United States Department of Energy

Nuclear Criticality Safety Program

Five-Year Execution Plan for the Mission and Vision

FY2014 through FY2018

National Nuclear Security Administration

October 2013

Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan for Fiscal Years 2014 through 2018, dated October 2014.

Approved:

Dr. Jerry N. McKamy
Manager
Nuclear Criticality Safety Program

TABLE OF CONTENTS

TABLE OF CONTENTS i

ACRONYMS AND DEFINITIONS ii

1.0 Nuclear Criticality Safety Program Mission and Vision 1
2.0 Technical Program Elements 1
- 2.1 Analytical Methods 4
- 2.2 Information Preservation and Dissemination 14
- 2.3 Integral Experiments 22
- 2.4 Nuclear Data 23
- 2.5 Training and Education 36

3.0 Criticality Safety Support Group 46
4.0 NCSP Technical Support 47

APPENDICES

Appendix A Work Authorization Statements for Fiscal Year 2014 A-1

Appendix B Nuclear Data B-1

Appendix C Fiscal Year 2014 Projected Foreign Travel C-1

ACRONYMS AND DEFINITIONS

ACE	"A Compact ENDF" file
AM	Analytical Methods
AMPX	Nuclear cross-section processing code
ANL	Argonne National Laboratory
ARH	Atlantic Richfield Hanford
BNL	Brookhaven National Laboratory
COG[1]	Lawrence Livermore National Laboratory Monte Carlo Computer Code
CritView	A plotting and interpolation software program designed to display criticality data from the ARH-600 Criticality Handbook
CSCT	Criticality Safety Coordinating Team
CSE	Criticality Safety Evaluation
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)
ESN	Enterprise Secure Network
FFTF	Fast Flux Test Facility
FY	Fiscal Year
GELINA	Linear Accelerator in Geel, Belgium
GForge	Web-based collaborative development environment
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[2]	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
NCSP	Nuclear Criticality Safety Program
NCSU	North Carolina State University
ND	Nuclear Data
NDAG	Nuclear Data Advisory Group
NDR	Nuclear Data Request
NJOY	Nuclear cross-section processing code
NNDC	National Nuclear Data Center
NNSA	National Nuclear Security Administration
NNSS	Nevada Nuclear Security Site

OECD/NEA	Organization for Economic Cooperation and Development/Nuclear Energy Agency
ORNL	Oak Ridge National Laboratory
POC	Point of Contact
PREPRO	Nuclear cross-section processing code
RPI	Renssalaer Polytechnic Institute
RSICC	Radiation Safety Information Computational Center
SAMMY[3]	A nuclear model computer code
SCALE[4]	A modular modeling and simulation system for nuclear safety analysis and design
SNL	Sandia National Laboratories
SQA	Software Quality Assurance
S/U	Sensitivity/Uncertainty
TACS	Training Assembly for Criticality Safety
TRG	Technical Review Group
TSUNAMI	Tool for Sensitivity and Uncertainty Analysis Methodology Implementation
TSURFER[5]	Tool for Sensitive and Uncertainty Analysis of Response Functionals Using Experimental Results
V&V	Verification and Validation
VIM	Argonne National Laboratory Monte Carlo neutron/proton transport code
WPEC	Working Party on International Nuclear Data Evaluation Corporation
WPNCS	Working Party on Nuclear Criticality Safety

[1]COG 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.

[2]KENO 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.

[3]SAMMY 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.

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

[5]TSURFER is a module of the SCALE code system that performs a generalized linear least squares adjustment of cross-section data to produce consistency between calculated and experimental results. When coupled with TSUNAMI sensitivity data for a criticality safety application, the adjusted cross-section data can be used to predict a computational bias and its uncertainty.

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 Udenta 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

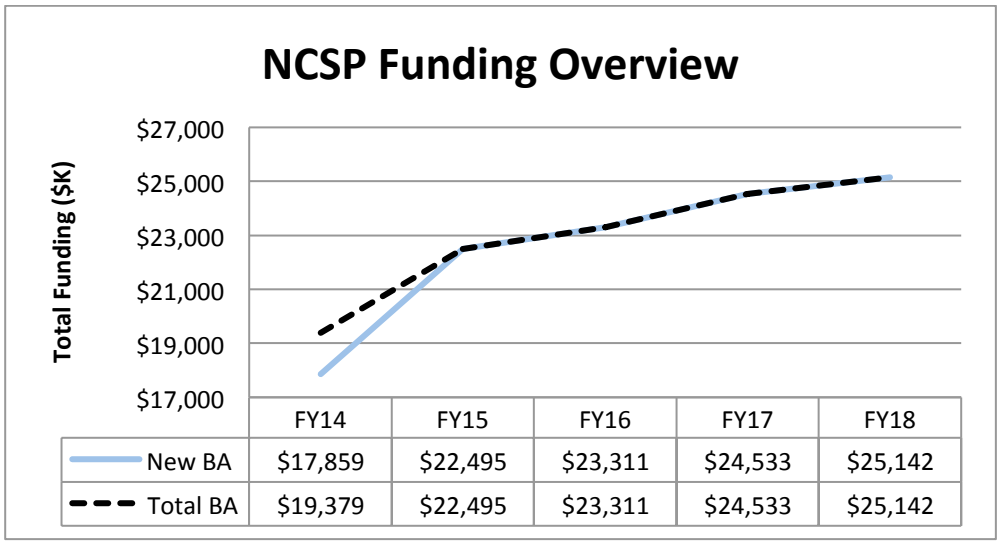
NCSP includes the following five technical program elements:

- 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.

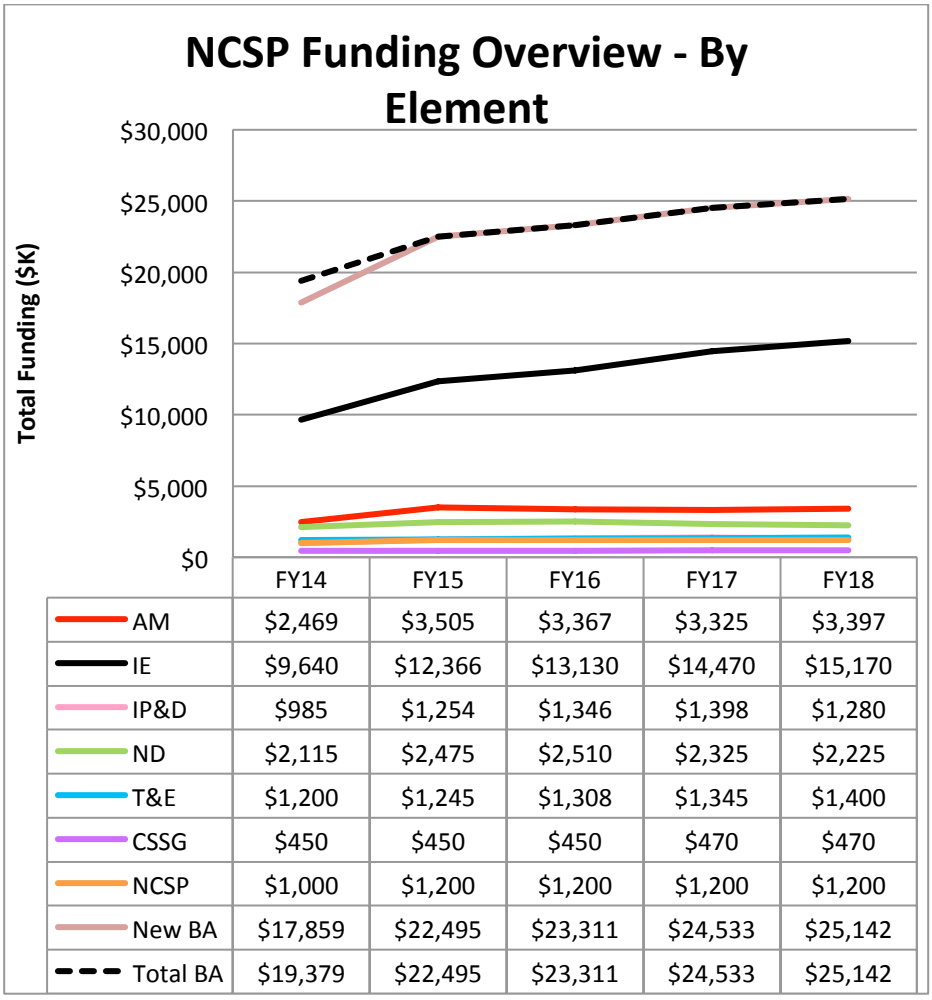
Funding for NCSP activities are shown in Tables 2.1, 2.2, and 2.3 (rounded to the nearest $K).

Table 2.1 NCSP Funding Overview



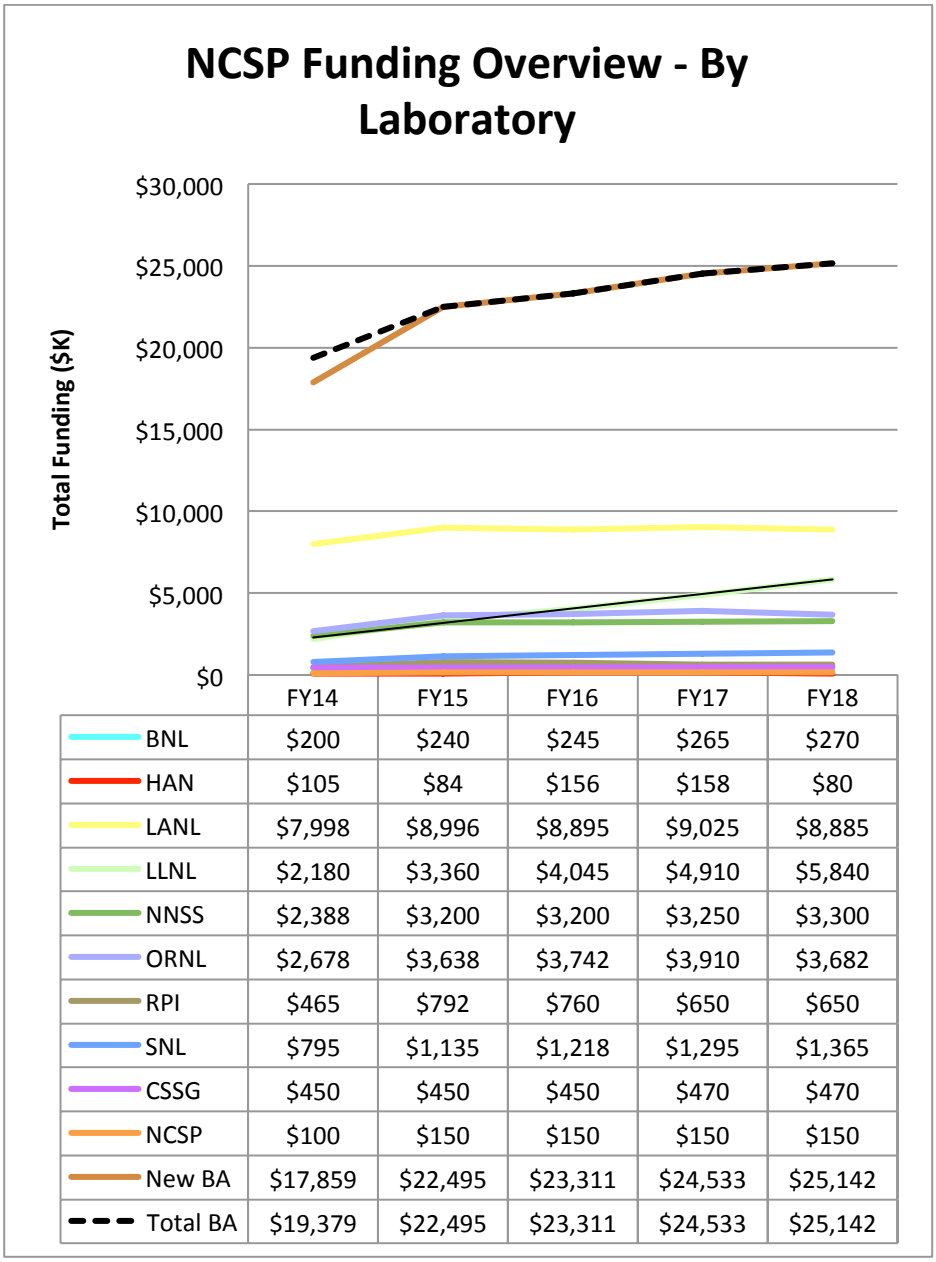
	FY14	FY15	FY16	FY17	FY18
New BA	$17,859	$22,495	$23,311	$24,533	$25,142
Total BA	$19,379	$22,495	$23,311	$24,533	$25,142

Table 2.2 NCSP Funding Overview – By Element



	FY14	FY15	FY16	FY17	FY18
AM	$2,469	$3,505	$3,367	$3,325	$3,397
IE	$9,640	$12,366	$13,130	$14,470	$15,170
IP&D	$985	$1,254	$1,346	$1,398	$1,280
ND	$2,115	$2,475	$2,510	$2,325	$2,225
T&E	$1,200	$1,245	$1,308	$1,345	$1,400
CSSG	$450	$450	$450	$470	$470
NCSP	$1,000	$1,200	$1,200	$1,200	$1,200
New BA	$17,859	$22,495	$23,311	$24,533	$25,142
Total BA	$19,379	$22,495	$23,311	$24,533	$25,142

Table 2.3 NCSP Funding Overview – By Laboratory



	FY14	FY15	FY16	FY17	FY18
BNL	$200	$240	$245	$265	$270
HAN	$105	$84	$156	$158	$80
LANL	$7,998	$8,996	$8,895	$9,025	$8,885
LLNL	$2,180	$3,360	$4,045	$4,910	$5,840
NNSS	$2,388	$3,200	$3,200	$3,250	$3,300
ORNL	$2,678	$3,638	$3,742	$3,910	$3,682
RPI	$465	$792	$760	$650	$650
SNL	$795	$1,135	$1,218	$1,295	$1,365
CSSG	$450	$450	$450	$470	$470
NCSP	$100	$150	$150	$150	$150
New BA	$17,859	$22,495	$23,311	$24,533	$25,142
Total BA	$19,379	$22,495	$23,311	$24,533	$25,142

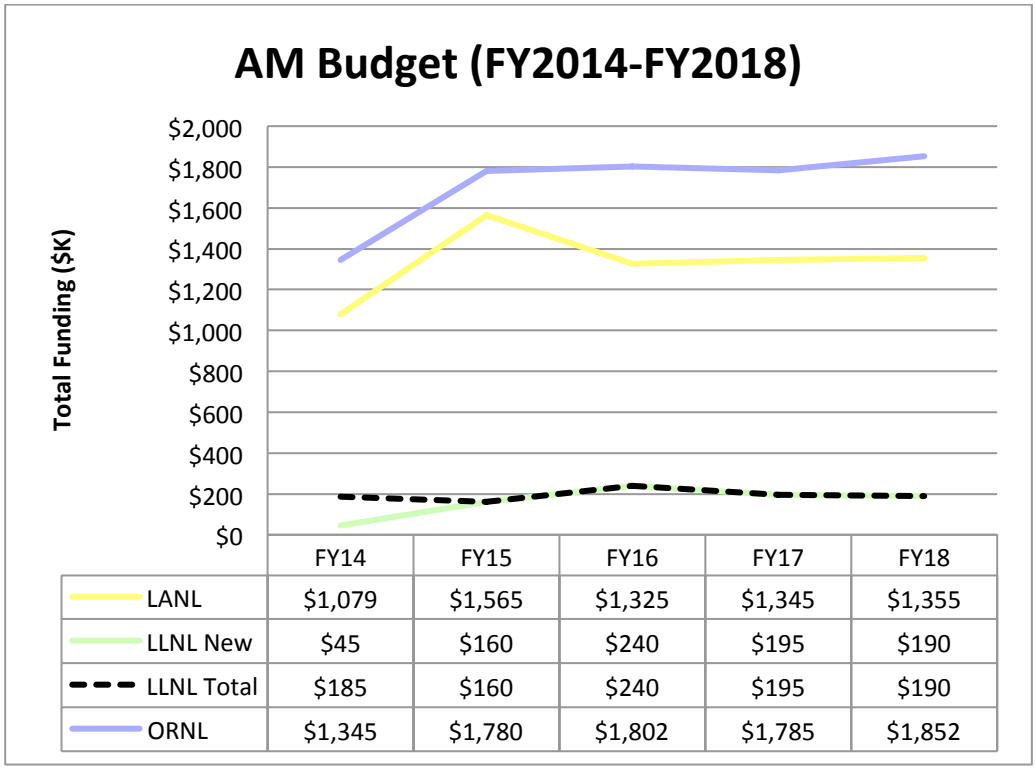
Finally, the goal of the NCSP is to provide "transparent responsiveness" for the DOE and Stakeholders. Therefore, this Plan and all accomplishments achieved under the auspices of the NCSP are posted in a timely manner on the NCSP website at: http://ncsp.llnl.gov/.

2.1 Analytical Methods (AM)

2.1.1 Program Element Description

The Analytical Methods (AM) 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 (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LANL	$1,079	$1,565	$1,325	$1,345	$1,355
LLNL New	$45	$160	$240	$195	$190
LLNL Total	$185	$160	$240	$195	$190
ORNL	$1,345	$1,780	$1,802	$1,785	$1,852

2.1.2 Approved Tasks

2.1.2.1 Los Alamos National Laboratory (LANL)

LANL AM1 ($750K)
Maintenance of the basic capabilities for performing Nuclear Criticality Safety calculations with MCNP, including general code maintenance, user support, improved nuclear data libraries, Verification and Validation (V&V), documentation, user training, and implementation of limited new capabilities. For all tasks, LANL reports will be issued and posted on the MCNP website (http://mcnp.lanl.gov/)

LANL AM2 ($94K)
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, particularly for the new NJOY2012 version of the code. All NJOY updates will be distributed to users through a LANL maintained website (http://t2.lanl.gov/nis/codes.shtml).

LANL AM3 ($235K)
This task is to further MCNP development during Fiscal Year (FY) 13-15 with the goal to provide the capability to extract uncertainties in the k-eigenvalue from ENDF covariance data. The scope of the work is to: define "A Compact ENDF" file (ACE) format for covariance data, modify NJOY to process ENDF covariance data into the ACE format, provide ACE covariance data libraries using the most recent ENDF evaluations, develop a post-processing capability for the data in MCNP (a continuous-energy sensitivity capability already exists), and provide documentation, instructions, and verification reports released on the MCNP website.

