

United States Department of Energy
Nuclear Criticality Safety Program
Five-Year Execution Plan for the Mission and Vision
FY 2011 through FY 2015



November 2010

Department of Energy Nuclear Criticality Safety Program Five-Year Execution Plan for Fiscal Years 2011 through 2015, November 2010.

Approved:

A handwritten signature in black ink, appearing to read "JN McKamy", with a long horizontal flourish extending to the right.

Jerry N. McKamy
Manager
Nuclear Criticality Safety Program

TABLE OF CONTENTS

ACRONYMS AND DEFINITIONS	ii
1.0 Nuclear Criticality Safety Program Mission and Vision	1
2.0 Technical Program Elements	1
2.1 Analytical Methods	2
2.2 Information Preservation and Dissemination	13
2.3 Integral Experiments	23
2.4 International Criticality Safety Benchmark Evaluation Project	39
2.5 Nuclear Data	42
2.6 Training and Education	54
3.0 Nuclear Criticality Safety Program Support	59
 APPENDICES	
Appendix A Nuclear Criticality Safety Program Task Managers	A-1
Appendix B Work Authorization Statements for Fiscal Year 2011	B-1
Appendix C International Criticality Safety Benchmark Evaluation Project Planned Benchmarks	C-1
Appendix D Nuclear Data	D-1
Appendix E Fiscal Year 2011 Projected Foreign Travel	E-1

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 _{Ed} T	Critical-Subcritical Experiment Design Team
CE-KENO	Continuous Energy Version of the KENO Code
CEF	Criticality Experiments Facility
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
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
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

¹COG 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.

²GNASH 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.

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

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

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

⁶TSURFER 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 the 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 (NA-16) 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

The NCSP includes the following six technical program elements:

- Analytical Methods
- Information Preservation and Dissemination
- Integral Experiments
- International Criticality Safety Benchmark Evaluation Project
- 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 six technical program elements, including a budget, subtasks, and milestones for completing the work and achieving the NCSP Vision. All subtasks are approved based on their contribution to the achievement of the five- and ten-year goals in the Mission and Vision document. A budget summary for the NCSP activities conducted in the

United States; and the MIRTE Integral Measurements Program and MIDAS Valduc Criticality Safety Facility Refurbishment and Utilization Program being conducted in France is contained in Table 2-1 (rounded to the nearest \$100K).

**Table 2-1. Nuclear Criticality Safety Program Funding
(United States Activities and MIRTE and MIDAS Programs in France)
Fiscal Years (FY) 2011 – 2015**

FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
\$18,700	\$22,500	\$24,700	\$24,600	\$24,900

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

2.1.1 Program Element Description

The Analytical Methods (AM) program element provides for the 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 subcriticality 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. Additional information about the AM vision and strategy can be found in the *Mission and Vision of the U.S. Department of Energy, Nuclear Criticality Safety Program*, dated March 2008. A funding table is provided at the end of this 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.

2.1.2 Approved Subtasks

Los Alamos National Laboratory (LANL) AM Subtasks

FY 2011

LANL AM Subtask 1 (\$775K)

Provide ongoing 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.

Milestones:

- Issue a MCNP V&V report and post on MCNP website (Q2).
- Release an updated version of MCNP to RSICC (Q4).
- Release quality-assured MCNP neutron cross-section library for priority NCSP isotopes to RSICC (Q4).
- Provide one on-site class at a DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Q4).
- Extend the suite of criticality benchmark problems used for MCNP validation and include with code distribution (Q4).
- Issue a report on MCNP testing on the latest computer platforms and post on MCNP website (Q4).

LANL AM Subtask 2 (\$100K)

Develop and maintain the NJOY nuclear data processing code system. Implement capabilities as needed to process new general purpose nuclear data files in evolving ENDF-6 format, including covariance data. Base versions of the NJOY code system will continue to be distributed to the domestic user community through the Radiation Safety Information Computational Center (RSICC) and to the international user community through the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD-NEA) with code updates distributed to all users through a LANL maintained website.

Milestone:

- Implement new ENDF-6 formats into NJOY (Q4).

FY 2012**LANL AM Subtask 1 (\$785K)**

The scope for this subtask is the same as FY 2011.

Milestones:

- Issue a MCNP V&V report and post on MCNP website (Q2).
- Implement a test for population size and other new diagnostics into MCNP and issue a report and post on MCNP website (Q4).
- Provide one on-site class at a DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Q4).
- Simplify, generalize, and document the user interface for generating sensitivity profiles with MCNP and post the report on MCNP website (Q4).
- Implement a new capability for performing subcritical calculations with MCNP (Q4).
- Issue a report on MCNP testing on the latest computer platforms and post on MCNP website (Q4).

LANL AM Subtask 2 (\$100K)

The scope for this subtask is the same as FY 2011.

Milestone:

- Issue a new base version of NJOY to RSICC (Q4).

FY 2013

LANL AM Subtask 1 (\$795K)

The scope for this subtask is the same as FY 2011.

Milestones:

- Issue a MCNP V&V report and post on MCNP website (Q2).
- Implement a capability to generate sensitivities in MCNP with respect to experimental geometry to allow propagation of dimensional uncertainty (Q2).
- Release an updated version of MCNP to RSICC (Q4).
- Release quality-assured MCNP neutron cross-section library for priority NCSP isotopes to RSICC (Q4).
- Provide one on-site class at DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Q4).
- Issue a report on MCNP testing on the latest computer platforms and post on MCNP website (Q4).

LANL AM Subtask 2 (\$100K)

The scope for this subtask is the same as FY 2011.

Milestone:

- Issue a revised NJOY User Manual, and send to RSICC (Q4).

FY 2014

LANL AM Subtask 1 (\$805K)

The scope for this subtask is the same as FY 2011.

Milestones:

- Issue a MCNP V&V report and post on MCNP website (Q2).
- Provide one on-site class at DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Q4).
- Simplify, generalize, and document the user interface for convoluting MCNP-generated sensitivity profiles with cross-section covariances (Q4).

- Issue report on MCNP testing on the latest computer platforms and post on MCNP website (Q4).
- Demonstrate MCNP capability for burn up credit calculations (Q4).

LANL AM Subtask 2 (\$100K)

The scope for this subtask is the same as FY 2011.

Milestone:

- Release NJOY code updates required to process modified versions of international general purpose nuclear data files on LANL NJOY website (Q4).

FY 2015

LANL AM Subtask 1 (\$815K)

The scope for this subtask is the same as FY 2011.

Milestones:

- Issue a MCNP V&V report and post on MCNP website (Q2).
- Provide one on-site class at DOE site on the theory and practice of Monte Carlo criticality calculations with MCNP (Q4).
- Release an updated version of MCNP to RSICC (Q4).
- Release quality-assured MCNP neutron cross-section library for priority NCSP isotopes to RSICC (Q4).
- Issue a report on MCNP testing on the latest computer platforms and post on MCNP website (Q4).

LANL AM Subtask 2 (\$100K)

The scope for this task is the same as FY 2011.

Milestone:

- Issue a new base version of NJOY to RSICC (Q4).

Lawrence Livermore National Laboratory (LLNL) AM Subtasks

FY 2011

LLNL AM Subtask 1 (\$287K)

Provide maintenance, user support and modest upgrades to existing LLNL analytical methods including nuclear data processing, geometry modeling, and Monte-Carlo methods. Participate in NCSP activities including the Critical-Subcritical Experiment Design Team (C_{EDT}), Cross Section Evaluation Working Group (CSEWG) and Nuclear Data Advisory Group (NDAG).

Milestones:

- Provide quarterly progress reports describing maintenance, user support, upgrades and participation in NCSP activities (Q1, Q2, Q3, Q4).
- Report level of C_{EdT}, CSEWG, and NDAG participation in quarterly reports to the NCSP Manager (Q1, Q2, Q3, Q4).

LLNL AM Subtask 2 (\$50K)

Assist the International Atomic Energy Agency (IAEA) in developing and maintaining the PREPRO nuclear data processing code system. Implement capabilities as needed to process and distribute new general-purpose nuclear data files in evolving ENDF-6 format. Updated PREPRO versions and processed point nuclear data will continue to be distributed to the domestic user community through the Radiation Safety Information Computational Center (RSICC) and to the international user community through the Organization for Economic Cooperation and Development/ Nuclear Energy Agency (OECD-NEA) Databank or available for downloading on-line from the IAEA-NDS website. PREPRO updates and processed data are distributed to all users through websites maintained for the International Atomic Energy Agency/Nuclear Data Section (IAEA-NDS).

Milestone:

- Release PREPRO code updates and processed nuclear data for ENDF/B-VII.1 and subsequent releases to the IAEA (Q4).

FY 2012

LLNL AM Subtasks 1 and 2 (\$344K)

Scope and milestones for Subtasks 1 and 2 remain the same as in FY 2011.

FY 2013

LLNL AM Subtasks 1 and 2 (\$351K)

Scope and milestones for Subtasks 1 and 2 remain the same as in FY 2011.

FY 2014

LLNL AM Subtasks 1 and 2 (\$358K)

Scope and milestones for Subtasks 1 and 2 remain the same as in FY 2011.

FY 2015

LLNL AM Subtasks 1 and 2 (\$365K)

Scope and milestones for Subtasks 1 and 2 remain the same as in FY 2011.

Oak Ridge National Laboratory (ORNL) AM Subtasks

FY 2011

ORNL AM Subtask 1 (\$375K)

RSICC. 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.

Milestones:

- Continue distribution of available and newly packaged software to the first 200 NCS community requesters (at no direct cost to them) and provide distribution totals quarterly (Q1, Q2, Q3, and Q4).
- Provide monthly newsletters to announce software updates, conferences and workshops newsletters and provide status quarterly (Q1, Q2, Q3, and Q4).
- Continue software and data library exchange with OECD/NEA Data Bank and provide activity reports quarterly (Q1, Q2, Q3, and Q4).

ORNL AM Subtask 2 (\$655K)

Provide SCALE/KENO/TSUNAMI maintenance and user support including: 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.

Milestones:

- Complete user validation package with TSUNAMI sensitivity data files for release with SCALE 6.2 (Q4).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (Q1, Q2, Q3, Q4).
- Issue an annual SCALE maintenance report to the NCSP Manager (Q1).
- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (Q2, Q4).
- Provide a status of SCALE SQA maintenance activities (Q1, Q2, Q3, Q4).
- 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 (Q1, Q2, Q3, Q4).

ORNL AM Subtask 3 (\$100K)

Conduct AMPX development and maintenance to include ensuring the AMPX software is up-to-date and in conformance with ENDF/B formats and procedures and the development of enhancements to the AMPX software to enable improved nuclear data processing capabilities in addition to providing new reaction physics capabilities needed to support radiation transport methods development and analyses (e.g., coupled energy/angle covariance data, continuous-energy adjoint capabilities, etc.). Also, continue to maintain and improve the PUFF-IV covariance processing package (which is part of AMPX) that is used to test the ability to process covariance files.

Milestones:

- Release AMPX cross-section processing package through RSICC and provide user support (Q4).
- Document technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (Q4).
- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (Q4).

ORNL AM Subtask 4 (\$400K)

Provide the design, evaluation, and documentation of benchmark quality measurements for Criticality Accident Alarm System (CAAS) experimental configurations to be performed in the SILENE reactor cell in Valduc, France. The design of the experimental configurations will consider input from DOE stakeholders, input from CEA staff related to availability of shielding materials (e.g., the lead shielding that can be used around the SILENE reactor and other CEA shielding materials), detectors and facility constraints, and results of design analyses. It is expected that no fewer than 12 different experimental configurations, with varying interstitial shielding materials and thicknesses, and configurations with streaming paths will be designed. Experimental design has occurred during FY 2010. During FY 2011 through FY 2012 the experiment will be executed, analyzed and published as an International Criticality Safety Benchmark Evaluation Project (ICSBEP) benchmark. Also during FY 2011 through FY 2012, the various calculational methods that were used to simulate the experiments will be evaluated, and proposals to improve these methods will be forwarded to the NCSP Manager through the annual proposal process for consideration.

One computational capability that will be developed as part of this task is a tool to perform a 3-dimensional (3D) fixed-source sensitivity/uncertainty (S/U) analysis. This new tool will enable the analysis and design of shielding experiments such as those needed for CAAS analyses. The sensitivity data from this 3D fixed source S/U tool will be compatible with all the TSUNAMI tools, so similarity assessment of experiments, bias determination, and visualization will all be possible. The first step in developing this tool, which will be completed during FY 2011, is to develop a fixed-source adjoint capability in the SCALE Monte Carlo code Monaco. The

development of a 3D fixed source S/U sequence in SCALE will also begin in FY 2011. During FY 2012 the development of the 3D fixed source S/U sequence in SCALE will be completed along with preliminary testing and validation. Finally, during FY 2013, development of a validation suite will be completed including the development of training materials for S/U analysis for CAAS.

Milestones:

- Complete draft benchmark evaluation and submit it to the ICSBEP for review (Q4).
- Complete draft report that documents the evaluation and includes user-guidance for accurate CAAS analyses that will be published as an ORNL technical report (Q4).
- Complete fixed-source adjoint capability in Monaco (Q4).

FY 2012

ORNL AM Subtask 1 (\$380K)

Scope and milestones for ORNL Subtask 1 remain the same as in FY 2011.

ORNL AM Subtask 2 (\$680K)

Scope for ORNL Subtask 2 remains the same as in FY 2011.

Milestones:

- Release SCALE 6.2 to RSICC (Q4).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (Q1, Q2, Q3, Q4).
- Provide ongoing SCALE SQA maintenance activities (Q4).
- Issue an annual SCALE maintenance report to the NCSP Manager (Q1).
- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (Q2, Q4).
- 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 (Q1, Q2, Q3, Q4).

ORNL AM Subtask 3 (\$100K)

Scope for ORNL Subtask 3 remains the same as in FY 2011.

Milestones:

- Complete automated continuous-energy data library checking utility for AMPX to perform consistency checks on SCALE CE libraries (Q4).
- Document technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (Q4).

- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (Q4).

ORNL AM Subtask 4 (\$200K)

FY 2012 Scope ORNL Subtask 4 is described in the FY 2011 Subtask 4 description (above).

Milestones:

- Complete the final benchmark evaluation (Q3).
- Complete final report that documents the evaluation and includes user-guidance for accurate CAAS analyses (Q3).
- Publish/present results of activity in an ORNL technical report (Q4).
- Complete letter report to the NCSP Manager describing outstanding user needs for CAAS analyses and recommended future work to address the needs (Q4).
- Complete production-level sensitivity and uncertainty analysis tool for CAAS for Release with SCALE (Q4).

FY 2013

ORNL AM Subtask 1 (\$385K)

Scope and milestones for ORNL Subtask 1 remain the same as in FY 2011.

ORNL AM Subtask 2 (\$690K)

Scope for ORNL Subtask 2 remains the same as in FY 2011.

Milestones:

- Complete initial version of automated verification tool and test suite for SCALE/KENO regression testing (Q4).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (Q1, Q2, Q3, Q4).
- Provide ongoing SCALE SQA maintenance activities (Q4).
- Issue an annual SCALE maintenance report to the NCSP Manager (Q1).
- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (Q2, Q4).
- 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 (Q1, Q2, Q3, Q4).

ORNL AM Subtask 3 (\$100K)

Scope for ORNL Subtask 3 remains the same as in FY 2011.

Milestones:

- Release updated version of AMPX through RSICC (Q4).
- Document technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (Q4).
- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (Q4).

