United States Department of Energy

Nuclear Criticality Safety Program

Five-Year Plan

FY2008 - 2012

Final

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Nuclear Criticality Safety Program Five-Year Plan, August 2007

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LIST OF ACRONYMS AND DEFINITIONS

AMPX	Nuclear Cross-Section Processing Computer Code
ANL	Argonne National Laboratory
ANS	American Nuclear Society
ANSI	American National Standards Institute
ARH-600	Atlantic Richfield Hanford
BL	Bettis Laboratory
BNL	Brookhaven National Laboratory
CED	Critical Experiment Decision
C_edT	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
COG [1]	Lawrence Livermore National Laboratory Monte Carlo Computer Code
CSCT	Criticality Safety Coordinating Team
CSEWG	Cross-Section Evaluation Working Group
CSIRC	Criticality Safety Information Resource Center
CSSG	Criticality Safety Support Group
CY	Calendar Year
DAF	Device Assembly Facility
DICE	Database for the International Criticality Safety Benchmark Evaluation Project
DOE	United States Department of Energy
EDA	Energy Dependent Analysis
EM	Office of Environmental Management
EMPIRE	BNL Nuclear Reaction Model Code for Evaluation of Cross Section
ENDF	Evaluated Nuclear Data File
EUG	End-Users Group
FFTF	Fast Flux Test Reactor
FY	Fiscal Year
GLLSM	Generalized Linear Least Squares Method
GNASH[2]	A Statistical Nuclear Model Computer Code

GNEP	Global Nuclear Energy Partnership
GUI	Graphical User Interface
HCTLTR	High Core Temperature Lattice Test Reactor
HEU	Highly-Enriched Uranium
ICSBEP	International Criticality Safety Benchmark Evaluation Project
INL	Idaho National Laboratory
IRSN	Institut De Radioprotection et De Sûreté Nucléaire
KALMAN	Bayesian Code that estimates covariances
KENO(3)	Monte Carlo Criticality Computer Code
LANL	Los Alamos National Laboratory
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
MOX	Mixed Oxide
NA-17	Assistant Deputy Administrator for Facility and Infrastructure Acquisition and Operation
NASA	National Aeronautics and Space Administration
NCS	Nuclear Criticality Safety
NCSET	Nuclear Criticality Safety Engineer Training
NCSP	Nuclear Criticality Safety Program
NE	Office of Nuclear Energy, Science and Technology
NERI	Nuclear Energy Research Initiative
NDAG	Nuclear Data Advisory Group
NNDC	National Nuclear Data Center
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OECD-NEA	Organization for Economic Cooperation and Development - Nuclear Energy Agency
ORELA	Oak Ridge Electron Linear Accelerator
ORNL	Oak Ridge National Laboratory
PCTR	Physical Constants Test Reactor
PRTR	Plutonium Recycle Test Reactor

RSICC	Radiation Safety Information Computational Center
RW	Office of Civilian Radioactive Waste Management
S/U	Sensitivity and/or Uncertainty
SAMMY[4]	A Nuclear Model Computer Code
SCALE[5]	Standardized Computer Analyses for Licensing Evaluation
SHEBA	Solution High Energy Burst Assembly
SQA	Software Quality Assurance
SRNL	Savannah River National Laboratory
TSR	Technical Safety Requirement
TSURFER	Tool for Sensitive and Uncertainty Analysis of Response Functionals using Experimental Results
VIM	Vastly Improved Monte Carlo Computer Code
WINCO	Westinghouse Idaho Nuclear Company
WPEC	Working Party on International Evaluation Cooperation
ZPPR	Zero-Power Physics Reactor
ZPR	Zero-Power Reactor

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

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

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

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

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

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

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

EXECUTIVE SUMMARY

The primary objective of the Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP) is to sustain a capability maintenance program aimed at preserving a unique skill set and associated technical infrastructure assets for the nation. Skills and infrastructure are preserved and maintained by doing mission-related work in each of the program elements. The results from these endeavors enhance criticality safety operational efficiency and confidence in the safety margin of operations throughout the Department. In addition to maintaining the infrastructure or base program, NCSP resources are routinely employed to identify and correct Departmental criticality safety program and implementation problems.

