

United States Department of Energy
Nuclear Criticality Safety Program
Five-Year Execution Plan for the Mission and Vision
FY2015 through FY2019



October 2014

Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan for Fiscal Years 2015 through 2019, dated October 2014.

Approved:

A handwritten signature in black ink, reading "Jerry N. McKamy". The signature is written in a cursive style with a long horizontal flourish extending to the right.

Dr. Jerry N. McKamy
Manager
Nuclear Criticality Safety Program

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ACRONYMS AND DEFINITIONS

ACE	“A Compact ENDF” file
ADVANCE	Automated Data Verification and Assurance for Nuclear Calculations Enhancement (ADVANCE)
AM	Analytical Methods
AMPX	Nuclear cross-section processing code
ANL	Argonne National Laboratory
ARH	Atlantic Richfield Hanford
AWE	Atomic Weapons Establishment
BNL	Brookhaven National Laboratory
CAAS	Criticality Accident Alarm System
CALIBAN	Fast burst metal assembly in Valduc, France
CEA	Commissariat à l'Énergie Atomique
CIELO ¹	Advanced Simulation and Computing Program computing system
COG ²	Lawrence Livermore National Laboratory Monte Carlo Computer Code
COMET	General Purpose Platform Lift Machine at NCERC
CritView	A plotting and interpolation software program designed to display criticality data from the ARH-600 Criticality Handbook
CRP	Coordinated Research Projects
CSCT	Criticality Safety Coordinating Team
CSEWG	Cross Section Evaluation Working Group
CSSG	Criticality Safety Support Group
DAF	Device Assembly Facility
DOE	Department of Energy
ENDF	Evaluated Nuclear Data File
EOC	Explanation of Change (for out-year peaks and dips in budget plots)
FLATTOP	Highly-Reflected Spherical Benchmark Assembly
FFTF	Fast Flux Test Facility
FUDGE	Lawrence Livermore National Laboratory nuclear data management infrastructure
FY	Fiscal Year
GELINA	Linear Accelerator in Geel, Belgium
GForge	Web-based collaborative development environment
GODIVA	Unreflected Fast-Burst Assembly
IAEA	International Atomic Energy Agency

ICSBEP	International Criticality Safety Benchmark Evaluation Project
IE	Integral Experiments
IER	Integral Experiment Request
IP&D	Information Preservation and Dissemination
IRMM	Institute for Reference Materials and Measurements
IRSN	Institut De Radioprotection et De Sûreté Nucléaire
KENO ³	Monte Carlo Criticality Computer Code
LA	Los Alamos (report)
LANL	Los Alamos National Laboratory
LINAC	Linear Accelerator
LLNL	Lawrence Livermore National Laboratory
MCNP	Monte Carlo N Particle (N currently equals 3) Computer Code
NA00-10	Office of Environment, Safety and Health
NCERC	National Criticality Experiments Research Center
NCS	Nuclear Criticality Safety
NCSET	Nuclear Criticality Safety Engineer Training
NCSP	Nuclear Criticality Safety Program
NCSU	North Carolina State University
ND	Nuclear Data
NDA	non-destructive assay
NDAG	Nuclear Data Advisory Group
NJOY	Nuclear cross-section processing code
NNDC	National Nuclear Data Center
NNSA	National Nuclear Security Administration
NNSS	Nevada Nuclear Security Site
NSTec	National Security Technologies
OECD/NEA	Organization for Economic Cooperation and Development/Nuclear Energy Agency
ORNL	Oak Ridge National Laboratory
PNNL	Pacific Northwest National Laboratory
POC	Point of Contact
PREPRO	Nuclear cross-section processing code
RPI	Renssalaer Polytechnic Institute
RSICC	Radiation Safety Information Computational Center

SAMMY ⁴	R-matrix nuclear data evaluation computer code
SCALE ⁵	A modular modeling and simulation system for nuclear safety analysis and design
SNL	Sandia National Laboratories
SQA	Software Quality Assurance
SRS	Savannah River Site
S/U	Sensitivity/Uncertainty
TACS	Training Assembly for Criticality Safety
T&E	Training and Education
TID	Technical Information Document (Los Alamos National Laboratory report)
TRG	Technical Review Group
TSUNAMI	Tool for Sensitivity and Uncertainty Analysis Methodology Implementation
US	United States of America
UT	University of Tennessee
V&V	Verification and Validation
WPEC	Working Party on International Nuclear Data Evaluation Corporation
WPNCs	Working Party on Nuclear Criticality Safety
Y-12	Y-12 National Security Complex

¹CIELO is a supercomputing platform that supports Los Alamos, Sandia, and Lawrence Livermore. This petascale (more than one quadrillion floating point operations per second) supercomputer helps NNSA ensure the safety, security, and effectiveness of the nuclear stockpile while maintaining the moratorium on testing.

²COG was originally developed to solve deep penetration problems in support of underground nuclear testing. Variance reduction techniques are very important to these problems and hence the name COG was chosen as in “to cog the dice” or cheat by weighting.

³KENO is a family of Monte Carlo criticality codes whose name came from an observation of the KENO game in which small spheres, under air levitation, arbitrarily move about in a fixed geometry.

⁴SAMMY is a nuclear model code, which applies R-Matrix theory to measured data and produces resolved and un-resolved resonance parameters in Reich-Moore and other formalisms.

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

**United States Department of Energy
Nuclear Criticality Safety Program
Five-Year Execution Plan**

1.0 Nuclear Criticality Safety Program Mission and Vision

The Nuclear Criticality Safety Program (NCSP) Mission and Vision, as stated in *The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2014-2023* (<http://ncsp.llnl.gov/NCSP-MV-COMPRESSED.pdf>), are:

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

The NCSP will be a **continually improving, adaptable, and transparent** program that **communicates** and **collaborates** globally to incorporate technology, practices, and programs to be **responsive** to the essential technical needs of those responsible for developing, implementing, and maintaining nuclear criticality safety.

The NCSP is funded by the National Nuclear Security Administration (NNSA). Dr. Jerry McKamy (NA00-10) is the NCSP Manager and Gladys Udentia is the Deputy NCSP Manager. They are supported by the Criticality Safety Support Group (CSSG) and the Nuclear Data Advisory Group (NDAG) regarding technical matters and by the Criticality Safety Coordinating Team (CSCT), consisting of Federal Criticality Safety Practitioners at the sites regarding DOE field criticality safety issues. Charters for the CSCT, CSSG, and the NDAG can be found on the NCSP website at: (<http://ncsp.llnl.gov/>). The NCSP Planning Calendar can also be found on the NCSP website at: (<http://ncsp.llnl.gov/>).

2.0 Technical Program Elements

NCSP includes the following five technical program elements:

- Analytical Methods (AM)
- Information Preservation and Dissemination (IP&D)
- Integral Experiments (IE)
- Nuclear Data (ND)
- Training and Education (T&E)

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

Funding for NCSP activities are shown in Tables 2.1, 2.2, and 2.3 (rounded to the nearest \$K).

Table 2.1 NCSP Funding Overview

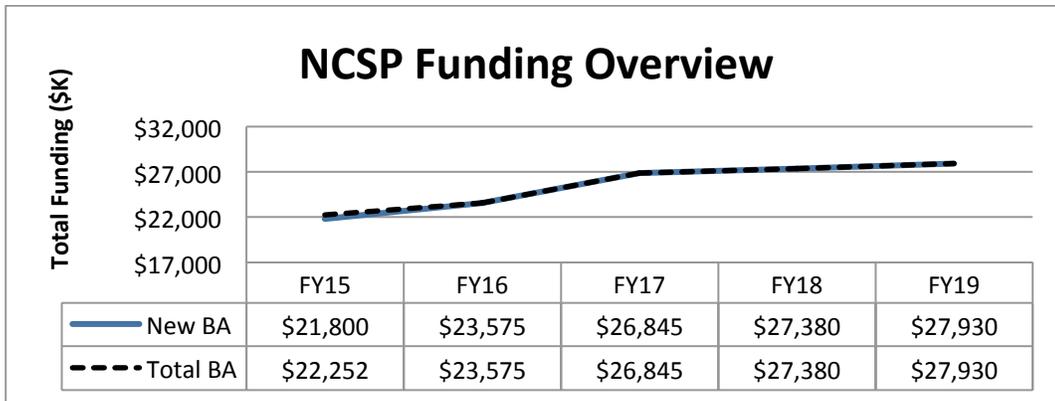


Table 2.2 NCSP Funding Overview – By Element

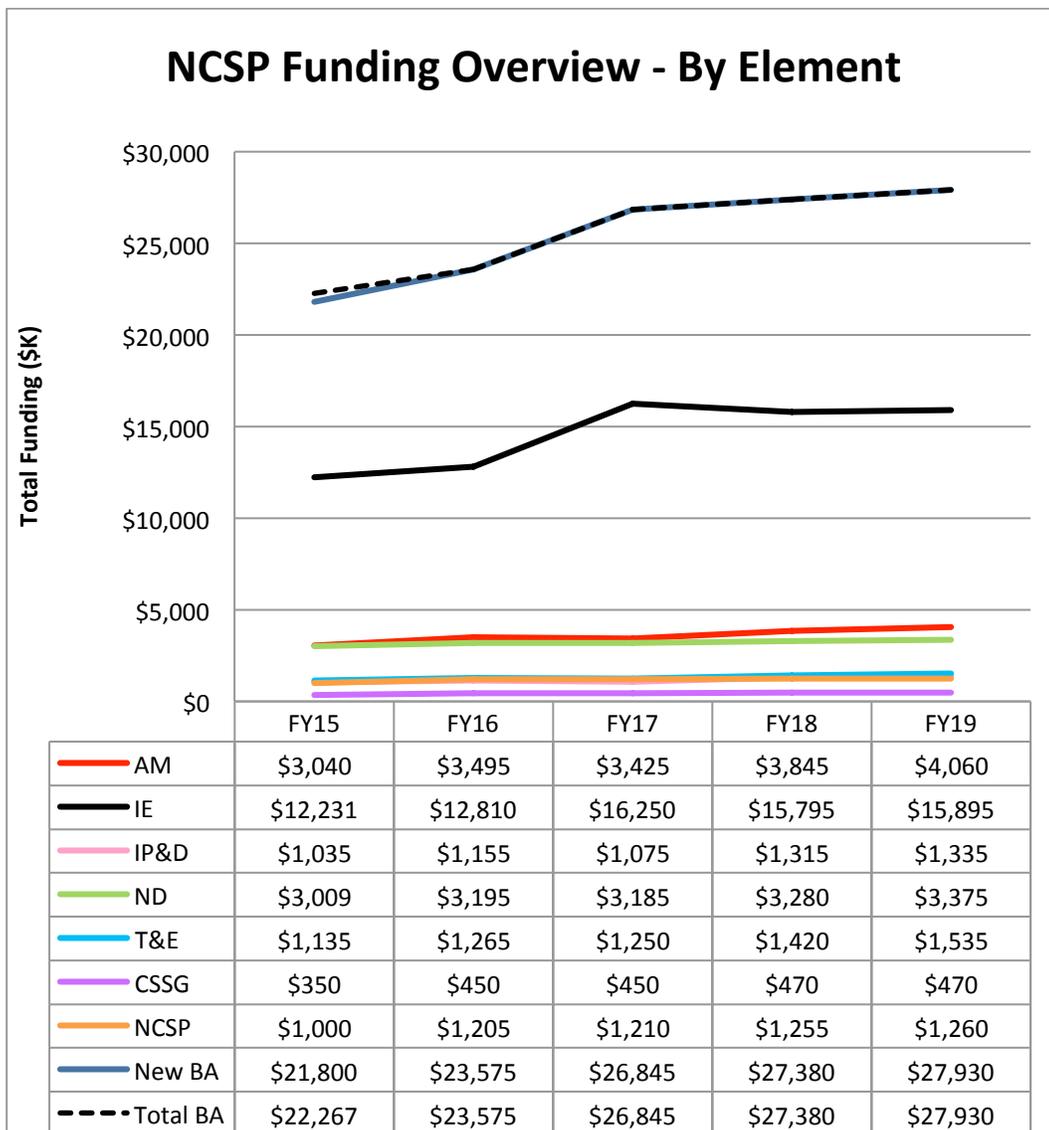
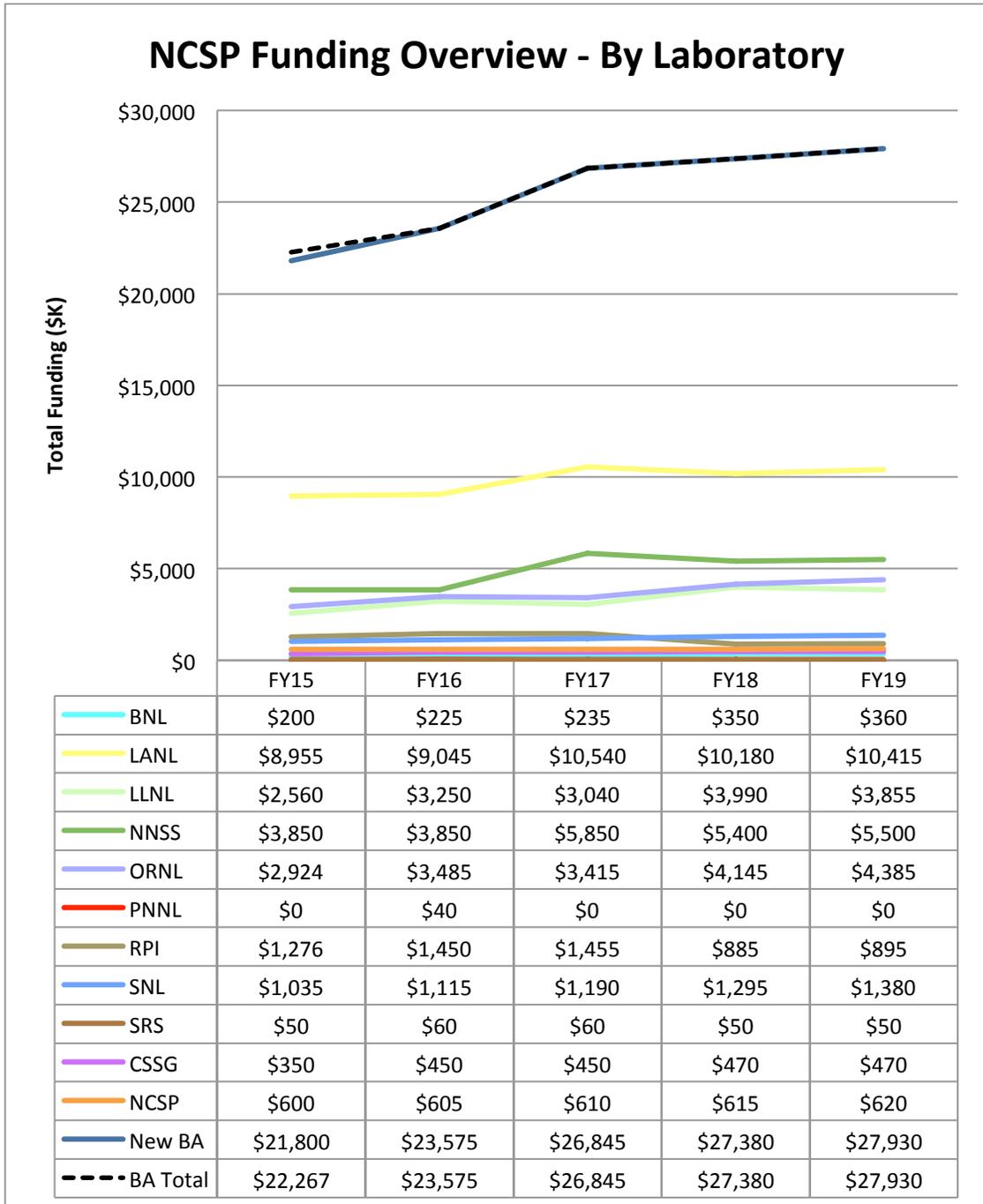


Table 2.3 NCSP Funding Overview – By Laboratory



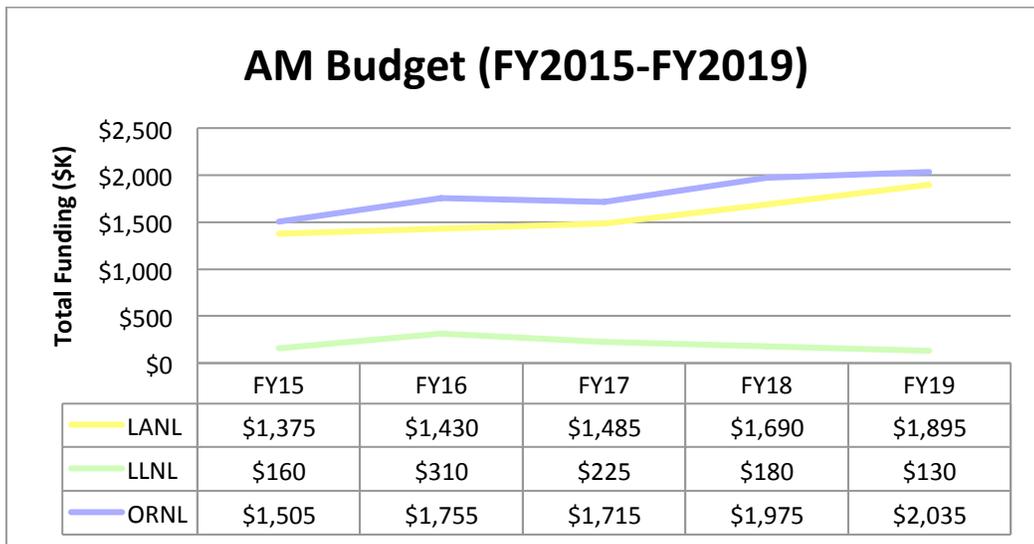
Finally, the goal of the NCSP is to provide “transparent responsiveness” for the DOE and Stakeholders. Therefore, this Plan and all accomplishments achieved under the auspices of the NCSP are posted in a timely manner on the NCSP website at: <http://ncsp.llnl.gov/>.

2.1 Analytical Methods (AM)

2.1.1 Program Element Description

The Analytical Methods program element provides development and maintenance of state-of-the-art analytical capabilities for the processing of nuclear data from the Evaluated Nuclear Data File (ENDF) and the radiation transport analysis needed to support Nuclear Criticality Safety (NCS) evaluations for subcriticality and shielding. An essential aspect of the AM capabilities is the human expertise required to develop the analytical software, provide software configuration control, and train and assist the user community.

Table 2.1-1 AM Budget (FY2015-FY2019)



2.1.2 Approved Tasks

2.1.2.1 Los Alamos National Laboratory (LANL)

LANL AM1 (\$1100K)

This is a continuing task for the maintenance of the basic capabilities for performing Nuclear Criticality Safety calculations with the Monte Carlo N Particle (MCNP) computer code, including general code maintenance, user support, improved nuclear data libraries, Verification and Validation (V&V), documentation, user training, and implementation of limited new capabilities; focus on modernizing MCNP for next-generation computing hardware; continue to develop MCNP for continuous-energy sensitivity / uncertainty analysis, and contribute to the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) Working Party on Criticality Safety. For all tasks, LANL reports will be issued and posted on the MCNP website.

LANL AM2 (\$275K) [IRSN Area of Collaboration]

This is a continuing task to support development and maintenance of the NJOY nuclear data processing code system, implement capabilities as needed to process new general purpose nuclear data files in the continuously evolving ENDF-6 format, provide support to NJOY users, modernize NJOY to adapt to modern code practices, new data formats, and next-generation computing hardware, and contribute to the NDAG, the Cross Section Evaluation Working Group (CSEWG), CIELO, the Working Party on International Nuclear Data Evaluation Corporation (WPEC) and the International Atomic Energy Agency (IAEA) Coordinated Research Projects (CRP) as approved by the NCSP Manager. All NJOY updates will be distributed to users through a LANL maintained website.

