused resonance energies not to be treated correctly if using that particular output format. ○ User support has been provided to SAMMY users performing NCSP-funded resolved resonance range nuclear data evaluations at ORNL and RPI. ○ A peer-reviewed journal article "Verification of R-matrix calculations for charged-particle reactions in the resolved resonance region for the 7Be system", Ian J. Thompson, R. J. deBoer, P. Dimitriou, S. Kunieda, M. T. Pigni, G. Arbanas, H. Leeb, Th. Srdinko, G. Hale, P. Tamagno and P. Archier, Eur. Phys. J. A (2019) 55:92, https://doi.org/10.1140/epja/i2019-12753-y, has been published. **ND7 - Nuclear Data Evaluation and Testing for Nuclear Criticality Safety Applications**

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 **Task Title:** see last page **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP090010/ORNL **Date of Report:** July 23, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	○ Isotopes of interest were updated to include those in the most recent NCSP 5 year plan, as well as ongoing evaluations. Updated to include Lead(Pb-208), Molybdenum(Mo-95), Rhodium (Rh-103), Gadolinium (Gd-155, 156, 157, 158, 160), Iron (Fe-54,56), Neptunium (Np-237). ○ Student started work at ORNL for the summer, where the list of modeled benchmarks grew to 29, encompassing 129 unique experiments. ○ Submitted an abstract of results as of last quarter to the PHYSOR 2020 conference. ○ Student began learning the VALID procedure, producing preliminary data and report for the HEU-MET-FAST-001 "Godiva" entry, as well as preliminary data and report for HEU-MET-INTER-006 "ZEUS" entry. ○ Method developed for examining changes in k-eff by isotope, as a result of library change (VII.1=>VIII in particular), which allows the impact of a particular cross section update to be measured in a system. ○ Overall ENDF-VIII improvement in modeled cases is undetermined; overall unchanged (as measured by RMS), but as a result of potential outliers and bias. **ND10 - Monte Carlo Evaluation of Differential and Integral Data** ○ In order to make an impactful demonstration of this project, U-233 was selected as the first isotope on which a prototype version of this method would be applied, since U-233 ENDF evaluation of R-matrix resonance parameters contains a covariance matrix that is needed for Monte Carlo random sampling of resonance parameters. ○ A prototype code for random sampling of R-matrix resonance parameters has been developed for this Monte Carlo method in Q3. Next, randomly perturbed samples generated by this code will be used to create a SCALE nuclear data libraries, and each library will be used to calculate keff of VALID's integral benchmark experiments (IBEs) that are sensitive to U-233 resolved resonance cross sections. ○ In Q3 we have started preparing SAMPLER input files for Monte Carlo random sampling of geometry and concentration parameters of U-233 IBEs, in particular U233-SOL-THERM-001. In conjunction with the effort described in the previous bullet point, this constitutes the first application of Monte Carlo method to resolved resonance parameters and IBE parameters, simultaneously.

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 **Task Title:** see last page **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP090010/ORNL **Date of Report:** July 23, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	○ Finally, for simultaneous differential cross section data evaluation, and in view of a large number of R-matrix resonance parameters to be randomly sampled using this Monte Carlo method, we have initiated theoretical investigation of the Metropolis-Hastings variant of Markov Chain Monte Carlo method, and in particular several parallelized versions of that method. This constitutes one step toward the first application of Markov Chain Monte Carlo method in re-solved resonance range nuclear data evaluations.

NCSP Quarterly Progress Report (FY-2019 Q3)

ORNL ND Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	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).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		Behind schedule with Ce-142 measurements due to sample shipping delays and a bad Ce-142 Al can weld that had to be redone.
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	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).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	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).		

	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	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).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		
	Document SAMMY modernization progress and report status annually to the NCSP Manager (ND6).		

Task Titles:

ND1 Nuclear Data Measurement and Evaluation

ND3 Isotopic Sample Leases to Support ND1 ND Measurements

ND6 SAMMY Nuclear Data Evaluation Code Modernization

ND7 Nuclear Data Evaluation and Testing for Nuclear Criticality Safety Applications

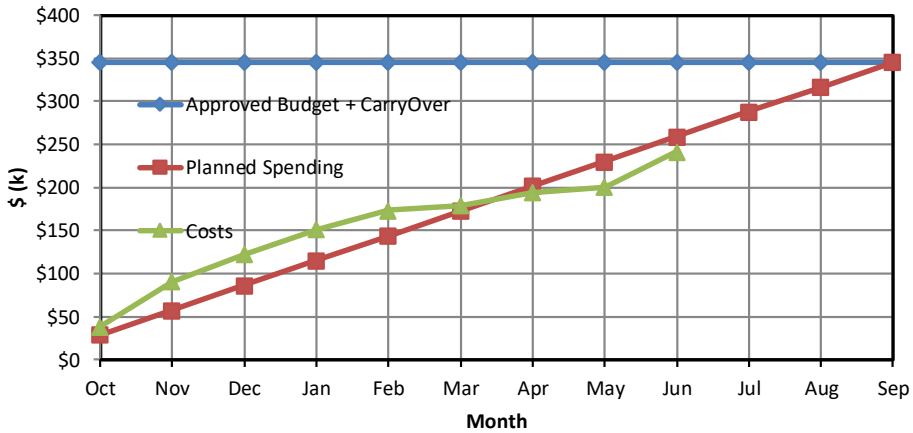
ND10 Monte Carlo Evaluation of Differential and Integral Data

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ND1
Task Title: Resonance Region Nuclear Data Measurement Capability at RPI
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: 7 ,12, 2019

BUDGET



1. **Carryover into FY 2019** = $ 5,733
2. **Approved FY 2019 Budget** = $345,733 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $122,637
4. **Actual spending for 2nd Quarter FY 2019** = $56,636
5. **Actual spending for 3rd Quarter FY 2019** = $62,488
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020** = $20,000

MAJOR ACCOMPLISHMENTS

- PhD student Jesse Brown graduated and moved to work in the nuclear data and criticality safety group at ORNL.
- A new PhD student Sukhjinder (Suk) Singh joined the group and will perform neutron capture measurements.
- Completed a new design of the C_6D_6 capture detector incorporating 3 new detectors for a total of 7 detectors in the array.
- Completed preliminary Cu scattering run for testing the keV detector array.

NCSP Quarterly Progress Report (FY-2019 Q3)

RPI ND1 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
	Complete analysis of measurement from FY18. (ND1)		
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
	Complete transmission measurement per the nuclear data schedule in Appendix B. (ND1)		**Working on Cu scattering**
	Complete capture measurement per the nuclear data schedule in Appendix B. (ND1)		**NDAG asked us to schedule Cu scattering measure-ments instead.**
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		

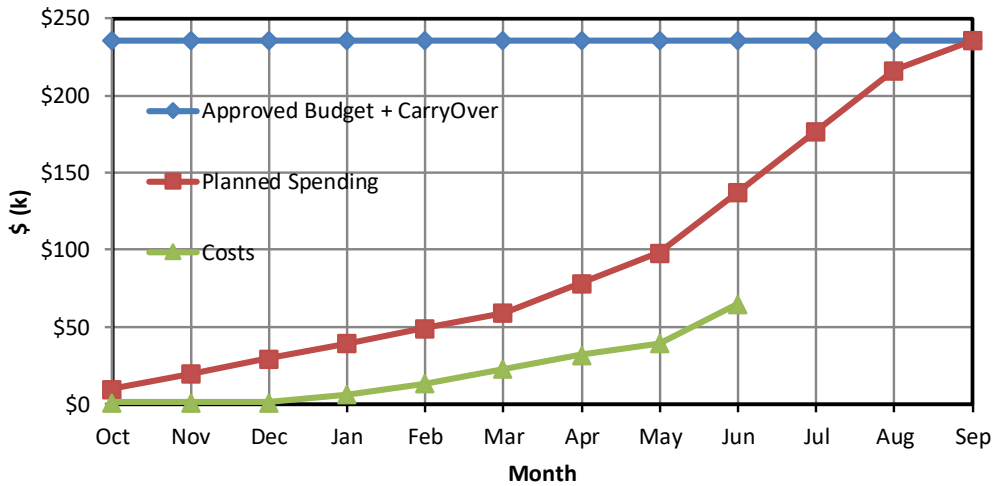
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
	Complete data analysis for transmission and capture measurements and provide the data to ORNL as needed to support the evaluation effort per the nuclear data schedule in Appendix B (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ND2
Task Title: Thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: 7, 12, 2019

BUDGET



1. **Carryover into FY 2019** = $35,974
2. **Approved FY 2019 Budget** = $235,974 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $1,190
4. **Actual spending for 2nd Quarter FY 2019** = $21,684
5. **Actual spending for 3rd Quarter FY 2019** = $42,254
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $40,000

MAJOR ACCOMPLISHMENTS

- Finalized the neutronic design of the cold moderator system
- Finalized the mechanical design of the cold neutron system

NCSP Quarterly Progress Report (FY-2019 Q3)

RPI ND2 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

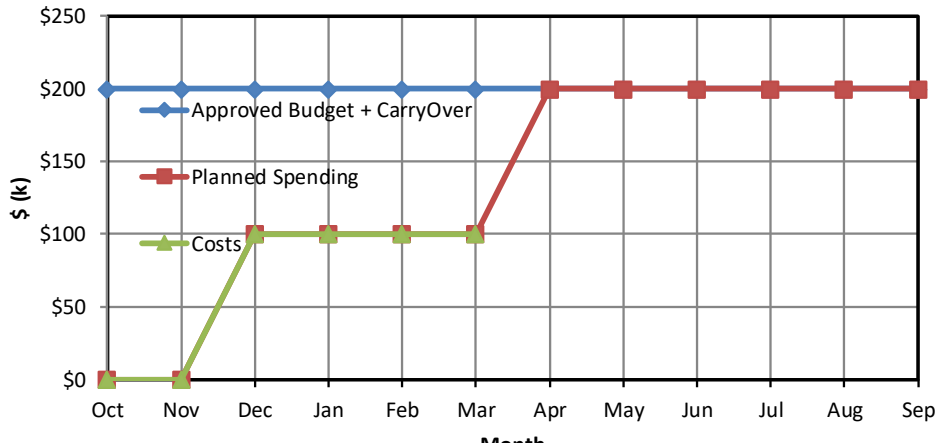
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
	Complete cold moderator preliminary design phase (ND2)		**Planning to submit large equipment orders in Q4**
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
	Complete cold moderator design (ND2)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: ND3
Task Title: RPI/ORNL: LINAC 2020 Nuclear Data Capabilities Maintenance Plan
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: 7, 12, 2019

BUDGET



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $200K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $100K
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $100K
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $0

MAJOR ACCOMPLISHMENTS

- Modulator 1 is now at RPI
- Two klystron were shipped to RPI
- Modulator 2-3 Factory acceptance test (FAT) successfully accomplished.

