United States Department of Energy

Nuclear Criticality Safety Program

Five-Year Execution Plan for the Mission and Vision

FY 2012 through FY 2016

National Nuclear Security Administration

August 2011

Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan for Fiscal Years 2012 through 2016, August 2011.

Approved:

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ACRONYMS AND DEFINITIONS

7uPCX	Seven Percent Critical Experiment
AM	Analytical Methods
AMPX	Nuclear Cross-Section Processing Computer Code Developed by ORNL
ANL	Argonne National Laboratory
ANS	American Nuclear Society
ANSI	American National Standards Institute
ARH	Atlantic Richfield Hanford
ASSNF	Assay Data for Spent Nuclear Fuel
BNL	Brookhaven National Laboratory
CAAS	Criticality Accident Alarm System
CEA	Commissariat à l'Énergie Atomique
C_EdT	Critical-Subcritical Experiment Design Team
CE-KENO	Continuous Energy Version of the KENO Code
CENTRM	Continuous-Energy Transport Module within the SCALE Code System
CFD	Computational Fluid Dynamics
CNEA	Argentina National Atomic Energy Commission
COG[1]	Lawrence Livermore National Laboratory Monte Carlo Computer Code
COMBINE	Idaho National Laboratory Cell Code
CritView	A plotting and interpolation software program designed to display criticality data from the ARH-600 Criticality Handbook
CSCT	Criticality Safety Coordinating Team
CSEWG	Cross-Section Evaluation Working Group
CSG	Criticality Safety Group
CSSG	Criticality Safety Support Group
DAF	Device Assembly Facility
DICE	Database for the International Criticality Safety Benchmark Evaluation Project
DOE	Department of Energy
DPP	Defense Programs Package
EDA	Energy Dependent Analysis
EMPIRE	BNL Nuclear Reaction Model Code System for Data Evaluation

ENDF	Evaluated Nuclear Data File
EUG	End-Users Group
FFTF	Fast Flux Test Facility
FY	Fiscal Year
GForge	Web-based collaborative development environment
GNASH[2]	A statistical nuclear model computer code
GODIVA	Fast-Burst Reactor
GUI	Graphical User Interface
HFIR	High Flux Isotope Reactor
HPGe	High Performance Germanium Detector
IAEA	International Atomic Energy Agency
ICSBEP	International Criticality Safety Benchmark Evaluation Project
IE	Integral Experiments
IPEN	Instituto de Pesquisas Energeticas Nuclear
INL	Idaho National Laboratory
IP&D	Information Preservation and Dissemination
IRMM	Institute for Reference Materials and Measurements
IRSN	Institut De Radioprotection et De Sûreté Nucléaire
ISOCS	In Situ Object Counting System (portable γ-spectroscopy system)
JEFF	Joint Evaluated Fission and Fusion File
JENDL	Japanese Evaluated Nuclear Data Library
KALMAN	Bayesian Code that Estimates Covariances
k_{eff}	The mean number of fission neutrons produced by a neutron during its life within the system
KENO[3]	Monte Carlo Criticality Computer Code
LA	Los Alamos (report)
LACEF	Los Alamos Critical Experiments Facility
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LLNL	Lawrence Livermore National Laboratory
McGNASH	A modern version of the GNASH code developed at LANL to produce nuclear data evaluation files for the ENDF
MCNP	Monte Carlo N Particle (N currently equals 3) Computer Code
MIDAS	U.S. – France collaboration on the Valduc Criticality Safety Facility Refurbishment/Utilization program

MIRTE	Matériaux Interaction Réflexion Toutes Epaisseurs
NA-16	Assistant Deputy Administrator for Facility and Infrastructure
NAD	Nuclear Accident Dosimeter
NCERC	National Criticality Experiments Research Center
NCS	Nuclear Criticality Safety
NCSET	Nuclear Criticality Safety Engineer Training
NCSP	Nuclear Criticality Safety Program
ND	Nuclear Data
NDAG	Nuclear Data Advisory Group
NJOY	A nuclear data processing code system
NNDC	National Nuclear Data Center
NNSA	National Nuclear Security Administration
OECD/NEA	Organization for Economic Cooperation and Development/Nuclear Energy Agency
ORELA	Oak Ridge Electron Linear Accelerator
ORNL	Oak Ridge National Laboratory
PATRM/PMC	Pulse Arrival-Time Recording Module / PCI Mezzanine Card
PNAD	Personal Nuclear Accident Dosimeters
RPI	Renssalaer Polytechnic Institute
PUFF	Multigroup Covariance Processing Code for the AMPX Cross-Section
RSICC	Radiation Safety Information Computational Center
SAMMY[4]	A nuclear model computer code
SCALE[5]	Standardized Computer Analyses for Licensing Evaluation
SILÈNE	Commissariat à l'Énergie Atomique Uranium Solution Critical Assembly
SNL	Sandia National Laboratories
SNM	Special Nuclear Materials
SOURCEX	An online collaboration tool
SPRF/CX	Sandia Pulsed Reactor Facility Critical Experiments
SQA	Software Quality Assurance
SRNS	Savannah River Nuclear Solutions
S/U	Sensitivity/Uncertainty
TACS	Training Assembly for Criticality Safety
TALLYX	An online collaboration tool

TRACY	Japan Atomic Energy Agency's (JAEA) – Transient Experiment Critical Facility
TSR	Technical Safety Requirement
TSUNAMI	Tool for Sensitivity and Uncertainty Analysis Methodology Implementation
TSURFER[6]	Tool for Sensitive and Uncertainty Analysis of Response Functionals Using Experimental Results
WINCO	Westinghouse Idaho Nuclear Company
ZPR	Zero-Power Reactor

[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]GNASH is a pre-equilibrium, statistical nuclear model code based on Hauser-Feshbach theory (and additional models) for the calculation of cross sections and emission spectra, primarily in the epithermal and fast neutron energy ranges.

[3]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.

[4]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.

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

[6]TSURFER is a prototype 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 2009-2018* (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.

NCSP is funded by the National Nuclear Security Administration (NNSA). Dr. Jerry McKamy (NA-162) is the NCSP Manager. He is 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/).

2.0 Technical Program Elements

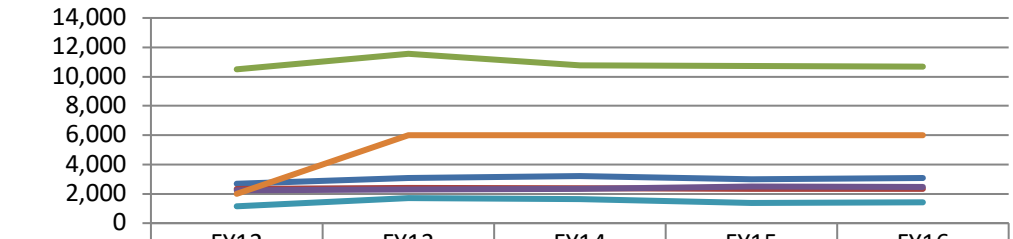
NCSP includes the following five technical program elements:

- Analytical Methods
- Information Preservation and Dissemination
- Integral Experiments
- Nuclear Data
- Training and Education

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 the last day of the month following the end of the quarter.

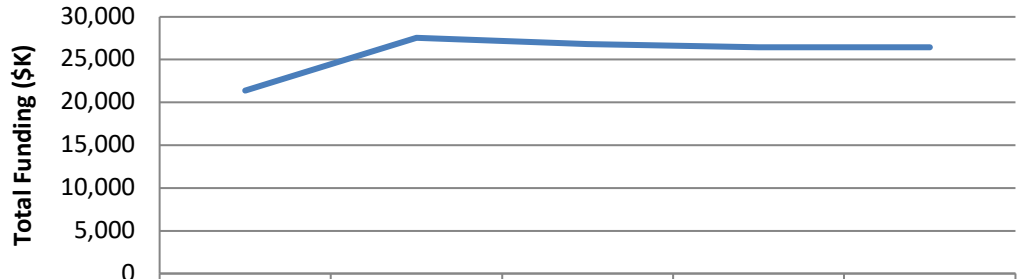
NCSP activities conducted in the United States; including programs in France are provided in Table 2-1 and 2-2 (rounded to the nearest $100K).

Table 2-1. Nuclear Criticality Safety Program Funding (United States Activities and Programs in France)



	FY12	FY13	FY14	FY15	FY16
AM	2,689	3,101	3,213	3,015	3,067
IP&D	2,334	2,404	2,367	2,338	2,356
IE	10,495	11,555	10,755	10,735	10,680
ND	2,241	2,307	2,333	2,500	2,489
T&E	1,150	1,710	1,643	1,393	1,416
MIDAS	2,000	6,000	6,000	6,000	6,000
Subtotal	**20,909**	**27,077**	**26,311**	**25,981**	**26,008**
CSG	**$475**	**$475**	**$475**	**$475**	**$475**
Total	**$21,384**	**$27,552**	**$26,786**	**$26,456**	**$26,483**

Table 2-2. Nuclear Criticality Safety Program Funding Overview - All Elements (United States Activities and Programs in France)



	1	2	3	4	5
TOTAL	21,384	27,552	26,786	26,456	26,483

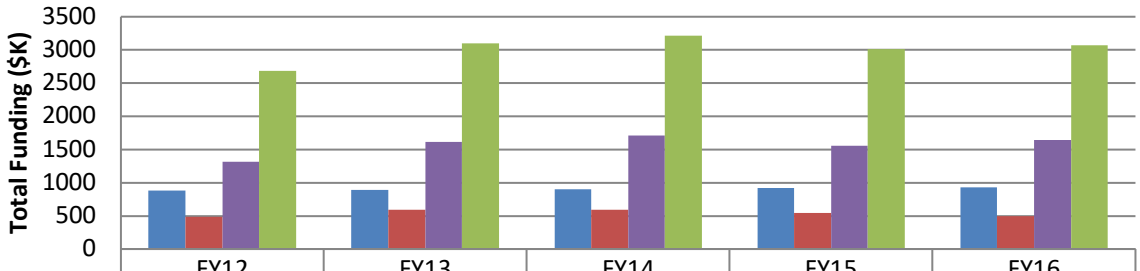
Finally, the goal of the NCSP is to provide "transparent responsiveness" for the DOE and Stakeholders. Therefore, this Plan and all accomplishments achieved under the auspices of the NCSP are posted in a timely manner on the NCSP website at: http://ncsp.llnl.gov/.

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 capability for the processing of nuclear data from the Evaluated Nuclear Data File (ENDF) and the radiation transport analysis needed to support nuclear criticality safety evaluations for sub criticality and shielding. An essential aspect of this capability 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 Analytical Method Budget (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
LANL	885	895	905	915	925
LLNL	489	591	593	545	497
ORNL	1315	1615	1715	1555	1645
TOTAL	2689	3101	3213	3015	3067

2.1.2 Approved Tasks

2.1.2.1 Los Alamos National Laboratory (LANL)

LANL AM1 ($785K)

Maintenance of the basic capabilities for performing Nuclear Criticality Safety (NCS) 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.

LANL AM2 ($100K)

This task supports 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, including covariance data and new reaction identifiers that support specialized data files such as the International Reactor Dosimetry File,

IRDF-2010. Base versions of the NJOY code system will continue to be distributed to the domestic user community through RSICC and to the international user community through the NEA Data Bank, with code updates distributed to all users through a LANL maintained website.

Table 2-1.2 LANL AM Budget Trend (FY2012 – FY2016)

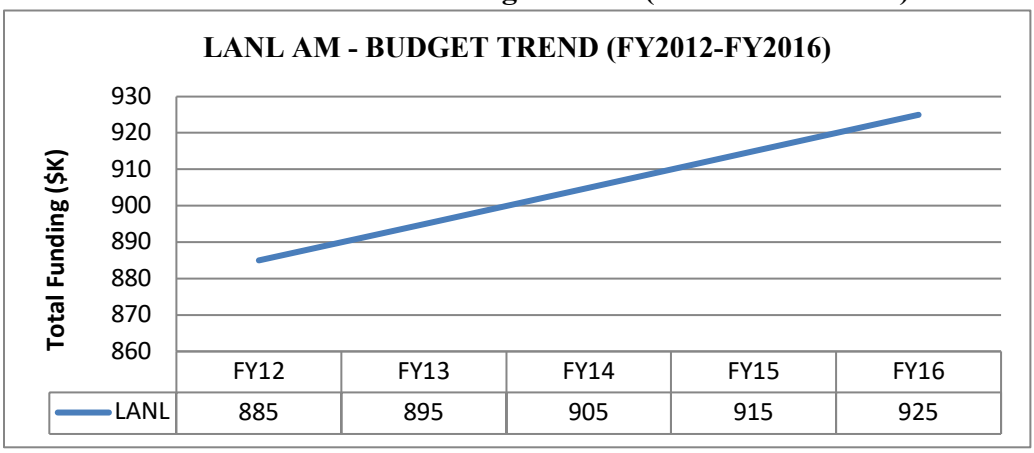
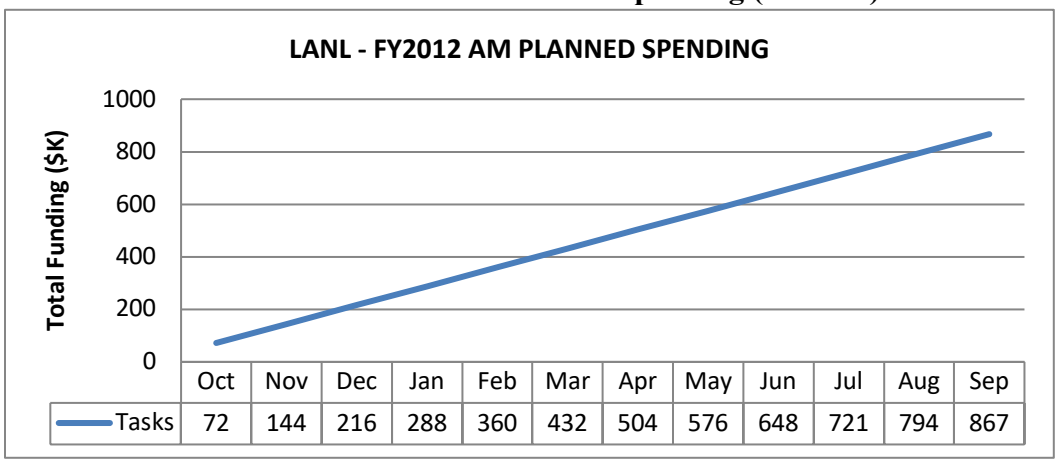


Table 2-1.3 LANL AM Planned Spending (FY2012)



LANL AM MILESTONES:

Quarter 2

- Issue an MCNP V&V report (Subtask 1).

Quarter 3

- Provide one on-site class at a DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Subtask 1).

Quarter 4

- Implement a test for population size and other new diagnostics into MCNP (Subtask 1).
- Improve the MCNP capabilities for performing uncertainty quantification (Subtask 1).
- Prepare a tutorial report on using MCNP for analyzing criticality alarm systems (Subtask 1).

- Release quality-assured MCNP neutron cross-section library for ENDF/B-VII.1 update to RSICC (Subtask 1).
- Provide user guidance and support for migrating from MCNP5 to MCNP6 (Subtask 1).
- Implement new ENDF-6 formats into NJOY (Subtask 2).

2.1.2.2 Lawrence Livermore National Laboratory (LLNL)

LLNL AM1 ($214K)

Provide maintenance, user support and modest upgrades to existing LLNL analytical methods including nuclear data processing, geometry modeling, and Monte-Carlo methods. This subtask also supports on-going LLNL assistance to the International Atomic Energy Agency (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 evolving ENDF-6 format. The subtask also supports participation in NCSP activities including the Cross Section Evaluation Working Group (CSEWG) and Nuclear Data Advisory Group (NDAG).

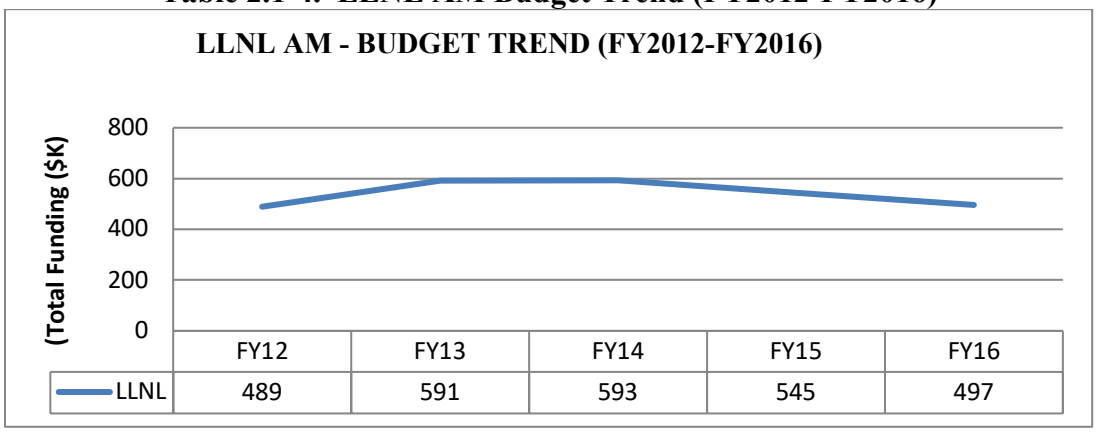
LLNL AM2 ($200K)

This subtask supports new work 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.