ORNL AM Subtask 4 (\$100K)

FY 2013 Scope ORNL Subtask 4 is described in the FY 2011 Subtask 4 description (above).

Milestone:

- Complete validation suite and training materials for sensitivity and uncertainty analysis tool for CAAS (Q4).

FY 2014

ORNL AM Subtask 1 (\$390K)

Scope and milestones for ORNL Subtask 1 remain the same as in FY 2011.

ORNL AM Subtask 2 (\$700K)

Scope for ORNL Subtask 2 remains the same as in FY 2011.

Milestones:

- Release SCALE 7 to RSICC (Q4).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (Q1, Q2, Q3, Q4).
- Provide ongoing SCALE SQA maintenance activities (Q4).
- Issue an annual SCALE maintenance report to the NCSP Manager (Q1).
- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (Q2, Q4).
- 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 (Q1, Q2, Q3, Q4).

ORNL AM Subtask 3 (\$100K)

Scope for ORNL Subtask 3 remains the same as in FY 2011.

Milestones:

- Release updated version of PUFF covariance processing package to RSICC (Q4).
- Document technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager (Q4).
- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (Q4).

ORNL AM Subtask 4 (\$0K)

Continued work in this area will be based on approval of proposals by the NCSP Manager through the annual proposal process.

FY 2015**ORNL AM Subtask 1 (\$395K)**

Scope and milestones for ORNL Subtask 1 remain the same as in FY 2011.

ORNL AM Subtask 2 (\$710K)

Scope for ORNL Subtask 2 remains the same as in FY 2011.

Milestones:

- Publish SCALE 7 V&V report as an ORNL technical report and release the test suite as a download from the SCALE website (Q4).
- Provide ongoing responses to user technical questions via email and SCALE electronic user notebook and report status quarterly (Q1, Q2, Q3, Q4).
- Provide ongoing SCALE SQA maintenance activities (Q4).
- Issue an annual SCALE maintenance report the NCSP Manager (Q1).
- Publish semiannual newsletters to users to communicate software updates, user notices, generic technical advice, and training course announcements (Q2, Q4).
- 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 (Q1, Q2, Q3, Q4)

ORNL AM Subtask 3 (\$100K)

Scope for ORNL Subtask 3 remains the same as in FY 2011.

Milestones:

- Release updated version of AMPX through RSICC (Q4).
- Document technical support for SCALE CE, multigroup, and covariance libraries and report status annually the NCSP Manager (Q4).
- Process new ORNL evaluations produced by the Nuclear Data Element to demonstrate evaluations conform to ENDF/B formats/procedures (Q4).

ORNL AM Subtask 4 (\$0K)

Continued work in this area will be based on approval of proposals by the NCSP Manager through the annual proposal process.

2.1.3 Analytical Methods Budget

Analytical Methods Budget, Fiscal Years 2011 – 2015

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
LANL	\$875	\$885	\$895	\$905	\$915
LLNL	\$337	\$344	\$351	\$358	\$365
ORNL	\$1,530	\$1,360	\$1,275	\$1,190	\$1,205
TOTAL	\$2,742	\$2,589	\$2,521	\$2,453	\$2,485

2.2 Information Preservation and Dissemination

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. Additional information about the IP&D vision and strategy can be found in the *Mission and Vision of the U.S. Department of Energy, Nuclear Criticality Safety Program*, March 2008 document. A funding table is provided at the end of this 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.

2.2.2 Approved Subtasks

Argonne National Laboratory (ANL) IP&D Subtasks

FY 2011

ANL IP&D Subtask 1 (\$40K)

This effort is a continuation of the FY 2010 task to collect and preserve the inventory records (size, composition, construction, etc.) of the ANL ZPR/ZPPR materials, some portion of which are planned to be retained and used at the Critical Experiment Facility (CEF) in Nevada.

Deliverables include: (1) Continue conversion of the data to the electronic format specified in FY 2010, Subtask 1 and (2) Generate an electronic database with catalog, index, keywords, and search capability.

Milestones:

- Document the electronic files produced from the available inventory records of the ANL ZPR/ZPPR materials (Q4).
- Deliver catalog of electronic files to the NCSP IP&D manager (Q4).
- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012 - FY 2015

Continued work in this area will be based on approval of proposals by the NCSP Manager through the annual proposal process.

Hanford IP&D Subtasks

FY 2011

Hanford IP&D Subtask 1 (\$40K)

Continue verification and validation for MCNP code calculations to be added to the database for CritView; add selected LA-10860 Data to CritView library; 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.

Milestones:

- Issue a peer reviewed report documenting added LA10860 Data for CritView libraries to the NCSP manager and to LLNL for posting on the NCSP website (Q4).
- Provide updated CritView data libraries and documentation to LLNL for posting on the NCSP website (Q4).
- Issue peer reviewed report documenting added MCNP calculations for secondary ARH-600 systems for the CritView libraries to the NCSP manager and to LLNL for posting on the NCSP website (Q4).

Hanford IP&D Subtask 2 (\$70K)

Continue developing a method for obtaining integral cross sections for actinides from reactor operations and special test data.

Milestones:

- Issue letter report containing relevant reactor operations data to LLNL for posting on the NCSP website (Q2).
- Issue letter report providing identification and compilation of potential benchmarks to LLNL for posting on the NCSP website (Q4).
- Issue letter report documenting computer model for extraction and sensitivity calculations to LLNL for posting on the NCSP website (Q4).
- Issue letter report documenting extracted cross sections for the U-Pu Tree to LLNL for posting on the NCSP website (Q4).

FY 2012

Hanford IP&D Subtask 1 (\$41K)

Continue performing selected MCNP and 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.

Milestones:

- Document changes to data files and provide them (MCNP, SCALE, ARH-600, LA10860) to LLNL for posting on the NCSP website (Q3).
- Provide updated and documented CritView code to LLNL for posting on the NCSP website (Q4).

Hanford IP&D Subtask 2 (\$120K)

Continue developing a method for obtaining integral cross sections for actinides from reactor operations and special test data. Also develop a data record matrix for isotopes and reactors.

Milestones:

- Provide draft letter report on cross section extraction, data adjustments and benchmark example identification to the NCSP Manager (Q1).
- Issue letter report providing comprehensive evaluation of data for all possible nuclear parameters to LLNL for posting on the NCSP website (Q4).
- Issue letter report providing identification and compilation of potential benchmarks to LLNL for posting on the NCSP website (Q4).
- Issue letter report documenting extracted cross sections for the U-Th Tree and the Am-Cm Tree to LLNL for posting on the NCSP website (Q4).

FY 2013

Hanford IP&D Subtask 1 (\$42K)

Continue performing selected MCNP and 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.

Milestones:

- Issue peer reviewed report documenting added SCALE calculations for CritView libraries to LLNL for posting on the NCSP website (Q4).
- Provide updated CritView SCALE data libraries and documentation to LLNL for posting on the NCSP website (Q4).

Hanford IP&D Subtask 2 (\$50K)

Complete developing a method for obtaining integral cross sections for actinides from production reactor operations and special test data and apply to common actinides. Perform validation by cross section checks between alternate pathways to obtain same cross section. Future work could involve completing an exhaustive search of relevant actinide irradiation data at Hanford and SRS, exploring different options for extraction of relevant, uncommon actinides (e.g., outside the Pu chain) cross sections and reaction rates and selecting best option for application to available data, identification of unanalyzed targets and the funding need to recover relevant data from these targets. If successful, future work beyond the original scope of this Subtask may be expanded to an examination of relevant fuel irradiations in FFTF and HFIR and subsequent chemical analyses.

Milestones:

- Issue the final report that assembles results into documentation suitable for nuclear criticality analyses to LLNL for posting on the NCSP website (Q2).
- Issue letter report providing identification and compilation of potential benchmarks to LLNL for posting on the NCSP website (Q4).

FY 2014

Hanford IP&D Subtask 1 (\$43K)

Continue performing selected MCNP and 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.

Milestones:

- Issue peer reviewed report documenting added SCALE calculations for CritView libraries to LLNL for posting on the NCSP website (Q4).
- Provide updated CritView data libraries and documentation to LLNL for posting on the NCSP website (Q4).

FY 2015**Hanford IP&D Subtask 1 (\$44K)**

Continue performing selected MCNP and 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.

Milestones:

- Provide updated and documented changes to data files (MCNP, SCALE, ARH-600, and LA10860) to LLNL for posting on the NCSP website (Q3).
- Update and document CritView code changes to LLNL for posting on the NCSP website (Q4).

LLNL IP&D Subtasks**FY 2011****LLNL IP&D Subtask 1 (\$126K)**

Operate and maintain the NCSP website. Monitor on-going operations, install monthly Operating System patches, perform daily backup of the Integral Experiment Request Form database, periodically procure and upgrade website hardware and software, perform monthly risk assessments required by NNSA cyber security policy, and maintain computer operations. Post information to the website, coordinate the implementation of the NCSP information from NCSP management, CSSG, and the CSCT onto the website, convert various document types into PDF files or web pages, and assist NCS users to solve website access and printing problems. Store and maintain NCSP records. NCSP will be sending files, records, and other materials as deemed necessary by NCSP management to LLNL for storage.

Milestone:

- Provide status reports of website activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 2 (\$134K)

Continue development and maintenance of the electronic Integral Experiment Request Form (i.e., CED-0, CED-1, CED-2, CED-3, CED-4, databases). Maintain the Nuclear Data Request

Form similar to Integral Experiments Request Form, to provide requestors with a means to submit online nuclear data measurement requests.

Milestones:

- Enhance IER Request Form with on-demand pop-up text boxes capabilities (Q1).
- Develop and deploy a utility to export each request form to PDF or ICSBEP Format (Q3).
- Maintain the electronic IER form and provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Maintain the electronic Nuclear Data Request Form and provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 3 (\$30K)

Institute multimedia web-based training: revamp training web pages to provide DOE-STD-1135-99, Section VIII Continuing Training Requirements, with multi-media streaming video feature. This subtask utilized LLNL HS3104 training module as a starting point in FY 2008, and is adding the Oak Ridge Critical Experiments Facility Heritage video series (10 DVDs) in FY 2009, the Los Alamos Critical Experiments Facility (LACEF) Heritage video series (9 DVDs) in FY 2010, the ORELA Heritage video series (8 DVDs) in FY 2011, and other materials as deemed necessary by IP&D Manager in the out years.

Milestones:

- Process and deploy the ORELA Heritage video series (8 DVDs) (Q4).
- Process additional videos as directed by the IP&D Manager and provide status reports of website activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 4 (\$52K)

Digitize and archive unclassified hardcopy bibliography reports starting with the LLNL hardcopy reports collections. The scanned bibliography files will be uploaded onto the NCSP website and will also be stored in CDs for distribution. In addition, limited copy services will be provided per individual requests.

Milestone:

- Provide status reports of digitize hardcopy bibliography reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 5 (\$52K)

Digitize and archive classified critical experiments data and benchmarks starting with the LLNL classical reports collection. Starting in FY 2012, procure hardware, software, and submit classified security plan for the classified Nuclear Criticality Safety Data Bank and Benchmark website. This NCSP classified website will be hosting the classified Critical/Subcritical Integral

Experimental forms, and to preserve and disseminate classified data including one-of-a-kind classified reports and benchmarks.

Milestones:

- Provide status reports of digitize classified critical experiments data and benchmarks in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Procure classified website hardware and software (FY 2012 Q3).
- Submit classified security plan to LSO for approval (FY 2012 Q4).
- Develop and deploy classified website (FY 2013 Q2).
- Operate and maintain the classified website and provide status reports in NCSP Quarterly Progress Reports (FY 2012 - FY 2015: Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 6 (\$50K)

Create a new searchable CSE database. This new CSE database will be searchable by CSE summary, title, authors, document ID, and date.

Milestones:

- Create and deploy searchable CSE database (Q4).
- Provide status reports in NCSP Quarterly Progress Reports (FY 2011 - FY 2015: Q1, Q2, Q3, Q4).

LLNL IP&D Subtask 7 (\$250K)

Operation, Maintenance, and Support for “Red” network at the Criticality Experiments Facility in Nevada.

Milestone:

- Provide status reports in NCSP Quarterly Progress Reports (FY 2011 - FY 2015: Q1, Q2, Q3, Q4).

FY 2012 - FY 2015

Scope and milestones for LLNL IP&D Subtasks 1-7 remain the same as stated above. Funding for these Subtasks is contained in the following table.

LLNL IP&D Budget for Subtasks 1-7 (Fiscal Years 2012 – 2015)

Subtask	FY 2012	FY 2013	FY 2014	FY 2015
Subtask 1	\$131K	\$136K	\$142K	\$146K
Subtask 2	\$77K	\$80K	\$83K	\$86K
Subtask 3	\$32K	\$34K	\$36K	\$38K
Subtask 4	\$54K	\$56K	\$58K	\$60K
Subtask 5	\$114K	\$256K	\$178K	\$140K
Subtask 6	\$50K	\$30K	\$32K	\$34K
Subtask 7	\$255K	\$260K	\$265K	\$270K

ORNL IP&D Subtasks

FY 2011

ORNL IP&D Subtask 1 (\$0K)

ORNL IP&D Subtask 1 is delayed until FY 2012 pending the availability of funds and successful conversion of the older ORELA magnetic tapes to a modern storage format.

ORNL IP&D Subtask 2 (\$60K)

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

Milestone:

- Inventory approximately one-third of the document inventory, create a bibliographic record, and provide the record for posting on the DOE NCSP website (Q4).

FY 2012

ORNL IP&D Subtask 1 (\$50K)

The objective of this task is to catalog and archive previously measured ORELA data taken over the past 40 years in a modern, retrievable database to support current and future resonance-region cross-section evaluation efforts. The measured data, currently on magnetic tape reels (~350 tapes), is needed to support the NCSP Nuclear Data program objectives to address the

highest priority nuclear data needs of nuclear criticality safety in a timely manner. In FY 2010, ORNL initiated an effort to convert the ORELA magnetic tapes to a modern data format (e.g., DVD). In FY 2012 through FY 2014, tasks will be performed to complete the cataloging and archiving of the ORELA data to enable future retrieval and analysis.

Milestone:

- Catalog and archive approximately one-third of the ORELA data converted from magnetic tapes (Q4).

ORNL IP&D Subtask 2 (\$60K)

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

Milestone:

- Inventory approximately one-third of the document inventory, create a bibliographic record, and provide the record for posting on the DOE NCSP website (Q4).

FY 2013

ORNL IP&D Subtask 1 (\$50K)

Scope for ORNL Subtask 1 remains the same as in FY 2012

Milestone:

- Catalog and archive approximately one-third of the ORELA data converted from magnetic tapes (Q4).

ORNL IP&D Subtask 2 (\$60K)

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

Milestone:

- Inventory approximately one-third of the document inventory, create a bibliographic record, and provide the record for posting on the DOE NCSP website (Q4).

FY 2014

ORNL IP&D Subtask 1 (\$50K)

Scope for ORNL Subtask 1 remains the same as in FY 2012

Milestone:

- Catalog and archive approximately one-third of the ORELA data converted from magnetic tapes (Q4).

ORNL IP&D Subtask 2 (\$60K)

Scan and create electronic copies of a selected subset of criticality document collections amassed by Dixon Callihan, Joe Thomas, Howard Dyer, and Jim Mincey. Subset will be based on judgment of potential utility and consideration of document availability.

Milestones:

- Determine target subset of records desirable for preservation. Within that subset, determine prioritization (Q1).
- Using remaining FY 2014 funding, generate electronic copies of the records according to document prioritization (Q4).