Table 2.1-2 LANL AM Budget Trend (FY2015-FY2019)

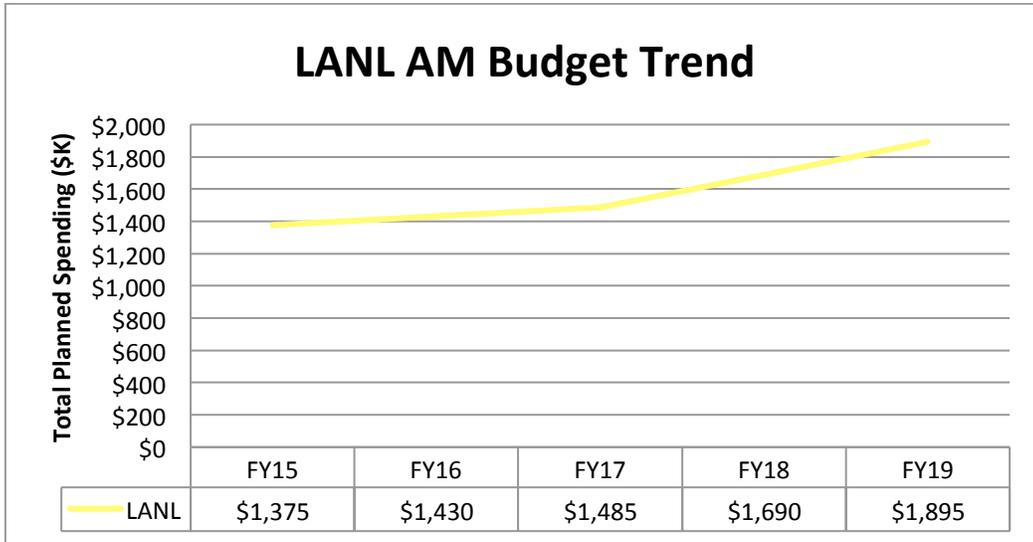
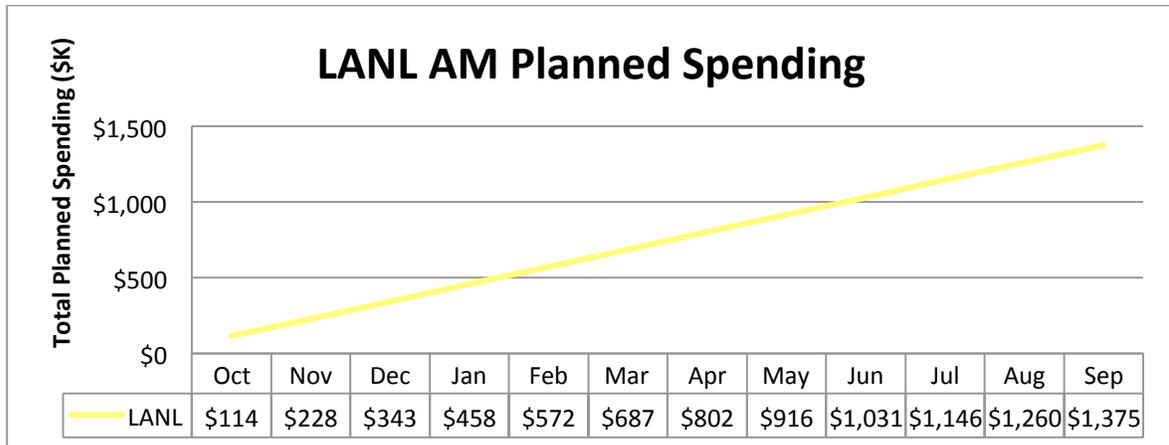


Table 2.1-3 LANL AM Planned Spending (FY2015)



LANL AM Milestones:

Occurs all 4 Quarters

- Provide status reports on LANL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest (AM1, AM2: All Qtrs).
- Provide enhanced capabilities for users of MCNP6 and NJOY (including cross-section libraries), release updated versions, and provide training courses on schedules consistent with development plans (AM1, AM2: All Qtrs).
- Support users of MCNP6 and NJOY (AM1, AM2: All Qtrs).

Explanation of Change (EOC) – for out-year peaks and dips in budget plots:

Modest increases in out-years for the development of a multi-point nuclear reactor kinetics methodology for use with a modern continuous-energy Monte Carlo Radiation Transport code as defined in the NCSP Mission and Vision document.

2.1.2.2 Lawrence Livermore National Laboratory (LLNL)

LLNL AM1 (\$160K)

This task is an ongoing approved activity to provide maintenance, user support and minor upgrades to existing LLNL analytical methods including nuclear data processing, geometry modeling and Monte-Carlo and multiphysics methods. This task also supports on-going LLNL assistance to Brookhaven National Laboratory (BNL), the IAEA and North Carolina State University (NCSU) in developing and maintaining FUDGE, PREPRO and other nuclear data processing code systems as needed to process distribute and test new general-purpose nuclear data files in evolving ENDF-6 format. The task also supports participation in NCSP activities including the CSEWG and NDAG.

LLNL AM2 (\$0K) [AWE and IRSN Area of Collaboration]

This is an ongoing task to support building upon existing LLNL state-of-the-art 3-D analytical multi-physics methods to develop and validate these methods for simulation of criticality excursions. The task will support work to simulate the response of GODIVA or CALIBAN to a fast reactivity insertion of various magnitudes and to simulate the GODIVA accidents including quantification of mechanical damage to support structures and surface oxidation and to add delayed neutron and photon emission physics.

LLNL AM3 (\$0K) [AWE and IRSN Area of Collaboration]

This is an ongoing task to support work to generate a criticality slide rule for plutonium systems.

Table 2.1-4 LLNL AM Budget Trend (FY2015-FY2019)

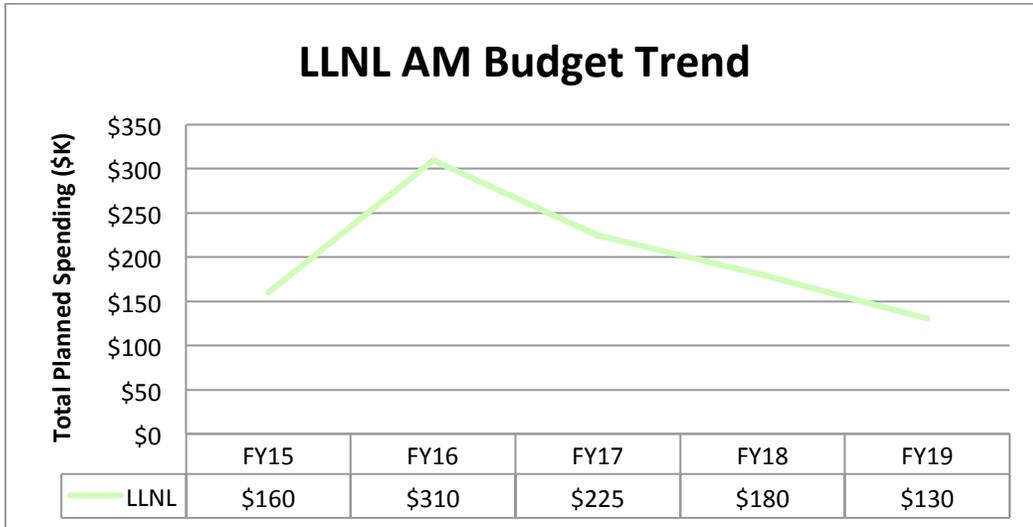
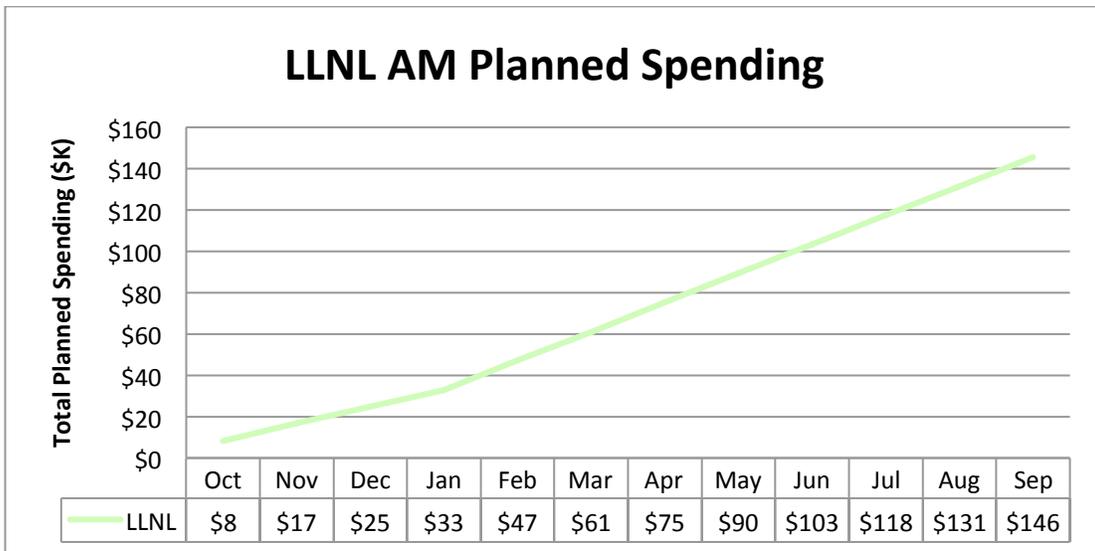


Table 2.1-5 LLNL AM Planned Spending (FY2015)*



* LLNL Planned Spending reduced by approximately 9% to account for required laboratory hold-back during FY continuing resolution (CR) funding uncertainty.

LLNL AM Milestones:

Occurs all 4 Quarters

- Provide status reports on LLNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest (AM1: All Qtrs).
- Provide enhanced capabilities for users of COG and PREPRO (including cross-section libraries), release updated versions, and provide training courses as required to maintain codes (AM1: All Qtrs).

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

Increase in Fiscal Year (FY) 16 due to funding of the Plutonium Slide Rule application task, decrease in out-years due to NCSP Management decision to stop support for COG due to funding constraints.

2.1.2.3 Oak Ridge National Laboratory (ORNL)

ORNL AM1 (\$360K)

This task supports the Radiation Safety Information Computational Center (RSICC) work to collect, update, package, and distribute software and associated nuclear data libraries to the criticality safety community (i.e., SCALE, MCNP, COG and nuclear data processing and analysis software (i.e., NJOY, AMPX and SAMMY). Also supports work to test and disseminate processed nuclear data associated with the software.

ORNL AM2 (\$820K)

This is an ongoing, approved task to provide SCALE/KENO/TSUNAMI maintenance and user support for performing NCS calculations with the SCALE package. Work tasks include: sustaining and continually improving SCALE NCS features through user-driven enhancements, software quality assurance (SQA) and V&V; assuring adaptability to various computing platforms and compilers; providing improved user interfaces and user documentation consistent with modern engineering software; supporting responsive communication to SCALE criticality safety users through SCALE Newsletters, email notices, and updates on the SCALE website. The task also includes support for modernizing the software infrastructure and capabilities to improve quality and reliability and to ensure long-term sustainability of the NCS capabilities.

ORNL AM3 (\$275K) [IRSN Area of Collaboration]

This is an ongoing, approved task to develop and maintain the AMPX nuclear data processing code system to provide cross-section and covariance data libraries for NCS radiation transport software such as SCALE. In addition, the task includes additional effort to implement new software enhancements needed to improve the quality and reliability of the nuclear data libraries that are produced by AMPX. The overall development and maintenance work effort will ensure the AMPX software is up-to-date and in conformance with ENDF/B formats and procedures. Moreover, the development and enhancements to the AMPX software will enable improved nuclear data processing capabilities needed to provide reliable nuclear data libraries to support radiation transport methods development and analyses.

ORNL AM4 (\$0K) [IRSN Area of Collaboration]

This is an ongoing approved task to complete the development of a three-dimensional (3D) multi-group fixed-source sensitivity/uncertainty analysis tool for SCALE that will support C_{ED}T analyses involving fixed-source benchmark experiments. Such a tool would be used to support the design, execution, and analysis of benchmark quality measurements for Criticality Accident Alarm System (CAAS) experimental configurations (e.g., analysis of previous experiments performed at Commissariat à l'Énergie Atomique (CEA) experiment facilities in Valduc, France in FY12).

ORNL AM6 (\$0K) [AWE and IRSN Area of Collaboration]

This is an ongoing approved task to provide a handheld nuclear criticality safety slide rule application for ease of use by criticality safety practitioners. This will be in the form of an application for deployment on a handheld device such as a smartphone or tablet PC.

ORNL AM12 (\$50K)

This is an ongoing approved task to support the University of Tennessee to identify an appropriate set of documented International Criticality Safety Benchmark Evaluation Project (ICSBEP) evaluations and provide TSUNAMI-generated sensitivity data files and verified SCALE input files for distribution with the ICSBEP Handbook. This is a historical-looking task to provide sensitivity profiles for benchmark evaluations that are already published in the ICSBEP Handbook. In this task, all work will be conducted within the quality assurance framework established by the *SCALE Procedure for Verification and Configuration Management of Models and Derived Data*.

Table 2.1-6 ORNL AM Budget Trend (FY2015-FY2019)

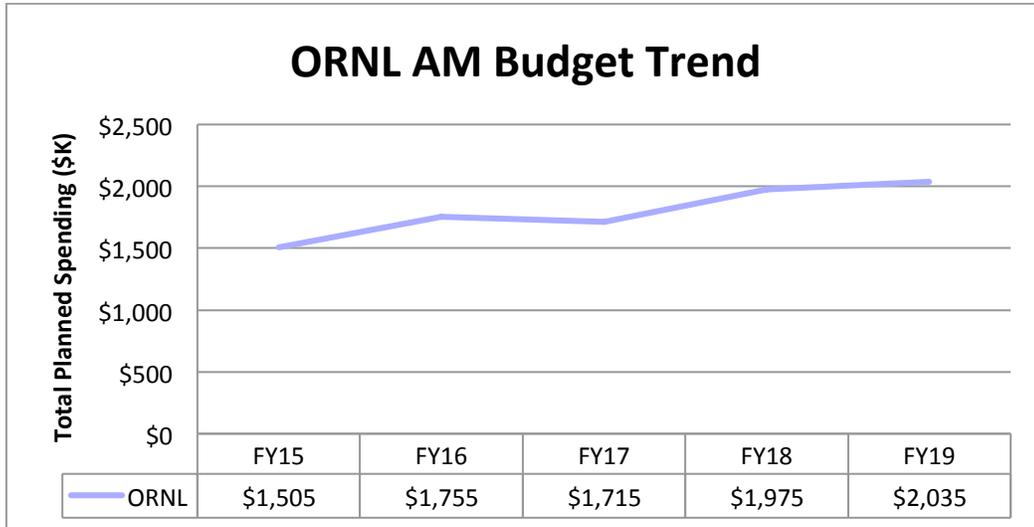
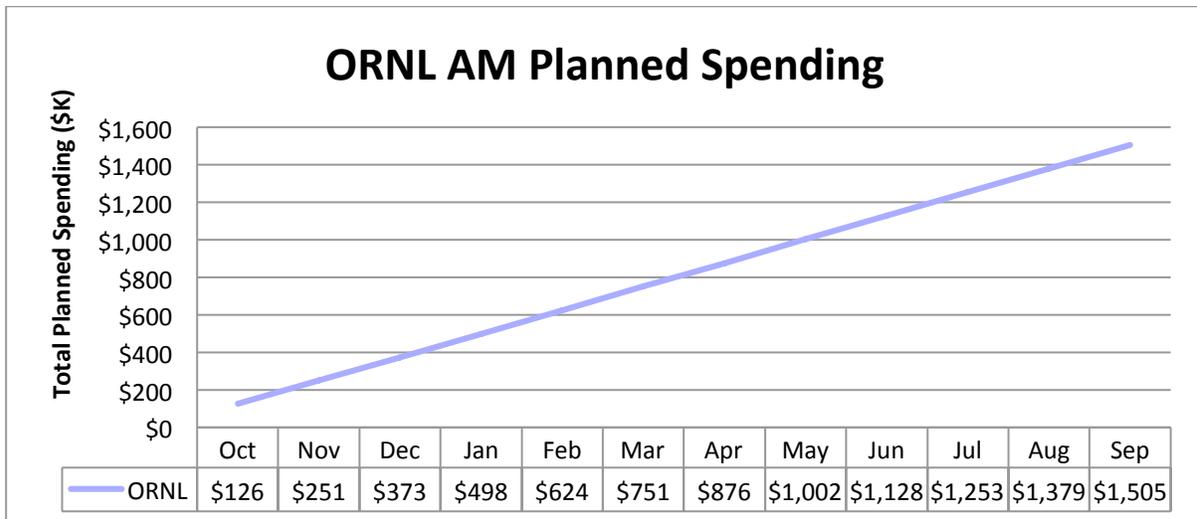


Table 2.1-7 ORNL AM Planned Spending (FY2015)



ORNL AM Milestones:

Occurs all 4 Quarters

- 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: All Qtrs).
- Provide enhanced capabilities for users of SCALE and AMPX (including cross-section libraries), release updated versions, publications to user community, and provide training courses as required to maintain codes (AM2, AM3: All Qtrs).
- 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: All Qtrs).

Quarter 4

- Provide TSUNAMI sensitivity data files and inputs for select, existing ICSBEP evaluations for distribution with the ICSBEP Handbook. (AM12: Q4).

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

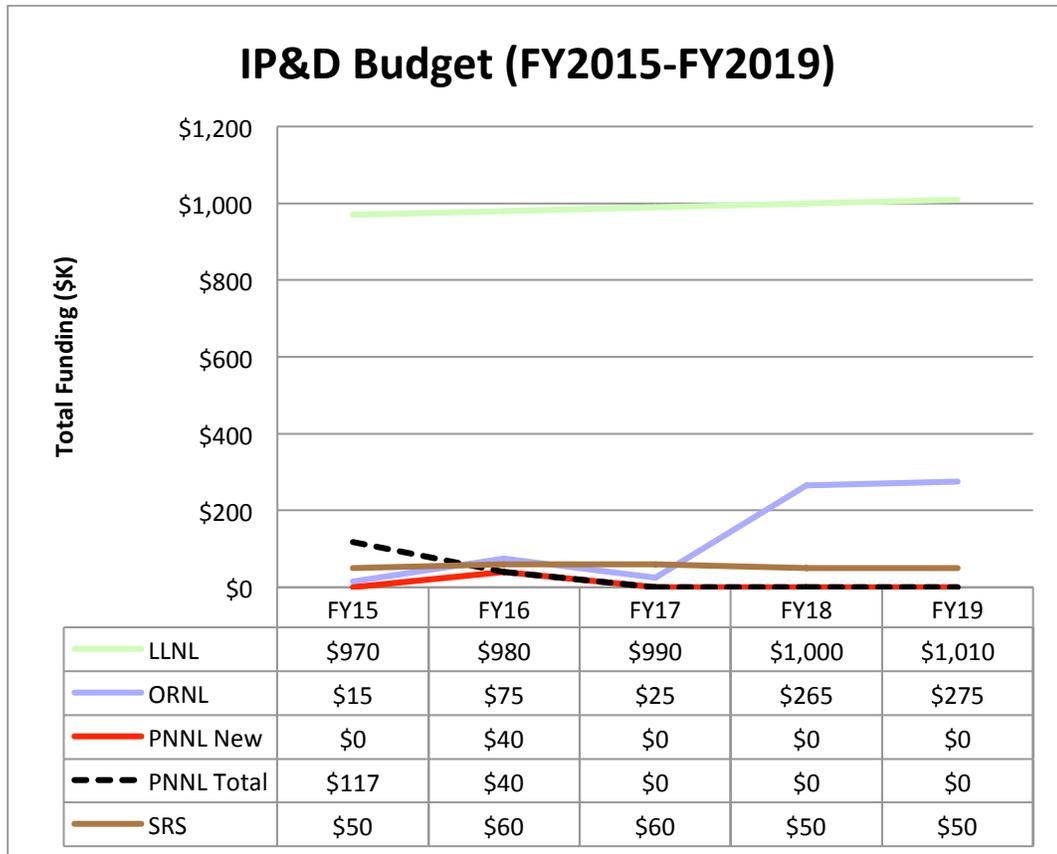
Increase in FY16 due to funding of Handheld Slide Rule application task. Modest increases in out-years for the development of advanced sensitivity analysis capabilities for foil activation experiment designs as defined in the NCSP Mission and Vision document.