LLNL AM3 ($75K)

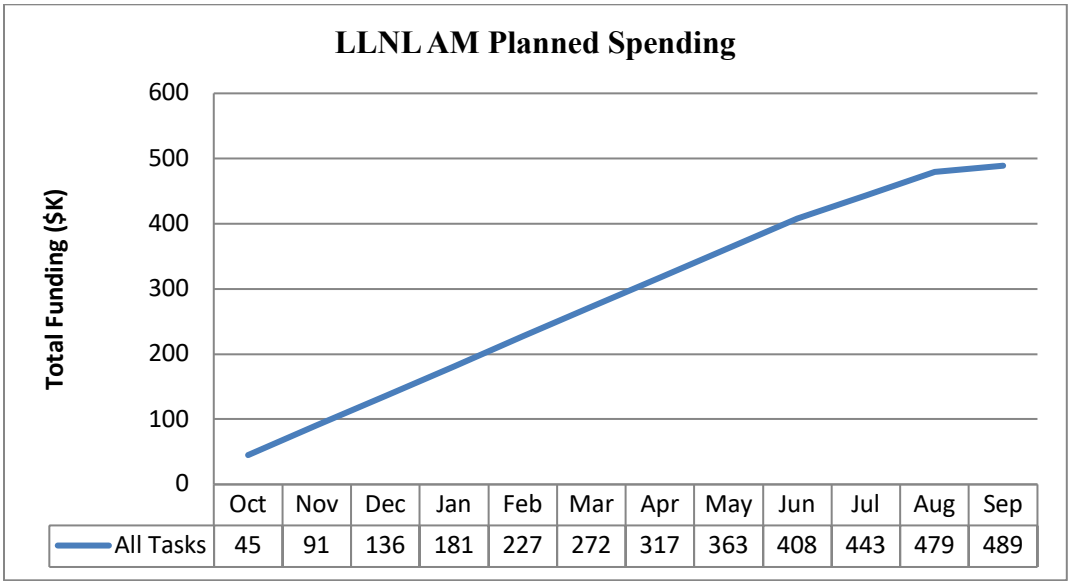
This subtask supports new work to generate a Criticality Slide Rule for Plutonium Systems using LLNL-developed analytical methods including time-dependent emission of delayed fission gammas. The results would be analogous to those available for uranium systems in "An Updated Nuclear Criticality Slide Rule" but in addition to tissue doses, the LLNL slide rule will include air dose, silicon dose and fluence, which are necessary for criticality accident alarm system applications. The final report is scheduled for publication in FY2015 with interim 1-D and 3-D results published in FY2013 and FY2014, respectively. An electronic version of the slide rule will be publicly available in FY2015 as both an NCSP web and iPhone application.

Table 2.1-4. LLNL AM Budget Trend (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
LLNL	489	591	593	545	497

Table 2.1-5. LLNL AM Planned Spending (FY2012)



LLNL AM MILESTONES:
Quarter 4

- Release PREPRO code updates and processed nuclear data for ENDF/B-VII.1 and subsequent releases to the IAEA (T1: Q3).
- Release COG supplemental library (or COG update, if required) with an ENDF/B-VII.1 nuclear data library (T1: Q4).
- Publish a preliminary report summarizing the available fast burst reactor excursion data such as fission yield, power history, surface motion and temperature data suitable for validation.

2.1.2.3 Oak Ridge National Laboratory (ORNL)

ORNL AM1 ($380K)
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 AM 2 ($480K)
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 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.

ORNL AM3 ($100K)
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. The 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 support radiation transport methods development and analyses.

ORNL AM4 ($100K)
New work task is to produce continuous-energy and multi-group cross-section libraries and covariance data libraries for the SCALE criticality safety analyses software based on the release of ENDF/B-VII.1 and subsequent releases of the latest ENDF/B evaluations from the National Nuclear Data Center.

ORNL AM5 ($75K)
New work task to provide TSUNAMI-generated sensitivity data files and verified SCALE input files for benchmark experiments that are currently published in the ICSBEP Handbook that are of priority interest to the NCSP. This task is a "historical-looking" task focused on preparing sensitivity data files and verified SCALE input files for existing ICSBEP benchmark experiments. In this task, all work will be conducted within the quality assurance framework established by the SCALE Procedure for Verified Archived Library Inputs and Data (VALID). The VALID procedure ensures traceability and quality in all inputs and data developed for deployment through the ICSBEP.

ORNL AM6 ($100K)
New work task to provide experimental uncertainty correlations for select ICSBEP benchmarks. Work will be performed to establish algorithms to quantify correlations in benchmark k_{eff} uncertainties for various types of experiments, such as solutions, lattices, and metals. Correlations will be generated for select series of experiments and provided to ICSBEP for distribution. In addition, a guidance document and automated tools will be distributed use by the NCS community.

ORNL AM7 ($80K)
New task to develop and deploy a handheld Nuclear Criticality Safety Slide Rule application (i.e., 'app') for use in a handheld mobile environment (e.g., iPhone, iPad, Android, etc.) thereby providing a powerful accident analysis capability to emergency responders who would likely be required to assemble at a centralized control point location (e.g., facility control room, assembly point, etc.) during an accident response to help coordinate emergency response efforts.

Table 2.1-6. ORNL AM Budget Trend (FY2012-FY2016)

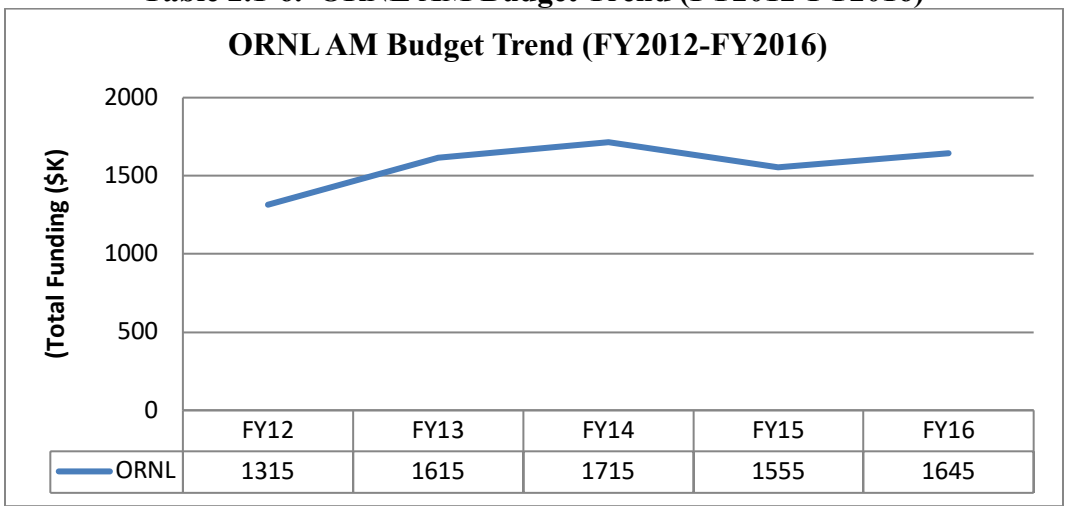
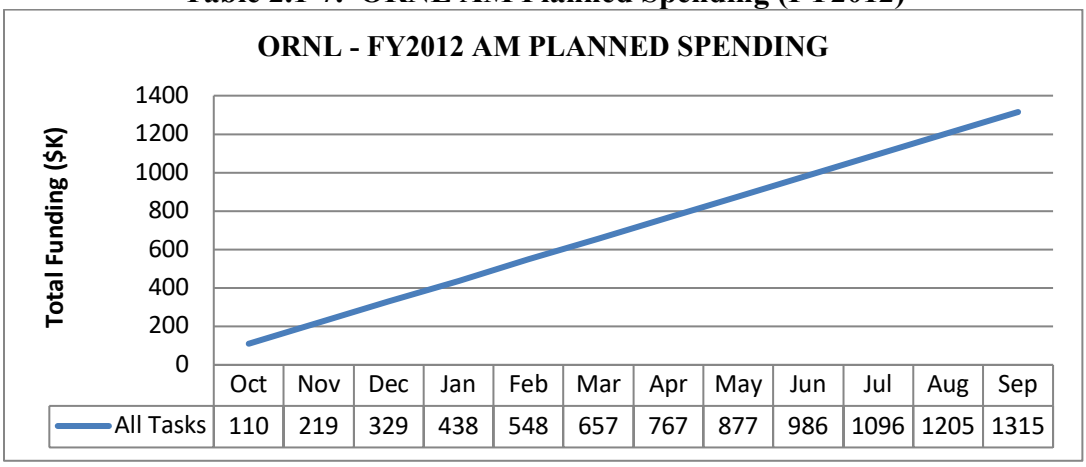


Table 2.1-7. ORNL AM Planned Spending (FY2012)



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).
- Provide monthly newsletters to announce software updates, conferences and workshops newsletters and provide status quarterly (T1).
- Continue software and data library exchange with OECD/NEA Data Bank and provide activity reports quarterly (T1).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (T2).
- Provide a status of SCALE SQA maintenance activities and report status quarterly (T2).
- Provide ongoing website maintenance including posting software updates for users to download, validation reports and other technical publications, training course schedules, and registration. Provide a status of these activities quarterly (T2).

- Provide ongoing responses to AMPX and nuclear data user technical questions via e-mail and report status in NCSP quarterly reports (T3).

Quarter 1

- Issue an annual SCALE maintenance report to the NCSP Manager (T2: Q1).

Quarter 2

- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (T2: Q2, Q4).

Quarter 4

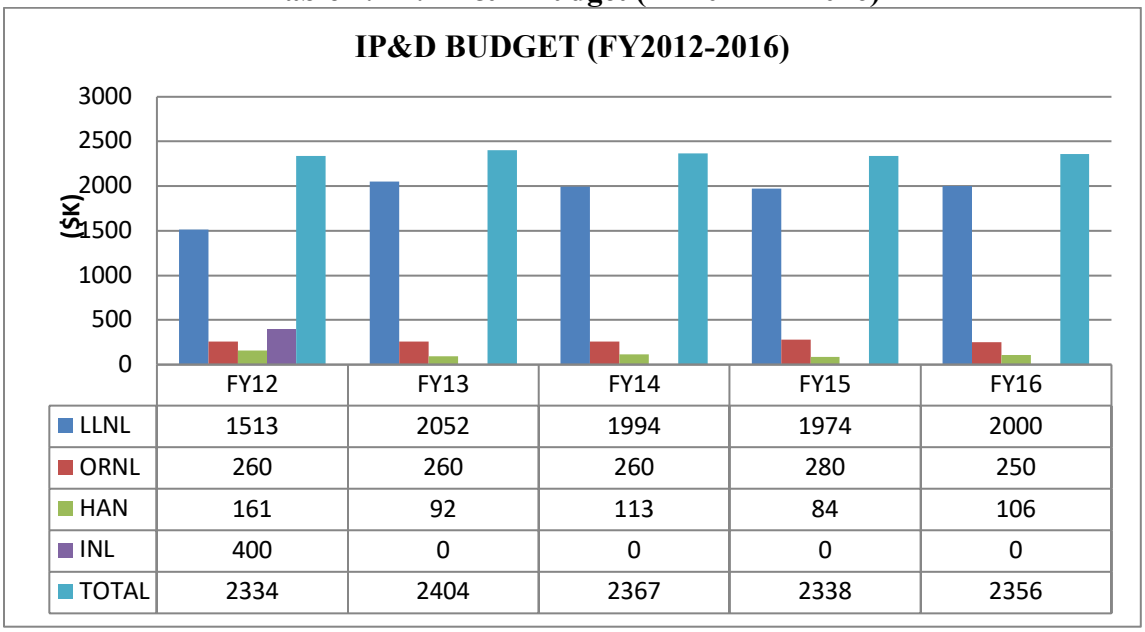
- Implement capability to quantify uncertainties in computed results due to uncertainties in material and geometry (T2: Q4).
- Complete automated continuous-energy data library checking utility for AMPX to perform consistency checks on SCALE CE libraries (T3: Q4).
- Document AMPX technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (T3: Q4).
- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (T3: Q4).
- Produce prototypic ENDF/B-VII.1 CE, MG, and covariance libraries to be available for testing with SCALE at ORNL (T4: Q4).
- Develop prototypic handheld app for uranium Nuclear Criticality Safety Slide Rule tool (T7: Q4).

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 internet 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 (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
LLNL	1513	2052	1994	1974	2000
ORNL	260	260	260	280	250
HAN	161	92	113	84	106
INL	400	0	0	0	0
TOTAL	2334	2404	2367	2338	2356

2.2.2 Approved Tasks

2.2.2.1 Hanford (H)

Hanford IP&D1 ($41K)
Provide verification and validation for MCNP and selected SCALE code calculations to be added to the database for CritView; provide documentation of these data and incorporation into the CritView program. Maintain and upgrade CritView as funding permits; provide limited response to user queries and any error identification.

Hanford IP&D2 ($120K)
Develop a method for obtaining integral cross sections for actinides from reactor operations and special test data. This subtask also will develop a data record matrix for isotopes and reactors.

Table 2.2-2. Hanford IP&D Budget Trend (FY2012-FY2016)

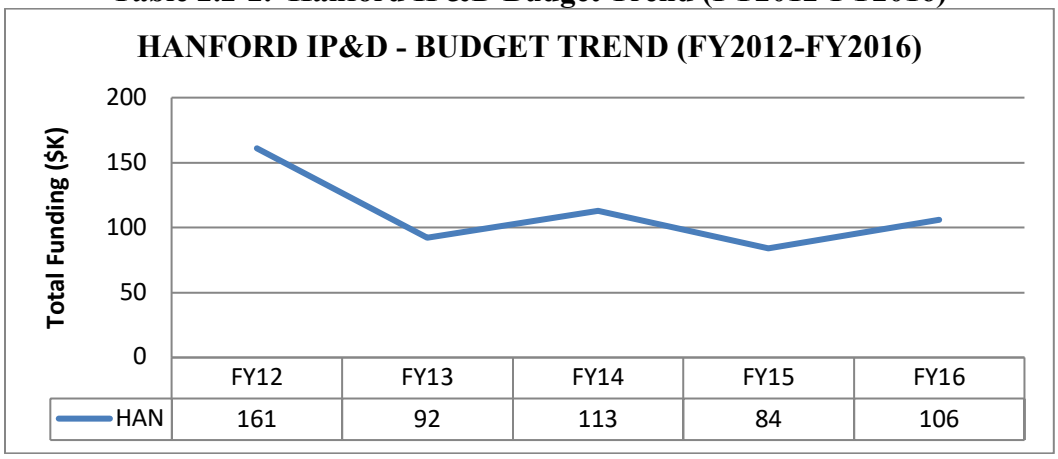
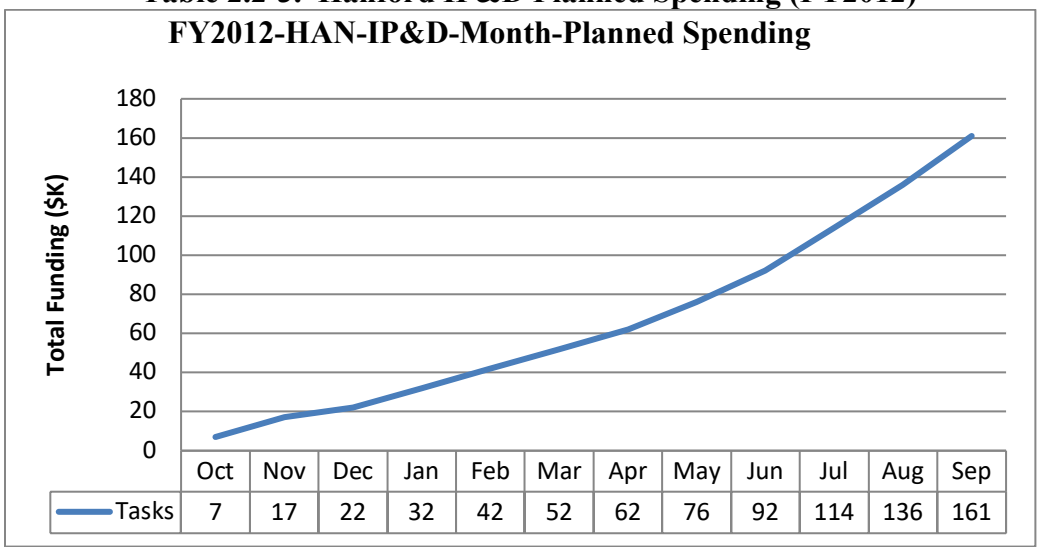


Table 2.2-3. Hanford IP&D Planned Spending (FY2012)



Hanford IP&D MILESTONES:

Quarter 2

- Update existing compilation of data (reactor and special test), issue data compilation report and provide report on NCSP website (T2: Q2).

Quarter 3

None

Quarter 4

- Provide updated and document changes to data files to LLNL for posting on the NCSP website (MCNP, SCALE, ARH-600, LA-10860) (T1:Q4).
- Provide updated and documented CritView code to new operating system to LLNL for posting on the NCSP website (T1: Q4).

- Issue letter report for U-Pu Tree with integral cross section and possible benchmark listing and provide report on NCSP website (T2: Q4).
- Issue letter report for demonstration of alternate information extraction and provide report on NCSP website (T2: Q4).

2.2.2.2 Idaho National Laboratory (INL)

INL IP&D1 ($400K)

INL IP&D Subtask 1 is a task to aid transition of ICSBEP from INL to LLNL Independent and Technical Review Group (TRG) reviews for all newly completed US Funded experiments that will be finalized and published on the NCSP Internet Site within two quarters of receipt of an Experiment Design Team reviewed and approved draft report (CED-4a). INL IPD Subtask 1 will also provide assistance to help transition leadership, coordination, and publication support for the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) International Criticality Safety Benchmark Evaluation Project (ICSBEP) to LLNL.

Table 2.2-4. INL IP&D Budget Trend (FY2012-FY2016)

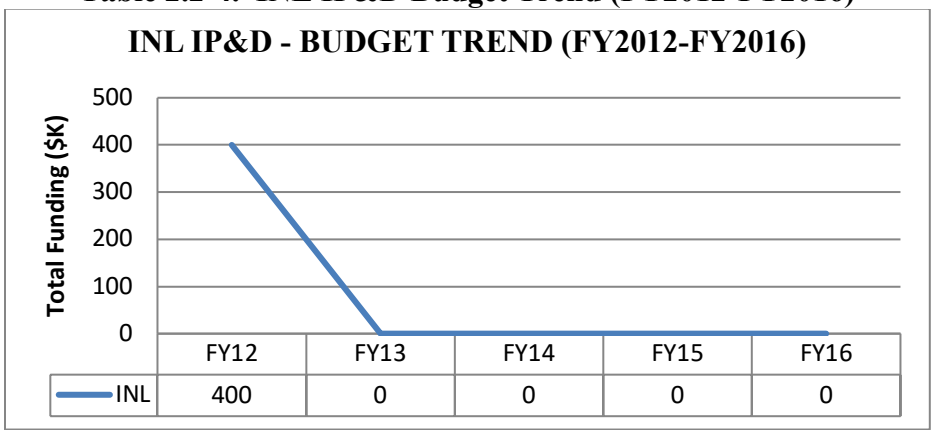
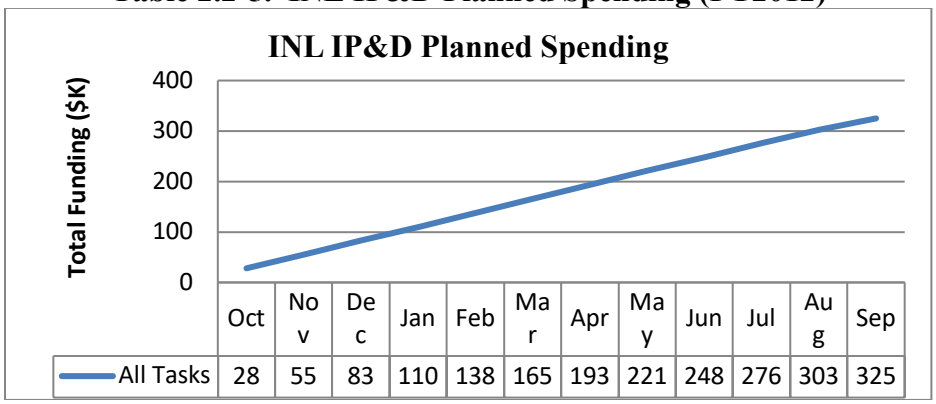


Table 2.2-5. INL IP&D Planned Spending (FY2012)



INL IP&D MILESTONES:
Occurs all 4 Quarters

- Transition ICSBEP to LLNL

2.2.2.3 Lawrence Livermore National Laboratory (LLNL)

LLNL IP&D1 ($800K)
Ongoing approved activity that provides Independent and Technical Review Group (TRG) reviews for all newly completed US Funded experiments. Priority historical experiments will be evaluated and reviewed (Internal, Independent, and TRG) as resources allow. All US funded experiments will be finalized and published on the NCSP Internet Site within two quarters of receipt of an Experiment Design Team reviewed and approved draft report (CED-4a). LLNL IP&D Subtask 1 will also provided leadership, coordination, and publication support for the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) International Criticality Safety Benchmark Evaluation Project (ICSBEP).