FY 2015

ORNL IP&D Subtask 2 (\$30K)

Scan and create electronic copies of a selected subset of criticality document collections amassed by Dixon Callihan, Joe Thomas, Howard Dyer, and Jim Mincey.

Milestone:

- Using remaining funding, generate electronic copies of the records according to document prioritization (Q4).

2.2.3 Information Preservation and Dissemination Budget

Information Preservation and Dissemination Budget (Fiscal Years 2011 – 2015)

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
ANL	\$40	\$0	\$0	\$0	\$0
Hanford	\$110	\$161	\$92	\$43	\$44
LLNL	\$694	\$713	\$852	\$794	\$774
ORNL	\$60	\$110	\$110	\$60	\$30
TOTAL	\$904	\$984	\$1054	\$897	\$848

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. Additional information about the IE vision and strategy can be found in the *Mission and Vision of the U.S. Department of Energy, Nuclear Criticality Safety Program*, March 2008 document. A funding table is provided at the end of this 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.

2.3.2 Approved Subtasks

Argonne National Laboratory (ANL) IE Subtask

FY 2011

ANL IE Subtask 1 (\$75K)

Engage the former ANL ZPR/ZPPR staff (G. R. Imel, J. A. Morman, R. W. Schaefer and R. D. McKnight) in development and execution of new experimental campaigns for the NCSP. Part of the development program will improve integral experiment capabilities by transferring some of the ANL expertise in planning, pre-analysis and execution of critical experiments to the next-

generation of experimenters. All activities will be fully integrated with the C_{ED}T process and with the approval of the C_{ED}T manager.

Milestone:

- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012 - FY 2015

Continued work in this area will be based on approval of proposals by the NCSP Manager through the annual proposal process.

Idaho National Laboratory (INL) IE Subtasks

FY 2011

INL IE Subtask 1 (\$250K)

The Institut De Radioprotection et De Sûreté Nucléaire (IRSN) has completed an experimental program, *Matériaux Interaction Réflexion Toutes Epaisseurs (MIRTE)*, in which integral reactivity characteristics of various structural materials were tested in critical assemblies on the APPARATUS B facility at the Commissariat à l'Énergie Atomique (CEA) Valduc Centre. Phase 1 of the MIRTE Program consisted of about 20 subcritical approaches extrapolated to critical conditions using the neutron amplification method. A similar number of reference and reproducibility experiments were also performed. Most configurations focused on interaction, but some focused on reflection. Only low-enriched UO₂ (4.738% enriched uranium) water-moderated rod arrays with thermal-energy spectra were constructed. The materials tested include: large absorber screens of concrete, iron, nickel, lead, zirconium, aluminum, copper, and cast-iron; thin plates of iron, nickel, copper and titanium; and reflected experiments with aluminum and SiO₂ (glass).

The results of Phase 1 of the IRSN MIRTE Program will be compiled and evaluated in accordance with the requirements of the ICSBEP. Phase 1 of the MIRTE Program, including funding, will end in FY 2011; however, evaluation and review of the data will extend into 2012.

Milestones:

- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Obtain Evaluation Reports of all data from IRSN (Q3).

INL IE Subtask 2 (\$300K)

Phase 2 of the IRSN MIRTE Program is an expansion in which integral reactivity tests of Mn, Cr, Mo, and Cl will be performed. The purpose of this subtask is to assist with the design of the experiments that will be performed on the APPARATUS B facility at the CEA Valduc Centre and possibly provide design and manufacture of some components. Design of Phase 2 of MIRTE should be completed during FY 2011, but manufacture of components may extend into FY 2012.

Milestone:

- Provide status in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

INL IE Subtask 3 (\$125K)

The Russian Federal Nuclear Center Institute of Technical Physics (VNIITF) possesses unique experimental capabilities for the performance of benchmark experiments that are essential for the verification of calculation techniques and nuclear data libraries. In addition to the evaluation of several series of existing benchmark experiments for the ICSBEP, scientists at VNIITF have performed several series of new experiments specifically for the NCSP. Included are experiments with titanium, vanadium, and tungsten. Similar experiments for molybdenum and nickel will be performed and evaluated beginning with molybdenum experiments in FY 2011. The Idaho National Laboratory (INL) is providing \$50K per year of independent programmatic funding to help reduce the total cost to the NCSP.

The results of the VNIITF Critical Experiment Program will be compiled and evaluated in accordance with the requirements of the International Criticality Safety Benchmark Evaluation Project (ICSBEP). Experiments with molybdenum will be performed during FY 2011 and the evaluation process will be initiated. Evaluation of results will likely extend into 2012.

Milestone:

- Provide status in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

INL IE Subtask 1 (\$0K)

Evaluation and review of Phase 1 MIRTE experimental data will continue into FY 2012. Final reports will be submitted to the ICSBEP for a proprietary peer review and preparation for publication. Release of the data will be restricted to the designated beneficiaries (including DOE and all DOE national laboratories) until 31 December 2017.

Milestone:

- Distribution of Final Evaluation Reports to beneficiaries ICSBEP (Q4).

INL IE Subtask 2 (\$500K)

Conduct Phase 2 of the IRSN MIRTE Program (Integral reactivity tests of Mn, Cr, Mo, and Cl)

Milestone:

- Provide status in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

INL IE Subtask 3 (\$140K)

Evaluation and review of the VNIITF molybdenum experiments will continue into FY 2012. Similar experiments with nickel will be performed and evaluated during FY 2012. Final review and approval of the associated evaluation reports may extend into FY 2013 at no extra cost. The Idaho National Laboratory (INL) will provide \$50K per year of independent programmatic funding to help reduce the total cost to the NCSP.

Milestones:

- Provide status in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Publication of VNIITF molybdenum experiments (Q4).

FY 2013

INL IE Subtask 2 (\$500K)

Phase 2 MIRTE experiments will be completed. Phase 2 results will be compiled and evaluated in accordance with the requirements of the ICSBEP. Evaluation and review will likely continue into FY 2014.

Milestone:

- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

INL IE Subtask 3 (\$0K)

Final evaluation, review, and approval of the VNIITF evaluations may extend into FY 2013 at no extra cost.

Milestone:

- Publication of VNIITF nickel experiments (Q4).

FY 2014

INL IE Subtask 2 (\$500K)

Evaluation of Phase 2 MIRTE experimental data will continue into FY 2014. Evaluation reports will be submitted to the ICSBEP for independent peer review.

Milestone:

- Obtain evaluation reports of all MIRTE 2 data from IRSN (Q3).

FY 2015

INL IE Subtask 2 (\$500K)

Evaluation and review of Phase 2 MIRTE experimental data will continue into FY 2015. Final reports will be submitted to the ICSBEP for review by the Technical Review Group and prepared for publication. Release of the selected data may be restricted to the designated beneficiaries (including DOE and all DOE national laboratories) until 31 December 2017.

Milestones:

- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Distribution of Final Evaluation Reports to beneficiaries (Q4).

LANL IE Subtasks

FY 2011

LANL IE Subtask 1 (\$3450K)

Provide Critical Experiments Facility (CEF) Operational Support at the Device Assembly Facility (DAF): The funding associated with this subtask is to be used to support the basic infrastructure associated with owning and operating CEF. These basic infrastructure costs – also referred to as fixed costs – are those costs that exist even if there is no programmatic work. These costs include: (1) safety-, security-, and regulatory-compliance-related activities that accompany owning, and being responsible and accountable for, a large quantity of special nuclear material, and (2) maintaining the infrastructure and capability necessary to execute the programmatic mission. Examples of the type of support that will be funded out of this subtask are: Real Estate / Operations Permit (REOP) management, health physics, criticality safety, industrial hygiene and safety, waste management, quality assurance, training, procedure writing and maintenance, critical assembly maintenance, Cognizant System Engineer (CSE) support, shipping and receiving, computer support, CEF warehouse operational support and support for Material Control & Accountability (MC&A) required activities. A detailed breakdown of these fixed operational and infrastructure costs is provided in LA-UR-09-01787, *Criticality Experiments Facility (CEF) Operational Staffing Plan, Revision 1, March 2009*.

Milestones:

- Complete all required Technical Safety Requirement (TSR) surveillances (Q1, Q2, Q3, Q4).
- Complete all required maintenance (both preventive and corrective) activities to keep the critical assemblies, vaults and high bays operational (Q1, Q2, Q3, Q4).
- Maintain all documents, procedures, permits and licenses current and fully capable of supporting the CEF programmatic missions (Q1, Q2, Q3, Q4).
- Provide status and assessment of services procured and services provided in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 2 (\$0K)

Conduct one subcritical experiment in the DAF during each fiscal year (FY 2011 through FY 2015). The experiments will be proposed, designed and executed in accordance with the guidelines promulgated in the C_{ED}T process, and will be documented in accordance with the requirements of Section 1 of a standard ICSBEP benchmark. At the direction of the NCSP Manager, no subcritical measurements will be performed during FY 2011. The priority activity during FY 2011 is startup of the CEF.

Milestone:

- See Appendix D for details on subcritical experiment milestones.

LANL IE Subtask 3 (\$150K)

Maintain and Train CEF Team Members: This subtask supports maintaining proficiency for the core team of crew chiefs and crew members during the transition to CEF operations and to begin the certification process for new operators. Final operator certifications for each machine will come as part of the execution of the CEF startup plan. The funding required for this subtask in out years will be used to maintain current operator certifications and to train and certify new critical assembly operators.

Milestones:

- Successfully complete all of the certification requirements for the core team of operators for the startup of the critical assembly machines, part of the execution of the CEF startup plan. This will result in the final certification of all CEF crew members and crew chiefs for the machines (Q1, Q2, Q3, Q4).
- Continue the operator certification process for new operators (Q1, Q2, Q3, Q4).
- Provide status reports on all operator training and certification activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 4 (\$450K)

Design and execute critical experiments: This subtask will support execution of the CEF startup plan. This subtask will also support the execution of at least one critical experiment that will provide new data. The critical experiment that will provide new data will be proposed, designed and executed in accordance with the guidelines promulgated in the C_{ED}T process, and will be documented in accordance with the requirements of Section 1 of a standard ICSBEP benchmark.

Milestones:

- Successfully complete the CEF startup process for two CEF critical assembly machines (Q1, Q2, Q3, Q4)
- Execute a critical experiment that will be proposed, designed and executed in accordance with the guidelines promulgated in the C_{ED}T process and that provides new data.

- Provide status reports on all critical experiment activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 5 (\$100K)

Upgrade the electronics and data acquisition system for the current experimental setup used to perform subcritical benchmark measurements. The proposed upgrade will augment NCSP capability by allowing the use and analysis of various and subcritical measurement techniques. Utilization of a list-mode data acquisition system, as proposed herein, enables the application of multiple analysis techniques on the same set of data (i.e., perform analysis in both the frequency and time domain). Passive and active measurement techniques are compatible with the proposed data acquisition system. Thus, static and dynamic benchmarks are possible.

LANL will upgrade the data acquisition system by integrating the Los Alamos custom designed Pulse Arrival-Time Recording Module / PCI Mezzanine Card (PATRM/PMC). This module has the capability to simultaneously record up to 32 channels of data (channel number and detection time) with a time resolution of 10 nanoseconds. The PATRM/PMC's basic mode of operation provides time and channel tagging of every detected neutron which accommodates multiple data analysis techniques. This Subtask will be completed during this fiscal year.

Milestones:

- Assess the PATRM/PMC data acquisition system functionality by performing californium source driven measurements as well as measurements with SNM and comparing results with previous subcritical benchmark experiments and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Certify the PATRM/PMC data acquisition system for use by the ICSBEP (Q4).

LANL IE Subtask 6 (\$300K)

Improve MCNP simulation capability for subcritical multiplication comparisons. This subtask involves collaboration between LANL (IE and AM Program Activities) and the University of Nevada Las Vegas (UNLV) Nuclear Engineering program. Initially, this work will involve code-to-code comparisons with MCNP-DSP and MCNP-Polimi and expand into other areas of interest that are focused on nuclear criticality safety.

Milestones:

- Perform experimental measurements for subcritical assemblies at CEF or LANL or use existing data for comparison with MCNP list-mode output modifications and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Characterize room return and detector efficiency by performing neutron leakage and spectral measurements and MCNP simulations (Q4).
- Continue comparisons with UNLV to document simulation results using currently available codes MCNP-DSP and MCNP-Polimi and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Apply variance reduction techniques based upon FY 2010 recommendations (Q4).

LANL IE Subtask 7 (\$150K)

Procure equipment for the CEF Count Room that will support critical experiments. The instrumentation includes an alpha spectrometer, a portable electrically-cooled High Performance Germanium (HPGe) detector, a fission chamber assembly-and-test stand, and a flux-wire counter. This Subtask will be completed during this fiscal year.

Milestones:

- Procure a fission chamber assembly-and-test stand (Q3).
- Procure a flux wire counter (Q4).

LANL IE Subtask 8 (\$100K)

Develop new subcritical analysis software. This Subtask will produce software which will take list-mode data from the new PATRM/PMC data acquisition system (LANL-IE Subtask 5) and format the data for analysis with various subcritical methods. All of the time domain methods (Feynman variance-to-mean, Rossi-Alpha, count-to-count interval distribution, etc.) require binning data in unique ways. The frequency domain methods (such as the ^{252}Cf source driven noise analysis method used in recent subcritical benchmarks) require the data to be specifically binned before performing Fourier transforms and other mathematical operations. The software produced will provide the means to fully utilize acquired data in future experiments.

Milestones:

- Include additional subcritical neutron noise techniques (Feynman variance-to-mean, Rossi-alpha, etc.) in the analysis software suite (Q2).
- Investigate multiple methods of channel comparisons for ^{252}Cf source driven noise measurements with detector systems containing a large number of channels (Q3).
- Investigate other noise analysis methods for future inclusion such as interval distribution, Bennett variance method, time-domain ^{252}Cf source driven noise analysis, etc. (Q3).
- Continue validating software by comparison with available experimental data and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Continue documentation effort for completed software for future users and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 9 (\$75K)

Conduct Integral Experiments to Validate Metal Criticality Accident Simulations. This subtask supports unclassified research collaboration between LANL and CEA/Valduc under the CEA-DOE agreement for Cooperation in Fundamental Science Supporting Stockpile Stewardship with a technical focus to study the dynamic physics of metal criticality accidents. This will involve a collaborative design of experiments to be performed with existing metal critical assemblies of both countries (Godiva IV, Flattop, Caliban, and Prospero) to provide physical data to improve and validate simulation capabilities used to study metal criticality accident scenarios.

Milestones:

- Review current metal criticality accident simulation capabilities of both parties and determine what experimental data is available that can help improve and validate simulation capabilities (Q2).
- Collaborate on paper submission for next ICNC conference meeting (Q3).
- Initiate C_{ED}T planning process for agreed upon experiments (Q4).

FY 2012**LANL IE Subtask 1 (\$3450K)**

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 2 (\$100K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 3 (\$155K)

Maintain and Train CEF Team Members: This subtask supports maintaining proficiency for the core team of crew chiefs and crew members during the transition to CEF operations and to begin the certification process for new operators. Final operator certifications for each machine will come as part of the execution of the CEF startup plan. The funding required for this subtask in out years will be used to maintain current operator certifications and to train and certify new critical assembly operators.