2.2 Information Preservation and Dissemination (IP&D)

2.2.1 Program Element Description

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

Table 2.2-1 IP&D Budget (FY2015-FY2019)



2.2.2 Approved Tasks

2.2.2.1 Lawrence Livermore National Laboratory (LLNL)

LLNL IP&D1 (\$320) [AWE and IRSN Area of Collaboration]

This is an ongoing approved task that provides independent and Technical Review Group (TRG) reviews for all newly completed NCSP funded experiments. Priority historical experiments will be evaluated and reviewed (internal, independent, and TRG) as resources allow. All NCSP funded experiments will be finalized and published on the NCSP website within two quarters of receipt of an Experiment Design Team reviewed and approved draft report (CED-4a). LLNL IP&D1 will also provide leadership, coordination, and publication support for the OECD/NEA ICSBEP.

LLNL IP&D2 (\$650K)

This is an ongoing approved task for operation and maintenance of both unclassified and classified NCSP websites. The NCSP websites are the central focal point for access to criticality safety information collected under the NCSP, and are the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources. This task also provides operations and maintenance for information technology supporting the NCERC (e.g., “Red” network).

Table 2.2-2 LLNL IP&D Budget Trend (FY2015-FY2019)

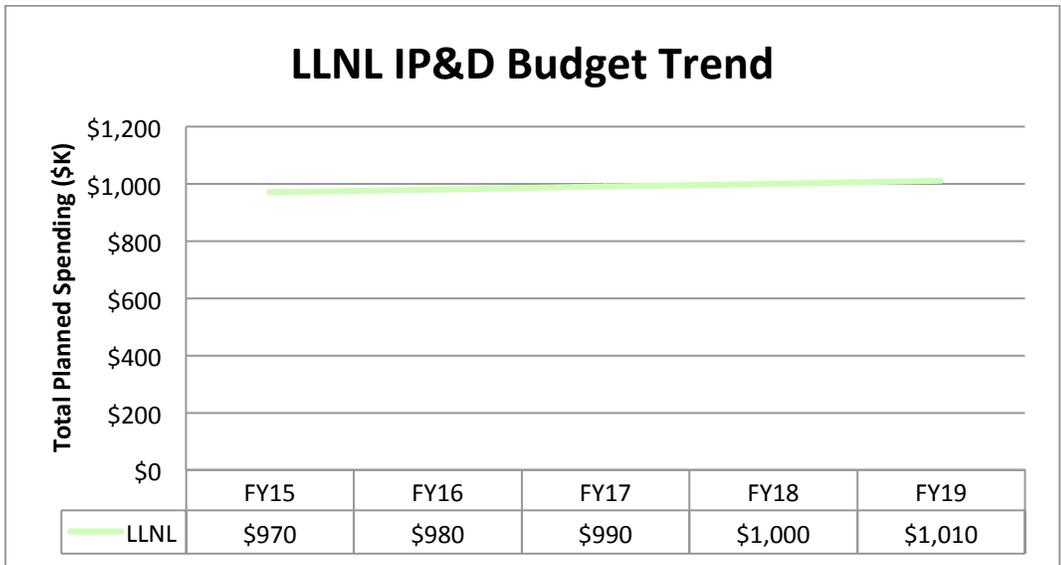
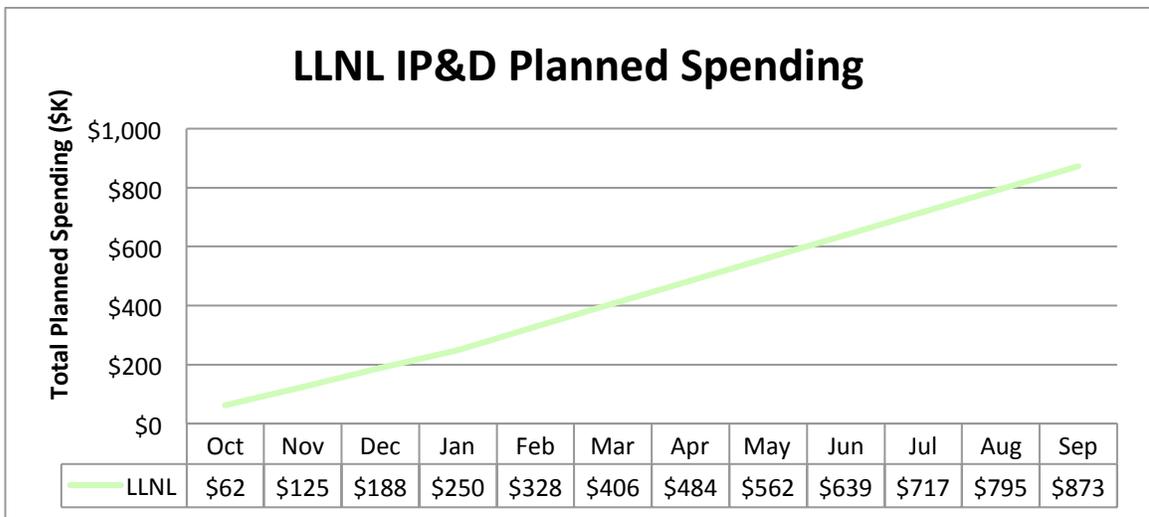


Table 2.2-3 LLNL IP&D Planned Spending (FY2015)*



* LLNL Planned Spending reduced by approximately 9% to account for required laboratory hold-back during FY CR funding uncertainty.

LLNL IP&D Milestones:

Occurs all 4 Quarters

- 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: All Qtrs).
- Provide status reports on LLNL participation in US and International IP&D collaborations (including ICSBEP) and provide brief trip summary report to NCSP Manager on items of NCSP interest (IPD1: All Qtrs).
- Maintain, operate and develop both unclassified and classified NCSP websites and “Red” network and provide user assistance as required (IPD2: All Qtrs).

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

Very modest increases in out-years to help mitigate increased cost of doing business.

2.2.2.2 Oak Ridge National Laboratory (ORNL)

ORNL IP&D3 (\$15K)

This is an ongoing approved companion task to ORNL AM Subtask 12 to lead the work with the University of Tennessee (UT) to identify an appropriate set of documented ICSBEP evaluations and provide TSUNAMI-generated sensitivity data files and verified SCALE input files for distribution with the ICSBEP Handbook. As part of this task ORNL will lead the work with the University of Tennessee and perform quality assurance reviews of the SCALE input files prepared by the University of Tennessee. The work and quality assurance reviews will be performed in accordance with the quality assurance framework established by the *SCALE Procedure for Verification and Configuration Management of Models and Derived Data*.

ORNL IP&D4 (\$0K) [IRSN Area of Collaboration]

This is an ongoing approved task to support NCSP efforts to provide experimental uncertainty correlations for select ICSBEP benchmarks and provide guidance documentation and automated tools for experimental uncertainty correlation determination.

Table 2.2-4 ORNL IP&D Budget Trend (FY2015-FY2019)

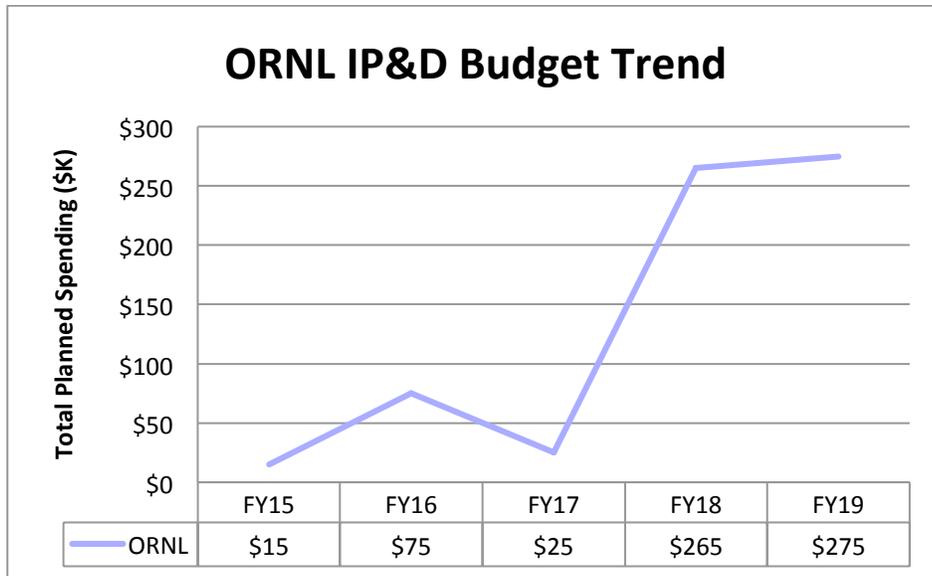
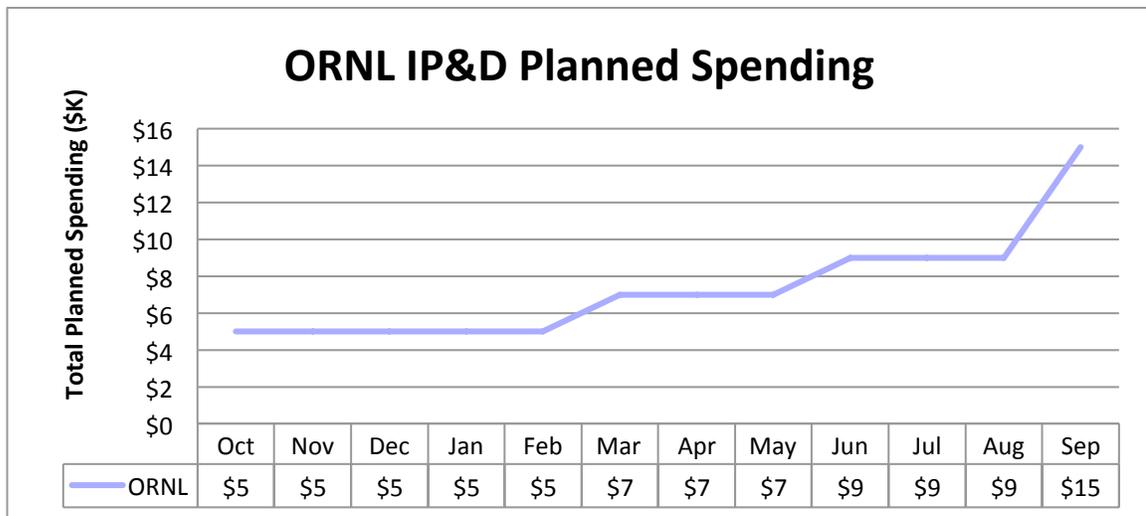


Table 2.2-5 ORNL IP&D Planned Spending (FY2015)



ORNL IP&D Milestones:

Quarter 4

- Provide TSUNAMI sensitivity data files and inputs for select, existing ICSBEP evaluations for distribution with the ICSBEP Handbook. (IPD3: Q4).
- Provide status reports on ORNL participation in US and International IP&D collaborations and (IPD3: All Qtrs).

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

FY17 funding decrease due to completion of major milestone in FY16. Increase in funding in out-years for additional work on TSUNAMI-generated sensitivity data files provided by UT and for anticipated ICSBEP evaluations due to increased experiments performed at the NCERC as defined in the NCSP Mission and Vision document.

2.2.2.3 Pacific Northwest National Laboratory (PNNL)

*FY15 Funding dispersed to Hanford in FY14, funding to be transferred to PNNL for FY15 task completion.

PNNL IP&D1 (\$0K [\$117K total*])

This is an ongoing approved task to identify and assess reactor operations and special test data from Hanford reactor operations that may provide relevant benchmark-like data for testing of actinide production. This task also develops a data record matrix for isotopes and reactors. This task will also support data preservation for these archived data.

Table 2.2-6 PNNL IP&D Budget Trend (FY2015-FY2019)

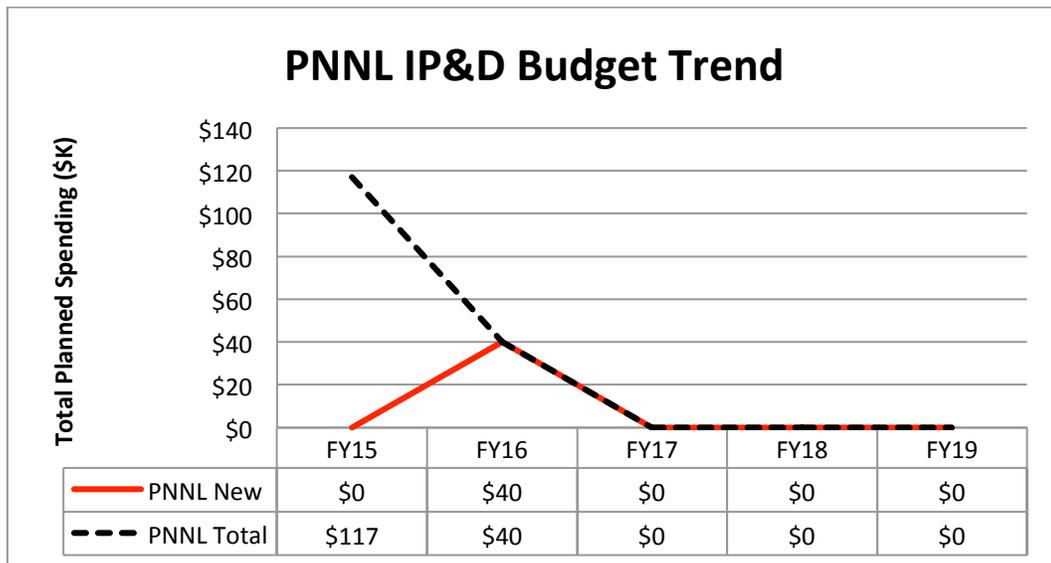
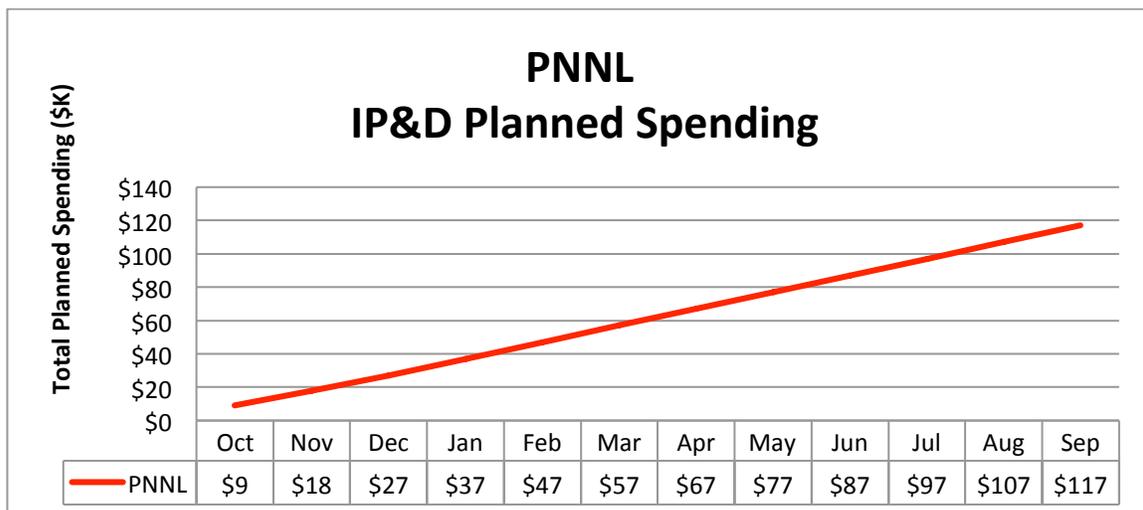


Table 2.2-7 PNNL IP&D Planned Spending (FY2015)



PNNL IP&D Milestones:

Quarter 2

- Update existing compilation of data (reactor and special test), issue data compilation report, and provide report on NCSP website (IPD1: Q2).

Quarter 4

- Issue letter report for data from Fast Flux Test Facility (FFTF) operations and special tests and possible benchmark listing for posting on NCSP website (IPD1: Q4).

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

Out-year funding zeros due to the completion of all milestones for this task element at PNNL.

2.2.2.4 Savannah River Site (SRS)

SRS IP&D1 (\$50K) [AWE Area of Collaboration]

This is new work for SRS that is a continuation of work started at Hanford to support the effort to revise the CritView code to 1) better handle large databases to support improved functionality and significantly more data, and 2) upgrade the user interface to provide a more efficient and user friendly program. Also provide limited response to user queries and any error identification.

Table 2.2-8 SRS IP&D Budget Trend (FY2015-FY2019)

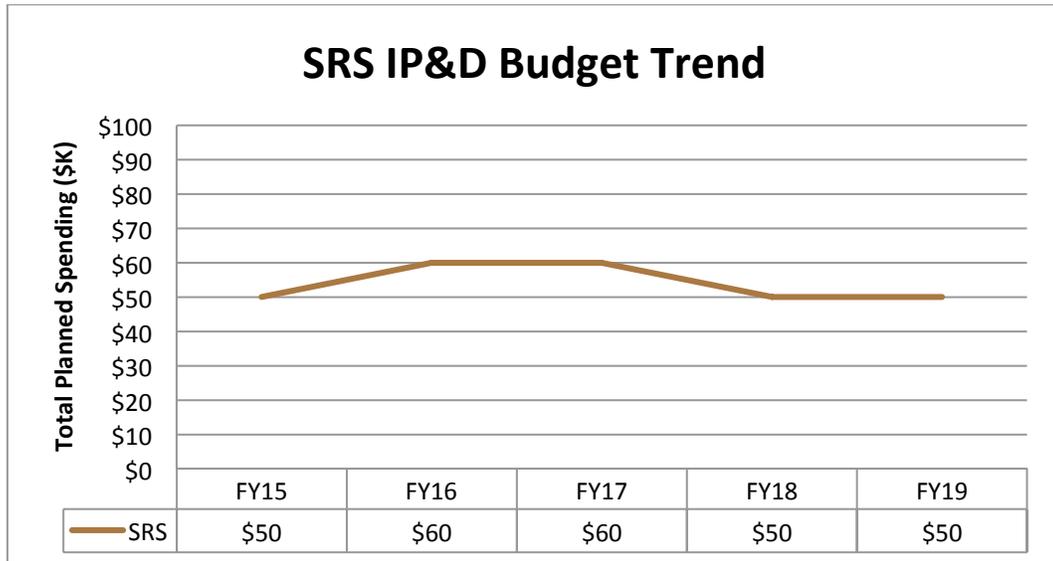
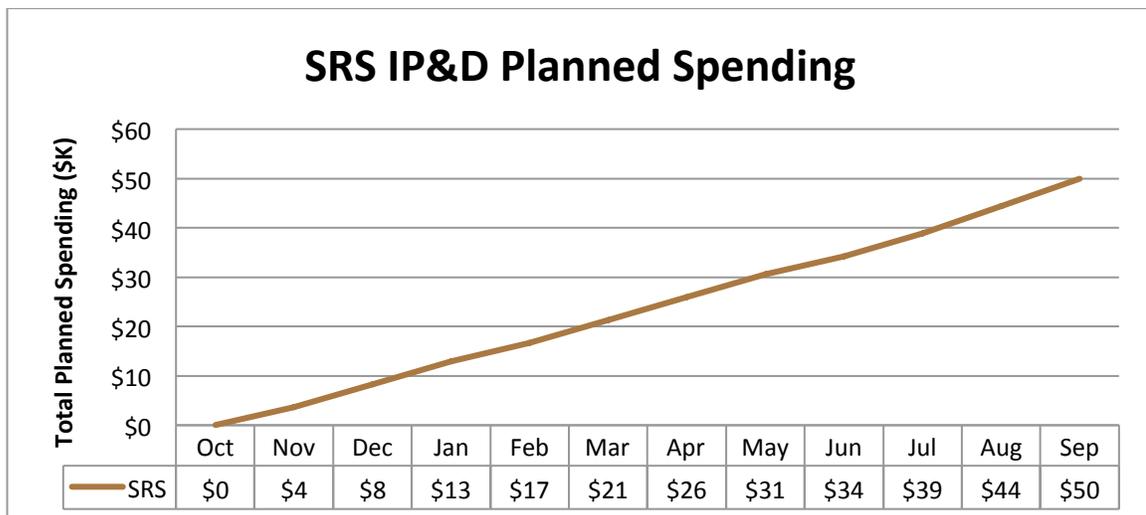


Table 2.2-9 SRS IP&D Planned Spending (FY2015)



SRS IP&D Milestones:

Quarter 3

- Interim release (as a beta) to implement some minor bug fixes and simple updates based on user requests to LLNL for distribution (IPD1:Q3).