Table 2.1-2 LANL AM Budget Trend (FY2014-FY2018)

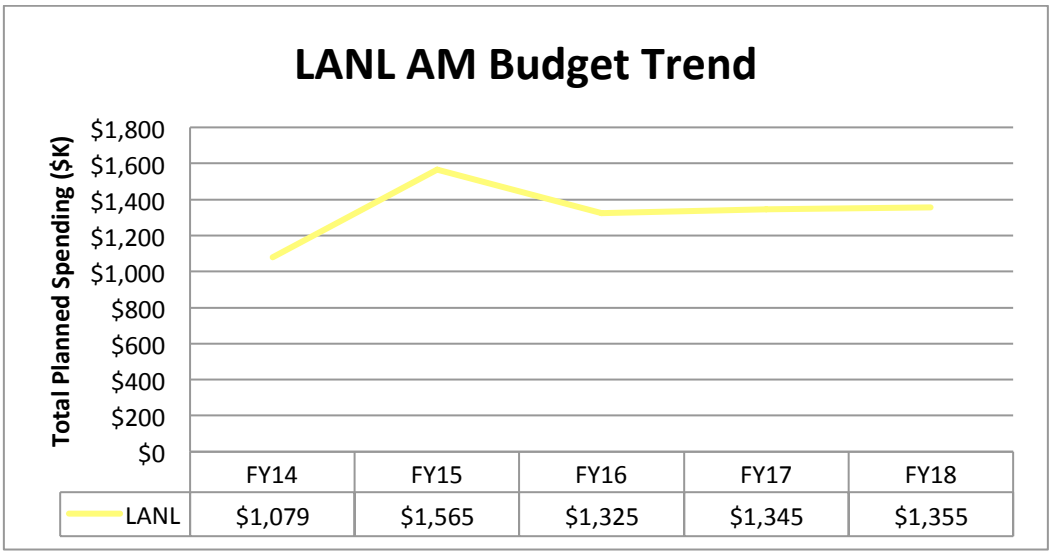
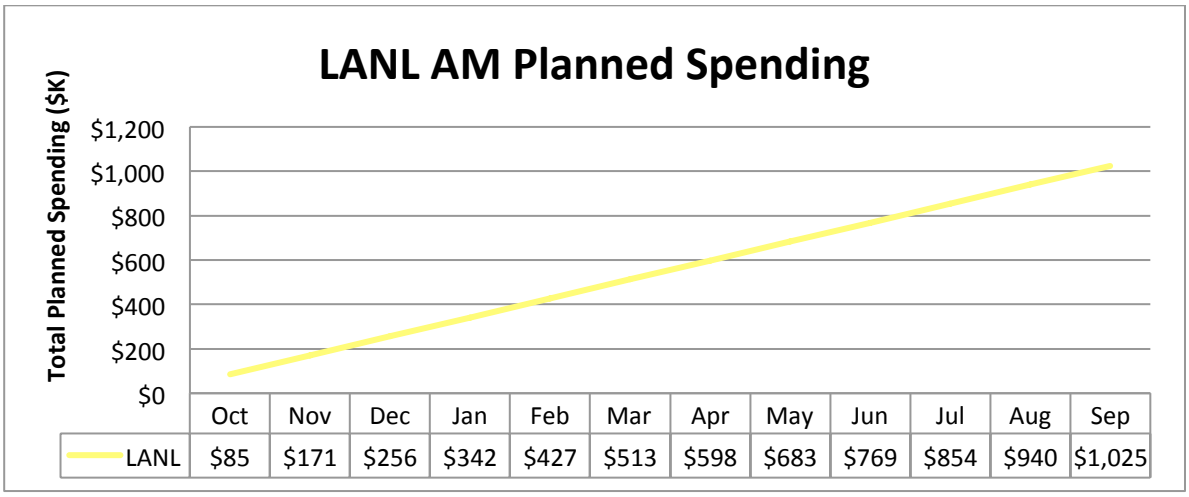


Table 2.1-3 LANL AM Planned Spending (FY2014)



LANL AM Milestones:

Occurs all 4 Quarters

- Participate in planning and development of new radiation damage models as proposed by the International Atomic Energy Agency (IAEA) Radiation Damage CRP and provide a summary report to NCSP Manager (T2: All Qtrs).
- Provide end-User consultation on NJOY code usage (T2: All Qtrs).

Quarter 1

- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the OECD/NEA Working Party on Nuclear Criticality Safety and various Expert Groups (T1: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo (T1: Q1).
- Develop the capability to create new (Version 2.0.0) ACE formatted files for use by MCNP6 (T2: Q1).

Quarter 2

- Issue an MCNP V&V report (T1: Q2).
- Produce training slides on use of the new sensitivity features in MCNP for NCSP DOE onsite instruction (T3: Q2).

Quarter 3

- Provide one on-site class at DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (T1: Q3).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the OECD/NEA Working Party for Evaluation Cooperation (WPEC) and various subgroups (T2: Q3).

Quarter 4

- Improve the MCNP capabilities for convergence acceleration using the fission matrix method (T1: Q4).
- Issue report on MCNP testing on the latest computer platforms (T1: Q4).
- Demonstrate MCNP capability for burn up credit calculations and provide a summary report to the NCSP Manager (T1: Q4).
- Release quality-assured MCNP neutron cross-section library for high-priority materials to Radiation Safety Information Computational Center (RSICC) (T1: Q4).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the International Conference on Reactor Physics (T1: Q4).
- Release NJOY code updates required to process incremental upgrades to ENDF-6 formats, as implemented in US and international general purpose and specialized nuclear data files (T2: Q4).
- Develop a branch of MCNP capable of reading ACE covariance data and computing uncertainties in k-eigenvalue (T3: Q4).
- Produce beta versions of ACE covariance data for major actinides and other important isotopes with modified NJOY (T3: Q4).
- Create and publish, on the MCNP website, a progress report on NJOY and MCNP modifications for sensitivity/uncertainty analysis (T3: Q4).

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

Increase in FY15 for code modernization efforts. Very modest increases in out years to help mitigate increased cost of doing business.

2.1.2.2 Lawrence Livermore National Laboratory (LLNL)

*FY13 Supplemental Funding dispersed to LLNL in FY13Q4 for FY14 task completion.

LLNL AM1 ($45K [$185K total*])
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 methods. This task also supports on-going LLNL assistance to the IAEA in developing and maintaining the PREPRO nuclear data processing code system as needed to process and distribute new general-purpose nuclear data files in the evolving ENDF-6 format. The task also supports participation in NCSP activities including the Cross Section Evaluation Working Group (CSEWG) and Nuclear Data Advisory Group (NDAG).

Table 2.1-4 LLNL AM Budget Trend (FY2014-FY2018)

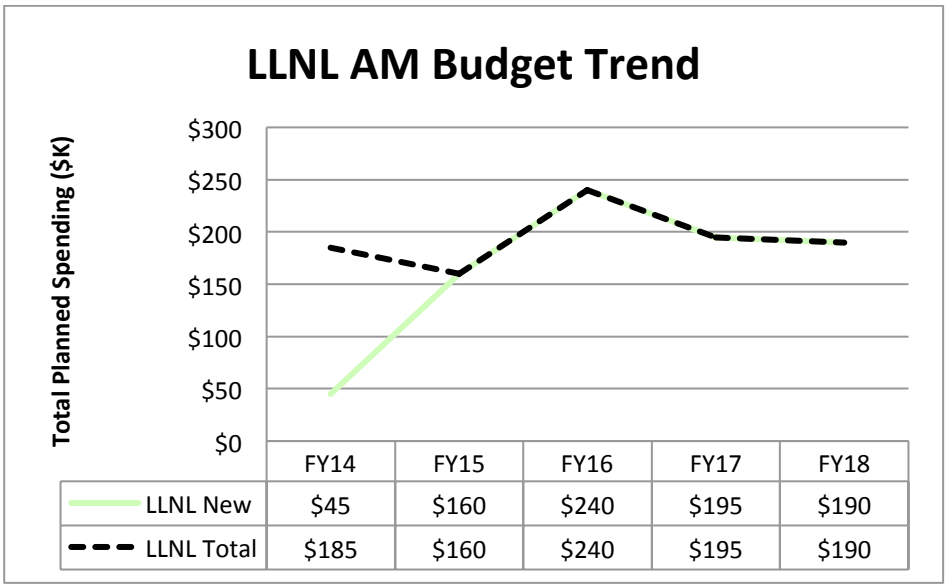
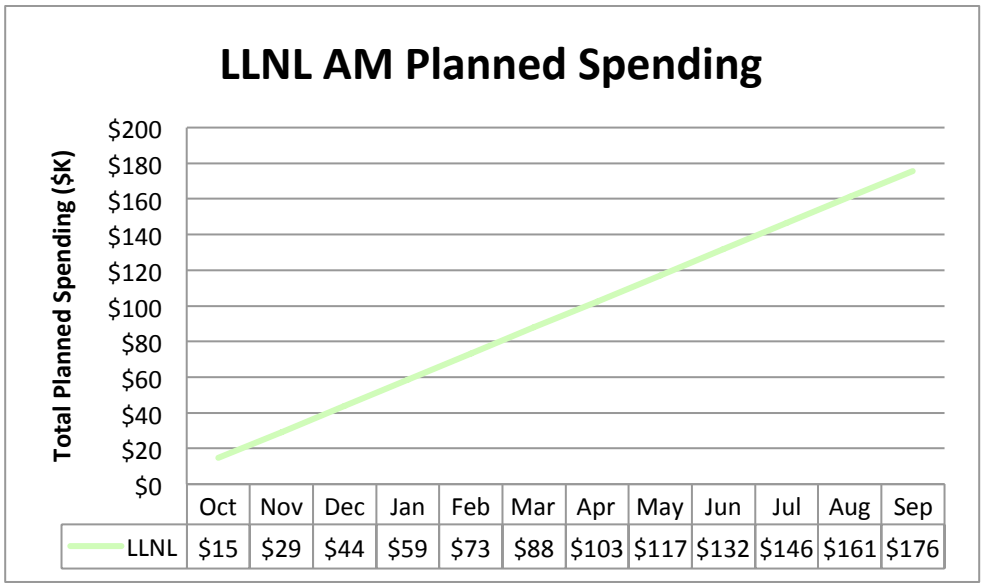


Table 2.1-5 LLNL AM Planned Spending (FY2014)



LLNL AM Milestones:

Quarter 1

- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the Expert Group meeting on Excursion Analysis and its associated WPNCS governance meeting (T1: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the Expert Group meeting on Burn-up Credit and its associated WPNCS governance meeting (T1: Q1).

Quarter 3

- Release COG supplemental library (or COG update, if required) with ENDL2011 and MCNP6.1 ENDF/B-VII.1 (ZAID.71c) nuclear data libraries (T1: Q3).

Quarter 4

- Use PREPRO to process and test ENDF/B-VII.2 preliminary data in support of the next release of the national nuclear data library (T1: Q4).

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

Mid-years ramp up for the development of a Criticality Slide Rule for Plutonium Systems. Overall increase for FY15-18 from FY14 is normal level of funding to maintain COG capabilities with FY14 funding reduction due to Supplemental Funding in FY13 and carryover.

2.1.2.3 Oak Ridge National Laboratory (ORNL)

ORNL AM1 ($360K)
RSICC ongoing approved task to collect, update, package, and distribute software and associated nuclear data libraries to the criticality safety community (i.e., SCALE, MCNP, VIM, and COG and nuclear data processing (i.e., NJOY, AMPX and SAMMY). Also, test and disseminate processed nuclear data associated with the software.

ORNL AM2 ($655K)
Ongoing, approved task to provide SCALE/KENO/TSUNAMI maintenance and user support for performing Nuclear Criticality Safety (NCS) calculations with the SCALE package. Work tasks include: sustaining and continually improving SCALE Nuclear Criticality Safety (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 (http://scale.ornl.gov/).

ORNL AM3 ($280K)
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 AM12 ($50K)
This is new work with the University of Tennessee to do sensitivity calculations for documented ICSEBP evaluations using the VALID Procedure. The task will identify an appropriate set of documented ICSEBP evaluations that would benefit from having reactivity and sensitivity calculations performed and documented.

Table 2.1-6 ORNL AM Budget Trend (FY2014-FY2018)

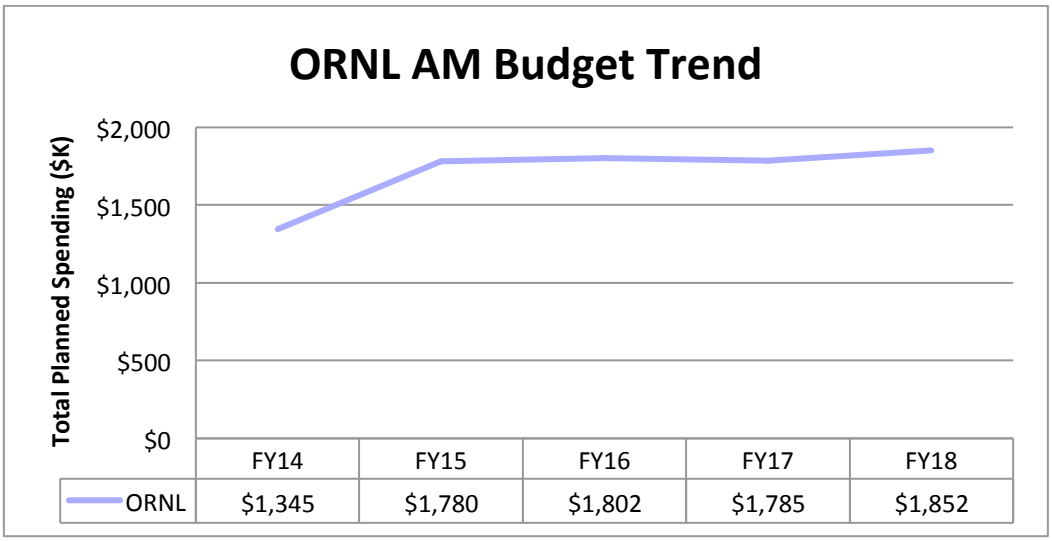
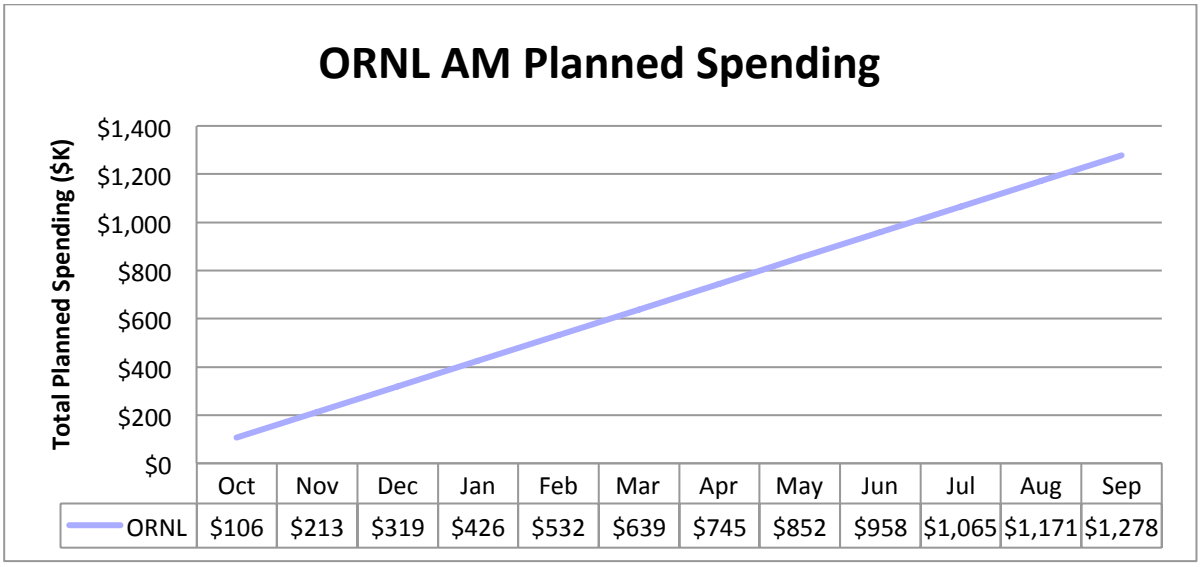


Table 2.1-7 ORNL AM Planned Spending (FY2014)



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 (T1: All Qtrs).

Quarter 1

- Issue an annual SCALE maintenance report to the NCSP Manager (T2: Q1).
- Document AMPX modernization and technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (T3: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the Working Party on Nuclear Criticality Safety (WPNCS) EG meeting on uncertainty analysis (T2: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the SNA+MC meeting (T2: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the WPEC Subgroup 38 meeting to develop a new international ENDF/B nuclear data format (T3: Q1).

Quarter 2

- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (T2: Q2).

Quarter 4

- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (T2: Q4).
- Participate in Expert Groups related to analytical methods that are import to criticality safety, including the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) expert groups on uncertainty analyses for criticality safety assessment. (T2: Q4).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the WPNCS EG meeting on uncertainty analysis (T2: Q4).
- Document status of sensitivity calculations for documented ICSEBP evaluations using the VALID Procedure activities and provide report to the NCSP Manager (T12: Q4).

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

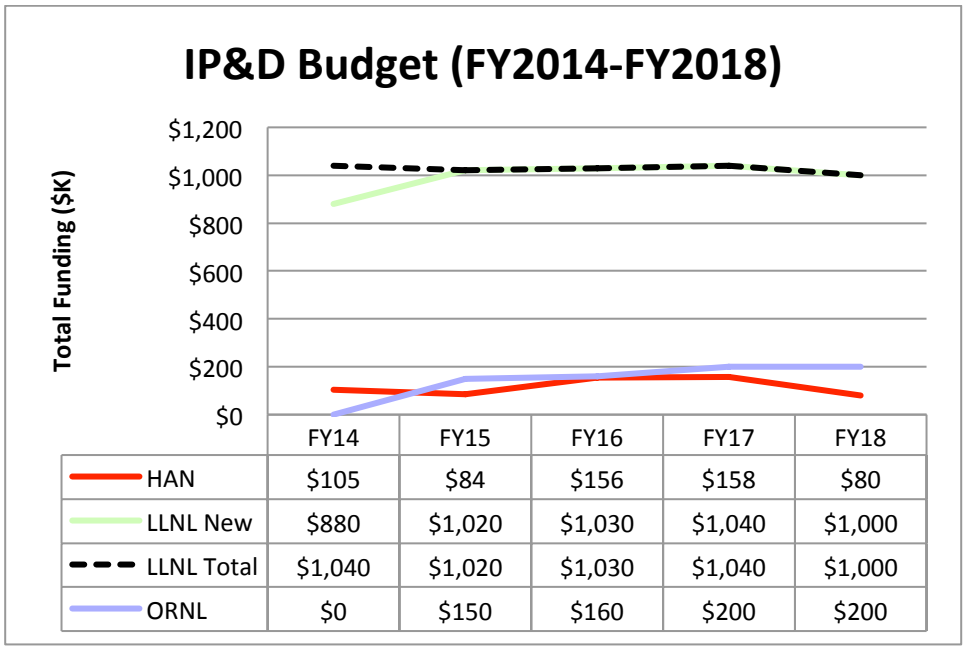
The ORNL AM budget includes incremental increases for inflation in the out years for RSICC and SCALE Maintenance tasks. An additional new subtask begins in FY15 and FY16 to develop a "handheld" NCS SlideRule App for deployment on a handheld device such as a smartphone or tablet PC ($40K and $80K in FY15 and FY16, respectively).

2.2 Information Preservation and Dissemination (IP&D)

2.2.1 Program Element Description

The Information Preservation and Dissemination (IP&D) 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 (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
HAN	$105	$84	$156	$158	$80
LLNL New	$880	$1,020	$1,030	$1,040	$1,000
LLNL Total	$1,040	$1,020	$1,030	$1,040	$1,000
ORNL	$0	$150	$160	$200	$200

2.2.2 Approved Tasks

2.2.2.1 Hanford

Hanford IP&D1 ($40K)
Modify data in the CritView database to conform with user requests. Perform V&V and issue documentation on the revised database. Maintain and upgrade CritView as funding permits and provide limited response to user queries and any error identification.

Hanford IP&D2 ($65K)
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 will also develop a data record matrix for isotopes and reactors. This task will also support data preservation for these archived data.