Milestones:

- Successfully complete all of the certification requirements for the core team of operators for the critical assembly machines, as part of the execution of the CEF startup plan. This will result in the final certification of all CEF crew members and crew chiefs for the machines started up (Q1, Q2, Q3, Q4).
- Continue the operator certification process for new operators (Q1, Q2, Q3, Q4).
- Provide status reports on all operator training and certification activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 4 (\$1300K)

Design and execute critical experiments: This subtask will support completion of the CEF startup plan. This subtask will also support the execution of new critical experiments that will provide new data. The critical experiments that will provide new data will be proposed, designed and executed in accordance with the guidelines promulgated in the C_{ED}T process, and will be documented in accordance with the requirements of Section 1 of a standard ICSBEP benchmark.

Milestones:

- Successfully complete the CEF startup process for CEF critical assembly machines not made operational during FY 2011 (Q1, Q2, Q3, Q4).
- Execute critical experiments that will be proposed, designed and executed in accordance with the guidelines promulgated in the C_{Ed}T process and that provide new data (Q1, Q2, Q3, Q4).
- Provide status reports on all critical experiment activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL IE Subtask 6 (\$305K)

The scope is the same as in FY 2011.

Milestones:

- Perform experimental measurements for subcritical assemblies at CEF and report progress in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
- Continue comparisons with UNLV to document simulation results using currently available codes MCNP-DSP and MCNP-Polimi (Q4).

LANL IE Subtask 8 (\$100K)

The scope and milestones are the same as in FY 2011. This Subtask will be completed during this fiscal year.

LANL IE Subtask 9 (\$75K)

The scope is the same as in FY 2011.

Milestone:

- Experiments will be performed based upon C_{Ed}T planning and improvements and validation of the simulation capabilities will be performed based upon experimental results. Results will be reported in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013

LANL IE Subtask 1 (\$3650K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 2 (\$105K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 3 (\$160K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 4 (\$1600K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 6 (\$310K)

The scope is the same as in FY 2012. Milestones are TBD.

LANL IE Subtask 9 (\$75K)

The scope and milestone are the same as in FY 2011. This Subtask will be completed during this fiscal year.

FY 2014

LANL IE Subtask 1 (\$3650K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 2 (\$110K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 3 (\$165K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 4 (\$1600K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 6 (\$315K)

The scope is the same as in FY 2012. Milestones are TBD.

FY 2015

LANL IE Subtask 1 (\$3650K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 2 (\$115K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 3 (\$170K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 4 (\$1700K)

The scope and milestones are the same as in FY 2011.

LANL IE Subtask 6 (\$320K)

The scope is the same as in FY 2012. Milestones are TBD.

LLNL IE Subtasks

The LLNL IE Subtasks are to allow LLNL and other criticality and dosimetry specialists to travel and participate in Nuclear Accident Dosimeter (NAD) exercises at CEA Valduc, France, and CEF.

FY 2011

LLNL IE Subtask 1 (\$185K)

Develop detailed plans for LLNL and other laboratory teams to participate in nuclear accident dosimetry exercises. Execute logistics plans necessary for LLNL and other participants to support the exercise, participate in the exercise, and publish the results.

Milestones:

- Develop logistics plans for participation in the first nuclear accident dosimetry exercise at the CEF (in 2012). The plan will include specific JNPO procedures and resource requirements (Q4).
- Execute logistics plans necessary to conclude the exercise at CEA-Valduc and for participants and equipment to depart France (Q1).
- Publish an LLNL report of the preliminary results of the exercise (Q2).
- Provide input, as requested, to assist the host laboratory and other laboratory teams in completion of their final reports (Q4).
- Provide status reports on all activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

LLNL IE Subtask 1 (\$160K)

Develop detailed plans for LLNL and other laboratory teams to participate in nuclear accident dosimetry exercises. Execute logistics plans necessary for LLNL and other participants to support the exercise, participate in the exercise, and publish the results.

Milestones:

- Complete logistics plans for participation in the first nuclear accident dosimetry exercise at the CEF (in 2012). The plan will include specific JNPO procedures and resource requirements (Q1).
- Execute logistics plans necessary to conduct the exercise at CEF and for participants and equipment to enter and depart NTS (Q2).
- Publish an LLNL report of the preliminary results of the exercise (Q4).

FY 2013

LLNL IE Subtask 1 (\$60K)

Execute logistics plans necessary for LLNL and other participants to support the exercise, participate in the exercise, and publish the results.

Milestones:

- Provide input, as requested, to assist the laboratory teams in completion of their final reports (Q1).
- Publish a summary conference paper or journal article summarizing the results of the exercise (Q4).
- Provide status reports on all activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

NNSS IE Subtasks

FY 2011

NNSS IE Subtask 1 (\$2100K)

NSTec will provide NNSS site, facility and operations support to ensure experiments are successfully completed as planned. Primary services provided include radiological control, craft support, equipment calibration, warehouse operations support, operational waste and environmental management, industrial hygiene, shipping/receiving, respirator training and fit test, and beryllium sampling and criticality safety as required. NSTec provides basic offices, vehicles, communication, medical, and information technology support through Laboratory Logistics.

Milestone:

- Provide status reports on how CEF experiments are facilitated in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

NNSS IE Subtasks

FY 2012 - 2015

NNSS IE Subtask 1 (\$2100K)

The scope and milestone are the same as in FY 2011.

ORNL IE Subtasks

FY 2011

ORNL IE Subtask 1 (\$110K)

Integration of TSUNAMI tools with the C_EdT process: ORNL will provide technical support for the C_EdT process, especially through SCALE/TSUNAMI analysis and design, by completing assigned tasks within the C_EdT process. Specifically, experiment designs designated by the NCSP Manager will be optimized within known constraints to maximize similarity to targeted applications. Benefits of modifying designs beyond known constraints will be identified as they are revealed by utilization of TSUNAMI in the optimization process.

Milestone:

- Provide status reports on all C_EdT related activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

ORNL IE Subtask 1 (\$115K)

The scope and milestones are the same as in FY 2011.

FY 2013

ORNL IE Subtask 1 (\$120K)

The scope and milestones are the same as in FY 2011.

FY 2014

ORNL IE Subtask 1 (\$125K)

The scope and milestones are the same as in FY 2011.

FY 2015

ORNL IE Subtask 1 (\$130K)

The scope and milestones are the same as in FY 2011.

SNL IE Subtasks

FY 2011

SNL IE Subtask 1 (\$830K)

Maintain the capability to perform water-moderated low-enriched lattice critical experiments in the Sandia Critical Experiments Facility. The initial focus will be on the Seven Percent Critical Experiment (7uPCX) and later will shift to other experiments as directed by the NCSP Manager. All critical experiments will be proposed, designed and executed in accordance with the guidelines promulgated in the C_EdT process, and will be documented in accordance with the requirements of Section 1 of a standard ICSBEP benchmark.

Milestones:

- Maintain the SPRF/CX facility authorization and operator proficiency by performing critical experiment operations (Q4).
- Prepare and submit benchmark evaluations of completed critical experiment series as necessary (Q4).
- Provide status reports on all critical experiment activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

SNL IE Subtask 1 (\$840K)

The scope and milestones are the same as in FY 2011.

FY 2013

SNL IE Subtask 1 (\$850K)

The scope and milestones are the same as in FY 2011.

FY 2014

SNL IE Subtask 1 (\$1000K)

The scope and milestones are the same as in FY 2011.

FY 2015

SNL IE Subtask 1 (\$1100K)

The scope and milestones are the same as in FY 2011.

The MIDAS Program

The CEF was constructed to accommodate four critical assemblies (Planet, Flattop, Comet, and Godiva) to 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 a formal Cooperative Agreement that is legally binding and will provide adequate controls and assurance that risk to the U.S. is maintained at an acceptably low level. A Governance Charter (formal agreement) 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: 2011 through 2019; and Utilization Phase: 2019 through 2040.

2.3.3 Integral Experiments Budget

Integral Experiments Budget (Fiscal Years 2011 – 2015)

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
ANL	\$75	\$0	\$0	\$0	\$0
INL	\$675	\$640	\$500	\$500	\$500
LANL	\$4,775	\$5,485	\$5,900	\$5,840	\$5,955
LLNL	\$185	\$160	\$60	\$0	\$0
NNSS	2,100	2,100	2,100	2,100	2,100
ORNL	\$110	\$115	\$120	\$125	\$130
SNL	\$830	\$840	\$850	\$1,000	\$1,100
MIDAS Program	\$1,000	\$4,000	\$6,000	\$6,000	\$6,000
TOTAL	\$9,750	\$13,340	\$15,530	\$15,565	\$15,785

2.4 International Criticality Safety Benchmark Evaluation Project

2.4.1 Program Element Description

The purpose of International Criticality Safety Benchmark Evaluation Project (ICSBEP) is to: (1) identify and evaluate a comprehensive set of criticality safety related experimental benchmark data; (2) verify the data, to the extent possible, by reviewing original and subsequently revised documentation, and by talking with the experimenters or individuals who are familiar with the experiments or the experimental facility; (3) evaluate the data and quantify overall uncertainties through various types of sensitivity analyses; (4) compile the data into a standardized format; (5) perform sample calculations using standard criticality safety codes and data; and (6) formally document the work into a single source of verified, extensively peer reviewed benchmark data. Additional information about the ICSBEP vision and strategy can be found in the *Mission and Vision of the U.S. Department of Energy, Nuclear Criticality Safety Program*, March 2008 document. A funding table is provided at the end of this program element section.

A small group (six to eight members) of criticality safety, integral measurement, and nuclear data experts was established (June 2008) to review available experimental data and, based on community needs, set future benchmark priorities. The group planned and prioritized U.S. funded benchmarks for five years. Specific data are considered “high-priority” and are included in the plan if they fill immediate criticality safety needs, fill gaps in the ICSBEP integral

benchmark database, are recently generated U.S. funded data (including data generated outside the U.S.), continue or enhance foreign collaboration, are expected to be of benchmark quality, or maintain U.S. capability by fostering next-generation participation. The result of this effort, a prioritized list of benchmarks, is given in Appendix C. The actual number of evaluated experiments will ultimately depend on the cost of each evaluation. Appendix C is reviewed and updated at least once per year. The prioritization process is an integral part of the ICSBEP planning effort.

A funding table is provided at the end of this 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.

2.4.2 Approved Subtasks

INL ICSBEP Subtasks

FY 2011

INL ICSBEP Subtask 1 (\$1,050K)

Maintain the ICSBEP Infrastructure: ICSBEP Infrastructure includes project management, project administration, independent peer review and technical editing, graphic arts, project meeting organization, publication costs, travel for selected participants who are contributing evaluations, internet site updates and maintenance, minimal support for the Russian Federation and others, and participation in other NCSP activities.

Milestones:

- Hold Benchmark Prioritization Meeting (Q1).
- Conduct annual ICSBEP Technical Review Group Meeting (Q3).
- Publish the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (Q4).

INL ICSBEP Subtask 2 (\$30K)

Support National Laboratory/Site/Institute Participation: Laboratory participation includes data evaluation; internal peer review; limited independent peer review; and ICSBEP meeting preparation, participation and travel by participants at each of seven national laboratories or sites: INL, LANL, LLNL, ORNL, ANL, SRNL, and the Hanford Site. SNL and Bettis Laboratory also participate at their own expense. Participation by non-U.S. institutes that are funded through the ICSBEP is included in this task. This task has been reduced significantly during FY 2011 pending the outcome of an NCSP Review of the ICSBEP that is scheduled to be completed in the Spring of 2011.

Milestone:

- Milestones are the same as INL ICSBEP Subtask 1.

INL ICSBEP Subtask 3 (\$150K)

A collaborative effort between the ICSBEP and the Institut De Radioprotection et De Sûreté Nucléaire (IRSN) was initiated in FY 2010 to qualify the data in DICE (**D**atabase for the **I**nternational Handbook of Evaluated **C**riticality Safety Benchmark **E**xperiments) and make improvements to the associated interface. The ICSBEP is responsible for verification of just over 2300 of the configurations in the 2009 Edition of the Handbook. A quality review of DICE data will be incorporated into the current ICSBEP peer review process for future evaluations. With the exception of Level 2 and Level 3 correlation data, which is beyond the scope of this task, the qualification efforts will be completed by the end of FY 2012.

Milestone:

- Provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

INL ICSBEP Subtask 1 (\$1,055K)

The scope and milestones are the same as in FY 2011.

INL ICSBEP Subtask 2 (\$855K)

The scope and milestones are the same as in FY 2011.

INL ICSBEP Subtask 3 (\$50K)

The scope and milestones are the same as in FY 2011.

FY 2013

INL ICSBEP Subtask 1 (\$1,060K)

The scope and milestones are the same as in FY 2011.

INL ICSBEP Subtask 2 (\$860K)

The scope and milestones are the same as in FY 2011.

FY 2014

INL ICSBEP Subtask 1 (\$1,065K)

The scope and milestones are the same as in FY 2011.

INL ICSBEP Subtask 2 (\$865K)

The scope and milestones are the same as in FY 2011.

FY 2015

INL ICSBEP Subtask 1 (\$1,070K)

The scope and milestones are the same as in FY 2011.

INL ICSBEP Subtask 2 (\$870K)

The scope and milestones are the same as in FY 2011.

2.4.3 International Criticality Safety Benchmark Evaluation Project Budget

International Criticality Safety Benchmark Evaluation Project Budget (Fiscal Years 2011 – 2015)
--

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
INL	\$1,230	\$1,960	\$1,920	\$1,930	\$1,940

2.5 Nuclear Data

2.5.1 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. Additional information about the ND vision and strategy can be found in the *Mission and Vision of the U.S. Department of Energy, Nuclear Criticality Safety Program*, March 2008 document. Refer to Appendix D for the FY 2011 through 2015 schedule, milestones and deliverables associated with specific nuclear data measurement, evaluation, and publication. Milestones not contained in Appendix D are delineated below. A funding table is provided at the end of this 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.

2.5.2 Approved Subtasks

ANL ND Subtasks

FY 2011

ANL ND Subtask 1 (\$230K)

Perform 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 will be on testing and reporting performance of priority evaluations identified by the Nuclear Data Advisory Group (NDAG). Support the NCSP website initiatives for addressing both integral and differential nuclear data needs. Participate in nuclear data international expert groups and working groups.

Milestones:

- Provide reports to NDAG and Cross Section Evaluation Working Group (CSEWG) documenting results of NCSP data testing and validation (Q1, Q3).
- Participate as ENDF representative in the OECD/NEA WPEC annual meeting and various subgroup activities, including the High-Priority Request List (Q3).
- Participate as NCSP representative to the OECD/NEA Working Party on Nuclear Criticality Safety (WPNCS) (Q4).
- Participate in nuclear data meetings, including CSEWG, CSEWG Executive Committee, and chair of the CSEWG Covariance Committee (Q4).
- 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 (Q4).
- Document support of NCSP website for both integral and differential nuclear data needs (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ANL ND Subtask 2 (\$40K)

Support 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. 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.

Milestones:

- Chair meetings of the CSEWG Covariance Committee and report contributions through NDAG and CSEWG (Q1, Q3).

- Document additional capability to produce quality covariance evaluations for ENDF (Q4).
- Report status in NCSP Quarterly Status Reports (Q1, Q2, Q3, Q4).

ANL ND Subtask 3 (\$25K)

Support the C_{EDT} process to ensure proper planning and execution of integral experiments, throughout the CD-0, CD-1, CD-2, CD-3 and CD-4 process.

Milestones:

- Participate in and support C_{EDT} teams as required (Q1, Q2, Q3, Q4).
- Report status in NCSP Quarterly Status Reports (Q1, Q2, Q3, Q4).

ANL ND Subtask 4 (\$75K)

Generate integral experiment covariance data in 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 over a two-year interval (FY 2011 through FY 2012) for inclusion in DICE.