Quarter 4

- Provide a development plan for the major updated CritView code and associated database file to guide upgrade in out-years (IPD1: Q4).

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

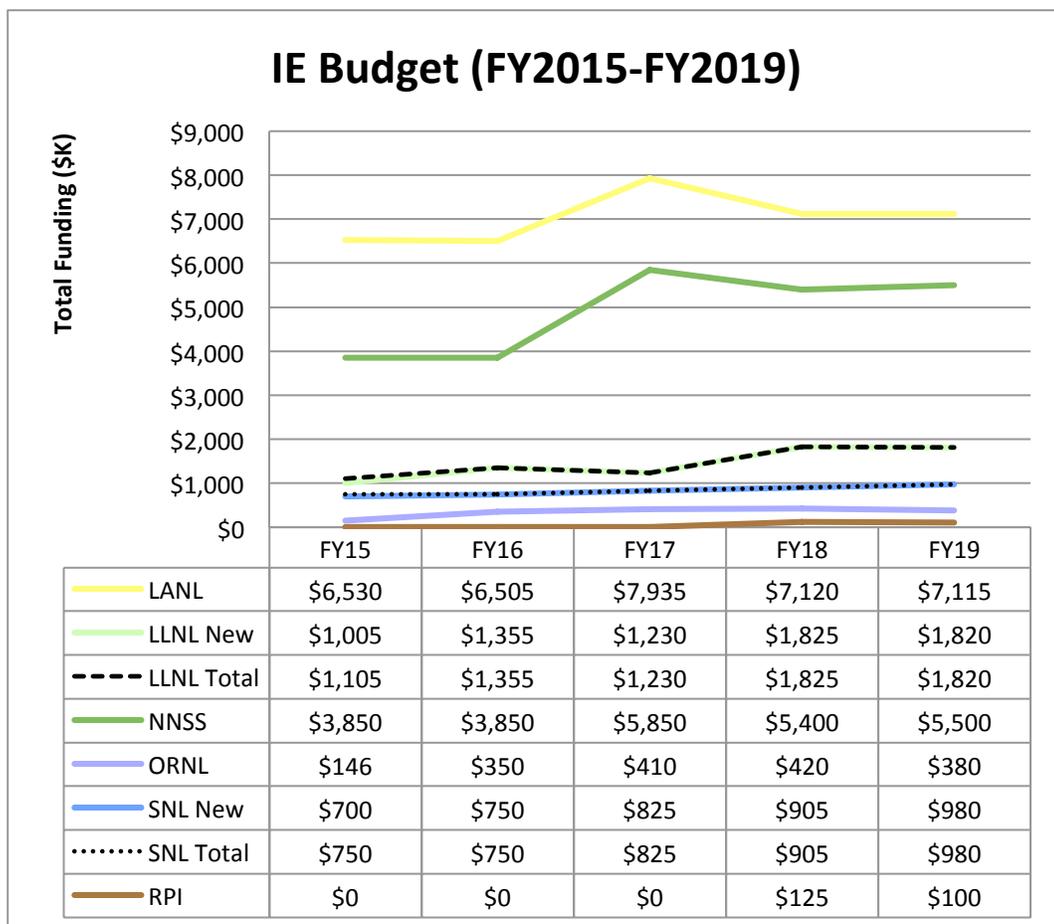
Initial increase in funding in FY16 is to support the major modification to the CritView code necessary to handle data points from additional references, such as from LA-10860 and TID-7016, handle data from multiple codes (MCNP, SCALE, etc.) with a range of k-effectives, and make the code interface more user friendly as defined in the NCSP Mission and Vision document. Out-year funding decreases to a maintenance level as upgrades will be complete.

2.3 Integral Experiments (IE)

2.3.1 Program Element Description

The Integral Experiments program element maintains a fundamental capability for the DOE NCSP to be able to perform critical, subcritical, and fundamental physics measurements, within the limits of its resources, to address specific-site needs on a prioritized basis. This program element also supports maintaining a fundamental nuclear materials handling capability, which enables hands-on NCS training programs and various other programs for the DOE NCSP and other government agencies.

Table 2.3-1 IE Budget (FY2015-FY2019)



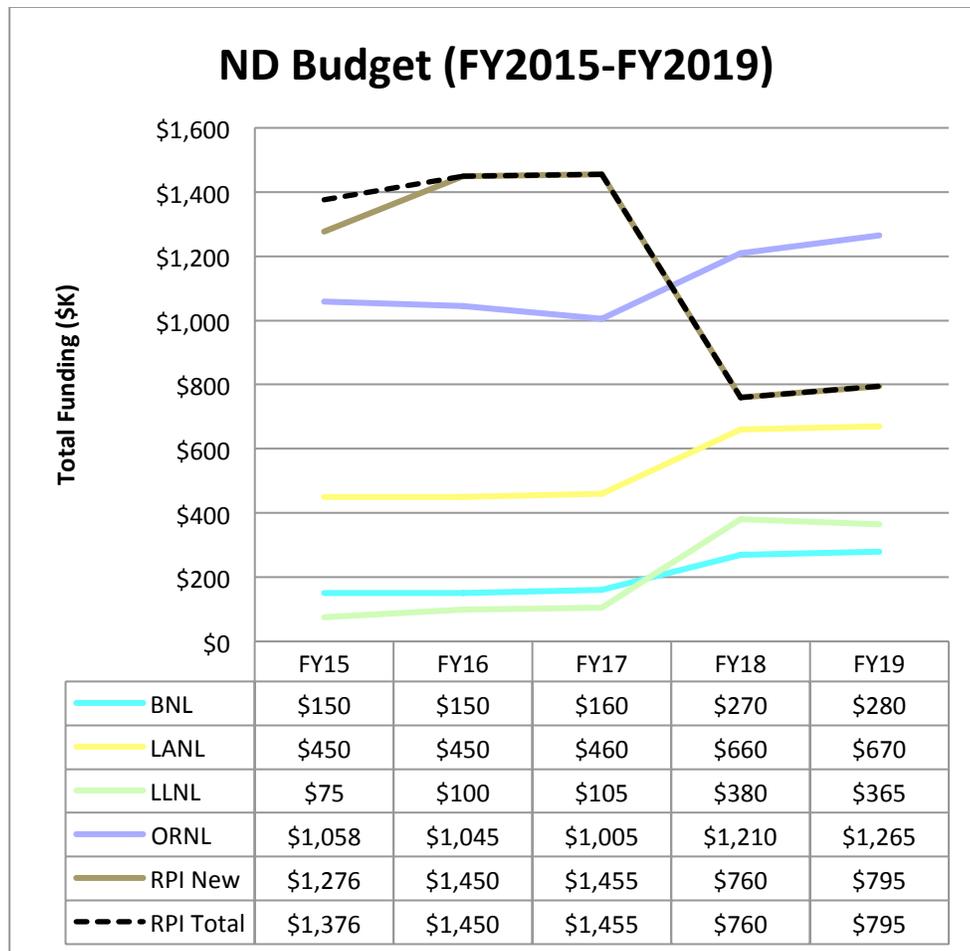
All Integral Experiment tasks and milestones are published as a standalone document. Contact the NSCP Program Manager, Dr. Jerry McKamy, if you have a 'Need-to-Know.'

2.4 Nuclear Data (ND)

2.4.1 Program Element Description

The Nuclear Data program element includes the measurement, evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to NCS analyses. The NCSP continues to improve coordination of ND activities by fostering a strong collaborative effort among all of the national and international resources in this highly technical area. The objective is to solve the highest priority ND problems relevant to criticality safety in a timely manner. This program element is essential for the NCSP because it provides the nuclear cross-section data required by the AM program element. Refer to Appendix B for the FY2015 through FY2019 schedule, milestones, and deliverables associated with specific nuclear data measurement, evaluation, and publication. Milestones not contained in Appendix B are delineated below.

Table 2.4-1 ND Budget (FY2015-FY2019)



2.4.2 Approved Tasks

2.4.2.1 Brookhaven National Laboratory (BNL)

BNL ND1 (150K)

This is an ongoing approved task to provide technical support to the NCSP to ensure that NCSP cross-section evaluations are checked, processed, visualized, reviewed, archived, and made available through the National Nuclear Data Center (NNDC) GForge system as candidate evaluations for the future versions of the ENDF/B library. Maintain Atlas of Neutron Resonances as a unique resource of thermal and resonance data and their uncertainties.

Table 2.4-2 BNL ND Budget Trend (FY2015-FY2019)

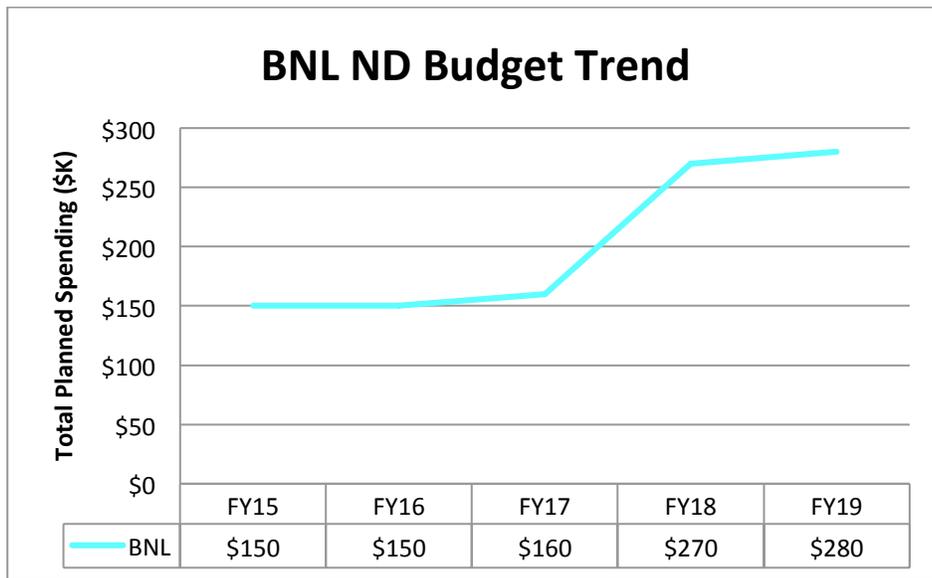
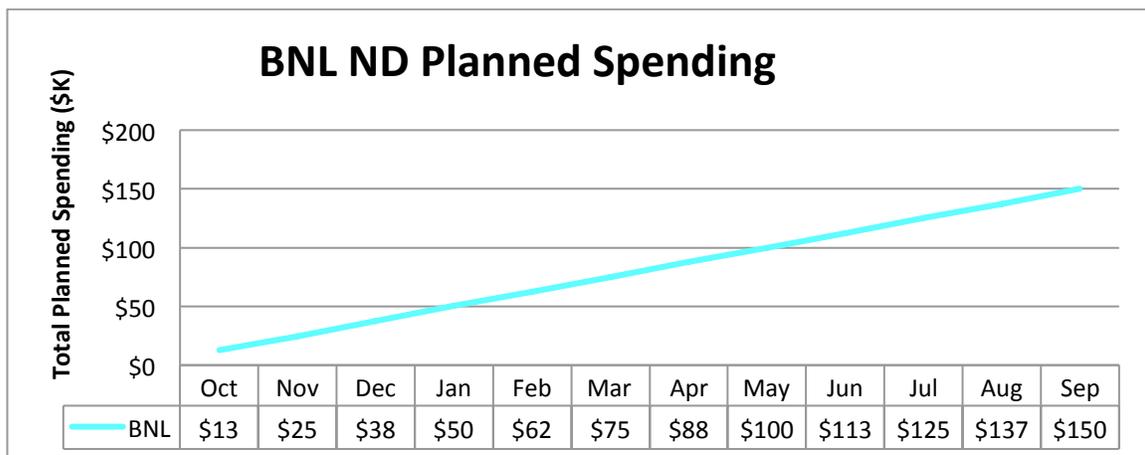


Table 2.4-3 BNL ND Planned Spending (FY2015)



BNL ND Milestones:

Occurs all 4 Quarters

- 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: All Qtrs).

Quarter 2

- If mandated by CSEWG, release new ENDF library (ND1: Q3).

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

Steady funding in FY16 due to completion of milestones for ADVANCE. Increase in funding in out-years for additional work on ADVANCE as defined in the NCSP Mission and Vision document.

2.4.2.2 Los Alamos National Laboratory (LANL)

*FY14 carryover in FY14Q4 authorized for FY15 task completion.

LANL ND1 (\$450K) [IRSN Area of Collaboration]

This is an ongoing approved task to provide differential data evaluation and covariance development in the energy region above the resonance range for heavy elements (often in partnership with resonance-range work from ORNL), and over the entire ENDF energy range for light elements. Particular focus will be on neutron fission. Perform data testing analysis with new evaluated sets. Contribute to NDAG, CSEWG, CIELO, WPEC, and IAEA CRP.

LANL ND2 (\$0K*)

This is a new approved task for LANL to provide support for the NDAG Chairmanship, participation in relevant Working Groups, and coordination of the NCSP ND element work program with current and future DOE needs.

Table 2.4-4 LANL ND Budget Trend (FY2015-FY2019)

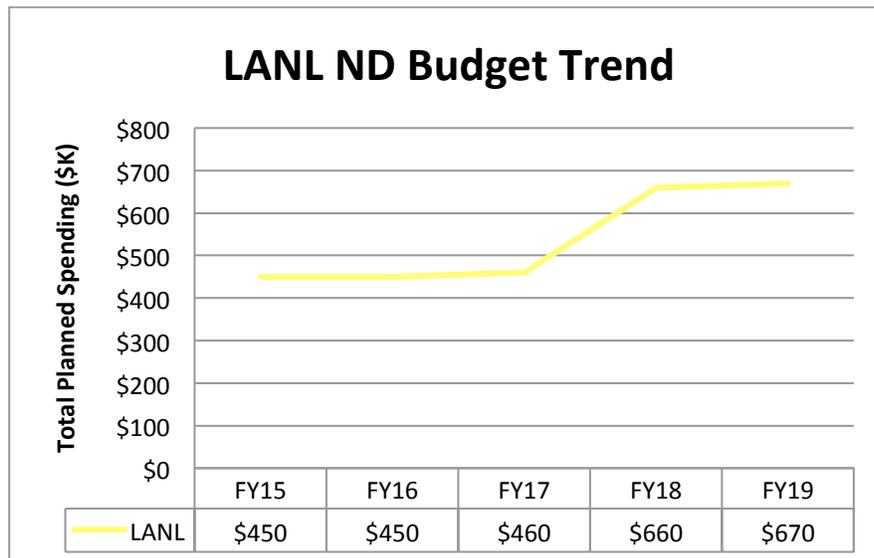
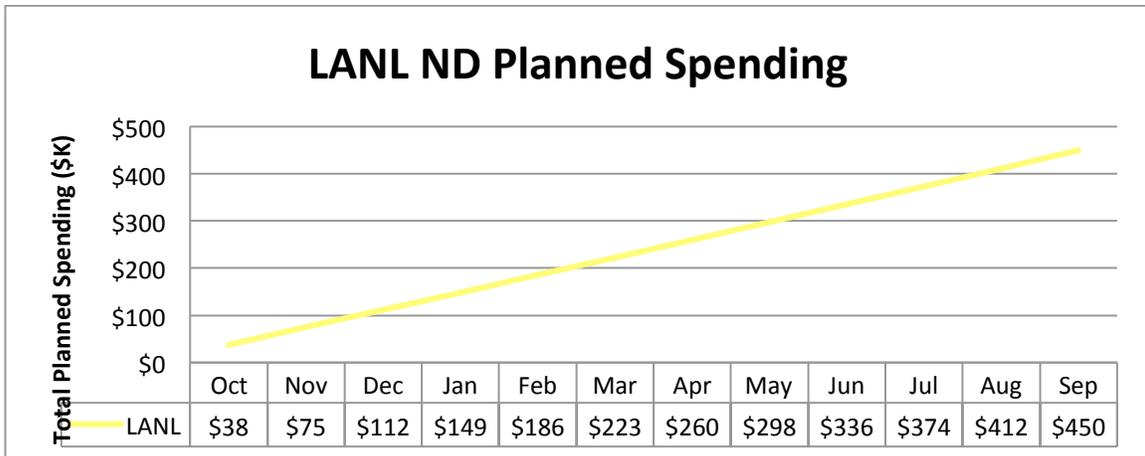


Table 2.4-5 LANL ND Planned Spending (FY2015)



LANL ND Milestones:

Occurs all 4 Quarters

- Provide status reports on LANL participation in US and International Nuclear Data collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest (ND1: All Qtrs).

Quarter 4

- Deliver nuclear data evaluations as indicated in Appendix B of the 5-Year Plan (ND1: Q4).
- Deliver improved R-Matrix code capabilities including hyper-spherical treatment and simultaneous covariance evaluation (ND1: Q4).
- Conduct annual NDAG meeting and coordinate the annual update to the NCSP nuclear data work schedule in the Five Year Plan (ND2: Q4).

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

Increase in funding in out-years to ramp up Nuclear Data Testing planned per Appendix B and as defined in the NCSP Mission and Vision document.

2.4.2.3 Lawrence Livermore National Laboratory (LLNL)

LLNL ND1 (\$0K) [IRSN Area of Collaboration]

This is an ongoing approved activity to develop a first principles analytic method to determine the equilibrium and time-dependent emission of delayed gammas based on event-by-event modeling of the fission process and subsequent fission product decay. This task supports continued data testing as new experimental data becomes available from foil activation measurements and dosimetry testing using GODIVA, FLATTOP and COMET.

LLNL ND2 (\$75K)

This is an ongoing approved task in collaboration with NCSU to develop basic atomistic models for executing molecular dynamics simulations for polymethyl methacrylate ($C_5H_8O_2$, trademark names: Lucite, Perspex, Plexiglas). A potential function describing the atomistic interactions will be chosen and parameterized to reproduce its observed characteristics. Subsequently, the excitation spectrum (i.e., vibrations, rotations, etc.) will be calculated. This information will be used to develop LEAPR-THERMR modules in NJOY to calculate the scattering law, $S(\alpha,\beta)$, and the thermal neutron scattering cross sections at temperatures of interest. The libraries produced will account for both inelastic and coherent elastic scattering, when applicable. With LLNL assistance, these $S(\alpha,\beta)$ libraries in both ENDF File 7 and ACE ("A Compact ENDF" file) formats will be tested in COG using relevant criticality safety benchmarks selected from the ICSBEP Handbook. Finally, the $S(\alpha,\beta)$ libraries in ENDF File 7 will be provided to the National Nuclear Data Center at Brookhaven National Laboratory. Additionally, work will begin for calculating the scattering law, $S(\alpha,\beta)$, and the thermal neutron scattering cross sections for polyethylene (CH_2).