NCSP Quarterly Progress Report (FY-2019 Q3)

RPI ND3 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

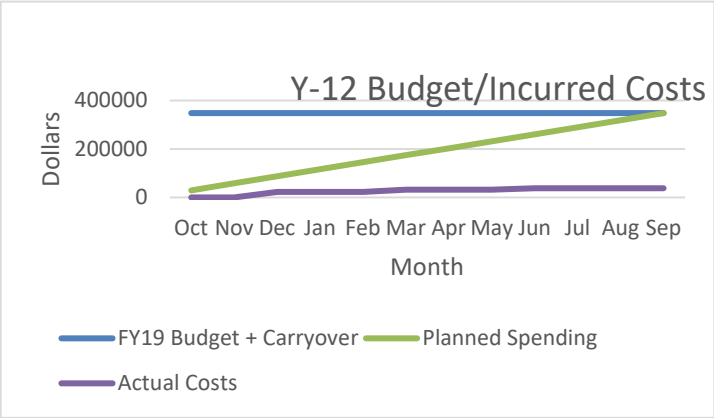
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Factory acceptance tests of RF Modulators 2 and 3 (ND3)		
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Delivery of RF Modulator 1 and Klystron 1 (ND3)		
	Factory acceptance tests of RF Modulators 4 and 5 (ND3)		**Cascade of delay I Modulator 1 factory test, Will be deferred to FY20 Q1 and Q2**
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Factory Acceptance test for Tapered Phase Velocity and Speed of Light #1 Accelerator Sections (ND3)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Delivery and of TPV and SOL1 Accelerator Sections (ND3)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: ND1
Task Title: Fabrication of New Uranium Target for IRMM/GELINA for Cross-section Measurements
M&O Contractor Name: Y12
Point of Contact Name: Kevin Reynolds
Point of Contact Phone: (865) 241-9067

Reference: B&R DP0909010
Date of Report: August 14, 2019

BUDGET



1. **Carryover into FY 2019** = $97,968
2. **Approved FY 2019 Budget** = $347,968 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $22,487
4. **Actual spending for 2nd Quarter FY 2019** = $9,167.78
5. **Actual spending for 3rd Quarter FY 2019** = $6,266.15
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

- Q1: Complete set of fabrication drawings complete in Q1. Coordinated with US and Belgium.
- Q2: For the 2nd quarter we were able to get the purchase order documents drafted (Statement of Work, sole source form, etc.) and had the drawings updated again to reflect some minor clarifications between the proposed supplier and the GELINA technical staff. We also had the supplier prepare an estimate for shipping the target directly to Belgium and incorporated this requirement into the SOW during one of several iterations required to make everyone happy. We have now gotten all of the documentation through DC Review.
- Q3: No update received from technical lead.

NCSP Quarterly Progress Report (FY-2019 Q3)

Y12 ND Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

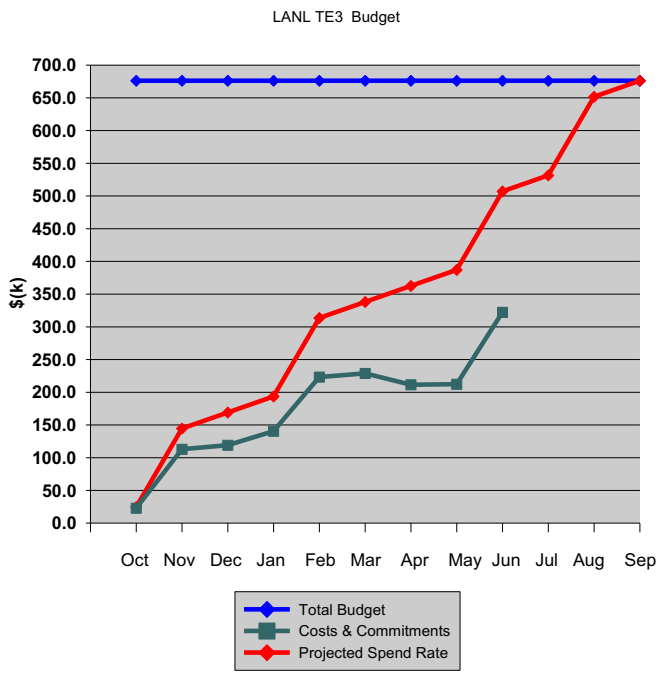
QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Fabrication of part to commence in Q2
Q2	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Fabrication of part is behind schedule. Will not complete this FY – tracking for end of Calendar 2019 at the moment.
Q3	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)	TRENDING RED	No report received from technical lead. Spending rate indicates considerable lack of progress. Will update with details when received.
Q4	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TE3
Task Title: Conduct Hands-On Criticality Safety Training Course at NCERC
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm
Point of Contact Phone: (505) 667-2440

Reference: DP0909010
Date of Report: July 24, 2019

BUDGET



1. **Carryover into FY 2019 = $300K**
2. **Approved FY 2019 Budget = $ 676K**
3. **Actual spending for 1st Quarter FY 2019 = $118.9K**
4. **Actual spending for 2nd Quarter FY 2019 = $109.8K**
5. **Actual spending for 3rd Quarter FY 2019 = $93.4K**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $**

MAJOR ACCOMPLISHMENTS

• Supported the NCERC "hands on" Criticality safety training for the one week manager's course that occurred in Q3.

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TE3 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

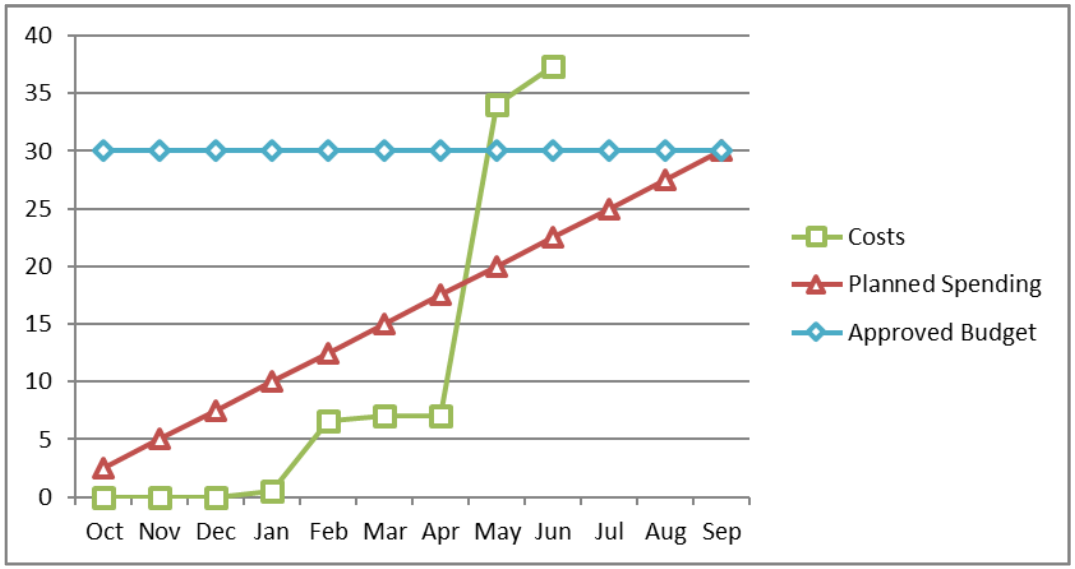
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q2	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q3	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q4	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TE4
Task Title: On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm / Bob Little
Point of Contact Phone: (505) 667-2440 / (505) 665-3487

Reference: B&R DP0909010
Date of Report: July 26, 2019

BUDGET



1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $30,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $0**
4. **Actual spending for 2nd Quarter FY 2019 = $7,013**
5. **Actual spending for 3rd Quarter FY 2019 = $30,364**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $0**

MAJOR ACCOMPLISHMENTS

- The joint LANL / ORNL Sensitivity / Uncertainty Workshop (that had been postponed due to weather in Q2) was held in May for Hanford and PNNL.

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TE4 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

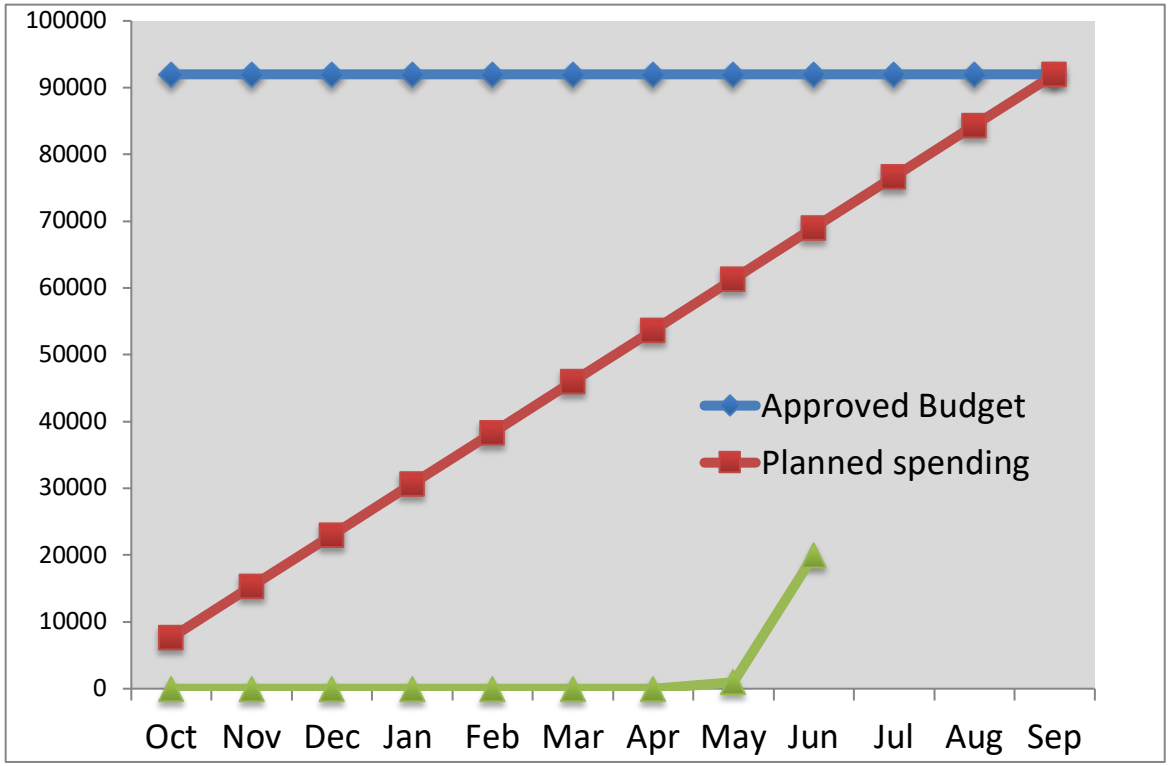
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	In collaboration with ORNL, provide introductory 1-day S/U workshop training to one or more DOE sites in FY19. (TE4)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TE6
Task Title: Development of University Pipeline for Criticality Safety Professionals
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: July 26, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 92K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $20K**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $**

MAJOR ACCOMPLISHMENTS

- Some support

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TE6 Milestones:
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