Milestones:

- Report progress on evaluation methodology and preliminary results (Q2).
- Deliver completed covariance evaluations to ICSBEP project (Q4).
- Report status in NCSP Quarterly Status Reports (Q1, Q2, Q3, Q4).

FY 2012

ANL ND Subtask 1 (\$235K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 2 (\$41K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 3 (\$30K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 4 (\$50K)

This effort is a continuation of the FY 2011 task to generate integral experiment covariance data in support of sensitivity/uncertainty methods, uncertainty quantification and nuclear data adjustment methods. The completed set of integral covariance data for the full set of evaluated ANL benchmarks will be delivered for inclusion in DICE.

Milestones:

- Deliver full set of evaluated covariance data files to ICSBEP project (Q4).
- Report status in NCSP Quarterly Status Reports (Q1, Q2, Q3, Q4).

FY 2013

ANL ND Subtask 1 (\$240K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 2 (\$42K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 3 (\$35K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 4 (\$50K)

Generate integral experiment covariance data in support of sensitivity/uncertainty methods, uncertainty quantification and nuclear data adjustment methods. Extend the effort of the preceding years to a broader range of integral data for inclusion into DICE. Continuation of this effort will be based on approval of proposals by the NCSP Manager through the annual proposal process.

Milestones:

- Report progress on preliminary results of covariance evaluations (Q2).
- Deliver completed covariance evaluations to ICSBEP project (Q4).
- Report status in NCSP Quarterly Status Reports (Q1, Q2, Q3, Q4).

FY 2014

ANL ND Subtask 1 (\$245K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 2 (\$43K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 3 (\$40K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 4 (\$60K)

The scope and milestones are the same as in FY 2013.

FY 2015

ANL ND Subtask 1 (\$260K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 2 (\$44K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 3 (\$45K)

The scope and milestones are the same as in FY 2011.

ANL ND Subtask 4 (\$65K)

The scope and milestones are the same as in FY 2013.

BNL ND Subtasks

FY 2011

BNL ND Subtask 1 (\$150K)

Provide technical support to the NCSP through the application of National Nuclear Data Center (NNDC) assets. The NNDC provides a link to CSEWG data community and ensures that NCSP cross-section evaluations are duly checked, processed, visualized, reviewed and archived in ENDF/A as candidate evaluations for new versions of the ENDF/B library. The NNDC also provides a link to the CSEWG covariance community and ensures quality of new NCSP covariance evaluations by performing in-depth analysis of these data using suitable quality assurance procedures and providing timely feedback to evaluators. Finally, the NNDC maintains the Atlas of Neutron Resonances as a unique resource of thermal and resonance data with uncertainties.

Milestones:

- Ensure that NCSP produced nuclear data are processed, reviewed and included in the ENDF (Q1, Q2, Q3, Q4).
- Perform quality assurance of new NCSP covariance data (Q2, Q4).
- Update Atlas of Neutron Resonances (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

BNL ND Subtask 1 (\$155K)

The scope and milestones are the same as in FY 2011.

FY 2013

BNL ND Subtask 1 (\$160K)

The scope and milestones are the same as in FY 2011.

FY 2014

BNL ND Subtask 1 (\$165K)

The scope and milestones are the same as in FY 2011.

FY 2015

BNL ND Subtask 1 (\$170K)

The scope and milestones are the same as in FY 2011.

LANL ND Subtasks

FY 2011

LANL ND Subtask 1 (\$450K)

Provide nuclear data evaluation support as delineated in Appendix D.

Milestone:

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL ND Subtask 2 (\$150K)

A high priority for the NCSP is to develop a prioritized list of experiments that will fully utilize CEF resources (machines and people) for the next 2-5 years. It is important that these experiments support relevant programs beyond the NCSP. This subtask supports the work necessary to develop well thought out IERs that meet needs of programs such as Stockpile Stewardship, Nuclear Counter Terrorism (NCT), and Nuclear Forensics (NTNF).

Milestone:

- Suite of IERs with documented justification of their value to programs such as Stockpile Stewardship, NCT, and NTNF (Q4).

FY 2012

LANL ND Subtask 1 (\$455K)

The scope is the same as in FY 2011.

Milestones:

- Implement Monte Carlo particle decay spectra in a new code (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL ND Subtask 2 (\$100K)

The scope and milestone are the same as in FY 2011.

FY 2013

LANL ND Subtask 1 (\$460K)

The scope is the same as in FY 2011.

Milestone:

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL ND Subtask 2 (\$100K)

The scope and milestone are the same as in FY 2011.

FY 2014

LANL ND Subtask 1 (\$460K)

The scope is the same as in FY 2011.

Milestones:

- Revise tabulated exclusive spectra for selected targets, using the new Monte Carlo treatment of particle emission spectra (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LANL ND Subtask 2 (\$100K)

The scope and milestone are the same as in FY 2011.

FY 2015

LANL ND Subtask 1 (\$470K)

The scope is the same as in FY 2011.

Milestone:

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).
-

LANL ND Subtask 2 (\$100K)

- The scope and milestone are the same as in FY 2011.

LLNL ND Subtasks

LLNL N-Division has developed a first principles analytical method to determine the time-dependent emission of delayed gammas based on event-by-event modeling of the fission process and subsequent fission product decay resulting in a new ENDF-6 format for β -delayed post fission γ 's, which was accepted by CSEWG in November 2006. The time dependent data is implemented in COG11.

FY 2011

LLNL ND Subtask 1 (\$75K)

Utilize existing LLNL-developed analytical methods to calculate and test the corresponding time independent (or total) delayed gamma emission from thermal, fast, and 14-MeV neutron induced fission in ^{235}U .

Milestones:

- Issue an LLNL report documenting the technical basis of the ^{239}Pu (n,f) γ equilibrium multiplicity data and spectra (Q4).
- Issue an LLNL report documenting testing of the data for criticality safety applications (Q4).
- Submit the ^{239}Pu data to the CSEWG/USNDP in ENDF-6 format (Q4).
- Present the testing results to the CSEWG Validation Subcommittee (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

LLNL ND Subtask 2 (\$75K)

Generate time-dependent and equilibrium data for other nuclides as directed by the NCSP Manager.

Milestone:

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013

LLNL ND Subtask 3 (\$75K)

The scope and milestones are the same as in FY 2012.

FY 2014

LLNL ND Subtask 3 (\$75K)

The scope and milestones are the same as in FY 2012.

FY 2015

LLNL ND Subtask 3 (\$75K)

The scope and milestones are the same as in FY 2012.

ORNL ND Subtasks

FY 2011

ORNL ND Subtask 1 (\$950K)

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. Development and maintenance of the SAMMY resonance analysis software will be performed to support the cross-section evaluation objectives for the NCSP. In addition, ORNL will continue to collaborate with other research institutions including LANL; ANL; Rensselaer Polytechnic Institute (RPI), the Institute for Reference Materials and Measurements (IRMM) in Geel, Belgium; the Argentina National Atomic Energy Commission (CNEA) in Bariloche, Argentina; and the Instituto de Pesquisas Energeticas Nuclear (IPEN) in Brazil to perform resonance-region cross-section measurements and obtain thermal scattering data, resonance integral data, and

high-energy cross-section evaluations with covariance data that complement the ORNL resonance evaluations thereby addressing nuclear data needs for the criticality safety community.

Milestones:

- Chair WPEC subgroup to improve URR analysis methodology and prepare final report for WPEC URR subgroup (Q4).
- Updates to SAMMY software to support NCSP data evaluation efforts (Q4).
- Participate in NDAG, CSEWG, and WPEC meetings (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ORNL ND Subtask 2 (\$40K to ORNL; \$310K to RPI through Naval Reactors)

ORNL and RPI will collaborate 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 Gaertner LINAC laboratory. Since the LINAC facility is operating under the Nuclear Engineering program at RPI, the work will also help educate the next generation of scientists and engineers with expertise in nuclear data relevant to the NCSP mission. Existing RPI equipment will be used when possible and new detection stations will be developed as needed to meet NCSP required capabilities currently not available at RPI. The task will: 1) develop new measurement capabilities, 2) perform cross-section measurements and qualification of the new capabilities, 3) provide accelerator infrastructure and upgrade support, and 4) provide support for ORNL to work with RPI staff to ensure the resonance-region measurement capabilities are addressed per the NCSP nuclear data requirements.

Milestones:

- Capability development: Complete calculations to estimate efficiencies for several detector concepts (C_6D_6 , BaF_2 , NE-226) (Q2).
- Capability development: Purchase prototype detectors of the selected concepts and perform scoping measurements with prototype detectors (Q4).
- Measurements: Measure Fe-56 total cross section in the high energy range (0.5 MeV-20 MeV) (Q3).
- Measurements: Complete transmission measurements to supplement ORNL measurements planned at IRMM (Ca, Ce, etc.) (Q4).
- Provide status reports on all ORNL/RPI nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

ORNL ND Subtask 1 (\$880K)

The scope is the same as in FY 2011. Milestones are the same as Milestones 3 and 4 from FY 2011.

ORNL ND Subtask 2 (\$41K to ORNL; \$314K to RPI through Naval Reactors)

The scope is the same as in FY 2011.

Milestones:

- Capability development: Perform scoping measurements with prototype detectors (Q1).
- Capability development: Build flight station and new capture detector (Q4).
- Measurements: Complete transmission measurements to supplement ORNL measurements planned at IRMM (Ca, Ce, etc.) (Q4).
- Measurements: Complete thermal transmission measurements for $^{185,187}\text{Re}$ (Q4).
- Provide status reports on all ORNL/RPI nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013

ORNL ND Subtask 1 (\$885K)

The scope is the same as in FY 2011.

Milestones:

- Participate in NDAG, CSEWG, and WPEC meetings (Q4).
- Complete a plan to establish fission resonance region measurement capability to address NCSP nuclear data needs (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ORNL ND Subtask 2 (\$42K to ORNL; \$318K to RPI through Naval Reactors)

The scope is the same as in FY 2011.

Milestones:

- Capability development: Complete capture detection system and perform testing (Q2).
- Measurements: Complete thermal capture measurements for $^{185,187}\text{Re}$ (Q4).
- Provide status reports on all ORNL/RPI nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2014

ORNL ND Subtask 1 (\$890K)

The scope is the same as in FY 2011.

Milestones:

- Participate in NDAG, CSEWG, and WPEC meetings (Q4).

- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ORNL ND Subtask 2 (\$43K to ORNL; \$322K to RPI through Naval Reactors)

The scope is the same as in FY 2011.

Milestones:

- Complete epithermal transmission measurements for $^{185,187}\text{Re}$ (Q4).
- Provide status reports on all ORNL/RPI nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2015

ORNL ND Subtask 1 (\$895K)

The scope is the same as in FY 2011.

Milestones:

- Participate in NDAG, CSEWG, and WPEC meetings (Q4).
- Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ORNL ND Subtask 2 (\$44K to ORNL; \$326K to RPI through Naval Reactors)

The scope is the same as in FY 2011.

Milestones:

- Complete epi-thermal capture measurements for $^{185,187}\text{Re}$ (Q4).
- Provide status reports on all ORNL/RPI nuclear data support activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

2.5.3 Nuclear Data Budget

Nuclear Data Budget (Fiscal Years 2011 – 2015)

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
ANL	\$370	\$356	\$367	\$388	\$414
BNL	\$150	\$155	\$160	\$165	\$170
LANL	\$600	\$555	\$555	\$555	\$555
LLNL	\$75	\$75	\$75	\$75	\$75
ORNL	\$990	\$921	\$927	\$933	\$939
RPI	\$310	\$314	\$318	\$322	\$326
TOTAL	\$2,495	\$2,376	\$2,407	\$2,443	\$2,494

2.6 Training and Education

2.6.1 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. Additional information about the T&E vision and strategy can be found in the *Mission and Vision of the U.S.*

Department of Energy, Nuclear Criticality Safety Program, March 2008 document. A funding table is provided at the end of this 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.

2.6.2 Approved Subtasks

LANL T&E Subtasks

FY 2011

LANL T&E Subtask 1 (\$150K)

Prepare for and conduct a pilot training class at LANL. Following successful completion of the pilot, continue conducting criticality safety training classes at LANL according to an integrated schedule developed by ORNL and approved by the NCSP Manager.

Milestone:

- Conduct the pilot training class at LANL (Q3).

FY 2012

LANL T&E Subtask 1 (\$350K)

Conduct criticality safety training classes at LANL and at the CEF according to an integrated schedule developed by ORNL and approved by the NCSP Manager.

Milestone:

- Conduct classes in accordance with the approved schedule and provide status reports on all training activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013

LANL T&E Subtask 1 (\$600K)

Scope and milestone are the same as in FY 2012.

FY 2014

LANL T&E Subtask 1 (\$610K)

Scope and milestone are the same as in FY 2012.

FY 2015

LANL T&E Subtask 1 (\$620K)

Scope and milestone are the same as in FY 2012.

LLNL T&E Subtasks

FY 2011

LLNL T&E Subtask 1 (\$400K)

Continue to offer a unique “hands-on” criticality safety training course for DOE practitioners and workers who handle SNM. These classes may be tailored to the interests of special groups with the concurrence of the NCSP Manager.

Milestones:

- Provide a class schedule for the NCSP Manager approval (Q1).
- Conduct eight classes in accordance with the approved schedule and provide status reports on all training activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

LLNL T&E Subtask 2 (\$100K)

Transfer TACS materials and associated equipment to DAF. Complete the certificate amendment to include the HEU shells as approved contents in the DPP-2. This subtask should be completed during this fiscal year. If not, it will be completed in FY 2012.

Milestone:

- Report status of transfer activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

LLNL T&E Subtask 1 (\$250K)

Contingent upon transfer of SNM, and start up of this activity in the DAF, continue to offer a unique “hands-on” criticality safety training course for DOE practitioners and workers who handle SNM at LLNL. These classes may be tailored to the interests of special groups with the concurrence of the NCSP Manager.

Milestones:

- Provide a class schedule for the NCSP Manager approval (Q1).
- Conduct four classes in accordance with the approved schedule and provide status reports on all training activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3).

ORNL T&E Subtasks

FY 2011

ORNL T&E Subtask 1 (\$100K)

Manage the collaborative development for the planning, designing, and suggested scheduling for the multi-faceted and phased NCSP training program and oversee the execution of the program.

Milestone:

- Provide status reports on training program development activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

ORNL T&E Subtask 2 (\$50K)

The objective of this subtask is to develop two NCSET modules for NCS practitioners on the following topics: 1) Validation, and 2) NDA fundamentals.

Milestones:

- Completed NCSET module on NDA fundamentals (Q2).
- Completed NCSET module on Validation (Q4).

FY 2012

ORNL T&E Subtask 1 (\$80K)

Manage the collaborative development for the planning, designing, and suggested scheduling for the multi-faceted and phased NCSP training program and oversee the execution of the program.

Milestone:

- Provide status reports on training program development activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013 - 2015

ORNL T&E Subtask 1 (\$65K per year)

Oversee the execution of the multi-faceted and phased NCSP training program.

Milestone:

- Oversee implementation of the training program and provide status reports in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

SNL T&E Subtasks

FY 2011

SNL T&E Subtask 1 (\$50K)

Develop a hands-on criticality safety training course that can be delivered to cleared or uncleared personnel. Develop the objectives, syllabus, and detailed outline for the classroom instruction. Develop hand-out materials for the class. Develop a plan for the laboratory training. Perform a dry run of the laboratory training.