LLNL IP&D2 ($713K)
Operate and maintain the NCSP website. The NCSP website is the central focal point for access to criticality safety information collected under the NCSP, and is the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources. This subtask also provides operations and maintenance for information technology supporting the National Criticality Experiments Research Center (e.g., "Red "network).

Table 2.2-6. LLNL IP&D Budget Trend (FY2012-FY2016)

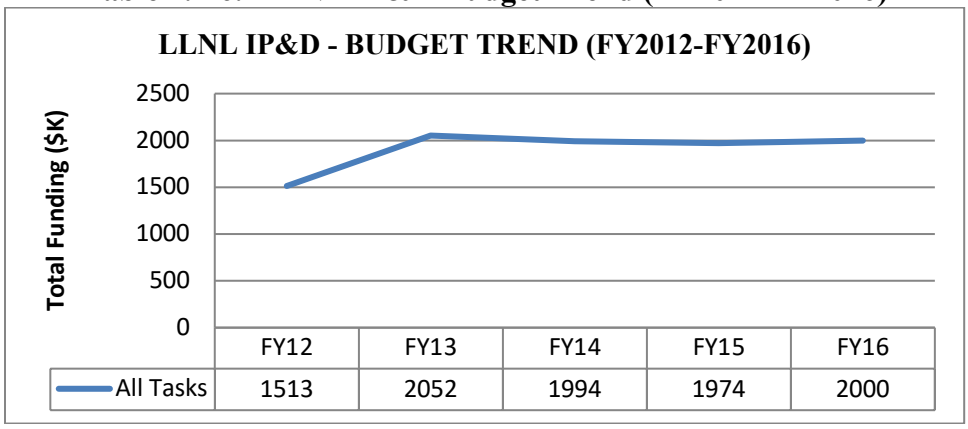
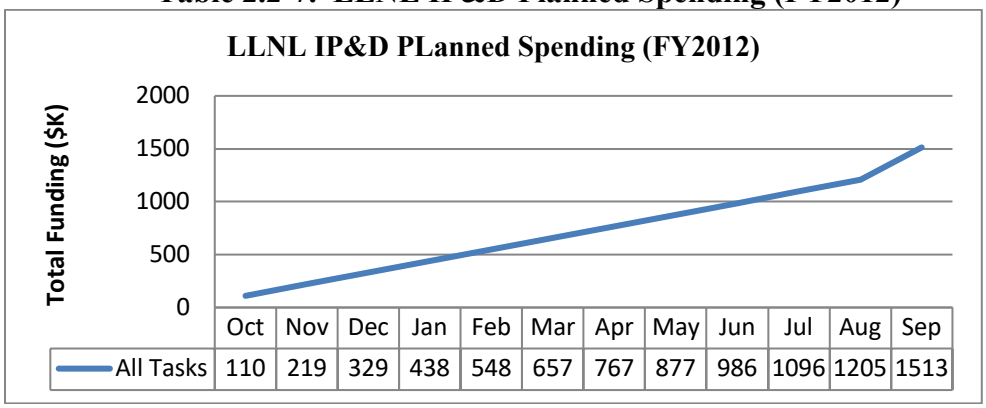


Table 2.2-7. LLNL IP&D Planned Spending (FY2012)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Tasks	110	219	329	438	548	657	767	877	986	1096	1205	1513

LLNL IP&D MILESTONES:

Occurs all 4 Quarters

- Maintain, operate and develop the NCSP website and "Red" network (T1).
- Maintain and develop the Integral Experiment Request (IER) and Nuclear Data Request forms (T1).
- Develop and deploy multimedia web-based training and videos as directed by the IP&D Manager (T1).
- Digitize and archive unclassified and classified hardcopy bibliography reports starting with the LLNL hardcopy report collections.
- Maintain and develop the searchable LLNL, Hanford and CSE databases (T1).

Quarter 1

- Deploy ICSBEP web content on the NCSP website (T1: Q1).

Quarter 2

- Maintain and develop ICSBEP web content (T1: Q2, Q3, Q4).
- Hold Annual ICSBEP TRG Meeting (T1).

Quarter 3

- Deploy the contents of the LA-10860-MS DVD contents on the NCSP website (T1: Q3).
- Procure classified website hardware and software (T1: Q3).

Quarter 4

- Submit security plan to LSO for approval to operate a classified NCSP website (T1: Q4).
- Complete Independent and TRG reviews of the MIRTE-1 Experiments and finalize for publication (Proprietary until 31 DEC 2017) — Carried over from FY-2011 (T1).
- Complete the annual publication of *International Handbook of Evaluated Criticality Safety Benchmark Experiments* and submit it to the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) for replication and distribution (T1).

2.2.2.4 Oak Ridge National Laboratory (ORNL)

ORNL IP&D1 ($200K)

New work task to provide TSUNAMI-generated sensitivity data files and verified SCALE input files for new benchmark evaluations that will be published in the ICSBEP Handbook in FY12 and the out years. Moreover, this task is a "forward-looking" task focused on preparing sensitivity data files and verified SCALE input files for new benchmark experiments that will be published in the ICSBEP Handbook in the future. 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. This task will provide the design, evaluation, and documentation of benchmark quality measurements for Criticality Accident Alarm System (CAAS) experimental configurations performed at CEA experiment facilities in Valduc France.

ORNL IP&D-2 ($60K)

Collect, catalog, and preserve criticality document collections amassed by Dixon Callihan, Joe Thomas, Howard Dyer, and Jim Mincey.

Table 2.2-8. ORNL IP&D Budget Trend (FY2012-FY2016)

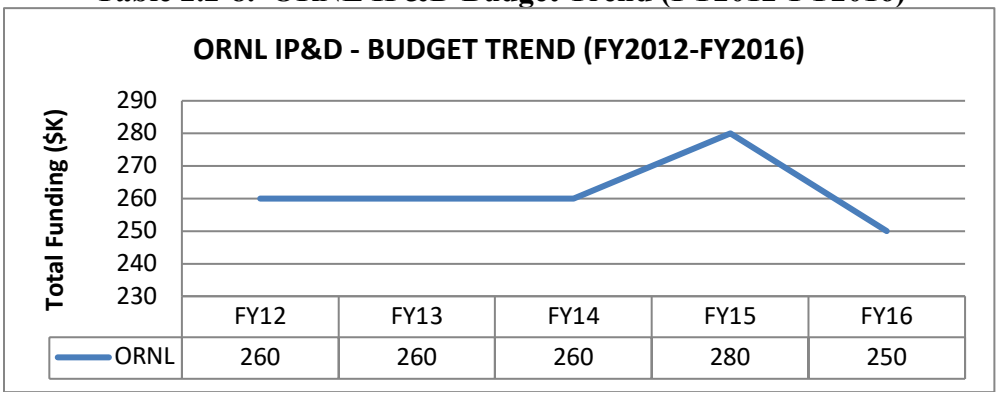
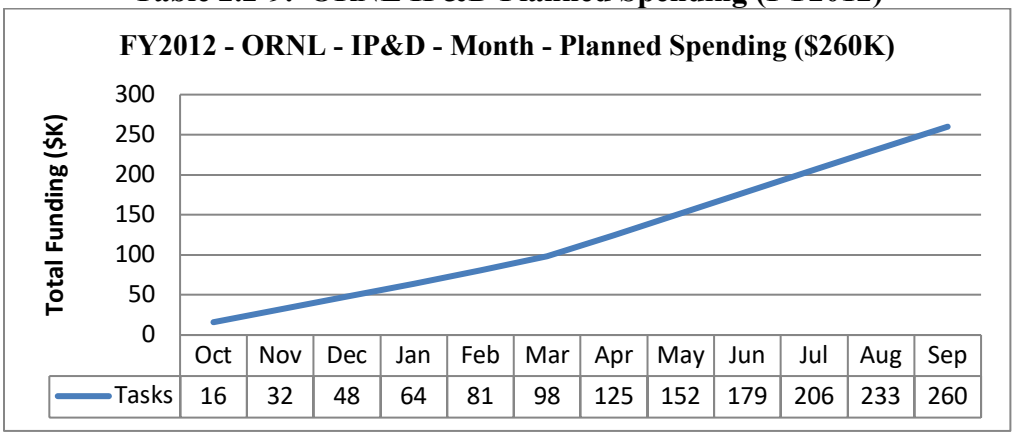


Table 2.2-9. ORNL IP&D Planned Spending (FY2012)



ORNL IP&D MILESTONES:
Quarter 4

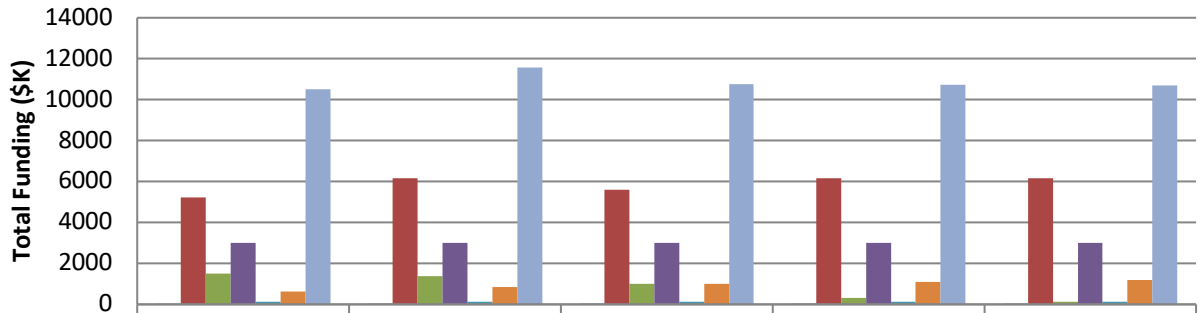
- Provide TSUNAMI sensitivity data files and inputs for all new evaluations to the ICSBEP for distribution (T1: Q4).
- Inventory approximately one-third of the ORNL NCS document collections of Dixon Callihan, Joe Thomas, and Jim Mincey, create a bibliographic record, and provide the record for posting on the DOE NCSP website (T2: Q4).
- Complete draft evaluation of second and third SILENE benchmark configurations (T4: Q4).
- For select ICSBEP benchmarks, provide TSUNAMI sensitivity data files and associated SCALE input decks to the ICSBEP for distribution (T6: Q4).
- Develop preliminary algorithms for the determination of experimental uncertainty correlations (T6: Q4).

2.3 Integral Experiments

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 nuclear criticality safety training programs and various other programs for the DOE/NCSP and other government agencies.

Table 2.3-1. IE Budget (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
ANL	30	35	40	45	50
LANL	5210	6175	5590	6155	6170
LLNL	1500	1375	1000	305	125
NNSS	3000	3000	3000	3000	3000
ORNL	115	120	125	130	135
SNL	640	850	1000	1100	1200
TOTAL	10495	11555	10755	10735	10680

All integral Experiments tasks and milestones are published as standalone documents. Contact NSCP program Manager Dr. Jerry McKamy if you have a need to know

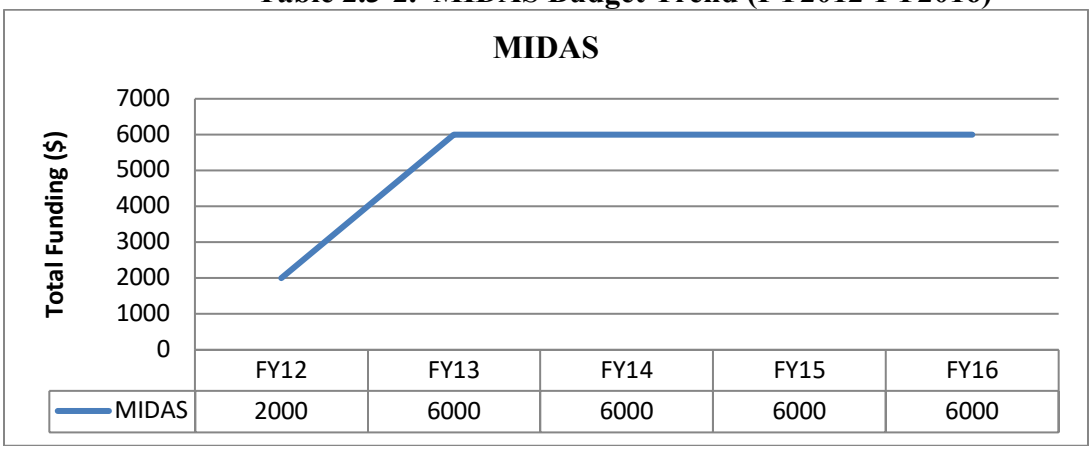
The MIDAS Program

The NCERC was constructed to accommodate critical assemblies that meet most of the U.S. needs for integral nuclear data measurements. There is, however, still a need for new precise integral nuclear data utilizing solutions containing plutonium, uranium and minor actinides in various combinations to support advanced reactor fuel cycles and materials disposition. There is also a need for integral nuclear data measurements for large dilute systems that can only be acquired with a large, multipurpose horizontal split table assembly. Representatives from the U.S. and France met in 2007 to discuss the possibility of collaborating to design, build, fund and use criticality experiment facilities to meet these broad technical needs, and have agreed that

there is a strategic need for a new high performance criticality experiment facility for research on criticality safety that none of them would be able to build and finance on their own. Therefore, the U.S. and France decided to cooperate in the joint refurbishment and subsequent operation of a Criticality Safety Facility that will be located in a modernized building at the CEA premises of Valduc, France, thereby combining their financial and technical resources to support the design, construction, funding and use of such a Criticality Safety Facility to meet the future emerging needs of both countries for the next twenty to thirty years.

Funding for this activity will be provided to the French through formal contractual instruments that are legally binding and will provide adequate controls and assurance that risk to the U.S. is maintained at an acceptably low level. These agreements will delineate the bylaws by which the U.S. and French will jointly manage the refurbishment phase and subsequently the utilization phase of the Criticality Safety Facility. The timeline for this activity is: Refurbishment Phase: 2012 through 2021; and Utilization Phase: 2021 through 2042.

Table 2.3-2. MIDAS Budget Trend (FY2012-FY2016)



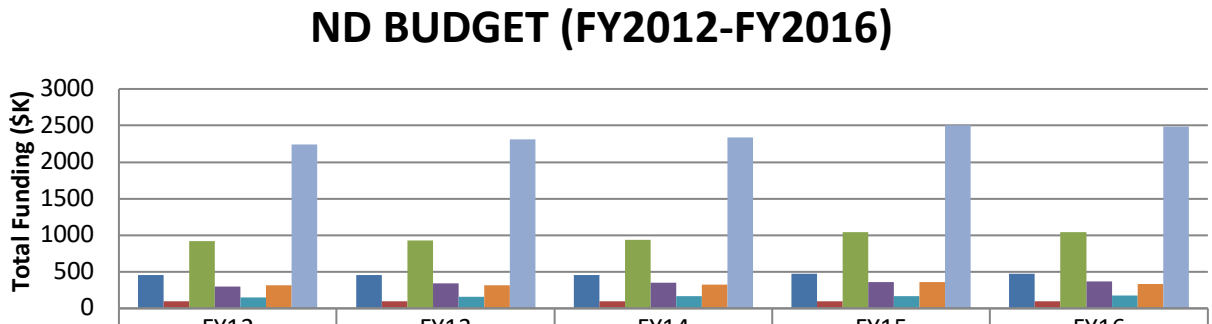
	FY12	FY13	FY14	FY15	FY16
MIDAS	2000	6000	6000	6000	6000

2.4 Nuclear Data

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 nuclear criticality safety analyses. The NCSP continues to improve coordination of Nuclear Data (ND) activities by fostering a strong collaborative effort among all of our 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 D for the FY 2012 through 2016 schedule, milestones and deliverables associated with specific nuclear data measurement, evaluation, and publication. Milestones not contained in Appendix D are delineated below.