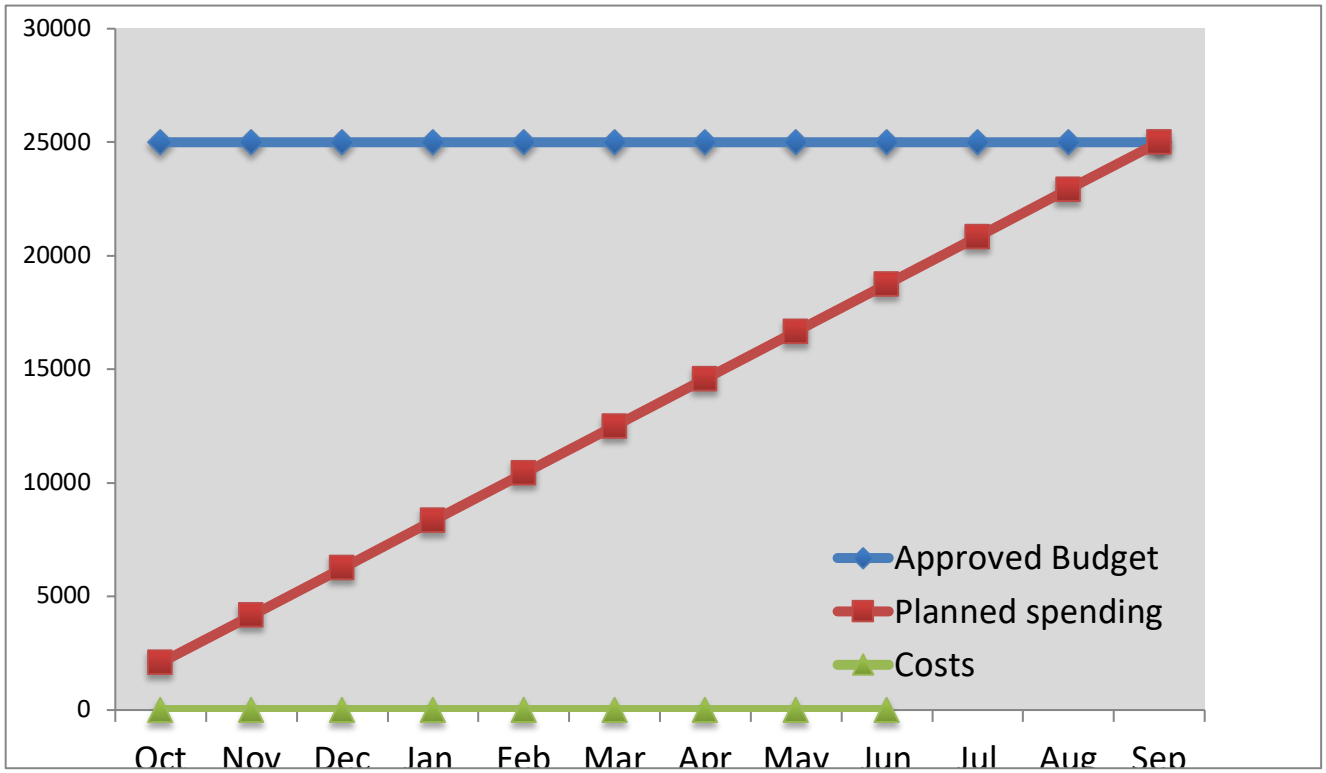
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE6)	NO REPORT	
Q2	Provide status reports on all training activities to the NCSP Manager. (TE6)	NO REPORT	**Will work with NCSD to develop plan for students**
Q3	Provide status reports on all training activities to the NCSP Manager. (TE6)		**NCSD reduced student population for this year to make more meaningful for the students they brought in.**
Q4	Provide status reports on all training activities to the NCSP Manager. (TE6)		
	Provide end of year progress report. (TE6)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TE7
Task Title: Design and Develop a New NCSP T&E Course Criticality Safety Officers at DOE/NNSA Nuclear Facilities
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: July 26, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 25K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $0**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $ 0**

MAJOR ACCOMPLISHMENTS

- No Progress

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TE7 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

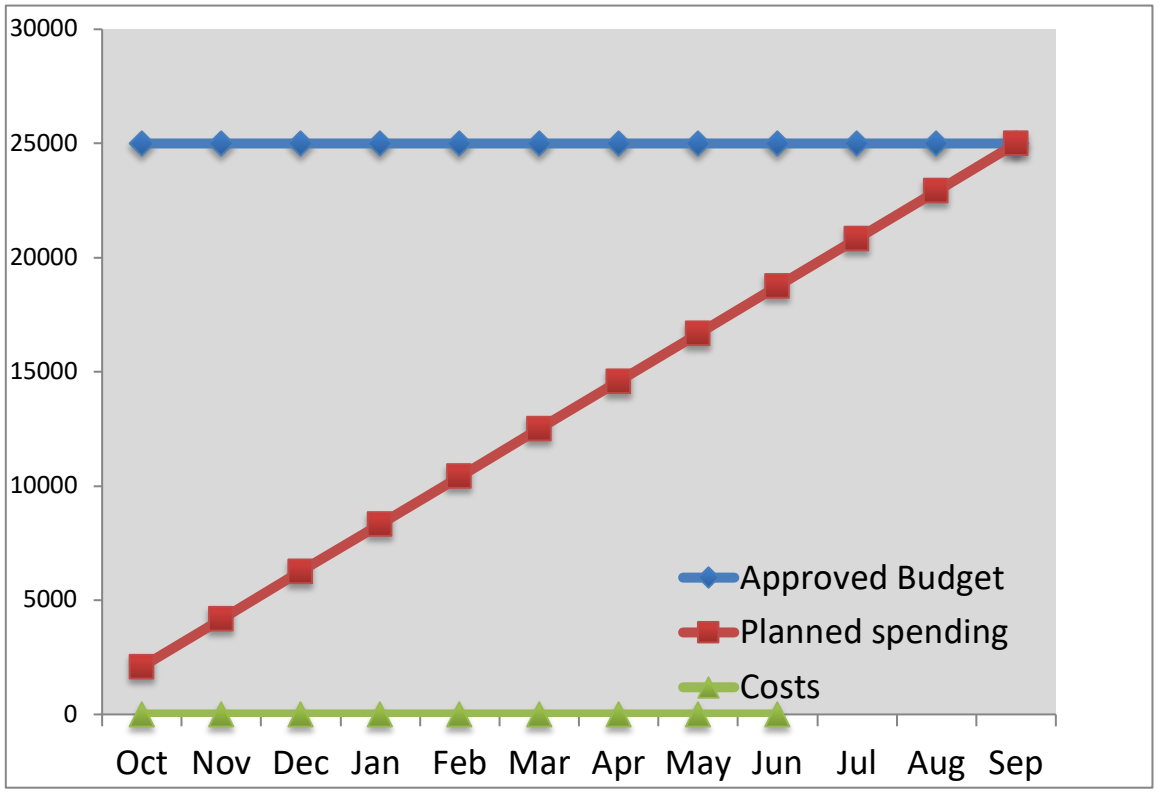
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE7)	NO REPORT	
Q2	Provide status reports on all training activities to the NCSP Manager. (TE7)	NO REPORT	
Q3	Provide status reports on all training activities to the NCSP Manager. (TE7)	NO REPORT	
Q4	Provide status reports on all training activities to the NCSP Manager. (TE7)		
	Provide end of year progress report. (TE7)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TE8
Task Title: Reactivity Simulation Aids
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: July 26, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 100K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $0**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $ 0**

MAJOR ACCOMPLISHMENTS

- No Progress

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TE8 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE8)	NO REPORT	**Will get work planned**
Q2	Provide status reports on all training activities to the NCSP Manager. (TE8)	NO REPORT	**Will get work planned**
Q3	Provide status reports on all training activities to the NCSP Manager. (TE8)	NO REPORT	**Will get work planned for early FY20**
Q4	Provide status reports on all training activities to the NCSP Manager. (TE8)		
	Provide end of year progress report. (TE8)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: TE1, 3, 8, 9

Task Titles:

TE1 Conduct Hands-on Training at the DAF (TACS)
TE3 Classroom Criticality Safety Training
TE8 Incorporate Superior Reflectors into TACS "Hands On" Training
TE9 Design and Develop a New NCSP T&E Course for Criticality Safety Officers

M&O Contractor Name: Lawrence Livermore National Laboratory

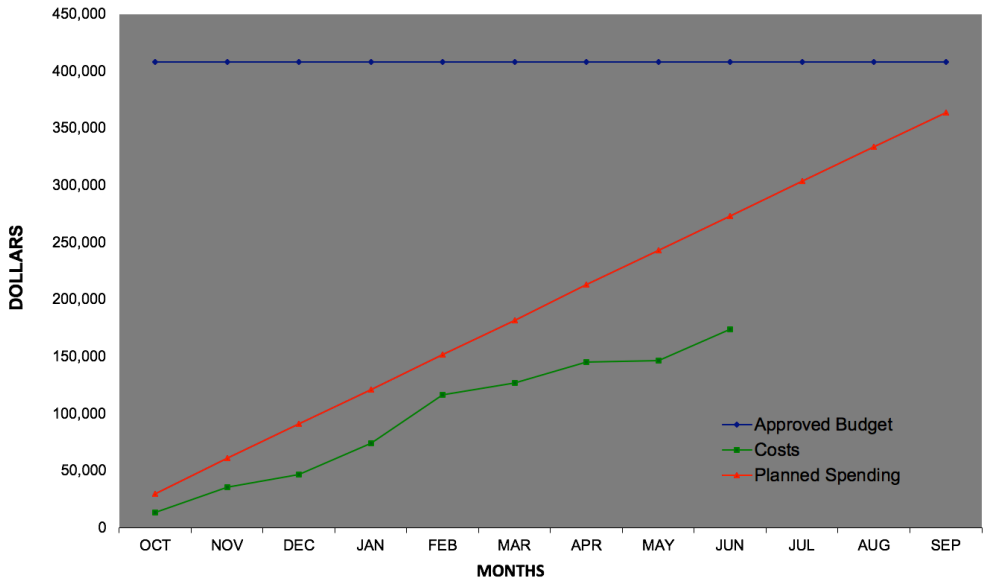
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: July 12, 2019

BUDGET



1. **Carryover into FY 2019** = $12,541
2. **Approved FY 2019 Budget** = $408,541 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $47,065
4. **Actual spending for 2nd Quarter FY 2019**= $80,195
5. **Actual spending for 3rd Quarter FY 2019** = $46,825
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $12,541 (11%)

MAJOR ACCOMPLISHMENTS

1. Provided registration and logistics support (TE1, TE3) for:
   - 1 week Managers course on April 8-12, 2019 at SNL
   - 1 week Managers course on June 3-7, 2019 at NFO & NCERC
   - 2-week CSE course on Aug 12-23, 2019 at NATM & NCERC/SNL
   - 2-week CSE course on Jan 27-Feb 7, 2020 at NATM & NCERC/SNL
   - 1 week Managers course on March 30-April 3, 2020 at SNL
   - 1 week Managers course on June 15-19, 2020 at NCERC
   - 2-week CSE course on Aug 10-21, 2020 at NATM & NCERC/SNL
2. Provided academic and hands-on instruction for the one-week Managers course at NFO and NCERC on June 3-7, 2019 including the following modules:
   - NCS Fundamentals
   - NCS Evaluation
   - Introduction to Experimental Methods
   - TACS
3. Participated in all T&E teleconferences (TE1, TE3).
4. The TACS CSE has been completely revised including adding use of the Be shells and issued as CSM-1748, *Criticality Safety Evaluation: LLNL Training Assembly for Criticality Safety (TACS) at the Device Assembly Facility* (TE8).
5. Reviewed and provided comments on May 23, 2019 to the CSSG 2018-01 subgroup on the design and development of a new NCSP T&E course for criticality safety officers. (TE9)

NCSP Quarterly Progress Report (FY-2019 Q3)

LLNL T&E Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

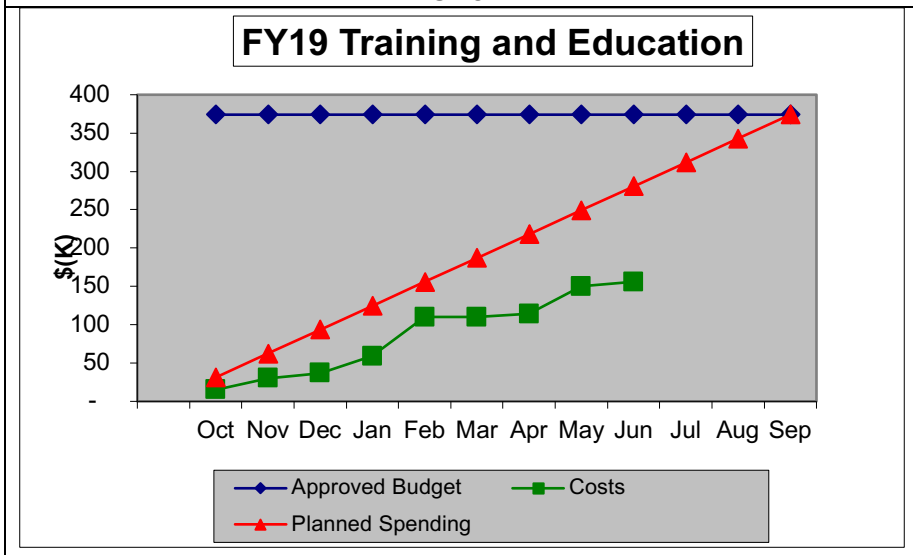
QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q2	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q3	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q4	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: TE1, 5, 9, 10
Task Title: See last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP0901010/ORNL
Date of Report: July 23, 2019

BUDGET



Carryover into FY 2019 = $40K

1. **Approved FY 2019 Budget** = $374 (includes carryover)
2. **Actual spending for 1st Quarter FY 2019** = $37K
3. **Actual spending for 2nd Quarter FY 2019** = $73K
4. **Actual spending for 3rd Quarter FY 2019** = $46K
5. **Actual spending for 4rd Quarter FY 2019Y** = $0

Projected carryover into FY 2020 = $20K

MAJOR ACCOMPLISHMENTS

TE1 - Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program

- Bowen coordinated the 1-week manager course at Sandia National Laboratory in April 2019. Bowen also provided instructor support. Course materials, exams, and student evaluations were reviewed, shared with task managers, and archived on the T&E SharePoint. The results were discussed with the NCSP manager.
- Bowen coordinated the 1-week manager course at NCERC in June 2019. Bowen also provided instructor support. Course materials, exams, and student evaluations were reviewed, shared with task managers, and archived on the T&E SharePoint. The results were discussed with the NCSP manager.