Milestones:

- Complete development of the classroom part of the hands-on training course (Q2).
- Complete development and testing of the laboratory part of the hands-on training course (Q3).
- Conduct one pilot hands-on training class (RTBF Level 2 Milestone) (Q4).
- Provide status reports on training program development activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

SNL T&E Subtask 2 (\$350K)

Complete critical assembly modifications to allow approach-to-critical experiments on water height. This Subtask will be completed during this fiscal year.

Milestones:

- Design, fabricate, and install critical assembly modifications (Q4).
- Obtain DOE authorization to achieve criticality using water height and/or control rods (RTBF Level 2 Milestone) (Q4).
- Provide status reports on training program development activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2012

SNL T&E Subtask 3 (\$170K)

Conduct criticality safety training classes at SNL according to an integrated schedule developed by ORNL and approved by the NCSP Manager.

Milestone:

- Conduct classes in accordance with the approved schedule and provide status reports on all training activities in NCSP Quarterly Progress Reports (Q1, Q2, Q3, Q4).

FY 2013

SNL T&E Subtask 3 (\$200K)

Scope and milestone remains the same as in FY 2012.

FY 2014

SNL T&E Subtask 3 (\$205K)

Scope and milestone remains the same as in FY 2012.

FY 2015

SNL T&E Subtask 3 (\$210K)

Scope and milestone remains the same as in FY 2012.

2.6.3 Training and Education Budget

Training and Education Budget (Fiscal Years 2011 – 2015)

LABORATORY	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
LANL	\$150	\$350	\$600	\$610	\$620
LLNL	\$500	\$250	\$0	\$0	\$0
ORNL	\$150	\$80	\$65	\$65	\$65
SNL	\$400	\$170	\$200	\$205	\$210
TOTAL	\$1,200	\$850	\$865	\$880	\$895

3.0 Nuclear Criticality Safety Program Support

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 x \$45K/members + \$20K for the CSSG Chair + \$20K 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 some 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.

3.4 Criticality Safety Program Support

NCSP Support Activities (Fiscal Years 2011 – 2015)

	FY 2011 (\$K)	FY 2012 (\$K)	FY 2013 (\$K)	FY 2014 (\$K)	FY 2015 (\$K)
CSSG	\$400	\$400	\$400	\$400	\$400
NDAG Chair (ANL)	\$25	\$25	\$25	\$25	\$25
TOTAL	\$425	\$425	\$425	\$425	\$425

Appendix A

Nuclear Criticality Safety Program Task Managers

ANL

Richard McKnight
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439
Telephone: 630-252-6088
Facsimile: 630-252-4500
E-Mail: rdmcknight@anl.gov

BNL

Mike Herman
National Nuclear Data Center
Building 197D
P.O. Box 5000
Brookhaven National Laboratory
Upton, NY 11973-5000
Telephone: 631-344-2802
Facsimile: 631-344-2806
E-Mail: mwherman@bnl.gov

Hanford

Raymond Puigh
Fluor Government Group
P.O. Box 1050
MSIN T5-54
Richland, WA 99352
Telephone: 509-376-3766
Facsimile: 509-373-2752
E-Mail: Raymond.Puigh@rl.gov

INL

J. Blair Briggs
Idaho National Laboratory
2525 North Fremont
P.O. Box 1625
Idaho Falls, ID 83415-3860
Telephone: 208-526-7628
Facsimile: 208-526-2930
E-Mail: j.briggs@inl.gov

LANL

Robert Margevicious
Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, NM 87545
Telephone: 505-606-0109
Facsimile: 505-665-5931
E-Mail: margevicious@lanl.gov

LLNL

David Heinrichs
Lawrence Livermore National Laboratory
P.O. Box 808
Mail Stop 198
7000 East Avenue
Livermore, CA 94551-0808
Telephone: 925-424-5679
Facsimile: 925-423-2854
E-Mail: heinrichs1@llnl.gov

ORNL

Mike Dunn
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6170
Telephone: 865-574-5260
Facsimile: 865-574-3527
E-Mail: parkscv@ornl.gov

SNL

Gary A. Harms
Sandia National Laboratory
P.O. Box 5800
Albuquerque, NM 87185-1146
Telephone: 505-845-3244
Facsimile: 505-284-3651
E-Mail: gaharms@sandia.gov

Appendix B
Work Authorization Statements for
Nuclear Criticality Safety Program Funding for Execution Year (FY 2011)
Provided to the NA-16 Budget Office in August 2010

Tasks: Information Preservation and Dissemination, Integral Experiments, Nuclear Data, and the Criticality Safety Support Group
Argonne National Laboratory (ANL): \$575K

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 November 2010, 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)
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 November 2010, or as directed by the NCSP Manager.

BNL POC: Mike Herman (631-344-2802)
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Task: Information Preservation and Dissemination
Hanford: \$110K

Reflects funds for the continued revision of ARH-600 and development of a method for obtaining integral cross sections for actinides from empirical data as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated November 2010 or as directed by the NCSP Manager.

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

Tasks: Integral Experiments, International Criticality Safety Benchmark Evaluation and the Criticality Safety Support Group

Idaho National Laboratory (INL): \$1,995K

Reflects funds to oversee United States participation in the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) Structural Matériels Expérimentés Program (MIRTE) and to conduct the International Criticality Safety Benchmark Evaluation Project (ICSBEP) as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated November 2010, 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.

INL POC: Blair Briggs (208-526-7628)

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): \$6,490K

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 November 2010, 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)

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): \$1,836K

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 November 2010, 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)

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

Tasks: Integral Experiments and the Criticality Safety Support Group

Nevada National Security Site (NNSS): \$2,100K

Reflects funds to continue support for integral experiments, as delineated in the NCSP Five-Year Plan dated November 2010, 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: Joel Leeman (702-295-4899)

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): \$2,950K

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 design of the future Nuclear Criticality Safety Program (NCSP) Training Program, as delineated in the NCSP Five-Year Plan dated November 2010, 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)

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

Tasks: Nuclear Data

Renssalaer Polytechnic Institute (RPI): \$310K

Reflects funds to conduct differential nuclear data measurements and data evaluation as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Execution Plan dated November 2010, or as directed by the NCSP Manager.

SNL POC: Yaron Danon (518-276-4008)

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

Tasks: Integral Experiments, Training and Education
Sandia National Laboratories (SNL): \$1,230K

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 November 2010, or as directed by the NCSP Manager.

SNL POC: Gary Harms (505-845-3244)
DOE POC: Jerry McKamy, NNSA (301-903-7980)

Appendix C
International Criticality Safety Benchmark Evaluation Project
Planned Benchmarks

ICSBEP BENCHMARK PRIORITIES FOR FY 2011		
United States Contribution		
<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
LEU-COMP-THERM-080	Water-Moderated Square-Pitched U(6.93)O ₂ Fuel Rod Lattices	New SNL LEU Experiment with increased U-235 enrichment (~7%).
PU-COMP-FAST-005	ZPR-3 Assembly 53: A Clean Cylindrical Pu Carbide Core, Reflected by DU	ZPR-3 Assembly 53 is a high-fidelity benchmark that serves as the reference case for Assembly 54. These data may be irretrievable within a few years.
PU-COMP-FAST-006	ZPR-3 Assembly 54: A Clean Cylindrical Pu Carbide Core, Reflected by Iron	This experiment provides unique, high-fidelity data for iron as a reflector and the data may be irretrievable within a few years.
PU-COMP-FAST-003	ZPR-9 Assembly 31: Plutonium Carbide Benchmark Assembly Reflected by DU	This experiment is a CSEWG Benchmark that has traditionally been used to test plutonium data in a slightly softened spectrum. These data may be irretrievable within a few years.
PU-SOL-THERM-037	PNL Arrays of Bottles Containing Plutonium Solution	Requested by Mike Durst of PNNL at NCSD Topical Meeting (2009) – Preservation of Plutonium Solution data that cannot be duplicated – Student Evaluation
HEU-MET-FAST-081	GROTESQUE: A U(93.2) Metal Assembly	These experiments test computational capabilities for complex geometries [Table 5, CAS23] – Student Evaluation
HEU-COMP-FAST-001	A Small Close-Packed Array Graphite-Reflected Highly Enriched UO ₂ Fuel Rods	These experiments involve a fast neutron spectrum for cores primarily comprised of U-235 and O-16. They may be of use to validate current reevaluation of the high-energy neutron cross sections for oxygen. (Reference: Appendix D, Chart D-1.13 of the U.S. DOE NCSP Five-Year Execution Plan for the Mission and Vision, FY 2010 through FY 2014.) --- From ORNL-TM-450 – Student Evaluation
HEU-COMP-FAST-002	A Small Array of Graphite-Reflected Highly Enriched UO ₂ Fuel Rods (Pitch = 1.506 cm)	See justification for ORNL-TM-450 experiments --- From ORNL-TM-561 – Student Evaluation
LEU-MET-THERM-004	Square and triangular lattices of 2.5cm Diameter LEU(4.95) rods in water	These are very unique experiments performed by Libby Johnson at ORNL. The rod diameter will likely challenge current neutronics codes – DOE-ID Staff and Student evaluation (No cost to NCSP)
HEU-MET-FAST-074	Delayed Critical ORNL Unreflected Uranium (93.2) Metal Sphere	Independent HEU sphere experiment performed at ORNL and evaluated by a Staff Member of the University of Utah
IEU-COMP-THERM-013 (NRAD-FUND-RESR-001)	Fresh-Core Reload Of The Neutron Radiography (NRAD) Reactor With Uranium(20)-Erbium-Zirconium-Hydride Fuel	Uranium Hydride Benchmark that can be used to validate safety analysis for the storage of this type of fuel.

ICSBEP BENCHMARK PRIORITIES FOR FY 2011

United States Contribution

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
HEU-MET-THERM-024	ATRC Reference Critical Configuration	ATRC – Funded Primarily by ATR User Facility and IRPhEP – Student Evaluation
PU-MET-FAST-001 Revision	Bare Sphere of Plutonium-239 Metal (Jezebel)	Revised to include more extensive uncertainty analysis and a detailed model
IEU-MET-FAST-007 Revision	Big Ten: A Large, Mixed-Uranium-Metal Cylindrical Core with 10% Average ²³⁵ U Enrichment, Surrounded by a Thick ²³⁸ U Reflector	The Big Ten benchmark is frequently used for Nuclear Data testing and refinement. The existing simplified model is still unnecessarily complicated – an improved simplified model is being provided

OTHER CONTRIBUTIONS PLANNED FOR FY 2011

LEU-COMP-THERM-074 (FRANCE)	<i>Four LEU Fuel Rod Arrays Separated by thin (5-mm & 10-mm) Titanium Absorbing Plates</i> – These experiments are part of the French / U.S. MIRTE Program performed on Apparatus B.	
PU-SOL-THERM-031 (FRANCE)	<i>Hafnium Plates Immersed in Plutonium Nitrate Solution in Apparatus B</i> – These experiments are unique and test both Plutonium and Hafnium.	
MIX-MISC-TBD-TBD (RUSSIAN FEDERATION)	<i>BFS-105 Assemblies: Critical Experiments with Heterogeneous Compositions of Plutonium, Depleted Uranium Dioxide, and Polyethylene</i> – Computational results for experiments performed on BFS-97, -99, -101 assemblies show a discrepancy between high and low Pu-240 content that exceeds the experimental uncertainty. The BFS-105 series was performed with intermediate Pu-240 content in order to verify the observed trend.	
LEU-COMP-THERM-092 (BRAZIL)	<i>Critical Loading of the IPEN/MB-01 Reactor Considering Temperature Variations from 14C to 80C</i> – The IPEN/MB-01 lattice measurements are among the more precisely measured of their kind. There are very few quality temperature dependant measurements currently in the ICSBEP Handbook.	
HEU-SOL-THERM-047 (SLOVENIA)	<i>Critical Parameters of Enriched ²³⁵U Solutions in Interacting Arrays of Cylinders</i> – These experiments provide a basis for data in LA-10860.	
IEU-SOL-THERM-003 (UNITED KINGDOM)	<i>Bare and water reflected cylinders of aqueous uranyl fluoride solutions (30.3% ²³⁵U)</i> – Very Unique IEU solution experiments that fills a definite gap.	
IEU-SOL-THERM-005 (UNITED KINGDOM)	<i>30.14% enriched UO₂ wax mixtures – bare and with single material reflectors (polythene and Perspex)</i> – Very Unique IEU solution experiments that fills a definite gap.	
LEU-COMP-THERM-095 (FRANCE)	<i>Reactivity worth measurement of major Fission Products in MINERVE reactor</i> – These are unique measurements of fission product data.	
TBD (JAPAN)	<i>Evaluation of STACY Experiments.</i>	
LEU-MET-THERM-003 (CANADA)	<i>ZED-2 Reactor: Natural-uranium Metal Fuel Assemblies in Heavy-water</i> – These are unique Heavy Water benchmarks.	
IEU-MET-FAST-022 (SWEDEN)	<i>The FRO Experiments with Diluted 20%-Enriched “Cylindrical” Uranium Metal Reflected by Copper</i> – Additional copper reflected configurations provided by E Mennerdahl Systems.	
HEU-MET-FAST-088 (RUSSIAN FEDERATION)	<i>Two Heterogeneous Polyethylene-Iron Moderated HEU Cylinders</i> – VNIITF experiments.	
HEU-MET-FAST-090 (RUSSIAN FEDERATION)	<i>Two Heterogeneous Polyethylene-Aluminum Moderated HEU Cylinders</i> – VNIITF experiments.	

ICSBEP BENCHMARK PRIORITIES FOR FY 2012

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
TBD	New CEF Experiments	New Experiments
LEU-COMP-THERM-TBD	LEU Fuel Rod Array Reflected by Al and SiO ₂	These experiments are part of the French / U.S./AREVA/ ANDRA MIRTE Program performed on Apparatus B
LEU-COMP-THERM-TBD	Two LEU Fuel Rod Arrays Separated by Large Absorbing Screens (Fe, Ni, Zr, Al, Pb, Cu)	These experiments are part of the French / U.S./AREVA/ ANDRA MIRTE Program performed on Apparatus B
LEU-COMP-THERM-TBD	Two LEU Fuel Rod Arrays Separated by Large Concrete Absorbing Screens	These experiments are part of the French / U.S./AREVA/ ANDRA MIRTE Program performed on Apparatus B
LEU-COMP-THERM-TBD	Four LEU Fuel Rod Arrays Separated by Thin Absorbing Plates (Cu, Ni, Fe)	These experiments are part of the French / U.S./AREVA/ ANDRA MIRTE Program performed on Apparatus B
MIX-COMP-FAST-TBD	ZPPR-2: (Pu,U) Oxide Fueled Assembly Reflected by DU	This experiment is a CSEWG Benchmark that simulates a mixed (Pu,U) Oxide Fueled Two-Zone Demonstration Reactor Benchmark. These data may be irretrievable within a few years.
LEU-MET-FAST-001	ZPR-3 Assembly 25: A Large, Clean, Cylindrical Uranium (9% ²³⁵ U) – Stainless Steel Assembly Reflected by Depleted Uranium	This assembly was a clean benchmark assembly with LEU (~9%)-SST core reflected by DU. These data may be irretrievable within a few years.
IEU-COMP-FAST-003	ZPR-6 Assembly 5: A Large, Clean, Cylindrical Uranium Carbide Benchmark Assembly Reflected by Depleted Uranium	This is a very clean assembly and provides a test of the uranium (~14% enriched) data in a slightly softened spectrum. The U/graphite ratio is representative of uranium carbide fuel. These data may be irretrievable within a few years.
HEU-MET-FAST-TBD	VNIITF HEU Metal Plates with Mo Reflectors, Diluents, etc.	Similar series of experiments as the V and W experiments. Mo is an important alloying element and reflector material.
HEU-SOL-THERM-041	HEU Solutions in Simple Geometries (K-343 and K-643)	Basis data for basic, simple-geometry, critical mass curves for HEU in LA-10860-MS (TID-7028) that are commonly used by NCS operational support staff are represented in the ICSBEP Handbook.--- Requested by Davis Reed of ORNL
HEU-SOL-THERM-048	Critical Parameters of Enriched ²³⁵ U Solutions in Annular Geometry	Basis for data in LA-10860.--- Provided by JSI in Slovenia
HEU-COMP-TBD-TBD	A Small Array of Beryllium-Reflected Highly Enriched UO ₂ Fuel Rods	See justification for ORNL-TM-450 experiments from ORNL-TM-655.--- Student Evaluation
HEU-MET-THERM-020	SPADE – BeO Moderated Oy Experiments with Special Materials	Special materials (TBD) for which there is little or no data in the ICSBEP database will be systematically selected from the large SPADE series of integral experiments that test nuclear cross sections of these materials.--- Tungsten, Tantalum, and Gold will be completed first. The evaluation will be revised in 2013 to include the remaining materials.