Table 2.4-1. ND Budget (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
LANL	455	460	460	470	470
LLNL	100	100	100	100	100
ORNL	921	927	933	1039	1044
ANL	301	342	348	359	365
BNL	150	160	170	170	180
RPI	314	318	322	362	330
TOTAL	2241	2307	2333	2500	2489

2.4.2 Approved Tasks

2.4.2.1 Argonne National Laboratory (ANL)

ANL ND1 Subtask 1 ($185K)

Perform on-going data testing in support of the data validation effort for Evaluated Nuclear Data File (ENDF)/B-VII and new evaluated nuclear data that are of interest to the criticality safety community. Emphasis is on testing and reporting performance of priority evaluations identified by the Nuclear Data Advisory Group (NDAG). Support the NCSP website initiatives for

addressing differential nuclear data needs. Participate and provide leadership roles in nuclear data international expert groups and working groups

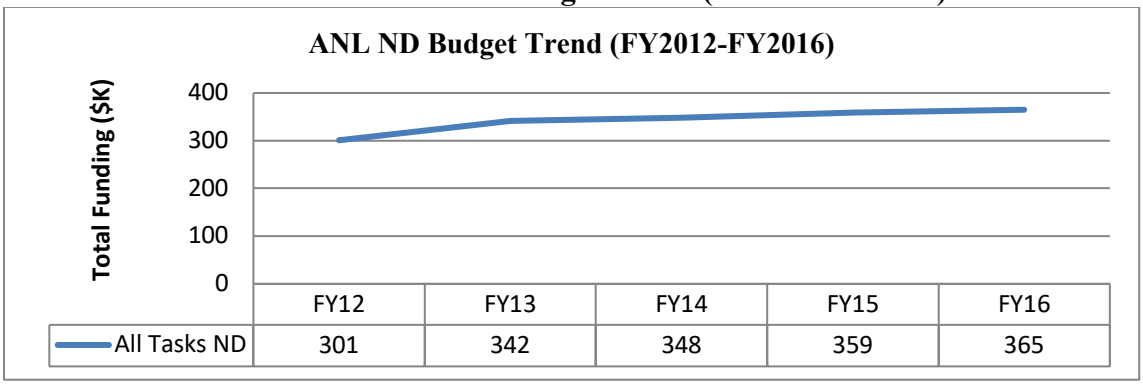
ANL ND1 Subtask 2 ($41K)

Support on-going development of advanced nuclear data covariance methodologies (e.g., material-to-material covariance, application of GANDER to assess nuclear data requirements, etc.), formats and Quality Assurance. Emphasis is to assure development of high quality covariance files required for NCSP Sensitivity/Uncertainty methods. This effort is lead by nuclear data experts Doug Muir and Donald Smith (Argonne Special Term Appointees), including the chairman of the CSEWG Covariance Committee.

ANL ND1 Subtask 3 ($75K)

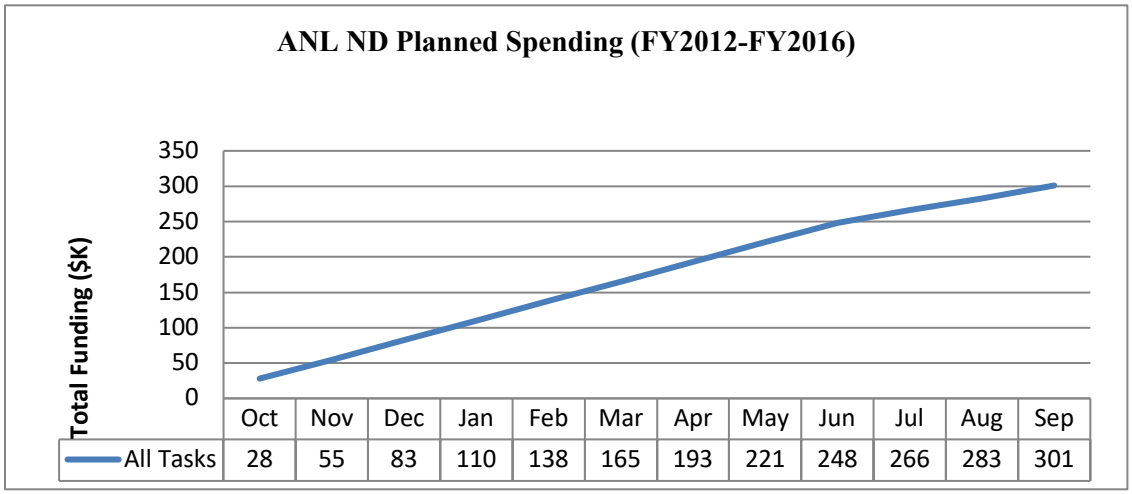
Generate integral experiment covariance data in on-going support of Sensitivity/Uncertainty methods, Uncertainty Quantification and nuclear data adjustment methods. Develop evaluation methodology for these covariance data and apply to the ANL ZPR/ZPPR experiments available in the ICSBEP Handbook. Covariance data will be produced for the full set of ANL benchmarks in FY12. On-going support will apply the methodology to produce covariance files for priority integral data for the NCSP.

Table 2.4-2. ANL ND Budget Trend (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
All Tasks ND	301	342	348	359	365

Table 2.4-3. ANL ND Planned Spending (FY2012)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Tasks	28	55	83	110	138	165	193	221	248	266	283	301

ANL ND MILESTONES:

Quarter 1

- Provide reports to NDAG and Cross Section Evaluation Working Group (CSEWG) documenting results of NCSP data testing and validation (T1: Q1 & Q3).
- Chair meetings of the CSEWG Covariance Committee and report contributions through NDAG and CSEWG (T2: Q1 & Q3).

Quarter 2

- Report progress on evaluation methodology and preliminary results (T4).

Quarter 3

- Participate as ENDF representative in the OECD/NEA WPEC annual meeting and various subgroup activities, including the High-Priority Request List (T1).

Quarter 4

- Participate as NCSP representative to the OECD/NEA Working Party on Nuclear Criticality Safety (WPNCS) (T1).
- Participate in Expert Groups related to nuclear data that are important to criticality safety, including the OECD-NEA Expert Groups on Uncertainty Analyses for Criticality Safety Assessment (UACSA), Assay Data for Spent Nuclear Fuel (ADSNF) for burn up credit, Expert Group on Burn-up Credit (BUC) and WPEC SG33 on Methods and Issues for the Combined Use of Integral Experiments and Covariance Data (T1).
- Document additional capability to produce quality covariance evaluations for ENDF (T2).
- Deliver completed covariance evaluations to ICSBEP project (T4).

BNL ND1 (150K)

Provide technical support to the NCSP to ensure that NCSP cross section evaluations are duly checked, processed, visualized, reviewed, archived and made available through the 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 subtask.

Table 2.4-4. BNL ND Budget Trend (FY2012-FY2016)

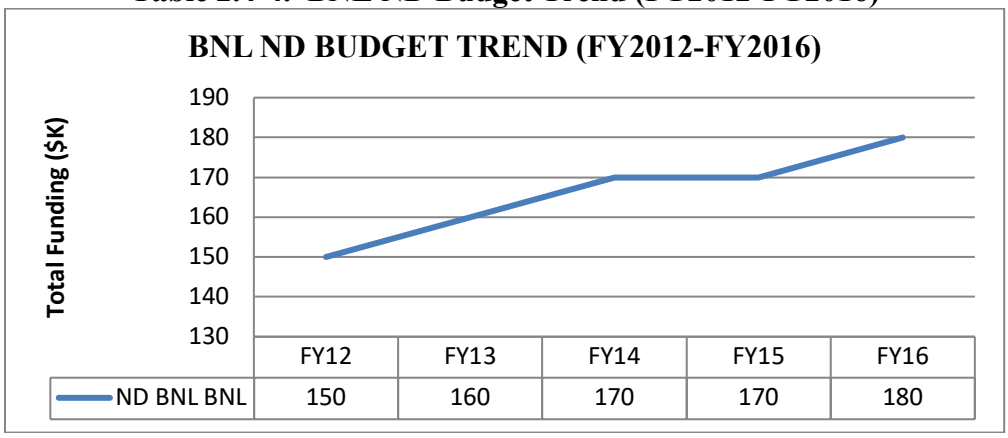
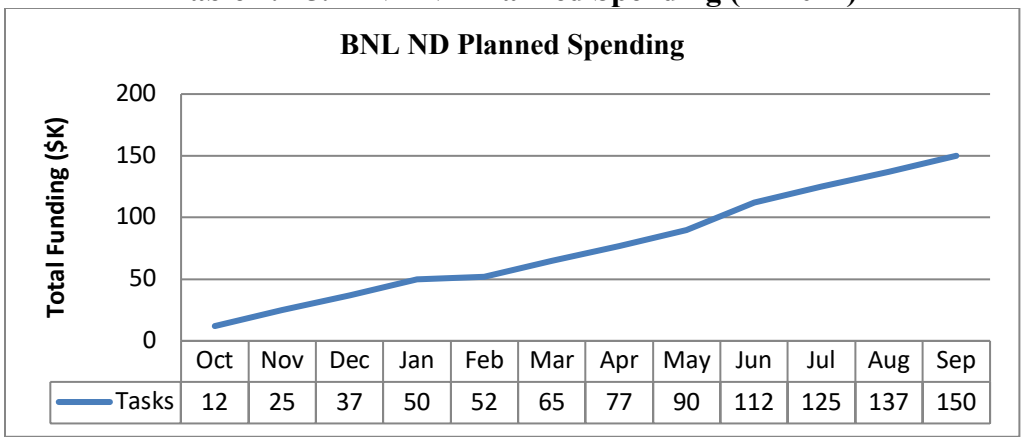


Table 2.4-5. BNL ND Planned Spending (FY2012)



BNL ND MILESTONES:
Occurs all 4 Quarters

- Perform data verification of new NCSP evaluations and store them in the GForge server (T1).

Quarter 2

- Perform QA of covariance data in new NCSP evaluations (T1).

Quarter 4

- Perform QA of covariance data in new NCSP evaluations (T1).

Los Alamos National Laboratory (LANL)

LANL ND1 ($455K)

Provide differential data evaluation, covariance development, and data testing work is 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.

Table 2.4-6. LANL ND Budget Trend (FY2012-FY2016)

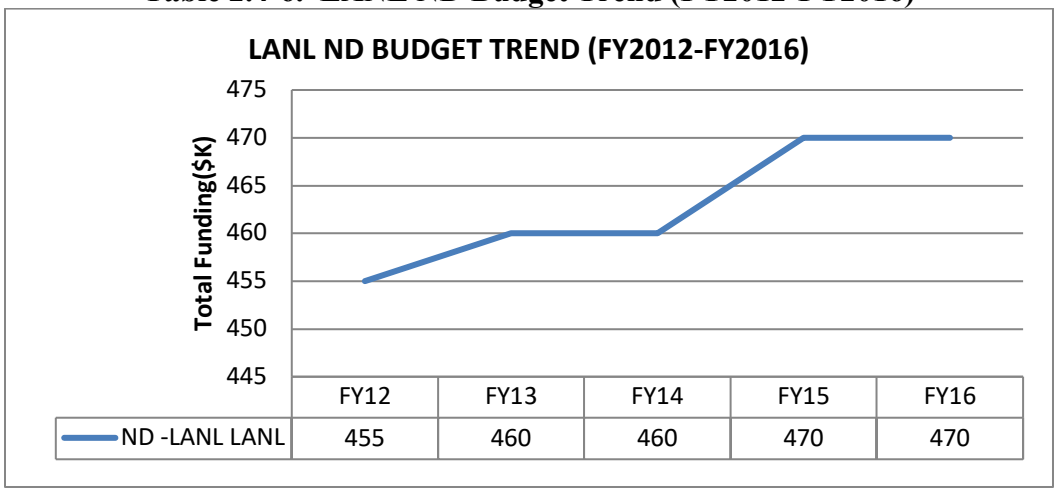
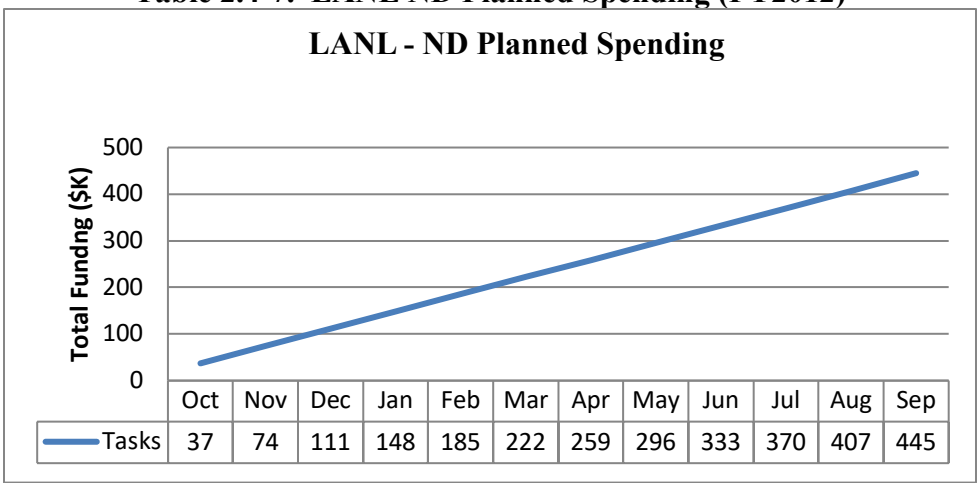


Table 2.4-7. LANL ND Planned Spending (FY2012)



LANL ND MILESTONES:

Quarter 1

- Propose format for p(nu) data to CSEWG for ENDF (T1).

Quarter 4

- Deliver updated high-energy evaluations for Ni-58 and Ni-60 to NNDC (T1).
- Using systematics, improve prompt fission neutron spectra (PFNS) for all minor actinides and deliver updated evaluations to NNDC (T1).

Lawrence Livermore National Laboratory (LLNL)

LLNL ND1 ($100K)

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. The subtask includes complete generation of delayed fission gamma data for all available nuclides in FY2012 and issuance of a comprehensive final report in FY2013 documenting the technical basis of the method and data testing results.

Table 2.4-8. LLNL ND Budget Trend (FY2012-FY2016)

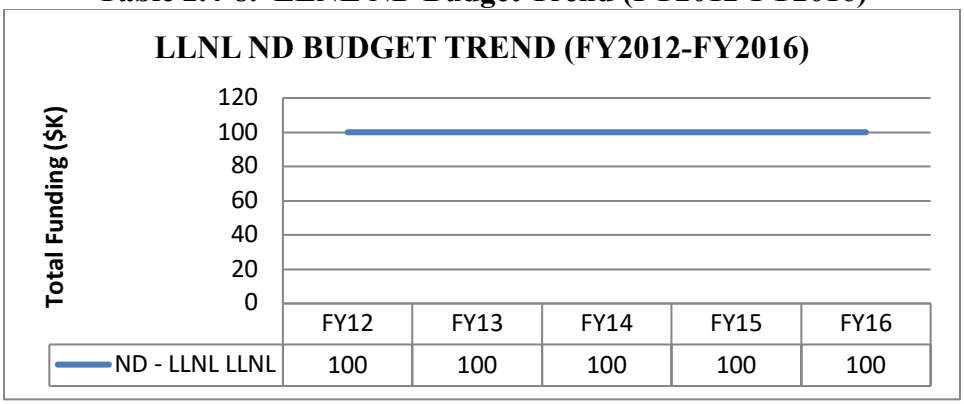
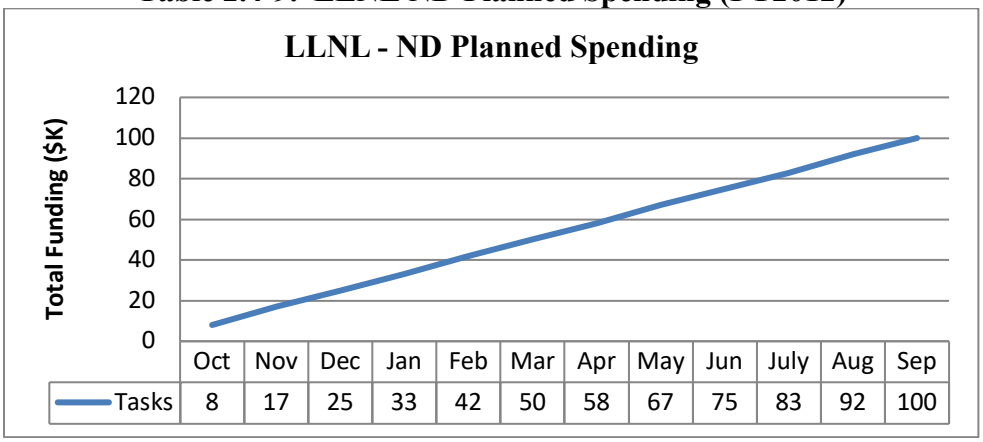


Table 2.4-9. LLNL ND Planned Spending (FY2012)



LLNL ND MILESTONES:

Quarter 4

- Complete generation of delayed fission gamma data for all available nuclides (T1: Q4).

Oak Ridge National Laboratory (ORNL)

ORNL ND1 ($880K)

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 D.

ORNL ND2 ($41K to ORNL; $314K to RPI through Naval Reactors)

Ongoing task for ORNL and RPI collaboration to broaden and maintain the U.S. cross-section measurement capabilities to support NCSP experimental nuclear data needs by enabling NCSP related nuclear data measurement at the RPI Gaerttner LINAC laboratory.