TE5 - On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools

- No activity in Q3 other than determining another site to conduct the next training session.

TE9 - Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities

- In Q3, the CSSG tasking report for 2018-01 was pending. Bowen participated on the CSSG team for 2018-01 during the quarter. No activity for the design and development of the course materials in Q3.

TE10 - Design of a Subcritical Assembly at ORNL for use with the CSO/FMH Courses

- Very little activity was completed on this task in Q3. Toward the end of Q3, Shane Hart and Andrew Holcomb began computations to support the feasibility report for an ORNL subcritical/critical assembly. ORNL management is very interested in this capability as a training tool for NCS staff and students in the eastern US. Ellen Saylor is working with Y-12 to locate AGN-201 cores for use for this assembly. The feasibility report may be delayed into FY20Q1.

NCSP Quarterly Progress Report (FY-2019 Q3)

ORNL TE Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q2	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		

NCSP Quarterly Progress Report (FY-2019 Q3)

Q3	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		**Although still on track, the CSSG tasking report for 2018-01 was not issued until the end of FY19Q3 (June 20th).**
Q4	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
	Develop a feasibility report to the NCSP manager for the design and installation of a subcritical assembly at ORNL using existing resources at Y-12. If the concept is feasible, submit a proposal for consideration for FY20. (TE10)		

NCSP Quarterly Progress Report (FY-2019 Q3)

Task Title:

TE1 Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program

TE5 On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools

TE9 Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities

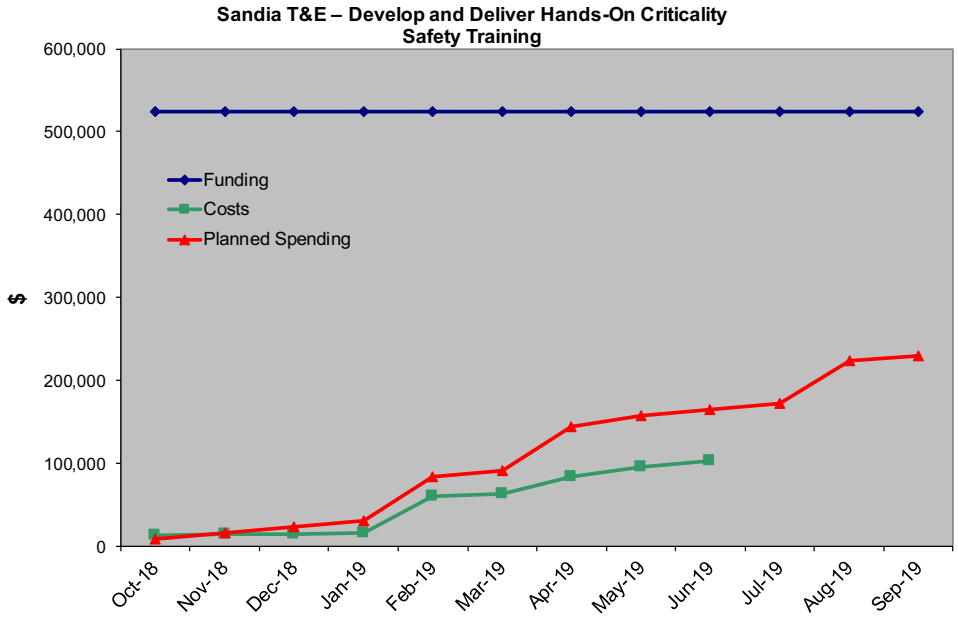
TE10 Design of a Subcritical Assembly at ORNL for use with the CSO/FMH Courses

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: SNL TE1, 2
Task Titles:
TE1 Prepare for and Conduct Hands-on Criticality Safety Training at SNL
TE2 Design and Develop a New NCSP T&E Course Criticality Safety Officers at DOE/NNSA Nuclear Facilities
M&O Contractor Name: Sandia National Laboratories (SNL)
Point of Contact Name: Gary A. Harms
Point of Contact Phone: (505)845-3244

Reference: **B&R DP 0909010**
Date of Report: **June 30, 2019**

BUDGET



1. **Carryover into FY 2019** = $295,351
2. **Approved FY 2019 Budget** = $229,000 (new) + $295,351 (carryover) = $524,351
3. **Actual spending for 1st Quarter FY 2019** = $13,447
4. **Actual spending for 2nd Quarter FY 2019** = $62,395
5. **Actual spending for 3rd Quarter FY 2019** = $101,942
6. **Actual spending for 4th Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

- We delivered a Hands-On criticality safety course for managers in April 2019.
- We are preparing to deliver the experiment portion of a Hands-On criticality safety course for NCSEs in August.

NCSP Quarterly Progress Report (FY-2019 Q3)

SNL T&E Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

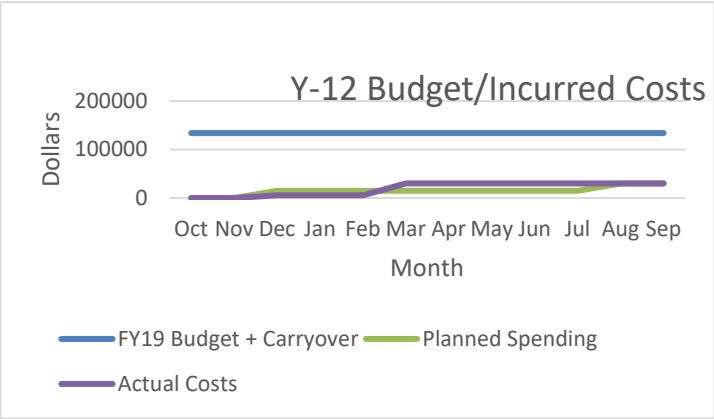
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
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)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
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)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
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)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: Y12 TE1, 3, 4
Task Title:
TE1 Conduct Hands-On Criticality Safety Training Course (Lecture support week 1 of 2-week hands-on course and course material development)
TE3 Design of a Subcritical Assembly at ORNL for use with the CSO Courses
TE4 Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities
M&O Contractor Name: Y12
Point of Contact Name: Kevin Reynolds
Point of Contact Phone: (865) 241-9067

Reference: B&R DP0909010
Date of Report: August 14, 2019

BUDGET



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $134k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $5,394.30
4. **Actual spending for 2nd Quarter FY 2019** = $24,750.20
5. **Actual spending for 3rd Quarter FY 2019** = $0.00
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

- TE1 is Chris Haught's time to teach at Hands On Courses. Minimal effort in Q1 – mostly prep for short course teaching which is to occur in Q2.
- TE3 and TE4 are ORNL tasks we fund as requested and so far no effort from us on these items has occurred.
- Q2 for TE1: Teaching prep for short course.
- Q2 for TE3 and TE4 are zero effort to date.
- Q3: TE3 – meeting held with Y-12 (Lloyd Jollay, Chris Haught and Kevin Reynolds) and ORNL (Ellen Saylor) to discuss initial planning. Y-12 (Lloyd Jollay) took and action to research inventory to determine what holdings we have that would be appropriate for ORNL's purposes (AGN-201 plates).
- Q3: TE1 and TE4 are zero effort for the quarter.

NCSP Quarterly Progress Report (FY-2019 Q3)

Y12 TE Milestones:

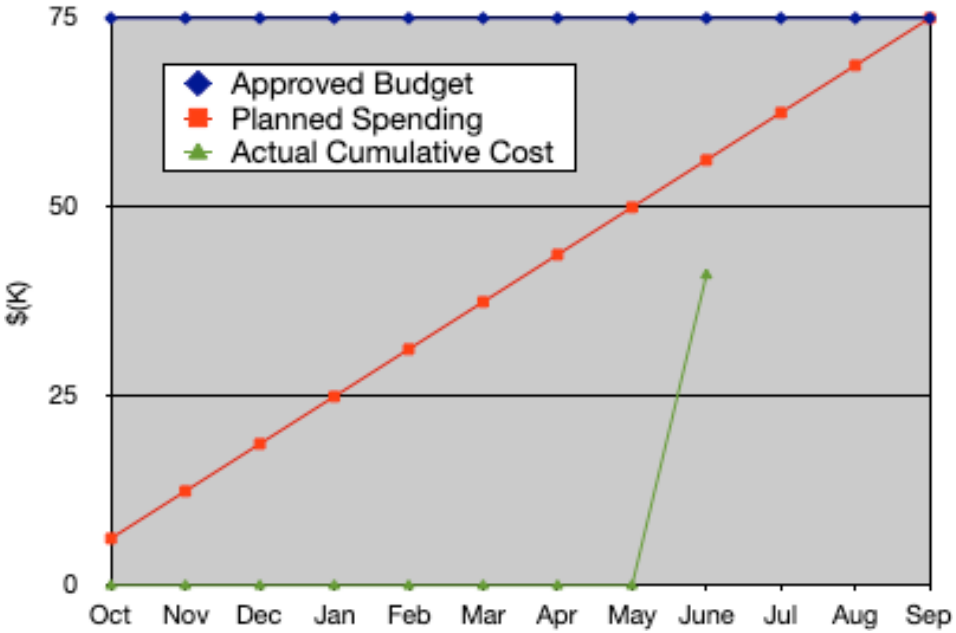
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q2	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q3	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q4	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: NCSP Technical Support TS6 Task Title: ND Succession Planning M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: DP0909010 Date of Report: July 12, 2019
BUDGET	**ACCOMPLISHMENTS**



1. **Carryover into FY 2019** = $ 0
2. **Approved FY 2019 Budget** = $75 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $41,060
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $0

None yet, stay tuned...