Table 2.4-6 LLNL ND Budget Trend (FY2015-FY2018)

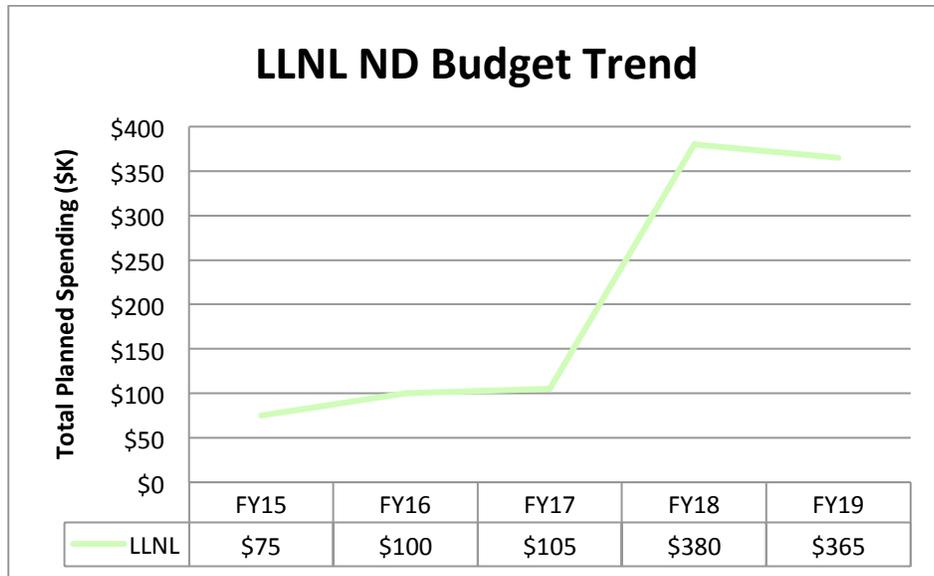
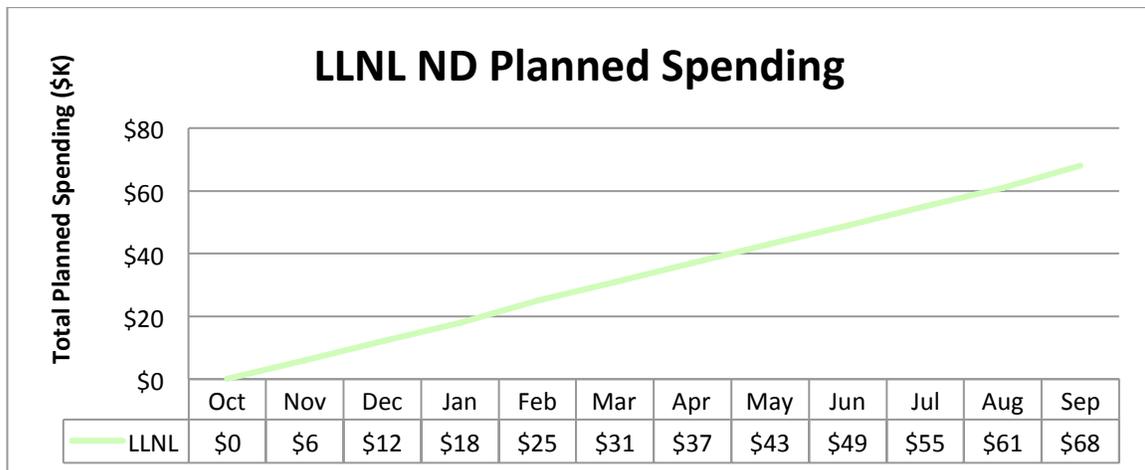


Table 2.4-7 LLNL ND Planned Spending (FY2015)*



* LLNL Planned Spending reduced by approximately 9% to account for required laboratory hold-back during FY CR funding uncertainty.

LLNL ND Milestones:

Occurs all 4 Quarters

- Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND2: All Qtrs).

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

Increase in funding in FY16 to support Delayed Fission Gamma Multiplicity and Spectra task. Increases in out-years for support of Nuclear Data Testing planned per Appendix B and as defined in the NCSP Mission and Vision document.

2.4.2.4 Oak Ridge National Laboratory (ORNL)

ORNL ND1 (\$950K) [IRSN Area of Collaboration]

This is an ongoing approved task to conduct nuclear data measurement and evaluation activities in support of the NCSP. This subtask continues to primarily focus on the resonance-region and includes cross-section measurements and the production of new cross-section evaluations with covariance data. The ORNL nuclear data measurements and evaluations are performed in accordance with the milestone schedule in Appendix B.

ORNL ND4 (\$65K)

This is an ongoing approved task to develop nuclear data evaluation capabilities to analyze thermal neutron scattering measurements to produce new cross-section evaluations for thermal moderators. This task is being performed in collaboration with the Renssalaer Polytechnic Institute (RPI) ND1 task to perform double differential thermal scattering measurements.

ORNL ND5 (\$43K)

This is an ongoing approved task to support Georgia Tech in order to train the next generation of nuclear data experts in performing nuclear data analysis work. The task effort will focus on developing and implementing new resonance analysis capabilities for the unresolved resonance region.

Table 2.4-8 ORNL ND Budget Trend (FY2015-FY2019)

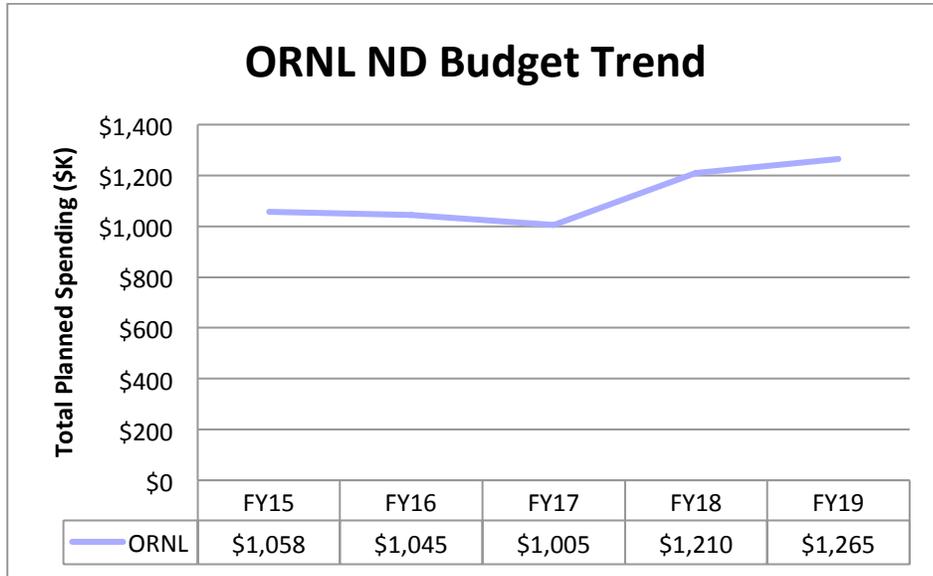
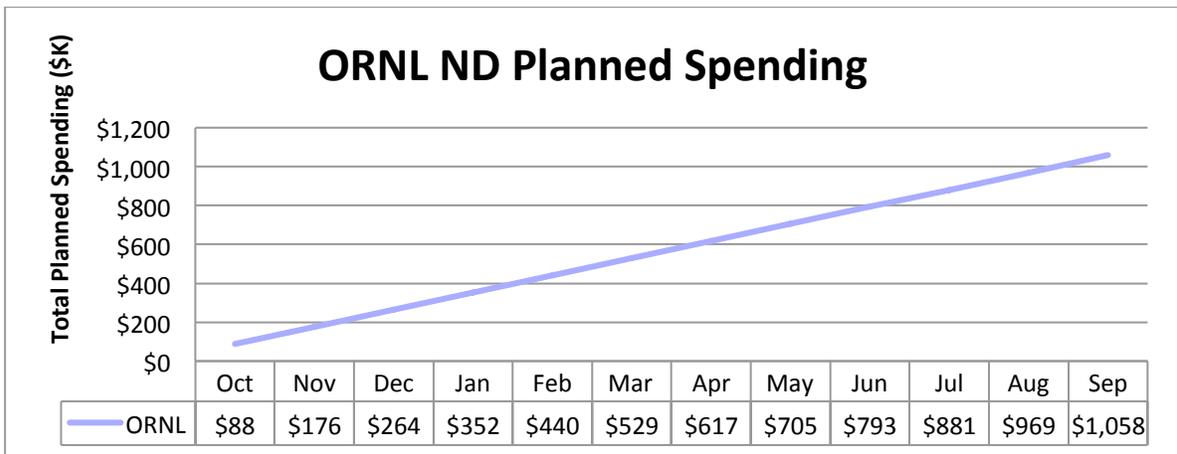


Table 2.4-9 ORNL ND Planned Spending (FY2015)



ORNL ND Milestones:

Occurs all 4 Quarters

- Provide status reports on all nuclear data support activities to NCSP Manager (ND1: All Qtrs).
- Provide status reports on ORNL participation in US and International Nuclear Data collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest (ND1: All Qtrs).
- Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND4: All Qtrs).

Quarter 4

- Develop prototypic methodology to analyze measured thermal neutron scattering data for supporting the development of a thermal cross-section evaluation capability (ND1: Q4).
- Develop a prototypic evaluation methodology for the unresolved resonance region (ND5: Q4).

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

Initial funding decrease due to the completion of major milestones. Increases in out-years for support of Nuclear Data Testing planned per Appendix B and as defined in the NCSP Mission and Vision document.

2.4.2.5 Renssalaer Polytechnic Institute (RPI)

*FY14 carryover in FY14Q4 authorized for FY15 task completion.

RPI ND1 (\$156K [\$256K total]*)

This is an ongoing approved task in collaboration with ORNL to support the resonance region Nuclear Data Measurement Capability at RPI and to perform cross-section measurements and qualification of the new capabilities.

RPI ND2 (\$120K)

This is an ongoing approved task in collaboration with ORNL to support the thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties. This task also supports the work to broaden and maintain the U.S. capabilities to support NCSP experimental nuclear data needs by providing priority NCSP thermal scattering law data.

RPI ND3 (\$1000K)

This is an ongoing approved task to support the RPI/ORNL: Linear Accelerator (LINAC) 2020 Nuclear Data Capabilities Maintenance Plan in collaboration with Naval Reactors (NA-30) who is cofunding 2/3 of the total refurbishment costs. In order to be able to continue to deliver a reliable neutron beam with the proper conditions required for these experiments, a long-term maintenance and update plan is being implemented.

Table 2.4-10 RPI ND Budget Trend (FY2015-FY2019)

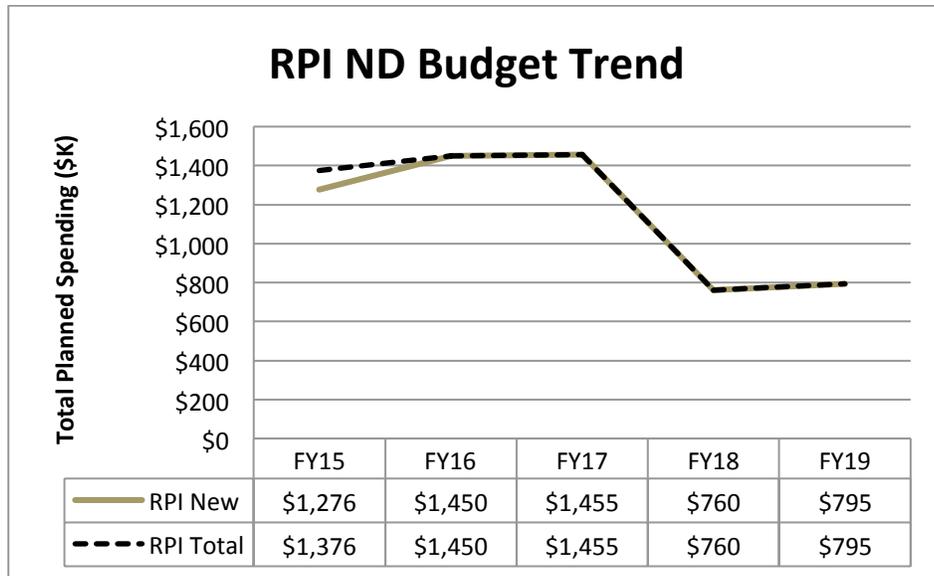
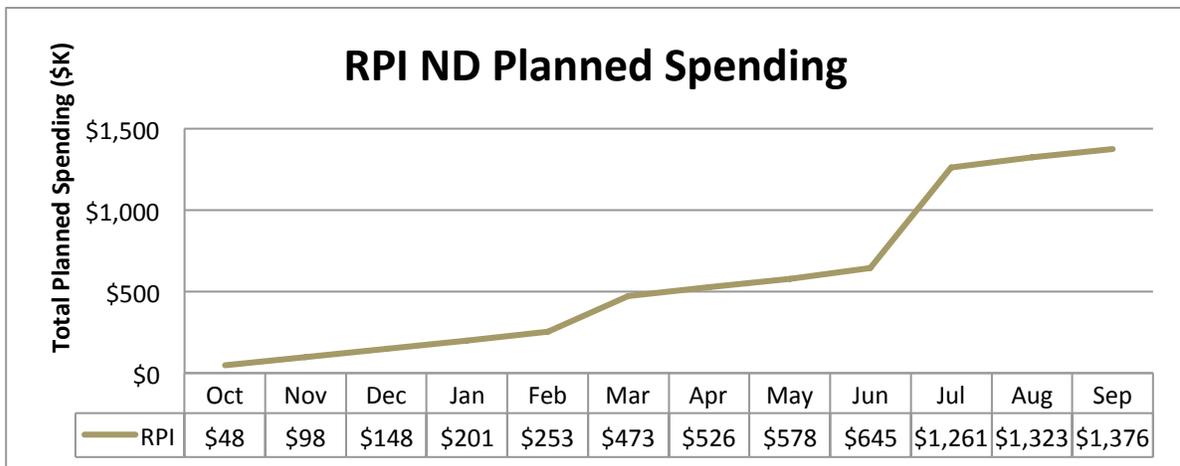


Table 2.4-11 RPI ND Planned Spending (FY2015)



RPI ND Milestones:

Occurs all 4 Quarters

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND2, ND3: All Qtrs).
- Complete cross-section measurement deliverables per the nuclear data schedule in Appendix B (ND1, ND2: All Qtrs).

Quarter 1

- Initiate klystron purchase in coordination with NR (ND3: Q1).

Quarter 3

- Initiate klystron purchase in coordination with NR (ND3: Q3).

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

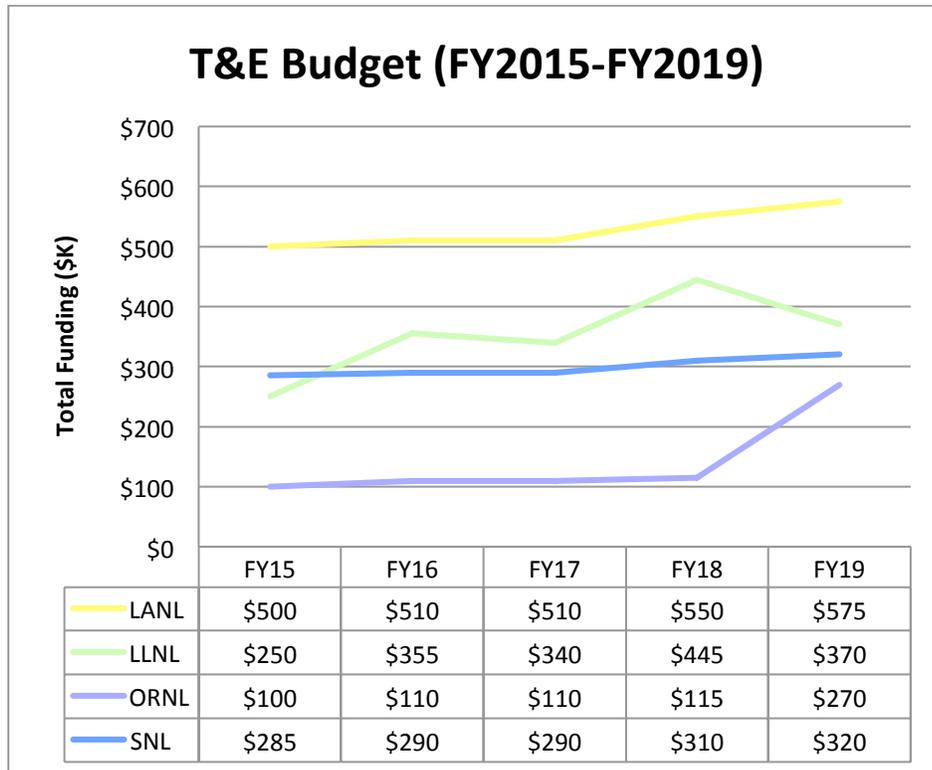
High funding level in FY15-17 supports the RPI LINAC 2020 Nuclear Data Capabilities Maintenance Plan for an initial investment period of 3 years with a decrease of funding at the end of that investment period.

2.5 Training and Education (T&E)

2.5.1 Program Element Description

The Training and Education program element continues to offer hands-on training courses as needed by DOE and identify training needs and develop training resources in areas where no suitable materials exist. The primary purpose of the T&E element is to maintain the technical capabilities of criticality safety professionals and provide for the training and education of people entering the criticality safety discipline from related scientific fields.

Table 2.5-1 T&E Budget (FY2015-FY2019)



2.5.2 Approved Tasks

2.5.2.1 Los Alamos National Laboratory (LANL)

LANL T&E1 (\$500K)

This is an ongoing approved task to conduct combined criticality safety classroom and hands-on training at LANL and NCERC according to an integrated schedule developed by ORNL and approved by the NCSP manager.

Table 2.5-2 LANL T&E Budget Trend (FY2015-FY2019)

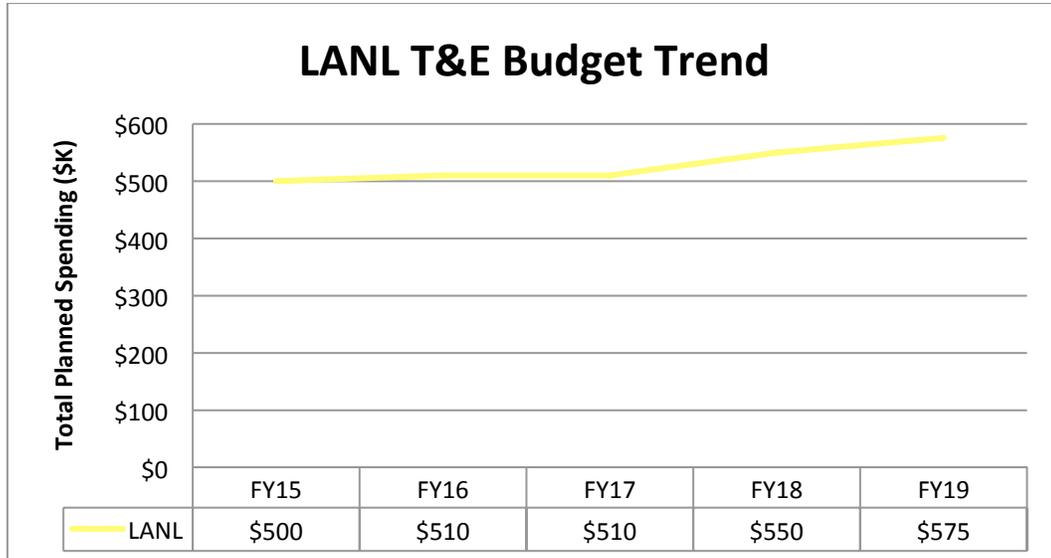
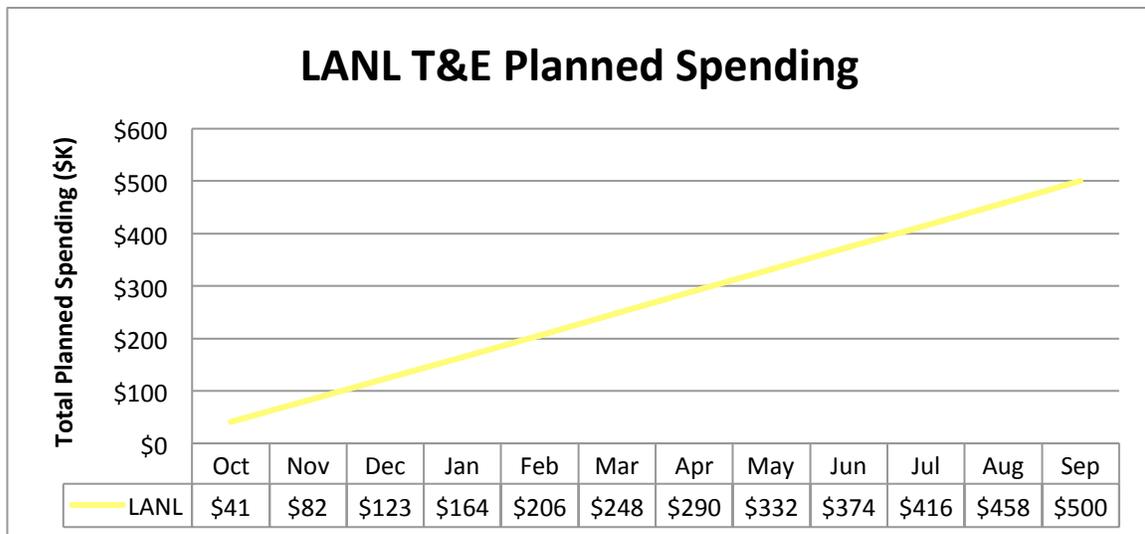


Table 2.5-3 LANL T&E Planned Spending (FY2015)



LANL T&E Milestones:

Occurs all 4 Quarters

- Provide training in accordance with the approved schedule and provide status reports on all training activities to the NCSP Manager (TE1: All Qtrs).