The NCSP is funded by the Assistant Deputy Administrator for Facility and Infrastructure Acquisition and Operation (NA-17), Defense Programs, National Nuclear Security Administration[1]. Dr. Jerry McKamy from NA-17 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, consisting of Federal criticality safety practitioners at the sites, and the End-Users Group (DOE contractor criticality safety representatives) regarding DOE Field criticality safety issues.

The infrastructure maintenance portion of the NCSP budget is requirements based. Requirements for preservation of capability in each of the seven technical program elements are provided in this Plan. Each program element includes a description of how it contributes to the operational criticality safety program as well as a budget and a schedule. Additionally, at the direction of the NCSP Manager, the expertise resident within the CSSG is used to assist sites by providing NCSP support for the operational criticality safety programs and technical program elements. Each of the seven technical program elements is overseen by a contractor manager appointed by the NCSP Manager. Proposed NSCP tasks for Fiscal Year (FY) 2008 total approximately $17M. Available funding for the NCSP tasks for FY 2008 is approximately $11.3M. All proposed tasks were considered, evaluated, and prioritized by the CSSG, NDAG, and NCSP Manager to determine the highest-priority tasks and to wisely allocate the limited funds available.

[1] In addition to the funding provided by NA-17, the DOE Office of Science is committed to maintain the Oak Ridge Electron Linear Accelerator in an operational state to support nuclear cross section data acquisition.

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

1.0 Nuclear Criticality Safety Program Purpose and Scope

The primary objective of the Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP) is to sustain a capability maintenance program aimed at preserving a unique skill set and associated technical infrastructure assets for the nation. Skills and infrastructure are preserved and maintained by doing mission-related work in each of the program elements. The results from these endeavors enhance criticality safety operational efficiency and confidence in the safety margin of operations throughout the Department. In addition to maintaining the infrastructure or base program, NCSP resources are routinely employed to identify and correct Departmental criticality safety program and implementation problems. This infrastructure includes key analytical tools, differential and integral data measurement capability, training resources, and web-based systems to enhance information preservation and dissemination.

The NCSP is funded by the Assistant Deputy Administrator for Facility and Infrastructure Acquisition and Operation (NA-17), Defense Programs, National Nuclear Security Administration (NNSA)[1]. Dr. Jerry McKamy, from NA-17 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, and the End-Users Group (EUG) (DOE Contractor Criticality Safety Representatives) regarding DOE field criticality safety issues. The NCSP organization chart is provided in Figure 1-1. A list of NCSP Task Managers is contained in Appendix A.