Table 2.4-10. ORNL ND Budget Trend (FY2012-FY2016)

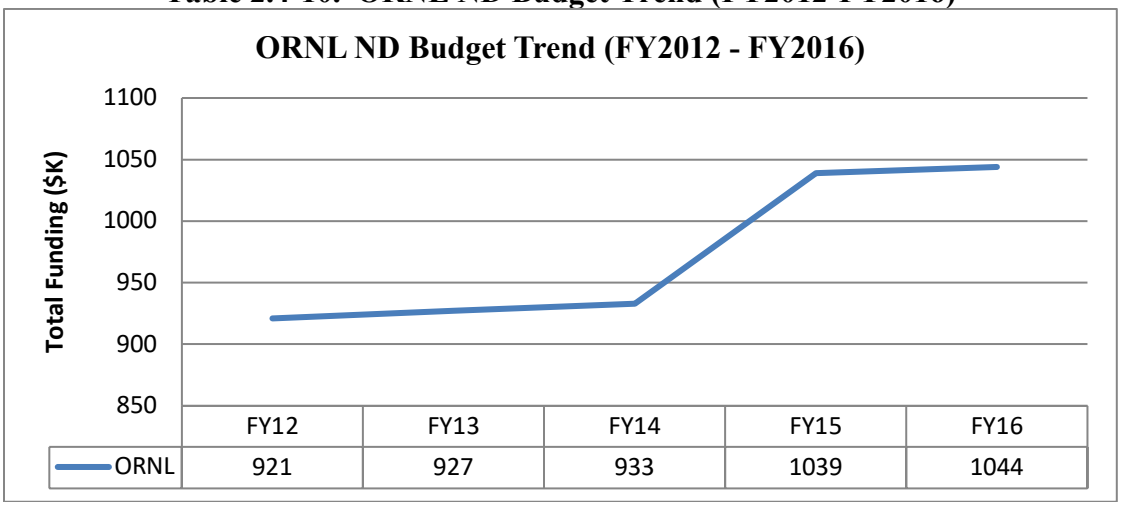


Table 2.4-11. RPI ND Budget Trend (FY2012-FY2016)

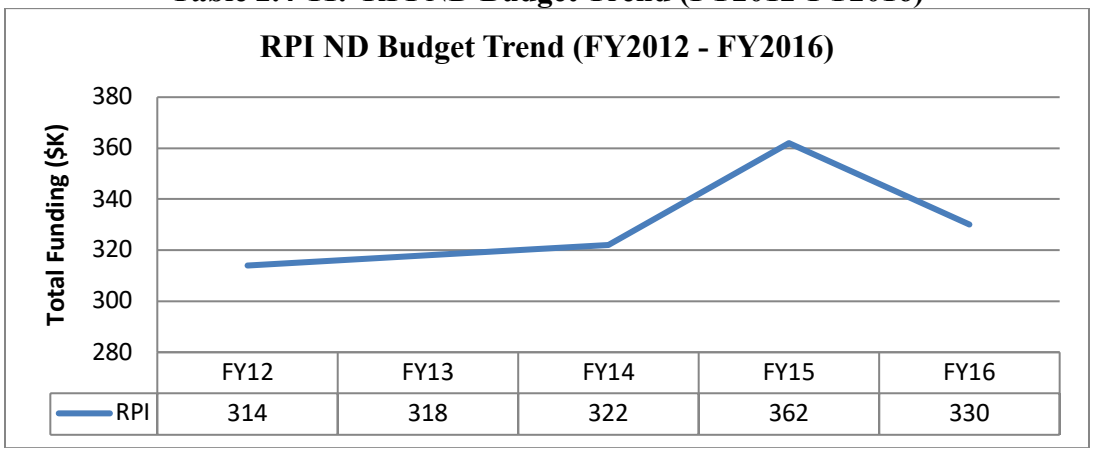
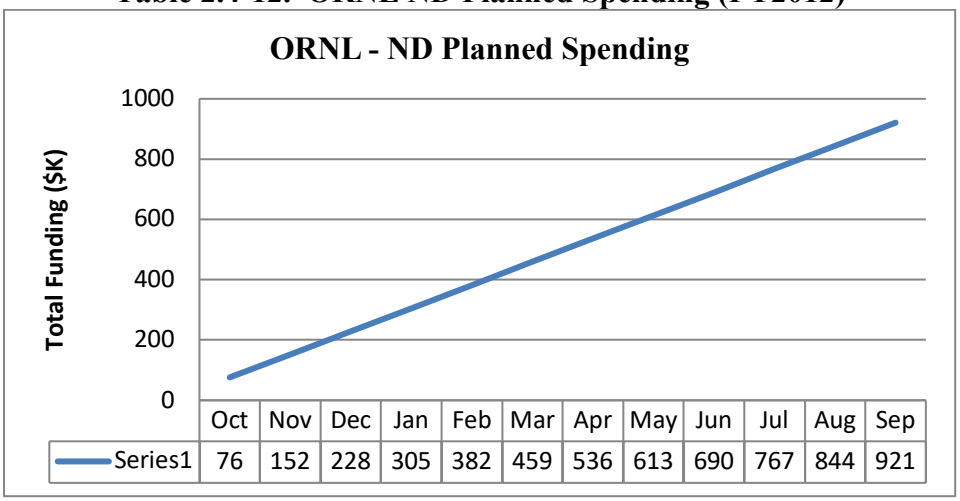
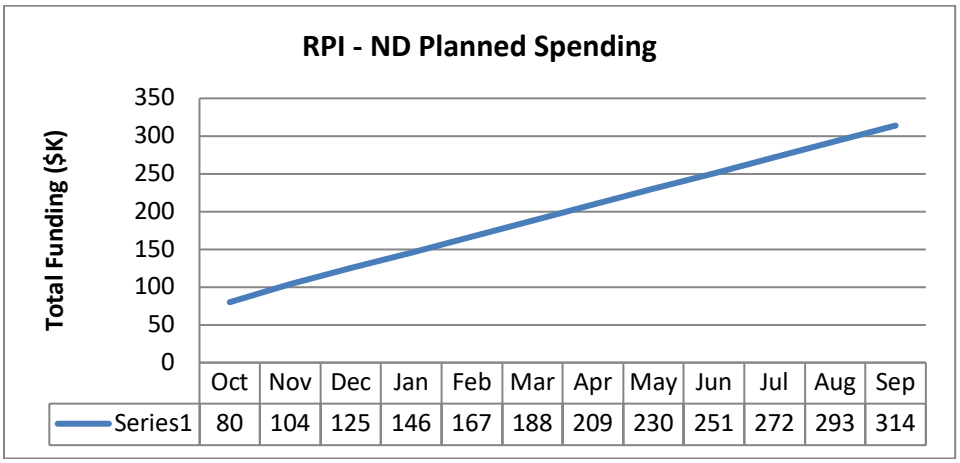


Table 2.4-12. ORNL ND Planned Spending (FY2012)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Series1	76	152	228	305	382	459	536	613	690	767	844	921

Table 2.4-13. RPI ND Planned Spending (FY2012)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Series1	80	104	125	146	167	188	209	230	251	272	293	314

ORNL ND MILESTONES:

Quarter 2

- Capability development: Perform scoping measurements with prototype detectors (T2: Q2).

Quarter 4

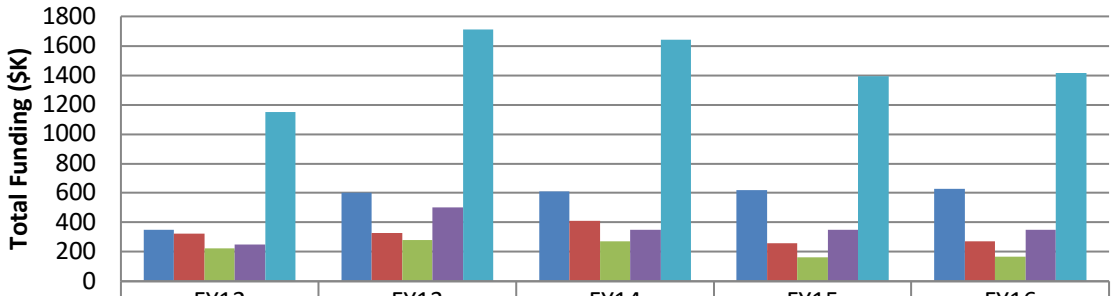
- Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix D (T1: Q4).
- Capability development: Build flight station and new capture detector (T2: Q4).
- Measurements: Complete measurement of ^{238}U scattered and fission neutrons (0.5-20 MeV) (T2: Q4).
- Measurements: Complete transmission measurements to supplement ORNL measurements planned at IRMM (T2: Q4).

2.5 Training and Education

2.5.1 Program Element Description

The Training and Education (T&E) program element will continue to offer hands-on training courses as needed by DOE and identify and develop training needs and 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 (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
LANL	350	600	610	620	630
LLNL	325	330	410	260	270
ORNL	225	280	273	163	166
SNL	250	500	350	350	350
TOTAL	1150	1710	1643	1393	1416

2.5.2 Approved Subtasks

LANL T&E1 (350K)

This is new work 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 (FY2012-FY2016)

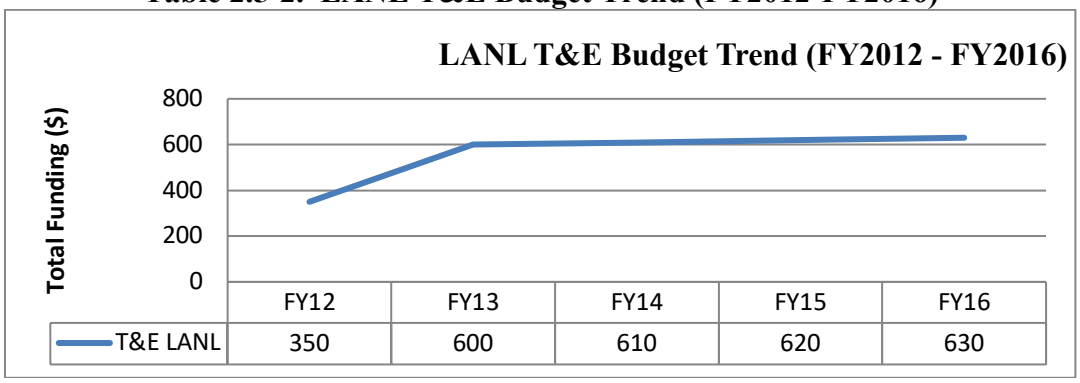
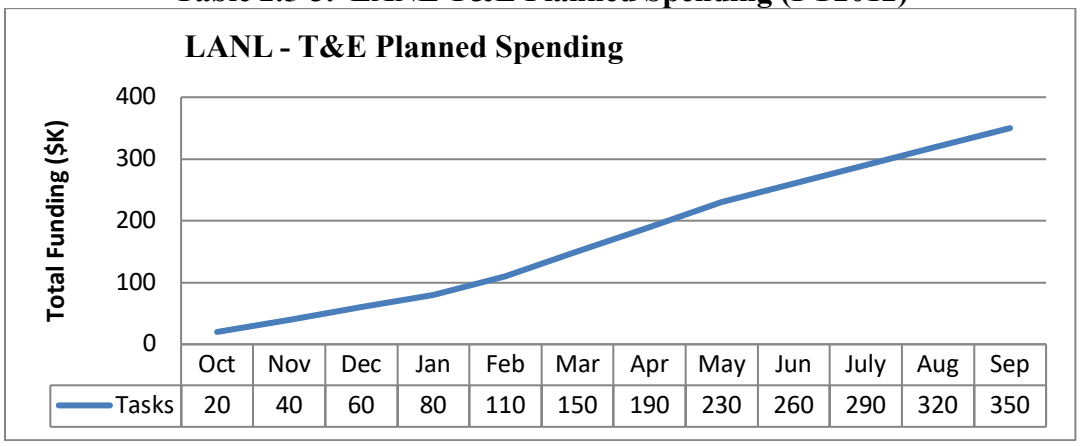


Table 2.5-3. LANL T&E Planned Spending (FY2012)



LANL T&E MILESTONES:
Occurs all 4 Quarters

- Provide class room and hands on training at LANL and at NCERC in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports (TE1-T1).
- Update NCERC Staffing plan to include training qualification for operating NCERC.
- Turn around time for operator training (number of operators trained every quarter).

LLNL T&E1 ($250K)

On-going approved activity to provide unique "hands-on" training at the Device Assembly Facility using the Training Assembly for Criticality Safety (TACS). Specifically, the subtask provides for LLNL support for four classes in FY2012, six classes in FY2013 and eight classes in FY2014 and beyond.

LLNL T&E2 ($75K)

New work to convert existing text-based NCSET training modules into modern multimedia presentations including embedded video and computerized artwork to facilitate comprehension

of the training. The approved schedule includes completion of Module 8 (Hand Calculation Methods, Part I), Module 14 (A Review of Criticality Accidents) and Module 13 (Measurement and Development of Cross Section Sets) in FY2012, FY2013 and FY2014, respectively.

Table 2.5-4. LLNL T&E Budget Trend (FY2012-FY2016)

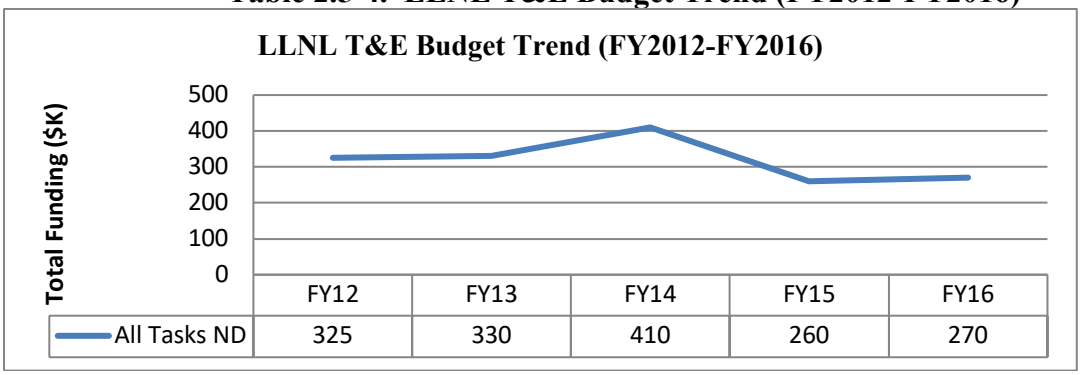
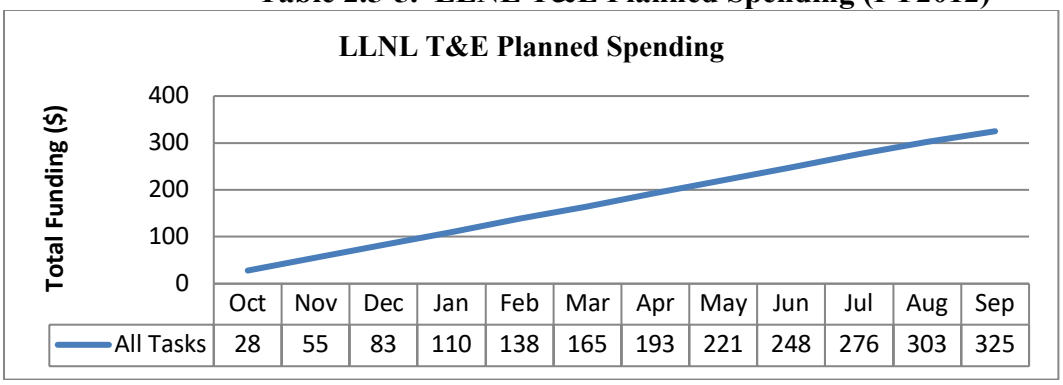


Table 2.5-5. LLNL T&E Planned Spending (FY2012)



LLNL T&E MILESTONES:
Quarter 4

- Complete registration process and provide "hands on" TACS training in support of four "hands-on" courses in accordance with the schedule approved by the NCSP Manager (T1: Q4).
- Complete multimedia conversion of NCSET Module 8, Hand Calculations Methods, Part I (T2: Q4).

Oak Ridge National Laboratory

ORNL T&E1 ($225K)

Manage the collaborative multi-laboratory development, designing, and scheduling of the multi-faceted and phased NCSP training program and oversee the execution of the program. In addition, ORNL will organize and host the annual NCSP Technical Seminar.

Table 2.5-6. ORNL T&E Budget Trend (FY2012-FY2016)

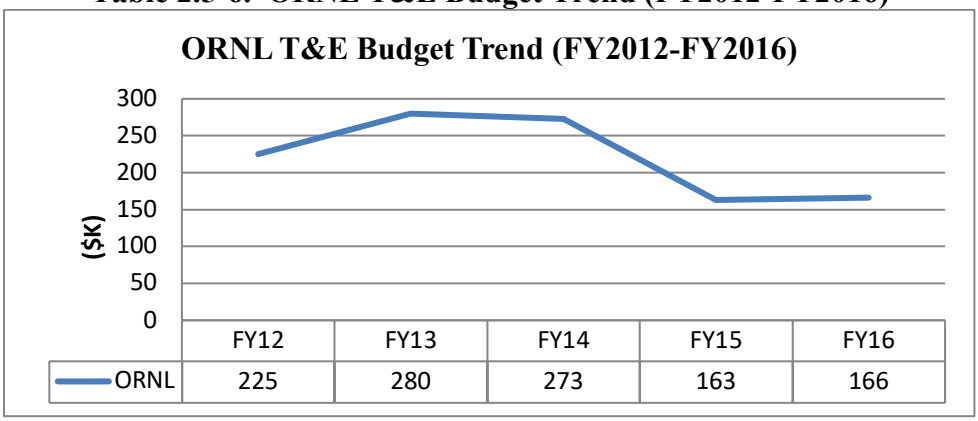
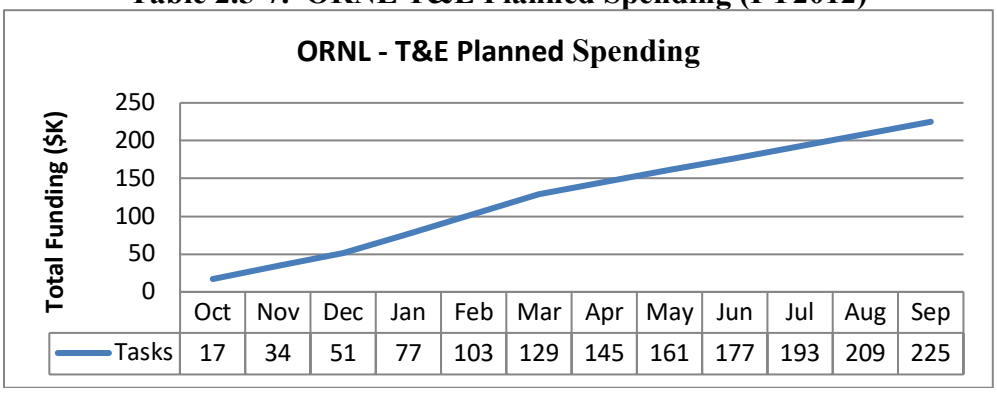


Table 2.5-7. ORNL T&E Planned Spending (FY2012)



ORNL T&E MILESTONES:
Quarter 2

- Organize and host the annual NCSP Technical Seminar (T1: Q2).

SNL T&E1 ($250K)

Conduct criticality safety training classes at SNL according to an integrated schedule developed by ORNL and approved by the NCSP Manager. 4 classes will be provided in FY12, 6 in FY13, and 8 in each of FY14 through FY16.