ICSBEP BENCHMARK PRIORITIES FOR FY 2013

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
TBD	New CEF Experiments	New Experiments
LEU-COMP-FAST-002	ZPR-3 Assembly 14: A Clean LEU (7.7% ²³⁵ U) Carbide Core Reflected by Depleted Uranium	This is a very clean assembly and provides a test of the uranium (~7.7% enriched) data in a slightly softened spectrum. This assembly was part of a U-graphite series. These data may be irretrievable within a few years.
IEU-MET-FAST-011	ZPR-6-1 All Aluminum - 14% Enriched	This experiment provides high-fidelity benchmark data that simulates a unique uranium enrichment of 14%. These data may be irretrievable within a few years.
MIX-MET-FAST-TBD	ZPPR-15 Pu/U/Zr Metal Fuel Core Reflected by DU	This experiment is of high interest for validation of both design and reprocessing of metallic Zr-alloy fuel. These data may be irretrievable within a few years.
MIX-COMP-FAST-TBD	ZPR-9 Assembly 29: Normal and Flooded Configurations of Mixed (Pu/U)-fueled GCFR Assembly	This experiment emphasizes the high-leakage and streaming paths in GCFR assemblies and may be a valuable test of analytical methods as well as nuclear data. These data may be irretrievable within a few years.
HEU-SOL-THERM-051	Critical parameters of enriched ²³⁵ U solutions in cylindrical 60-degree "Y" and 90 degree	Basis for data in LA-10860.--- Provided by JSI in Slovenia
HEU-MET-THERM-020 (Rev 1)	SPADE – BeO Moderated Oy Experiments with Special Materials	Special materials (TBD) for which there is little or no data in the ICSBEP database will be systematically selected from the large SPADE series of integral experiments that test nuclear cross sections of these materials. --- Revised to include all remaining Mtls.
HEU-MET-MIXED-013	SNOOPY Experiments -- Graphite Moderated HEU Foils – Part II (C/U = 1200)	This experiment provides data for a unique carbon-to-uranium ratio.
U233-COMP-THERM-002	LWBR ²³³ UO ₂ -ThO ₂ Detailed Cell Experiments -- Work For Others	Last remaining U.S. U-233 benchmarks to be evaluated. These are believed to be very precisely measured experiments.--- Provided by BAPL

ICSBEP BENCHMARK PRIORITIES FOR FY 2014

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
TBD	New CEF Experiments	New Experiments
U233-COMP-THERM-003	LWBR ²³³ UO ₂ -ThO ₂ BMU Experiments -- Work For Others	Last remaining U.S. U-233 benchmarks to be evaluated. These are believed to be very precisely measured experiments – Provided by BAPL
HEU-MET-THERM-021	SNOOPY Experiments -- Graphite Moderated HEU Foils – Part III(C/U = 2340)	This experiment provides data for a unique carbon-to-uranium ratio.

ICSBEP BENCHMARK PRIORITIES FOR FY 2014

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
PU-MET-FAST-TBD	Spherical Plutonium Metal Assembly with Reflected by Various Materials (U, Be, C, Li, Ti)	These experiments provide independent data for key reflector materials.--- From UCRL-4957
PU-MET-FAST-TBD	Cylindrical Plutonium Metal Assembly with Reflected by Various Materials (U, Be, C, Steel, Polyethylene)	These experiments provide independent data for key reflector materials.--- From UCRL-4957

ICSBEP BENCHMARK PRIORITIES FOR FY 2015

<i>IDENTIFIER</i>	<i>DRAFT TITLE</i>	<i>JUSTIFICATION</i>
TBD	New CEF Experiments	New Experiments
TBD	New MIRTE-2 Experiments	New Experiments
LEU-SOL-THERM-TBD	Intersecting Cylinders of Aqueous Uranyl Fluoride Solutions (5% Enriched U-235)	These experiments fill gaps in the ICSBEP integral benchmark database. The handbook is currently limited to a total of seven benchmark configurations for homogeneous uranium solution at enrichments of 5 weight % U-235 or less. --- From Y-DR-129
HEU-COMP-THERM-TBD	ROVER Reactor Fuel Elements with Fixed Boron-Carbide Neutron Absorbers	The Rover experiments may be of utility for NCS validation of fuel cycle activities related to high temperature gas cooled reactors (HTGRs), such as being considered for the Next Generation Nuclear Plant (NGNP) Project. --- From ORNL-TM-1704
HEU-COMP-THERM-TBD	Critical Arrays of ROVER KIWI-B-2A Reactor Fuel Elements	See justification for ORNL-TM-1704 experiments. --- From ORNL-TM-264
LEU-SOL-THERM-TBD	5% Enrichment Uranium Solution with Composite Steel-Water Reflectors	See justification for Y-DR-129 experiments. These experiments also include measurements of the effect of composite steel-water reflectors. Composite steel-water reflectors are a common concern for NCS process applications (e.g., provision of personnel or water reflectors near steel vessels containing process solutions). Few benchmarks exist for steel-water reflectors in the current handbook, and none of those are directly applicable to LEU solutions. --- ORNL-4280

Appendix D Nuclear Data

Differential Measurements and Evaluations – Elements	D-1
Beryllium (Be)	D-1.1
Calcium (Ca)	D-1.2
Carbon (C-12)	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
Manganese (Mn-55)	D-1.10
Neptunium (Np-237)	D-1.11
Nickel (Ni-58, 60, 61, 62, 64)	D-1.12
Oxygen (O-16)	D-1.13
Plutonium (Pu-239)	D-1.14
Titanium (Ti-46, 47, 48, 49, 50)	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)	D-1.20
Planning for Fission Measurements	D-1.21
 Differential Measurements and Evaluations – Compounds	 D-2
Silicon Dioxide (SiO ₂)	D-2.1
 Integral Measurements and Publication of Benchmark – Sub Critical (Placeholder: Sub Critical experiments will resume in FY 2012; experiments to be determined in FY 2011.)	 D-3
 Integral Measurements and Publication of Benchmark – Critical	 D-4
Planet (CEF Start-Up Plan)	D-4.1
Comet (CEF Start-Up Plan)	D-4.2
Flattop (CEF Start-Up Plan)	D-4.3
Godiva (CEF Start-Up Plan)	D-4.4
One new experiment TBD (RTBF Level 2 Milestone)	
 Cross-Section Data Assessments (all on one chart)	 D-5
Re-185, 187; Fe-56; Zr; Hf; La; Nd; Sr	

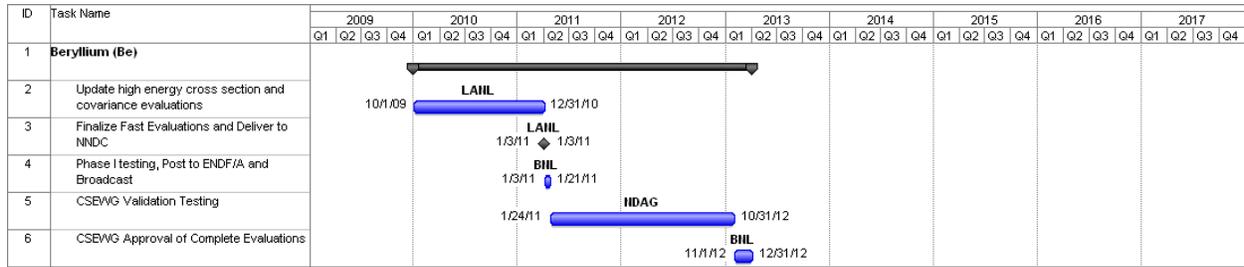
Summary of Nuclear Data Needs and Current NCSP Nuclear Data Schedule/Progress

Priority Needs / Additional Needs		Thermal scattering (BeO, HF, D ₂ O, SiO ₂ , CH ₂ , C ₂ F ₄ , C ₂ O ₂ H 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 <i>ORNL, RPI</i>	^{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 <i>LANL, IRSN, VNIITF</i>	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 <i>BNL, LANL, ORNL</i>	^{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 ⁸⁵ U UR, ²³⁸ 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 ¹⁶ 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.

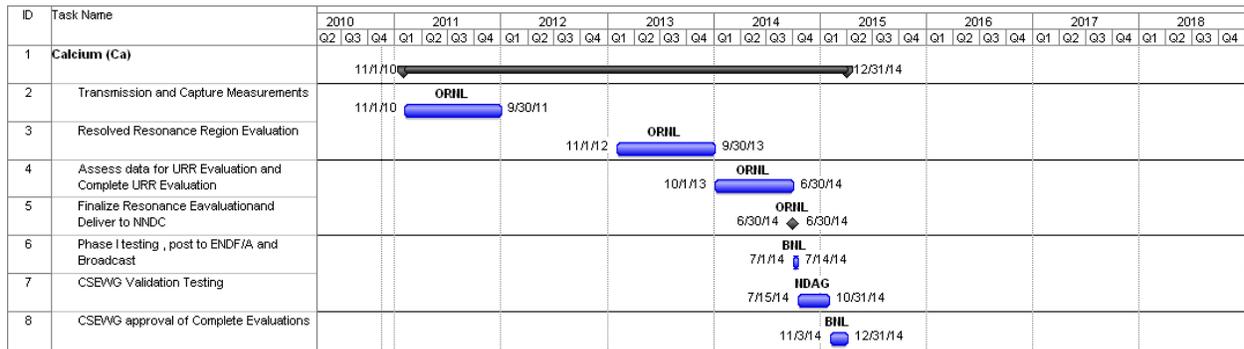
D-1 Differential Measurements and Evaluations – Elements

D-1.1 Beryllium (Be)



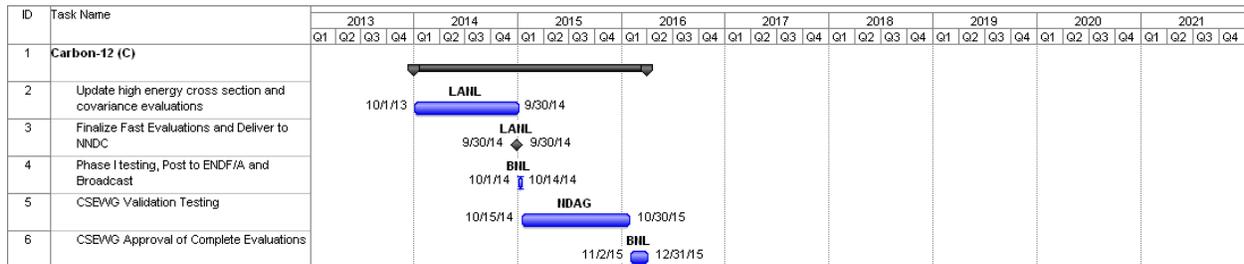
D-1 Differential Measurements and Evaluations – Elements

D-1.2 Calcium (Ca)



D-1 Differential Measurements and Evaluations – Elements

D-1.3 Carbon (C-12)



D-1 Differential Measurements and Evaluations – Elements

D-1.4 Cerium (Ce)

ID	Task Name	2011				2012				2013				2014				2015				2016				2017				2018				2019			
		Q1	Q2	Q3	Q4																																
1	Cerium (Ce)																																				
2	Transmission and Capture Measurements																																				
3	Resolved Resonance Region Evaluation																																				

D-1 Differential Measurements and Evaluations – Elements

D-1.5 Chromium (Cr-50, 52, 53, 54)

ID	Task Name	2010				2011				2012				2013				2014				2015				2016				2017				2018			
		Q4	Q1	Q2	Q3																																
1	Chromium (Cr50,52,53,54)																																				
2	Update high energy cross section and covariance evaluations																																				
3	Finalize Fast Evaluation and Deliver to NNDC																																				
4	Phase I testing, Post to ENDF/A and Broadcast																																				
5	CSEWG Validation Testing																																				
6	CSEWG Approval of Complete Evaluation(s)																																				

D-1 Differential Measurements and Evaluations – Elements

D-1.6 Copper (Cu-63, 65)

ID	Task Name	2009				2010				2011				2012				2013				2014				2015				2016				2017			
		Q1	Q2	Q3	Q4																																
1	Copper (Cu 63,65)																																				
2	Transmission and Capture Measurements																																				
3	Resolved Resonance Region Evaluation																																				
4	Assess data for URR Evaluation; Complete Evaluation & Deliver to NNDC																																				
5	Phase I testing, Post to ENDF/A and Broadcast																																				
6	CSEWG Validation Testing																																				
7	CSEWG Approval of Complete Evaluation(s)																																				
8	Update high energy cross section and covariance evaluations																																				
9	Finalize Fast Evaluations and Deliver to NNDC																																				
10	Phase I testing, Post to ENDF/A and Broadcast																																				
11	CSEWG Validation Testing																																				
12	CSEWG Approval of Complete Evaluations																																				

D-1 Differential Measurements and Evaluations – Elements

D-1.7 Dysprosium (Dy-161,162,163,164)

ID	Task Name	2008				2009				2010				2011				2012				2013				2014				2015				2016			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Dysprosium (Dy)	[Timeline bar from Q1 2009 to Q4 2013]																																			
2	Perform Capture Measurements	RPI 4/1/09 to 12/31/09																																			
3	Perform SAMMY Analysis	RPI 1/1/10 to 9/30/10																																			
4	Resolve Resonance Region Evaluation for DY-161,162,163,164	ORIL 10/1/12 to 9/30/13																																			
5	Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC	ORIL 9/30/13 to 9/30/13																																			
6	Phase I Testing, Post to ENDF/A and Broadcast	BIL 10/1/13 to 10/14/13																																			
7	CSEWG Validation Testing	HDAG 10/15/13 to 10/31/13																																			
8	CSEWG Approval of Complete Evaluation	BIL 11/1/13 to 12/31/13																																			

D-1 Differential Measurements and Evaluations – Elements

D-1.8 Gadolinium (Gd-155,156,157,158,160)

ID	Task Name	2008				2009				2010				2011				2012				2013				2014				2015				2016			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Gadolinium (Gd)	[Timeline bar from Q1 2009 to Q4 2013]																																			
2	Perform Capture Measurements	RPI 10/1/08 to 12/31/09																																			
3	Perform SAMMY Analysis	RPI 1/1/10 to 3/31/10																																			
4	Resolve Resonance Region Evaluation for Gd-155,156,157,158,160	ORIL 10/1/11 to 9/27/12																																			
5	Finalize Resonance Region Evaluation and Deliver to NNDC	ORIL 9/30/12 to 9/30/12																																			
6	Phase I Testing, Post to ENDF/A and Broadcast	BIL 10/1/12 to 10/12/12																																			