NCSP Quarterly Progress Report (FY-2019 Q3)

BNL TS6 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

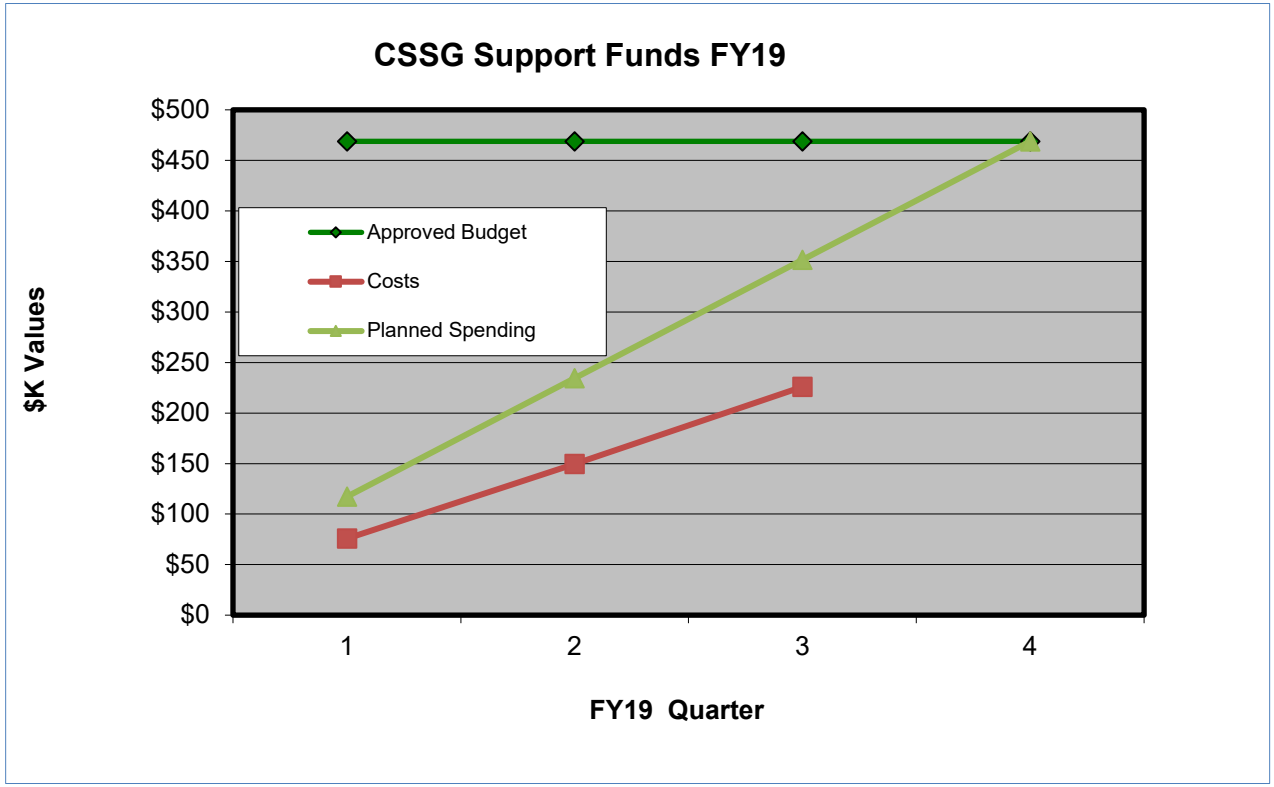
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		**n/a**
Q2	NONE		**n/a**
Q3	NONE		**Summer student has arrived, work on rewriting the Atlas analysis codes has begun!**
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: TS1
Task Title: CSSG Support
M&O Contractor Name(s): AECOM, ANL, LANL, LLNL, PNNL, SRNS, Y-12
Point of Contact Name: David Hayes (CSSG Deputy Chair)
Point of Contact Phone: 505-667-4523

Reference: B&R DP 0909010
Date of Report: July 25, 2019

BUDGET



1. **Carryover into FY 2019** = $k 48.8
2. **Approved FY 2019 Budget** = $k 468.8 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $k 76
4. **Actual spending for 2nd Quarter FY 2019** = $k 74
5. **Actual spending for 3rd Quarter FY 2019** = $k 77
6. **Actual spending for 4rd Quarter FY 2019** = $k
7. **Projected carryover into FY 2020** = $ 0

MAJOR ACCOMPLISHMENTS

- Tasking 2018-01 complete/issued
- CSSG Face-to-Face meeting in Minneapolis
- Tasking 2019-01 complete
- Regular CSSG Telecons

NCSP Quarterly Progress Report (FY-2019 Q2)

CSSG TS Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

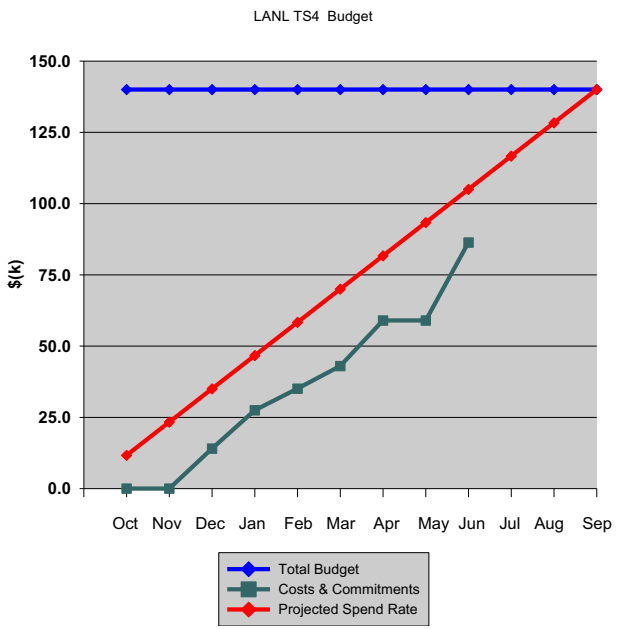
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		
Q2	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		
Q3	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		**Tasking 2019-01 input provided on FY20 proposals. Need to close the task**
Q4	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: LANL TS4
Task Title: AM, IE, ND Succession Planning
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: July 24, 2019

BUDGET



1. **Carryover into FY 2019** = $ 0
2. **Approved FY 2019 Budget** = $ 140K
3. **Actual spending for 1st Quarter FY 2019** = $14.0K
4. **Actual spending for 2nd Quarter FY 2019** = $29.0K
5. **Actual spending for 3rd Quarter FY 2019** = $43.2K
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

NCSP Quarterly Progress Report (FY-2019 Q3)

LANL TS4 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

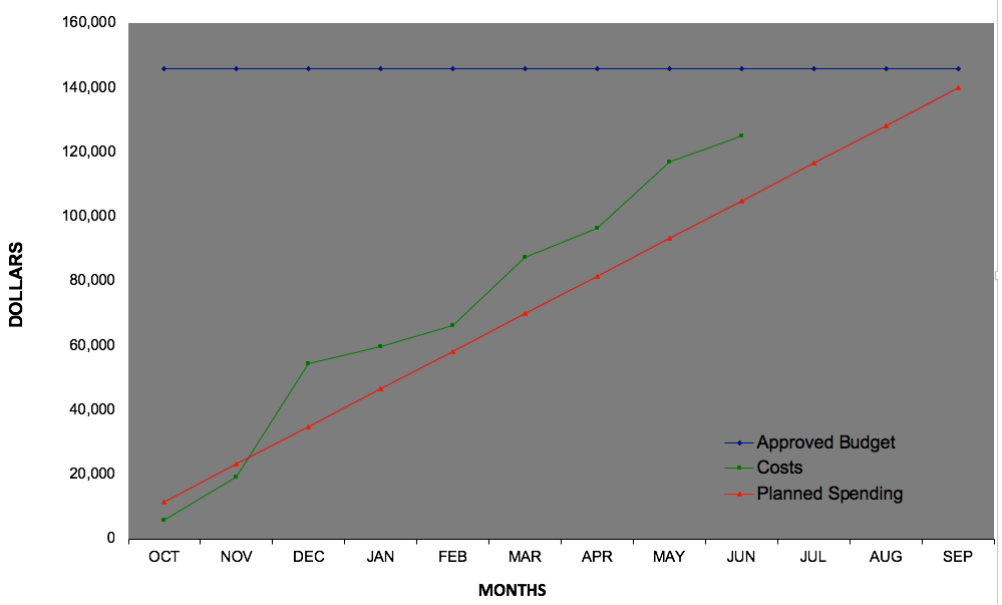
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: TS5
Task Title: LLNL Succession Planning
M&O Contractor Name: Lawrence Livermore National Laboratory
Point of Contact Name: David Heinrichs
Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010
Date of Report: July 12, 2019

BUDGET



1. **Carryover into FY 2019** = $6,086
2. **Approved FY 2019 Budget** = $146,086 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $54,353
4. **Actual spending for 2nd Quarter FY 2019**= $33,114
5. **Actual spending for 3rd Quarter FY 2019** = $37,533
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $6,086 (4%)

MAJOR ACCOMPLISHMENTS

1. Heinrichs attended the ASME Verification and Validation (V&V) Symposium in Las Vegas, NV, on May 15-17, 2019. (AM)
2. Shauntay Coleman and Will Zywiec (representing Heinrichs) attended the JOWOG 30-23 Criticality Safety Summit Meeting at AWE-Aldermaston (UK) on May 20-24, 2019. (AM, IE)
3. Daniel Stone (replacing Hickman) attended the 3rd International Conference on Dosimetry and its Applications (ICDA-3) on May 27-31, 2019, in Lisbon, Portugal. (IE)
4. Catherine Percher and Jesse Norris attended the 2019 International Conference on Nuclear Data for Science and Technology on May 19-24, 2019, in Beijing, China. (IE, ND)
5. Catherine Percher and Will Zywiec are hosting three DOD summer students [John Langley (USA ROTC, Texas A&M), MIDN Samuel Rice (US Naval Academy), Mark Westman (USN ROTC, University of Rochester)]. (IE)

NCSP Quarterly Progress Report (FY-2019 Q3)

LLNL TS5 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

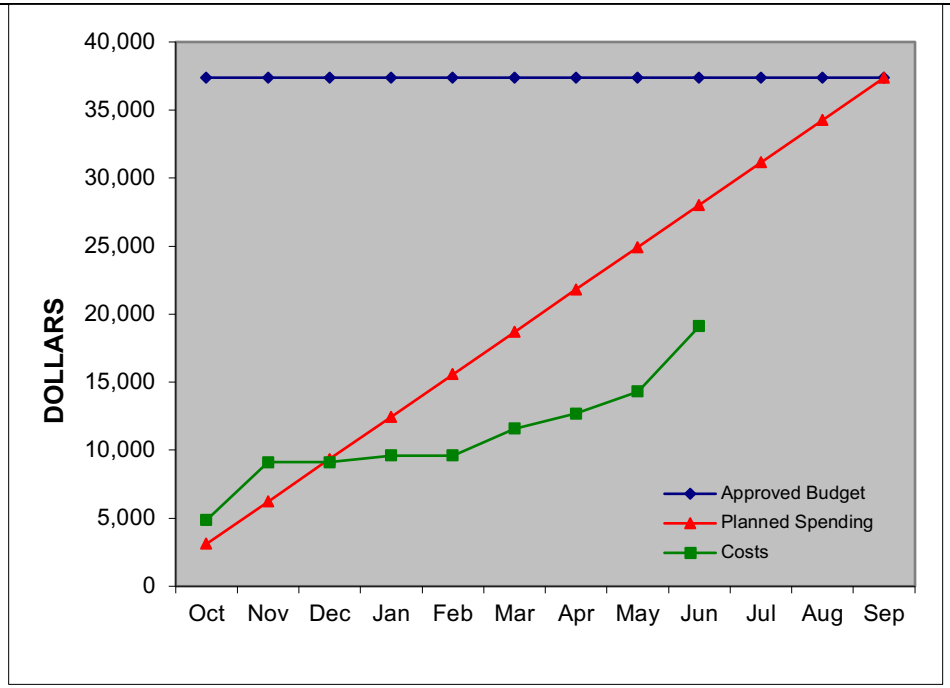
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: NNL TS9
Task Title: NNL – Support for NDAG Chair activities
M&O Contractor Name: NNL
Point of Contact Name: Mike Zerkle
Point of Contact Phone: (412) 476-6188

Reference: B&R DP0909010
Date of Report July 24, 2019

BUDGET



1. **Carryover into FY 2019** = $8k
2. **Approved FY 2019 Budget** = $37k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $9k
4. **Actual spending for 2nd Quarter FY 2019** = $3k
5. **Actual spending for 3rd Quarter FY 2019** = $8k
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $8k (22%)

MAJOR ACCOMPLISHMENTS

1. Participated in April 2019 IE Face-to-Face Meeting.
2. Participated in 2019 WPEC Meeting as NDAG Chair including SG45 (Vandal), SG46 (IE), SG47 (SINBAD), HPRL. Supported new SG proposal on thermal neutron scattering.
3. Performed ICSBEP and IRPhEP benchmark evaluation TRG comment resolution reviews in support of the publication of the 2018 edition of these handbooks.
4. Provided comments on draft NCSP FY2020-FY2024 Execution Plan.
5. CEdT process support as NDAG Chair and CEdT Team Member for:
    a. IER-184 (TEX Pu/Ta) CED-3b
    b. IER-209 (7uPCX w/ Water Height Control) CED-3b
    c. IER-230 (7uPCX w/ Optimal Moderation) CED-3a
    d. IER-297 (TEX HEU/Hf) CED-3a
    e. IER-489 (Curie) CED-2 and CED-3a
    f. IER-498 (CAAS)