Table 2.5-8. SNL T&E Budget Trend (FY2012-FY2016)

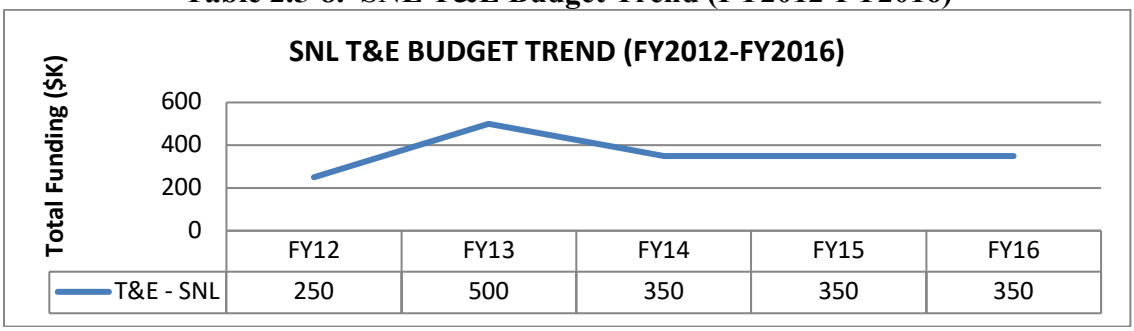
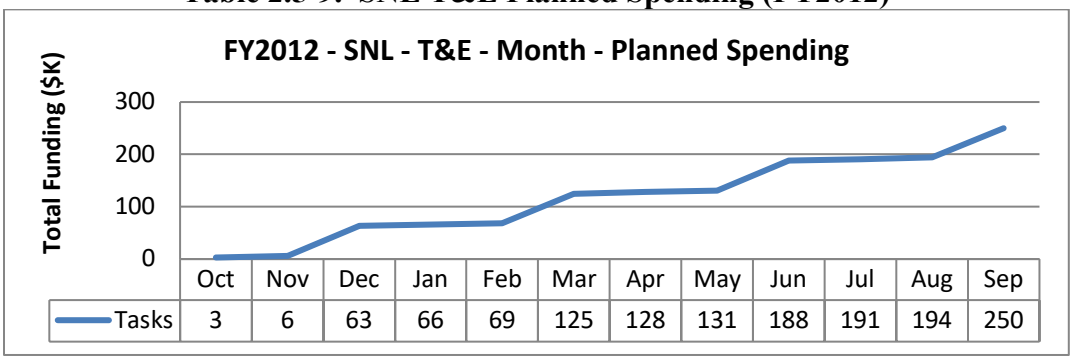


Table 2.5-9. SNL T&E Planned Spending (FY2012)



SNL T&E MILESTONES:

Quarter 4

- Conduct four hands-on training classes in accordance with the approved schedule (T1).

3.0 Criticality Safety Group (CSG)

The NCSP Manager is supported by several groups of criticality safety experts. These groups are described in this section. Complete information about these groups (membership, charter, taskings, etc.) can be found on the NCSP website. A funding table is provided at the end of this Section.

3.1 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 (8 CSSG contractor members' $50K/member + $25K for the CSSG Chair + $25K for the CSSG Deputy Chair).

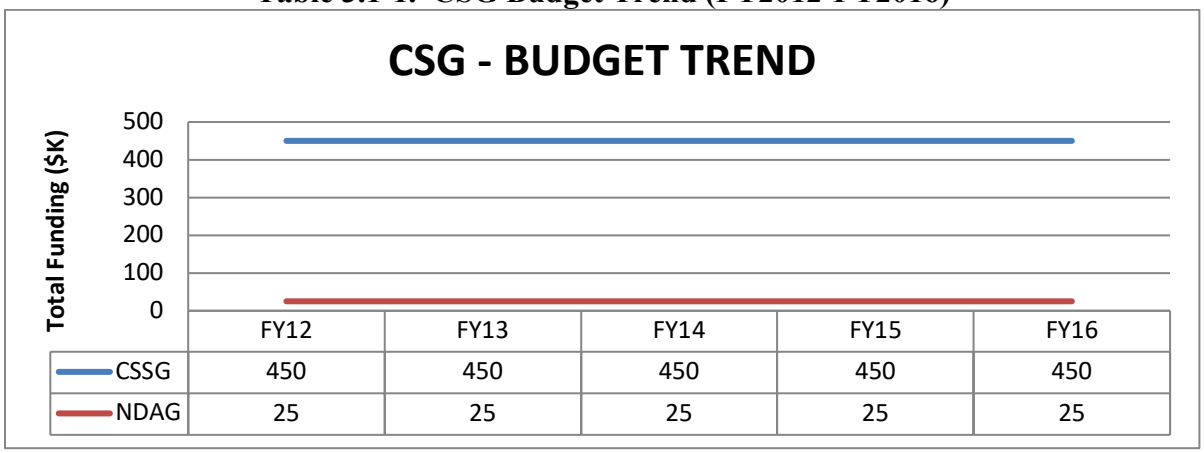
3.2 Nuclear Data Advisory Group

The NDAG, through making recommendations to the NCSP Manager, enhances the coordination of the NCSP ND element work program with current and future DOE needs and promotes the integration of this work program with other elements of the NCSP. The NDAG Chair receives funding ($25K) to support his management of the NDAG.

3.3 Criticality Safety Coordinating Team

The CSCT is the group of federal staff providing line oversight for criticality safety at the field level. The NCSP Manager either chairs the group or designates the Chair of the CSCT. The CSCT members at the site offices ensure that the contractors implement DOE criticality safety orders and standards in their role as individual line management safety oversight. They also have a pivotal role to play in understanding the technical infrastructure needs at the site level that the NCSP provides. The primary function of the CSCT is to ensure uniformity of criticality safety programs and compliance throughout all the sites. They form the cadre of federal criticality safety subject matter experts and will also assist the site office managers and headquarters with monitoring criticality safety programs through site assistance visits.

Table 3.1-1. CSG Budget Trend (FY2012-FY2016)



	FY12	FY13	FY14	FY15	FY16
CSSG	450	450	450	450	450
NDAG	25	25	25	25	25

Appendix A
Work Authorization Statements for
Nuclear Criticality Safety Program Funding for Execution Year (FY 2012)
Provided to the NA-16 Budget Office in August 2011

Tasks Nuclear Data and the Criticality Safety Support Group
Argonne National Laboratory (ANL): $406K

Reflects funds to continue supporting nuclear data activities, including chairing the Nuclear Data Advisory Group, as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2011, or as directed by the NCSP Manager; 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.

ANL POC: Richard McKnight (630-252-6088), rdmcknight@anl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Task: Nuclear Data
Brookhaven National Laboratory (BNL): $150K

Reflects funds to continue supporting nuclear data activities, including shepherding new data evaluations through the Cross Section Evaluation Working Group (CSEWG) process and subsequent publication of these data in the United States Evaluated Nuclear Data File (ENDF) as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2011, or as directed by the NCSP Manager.

BNL POC: Mike Herman (631-344-2802), mwherman@bnl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Task: Information Preservation and Dissemination
Hanford: $161K

Reflects funds for obtaining integral cross sections for actinides from reactor operations and special test data; provide verification and validation for MCNP and selected SCALE code calculations to be added to the database for CritView.

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

Tasks: Integral Experiments, Information Preservation and Dissemination and the Criticality Safety Support Group
Idaho National Laboratory (INL): $400K

Reflects funds to transition International Criticality Safety Benchmark Evaluation Project (ICSBEP) to LLNL as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2011, or as directed by the NCSP Manager.

INL POC: Blair Briggs (208-526-7628), j.briggs@inl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Tasks: Analytical Methods, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group
Los Alamos National Laboratory (LANL): $7,000K

Reflects funds to continue analytical methods; integral experiments; nuclear data; training and education support as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2011, or as directed by the NCSP Manager; 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 (505-606-0109), margevicius@lanl.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Tasks: Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group
Lawrence Livermore National Laboratory (LLNL): $4,102K

Reflects funds to continue support for analytical methods; the DOE Nuclear Criticality Safety Program (NCSP) website; the accident dosimetry exercise in Valduc, France; nuclear data; and hands-on criticality safety training, as delineated in the NCSP Five-Year Plan dated August 2011, or as directed by the NCSP Manager; 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)

Tasks: Integral Experiments
Nevada National Security Site (NNSS): $3000K

Reflects funds to continue support for integral experiments, as delineated in the NCSP Five-Year Plan dated August 2011, or as directed by the NCSP Manager; 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.

NNSS POC: Joel Leeman (702-295-4899), LeemanJD@nv.doe.gov
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Tasks: Analytical Methods, Information Preservation and Dissemination, Integral Experiments, Nuclear Data, Training and Education, and the Criticality Safety Support Group
Oak Ridge National Laboratory (ORNL): $2,961K

Reflects funds to continue support for analytical methods; information preservation and dissemination; integral experiments; nuclear data; the acquisition and evaluation of new differential nuclear data; criticality safety related code distribution and user support through Radiation Safety Information Computational Center (RSICC); and the coordination of the Nuclear Criticality Safety Program (NCSP) Training Program, as delineated in the NCSP Five-Year Plan dated August 2011, or as directed by the NCSP Manager; 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.

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

Tasks: Nuclear Data
Renssalaer Polytechnic Institute (RPI): $314K

Reflects funds to conduct differential nuclear data measurements and data evaluations delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Execution Plan dated August 2011, 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)

Tasks: Integral Experiments, Training and Education
Sandia National Laboratories (SNL): $890K

Reflects funds to continue support for integral experiments and hands-on training as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Execution Plan dated August 2011, 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)

Appendix B
Nuclear Data

Summary of Nuclear Data Needs and Current NCSP Nuclear Data Schedule/Progress

Priority Needs / Additional Needs		Thermal scattering (BeO, HF, D_2O, SiO_2, CH_2, C_2F_4, $C_5O_2H_8$, ZrH_2, etc.), ^{239}Pu, Cr, ^{237}Np, Pb, W, ^{55}Mn,Ti, ^{240}Pu, Fe, ^{58}Ni, ^{60}Ni, / ^{233}U, Th, Be, ^{63}Cu, ^{65}Cu, ^{51}V, Zr, F, K, Ca, Mo, Na, La				
Completed Evaluations (FY)		^{180,182,183,184,186}W (10), ^{239}Pu (09), ^{52,53}Cr (09), ^{58,60}Ni (09), ^{55}Mn (09), ^{39,41}K (09), ^{19}F (09)				
Activity	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**
Differential Measurements ***ORNL, RPI***	^{63,65}Cu thermal scatt SiO_2 Dy,Gd	Ca ^{56}Fe, Ca, Ce	Ce Ca, Ce, ^{185,187}Re	V ^{185,187}Re	Zr ^{185,187}Re	 ^{185,187}Re
Integral Measurements ***LANL,*** IRSN, VNIITF	Sub-Criticals: Criticals: *Fe, Ni, Pb, Ti, Zr*	Sub-Criticals: planning resumes Criticals: Start Planet, Flattop and Comet, Mo	Sub-Criticals: expts resume Criticals: Start Godiva, *Cr, Mn, Mo, Cl*	Sub-Criticals: TBD Criticals: TBD	Sub-Criticals: TBD Criticals: TBD	Sub-Criticals: TBD Criticals: TBD
Complete Data Evaluations ***BNL, LANL, ORNL***	^{182,183,184,186}W RR, ^{48}Ti UR ^{16}O, ^{51}V, Be, ^{55}Mn ^{239}Pu χ	^{63,65}Cu RR ^{182,183,184,186}W RR, ^{56}Fe, ^{239}Pu, assess ^{185,187}Re, ^{56}Fe, Zr ^{55}Mn, Be, ^{50,52,53,54}Cr,	^{63,65}Cu UR, ^{155,156,157,158,160}Gd RR, assess Hf, La, Nd, Sr ^{235}U UR, ^{239}Pu ^{182,183,184,186}W UR, ^{50,52,53,54}Cr, ^{58,60,61,62,64}Ni, ^{235}U χ	Ca RR, ^{161,162,163,164}Dy RR, ^{238}U UR, ^{58,60,61,62,64}Ni, ^{63,65}Cu	Ca UR, ^{239}Pu UR, Ce RR, V RR ^{239}Pu UR ^{12}C, ^{238}U χ	Zr RR, V URR ^{56}Fe

Requests for additional I.E. measurements: Ni, Mo, Cr (Fe-Cr alloys), Mn in intermediate energy range (VNIITF, CEF).
Request for measurements and evaluation of angular distributions at high energy for Cu.
Continuing need for thermal scattering data.

D-1 Differential Measurements and Evaluations - Elements

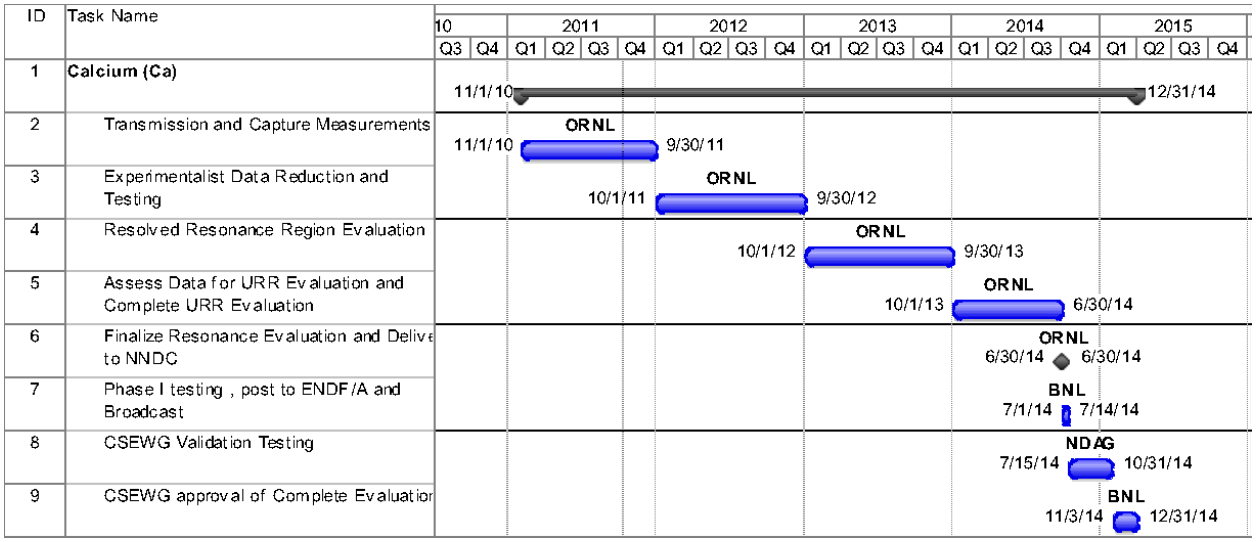
D-1.1 Calcium (Ca)
D-1.2 Carbon (C-12,13)
D-1.3 Cerium (Ce)
D-1.4 Chromium (Cr-50,52,53,54)
D-1.5 Copper (Cu-63,65)
D-1.6 Dysprosium (Dy-161,162,163,164)
D-1.7 Gadolinium (Gd-155,156,157,158,160)
D-1.8 Iron (Fe-56)
D-1.9 Lead (Pb-208)
D-1.10 Manganese (Mn-55)
D-1.11 Minor Actinides
D-1.12 Nickel (Ni-58,60)
D-1.13 Plutonium (Pu-239)
D-1.14 Strontium (Sr)
D-1.15 Tungsten (W-182,183,184,186)
D-1.16 Uranium (U-235)

D-1.17 Uranium (U-238)
D-1.18 Vanadium (V-51)
D-1.19 Zirconium (Zr-90,91,92,94,96)

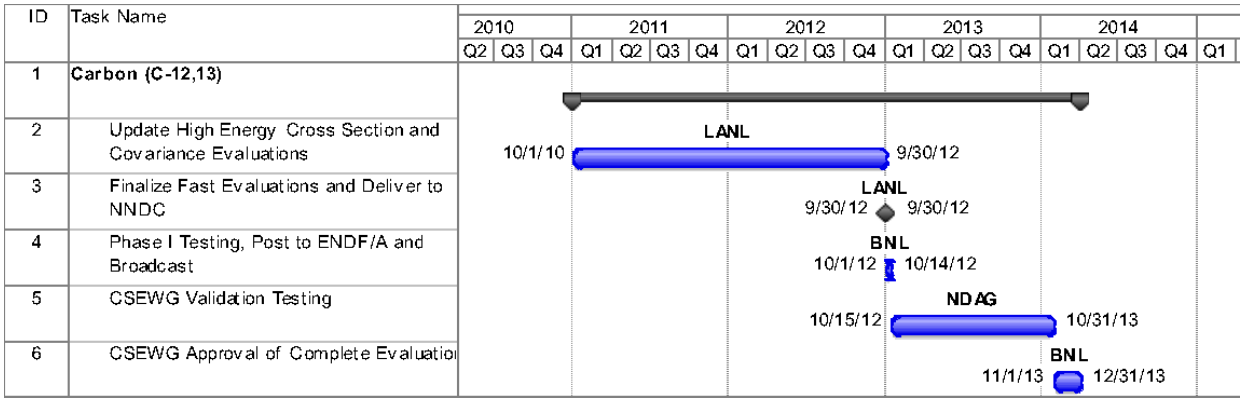
D-2 Differential Measurements and Evaluations – Compounds

D-2.1 Polyethylene (CH_2)
D-2.2 Silicon Dioxide (SiO_2)

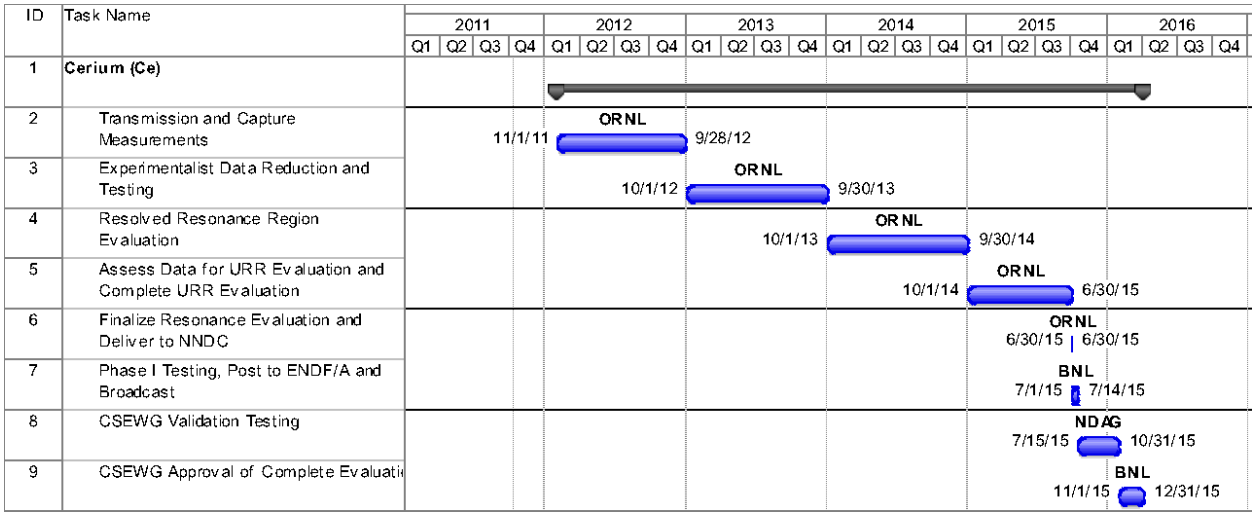
D-1.1 Calcium (Ca)