Table 2.2-2 Hanford IP&D Budget Trend (FY2014-FY2018)

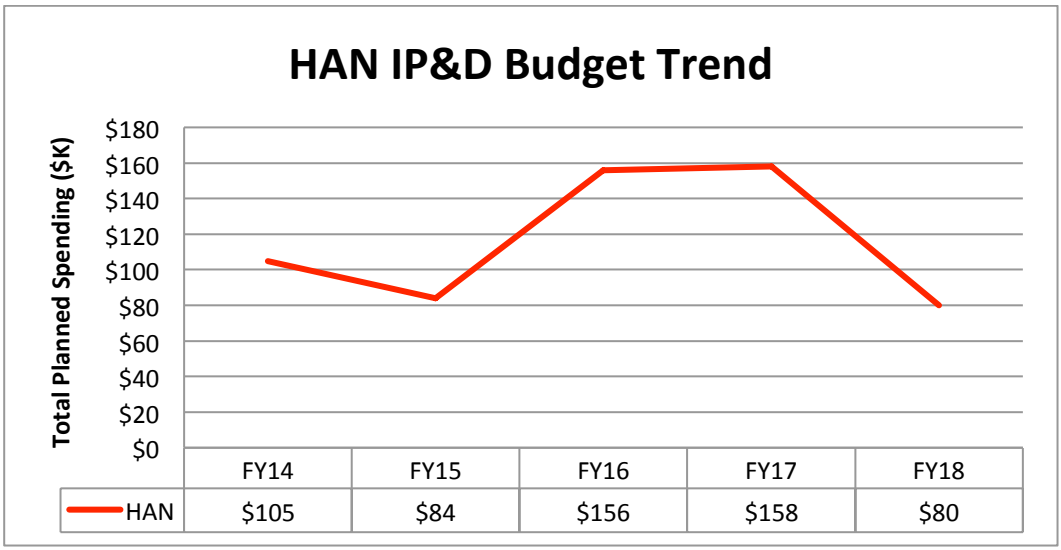
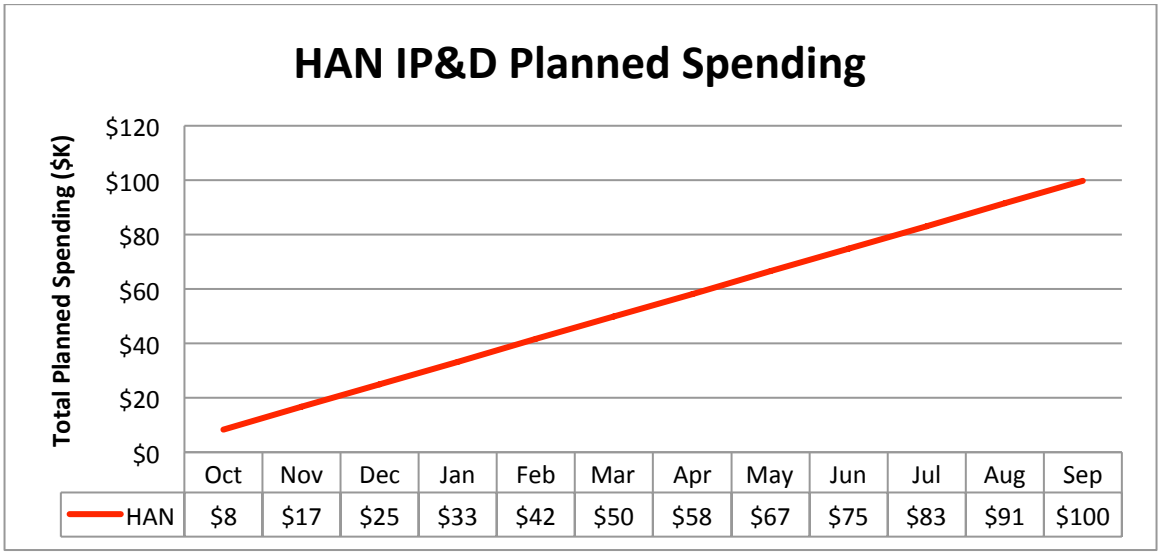


Table 2.2-3 Hanford IP&D Planned Spending (FY2014)



Hanford IP&D Milestones:

Quarter 2

- Provide updated CritView database file and associated documentation to address user identified issues to LLNL for posting on the NCSP website (T1: Q2).
- Update existing compilation of data (reactor and special test), issue data compilation report, and provide report on NCSP website (T2: Q2).

Quarter 4

- Provide beta test version of updated CritView code and associated database file to LLNL for limited distribution (T1: Q4).
- Issue letter report for data from Fast Flux Test Facility (FFTF) operations and special tests and possible benchmark listing for posting on NCSP website (T2: Q4).

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

Variances in out-year funding levels reflect funding changes to the continuing tasks (Hanford IP&D1 and Hanford IP&D2) and two new tasks. The ARH-600 task (Hanford IP&D1) is planned to restart in FY2014 at the $40K funding level and increase to $44K in FY2015. The ARH-600 task has an increase in its approved FY16 through FY18 budget ($76K, $78K and $80K, respectively), above the maintenance level funding, to support a modification to the CritView code to handle data points such as from LA-10860 and make the code interface more user friendly. The Obtaining Integral Actinide Cross Sections from Reactor Operations and Special Test Data task (Hanford IP&D2) ends after FY15 and has approved funding of $40K for fiscal year FY15. A new task is identified to start in FY16.

A Smartphone App for Dissemination of Criticality Safety Handbook Data in the Field task is currently a new task proposed that was proposed in FY2012. The requested funding for this task is $80K for two fiscal years and proposed to start in FY16.

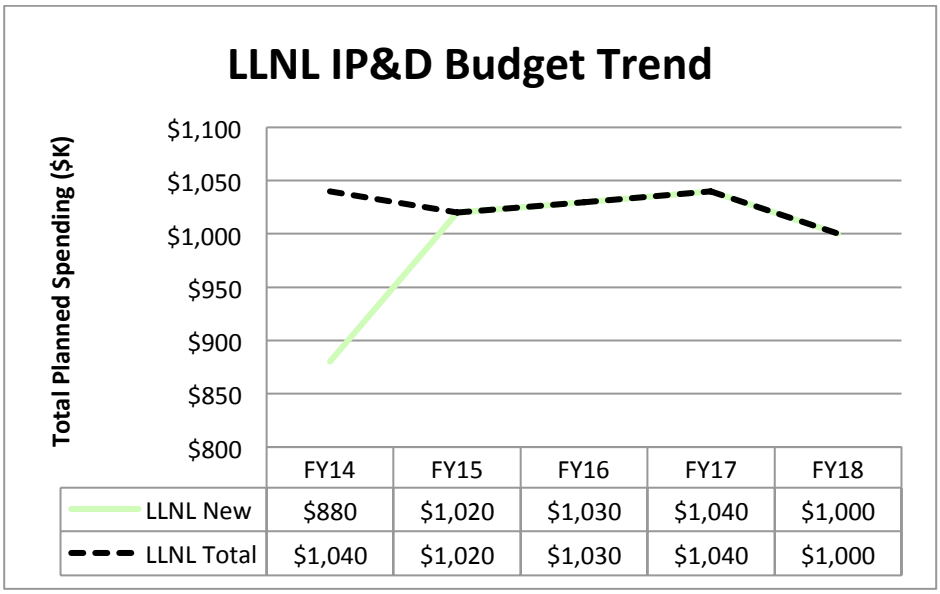
2.2.2.2 Lawrence Livermore National Laboratory (LLNL)

*FY13 Supplemental Funding dispersed to LLNL in FY13Q4 for FY14 task completion.

LLNL IP&D1 ($230K [$390K total*])
Ongoing approved activity 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&D Subtask 1 will also provide leadership, coordination, and publication support for the OECD/NEA International Criticality Safety Benchmark Evaluation Project (ICSBEP).

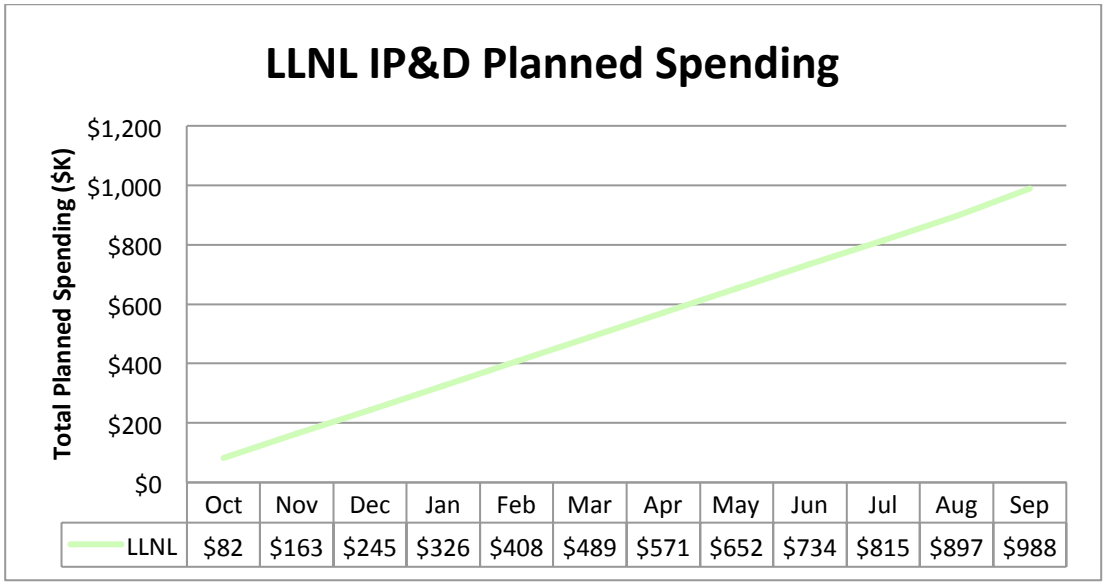
LLNL IP&D2 ($650K)
Ongoing approved activities for operation and maintenance of both unclassified and classified NCSP websites. The NCSP websites are the central focal point for access to criticality safety information collected under the NCSP, and are the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources. This task also provides operations and maintenance for information technology supporting the National Criticality Experiments Research Center (NCERC) (e.g., "Red" network).

Table 2.2-4 LLNL IP&D Budget Trend (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LLNL New	$880	$1,020	$1,030	$1,040	$1,000
LLNL Total	$1,040	$1,020	$1,030	$1,040	$1,000

Table 2.2-5 LLNL IP&D Planned Spending (FY2014)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
LLNL	$82	$163	$245	$326	$408	$489	$571	$652	$734	$815	$897	$988

LLNL IP&D Milestones:

Occurs all 4 Quarters

- Provide additional member support throughout the C_EdT process for experiments selected for ICSBEP publication (T1: All Qtrs).
- Provide external review and assist evaluators and their internal reviewers in finalizing and publishing ICSBEP evaluations per schedule specified in the Integral Experiments Section of the Five-Year Execution Plan, Appendix A, Integral Experiments GANTT Charts (T1: All Qtrs).
- Coordinate with the OECD NEA for ICSBEP activities (T1: All Qtrs).
- Maintain and develop ICSBEP web content (T1: All Qtrs).
- Maintain, operate and develop both unclassified and classified NCSP websites and "Red" network (T2: All Qtrs).
- Maintain and assist users in establishing classified Enterprise Secure Network (ESN) connectivity from NNSA sites to classified NCSP website (T2: All Qtrs).
- Maintain and develop both unclassified and classified Integral Experiment Request (IER) forms and Nuclear Data Request (NDR) forms (T2: All Qtrs).
- Digitize and archive unclassified and classified hardcopy bibliography reports starting with the LLNL hardcopy report collections (T2: All Qtrs).
- Maintain and develop the searchable LLNL, Hanford and Criticality Safety Evaluation (CSE) databases (T2: All Qtrs).

Quarter 1

- Deploy ICSBEP content received from OECD/NEA on the NCSP website (T1: Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the Monte Carlo Codes invited session of the SNA+MC meeting (T2: Q1).

Quarter 3

- Hold annual ICSBEP TRG meeting (T1: Q3).
- Provide brief trip summary report to NCSP Manager from annual ICSBEP TRG meeting (T1: Q3).

Quarter 4

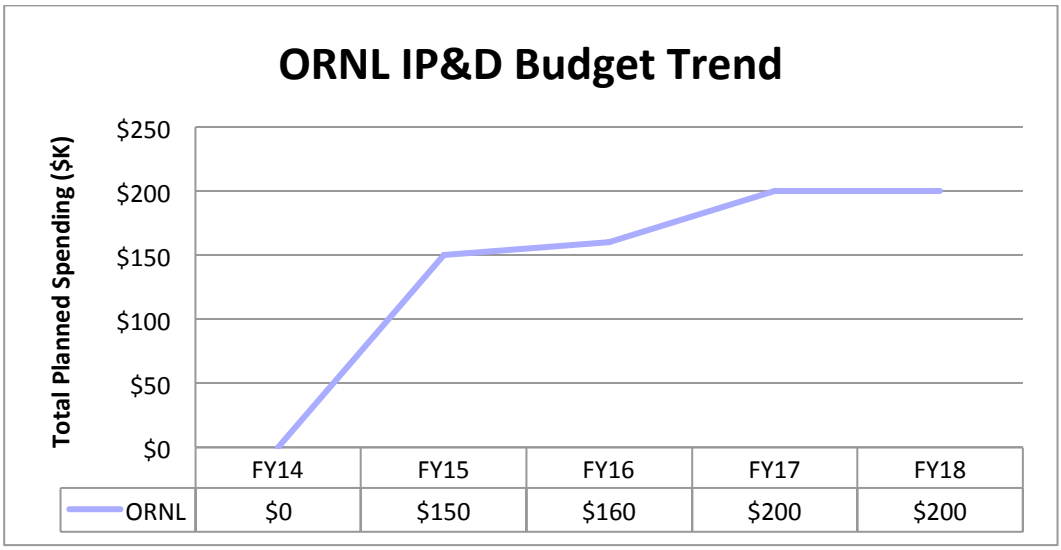
- Provide publication support to OECD/NEA as required to assist in completion, replication and distribution of the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (T1: Q4).

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

Overall increase for FY15-18 from FY14 is normal level of funding to maintain LLNL IP&D capabilities with FY14 funding reduction due to Supplemental Funding in FY13. Very modest increases in out years to help mitigate increased cost of doing business. Modest decrease in FY18 due to lower level of IERs.

2.2.2.3 Oak Ridge National Laboratory (ORNL)

Table 2.2-6 ORNL IP&D Budget Trend (FY2014-FY2018)



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

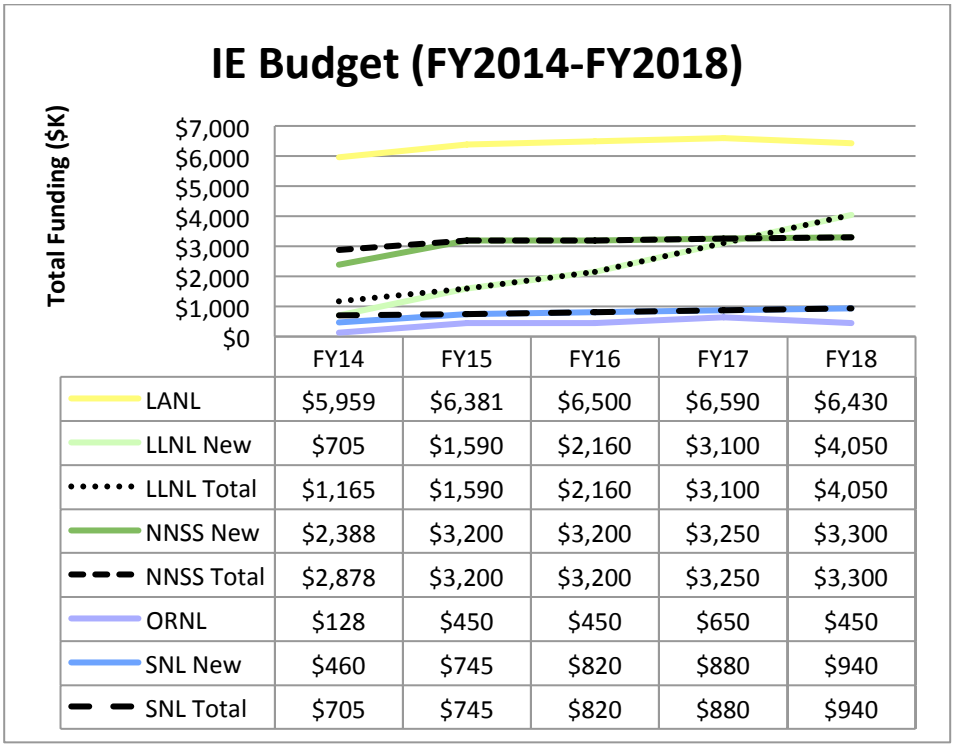
There is no funding in FY14 for IP&D. Increase in FY15 for generating sensitivity data files and corresponding verified SCALE input files for new ICSBEP FY14 and 15 evaluations and the development of experimental correlation data for distribution through ICSBEP. Very modest increases in out years to help mitigate increased cost of doing business.

2.3 Integral Experiments (IE)

2.3.1 Program Element Description

The Integral Experiments (IE) 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 (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LANL	$5,959	$6,381	$6,500	$6,590	$6,430
LLNL New	$705	$1,590	$2,160	$3,100	$4,050
LLNL Total	$1,165	$1,590	$2,160	$3,100	$4,050
NNSS New	$2,388	$3,200	$3,200	$3,250	$3,300
NNSS Total	$2,878	$3,200	$3,200	$3,250	$3,300
ORNL	$128	$450	$450	$650	$450
SNL New	$460	$745	$820	$880	$940
SNL Total	$705	$745	$820	$880	$940

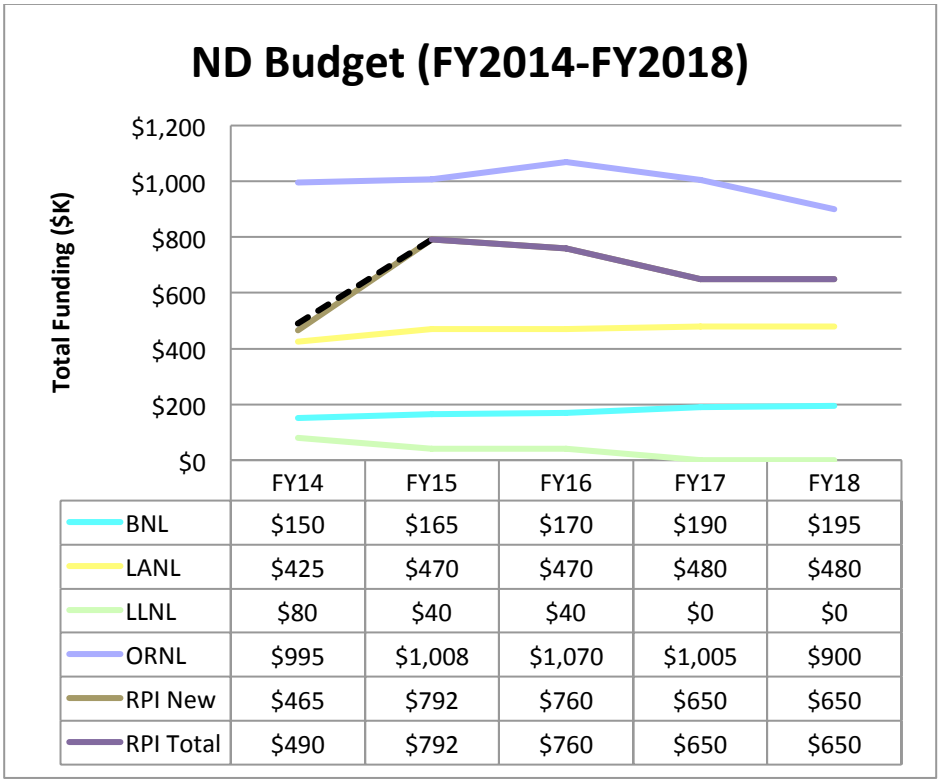
All Integral Experiment tasks and milestones are published as a standalone document. Contact the NSCP Program Manager, Dr. Jerry McKamy, if you have a 'Need-to-Know.'