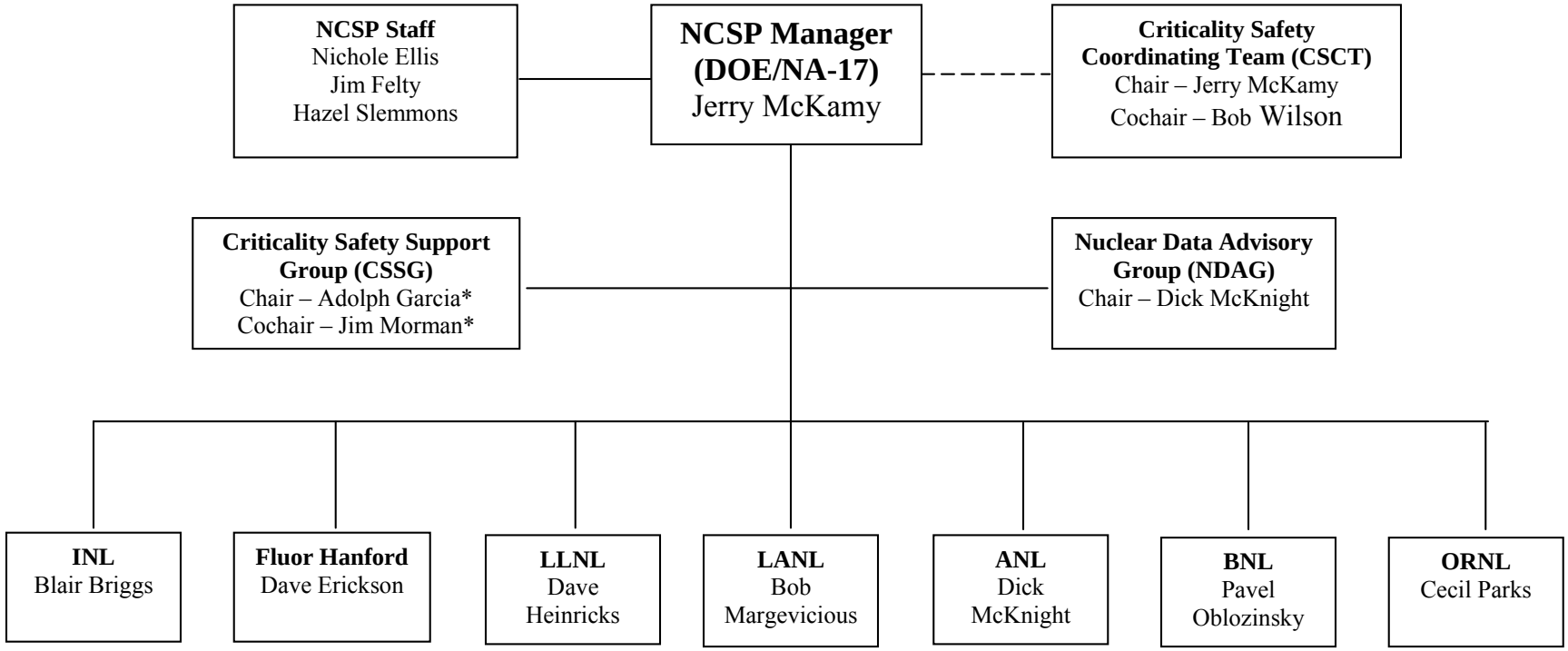
The NCSP includes the following seven technical program elements and one key support element:

- International Criticality Safety Benchmark Evaluation Project: identify, evaluate and make available benchmark data to support validation of criticality safety analyses.

- Analytical Methods Development and Code Support: support and enhance numerical processing codes used in criticality safety analyses.

[1] In addition to the funding provided by NA-17, the DOE Office of Science is committed to maintain the Oak Ridge Electron Linear Accelerator in an operational state to support nuclear cross section data acquisition. Also, the Office of Nuclear Energy's Idaho Office has agreed to support Mr. Adolf Garcia's activities associated with his chairmanship of the CSSG.

Figure 1-1. Nuclear Criticality Safety Program (NCSP) Organization



*Term ends March 31, 2008

- Nuclear Data: evaluate, test, and publish differential nuclear cross-section data required for codes to accurately model fissionable systems encountered by operational criticality safety programs.

- Differential Measurements: measure differential nuclear cross-section data required for codes to accurately model fissionable systems encountered by operational criticality safety programs.

- Integral Experiments: provide integral experimental data for the validation of the calculation methods used to support criticality safety analyses.

- Information Preservation and Dissemination: collect, preserve and make readily available criticality safety information.

- Training and Qualification: maintain and improve training resources and qualification standards for criticality safety practitioners.

- Nuclear Criticality Safety Program Support: provide technical expertise and structured communications/feedback process to support operational criticality safety programs.

Each of these areas is interdependent on the others and together they form a complete criticality safety infrastructure. If any of these program elements is eliminated, the ability of the Department's criticality safety engineers to perform their work will be substantially diminished. In addition to these program elements, two facilities provide nuclear data measurement capability for the NCSP: 1) the Criticality Experiments Facility (CEF), and 2) the Oak Ridge Electron Linear Accelerator (ORELA). Figure 1-2 depicts how the NCSP operates.