D-1 Differential Measurements and Evaluations – Elements

D-1.9 Iron (Fe-56)

ID	Task Name	2010				2011				2012				2013				2014				2015				2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Iron (Fe-56)	[Timeline bar from Q1 2011 to Q4 2015]																																			
2	Re-evaluation of Resonance Region for Fe-56	ORIL 10/1/10 to 9/30/11																																			
3	Finalize Resonance Region Evaluation and Deliver to NNDC	ORIL 10/1/11 to 10/1/11																																			
4	Phase I Testing, Post to ENDF/A and Broadcast	BIL 10/1/11 to 10/14/11																																			
5	CSEWG Validation Testing	HDAG 10/17/11 to 11/1/11																																			
6	CSEWG Approval of Completed Evaluation	BIL 11/1/11 to 12/30/11																																			
7	Update high energy cross section and covariance evaluations	LAIL 9/1/14 to 8/31/15																																			
8	Finalize Fast Evaluations and Deliver to NNDC	LAIL 10/1/15 to 10/1/15																																			
9	Phase I Testing, Post to ENDF/A and Broadcast	BIL 10/1/15 to 10/14/15																																			
10	CSEWG Validation Testing	HDAG 10/1/15 to 10/19/15																																			
11	CSEWG Approval of Complete Evaluations	BIL 11/2/15 to 12/30/15																																			

D-1 Differential Measurements and Evaluations – Elements

D-1.10 Manganese (Mn-55)

ID	Task Name	2007				2008				2009				2010				2011				2012				2013				2014			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
1	Manganese (Mn 55)																																
2	Resonance Evaluation with Covariance Data					10/1/07					ORHL					3/31/08																	
3	Finalize Resonance Evaluation and Deliver to NNDC										ORHL					4/1/08					4/1/08												
4	Phase I testing, Post to ENDF/A and Broadcast										BHL					4/1/08					4/14/08												
5	CSEWG Validation Testing										IDAG					4/15/08					10/1/08												
6	CSEWG Approval of Complete Evaluations										BHL					11/3/08					12/31/08												
7	Update high energy cross section and covariance evaluations										LAHL					4/1/10					9/30/11												
8	Finalize Fast Evaluation and Deliver to NNDC										LAHL					9/30/11					9/30/11												
9	Phase I testing, Post to ENDF/A and Broadcast										BHL					10/3/11					10/14/11												
10	CSEWG Validation Testing										IDAG					10/17/11					10/31/11												
11	CSEWG Approval of Complete Evaluations										BHL					11/1/11					12/30/11												

D-1 Differential Measurements and Evaluations – Elements

D-1.11 Neptunium (Np-237)

ID	Task Name	2007				2008				2009				2010				2011				2012				2013				2014				2015			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Neptunium (Np 237)																																				
2	Update high energy cross section and covariance evaluations					4/1/08					LAHL					9/30/09																					
3	Finalize fast Evaluation and Deliver to NNDC										LAHL					10/1/09					10/1/09																
4	Phase I testing, Post to ENDF/A and Broadcast										BHL					10/2/09					10/15/09																
5	CSEWG Validation Testing										IDAG					10/15/09					10/29/10																
6	CSEWG Approval of Fast Evaluations										BHL					11/1/10					12/31/10																
7	Develop Measurement Plan and Cost Estimate										ORHL					2/1/08					3/31/08																

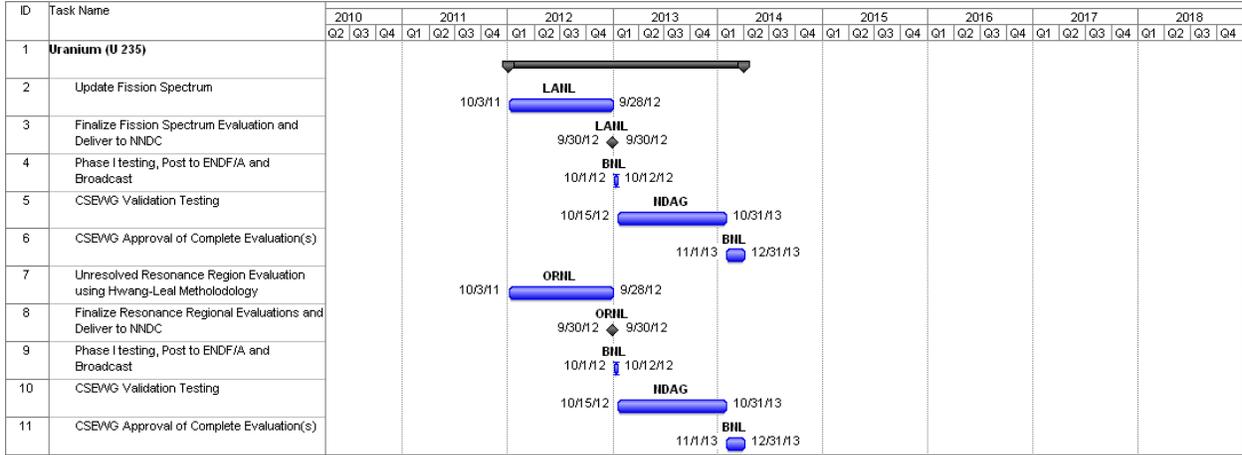
D-1 Differential Measurements and Evaluations – Elements

D-1.12 (Ni-58,60,61,62,64)

ID	Task Name	2011				2012				2013				2014				2015				2016				2017				2018				2019			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1	Nickel (Ni 58,60,61,62,64)																																				
2	Update high energy cross section and covariance evaluations					10/3/11					LAHL					12/31/12																					
3	Finalize Fast Evaluation and Deliver to NNDC										LAHL					12/31/12					12/31/12																
4	Phase I testing, Post to ENDF/A and Broadcast										BHL					1/1/13					1/14/13																
5	CSEWG Validation Testing										IDAG					1/15/13					10/31/13																
6	CSEWG Approval of Complete Evaluation(s)										BHL					11/1/13					12/30/13																

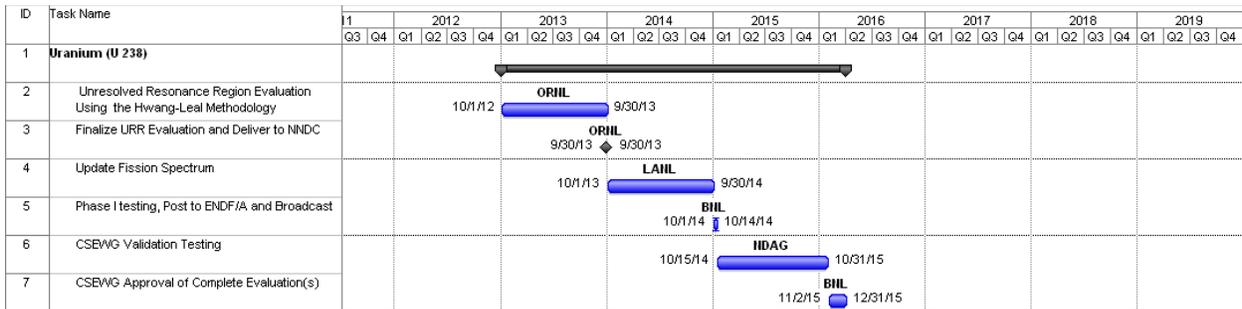
D-1 Differential Measurements and Evaluations – Elements

D-1.17 Uranium (U-235)



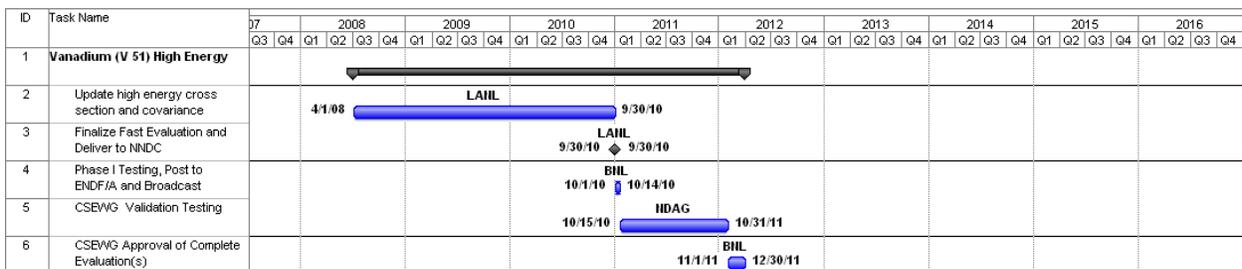
D-1 Differential Measurements and Evaluations – Elements

D-1.18 Uranium (U-238)



D-1 Differential Measurements and Evaluations – Elements

D-1.19 Vanadium (V-51)



D-2 Differential Measurements and Evaluations – Compounds

D-2.1 Silicon Dioxide (SiO₂)

ID	Task Name	2008				2009				2010				2011				2012				2013				2014				2015				2016			
		Q1	Q2	Q3	Q4																																
1	Silicon Dioxide																																				
2	Assess thermal scattering (CNEA/JORNL assessment of NCSP Thermal Moderators)																																				
3	Thermal Scattering Evaluation																																				
4	Finalize Thermal Scattering Evaluation; Deliver to NNDC																																				
5	Phase I Testing, Post to ENDF/A and Broadcast																																				
6	CSEWG Validation Testing																																				
7	CSEWG Approval of Complete Evaluations																																				

D-3 Integral Measurements and Publication of Benchmark – Sub Critical

(Placeholder: Sub Critical experiments will resume in FY 2012; experiments to be determined in FY 2011.)

D-4 Integral Measurements and Publication of Benchmark – Critical

D-4.1 Planet (CEF Start-Up Plan)

ID	Task Name	2009				2010				2011				2012				2013				2014				2015				2016				2017							
		Q2	Q3	Q4	Q1	Q2	Q3	Q4																																	
1	Planet (CEF Start-Up Plan)																																								
2	Planning and Pre-analysis																																								
3	Perform Integral Measurements																																								

D-4 Integral Measurements and Publication of Benchmark – Critical

D-4.2 Comet (CEF Start-Up Plan)

ID	Task Name	2009				2010				2011				2012				2013				2014				2015				2016				2017							
		Q2	Q3	Q4	Q1	Q2	Q3	Q4																																	
1	Comet (CEF Start-Up Plan)																																								
2	Planning and Pre-analysis																																								
3	Perform Integral Measurements																																								

Appendix E
Fiscal Year 2011 Projected Foreign Travel

Meeting or Conference	Date	Organization	No. of Travelers	One Sentence Justification
NEA WPEC Subgroup 33 Meeting (NEA, France)	11/2010	ANL	1	WPEC SG33 on Methods and Issues for the Combined Use of Integral Experiments and Covariance Data (McKnight)
NEA WPEC Meeting (NEA, France)	5/2011	ANL	1	ENDF Representative to WPEC Meeting, HPRL and Data Adjustment Expert Groups (McKnight)
ICNC-2011 (Scotland)	9/2011	ANL	≤ 3	Present Criticality Safety Standards work, Session Chair, and NEA Expert Group Meeting (Lell, Morman, McKnight)
Working Party on Nuclear Criticality Safety (England)	9/2011	ANL	1	U.S. Representative on WPNCS and participate in Associated Expert Groups (McKnight)
Programmatic Visit to IRSN (France)	11/2010	INL	1	Continue Collaboration on MIRTE (Briggs)
ICSBEP Meeting (NEA, France)	5/2011	INL	6	Hold Annual ICSBEP Meeting (Briggs, McKnight, Harms, Bess, Ellis, Scott)
Programmatic Meeting with IPPE and IRSN (France)	8/2011	INL	3	DICE Spectra Data & Balance Files meeting (Briggs, Bess, and Ellis)
Working Party on Nuclear Criticality Safety (UK)	9/2011	INL	1	Report to the WPNCS on Status of ICSBEP and DICE and participate in Expert Group on Uncertainty Analysis (Briggs)
ICNC-2011 (Scotland)	9/2011	INL	4	Participation in ICNC-2011; provide ICSBEP and DICE related papers and training (Briggs, Bess, Marshall, Ellis)
Joint International Conference of Supercomputing in Nuclear Applications and Monte Carlo (Japan)	10/2010	LANL	2	Participation and presentations at SNA+MC2010 (Brown, Kiedrowski)
2011 International Conference on	5/2011	LANL	2	Participation and presentations at International Conference (Brown,

Mathematics, Computational Methods and Reactor Physics (Brazil)				Kiedrowski)
NEA WPEC Meeting (NEA, France)	5/2011	LANL	1	Participate in WPEC meeting and associated Expert Group meetings (Kahler)
ICNC-2011 (Scotland)	9/2011	LANL	7	Participation in ICNC-2011; presentation of papers (Brown, Kiedrowski, Myers, Hayes, Clement, Sanchez, Bounds)
Working Party on Nuclear Criticality Safety (UK)	9/2011	LANL	1	Lead Expert Group on Monte Carlo Methods (Brown)
ICNC-2011 (Scotland)	9/2011	LLNL	≤ 4	Present NCSP work (Heinrichs, Lee, Percher, Scorby)
AWE (Aldermaston)	4/2011	LLNL	≤ 3	Provide COG training to AWE (A) personnel (Heinrichs, Lee, Buck)
CAAS-related measurements at SILENE (France)	10/2010	ORNL	3	Perform SILENE measurements (Miller, Dunn, and Wagner)
CAAS-related measurements at SILENE (France)	3/2011	ORNL	2	Planning for future measurement and follow-up on previous SILENE experiment (Miller and Wagner)
Resonance Region Differential Measurements at IRMM (Belgium)	10/2010 2/2011 5/2011 9/2011	ORNL	1 (4 trips)	Perform NCSP resonance region measurements at GELINA accelerator (Guber)
OECD/NEA WPEC Subgroup 33 on combined use of integral experiments and covariance data (France)	11/2010	ORNL	2	Participate in expert group and represent SCALE S/U methods and capabilities and transition; Meeting with IRSN to discuss SCALE integration with IRSN tools for parametric analysis (Rearden and Mueller)
OECD/NEA WPEC Meeting (France)	5/2011	ORNL	2	ENDF/B Formats Chair; Chairs/participates in 3 data subgroups (Dunn and Leal)
Coordination of DICE Activities (France)	6/2011	ORNL	2	Coordinate/address VIBE/DICE integration and distribution of SCALE/TSUNAMI data (Rearden and Lefebvre)
Working party on Nuclear Criticality Safety; Expert Group meeting on	9/2011	ORNL	2	Participate in WPNCS meeting and represent SCALE NCS analysis capabilities; ORNL is leading technical efforts in the UACSA and

Uncertainty Analysis for Criticality Safety Assessment; Expert Group meeting on Advanced Monte Carlo (TBD: England or Scotland)				Advanced Monte Carlo expert groups and meeting participation is needed to sustain technical leadership in expert groups (Wagner and Rearden)
ICNC-2011 (Scotland)	9/2011	ORNL	≤ 4	Publish AM and ND work for NCSP; Session chair; participate in expert group meetings (Dunn, Leal, Miller, Hopper)
OECD Working Party on Uncertainty Analysis in Best-Estimate Modeling (UAM)	Time and location TBD in FY 2011	ORNL	1	Represent NCSP work efforts in S/U methods and covariance data analyses and facilitate continued international collaborations in the S/U area (Rearden)