2.4 Nuclear Data (ND)

2.4.1 Program Element Description

The Nuclear Data (ND) 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 FY2014 through FY2018 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 (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
BNL	$150	$165	$170	$190	$195
LANL	$425	$470	$470	$480	$480
LLNL	$80	$40	$40	$0	$0
ORNL	$995	$1,008	$1,070	$1,005	$900
RPI New	$465	$792	$760	$650	$650
RPI Total	$490	$792	$760	$650	$650

2.4.2 Approved Tasks

2.4.2.1 Brookhaven National Laboratory (BNL)

BNL ND1 ($150K)

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. This is an approved ongoing task.

Table 2.4-2 BNL ND Budget Trend (FY2014-FY2018)

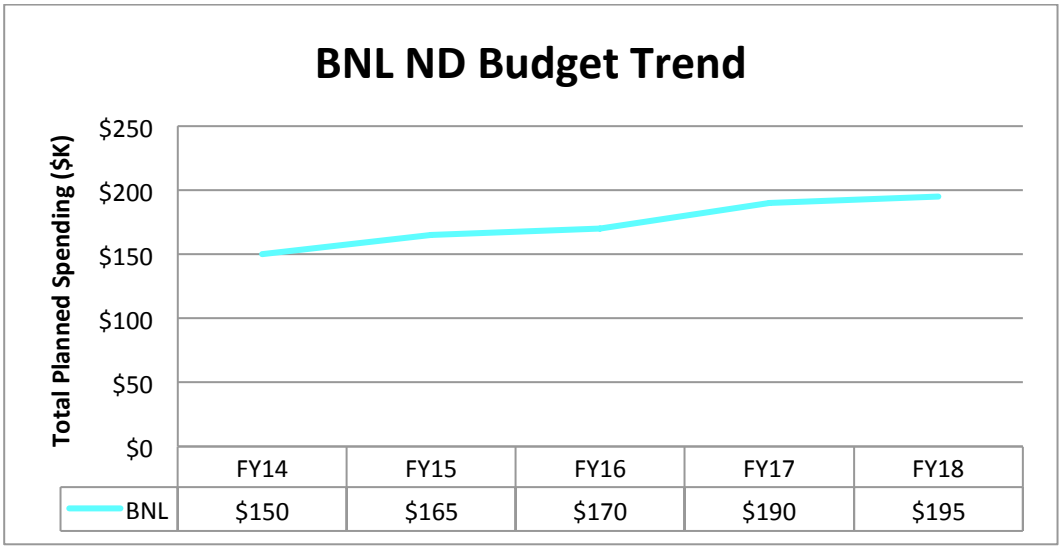
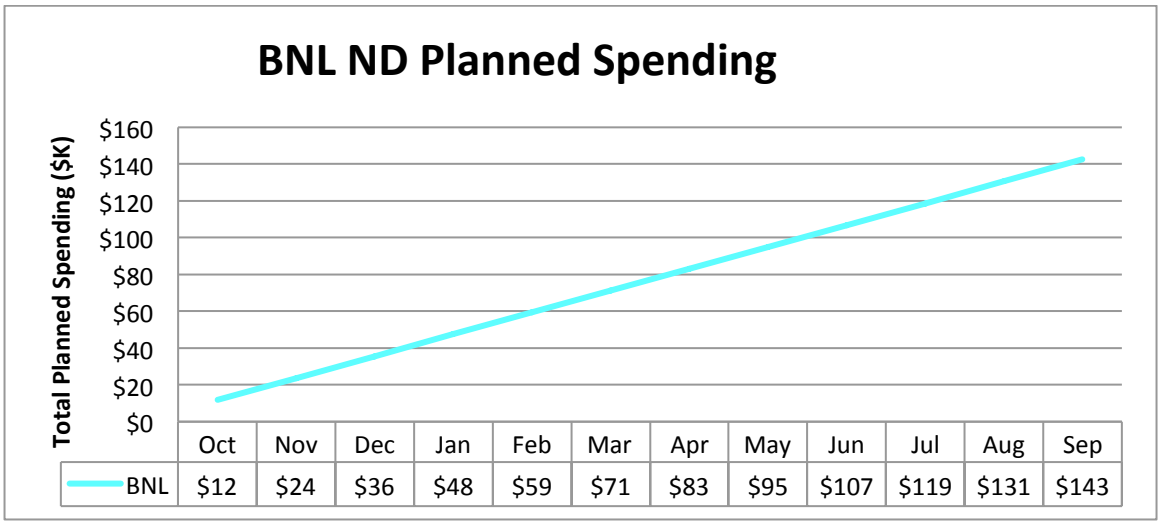


Table 2.4-3 BNL ND Planned Spending (FY2014)



BNL ND Milestones:

Occurs all 4 Quarters

- Perform data verification of new NCSP evaluations, store them in the GForge server and perform quality assurance on the data mean values and covariances using the ADVANCE continuous integration system. (T1: All Qtrs).

Quarter 2

- Maintain and upgrade ADVANCE per user requests: improve NJOY, Fudge and PREPRO processing (T1: Q2, Q4).
- Submit journal article describing the ADVANCE code system (T1: Q2).
- If mandated by CSEWG, release new ENDF library (T1: Q2).

Quarter 4

- Open source release of ADVANCE code system (T1: Q4).

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

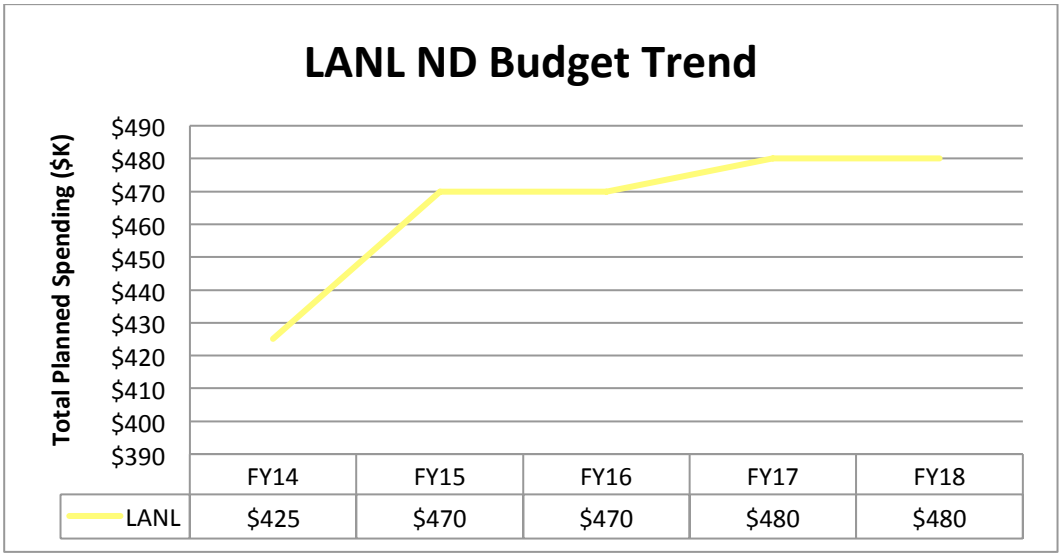
Very modest increases in out years to help mitigate increased cost of doing business.

2.4.2.2 Los Alamos National Laboratory (LANL)

LANL ND1 ($425K)

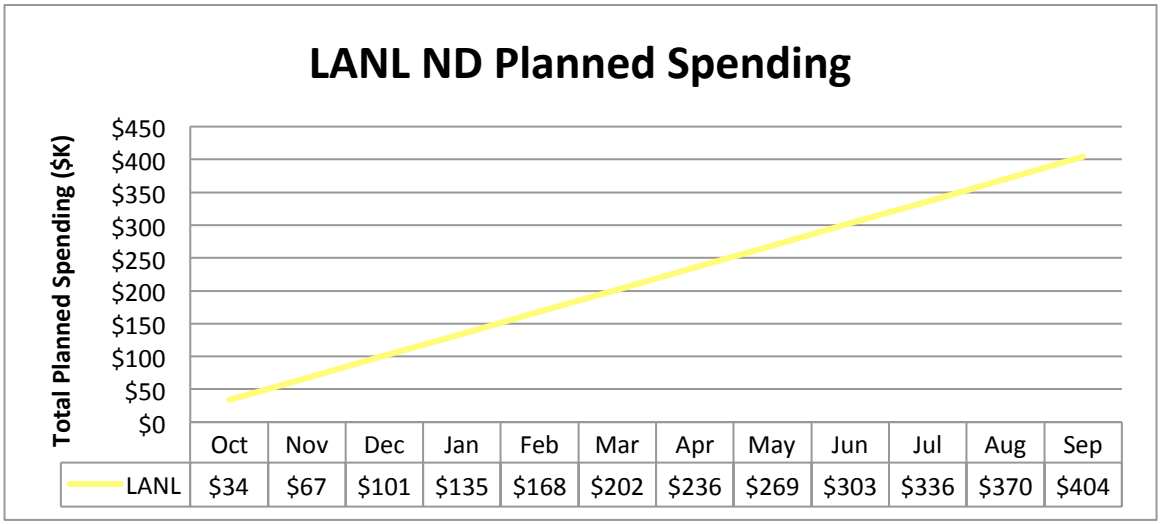
Provide differential data evaluation and covariance development in the energy region above the resonance range for heavy elements (often in partnership with resonance-range work from ORNL), and over the entire ENDF energy range for light elements. Particular focus will be on neutron fission. Perform data testing analysis with new evaluated sets. Contribute to NDAG, CSEWG, and the Working Party on International Nuclear Data Evaluation Corporation (WPEC).

Table 2.4-4 LANL ND Budget Trend (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LANL	$425	$470	$470	$480	$480

Table 2.4-5 LANL ND Planned Spending (FY2014)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
LANL	$34	$67	$101	$135	$168	$202	$236	$269	$303	$336	$370	$404

LANL ND Milestones:

Occurs all 4 Quarters

- Provide status reports on all nuclear data activities in NCSP Quarterly Progress Reports (T1: All Qtrs).

Quarter 2

- Deliver updated high-energy evaluations for Cu-63 and Cu-65 to NNDC (T1: Q2).

Quarter 4

- Deliver multiplicity-dependent fission spectra for U-235, U-238, and Pu-239 (T1: Q4).

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

Increase in FY15 to retain LANL capacity to perform ND work. Very modest increases in out years to help mitigate increased cost of doing business.

2.4.2.3 Lawrence Livermore National Laboratory (LLNL)

LLNL ND2 ($80K)

This is new work with North Carolina State University (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 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.

Table 2.4-6 LLNL ND Budget Trend (FY2014-FY2018)

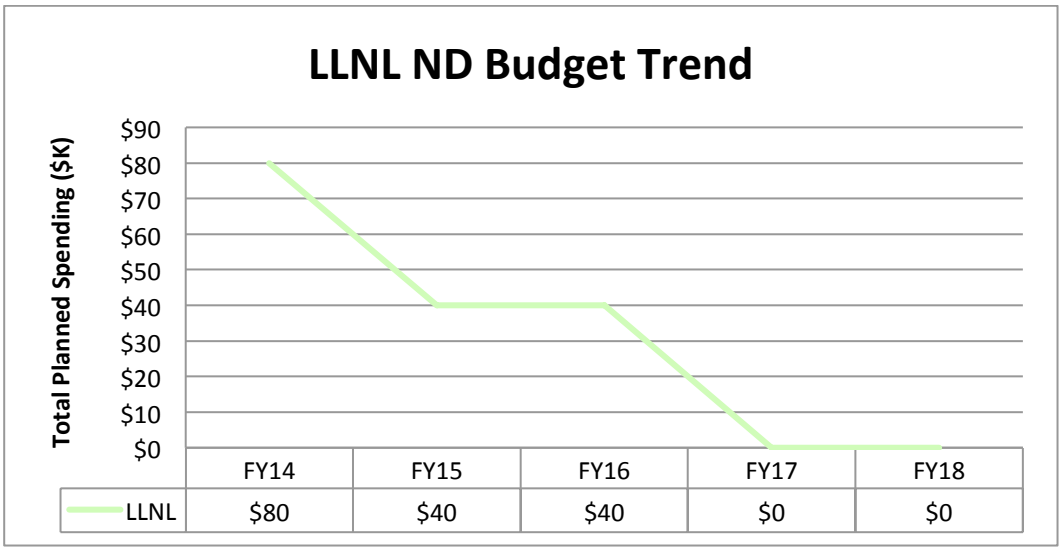
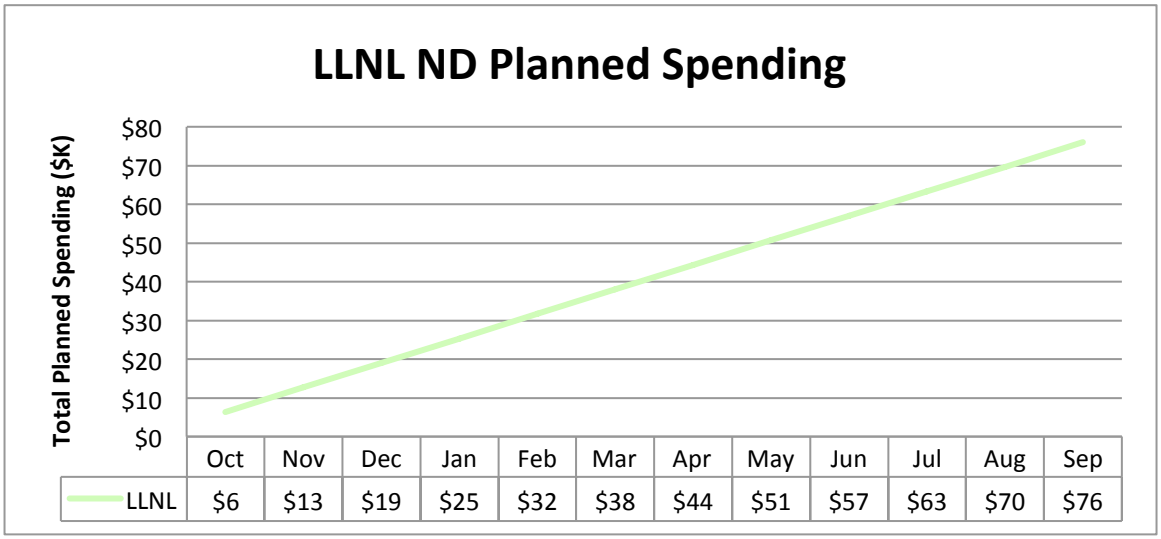


Table 2.4-7 LLNL ND Planned Spending (FY2014)



LLNL ND Milestones:

Occurs all 4 Quarters

- Provide status on nuclear data activities in NCSP Quarterly Progress Reports (T2: All Qtrs).

Quarter 4

- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the PHYSOR 2014 Meeting (T2: Q4).

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

Funding decrease of costs for single task to develop basic atomistic models for executing molecular dynamics simulations for polymethyl methacrylate. Out year funding zero due to no approved LLNL ND tasks.

2.4.2.4 Oak Ridge National Laboratory (ORNL)

*FY13 carryover in FY13Q4 authorized for FY14 task completion.

ORNL ND1 ($830K)
Ongoing 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.

RPI ND1 ($300K)
Resonance Region Nuclear Data Measurement Capability at Renssalaer Polytechnic Institute (RPI). Perform cross-section measurements and qualification of the new capabilities.

RPI ND2 ($95K [$120k total])
Thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties. Broaden and maintain the U.S. capabilities to support NCSP experimental nuclear data needs by providing priority NCSP thermal scattering law data.

RPI ND3 ($70K)
RPI/ORNL: Linear Accelerator (LINAC) 2020 Nuclear Data Capabilities Maintenance Plan. 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 currently under development.

ORNL ND4 ($65K)
Thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties. Produce thermal scattering law data analysis evaluation capability (companion task to RPI-ND2 thermal scattering task).

ORNL ND5 ($50K)
New Methodology for Treating the Unresolved Resonance Region. This is a new university collaboration task between ORNL and the Georgia Institute of Technology to derive quasi-resonances parameters with the same statistical properties as in the RRR. These parameters will reproduce the average experimental cross-sections together with a resonance formalism based on the R-Matrix theory.

ORNL ND6 ($50K)
NDAG Interim Support. Re-assess NDAG charter/membership & make recommendations for revision as needed. Provide interim NDAG Chair support, participate in relevant Working Groups, and coordinate NCSP ND element work program with current and future DOE needs.

Table 2.4-8 ORNL ND Budget Trend (FY2014-FY2018)

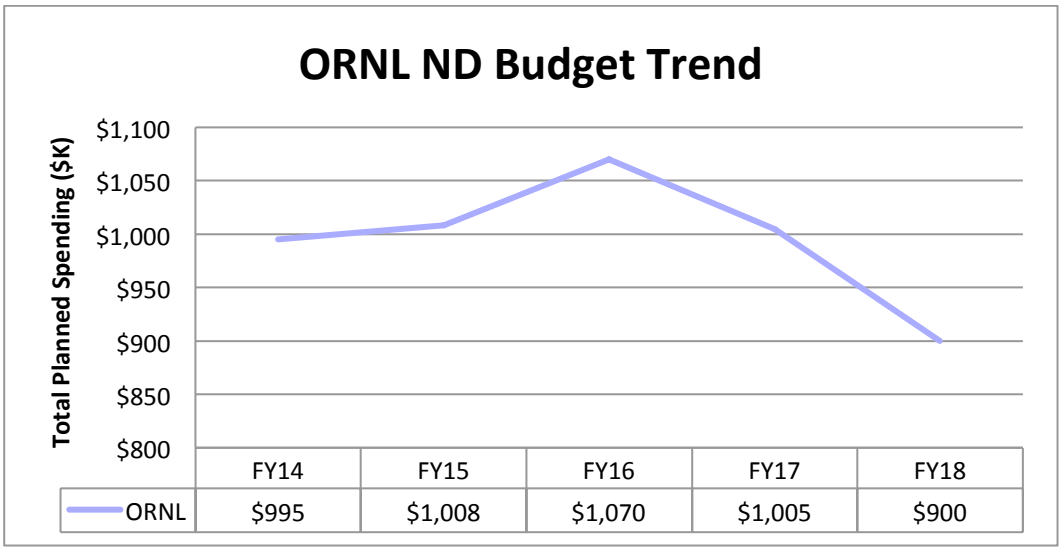


Table 2.4-9 RPI ND Budget Trend (FY2014-FY2018)