The infrastructure maintenance portion of the NCSP budget is requirements based. Requirements for preservation of capability in each of the seven technical program elements are provided in this Plan. Each program element subsection includes a description of how it contributes to the operational criticality safety program as well as a budget and a schedule. Additionally, at the direction of the NCSP Manager, the expertise resident within the CSSG is used to assist sites by providing NCSP support for the operational criticality safety programs and technical program elements. Additionally, at the direction of the NCSP Manager, the expertise resident within the CSSG is used to assist sites by providing NCSP support for the operational criticality safety programs and technical program elements. Proposed NSCP tasks for Fiscal Year (FY) 2008 total approximately $17M. Available funding for the NCSP tasks for FY 2008 is approximately $11.3M. All proposed tasks were considered, evaluated, and prioritized recommendations were provided by the CSSG and NDAG to the NCSP Manager for a final prioritization by the Manager. Approved tasks are included in each of their respective subsections of this Plan. A budget summary for the NCSP is contained in Table 1-1. A prioritized list of the top eight unfunded tasks is included in Appendix F.

Figure 1-2. How the Nuclear Criticality Safety Program Works

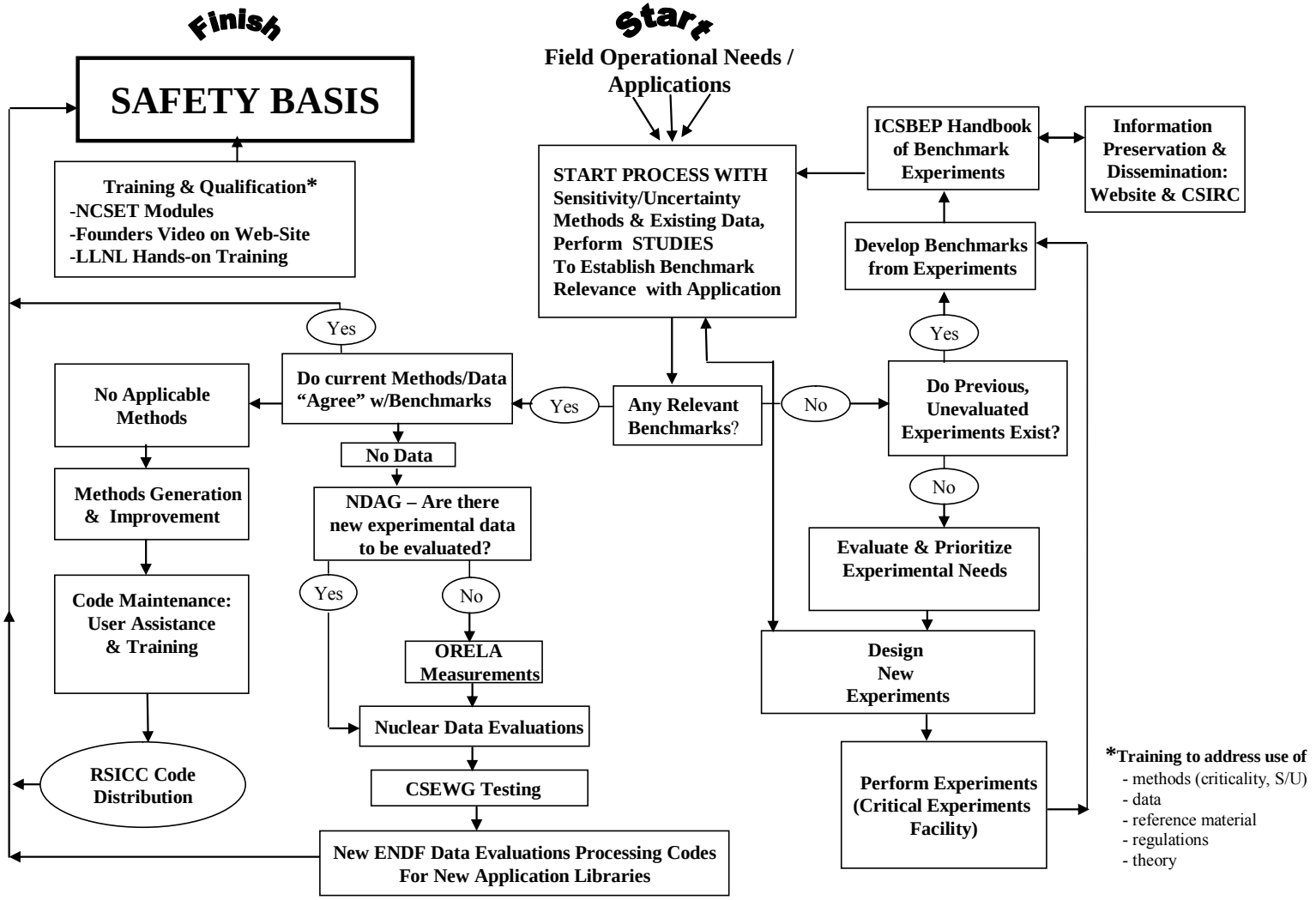


Table 1-1. Nuclear Criticality Safety Program Base Funding
Fiscal Years 2008 – 2012

TECHNICAL PROGRAM ELEMENT	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
International Criticality Safety Benchmark Evaluation Project	1,975	2,015	2,055	2,096	2,138
Analytical Methods Development and Code Support	2,915	2,973	3,033	3,094	3,156
Nuclear Data	2,030	2,015	2,055	2,096	2,137
Differential Measurements	970	357	364	371	378
Integral Experiments	2,295	2,800	3,000	3,060	3,121
Information Preservation and Dissemination	238	243	248	253	258
Training and Qualification	475	651	672	693	734
NCSP Support	400	440	449	458	467
TOTAL	$11,298	$11,494	$11,876	$12,121	$12,389

DOE program-specific applications consist of unofficial activities aligned with NCSP infrastructure program elements. DOE program-specific applications of NCSP resources are coordinated by the NCSP Manager and costs are recovered wherever appropriate. Details about theses activities are contained in the DOE program-specific applications section of the Plan.

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://ncsc.llnl.gov/.

1.1 Technical Program Elements