NCSP Quarterly Progress Report (FY-2019 Q3)

NNL TS9 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

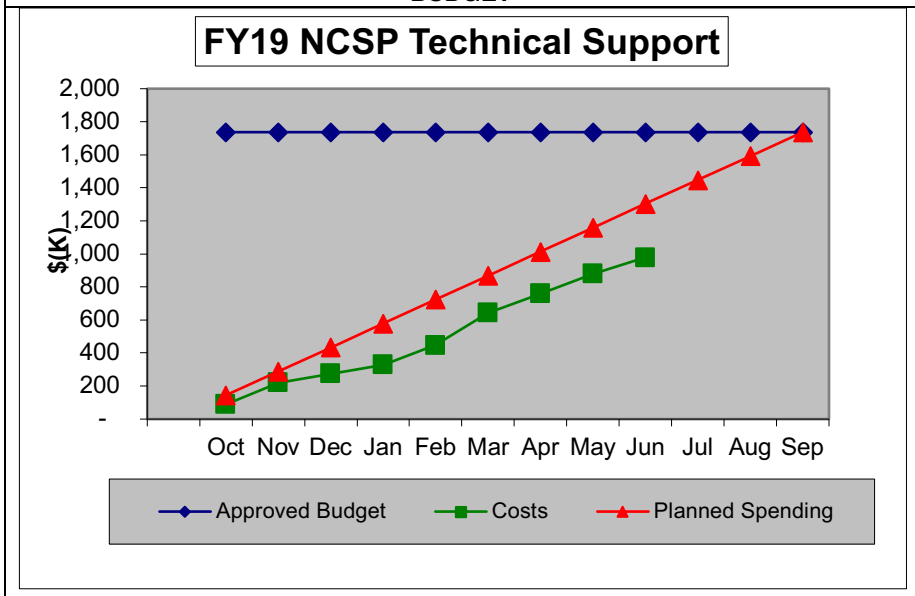
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q2	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q3	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q4	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Development), TS11 (CEdT Manager Support)
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP0902000/ORNL
Date of Report: July 30, 2019

BUDGET



1. **Carryover into FY 2019** = $613K
2. **Approved FY 2019 Budget** = $ 1737K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $275K
4. **Actual spending for 2nd Quarter FY 2019** = $369K
5. **Actual spending for 3rd Quarter FY 2019** = $335K
6. **Actual spending for 4rd Quarter FY 2019** = $0K
7. **Projected carryover into FY 2020 = $~150K (G2 programming)**

MAJOR ACCOMPLISHMENTS

TS2

- Prepare and maintain elements of NCSP Plan and associated activities:
  - Monitor Five-Year Plan progress,
  - Review/revise task list, and
  - Schedule/participate in meetings and teleconferences.
  - 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 Q2 QPRs into a single bookmarked PDF file for use in QPR. Conducted Q2 telecon.
- Worked with Mission and Vision team leads to complete their draft Mission and Vision sections. Compiled final draft of the document.
- The NCSP MGT team worked with NDAG and the CSSG on proposal vetting efforts and to compile a new, predecisional spreadsheet for task manager review. The predecisional spreadsheets were discussed with the NCSP manager and sent to the task managers for two rounds of review in June 2019. The main 5-year plan was also drafted and sent for task manager review with the predecisional spreadsheets.
- Participated in CSSG telecons and assisted with CSSG tasks as necessary. Bowen supporting CSSG tasking 2018-01 CSO course baseline.
- Finalized efforts to improve documentation of NCSP accomplishments to ensure NCSP work is linked to final 5YP milestones. Lori Scott has created new quarterly reporting templates for distribution to the site task managers.
- Led and participated telecons and WebEx meetings as necessary to track NCSP MGT team actions and deliverables.
- Worked with LLNL to develop a new NDA website (http://nda.llnl.gov) to support the NDA Technical Infrastructure Project.

TS7

- Chris Chapman continued to work on nuclear data evaluations with Vlad Sobes and Marco Pigni for Ce and V nuclear data evaluations. Chris is also working on thermal neutron scattering measurements at the ORNL SNS. Andrew Holcomb continued working on tasks to utilize SAMMY and AMPX for NCSP projects. Two

NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Development), TS11 (CEdT Manager Support) **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0902000/ORNL **Date of Report:** July 30, 2019
	new ORNL staff are starting to use this funding to learn ND measurements and evaluation work. **TS8** • ORNL continued work on an initial prototype of a new NCSP Program Management Tool. Bowen supported multiple meetings in person and via WebEx with G2 programmers to discuss desired IER database features for the May 2019 G2 campaign. A prototype may be ready in early Q4. **TS11** • ORNL lead a face-to-face IE meeting at LANL in April. No IE telecons were scheduled in May/June. • The CEDT manager tracked IER products and Baseline Change Reviews and worked with the NCSP manager to approve tasks, as required. • Bowen, Scott, and Miller worked to prepare the IER prioritization spreadsheets for each site with IER work for 5-year plan (IE section) planning. • Bowen worked with Miller (Sandia) in Q3 to continue transition efforts, although Doug still needed to lead CEDT efforts. This position takes time to learn and John is doing a great job learning the NCSP processes and interacting with the task managers.

NCSP Quarterly Progress Report (FY-2019 Q3)

ORNL TS Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	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)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q2	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	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)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q3	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	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-2019 Q3)

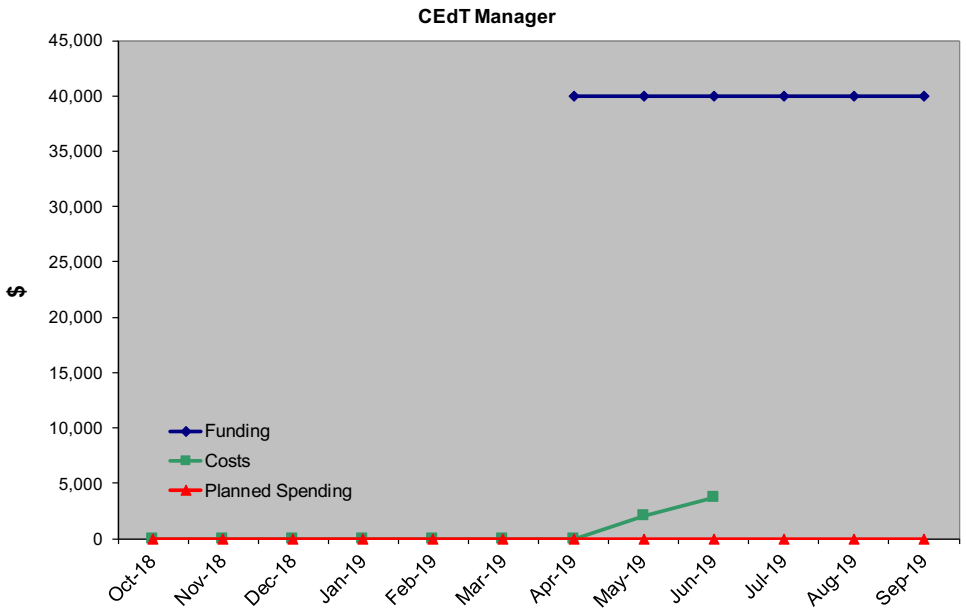
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q4	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
	Participate in Q4 Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY. (TS2)		
	Publish final Five-Year Plan. (TS2)		
	Provide NCSP Manager annual report of succession planning efforts. (TS7)		
	Provide NCSP Manager a status report of progress on the development of a program management tool. (TS8)		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: SNL TS
Task Title: C_EdT Manager
M&O Contractor Name: Sandia National Laboratories (SNL)
Point of Contact Name: Gary A. Harms
Point of Contact Phone: (505)845-3244

Reference: **B&R DP 0909010**
Date of Report: **June 30, 2019**

BUDGET



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $40,000 (from IE carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $3,690
6. **Actual spending for 4th Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

- A Sandia employee is spinning up as the C_EdT manager.

NCSP Quarterly Progress Report (FY-2019 Q3)

SNL TS Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

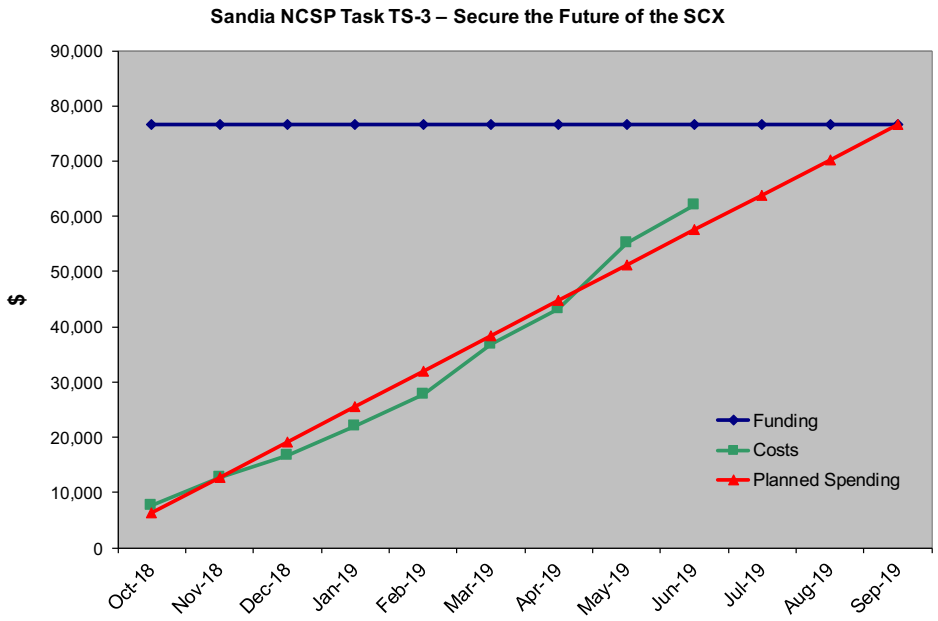
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	NONE		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element: SNL TS3
Task Title: Support for Experimentalist Succession Planning
M&O Contractor Name: Sandia National Laboratories (SNL)
Point of Contact Name: Gary A. Harms
Point of Contact Phone: (505)845-3244

Reference: **B&R DP 0909010**
Date of Report: **June 30, 2019**

BUDGET



1. **Carryover into FY 2019** = $1,682
2. **Approved FY 2019 Budget** = $75,000 (new) + $1,682 (carryover) = $76,682
3. **Actual spending for 1st Quarter FY 2019** = $16,753
4. **Actual spending for 2nd Quarter FY 2019** = $36,771
5. **Actual spending for 3rd Quarter FY 2019** = $62,134
6. **Actual spending for 4th Quarter FY 2019** = $
7. **Projected carryover into FY 2020** = $

MAJOR ACCOMPLISHMENTS

- We have a matrixed employee who is being trained as an experimenter.
- The new experimenter has been executing and documenting the IER-451 experiments. The evaluation LEU-COMP-THERM-099 that documents the experiments is is complete and submitted for publication.
- The new experimenter has taken the lead role on the CEdT for IER-230.
- The new experimenter has been actively participating in the NCS community by attending conferences and publishing papers.
- We have hired a nuclear engineering graduate intern from Missouri S&T to develop knowledge and participate in Sandia's process for performing integral experiments.