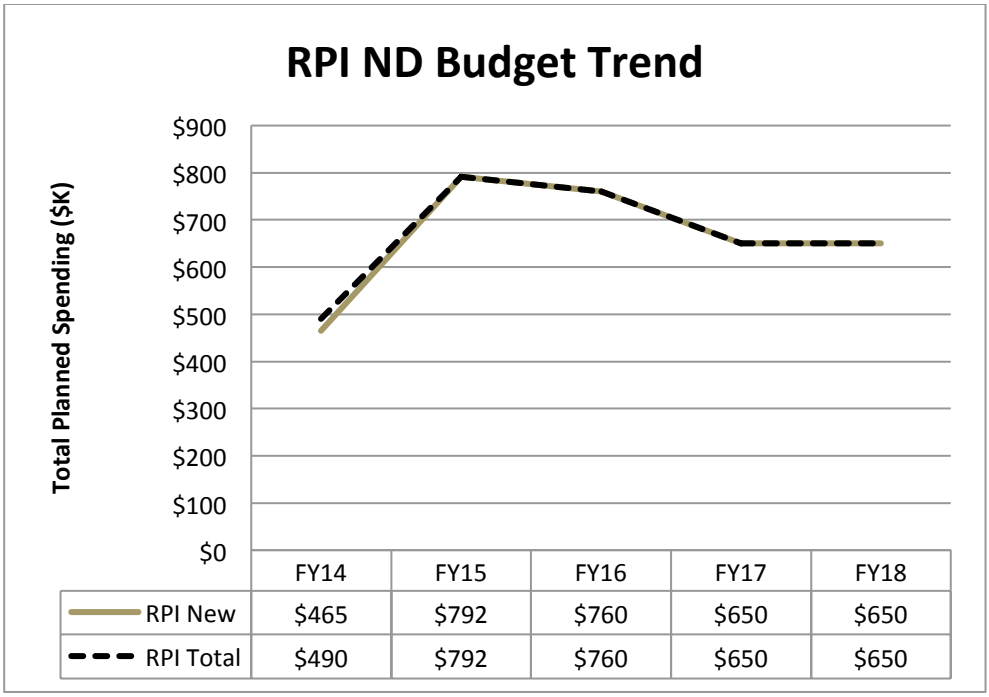
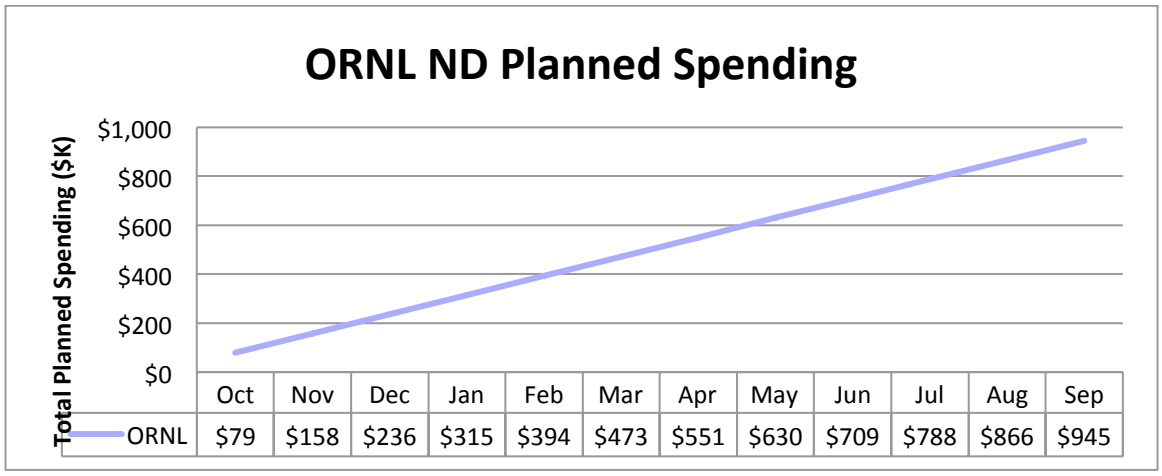
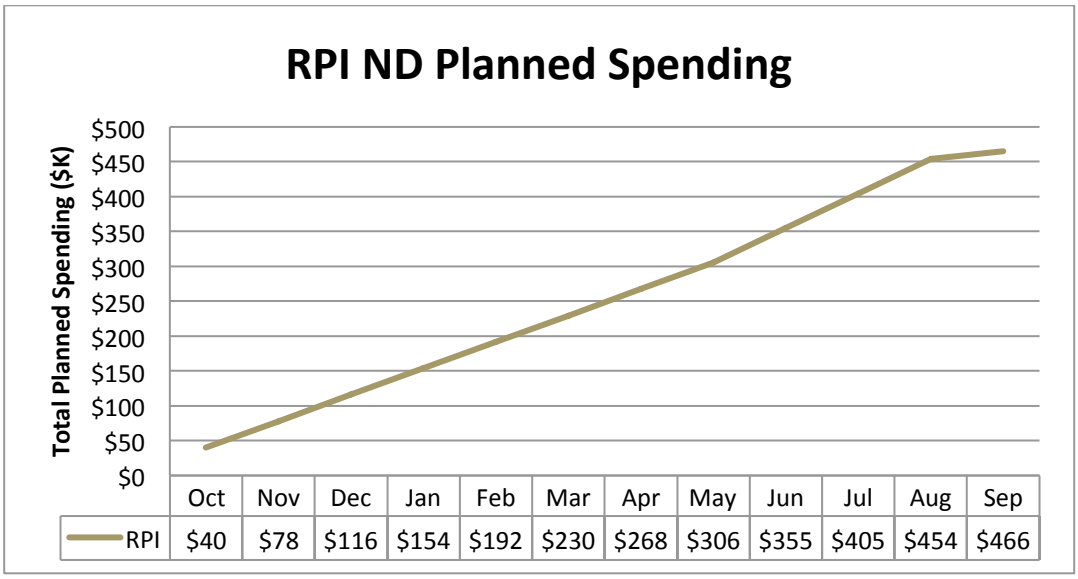


Table 2.4-10 ORNL ND Planned Spending (FY2014)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
ORNL	$79	$158	$236	$315	$394	$473	$551	$630	$709	$788	$866	$945

Table 2.4-11 RPI ND Planned Spending (FY2014)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
RPI	$40	$78	$116	$154	$192	$230	$268	$306	$355	$405	$454	$466

ORNL/RPI ND Milestones:

ORNL

Occurs all 4 Quarters

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (T1, T2: All Qtrs).

Quarter 1

- Provide brief trip summary report to NCSP Manager from testing of ^{56}Fe and ^{235}U resonance region performed at the Institut De Radioprotection et De Sûreté Nucléaire (IRSN) (T1:Q1).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from the NEMEA-7 nuclear data workshop (T1: Q1).

Quarter 3

- Provide brief trip summary report to NCSP Manager on items of NCSP interest from WPEC annual meeting to present NCSP/ORNL nuclear data evaluation work on Pu-239, Fe-56, and O-16 (T1, T6: Q3).

Quarter 4

- Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (T1: Q4).
- Provide brief trip summary report to NCSP Manager from nuclear data measurements taken at the GELINA facility at IRMM (T1:Q4).
- Participate in NDAG, CSEWG, and WPEC meetings (T1: Q4).
- Develop methodology to analyze thermal neutron scattering measured data for supporting the development of a thermal cross-section evaluation capability (T4: Q4).
- Develop and demonstrate a quasi-resonance parameter evaluation for the unresolved resonance region for a single isotope of importance to the NCSP (T5: Q4).
- Issue letter report to NCSP Manager documenting the NDAG Interim Chair tasks with recommendations to update the NDAG Charter (T6: Q4).
- Participate in NDAG, CSEWG, and WPEC meetings (T6: Q4).

RPI

Occurs all 4 Quarters

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (T1: All Qtrs).

Quarter 1

- Measurements: Perform thermal neutron scattering measurements of water at elevated temperatures from room temperature up to 550K and SiO_2 (glass) at room temperature (as an example of other moderators) (T2: Q1).
- Capability development: Perform testing of the new capture detector (T3: Q1).

Quarter 2

- Work with ORNL on using data for evaluations of the thermal scattering kernel (T2: Q2, Q3).

Quarter 3

- Measurement: Measure capture cross section of Mo-95 (T1: Q3).
- Measurements: Initiate capture measurements using new RPI capture detection system to supplement ORNL measurements planned at the Institute for Reference Materials and Measurements (IRMM) (T1: Q3).
- Provide brief trip summary report to NCSP Manager on items of NCSP interest from WPEC annual meeting to present NCSP/ORNL and RPI nuclear data measurement work (T1: Q3).

Quarter 4

- Analyze measured data, implement in MCNP to study effect on benchmarks (T1: Q4).
- Submit status report to NCSP manager of thermal neutron scattering measurements and analysis of initial measurements (T1: Q4).
- Analysis: Analyze the previously measured capture data (T1: Q4).
- Submit status report to NCSP manager of thermal neutron scattering measurements and analysis of initial measurements (T1: Q4).

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

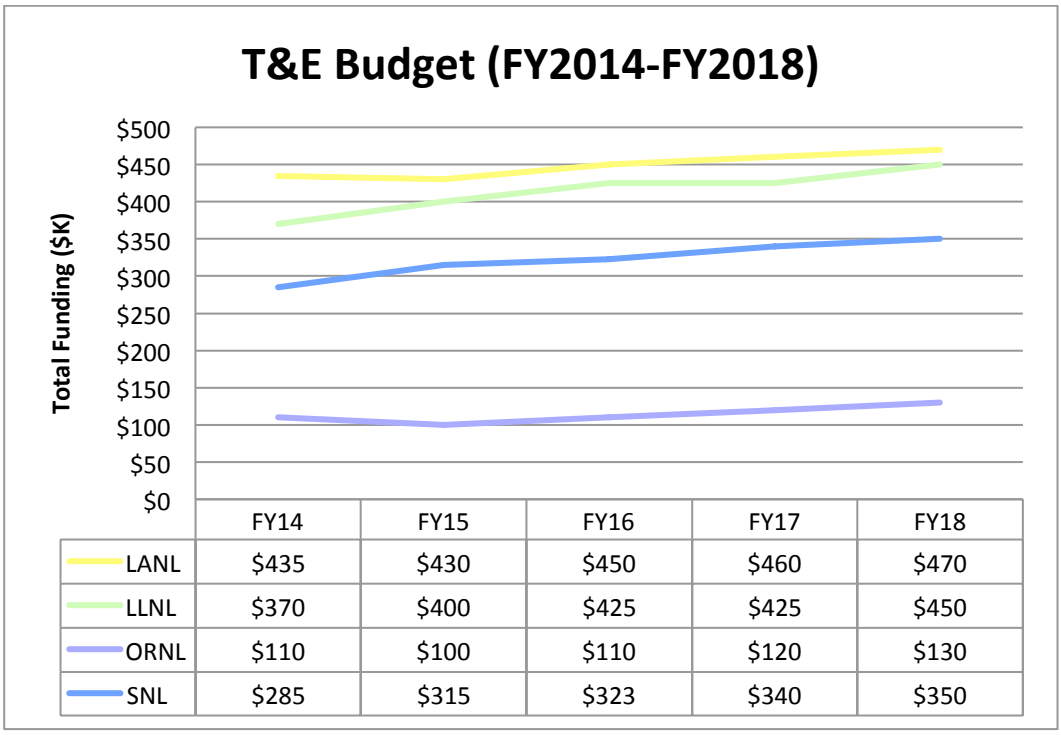
The ORNL ND budget includes incremental increases for inflation in the out years. Beginning in FY16, a new subtask will be initiated to help quantify NCSP differential data target accuracies needed to address target integral experiment/application accuracies. This new nuclear data subtask will utilize SCALE inverse sensitivity/uncertainty analysis tools that are currently being developed to quantify the differential data target accuracies and facilitate prioritization of NCSP nuclear data work efforts. For RPI ND, budget increases in FY15 for NCSP investment in RPI/ORNL: Linear Accelerator (LINAC) 2020 Nuclear Data Capabilities Maintenance Plan in order to maintain the ability to deliver a reliable neutron beam with the proper conditions required for NCSP differential measurements. Moderate increase in out years for the cost of doing business.

2.5 Training and Education (T&E)

2.5.1 Program Element Description

The Training and Education (T&E) 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 (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LANL	$435	$430	$450	$460	$470
LLNL	$370	$400	$425	$425	$450
ORNL	$110	$100	$110	$120	$130
SNL	$285	$315	$323	$340	$350

2.5.2 Approved Tasks

2.5.2.1 Los Alamos National Laboratory (LANL)

LANL T&E1 ($435K)

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 (FY2014-FY2018)

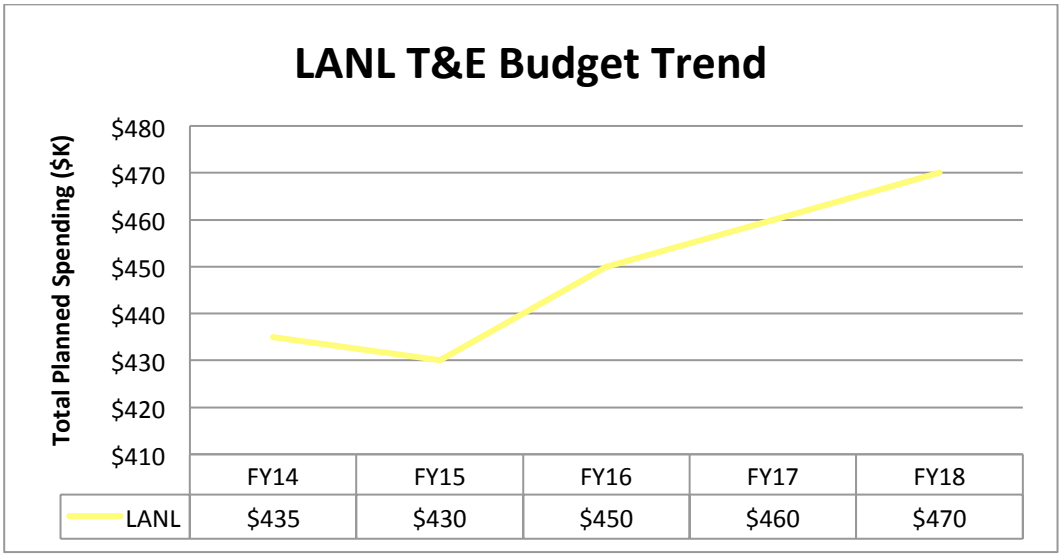
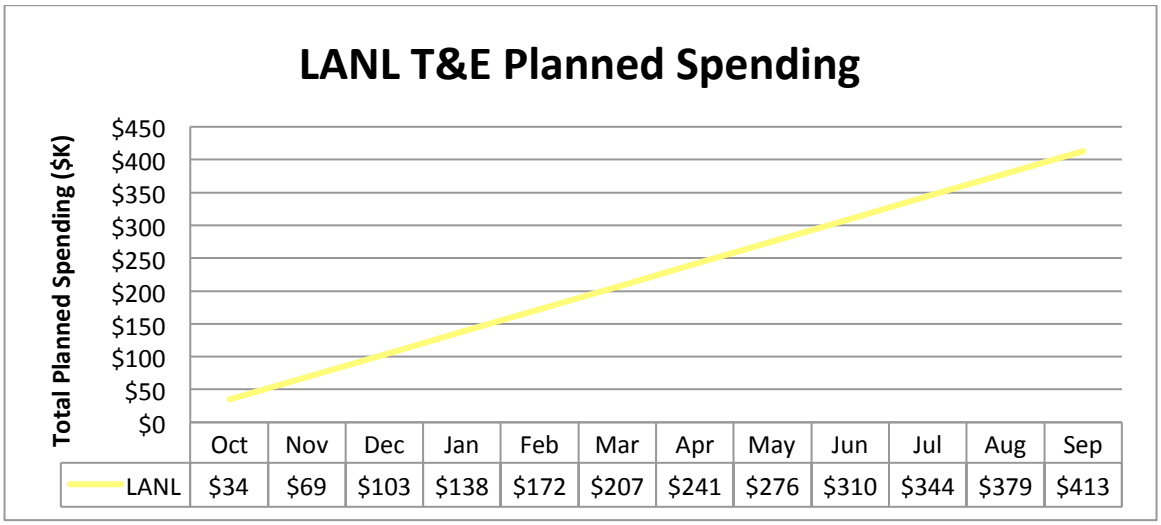


Table 2.5-3 LANL T&E Planned Spending (FY2014)



LANL T&E Milestones:

Occurs all 4 Quarters

- Provide training in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports (T1: All Qtrs).

Quarter 4

- Provide Nevada Field Office Managers training course and provide status report to the NCSP Manager upon completion (T1: Q4).

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

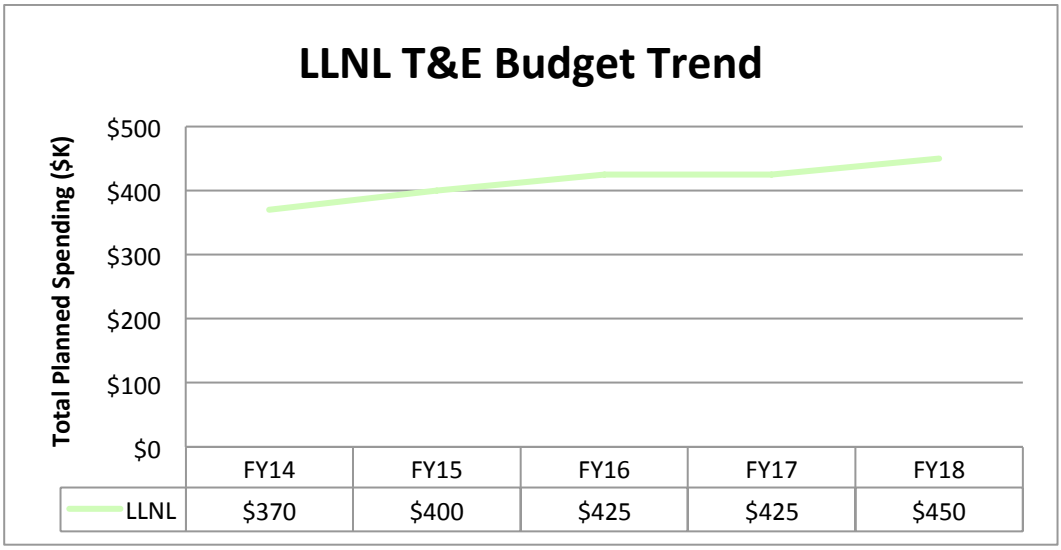
FY14 funding increase for additional one time training for the Nevada Field Office Managers. Very modest increases in out years to help mitigate increased cost of doing business.

2.5.2.2 Lawrence Livermore National Laboratory (LLNL)

LLNL T&E1 ($370K)

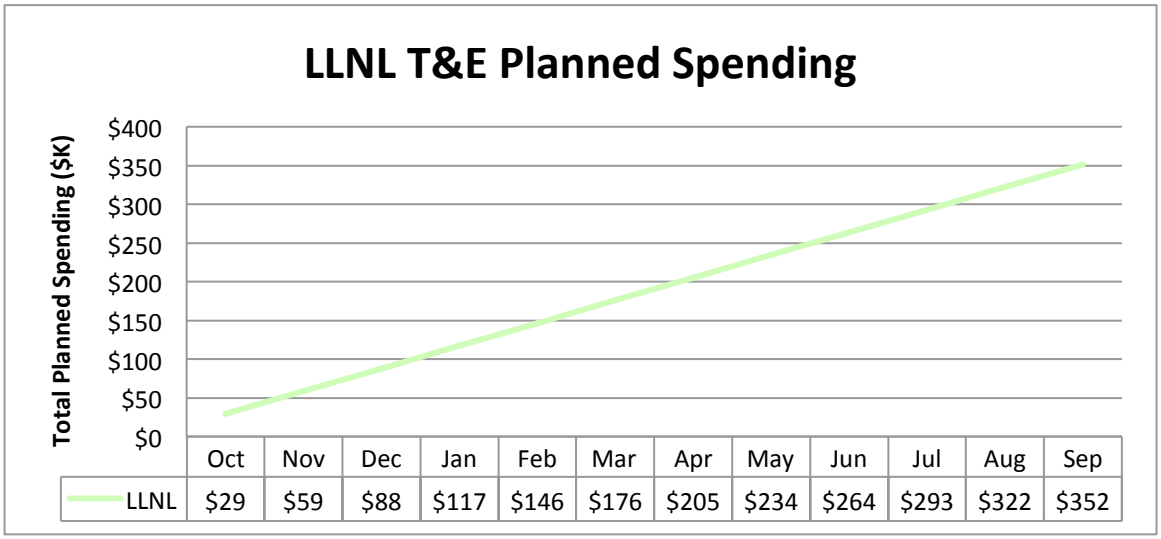
Ongoing approved activity to provide unique "hands-on" training at the Device Assembly Facility (DAF) using the Training Assembly for Criticality Safety (TACS). Specifically, the task provides for LLNL support for four classes at NCERC in FY2014, and beyond. This task also supports continued LLNL coordination of the course registration process for all courses at LANL, NCERC and SNL and continued LLNL participation in the T&E planning activities.