The NCSP includes seven technical program elements and one key support element. A description of how each element contributes to the operational criticality safety program is accompanied by a budget and schedule in the following subsections.

1.1.1 International Criticality Safety Benchmark Evaluation Project

1.1.1.1 Program Element Description

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) was initiated in 1992 by DOE's Defense Programs, now an organization within NNSA. The project is managed through the Idaho National Laboratory (INL), but involves nationally known criticality safety experts from eight other DOE national laboratories or sites [Argonne National Laboratory (ANL), Bettis Laboratory (BL), Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Sandia National Laboratories (SNL), Savannah River National Laboratory (SRNL), and the Hanford Site] and 19 foreign countries. The ICSBEP is also an official activity of the Organization for Economic Cooperation and Development - Nuclear Energy Agency (OECD-NEA).

The purpose of the 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.

The arguments that were originally made to justify the ICSBEP are even stronger today. Knowledgeable individuals upon whom the ICSBEP rely continue to age. The window of opportunity to evaluate valuable existing data at ANL, INL, Hanford, LANL, LLNL, and ORNL is closing. It is also essential that new or recently performed experiments at LANL, SNL, and other locations be evaluated while materials and components are still available for examination and while the experiments are still fresh in the minds of the experimenters.

In terms of the NCSP prioritization criteria, the ICSBEP is considered a *capability maintenance* activity that helps reduce operational costs and inefficiency and provides benchmark quality data and related search software that supports validation activities consistent with the American National Standards Institute (ANSI) American Nuclear Society (ANS) standards and Nuclear Regulatory Commission (NRC) license requirements. For management purposes, the ICSBEP is divided into three subtasks: 1) ICSBEP Infrastructure, 2) National Laboratory Participation, and 3) International Experiments. Milestones are not broken down by subtask because the first two subtasks reflect an ongoing level of effort for evaluating and publishing benchmarks and the third subtask is a place holder for the probable continuation of integral experiments in the Russian Federation. Milestones for Subtask 3 will be established if the decision is made to continue this work. Specific ICSBEP plans are contained in Appendix C.