NCSP Quarterly Progress Report (FY-2019 Q3)

SNL TS3 Milestones:

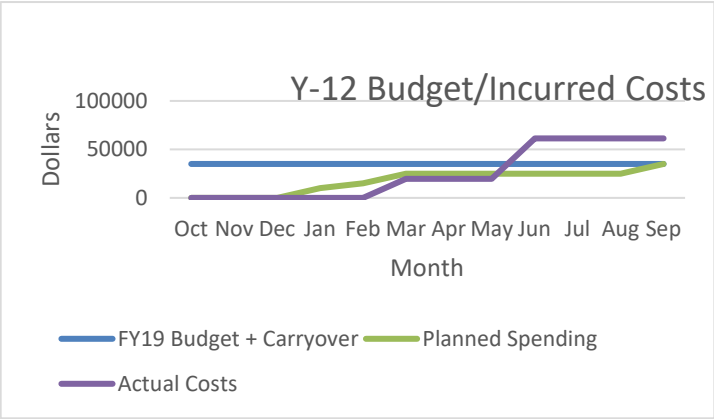
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q3)

NCSP Element and Subtasks: Y12 TS10 **Task Title:** TPR and Foreign Travel **M&O Contractor Name:** Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference: B&R DP0909010** **Date of Report: August 14, 2019**
BUDGET	**MAJOR ACCOMPLISHMENTS**



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $35k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0
4. **Actual spending for 2nd Quarter FY 2019** = $19,790.34 (TPR)
5. **Actual spending for 3rd Quarter FY 2019** = $41,562.16
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

- Q1: Abstracts for ICNC drafted and submitted for two papers to be presented in support of NCSP funding.
- Q1: TPR arrangements begun (ongoing)
- Q2: TPR planning complete and meeting held at Pantex
- Q3: TPR complete – no actions
- Q3: ICNC2019 foreign travel for Kevin Reynolds, Travis Wilson and Kristen Wessels being entered.

NCSP Quarterly Progress Report (FY-2019 Q3)

Y12 TS10 Milestones:

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

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10)		
Q2	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10)		Original budget was for TPR and 2 trips to ICNC 2019. I believe Angela approved a third trip (Kristen Wessels) and so we will need additional funds to cover this trip. TPR was under budget by almost $6k
Q3	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10) – only if still applicable		Account overspent due to adding third ICNC trip. Original budget was for 2 persons to travel to ICNC.
Q4	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10) – only if still applicable		
	Provide Foreign Trip Report for ICNC. (TS10)		

Summary of NDAG Chair Activities during FY2019 Q3

July 24, 2019

M. L. Zerkle

This report provides a summary of the NDAG Chair activities, meetings, and tasks during the third quarter of FY2019 (4/1/2019 to 6/30/2019).

1. Participated in April 2019 IE Face-to-Face Meeting.
2. Participated in 2019 WPEC Meeting including SG45 (Vandal), SG46 (IE), SG47 (SINBAD), and HPRL. Supported new proposed SG on thermal neutron scattering during WPEC meeting.
3. Performed NDAG Chair technical review of NCSP FY2020 IE and ND proposals, provided results to CSSG and NCSP Management Team.
4. Performed ICSBEP/IRPhEP benchmark evaluation TRG comment resolution reviews in support of the publication of the 2018 Edition of these handbooks.
5. Provided comments on draft NCSP FY2020-FY2024 Execution Plan.
6. CEdT process support as NDAG Chair and CEdT Team Member for:
    a. IER-184 (TEX Pu/Ta) CED-3b
    b. IER-209 (7uPCX w/ Water Height Control) CED-3b
    c. IER-230 (7uPCX w/ Optimal Moderation) CED-3a
    d. IER-297 (TEX HEU/Hf) CED-3a
    e. IER-489 (Curie) CED-2 and CED-3a
    f. IER-498 (CAAS)

$8k was expended in support of NDAG Chair activities during FY2019 Q3.

Summary of MCNP Criticality Classes in FY 2019

F.B. Brown, M.E. Rising, J.L. Alwin
Monte Carlo Methods, Codes, & Applications Group (XCP-3), LANL

FY2019 – Q3 classes are highlighted in red. (102 students, total)

Classes sponsored by DOE-NNSA-NCSP (LANL-AM1, TE4)

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation**
  - **May 15 & 16, 2019 Hanford & PNNL 17 students**

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

  - **July 8, 2019 LANL – NCS group 15 students (local class, mcnp-whisper)**

- **Criticality Calculations with MCNP6**
  - Mar 18-22, 2019 LANL 7 students
  - **May 6-9, 2019 Sandia 17 students**
  - Aug 5-9, 2019 LANL scheduled
  - Oct 21-24, 2019 Y-12 scheduled

  MCNP criticality class for NCS & reactor physics practitioners, with focus on best practices. Includes 1 day on NCS validation using MCNP6-Whisper. For classes at LANL, NCSP-sponsored students do not pay registration fees. For classes at other DOE sites, there are no registration fees.

- **Monte Carlo Techniques for Nuclear Systems**
  - Aug 24 – Dec 6, 2019 UNM 20 students

  This is a 1-semester class for senior undergrads & graduate students at the University of New Mexico. Required for UNM graduation in Nuclear Engineering. Includes Monte Carlo theory & practical use of MCNP6. Several of the students are part of the LANL NCS intern program. (This teaching is partially supported by NCSP, ASC, and other programs.)

Other Classes

- **Introduction to MCNP6**
  - Dec 3-7, 2018 LANL 15 students
  - Mar 4-8, 2019 LANL 15 students
  - **Apr 1-5, 2019 OECD-NEA, Paris 7 students**
  - **June 3-7, 2019 LANL 15 students**
  - **June 17-21, 2018 LANL 15 students**
  - July 29 – Aug 2, 2019 LANL scheduled
  - Oct 21-25, 2019 LANL scheduled

  Standard introductory class, includes 1/2 day on criticality calculations (without coverage of NCS validation using mcnp6-whisper). Classes are supported by student registration fees.

- **Intermediate MCNP6**
  - Mar 11-15, 2019 LANL 15 students
  - **Apr 8-12, 2019 OECD-NEA, Paris 16 students**
  - Oct 7-11, 2019 OECD-NEA, Paris scheduled
  - Oct 28 – Nov 1, 2019 LANL scheduled

  Classes are supported by student registration fees.

2019 Q3 – SCALE Training Courses Report for the Nuclear Criticality Safety Program

Class Name	SCALE/MAVRIC Spent Fuel Cask Analysis Using ORIGEN Source Terms
Class Dates	April 14, 2019
Location	Knoxville, TN
Number of Attendees	6
Short Description	This was a four-hour workshop presented during the International High-Level Radioactive Waste Management conference held in Knoxville, TN

Q3 2019-20 Financial Year, 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 intercomparison of nuclear accident dosimetry using Flattop	LLNL-IE1 IRSN-IE15	Co-author final report (CED-4b)	C. WILSON	D. HICKMAN	LLNL
No further progress in Chris Wilson's absence						
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	C. WILSON	D. HICKMAN	LLNL
No further progress in Chris Wilson's absence						
AWE-IE3 **IER 406**	Cf-252 CAAS benchmark	LLNL-IE1 IRSN-IE28	Perform/support PNS(TLD) measurements with a shadow cone	C. WILSON	D. HEINRICHS	LLNL
No further progress in Chris Wilson's absence						
AWE-IE4 **IER 175**	Godiva-IV CAAS benchmark	ORNL-IE4 IRSN-IE27	Review of experiment design. Provide measurement capability as required	C. WILSON	T. MILLER	ORNL
No further progress in Chris Wilson's absence						
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)	C. WILSON	D. HEINRICHS	LLNL
No further progress in Chris Wilson's absence						
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	C. WILSON	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.						
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	C. WILSON	T. CUTLER B. MYERS	LANL
No further progress in Chris Wilson's absence						
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
Liquid scintillation system deployed to DAF in Q3. Measurement data acquired from bulk material assemblies. System and data returned to AWE May '19. Data is yet to undergo analysis.						
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 is continuing to prepare a report summarising the results from analysis of bulk material measurements. Lower mass assemblies give promising results, higher mass assemblies give high count rates requiring dead time correction that is still to be devised and incorporated. Good confidence of completion before the Technical Program Review.						
AWE-IE10	Enhanced methods of criticality accident dosimetry No funding for FY19 awe will provide proposal for FY20	LLNL-IE1 IRSN-30 IRSN-33 Naval Dosimetry Center	Develop prototypes, participate in design, execution and reporting of dosimetry experiments	C. WILSON	F. TROMPIER	LLNL
No further progress in Chris Wilson's absence.						
AWE-IE11	International intercomparison 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	C. WILSON	D. HICKMAN	LLNL
No further progress in Chris Wilson's absence.						

No further progress in Chris Wilson's absence

Reference			AWE Contributions and POCs			
AWE Reference	**Task Description**	**NCSP Reference**	**FY2018 AWE Contribution**	**AWE Technical POC**	**Collaborator POC**	**DOE Lab**
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, findings and learning is at first draft.						
AWE-IE13	Characterization of AFRRI TRIGA reactor radiation field AWE will provide onsite measurement	LLNL-IE18 SNL-IE4	Provide support to experiment design	C. WILSON	A. ROMANYUKHA	LLNL
No further progress in Chris Wilson's absence.						
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	C. WILSON	D. HEINRICHS	LLNL
Not started.						
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 current plans to attend courses.						

STATUS REPORT
on the
International Collaboration with the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) for FY2019