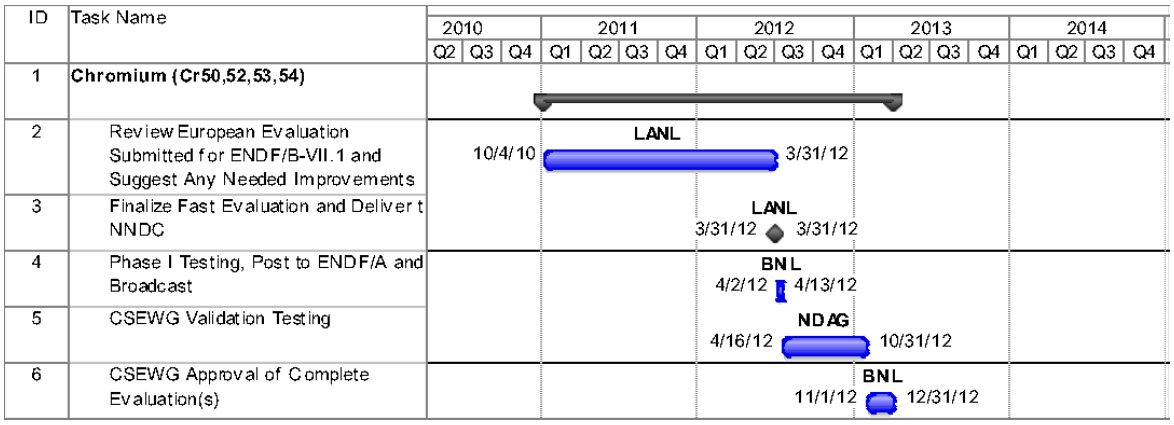
D-1.2 Carbon (C-12,13)



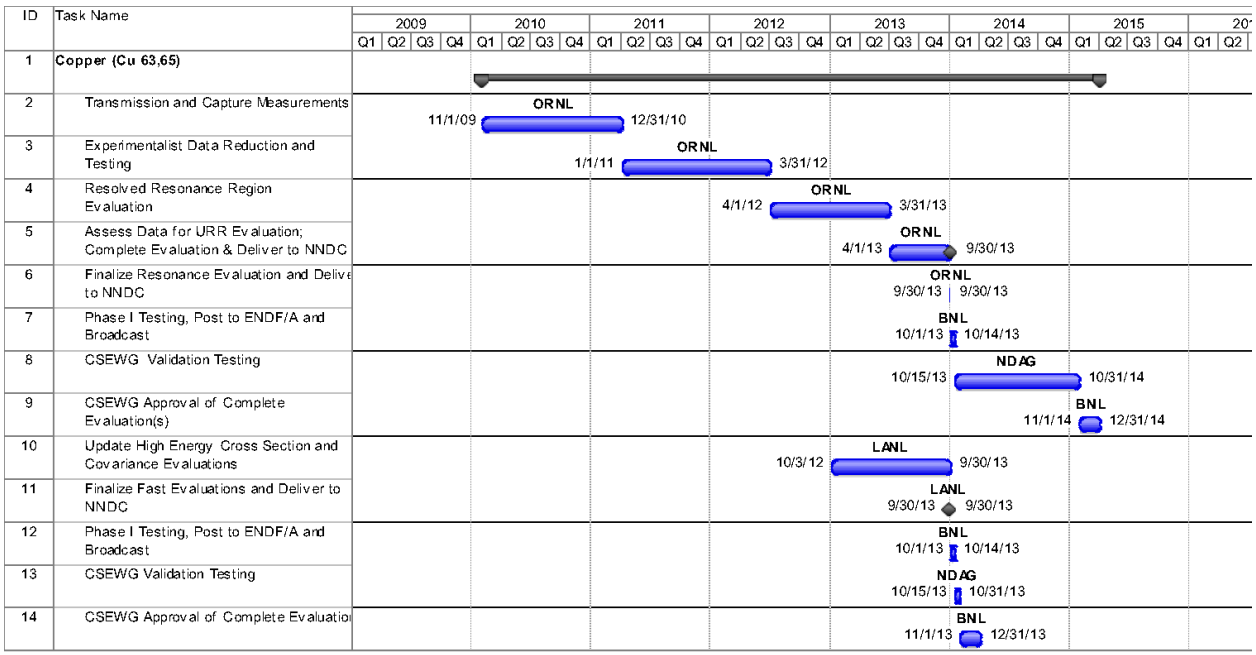
D-1.3 Cerium (Ce)



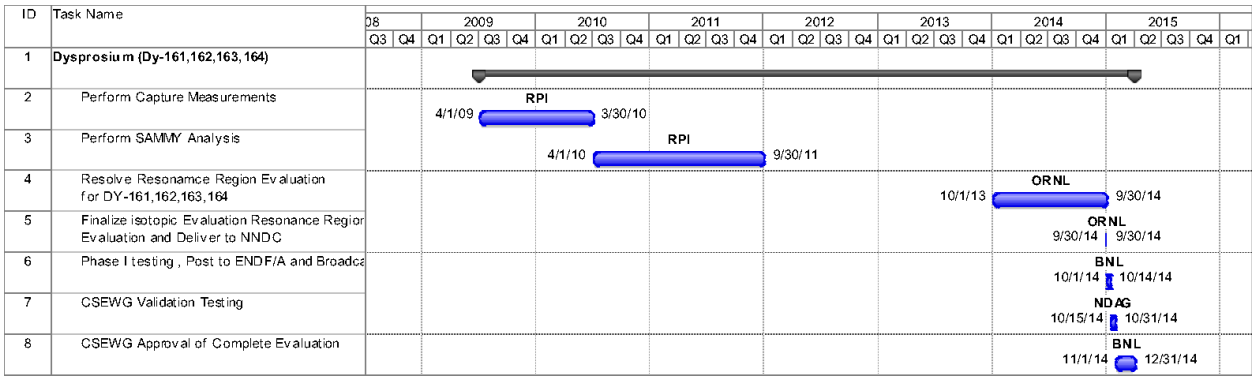
D-1.4 Chromium (Cr-50,52,53,54)



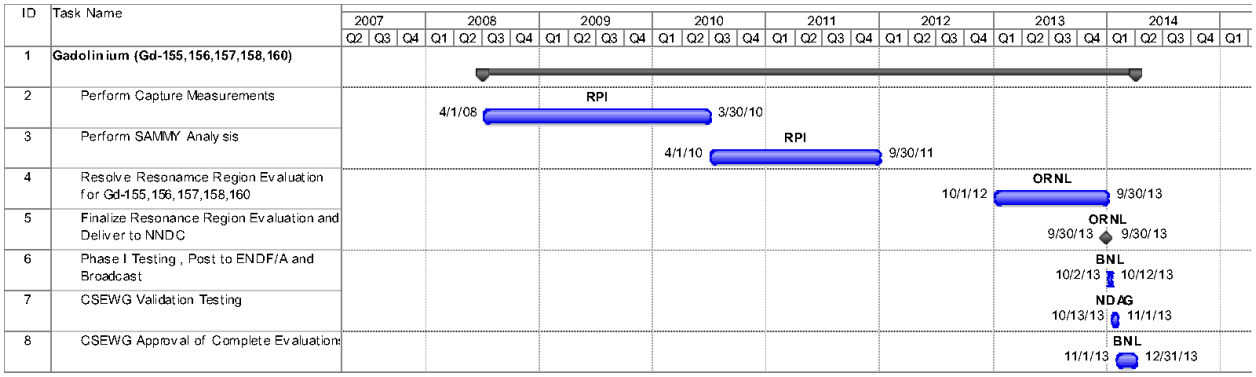
D-1.5 Copper (Cu-63,65)



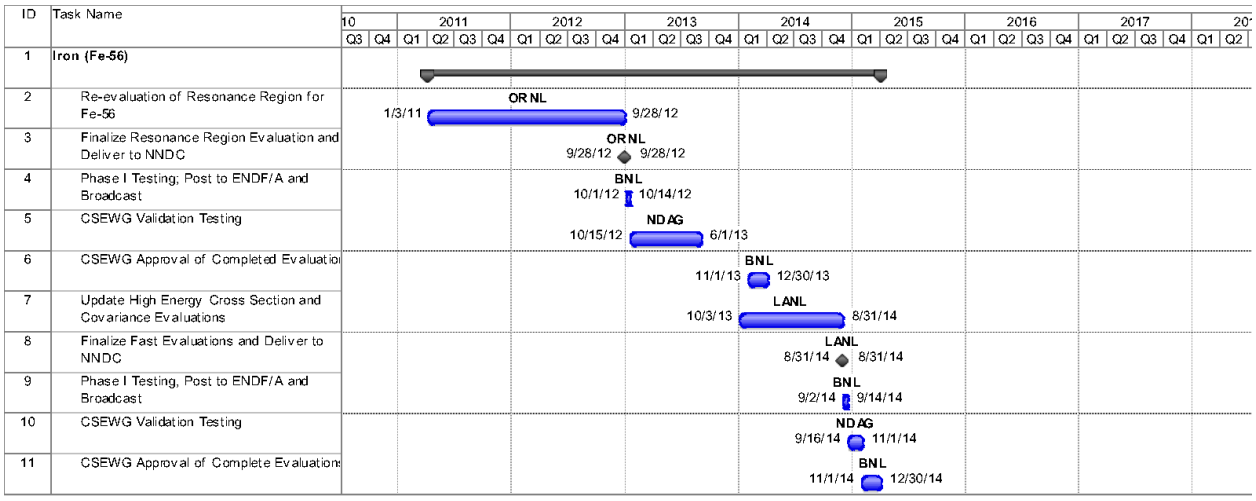
D-1.6 Dysprosium (Dy-161,162,163,164)



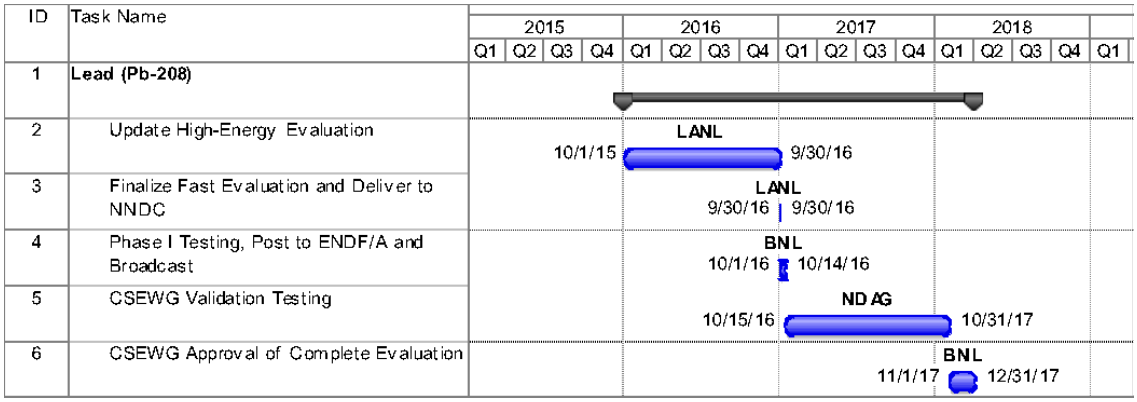
D-1.7 Gadolinium (Gd-155,156,157,158,160)



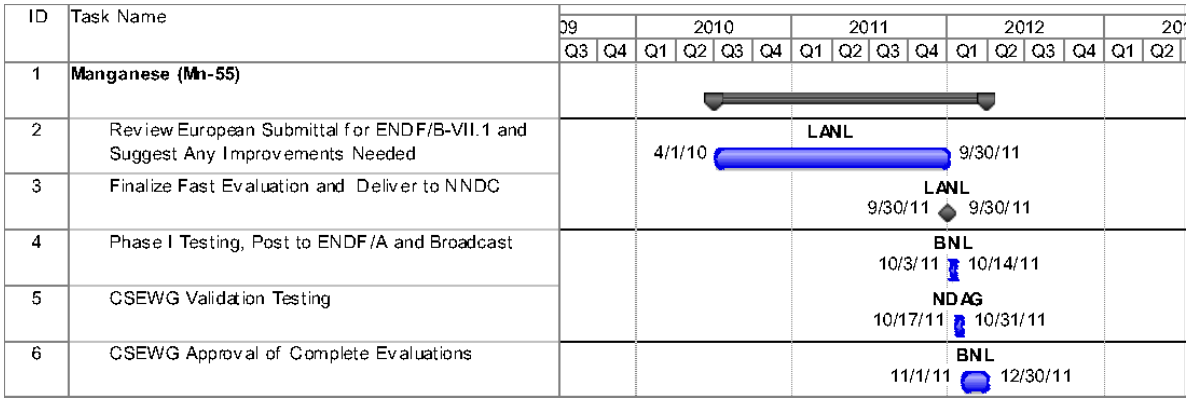
D-1.8 Iron (Fe-56)



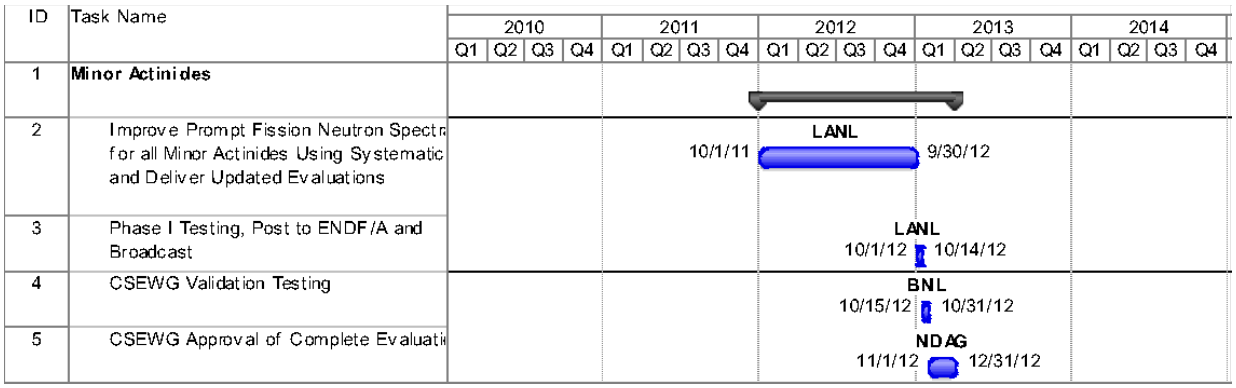
D-1.9 Lead (Pb-208)



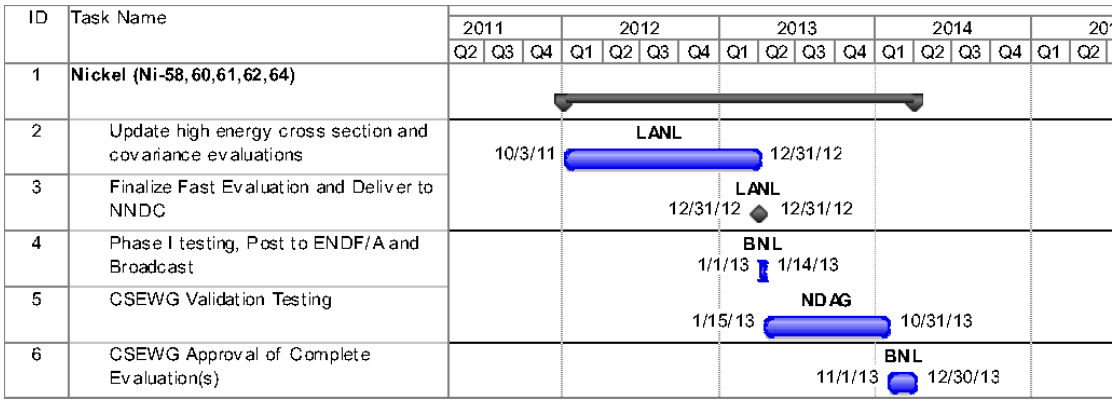
D-1.10 Manganese (Mn-55)



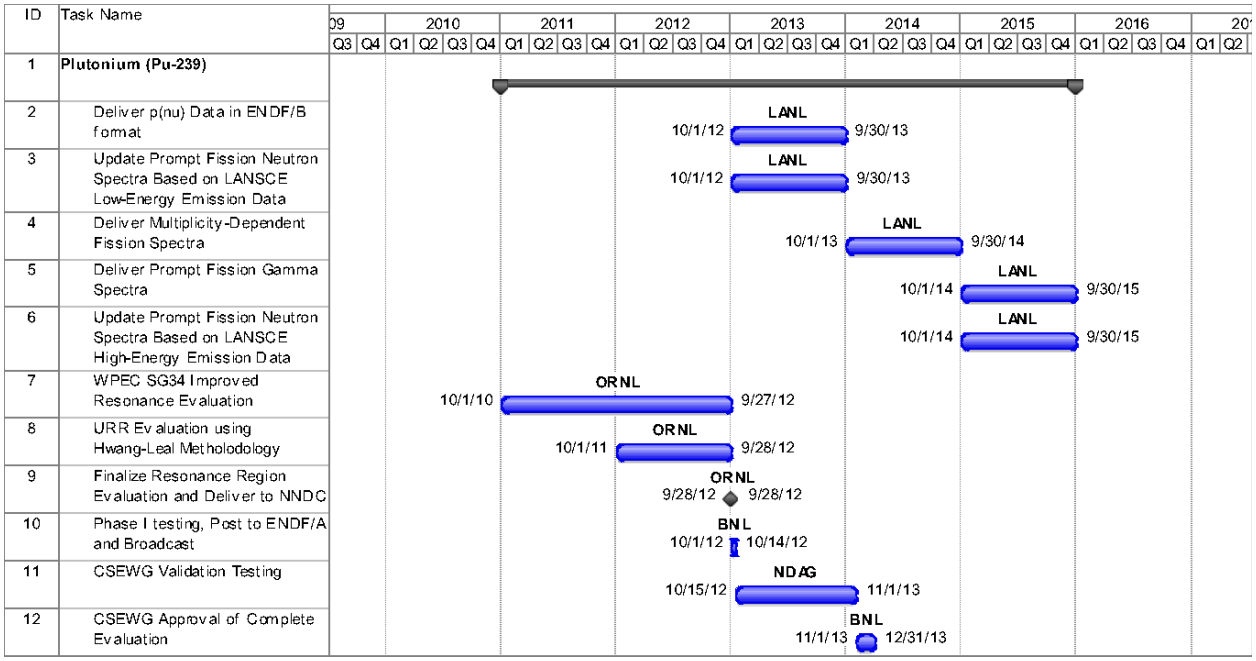
D-1.11 Minor Actinides



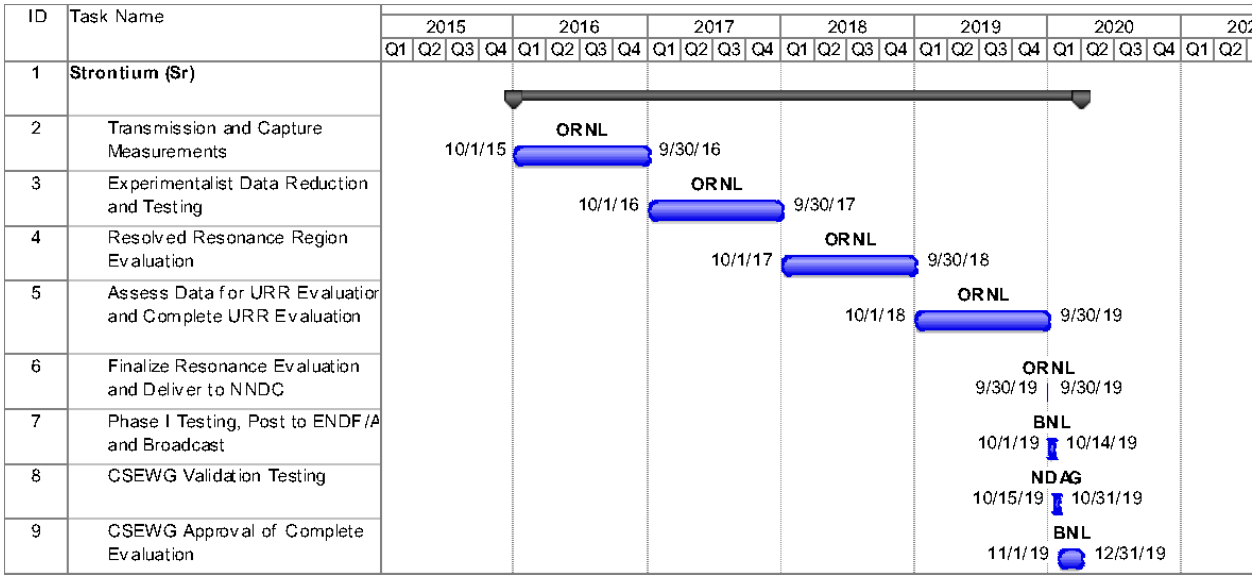
D-1.12 Nickel (Ni-58,60)