1.1.1.2 Approved Subtasks (FY 2008)

Subtask 1 ($1,050K) - Maintain the ICSBEP Infrastructure: ICSBEP Infrastructure includes project management, project administration, a significant fraction of independent peer review

and technical editing, graphic arts, project meeting organization, publication costs, travel for selected participants who are contributing evaluations, database (DICE) upgrades and maintenance, internet site upgrades and maintenance, minimal support for the Russian Federation and others, and participation in other NCSP activities.

Subtask 2 ($825K) - Support National Laboratory 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 BL also participate at their own expense.

Subtask 3 ($100K) - Support International Experiments: The International Experiments subtask includes the procurement and evaluation of new experiments at non U.S. facilities. Such experiments are supported through the NCSP only when U.S. facilities are unavailable to respond to specific DOE programmatic needs or when it is not feasible to conduct these experiments in U.S. facilities. Opportunities for continuation of integral experiments in the Russian Federation will be evaluated by the NCSP Manager and a decision will be made early in FY 2008 when the current suite of experiments is completed. When possible, LANL experimenters are given the opportunity to participate in or observe experiments that are conducted abroad.

Milestones:

1. Conduct the ICSBEP meeting by (June 30, 2008).
2. Participate in the bi-annual NCSP reviews by (January 31 and September 30, 2008) and NDAG meetings by (December 31, 2007 and June 30, 2008).
3. Update the ICSBEP subsection of the NCSP Five-Year Plan by (June 30, 2008).
4. Publish the 2008 edition of the "International Handbook of Evaluated Criticality Safety Benchmark Experiments" by (September 30, 2008).

1.1.1.3 Proposed Future Subtasks (FY 2009 and Beyond)

Specific evaluations planned for FY 2008 through FY 2012 are provided in Appendix C. The lists of planned experiment evaluations, provided in Appendix C, are dynamic and are not all-inclusive. Every planned benchmark shown in the appendix has been selected because of its importance to programs at one or more of the participating DOE laboratories or sites. Classified benchmark experiments may also be evaluated, reviewed, and published. Classified evaluations and reviews are handled by appropriately cleared U.S. participants only.

1.1.1.4 Budget

ICSBEP Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
INL	1,050	1,070	1,090	1,112	1,134
Other National Laboratory Participation	825	842	860	877	895
International Experiments (Russia)	100	103	105	107	109
TOTAL	$1,975	$2,015	$2,055	$2,096	$2,138

1.1.2 Analytical Methods Development and Code Support

1.1.2.1 Program Element Description

This 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 predict system k-effective values. 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 throughout the DOE complex. The software is distributed through the Radiation Safety Information Computational Center (RSICC) at the ORNL. The NCSP software (codes and processed data) supported by this program element are key tools used in most nuclear criticality safety (NCS) evaluations and are routinely used by the ICSBEP in evaluation of critical experiments. The work done under this NCSP work element to maintain the software and associated staff expertise contributes significantly to:

- Reduce safety risk and operational costs by providing rigorous and reliable software with associated technical information and training materials needed to qualify users.
- Maintain a unique technical capability.
- Provide the analytical capability to meet DOE compliance requirements and external regulatory commitments.

This program element supports work at ANL, Brookhaven National Laboratory (BNL), LANL, and ORNL and not only maintains and enhances codes important to operational criticality safety, but also maintains diverse expertise in an esoteric discipline that represents an essential unique capability. The Analytical Methods Development and Code Support program element is closely tied to the Nuclear Data program element.

1.1.2.2 Approved Subtasks (FY 2008)

ANL: Analytical Methods Support to the NCSP ($500K of FY 2008 funding, plus $10K of FY 2007 carryover):

Subtask 1 ($410K) - Continue development of improved nuclear modeling methods, including: improved resonance theory, implementation of the extended Reich Moore treatment and analytical treatment of the unresolved resonance region, which can be implemented in the other NCSP-supported codes; study broadening methodologies; and comparison of VIM continuous-energy cross sections with corresponding MCNP and CE KENO libraries; further improvements in fission source convergence in calculations supporting criticality safety analyses and other related calculations, fostered by U.S./Argonne leadership as Chair of the OECD-NEA Working Party on Nuclear Criticality Safety's Expert Group on Source Convergence in Criticality Safety Analysis; continued maintenance of VIM and its auxiliary codes and software quality assurance (SQA) over computer operating system upgrades with emphasis on the utilization of VIM and advanced methods to independently verify the NJOY/MCNP and AMPX/CE KENO methodologies; and user assistance.