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Analytical Methods						
IRSN-AM15	MCNP Maintenance and Support / Uncertainty Analysis Development / Modernization / etc.	LANL-AM1	Interest for uncertainty analysis, source convergence development and modernization strategy	E. DUMONTEIL	F. BROWN	LANL
Q2: Theoretical modeling of variance to mean ratio and spatial correlation of critical and under-critical systems with intrinsic sources. Q3: End of theoretical modeling of uncertainties with intrinsic sources -> presentation at OECD/NEA/SG6 and ICTT 2019 + exchanges with Forrest at this time						
IRSN-AM16	Multi-Physics Methods for Simulation of Criticality Excursions	LLNL-AM2	Technical exchanges on the proposed multiphysics tasks for simulating criticality excursions.	M. DULUC	D. HEINRICHS	LLNL
Task not started. To be deleted from the list of IRSN contributions.						
IRSN-AM1	Validation and qualification methods	ORNL-AM2 ORNL-IPD4	Covariance matrices establishment of the selection of Integral Experiments	I. DUHAMEL	D. BOWEN B. REARDEN	ORNL
This task was initiated in the frame of the OECD/NEA UACSA expert group. Experimental correlations were established for LCT007 and LCT039 – need to contact Brad Rearden to discuss about the experiments of interest for the FY2019. Q3: no progress. IRSN proposal to work on experimental correlations of MIRTE 1 experiments.						
IRSN-AM3	Monte Carlo & sensitivity calculations	ORNL-AM2	Technical exchanges on sources convergence issues, sensitivity coefficients calculations and kinetics parameters calculations	B. DECHENAUX	D. BOWEN B. REARDEN	ORNL
No action is planned. This task should be removed from future planning in view of the departure of original contributors from both parties. Task completed.						
IRSN-AM5	Update of the slide rule	ORNL-AM6 LLNL-AM3 AWE-AM1	Subtask 2 of IRSN proposal Update of the "slide rule" for the rapid response estimation of a criticality accident (using COG, MCNP, MAVRIC, ATTILA…)	M. DULUC	D. BOWEN D. HEINRICHS C. WILSON	ORNL LLNL AWE
Q2: Report published. The next step will be in particular the number of fissions estimate (meeting about this subject during the TPR meeting, Amarillo).						
IRSN-AM7	ACE QA testing and implementation	LANL-AM2	Implementation of the defined QA tests in ACEtk and integration in GAIA	L. LEAL	J. CONLIN	LANL
Report provided by LANL to IRSN by Wim Haeck with detailed descriptions.						
IRSN-AM8	Analytical Methods Working Group	NCSP-TS2	IRSN participation to NCSP analytical methods Working Group and IRSN participation to TPR meeting	S. EVO	F. BROWN D. BOWEN	NCSP
Q2: IRSN participation in AMWG and TPR meeting in March 2019 at Pantex Plant.						
IRSN-AM9	Cross sections processing validation	ORNL-AM3	Development of an interface between GAIA and AMPX and test interface capabilities. AMPX training desired by IRSN staff in FY2019.	R. ICHOU	D. WIARDA D. BOWEN	ORNL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Tool for generating AMPX multigroup cross section library with DRAGON. Task needs completion. Possibility of an AMPX training course in Fall?						
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. (Completion of this task before ORNL-AM9 and LANL-AM4 would be useful to identify common benchmarks.)	I. DUHAMEL	D. HEINRICHS D. BOWEN F. BROWN	LLNL ORNL LANL
IRSN-AM13 in progress –Results from different labs collected – preliminary analyses done → feedback on COG and MORET input decks – common paper for ICNC (abstract submitted) Q2: preliminary analyses presented at TPR meeting in March 2019 – common paper planned for ICNC 2019 Q3: common paper was submitted at ICNC conference (accepted) and at ANS winter meeting (pending notification)						
IRSN-AM14	Sensitivity/Uncertainty comparison study with a focus on Upper Subcritical Limits	ORNL-AM9 LANL-AM4	Definition of three test cases Calculations and intercomparison technical report	I. DUHAMEL	F. BROWN D. BOWEN	LANL ORNL
In progress – LANL and ORNL results are available Q2 : technical exchanges during AM meeting in March Q3: a new release of MACSENS is available and new results will be provided soon						
IRSN-AM17	Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers	ORNL-AM16 LANL-AM6 LLNL-AM7	Contribution to measurements definition. Comparison of density laws (isopiestic law for instance)…	N. LECLAIRE	D. BOWEN	ORNL
Measurements should have been performed last autumn 2018. IRSN contacted Jennifer Alwyn and the measurements were not performed due to budget issues. Pending resolution of these issues, the action could be performed in 2019-2020. Plutonium sulfate densities should be retrieved from US laboratories and a comparison could be done with plutonium nitrate densities. It is also planned to make density vs temperature measurements. Action to be revived when measurements planned.						
Integral Experiments						
IRSN-IE1 **IER 184**	TEX - Ta experiment	LLNL-IE4	Sensitivity/uncertainty calculations Contribution to the evaluation of the first experiments.	M. BROVCHENKO	C. PERCHER	LLNL
IRSN is involved in TEX program since the beginning in 2011 and participated in the kick-off meeting. IRSN is part of the CED team and review the CED reports. In addition, in 2014 and 2015, IRSN performed sensitivities calculations on the designed configurations for TEX-Ta experiments. Regular VTC were organized to discuss the status of experiments. IRSN participated at the 2 last experiments in NNSS and will be involved in the ICSBEP evaluation in 2019 as independent reviewer. IRSN is waiting for the ICSBEP evaluation as the independent reviewer						
IRSN-IE3 **IER 209**	New 7uPCX experiment	SNL-IE1	Contribution to ICSBEP reevaluation.	N. LECLAIRE	G. HARMS	SNL
These experiments were finally not presented at the October 2018 meeting Presentation to the ICSBEP meeting not planned yet.						
IRSN-IE6 **IER 306**	Rh foils experiment	SNL-IE1	IRSN proposal: preliminary evaluation of experimental uncertainties prior to the experiment's CED-2 report.	N. LECLAIRE	G. HARMS	SNL
CED 1 report has been sent to the NCSP team review and is also in the IRSN validation process and will be issued in September 2019. Preliminary effects on keff of experimental uncertainties have been calculated and will be added in the CED-2 report in 2019. (supported by a sub-contract) Comments from Gary Harms have been received and will be taken into account (zoom on figures, editorial). Comments from other NCSP team members are expected. Technical issues with respect to the use of Al-clad rods in nitrate solutions and with the diameter of Rh sleeves were raised. Additional configurations are planned and will be added in						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
the CED-2 report						
IRSN-IE7 **IER 305**	Mo foils and rods experiment	SNL-IE1	IRSN proposal: Leading the CED-3a report; Supplying the Mo rods for the experiment.	N. LECLAIRE	G. HARMS	SNL
The CED-2 report has been postponed to the end of 2019. As a consequence, this task should not be totally done in 2019. We looked at potential suppliers for the Mo sleeves and estimated the costs. However, we waited for the CED-2 report to be finished before proceeding to the supplying of sleeves.						
IRSN-IE8 **IER 451**	Ti experiment	SNL-IE1	Analysis of the experiments Comparison with MIRTE program	N. LECLAIRE	G. HARMS	SNL
The independent review of experiments was done for the ICSBEP October 2018 meeting. The experiments were calculated with MORET 5. Some comparisons of sensitivity profiles were expected with the sensitivity obtained with TSUNAMI. In addition, we also planned to compare them with the sensitivities obtained for the MIRTE experiments. These tasks were subject to a subcontract beginning in May 2019, which is now finished. A report from the subcontractor was issued.						
IRSN-IE11 **IER 297**	TEX - Hf experiment	LLNL-IE4	Contribution to Jemima plates characterization. Contribution to CED report.	M. BROVCHENKO	C. PERCHER	LLNL
IRSN was involved in the review of the CED2 report and provide some sensitivity calculations to LLNL. The status of the program has been discussed regularly during VTC until 2017 with LLNL. On stand-by, waiting from LLNL						
IRSN-IE15 **IER 253**	International intercomparison exercise using FLATTOP	LLNL-IE1 AWE-IE3	Participation in the design, contribution to the experiments with IRSN materials, and the report.	M. DULUC F. TROMPIER	D. HEINRICHS C. WILSON	LLNL AWE
Exercise done in May 2018. Report released. No further action.						
IRSN-IE19	Solution reactor	Y12-IE2	Strong IRSN interest for participation in the design, specification… of a solution reactor	M. DULUC	P. ANGELO	Y-12
Task started. A first contact with Peter Angelo.						
IRSN-IE25 **IER 296**	TEX - MOX experiment	LLNL-IE4	IRSN leads this proposal for design and will author the CED-1 & 2 reports with LLNL support. Characterization of moderator and reflector plates. IRSN contribution to the moderator and reflector plates funding.	M. BROVCHENKO	C. PERCHER	LLNL
Design optimization for TEX-MOX ongoing. (Supported by sub-contracts in 2018 and 2019)						
IRSN-IE26 **IER 295**	TEX - Iron experiment	LLNL-IE4	Contribution to the experiments design. Contribution to CED reports and review.	M. BROVCHENKO	C. PERCHER	LLNL
This task is on stand-by for NCSP						
IRSN-IE27 **IER 175**	GODIVA CAAS benchmark	ORNL-IE4	Participation in the design. Provide IRSN materials for irradiation, analysis of results.	M. DULUC	D. BOWEN	ORNL
Task not started. Q3: A first contact with Doug BOWEN and Riley CUMBERLAND.						
IRSN-IE28 **IER 406**	Cf-252 CAAS benchmark	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Discussion in progress to perform additional measurement in 2019.						
IRSN-IE29	Correction factor for dosimetry linked to the orientation of the victim	LLNL-IE1 AWE-IE7	Participation in the design. Provide IRSN materials for irradiation, analysis of results.	M. DULUC F. TROMPIER	D. HEINRICHS C. WILSON	LLNL AWE
Task not started						

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IRSN-IE30	Full dosimetry exercise around GODIVA/FLATTOP reactors	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Task not started						
IRSN-IE33	Sodium activation experiment around GODIVA/FLATTOP	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Task not started						
IRSN-IE34	HEU critical and Subcritical measurements	LANL-IE23	Participation in the definition and the design of the experiment	W. MONANGE	J. HUTCHINSON	LANL
Q3: Task in progress. IRSN's simulations in progress.						
IRSN-IE35 **IER 434**	Godiva benchmark for time dependent code validation	LANL-IE3	Participation in the preliminary design and CED-1 report.	M. DULUC	J. GODA	LANL
Task not started						
IRSN-IE36	ICSBEP Shielding benchmarks for shipping containers	LLNL-IE13 AWE-IE8	Participation in the preliminary design and CED-1 report	M. DULUC	D. HEINRICHS C. WILSON	LLNL AWE
Task not started						
IRSN-IE37	Critical and subcritical measurements with a Zero-Power research reactor (On going task)	LANL-IE21	Analysis of the experiments, participation in the final technical report.	E. DUMONTEIL	J. HUTCHINSON	LANL
Q2: End of Nick Thompson postdoc at IRSN. The work on error bars estimation on power and positions has mostly been achieved. Simulations with intrinsic sources are on-going. Q3: Simulations with intrinsic sources are still ongoing (problem with HPC at IRSN) and should be done by end of august 2019. The writing of the paper is ongoing (end of theory and experimental sections by end of July 2019 and end of numerical section by end of september 2019). Ongoing discussion to define an experimental setup to measure correlations vs decoupling.						
IRSN-IE39	Thermal/Epithermal Experiments (TEX) Plutonium Experiments at Low Temperatures	LLNL-IE19	Participation in experiments design and CED reports. To be discussed with LLNL.	M. BROVCHENKO	D. HEINRICHS	LLNL
Task not started.						
IRSN-IE40	CAAS performance testing	LLNL-IE21	Participation in testing activities. Provide IRSN materials and French CAAS probes. To be discussed with LLNL.	M. DULUC	D. HEINRICHS	LLNL
Task not started						
IRSN-IE41	Thermal/Epithermal Experiments (TEX) with Chlorine and Lithium	LLNL-IE23	Participation in experiments design and CED reports. To be discussed with LLNL.	M. BROVCHENKO	D. HEINRICHS	LLNL
Task not started.						

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IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-IE42	Neptunium Subcritical Observations (NeSO) experiment	LANL-IExx	Participation in experiments and independent review of the ICSBEP evaluation.	W. MONANGE	J. HUTCHINSON	LANL
Q2: Participation to the experiments. Independent review of the ICSBEP evaluation in Q4?						
Information Preservation and Dissemination						
IRSN-IPD1	ICSBEP reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks are reported in the IE tasks	I. DUHAMEL	D. HEINRICHS	LLNL
ICSBEP reviews of SCRAP, ISSA and titanium experiments in October 2018 – Review of TEX-Ta planned for the Q4 of FY 2019						
IRSN-IPD3	ICSBEP benchmark reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks	I. DUHAMEL	J. FAVORITE	LANL
Not started – waiting for FLATTOP re-evaluation						
Nuclear Data						
IRSN-ND1	Contribution to new evaluations	ORNL-ND1	Contribution to new evaluation and validation for ^{54}Fe, ^{103}Rh, ^{55}Mn and Gd isotopes	L. LEAL	D. BOWEN	ORNL
^{103}Rh resolved evaluation completed. Progress on the ^{54}Fe and ^{56}Fe and preliminary resonance evaluation generated. IRSN benchmark assembled for testing the ^{55}Mn evaluation. New capture data from NTOF included in the Gd-155 and Gd-157 evaluation. Improved Gd resonance parameters available. Q2: Paper on Gd for ND2019 conference. Generation of covariance data for ^{155,157}Gd. Q3: Testing of the Gd evaluation has started; The Fe resonance evaluation continue						
IRSN-ND2	Nuclear data processing	LANL-ND1	Benchmark testing of ^{235}U and ^{239}Pu cross section library	L. LEAL	J. CONLIN	LANL
Test performed and new ^{235}U and ^{239}Pu resonance parameters generated. Benchmark testing on the ^{235}U and ^{239}Pu underway. Sensitivity analysis of the benchmark results will be done Q3: Abstract submitted to Physor 2020						
IRSN-ND3	Nuclear data processing	LLNL-ND4	Resonance evaluation of ^{233}U (Pending prioritization of ^{233}U ND tasks for the NCSP)	L. LEAL	D. HEINRICHS	LLNL
Existing resonance evaluation extended to 2 keV. New resonance parameters derived. New ^{233}U fission and capture cross section data from n_TOF may become available shortly. The data will be incorporate in the evaluation and benchmark testing will be performed						
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. EVO	D. BOWEN	NCSP
2 IRSN staff attending the hands-on training in January 2019.						