Table 2.5-4 LLNL T&E Budget Trend (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
LLNL	$370	$400	$425	$425	$450

Table 2.5-5 LLNL T&E Planned Spending (FY2014)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
LLNL	$29	$59	$88	$117	$146	$176	$205	$234	$264	$293	$322	$352

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 (T1: All Qtrs).

Quarter 4

- Provide Nevada Field Office Managers training course and provide status report to the NCSP Manager upon completion (T1: Q4).

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

Flat line budget for out years with modest increase for increased cost of doing business.

2.5.2.3 Oak Ridge National Laboratory (ORNL)

ORNL T&E1 Subtask 1 ($55K)
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 ($46K)
Provide training for the application of non-destructive analyses (NDA) measurement results to NCS evaluations.

ORNL T&E1 Subtask 3 ($9K)
Make necessary modification to NCS staff training program based on experience/feedback gained from the pilot training events.

Table 2.5-6 ORNL T&E Budget Trend (FY2014-FY2018)

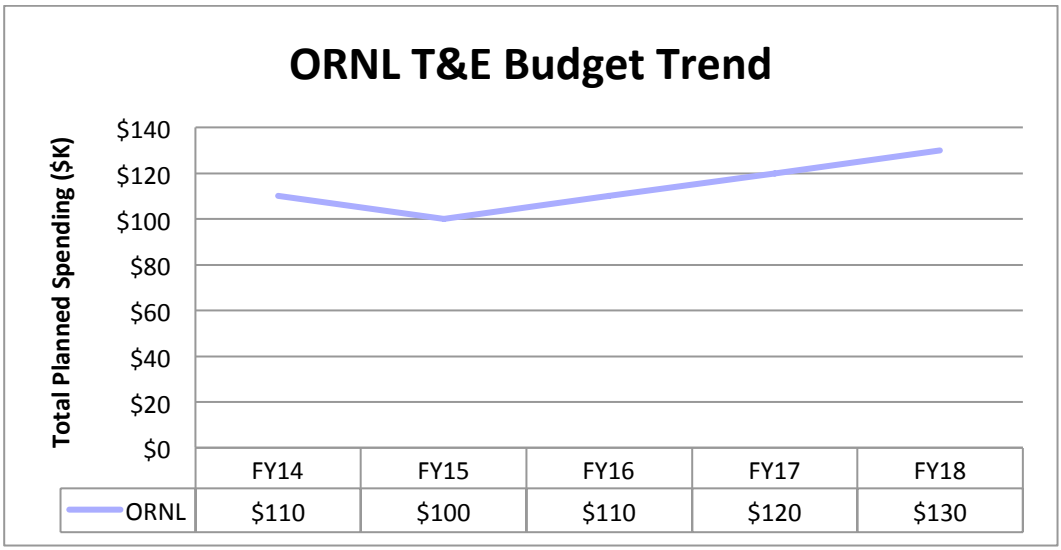
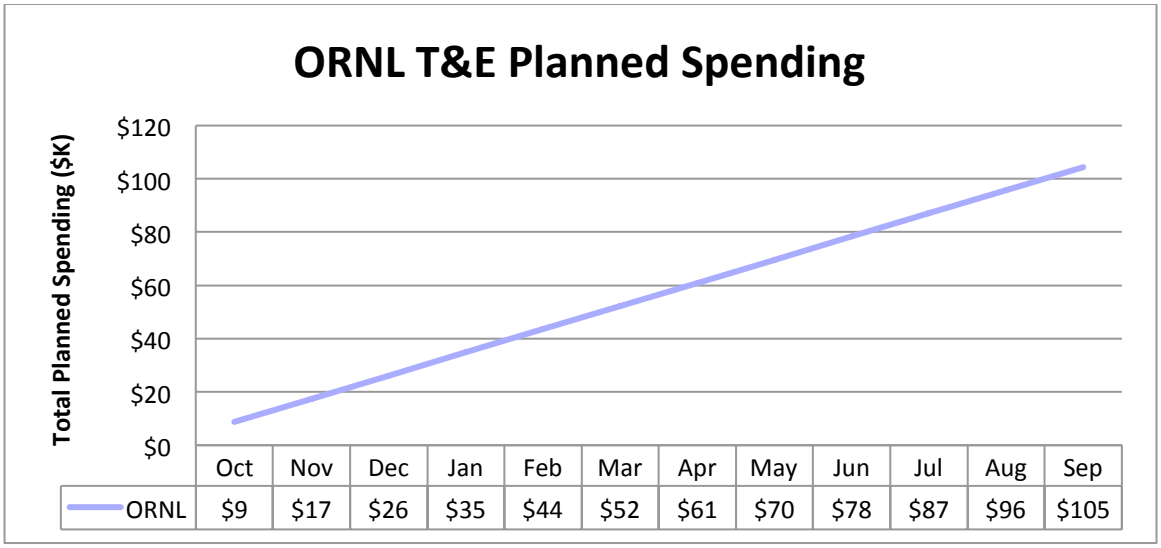


Table 2.5-7 ORNL T&E Planned Spending (FY2014)



ORNL T&E Milestones:

Occurs all 4 Quarters

- Provide status reports in NCSP Quarterly Progress Reports on implementation of the NCS training program (T1: All Qtrs).
- Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on self-evaluation and feedback from reviewers, observers, trainers, and the NCSP manager (T1: All Qtrs).

Quarter 4

- Provide Nevada Field Office Managers training course and provide status report to the NCSP Manager upon completion (T1: Q4).

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

The ORNL T&E budget includes a planned decrease in funding beginning in FY15 as the training courses reach steady-state operation thereby requiring less oversight and monitoring. FY14 funding includes additional one time training for the Nevada Field Office Managers.

2.5.2.4 Sandia National Laboratories (SNL)

SNL T&E1 ($285K)

Conduct criticality safety training classes at SNL according to an integrated schedule developed by ORNL and approved by the NCSP Manager. Provide Human Factors and Equipment Reliability module support to the training class at LANL.

Table 2.5-8 SNL T&E Budget Trend (FY2014-FY2018)

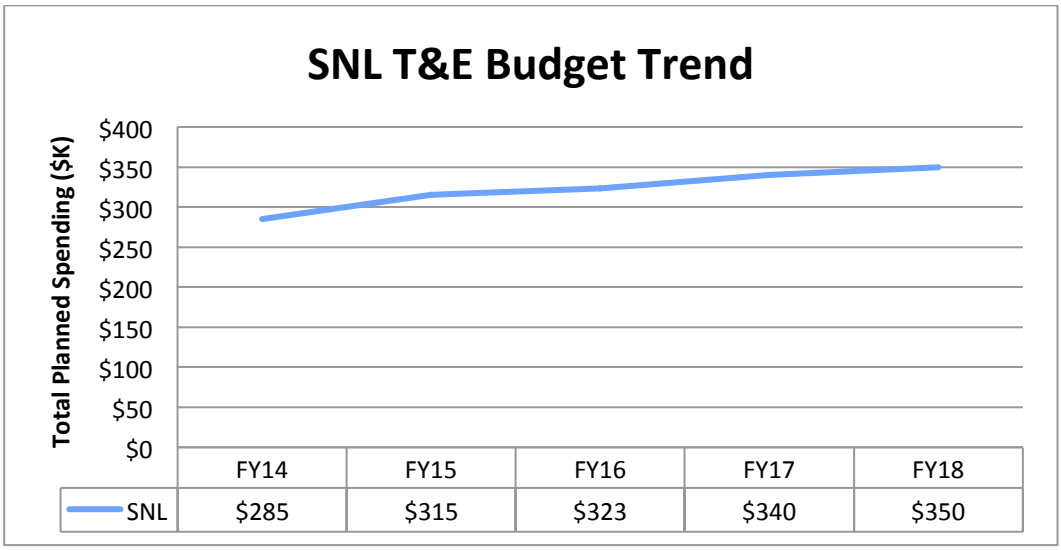
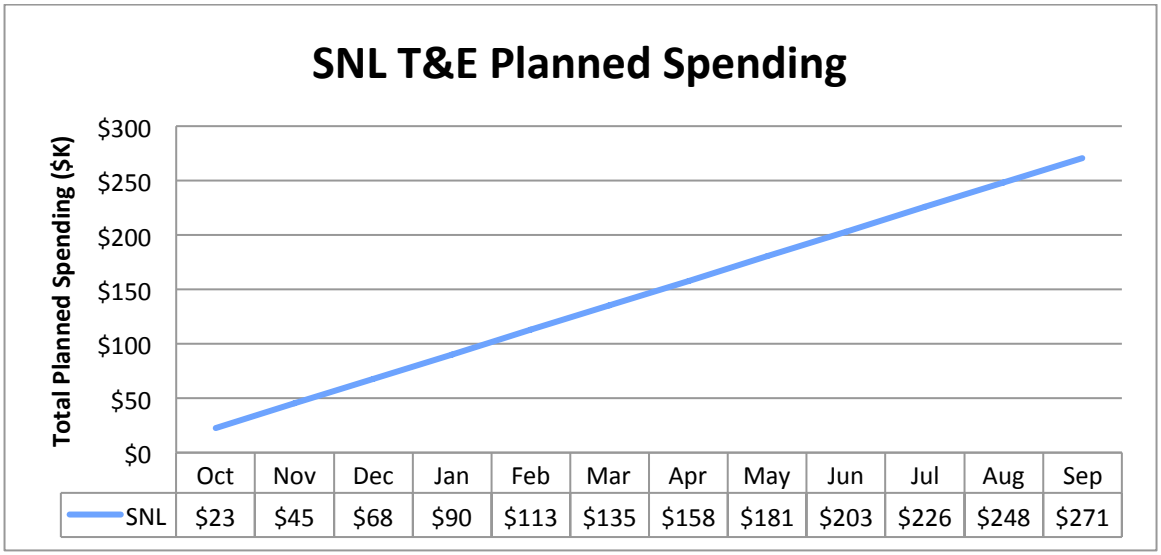


Table 2.5-9 SNL T&E Planned Spending (FY2014)



SNL T&E Milestones:

Quarter 4

- Conduct hands-on training classes at Sandia in accordance with the approved schedule (T1: Q4).
- Provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule (T1: Q4).

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

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

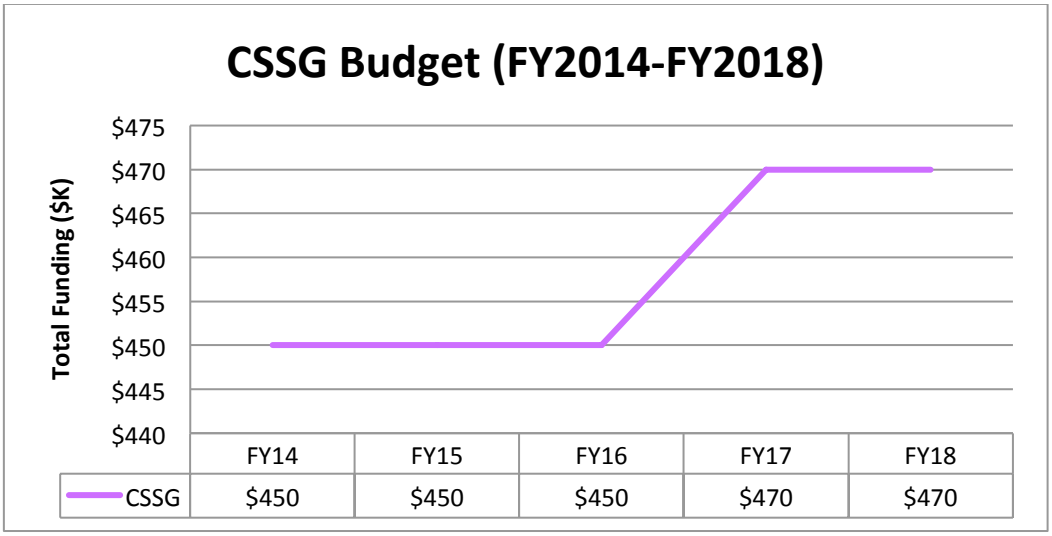
3.0 Criticality Safety Support Group (CSSG)

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).

NCSP TS1 ($450K)

Technical Support as tasked by NCSP Manager.

Table 3.1 CSSG Budget Trend (FY2014-FY2018)



4.0 NCSP Technical Support

Ongoing ORNL task to support the NCSP Management Team in the program management and execution of the NCSP. New tasks at specific national laboratories for the succession planning of key program element expert capabilities as defined in the Mission and Vision.

NCSP TS2 ($600K) - ORNL

Technical Support for support staff of the NCSP Manager and Deputy NCSP Manager. Provide NCSP Management and Planning assistance for the overall NCSP in support of the NCSP Manager but including at a minimum leading preparation of the annual 5-Year plan update, management of the C_EdT/IER process, management/lead for the NCSP Training & Education and IP&D elements.

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

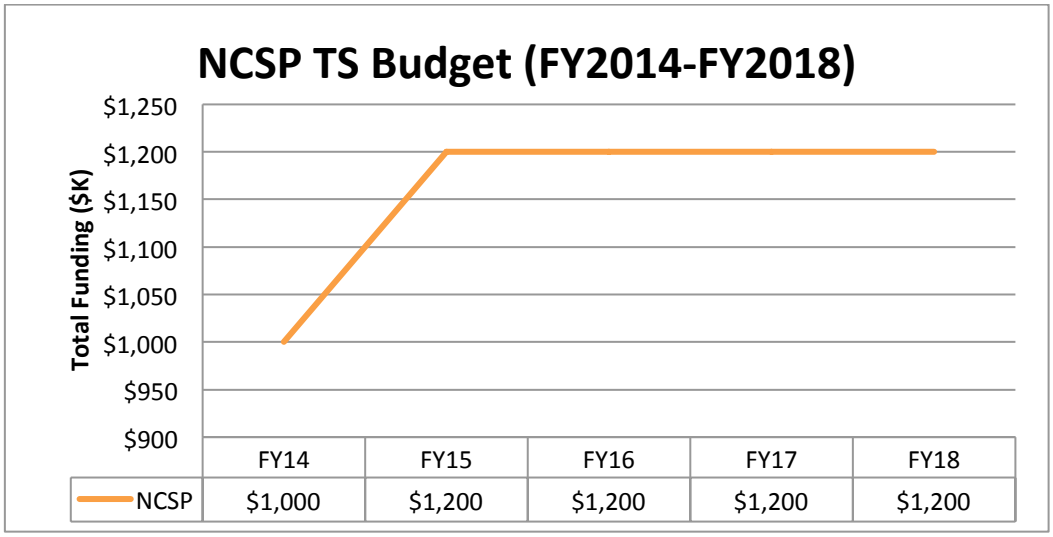
In accordance with the ten-year Mission and Vision, the NCSP has identified the need to develop and implement succession plans for key staff expert capabilities to support continued execution of the NCSP Mission. There is a need to maintain expertise in the nuclear data analysis capabilities that currently 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

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

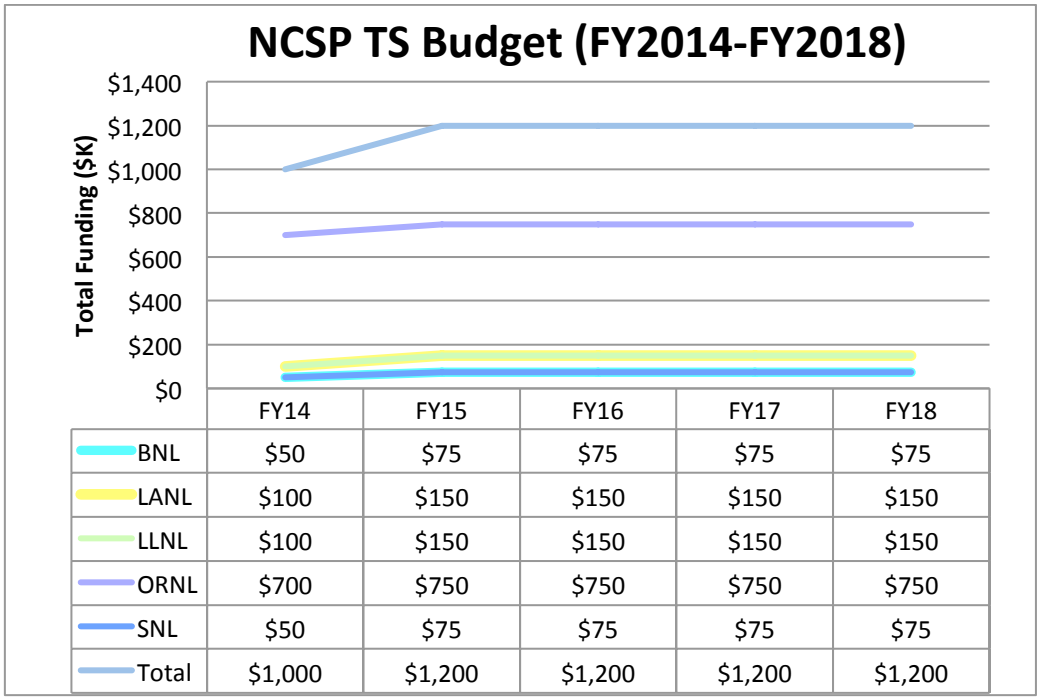
the NCSP Mission. There is a need to maintain expertise in the analytical methods and nuclear data capabilities that currently exist at ORNL. The work associated with this task is to develop and execute AM and ND Succession Planning at ORNL as defined in the NCSP Mission and Vision document for cross-section processing developers, radiation transport methods developers, nuclear data evaluators, experimentalists, and nuclear data methods developers.

Table 4.1 NCSP Technical Support (FY2014-FY2018)



	FY14	FY15	FY16	FY17	FY18
NCSP	$1,000	$1,200	$1,200	$1,200	$1,200

Table 4.2 NCSP Technical Support (FY2014-FY2018) - by Laboratory



	FY14	FY15	FY16	FY17	FY18
BNL	$50	$75	$75	$75	$75
LANL	$100	$150	$150	$150	$150
LLNL	$100	$150	$150	$150	$150
ORNL	$700	$750	$750	$750	$750
SNL	$50	$75	$75	$75	$75
Total	$1,000	$1,200	$1,200	$1,200	$1,200

MILESTONES:

Occurs all 4 Quarters

- Manage C_EdT process and ensure completion of planned IERs each FY (T2: All Qtrs).
- Manage NDR process and ensure completion of planned NDRs each FY (T2: All Qtrs).
- Manager Quarterly Program Reviews and Milestone completion (T2: All Qtrs).
- Publish the NCSP quarterly reports (T2: All Qtrs).

Quarter 1

- Initiate all FY14 IERs (T2: Q1).
- Publish NCSP posters/publications at Winter ANS meeting (T2: Q1).

Quarter 2

- Organize and host annual NCSP Technical Program Review (T2: Q2).

Quarter 3

- Manage NCSP Technical Program Review Award Winners notification and submittal of abstracts for Winter ANS Meeting, organize ANS session, etc. to ensure winner abstracts are processed by the Nuclear Criticality Safety Division of the American Nuclear Society (T2:Q3).
- Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the spring NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team (T2: Q3).