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

Very modest increases in out-years to help mitigate increased cost of doing business.

2.5.2.2 Lawrence Livermore National Laboratory (LLNL)

LLNL T&E1 (\$250K)

This is an ongoing approved task to provide unique “hands-on” training at the Device Assembly Facility (DAF) using the Training Assembly for Criticality Safety (TACS). This task also supports continued LLNL coordination of the course registration process for all courses at LANL, NCERC and SNL and continued LLNL participation in the T&E planning activities.

LLNL T&E3 (\$0K) [AWE Area of Collaboration]

This is new work to provide a mobile training course and to train local instructors and fissile material handlers with on-site “hands-on” training. This training may include the shipping of TACS to the Atomic Weapons Establishment (AWE), UK in order to provide on-site “hands-on” training.

Table 2.5-4 LLNL T&E Budget Trend (FY2015-FY2019)

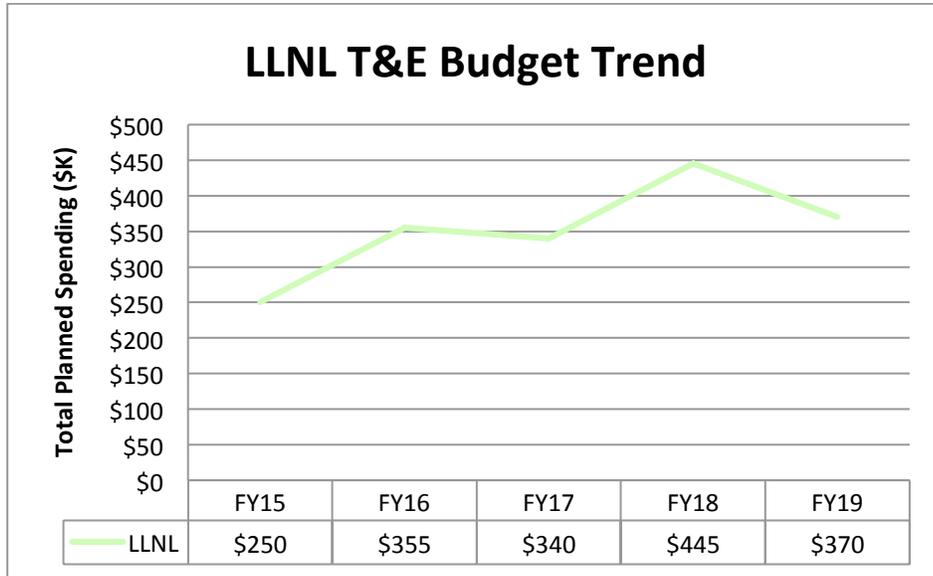
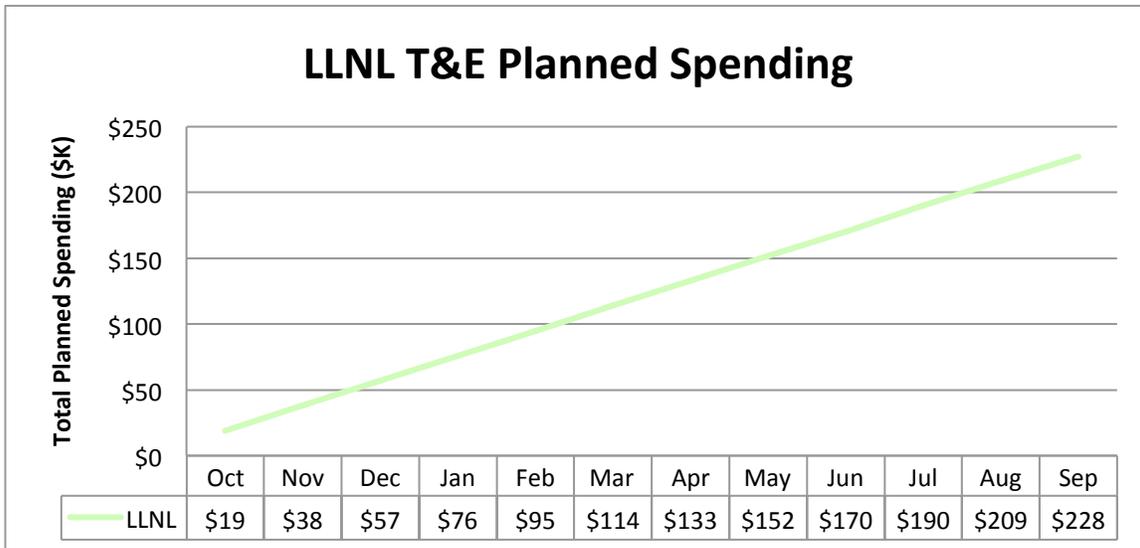


Table 2.5-5 LLNL T&E Planned Spending (FY2015)*



* LLNL Planned Spending reduced by approximately 9% to account for required laboratory hold-back during FY CR funding uncertainty.

LLNL T&E Milestones:

Occurs all 4 Quarters

- Update, maintain and support the registration process and provide “hands on” TACS training in accordance with the schedule approved by the NCSP Manager (TE1: All Qtrs).

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

FY16 increase in funding supports the Mobile Hands-On Nuclear Criticality Safety Course and out-year fluctuations support the conversion of various existing NCSET Modules to Multimedia Format as defined in the NCSP Mission and Vision document.

2.5.2.3 Oak Ridge National Laboratory (ORNL)

ORNL T&E1 Subtask 1 (\$55K)

This is an ongoing approved task to manage the collaborative development and documentation for the planning, designing, and scheduling for the phased and multi-faceted NCSP Training Program.

ORNL T&E1 Subtask 2 (\$45K) [AWE Area of Collaboration]

This is an ongoing approved task to provide training for the application of non-destructive assay (NDA) measurement results to NCS evaluations.

Table 2.5-6 ORNL T&E Budget Trend (FY2015-FY2019)

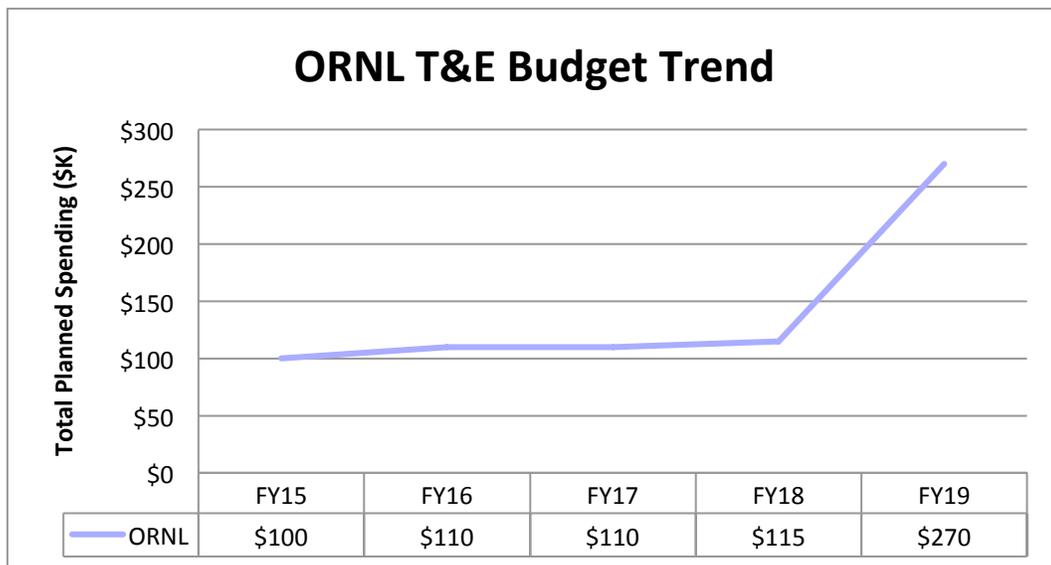
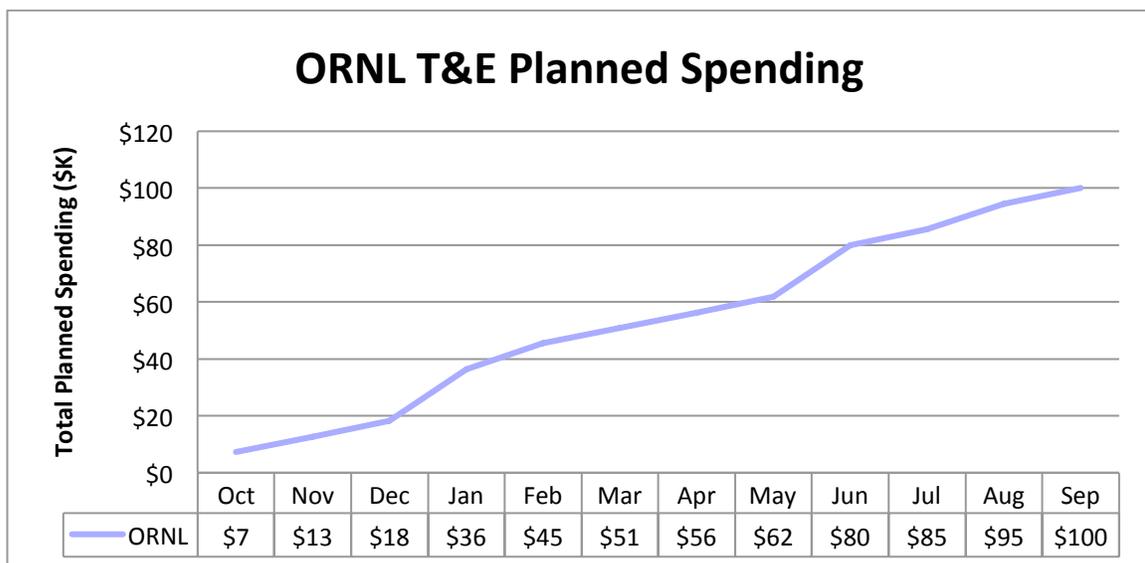


Table 2.5-7 ORNL T&E Planned Spending (FY2015)



ORNL T&E Milestones:

Occurs all 4 Quarters

- Provide status reports to the NCSP Manager on implementation of the NCS training program (TE1: All Qtrs).
- Provide status reports to NCSP Manager on improvements/modifications to baseline NCS course training materials based on self-evaluation and feedback from reviewers, observers, trainers, and the NCSP manager (TE1: All Qtrs).
- Provide status reports to the NCSP Manager on the execution of the NDA training as part of the NCS training course. (TE2: All Qtrs).

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

Increase in FY16 to return funding to expected spend rate for 4 classes or more per year. FY19 increase supports the development of an expanded and improved version of the hand-calculation primer, LA-14244-M that can be used to support NCSP Training and Education needs as defined in the NCSP Mission and Vision document.

2.5.2.4 Sandia National Laboratories (SNL)

SNL T&E1 (\$285K)

This is an ongoing approved task to conduct criticality safety training classes at SNL according to an integrated schedule developed by ORNL and approved by the NCSP Manager. This task also provides Human Factors and Equipment Reliability module support to the training class at LANL.

Table 2.5-8 SNL T&E Budget Trend (FY2015-FY2019)

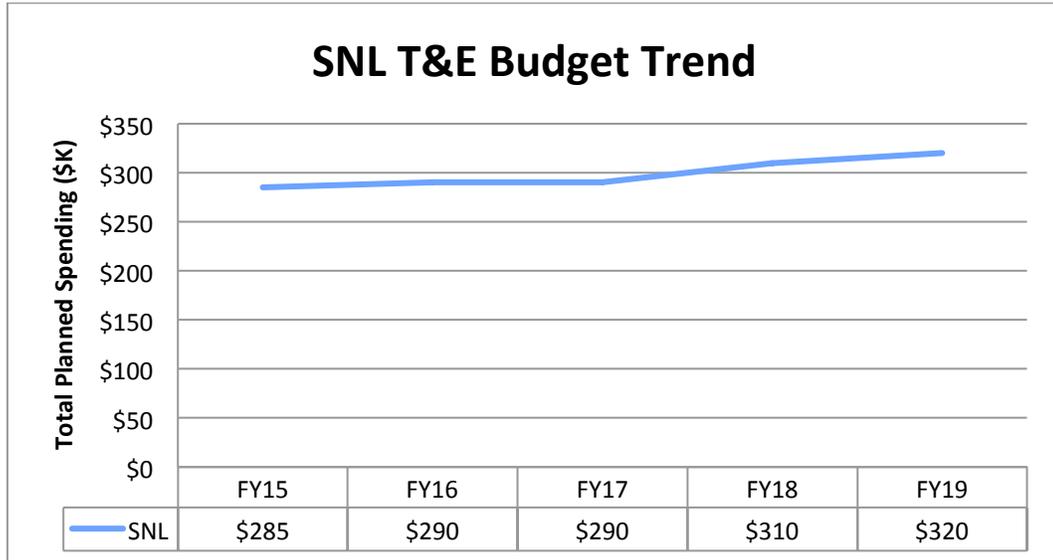
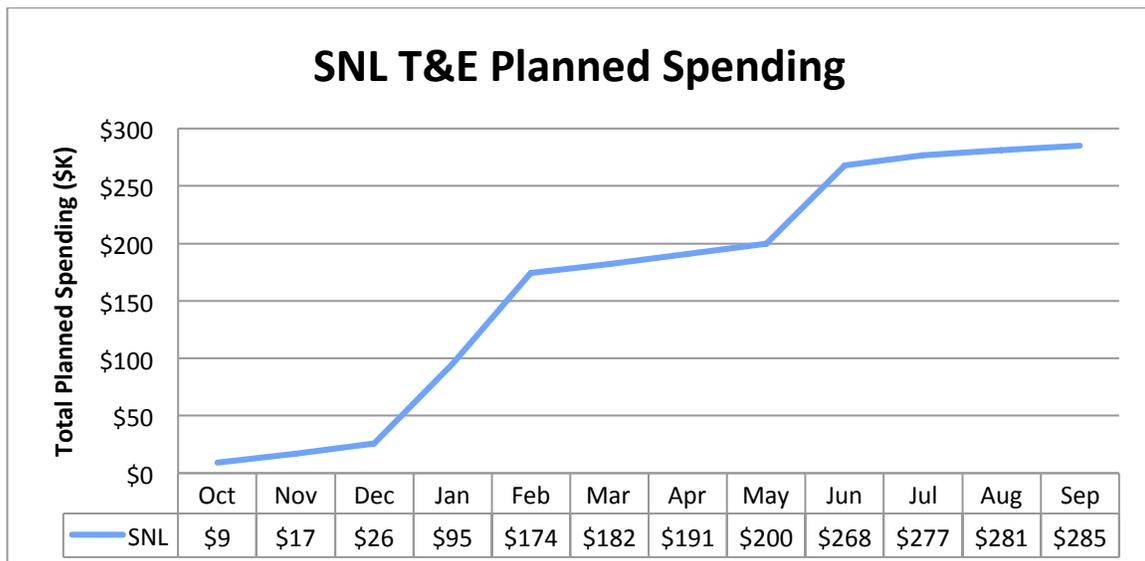


Table 2.5-9 SNL T&E Planned Spending (FY2015)



SNL T&E Milestones:

All Quarters

- 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: All Qtrs).

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

Very modest increases in out-years to help mitigate increased cost of doing business.

3.0 Criticality Safety Support Group (CSSG)

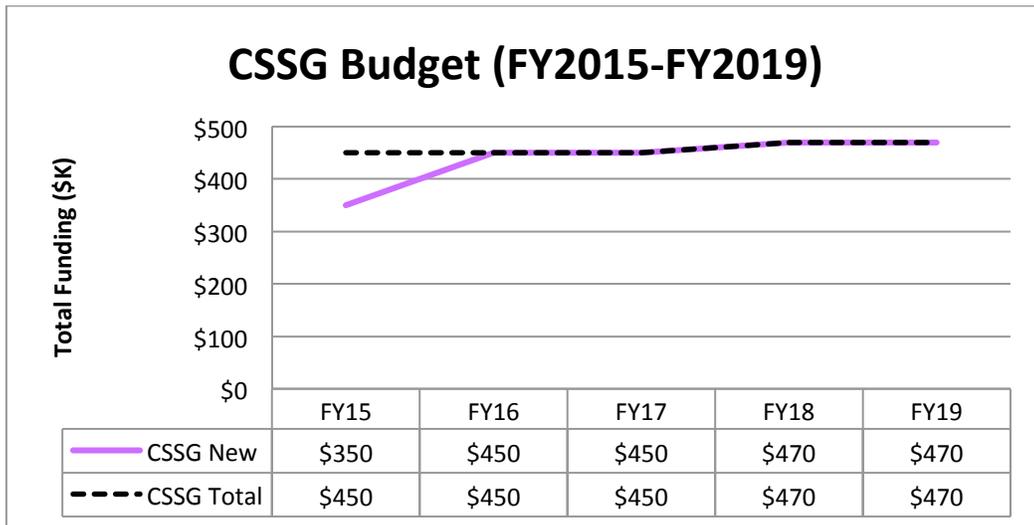
The CSSG is comprised of recognized criticality safety experts from DOE offices and contractor organizations. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. The CSSG also provides the NCSP Manager with technical reviews of orders, standards, rules, and guides issued by DOE related to criticality safety. In addition, the CSSG responds to requests from the NCSP Manager for information, technical reviews, and evaluations of criticality safety issues throughout the complex. The CSSG receives modest support for its contractor members (eight CSSG contractor members’ \$50K/member + \$25K for the CSSG Chair + \$25K for the CSSG Deputy Chair).

*FY14 carryover in FY14Q4 authorized for FY15 task completion.

NCSP TS1 (\$350K [\$450K total]*)

This is an ongoing approved task to provide Technical Support as tasked by NCSP Manager through approved CSSG Taskings as found on the NCSP Website.

Table 3.1 CSSG Budget Trend (FY2015-FY2019)



4.0 NCSP Technical Support

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

NCSP TS2 (\$600K) - ORNL

This is an ongoing approved task for ORNL to support the DOE NCSP Management in the program management and execution of the NCSP.

NCSP TS3 (\$50K) - SNL

In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. At SNL, there is a need to maintain the integral experiment expertise using the SNL critical experiment capabilities. The work associated with this task is to develop and execute IE Succession Planning for new experimentalists at SNL.

NCSP TS4 (\$100K) - LANL

In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the analytical methods, integral experiments and nuclear data capabilities that currently exist at LANL. The work associated with this task is to develop and execute AM, IE, and ND Succession Planning at LANL as defined in the NCSP Mission and Vision document for cross-section processing developers, radiation transport methods developers, experimentalists, and nuclear data evaluators.

NCSP TS5 (\$100K) - LLNL

In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the analytical methods and integral experiment capabilities that currently exist at LLNL. The work associated with this task is to develop and execute AM and IE Succession Planning at LLNL as defined in the NCSP Mission and Vision document for integral experiment equipment Support, facility support, and radiation transport methods developers.