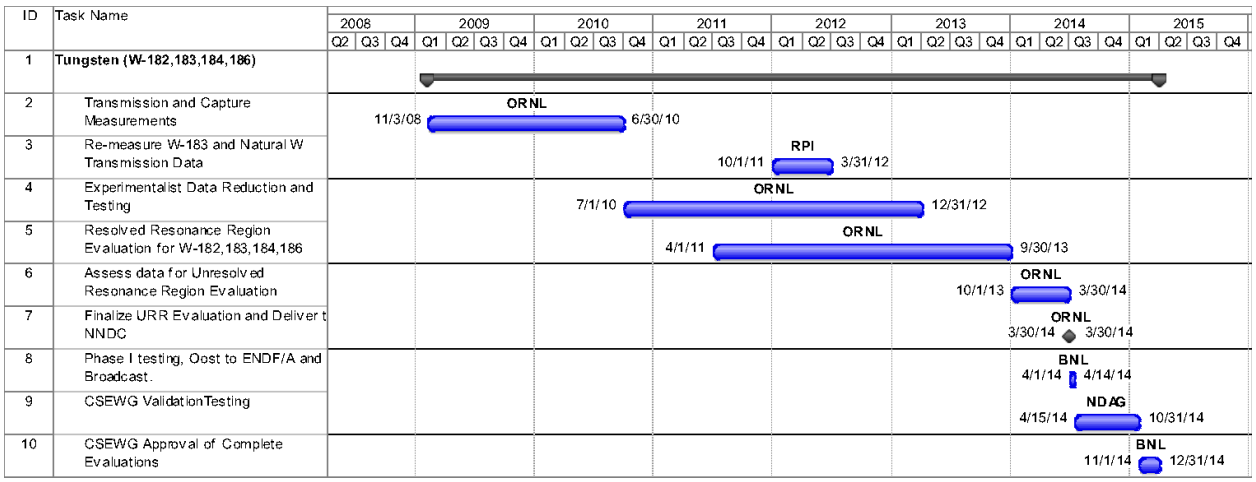
D-1.13 Plutonium (Pu-239)



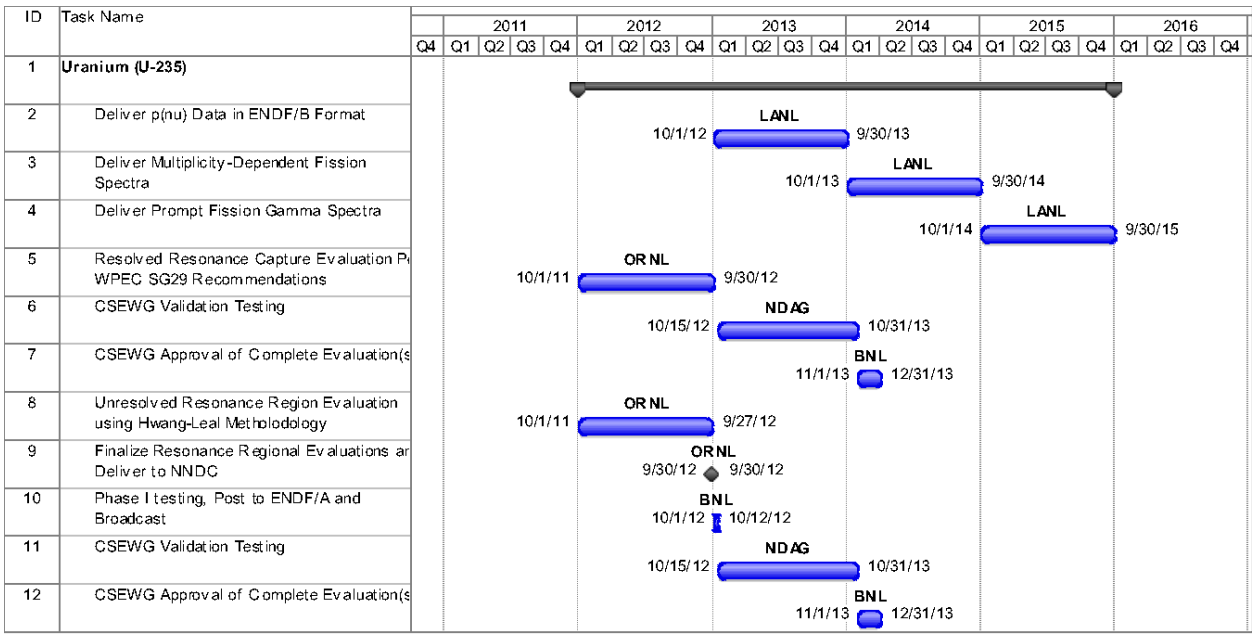
D-1.14 Strontium (Sr)



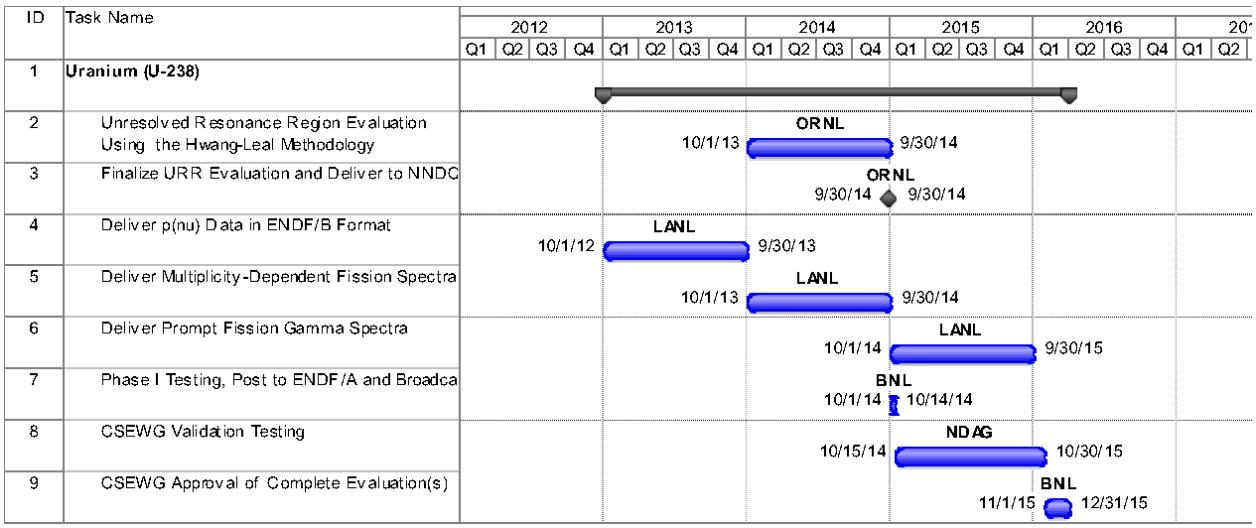
D-1.15 Tungsten (W-182,183,184,186)



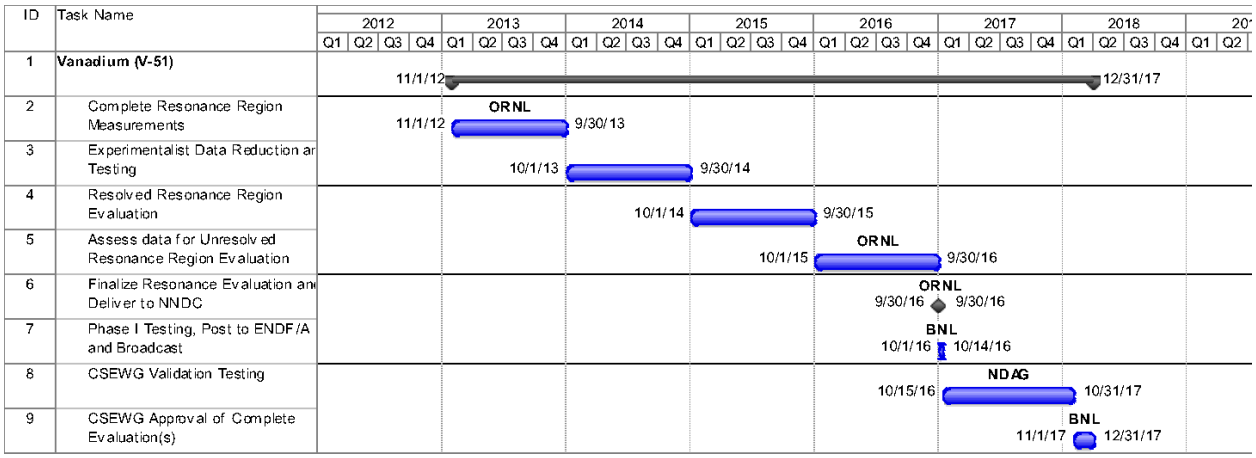
D-1.16 Uranium (U-235)



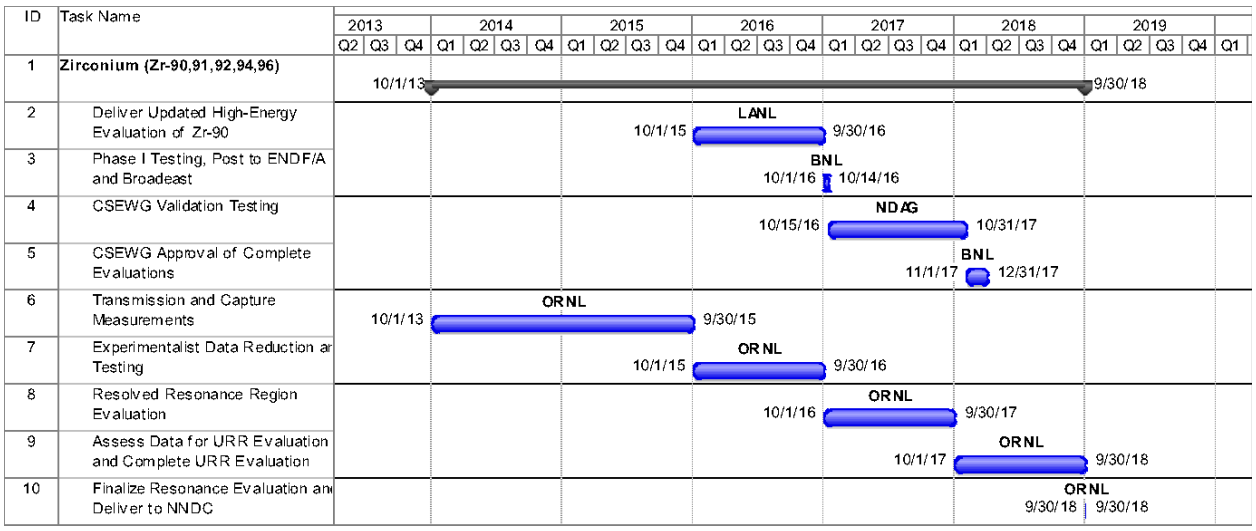
D-1.17 Uranium (U-238)



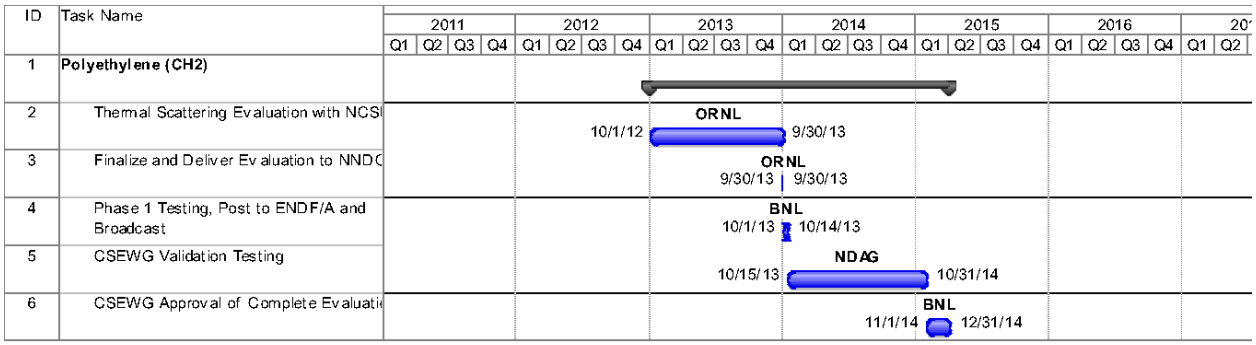
D-1.18 Vanadium (V-51)



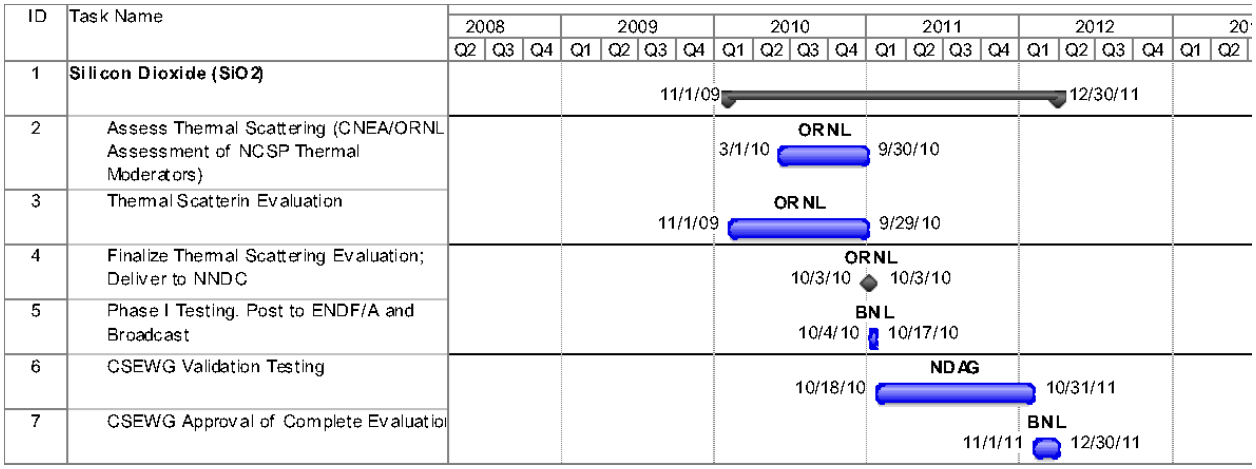
D-1.19 Zirconium (Zr-90,91,92,94,96)



D-2.1 Polyethylene (CH_2)



D-2.2 Silicon Dioxide (SiO_2)



Appendix C
Fiscal Year 2012 Projected Foreign Travel

Destination	Date	Task Element	No. of Travelers	Costs ($)	One Sentence Justification
NEA WPEC France	6/2012	ANL-ND1	1	5,000	ENDF Representative to WPEC Meeting, HPRL and Data Adjustment Expert Groups (McKnight)
Paris, France	9/2012	ANL-ND1	1	5,000	U.S. Representative on WPNCS and participate in Associated Expert Groups (McKnight)
OECD/NEA France	9/2012	LANL-AM1	1	4,000	Expert Group on Advanced Monte Carlo Techniques (Brown)
NEA, France	5/2012	LANL-ND1	1	4,000	Participate in WPEC meeting and associated Expert Group meetings (Kahler)
WGB9, Germany	TBD	LLNL-IE1	2	14,000	WGB9 meeting on IEC 60860 Ed.2: Radiation protection instrumentation (Heinrichs, Dulik)
AWE and IRSN	TBD	LLNL-IE1	2	20,000	Attend meetings at AWE/Aldermaston and IRSN/Paris concerning their participation in LLNL IE Subtask 1 (IER 147) (Heinrichs, Scorby)
IRMM Mol, Belgium	11/2011 3/2012 6/2012 9/2012	ORNL-ND1	1(4trips)	60,000	Perform resonance region nuclear data measurements using the GELINA facility at IRMM. (Guber)
OECD/NEA France	5/2012	ORNL-ND1	2	10,000	Participate in WPEC meeting and associated working group meetings (Leal and Dunn)
OECD/NEA France	5/2012	RPI-ND1	1	3,000	Participate in WPEC meeting and associated working group meetings (Danon)
TOTAL				**125,000**	