Quarter 4

- Participate in Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY (T2: Q4).
- Provide NCSP Management Team and NCSP stakeholders draft Five Year Plan for review after Budget Execution Meeting (T2: Q4).
- Provide draft Five Year Plan to NCSP Manager for final review (T2: Q4).
- Publish final Five Year Plan (T2: Q4).
- Publish FY NCSP Planning Calendar (T2: Q4).
- Provide NCSP Manager proposed succession plan for developing new experimentalists at Sandia (T3: Q4).
- Provide NCSP Manager proposed succession plan for developing key components of the AM, IE, and ND task elements at LANL (T4:Q4).
- Provide NCSP Manager proposed succession plan for developing key components of the AM and IE task elements at LLNL (T5:Q4).
- Provide NCSP Manager proposed succession plan for developing key components of the ND task element at BNL (T6:Q4).
- Provide NCSP Manager proposed succession plan for developing key components of the AM and ND task elements at ORNL (T7:Q4).

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

FY15 increase due to increased funding for succession planning in various areas of expertise. Remaining years flat line budget.

Appendix A
Work Authorization Statements for
Nuclear Criticality Safety Program Funding for Execution Year FY2014
Provided to the NA-00 Budget Office in September 2013

Argonne National Laboratory (ANL): $50K

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) FY14 Five-Year Plan dated October 2013, 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)

Hanford (HAN): $105K

Task: Information Preservation and Dissemination

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) FY14 Five-Year Plan dated October 2013, or as directed by the NCSP Manager.

Hanford POC: Raymond Puigh (509-376-3766), Raymond.Puigh@rl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Los Alamos National Laboratory (LANL): $8,048K

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) FY14 Five-Year Plan dated October 2013, 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): $2,430K

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) FY14 Five-Year Plan dated October 2013, 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 (NNSS): $2,388K

Task: Integral Experiments

Reflects funds to continue support for integral experiments, as delineated in the Nuclear Criticality Safety Program (NCSP) FY14 Five-Year Plan dated October 2013, or as directed by the NCSP Manager.

NNSS POC: Rashelle Will (702-295-4777), willrd@nv.doe.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Oak Ridge National Laboratory (ORNL): $3,278K

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

Reflects funds to continue support for analytical methods; integral experiments; nuclear data, including Interim Chair of the Nuclear Data Advisory Group; and training and education as delineated in the Nuclear Criticality Safety Program (NCSP) FY14 Five-Year Plan dated October 2013, 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): $50K

Task: Criticality Safety Support Group

Reflects funds 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.

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

Renssalaer Polytechnic Institute (RPI): $465K

Task: Nuclear Data

Reflects funds to conduct differential measurements as delineated in the Nuclear Criticality Safety Execution (NCSP) Five Year Execution Plan dated October 2013 and initiate 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): $795K

Tasks: Integral Experiments, 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) FY14 Five-Year Execution Plan dated October 2013, 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)

Y-12 National Security Complex (Y-12): $50K

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), kimball@y12.doe.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Appendix B
Nuclear Data

Priority Needs / Additional Needs	Thermal scattering (BeO, HF, D_2O, SiO_2, CH_2, C_2F_4, $C_5O_2H_8$, etc.), ^{239}Pu, Cr, ^{237}Np, Pb, W, ^{55}Mn, Ti, ^{240}Pu, Fe, ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu / ^{233}U, Th, Be, ^{51}V, Zr, F, K, Ca, Mo, Na, La
Completed Evaluations	Minor Actinides , SiO_2, ^{55}Mn, ^{180,128,183,184,186}W , ^{239}Pu , ^{50,52,53,54}Cr , ^{58,60}Ni , ^{55}Mn , ^{39,41}K, ^{19}F

Measurements

Materials	Pre-FY2013	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	Post-FY2019
Calcium (Ca)									
Cerium (Ce)									
Copper (Cu)									
Dysprosium (Dy)									
Gadolinium (Gd)									
Iron (Fe)									
Strontium (Sr)									
Tungsten (W)									
Vanadium (V)									
Zirconium (Zr)									
Polyethylene (CH_2)			H_2O / CH_2						

Complete Evaluations

Materials	Pre-FY2013	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	Post-FY2019
Calcium (Ca)									
Cerium (Ce)									
Cobalt (Co)									
Copper (Cu)									
Dysprosium (Dy)									
Gadolinium (Gd)									
Iron (Fe)									
Lead (Pb)									
Nickel (Ni)									
Oxygen (O)									
Plutonium-239									
Strontium (Sr)									
Tungsten (W)									
Uranium-235									
Uranium-238									
Vanadium (V)									
Zirconium (Zr)									
Polyethylene (CH_2)									
	ORNL		RPI		LANL				

- 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.

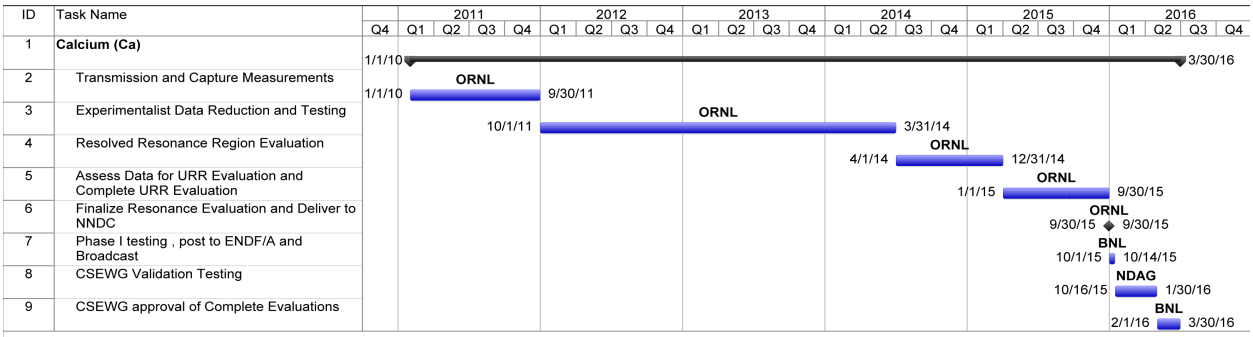
B-1 Differential Measurements and Evaluations – Elements

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 Plutonium (Pu-239)
B-1.12 Strontium (Sr)
B-1.13 Tungsten (W-182,183,184,186)
B-1.14 Uranium (U-235)
B-1.15 Uranium (U-238)
B-1.16 Vanadium (V-51)
B-1.17 Zirconium (Zr-90, 91, 92, 94, 96)

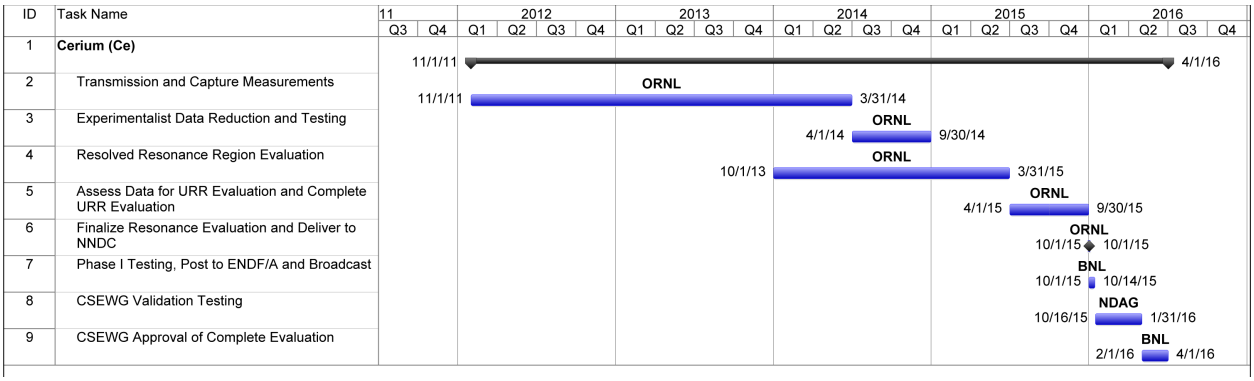
B-2 Differential Measurements and Evaluations – Compounds

B-2.1 Polyethylene (CH_2)

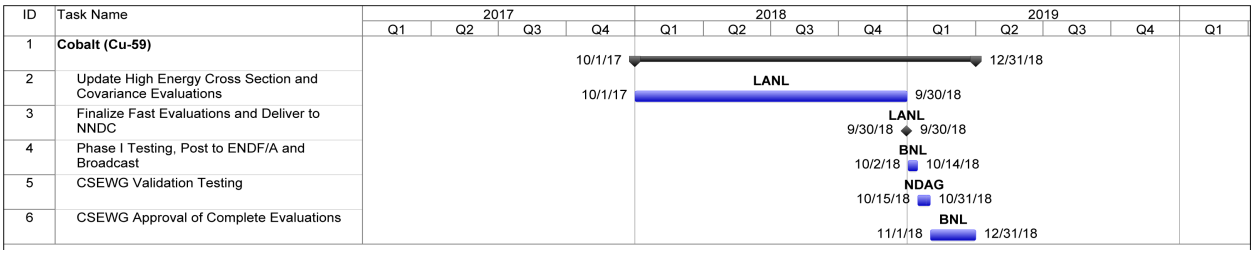
B-1.1 Calcium (Ca)



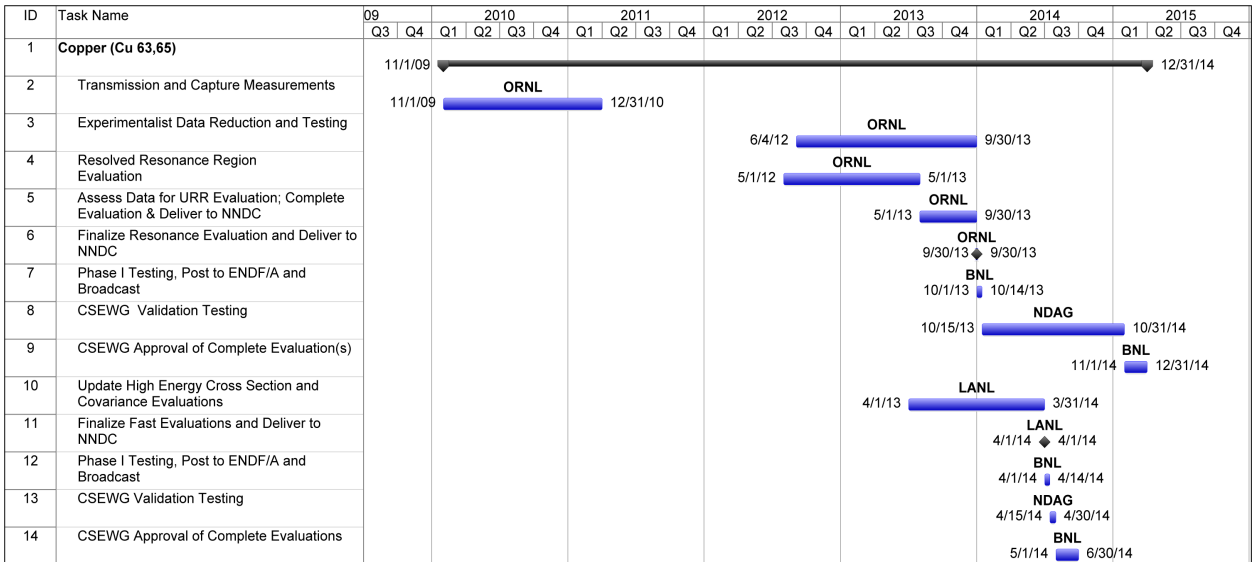
B-1.2 Cerium (Ce)



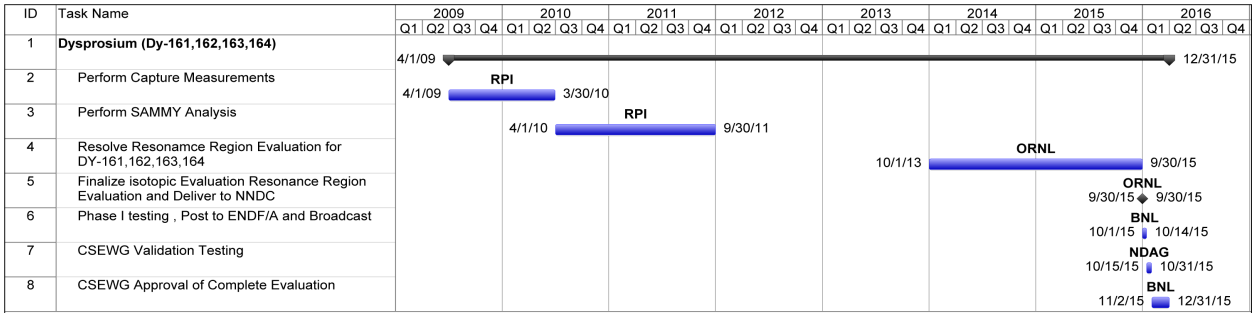
B-1.3 Cobalt (Co-59)



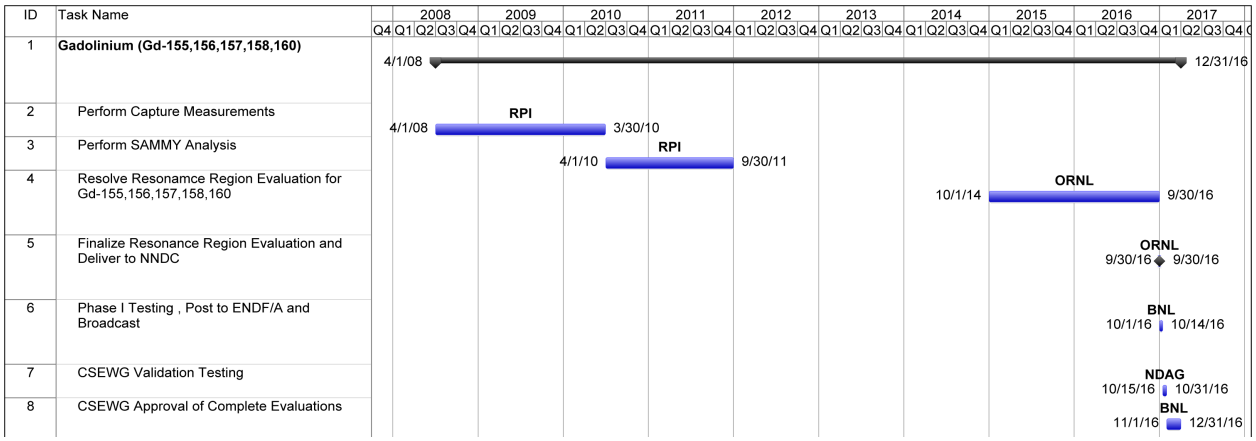
B-1.4 Copper (Cu-63, 65)



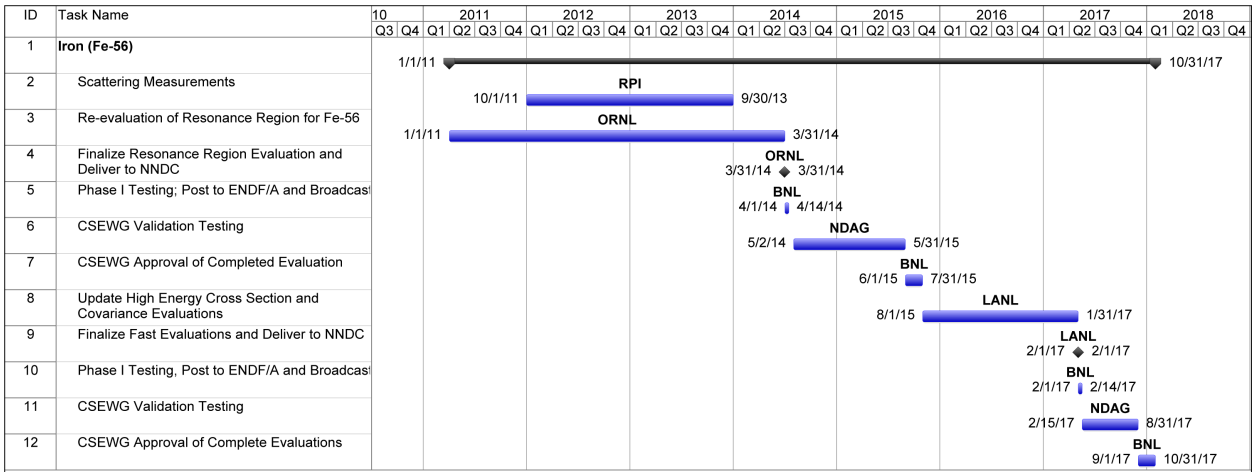
B-1.5 Dysprosium (Dy-161,162,163,164)



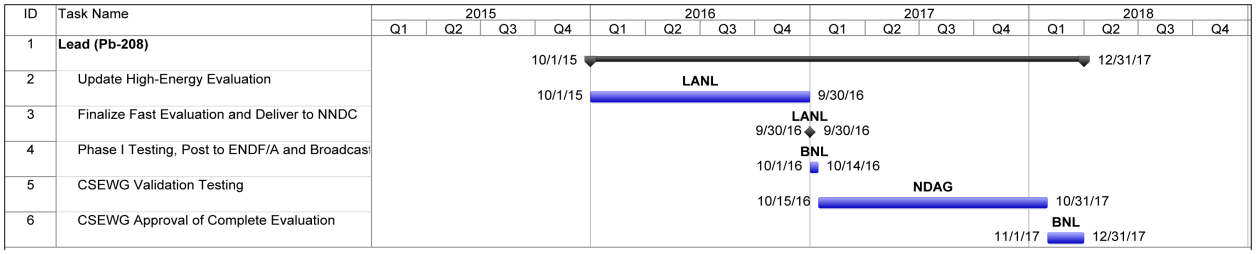
B-1.6 Gadolinium (Gd-155,156,157,158,160)



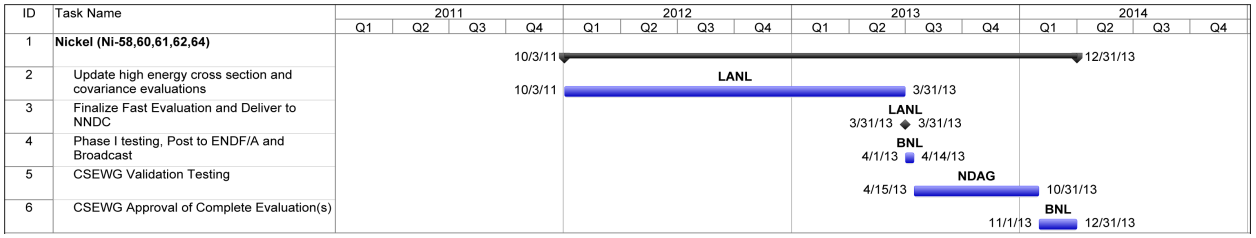
B-1.7 Iron (Fe-56)



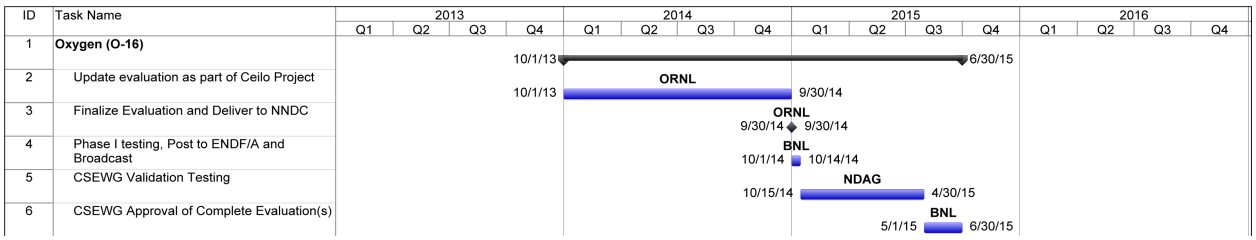
B-1.8 Lead (Pb-208)