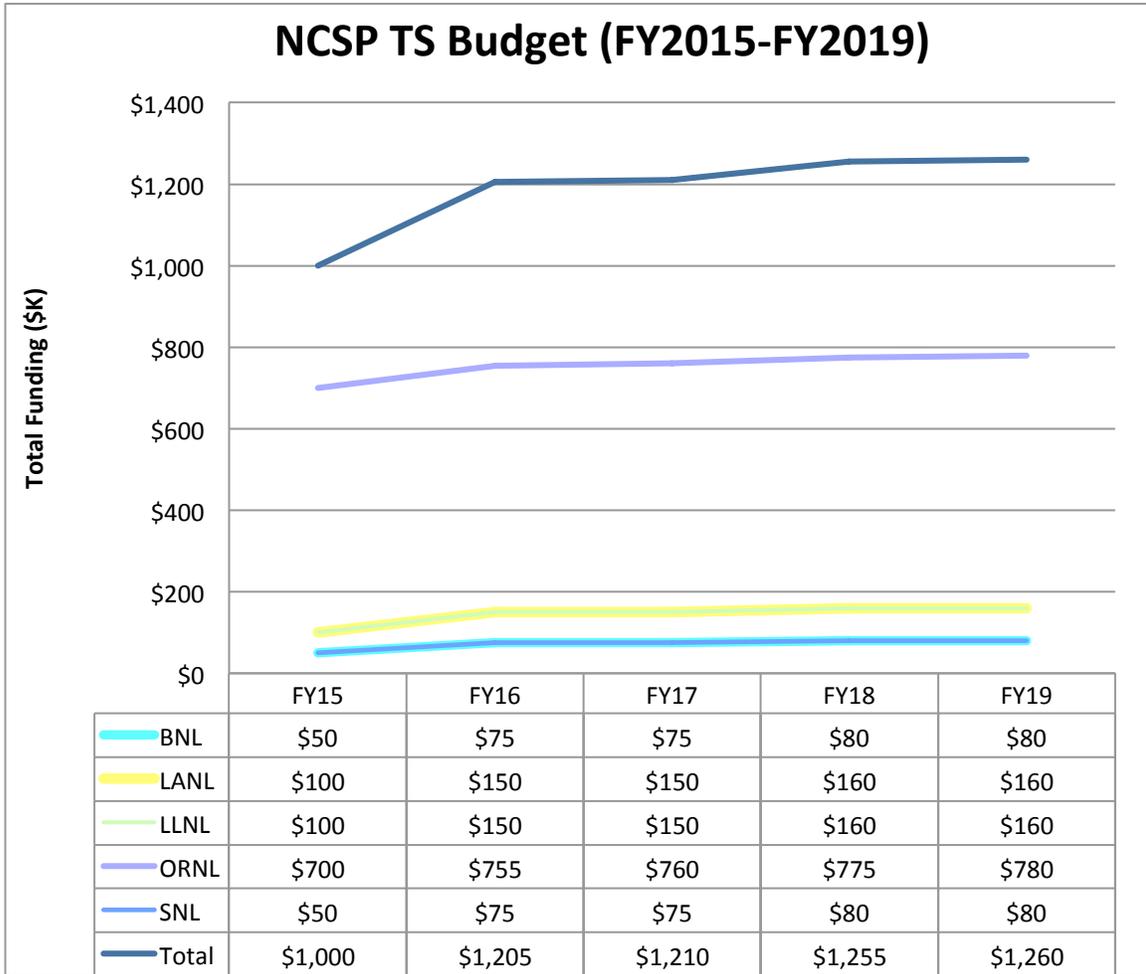
NCSP TS6 (\$50K) - BNL

In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the nuclear data analysis capabilities that currently exist at BNL. The work associated with this task is to develop and execute ND Succession Planning at BNL as defined in the NCSP Mission and Vision document for nuclear data analysis capabilities needed to support operations at the National Nuclear Data Center.

NCSP TS7 (\$100K) - ORNL

Task to address key nuclear data evaluator succession planning needs for the NCSP. As part of this task, a post-doctoral staff member will work with an ORNL nuclear data evaluation specialist to complete NCSP nuclear data evaluation work tasks thereby training the next generation of nuclear data experts to perform neutron resonance analyses for the NCSP.

Table 4.1 NCSP Technical Support (FY2015-FY2019) - by Laboratory



NCSP TS Milestones:

Occurs all 4 Quarters

- Manage C_EdT process and coordinate execution of planned Integral Experiment Requests (IERs) each FY (TS2: All Qtrs).
- Support NCSP Manager with request for proposals, quarterly reports, NCSP calendar, NCSP Management Conference Calls, and other related activities as approved by the NCSP Manager (TS2: All Qtrs).
- Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager from the receipt of proposals, through the final task prioritization efforts by all NCSP participants, and until final approval by the NCSP Manager. This may require mid-year adjustments due to CRs, supplemental funding, etc. (TS2: All Qtrs).

Quarter 4

- Coordinate and participate in Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY, including prioritization meetings, end-of-year projections, International Collaboration efforts, and other activities as approved by the NCSP Manager (TS2: Q4).
- Publish final Five Year Plan (TS2: Q4).
- Provide NCSP Manager annual report of succession planning efforts (TS3, TS4, TS5, TS6, TS7: Q4).

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

Increase in FY16 to return funding level to expected need levels for succession planning with very modest increases in out-years to help mitigate increased cost of doing business.

Appendix A

Work Authorization Statements for Nuclear Criticality Safety Program Funding for Execution Year FY2015 Provided to the NA-00 Budget Office in September 2014

Argonne National Laboratory (ANL): \$20K

Task: Criticality Safety Support Group

Reflects funds for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the Nuclear Criticality Safety Program (NCSP) Manager regarding planning and execution of the NCSP.

ANL POC: Jim Morman (630-252-6076), jamorman@anl.gov

DOE POC: Jerry McKamy, NNSA (301-903-7980)

Brookhaven National Laboratory (BNL): \$200K

Task: Nuclear Data

Reflects funds to continue supporting nuclear data activities, including shepherding new data evaluations through the Cross Section Evaluation Working Group (CSEWG) process, subsequent publication of these data in the United States Evaluated Nuclear Data File (ENDF), and nuclear data succession planning as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager.

BNL POC: David Brown (631-344-2814), dbrown@bnl.gov

DOE POC: Jerry McKamy, NNSA (301-903-7980)

Los Alamos National Laboratory (LANL): \$9,055K

Tasks: Analytical Methods, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group

Reflects funds to continue analytical methods; integral experiments; nuclear data; and training and education support, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager; succession planning for Cross-Section processing developers, Radiation transport developers, Experimentalists, and/or Nuclear Data developers/evaluators; and for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

LANL POC: Robert Margevicius (505-665-8965), margevicius@lanl.gov

DOE POC: Jerry McKamy, NNSA (301-903-7980)

Lawrence Livermore National Laboratory (LLNL): \$2,685K

Tasks: Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group

Reflects funds to continue support for analytical methods; information preservation and dissemination; integral experiments; nuclear data; training and education, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager; succession planning for Equipment Support, Facility support, and/or Radiation transport developers; and for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

LLNL POC: David Heinrichs (925-424-5679), heinrichs1@llnl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Nevada National Security Site - NSTec (NNS): \$3,850K

Task: Integral Experiments

Reflects funds to continue support for integral experiments, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager.

NNS POC: Jeff Lewis (702-524-0647), lewisjm@nv.doe.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Oak Ridge National Laboratory (ORNL): \$3,524K

Tasks: NCSP Technical Support, Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, and Training and Education

Reflects funds to continue support for analytical methods; information preservation and dissemination; integral experiments; nuclear data; and training and education, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager; Technical Support for NCSP management; and for succession planning for Cross-Section processing developers, Radiation transport developers, and/or Nuclear Data evaluators/experimentalists/developers.

ORNL POC: Mike Dunn (865-574-5260), dunnme@ornl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Pacific Northwest National Laboratory (PNNL): \$30K

Tasks: Information Preservation and Dissemination and the Criticality Safety Support Group

Reflects funds for obtaining integral cross sections for actinides from reactor operations and special test data, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager and for participation in the CSSG, as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

PNNL POC: Michael Brady Raap (509-588-3511), MikeyBrady@aol.com
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Rensselaer Polytechnic Institute (RPI): \$1,276K

Task: Nuclear Data

Reflects funds to conduct differential measurements as delineated in the Nuclear Criticality Safety Execution (NCSP) FY15 Five-Year Plan dated October 2014 and continue work, as defined in the RPI LINAC 2020 Nuclear Data Capabilities Maintenance Plan, or as directed by the NCSP Manager.

RPI POC: Yaron Danon (518-276-4008), danony@rpi.edu
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Sandia National Laboratories (SNL): \$1,035K

Tasks: Integral Experiments and Training and Education

Reflects funds to continue support for integral experiments; training and education; and succession planning for experimentalists as, delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager.

SNL POC: Gary Harms (505-845-3244), gaharms@sandia.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Savannah River Site (SRS): \$115K

Tasks: Information Preservation and Dissemination and the Criticality Safety Support Group

Reflects funds for updating and maintaining data in the CritView database and performing validation and verification (V&V) on the revised database, as delineated in the Nuclear Criticality Safety Program (NCSP) FY15 Five-Year Plan dated October 2014, or as directed by the NCSP Manager and for participation in the CSSG, as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP.

SRS POC: David Erickson (803-557-9445), david.erickson@srs.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Y-12 National Security Complex (Y-12): \$10K

Task: Criticality Safety Support Group

Reflects funds for participation in the Criticality Safety Support Group (CSSG), as it provides technical support to the Nuclear Criticality Safety Program (NCSP) Manager regarding planning and execution of the NCSP.

Y-12 POC: Kevin Kimball (865-576-6675), kevin.kimball@cns.doe.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Appendix B Nuclear Data

Priority Needs / Additional Needs		Thermal scattering (BeO, HF, D ₂ O, SiO ₂ , CH ₂ , C ₂ F ₄ , C ₅ O ₂ H ₈ , etc.), ²³⁹ Pu, Cr, ²³⁷ Np, Pb, ⁵⁵ Mn, Ti, ²⁴⁰ Pu / ²³³ U, Th, Be, ⁵¹ V, Zr, F, K, Ca, Mo, Na, La								
Completed Evaluations (FY)		Minor Actinides (13), SiO ₂ (12), ⁵⁵ Mn (12), ^{180,128,183,184,186} W (10)								
	Materials	Pre FY2014	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	Post-FY2020
Measurements	Calcium (Ca)									
	Cerium (Ce)									
	Copper (Cu)									
	Iron (Fe)									
	Lucite (C ₅ O ₂ H ₈)									
	Strontium (Sr)									
	Tungsten (W)									
	Vanadium (V)									
	Zirconium (Zr)									
	Polyethylene (CH ₂)			H ₂ O / CH ₂						
	Materials	Pre FY2014	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	Post-FY2020
Complete Evaluations	Calcium (Ca)									
	Cerium (Ce)									
	Cobalt (Co)									
	Copper (Cu)									
	Dysprosium (Dy)									
	Gadolinium (Gd)									
	Iron (Fe)									
	Lead (Pb)									
	Nickel (Ni)									
	Oxygen (O)									
	Rhodium (Rh)									
	Plutonium-239									
	Strontium (Sr)									
	Tungsten (W)									
	Uranium-235									
	Uranium-238									
	Vanadium (V)									
	Zirconium (Zr)									
	Hydrofluoric Acid (HF)									
	Lucite (C ₅ O ₂ H ₈)									
Polyethylene (CH ₂)										
		ORNL		RPI		LANL		LLNL/NCSU		
<ul style="list-style-type: none"> • Requests for additional IE measurements: Ni, Mo, Cr (Fe-Cr alloys), Mn in intermediate energy range (VNIITF, NCERC). • Request for measurements and evaluation of angular distributions at high energy for Cu. • Continuing need for thermal scattering data. 										

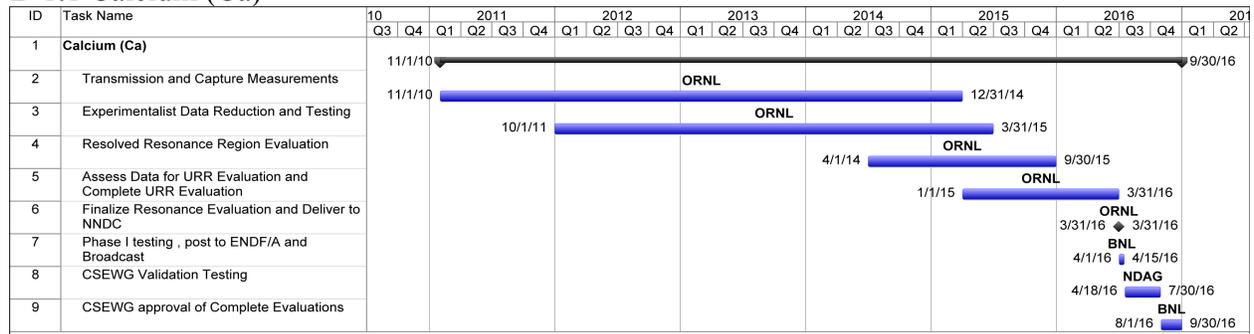
B-1 Differential Measurements and Evaluations – Elements

- B-1.1 Calcium (Ca)
- B-1.2 Cerium (Ce)
- B-1.3 Cobalt (Co-59)
- B-1.4 Copper (Cu-63, 65)
- B-1.5 Dysprosium (Dy-161,162,163,164)
- B-1.6 Gadolinium (Gd-155,156,157,158,160)
- B-1.7 Iron (Fe-56)
- B-1.8 Lead (Pb-208)
- B-1.9 Nickel (Ni-58, 60)
- B-1.10 Oxygen (O-16)
- B-1.11 Rhodium (Rh-103)
- B-1.12 Plutonium (Pu-239)
- B-1.13 Strontium (Sr)
- B-1.14 Tungsten (W-182,183,184,186)
- B-1.15 Uranium (U-235)
- B-1.16 Uranium (U-238)
- B-1.17 Vanadium (V-51)
- B-1.18 Zirconium (Zr-90, 91, 92, 94, 96)

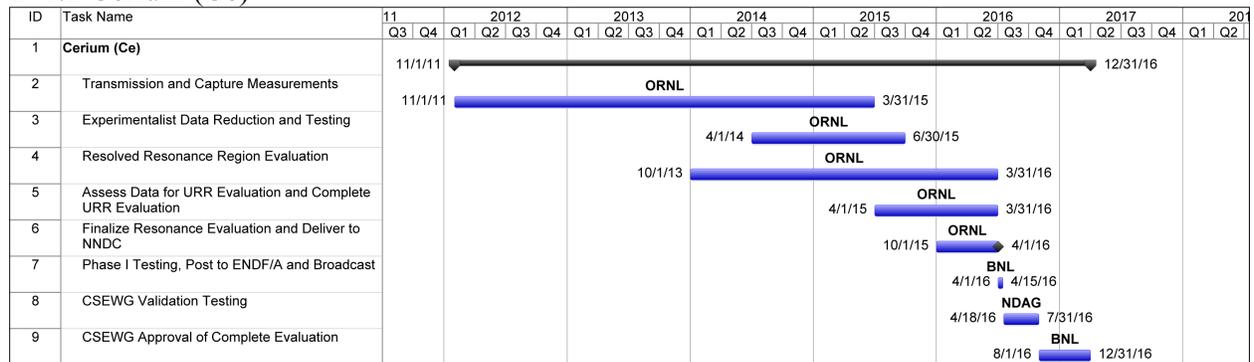
B-2 Differential Measurements and Evaluations – Compounds

- B-2.1 Hydrofluoric Acid (HF)
- B-2.2 Lucite (C₅O₂H₈)
- B-2.3 Polyethylene (CH₂)

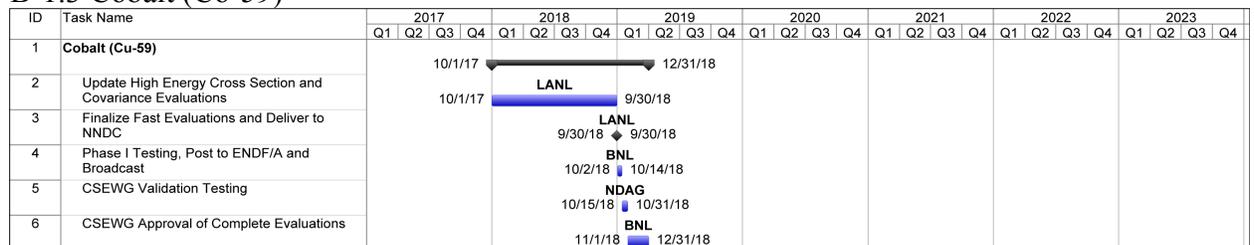
B-1.1 Calcium (Ca)



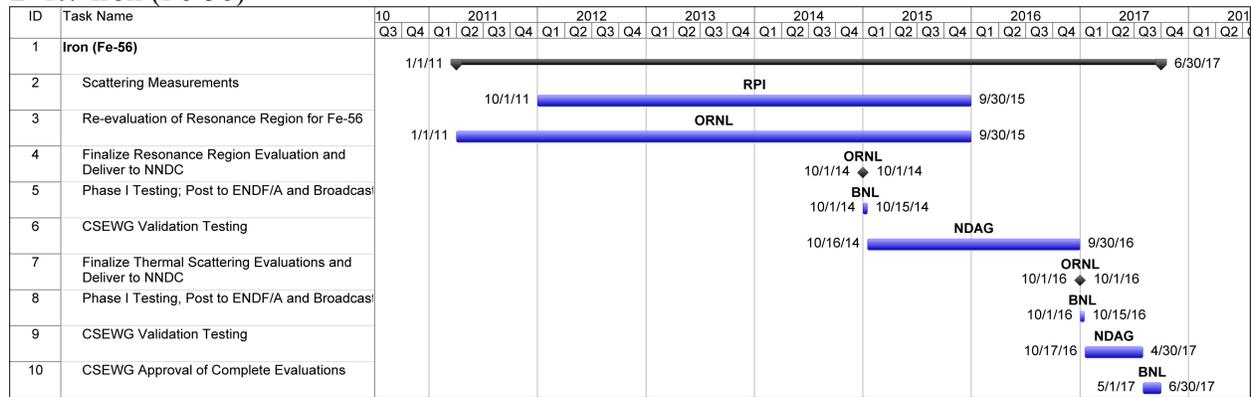
B-1.2 Cerium (Ce)



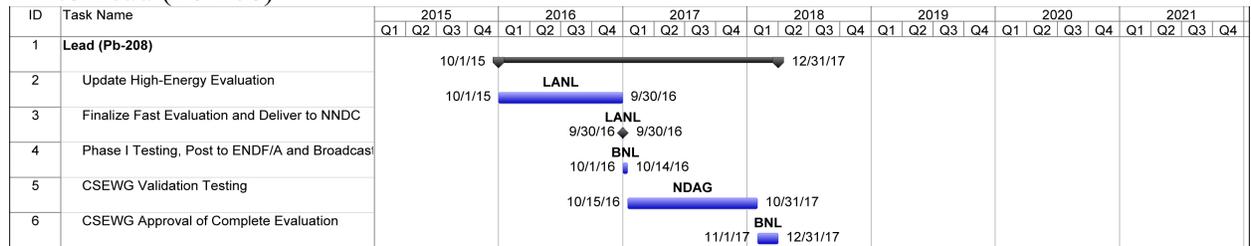
B-1.3 Cobalt (Co-59)



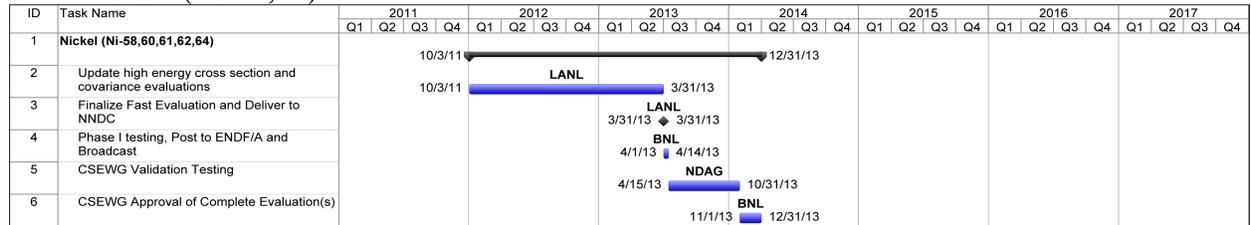
B-1.7 Iron (Fe-56)



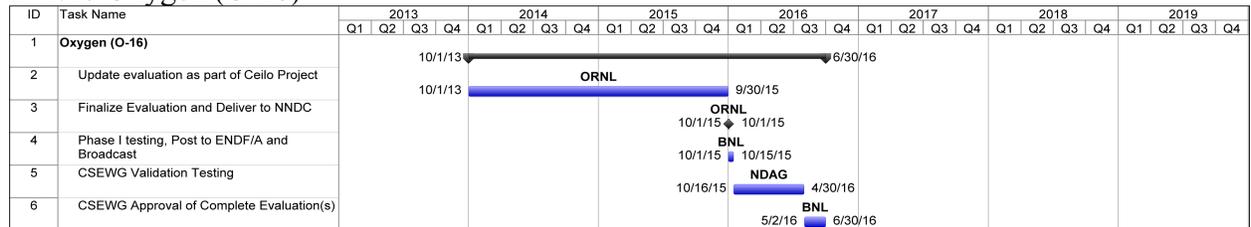
B-1.8 Lead (Pb-208)



B-1.9 Nickel (Ni-58,60,61,62,64)



B-1.10 Oxygen (O-16)



B-1.11 Rhodium (Rh-103)

ID	Task Name	2014				2015				2016				2017				2018				2019				2020			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Rhodium (Rh-103)																												
2	Assess data for Unresolved Resonance Region Evaluation				10/1/14																								
3	Finalize Resonance Evaluation and Deliver to NNDC				10/1/14																								
4	Phase I Testing, Post to ENDF/A and Broadcast																												
5	CSEWG Validation Testing																												
6	CSEWG Approval of Complete Evaluation(s)																												

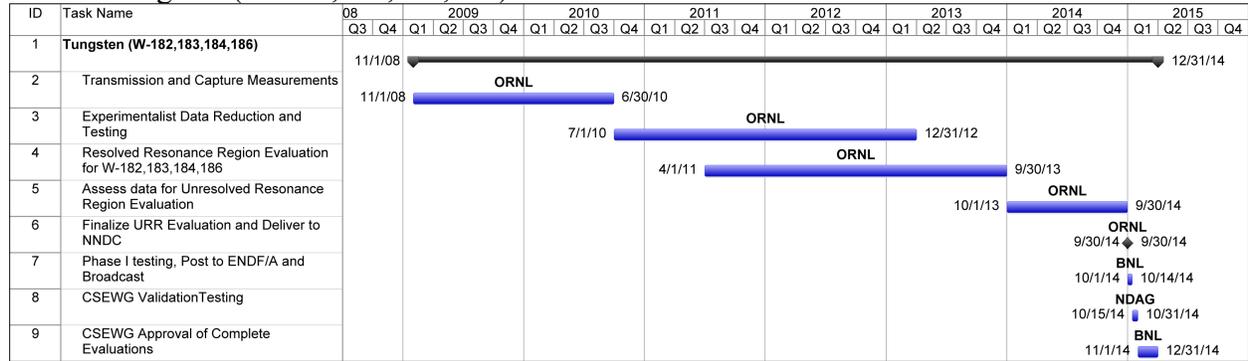
B-1.12 Plutonium (Pu-239)

ID	Task Name	2010				2011				2012				2013				2014				2015				2016				2017				2018				2019			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Plutonium (Pu-239)																																								
2	Deliver p(nu) Data in ENDF/B format				10/1/10																																				
3	Update Prompt Fission Neutron Spectra Based on LANSCE Low-Energy Emission Data																																								
4	Deliver Multiplicity-Dependent Fission Spectra																																								
5	Deliver Prompt Fission Gamma Spectra																																								
6	Update Prompt Fission Neutron Spectra Based on LANSCE High-Energy Emission Data																																								
7	WPEC SG34 Improved Resonance Evaluation				10/1/10																																				
8	URR Evaluation using Hwang-Leal Methodology																																								
9	Finalize Resonance Region Evaluation and Deliver to NNDC																																								
10	Phase I testing, Post to ENDF/A and Broadcast																																								
11	CSEWG Validation Testing																																								
12	CSEWG Approval of Complete Evaluation																																								
13	Update Fission Cross-Section Based on TPC Results																																								
14	Update Evaluation Based on LANL Updates and CSEWG & WPEC Testing																																								

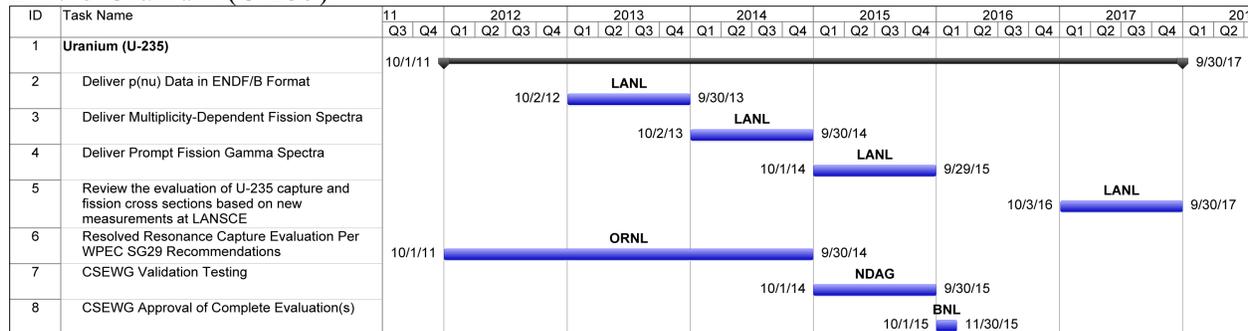
B-1.13 Strontium (Sr)

ID	Task Name	2015				2016				2017				2018				2019				2020				2021										
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4							
1	Strontium (Sr)																																			
2	Transmission and Capture Measurements				10/1/15																															
3	Experimentalist Data Reduction and Testing				10/1/15																															
4	Resolved Resonance Region Evaluation																																			
5	Assess Data for URR Evaluation and Complete URR Evaluation																																			
6	Finalize Resonance Evaluation and Deliver to NNDC																																			
7	Deliver Updated High-Energy Evaluation of Sr-88																																			
8	Phase I Testing, Post to ENDF/A and Broadcast																																			
9	CSEWG Validation Testing																																			
10	CSEWG Approval of Complete Evaluation																																			

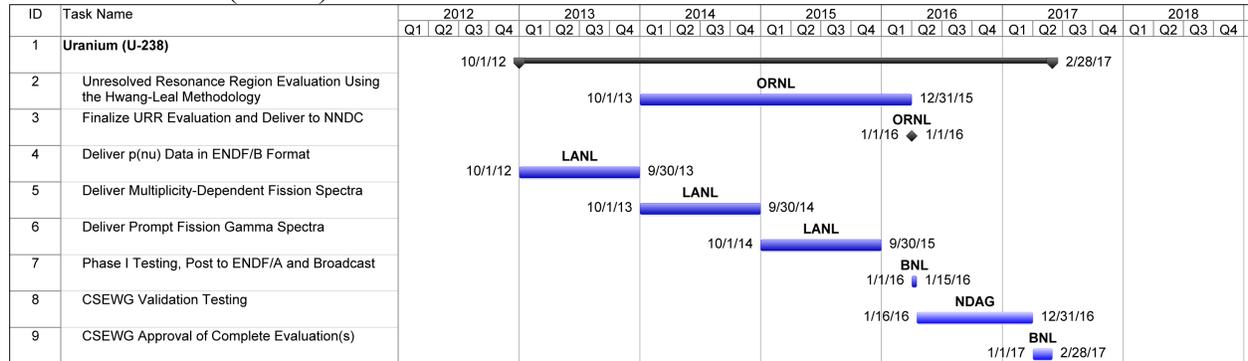
B-1.14 Tungsten (W-182,183,184,186)



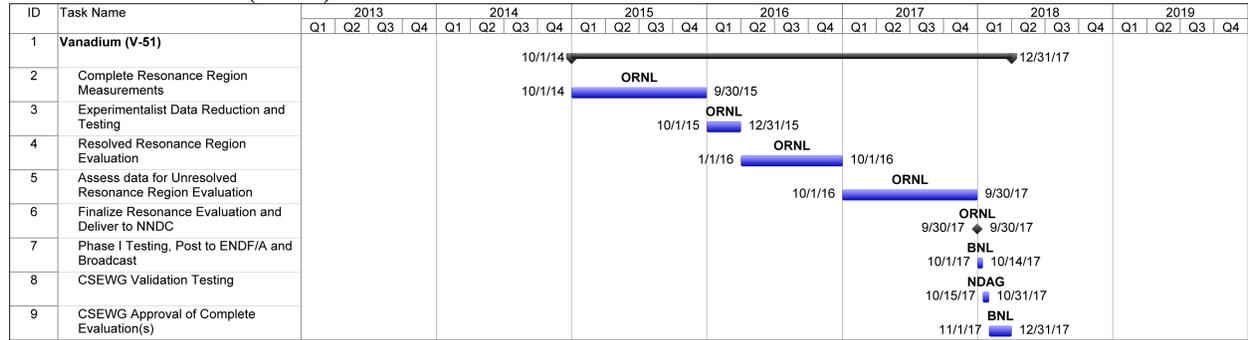
B-1.15 Uranium (U-235)



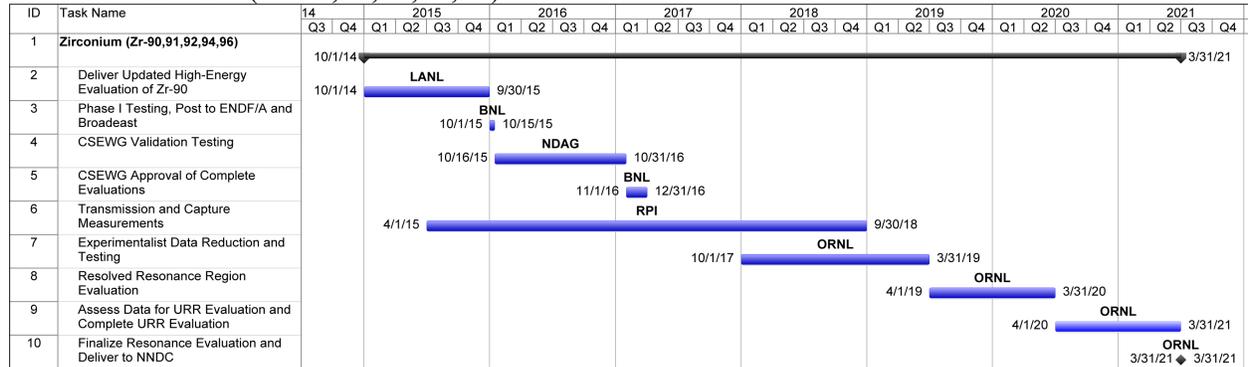
B-1.16 Uranium (U-238)



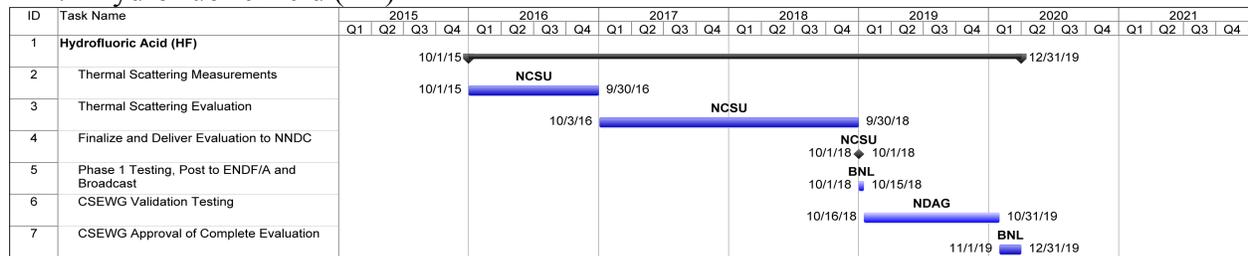
B-1.17 Vanadium (V-51)



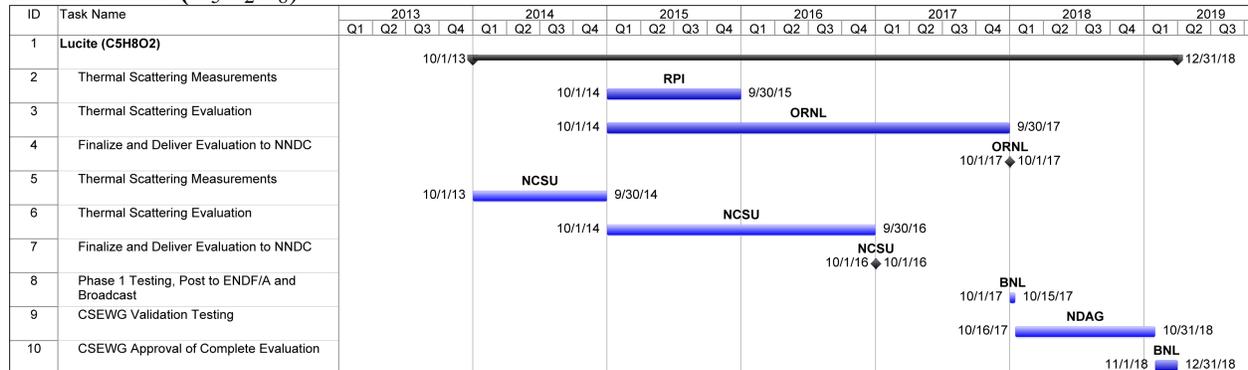
B-1.18 Zirconium (Zr-90,91,92,94,96)



B-2.1 Hydrofluoric Acid (HF)



B-2.2 Lucite (C5O2H8)



Appendix C
Fiscal Year 2015 Projected Foreign Travel

Destination	Date	Labs	Count	Costs (\$)	One Sentence Description	Task	Milestone	Justification
NEA WPNCs Paris, France	Sep-15	LANL	1	7,000	Participate in annual OECD/NEA Working Party on Nuclear Criticality Safety and various Expert Groups (Brown)	LANL-AM1	Provide brief trip summary report to NCSP Manager (Q1).	NCSP Monte carlo people from LANL & ORNL traditionally participate in these meetings. Benefits V&V, methods, data, etc. Forrest specifically is the founder & participant in the Expert Group for Advanced Monte Carlo Techniques.
NEA WPEC Paris, France	May-15	LANL	3	15,000	Participate in annual OECD/NEA Working Party for Evaluation Cooperation (WPEC) and various subgroups (Kahler, Hale, Conlin)	LANL-AM2, LANL-ND1	Provide brief trip summary report to NCSP Manager (Q3).	Will include emphasis on CIELO Project and GND Project. CIELO related work includes international evaluation of important isotopes and criticality data testing of new cross sections that will subsequently appear in a next generation ENDF library. GND related work ensures that the needs of NCSP are met by the new nuclear data format and relates to the next generation NJOY code, NJOY21.
Vienna	Spring or Summer 2015	LANL	1	0	IAEA Coordinated Research Project meetings on Radiation Damage and Testing/Validating a new Dosimetry Cross Section Library (Kahler)	LANL-AM2	Provide brief trip summary report to NCSP Manager (Q3).	(Cost is salary only as the IAEA typically pays participant transportation, lodging and per diem expenses) The Radiation Damage CRP is expected to yield improved/updated NJOY processing methods. The CRP focused on Dosimetry Cross Section Library is expected to yield updated data for selected ENDF/B evaluations.
AWE Aldermaston, UK	TBD	LANL	2	10,000	Possible MCNP Criticality safety Class at AWE	LANL-AM1	Provide brief trip summary report to NCSP Manager (Q3).	Has been discussed previously, but never funded and finalized. Such a class would benefit both LANL and AWE.
OECD NEA Paris, France	May-15	LANL LLNL ORNL SNL	8	40,000	Present/publish NCSP ICSBEP evaluations at annual ICSBEP Technical Meeting (Harms, Hayes, Hutchinson, Heinrichs, Keefer, T. Miller, A. Miller, Percher)	LLNL-IPD1	Provide brief trip summary report to NCSP Manager (Q3).	Present/publish NCSP ICSBEP evaluations at annual ICSBEP Technical Meeting.
OECD NEA Paris, France	Sep-15	LLNL	1	5,000	Participate in the Expert Group meeting on Excursion Analysis and its associated WPNCs governance meeting (Scorby)	LLNL-AM2	Provide brief trip summary report to NCSP Manager (Q1).	Continues NCSP leadership in excursion analysis methods and fosters continued collaboration with international partners to improve NCSP excursion analysis capabilities for supporting criticality safety applications.
OECD NEA Paris, France	Sep-15	LLNL	2	10,000	Participate in the Expert Group meeting on Burn-up Credit and its associated WPNCs (and ICSBEP) governance meeting (Heinrichs, Percher)	LLNL-AM1	Provide brief trip summary report to NCSP Manager (Q1).	Continues NCSP leadership in Monte Carlo methods and fosters continued collaboration with international partners to test and improve NCSP AM capabilities for supporting criticality safety applications.
AWE Aldermaston, UK	TBD	LLNL	2	10,000	Coordinate International Collaboration Efforts (Heinrichs, Scorby)	LLNL-all	Provide brief trip summary report to NCSP Manager (Q1).	Allows LLNL to discuss International Collaboration efforts that must be done in person (i.e., determining material or equipment that needs transporting, etc.).

Destination	Date	Labs	Count	Costs (\$)	One Sentence Description	Task	Milestone	Justification
Poole, UK	May-15	LLNL	2	10,000	ANSWERS Seminar (Lee, Percher)	LLNL-AM1	Provide brief trip summary report to NCSP Manager (Q1).	Attend the AMEC 2015 ANSWERS Seminar devoted to radiation shielding, reactor physics and nuclear criticality safety software applications, V&V and R&D.
IRMM Mol, Belgium	Oct-14 Nov-14 Feb-15 Jun-15 Sep-15	ORNL	1	60,000	Perform resonance region nuclear data measurements using GELINA facility at IRMM in accordance with Appendix B of the Five Year Plan (Guber)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q4).	Continues cross-section measurements and the production of new cross-section evaluations with covariance data for U.S.
IRSN Paris, France	Oct-14 Apr-15	ORNL	1	30,000	Perform nuclear data evaluation and testing work with IRSN (Leal)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q1).	Continues cross-section evaluation and testing work with IRSN to provide new cross-section evaluations with covariance data for U.S.
OECD/NEA Paris, France	May-15	ORNL	2	10,000	Participate in WPEC annual meeting as Chair of ENDF Formats Committee, coordinate international nuclear data collaborations for the NCSP, and present NCSP/ORNL nuclear data evaluation work (Dunn, Leal)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q3).	Exchange of information with international nuclear data community to improve NCSP nuclear data evaluations and cultivate new collaborations to support future NCSP nuclear data evaluation work tasks. Also, includes Interim NDAG Chair participation in WPEC meeting.
OECD/NEA Paris, France	Sep-15	ORNL	1	5,000	Participate in WPNCs (Rearden)	ORNL-AM2	Provide brief trip summary report to NCSP Manager (Q4).	Continues NCSP leadership in S/U analysis methods and fosters continued collaboration with international partners to test and improve NCSP S/U analysis capabilities for supporting criticality safety applications.
Dresden, Germany	Dec-14	ORNL	1	5,000	Participate in the WINS nuclear scattering workshop (Leal)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q4).	Participate in the WINS nuclear scattering workshop to present NCSP/ORNL nuclear data scattering work for resonance evaluations and thermal moderator data.
France Argentina	Oct-14 Jun-15	ORNL	1	10,000	Participate in ISO Standards meeting (Bowen).	NCSP-TS7	Provide brief trip summary report to NCSP Manager (Q4).	Participate in ISO Standards meeting (ISO TC85/SC5/WG8) on nuclear criticality safety to ensure US NCSP interests are represented in the international standards development and as succession planning for replacement of Hopper participation (Bowen).
OECD/NEA Paris, France	May-15	RPI	1	4,000	Participate in WPEC annual meeting (Danon)	RPI-ND1	Provide brief trip summary report to NCSP Manager (Q3).	As US Measurements Chair, participate in WPEC annual meeting to present NCSP/RPI nuclear data measurement work (Danon).
Dresden, Germany	Dec-14	RPI	1	5,000	Participate in the WINS nuclear scattering workshop (Danon)	RPI-ND2	Provide brief trip summary report to NCSP Manager (Q4).	Participate in the WINS nuclear scattering workshop to present NCSP/RPI thermal scattering work to address thermal moderator data needs for criticality safety applications.

FYI - NOTE: Any of the above projected foreign travel meetings are and have been confirmed as technical working group meetings and not as conferences.