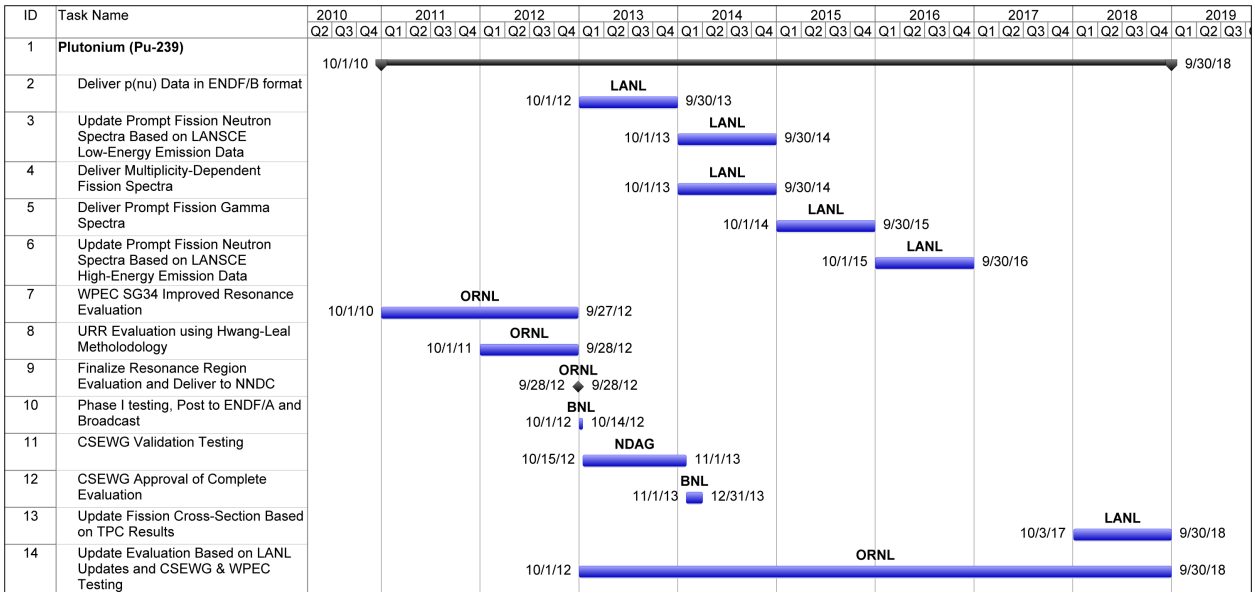
B-1.9 Nickel (Ni-58,60)



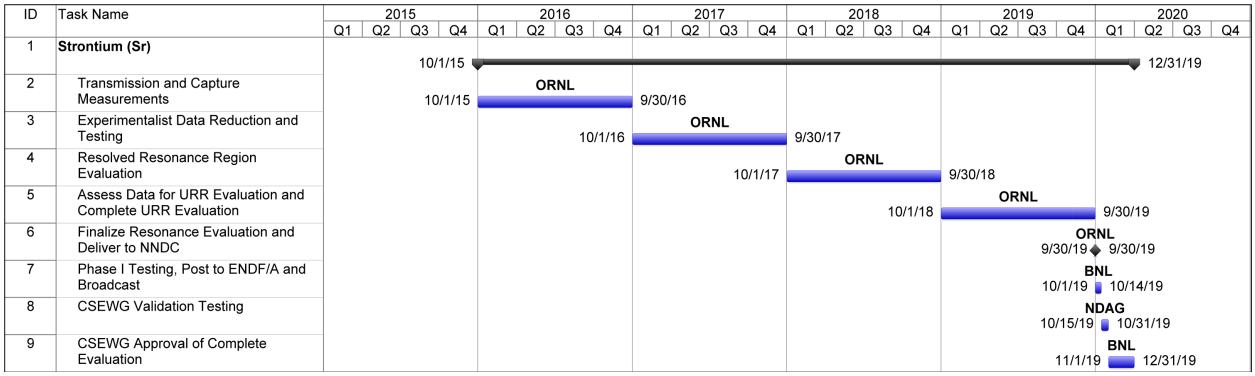
B-1.10 Oxygen (O-16)



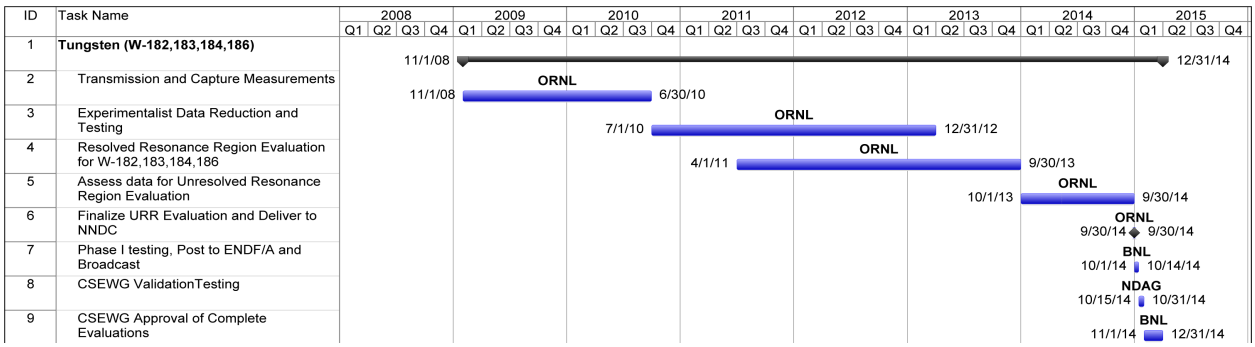
B-1.11 Plutonium (Pu-239)



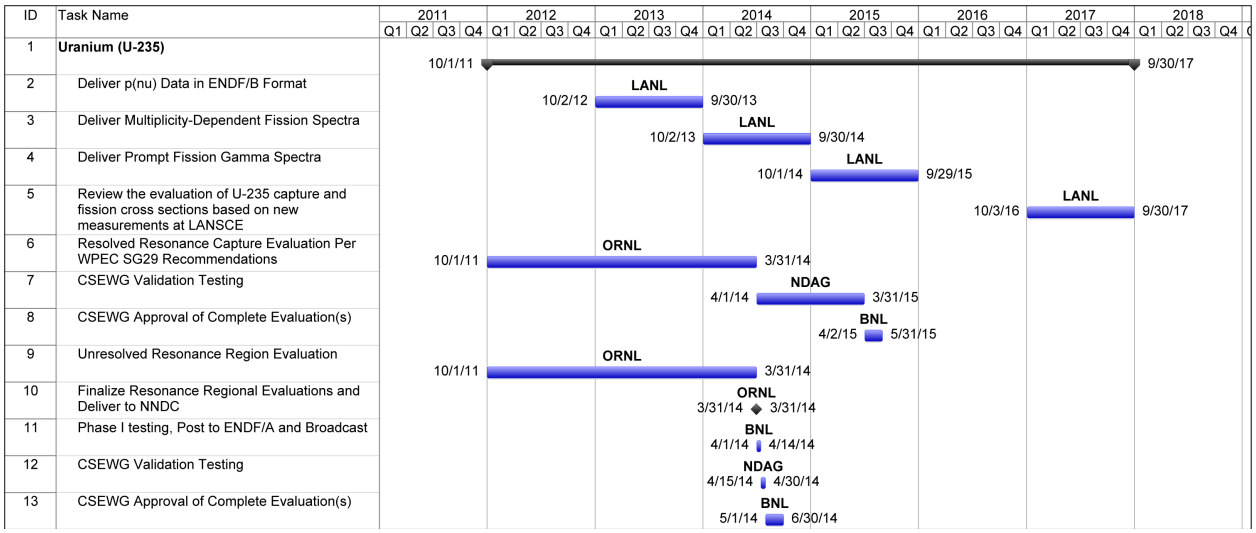
B-1.12 Strontium (Sr)



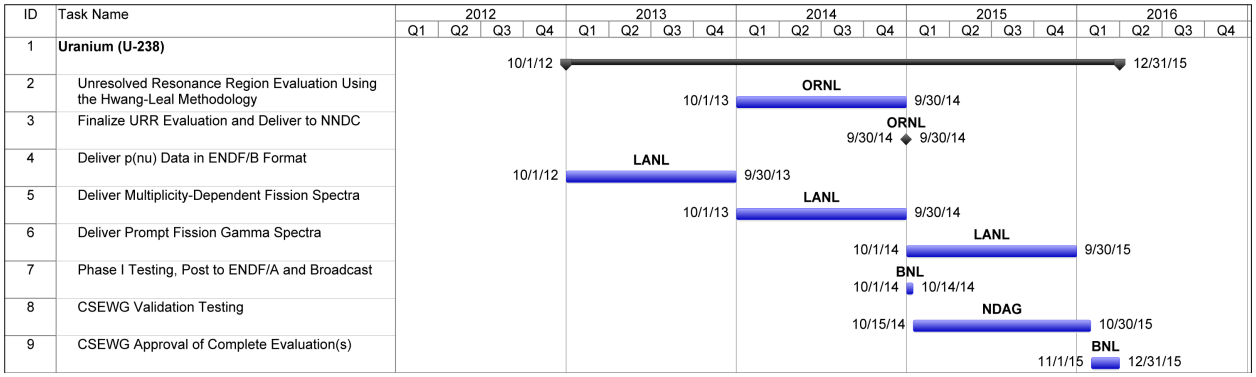
B-1.13 Tungsten (W-182,183,184,186)



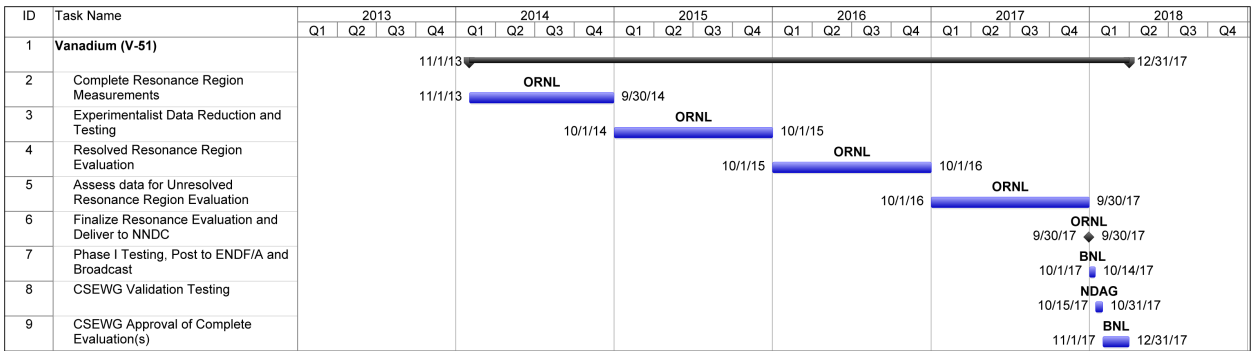
B-1.14 Uranium (U-235)



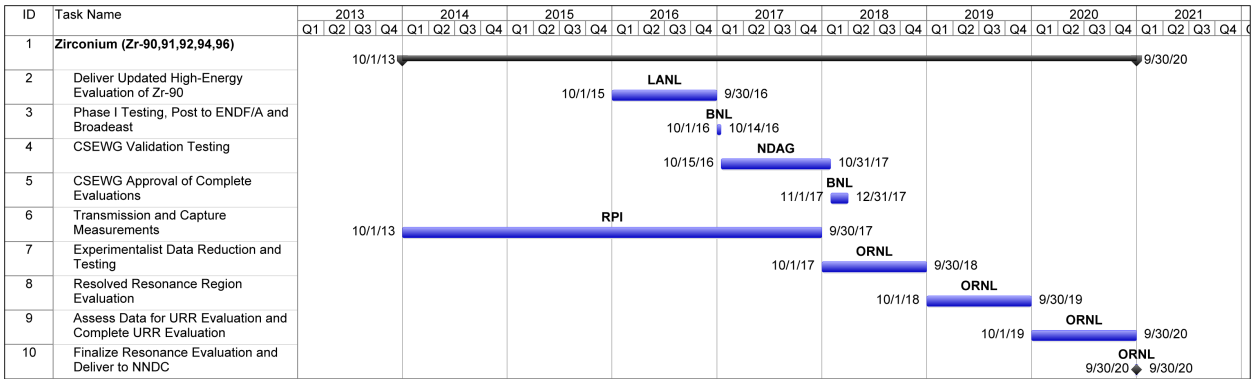
B-1.15 Uranium (U-238)



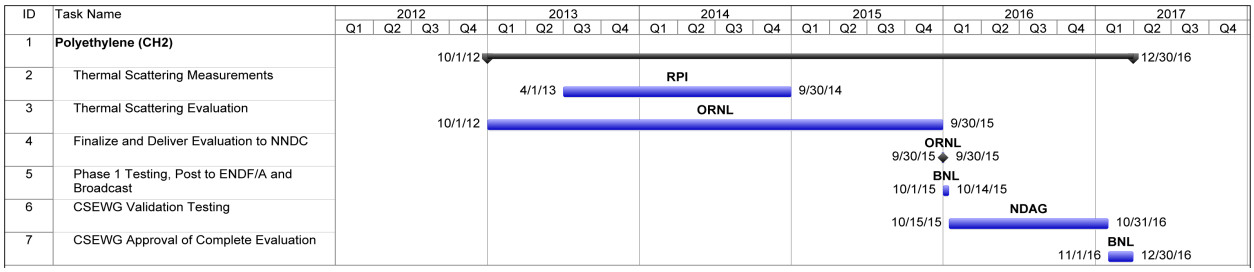
B-1.16 Vanadium (V-51)



B-1.17 Zirconium (Zr-90,91,92,94,96)



B-2.1 Polyethylene (CH_2)



Appendix C
Fiscal Year 2014 Projected Foreign Travel

Destination	Date	Labs	Count	Costs ($)	One Sentence Description	Task	Milestone	Justification
OECD NEA Paris, France	May-14	LANL LLNL SNL	5	25,000	Present/publish NCSP ICSBEP evaluations at annual ICSBEP Technical Meeting (Harms, Heinrichs, Snyderman, Sood)	LLNL-IPD1	Provide brief trip summary report to NCSP Manager (Q3).	Conduct ICSBEP for approved Benchmarks and publish annual revision to the Handbook.
IRMM Mol, Belgium	Oct-13 Feb-14 May-14 Sep-14	ORNL	1	60,000	Perform resonance region nuclear data measurements using the GELINA facility at IRMM (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-13	ORNL	1	20,000	Work with the IRSN to finalize and test ^{56}Fe and ^{235}U resonance region evaluations (Leal)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q1).	Continues cross-section measurements and the production of new cross-section evaluations with covariance data for U.S.
NEA WPNCS Paris, France	Oct-13	LANL	1	6,000	Participate in annual OECD/NEA Working Party on Nuclear Criticality Safety and various Expert Groups (Kiedrowski)	LANL-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.
NEA WPEC Paris, France	May-14	LANL	1	5,000	Participate in annual OECD/NEA Working Party for Evaluation Cooperation (WPEC) and various subgroups (Kahler)	LANL-AM2	Provide brief trip summary report to NCSP Manager (Q3).	Continues NCSP leadership in processing codes and fosters continued collaboration with international partners to test and improve NCSP AM capabilities for supporting criticality safety applications.
SNA+MC 2013 Paris, France	Oct-13	LANL	1	5,000	Present papers and participate in the Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo (Brown)	LANL-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.
PHYSOR 2014 Kyoto, Japan	Sep-14	LANL	2	14,000	Present papers and participate in the International Conference on Reactor Physics (Kiedrowski, Brown)	LANL-AM1	Provide brief trip summary report to NCSP Manager (Q4).	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.

Destination	Date	Labs	Count	Costs ($)	One Sentence Description	Task	Milestone	Justification
Moscow, Russia & Paris, France	Oct-13	ORNL	1	10,000	Participate in (Working Party on Nuclear Criticality Safety) WPNCS EG meeting on uncertainty analysis to present results of Sensitivity/Uncertainty (S/U) benchmark analyses with SCALE followed by participation in SNA+MC to present advancements in SCALE Monte Carlo analysis capabilities (Rearden)	ORNL-AM2	Provide brief trip summary report to NCSP Manager (Q1).	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.
Geel, Belgium	Nov-13	ORNL	1	5,000	Participate in NEMEA-7 nuclear data workshop to represent ORNL/NCSP resonance region nuclear data work and discuss continued differential measurement collaboration with IRMM (Dunn)	ORNL-ND1	Provide brief trip summary report to NCSP Manager (Q1).	Represent ORNL/NCSP nuclear data work and discuss continued ORNL-IRMM nuclear data measurement collaboration to ensure the NCSP will have continued access to the IRMM accelerator for completing NCSP differential measurements as scheduled in the Five Year
Tokai, Japan	Dec-13	ORNL	1	5,000	Participate in WPEC Subgroup 38 to develop a new international ENDF/B nuclear data format (Dunn)	ORNL-AM3	Provide brief trip summary report to NCSP Manager (Q1).	As ENDF/B moves to a new format, all of the NCSP processing and radiation transport capabilities will need to be able to utilize the new ENDF/B data format. The benefit is to ensure NCSP evaluation generation and processing needs are represented.
OECD/NEA Paris, France	May-14	ORNL RPI	3	13,600	Participate in WPEC annual meeting to present NCSP/ORNL and RPI nuclear data measurement work and ORNL evaluation work on Pu-239, Fe-56, and O-16 and coordinate international collaborations to improve NCSP nuclear data evaluations (Leal, Dunn. Danon)	ORNL-ND1 ORNL-ND6 RPI-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-14	ORNL	1	5,000	Participate in WPNCS EG meeting on uncertainty analysis to present ORNL S/U analysis capabilities and updates on previous benchmarking work tasks (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.
OECD NEA Paris, France	Oct-13	LLNL	1	5,000	Participate in the Expert Group meeting on Excursion Analysis and its associated WPNCS governance meeting (Scorby)	LLNL-AM1	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.

Destination	Date	Labs	Count	Costs ($)	One Sentence Description	Task	Milestone	Justification
OECD NEA Paris, France	Oct-13	LLNL	1	5,000	Participate in the Expert Group meeting on Burn-up Credit and its associated WPNCS (and ICSBEP) governance meeting (Heinrichs)	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.
SNA+MC 2013 Paris, France	Oct-13	LLNL	2	10,000	Invited participants in the Monte Carlo Codes invited session (Heinrichs, Lee)	LLNL-IPD2	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.
ISRD2014 Aix en Provence, France	May-14	LLNL	1	5,000	Present/publish LLNL Experiment results at the International Symposium on Reactor Dosimetry (Hickman)	LLNL-IE2	Provide brief trip summary report to NCSP Manager (Q3).*	Continues NCSP leadership in dosimetry evaluation and processing methods and fosters continued collaboration with international partners to test and improve NCSP IE and analysis capabilities for supporting criticality safety applications.
PHYSOR 2014 Kyoto, Japan	Sep-14	LLNL	1	5,000	Present results of hybrid Monte-Carlo and Sn methods, automated verification & validation code and nuclear data testing results, and/or criticality safety research related to Fukushima accident (Walston)	LLNL-ND2	Provide brief trip summary report to NCSP Manager (Q4).	Continues NCSP leadership in V&V methods and fosters continued collaboration with international partners to test and improve NCSP ND capabilities for supporting criticality safety applications.

*Milestone rolled up into IE Section of 5-Year Plan.

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