Milestones:

1. Improved unresolved resonance methods will be implemented and tested, reported to Cross-Section Evaluation Working Group (CSEWG), and shared with the NCSP by (September 30, 2008).
2. Attend and Chair the annual OECD-NEA Working Party on Nuclear Criticality Safety's Expert Group on Source Convergence meeting by (September 30, 2008).
3. Conduct interim communications with LANL and ORNL staff and produce final documentation of continuous energy library comparison by (September 30, 2008).
4. Release an updated version of VIM to RSICC by (September 30, 2008).

Subtask 2 ($100K) - Process and test new versions of ENDF/B-VII.1 libraries.

Milestone:

1. Distribute a current ENDF/B-VII library to RSICC by (September 30, 2008).

LANL: MCNP Maintenance, User Support, Nuclear Licensing, and NJOY Support ($720K):

Subtask 1 ($400K) - Provide ongoing maintenance of MCNP, including SQA, code implementation on new platforms and compilers, documentation, etc.

Subtask 2 ($50K) - Provide MCNP user support and training.

Subtask 3 ($50K) - Enhance MCNP output by providing HTML formatting and hyperlinks.

**Subtask 4 ($75K**) - Produce an S($\alpha$,$\beta$) library for MCNP based on ENDF/B-VII.

Subtask 5 ($25K) - Produce a limited release of a general-purpose neutron library for MCNP based on beta evaluations submitted for ENDF/B-VII beta1.

Subtask 6 ($90K) - Release a Fortran 90 version of NJOY that includes all the functionality found in the current Fortran 77 version and new capabilities unique to the Fortran 90 code.

Subtask 7 ($20K) - Develop training for NJOY.

Subtask 8 ($10K) - Offer either a workshop or class on the NJOY code system.

Milestones:

1. Provide an updated version of MCNP to RSICC by (September 30, 2008).
2. Release MCNP data libraries to RSICC including S(α,β) data from ENDF/B-VII and a library based on any beta1 neutron evaluations by (September 30, 2008).
3. Provide a Fortran 90 version of NJOY to RSICC by (September 30, 2008).
4. Develop NJOY training material by (June 30, 2008).
5. Provide an NJOY class or workshop by (September 30, 2008).

ORNL: ($1695K FY 2008 funding plus $200K of FY 2007 carryover):

Perform SCALE/KENO Maintenance, Training, and User Support ($750K):

Subtask 1 ($475K) - Provide ongoing SCALE SQA maintenance activities.

Subtask 2 ($100K) - Provide technical support and training to users.

Subtask 3 ($100K) - Update and consolidate existing validation critical experiment benchmark cases for criticality safety into a single validation benchmark suite for distribution with the SCALE code package.

Subtask 4 ($75K) - Prepare a SCALE/KENO-VI Criticality Primer written similar in scope to the SCALE/KENO V.a Criticality Primer.

Milestones:

1. Release SCALE Version 6 to RSICC by (September 30, 2008).
2. Conduct two SCALE workshops by (June 30, 2008).
3. Draft the annual SCALE maintenance report by (September 30, 2008).
4. Distribute two SCALE newsletters (January 31, 2008 and July 31, 2008).

Continue Development of the AMPX Cross-Section Processing Methodology ($110K)

Subtask 1 ($40K) - Implement and test ability to generate temperature-dependent point wise energy meshes.

Subtask 2 ($70K) - Prepare and test final AMPX-formatted libraries for SCALE Version 6.

Milestones:

1. Test needed AMPX modifications by (July 31, 2008).
2. Produce final AMPX-formatted libraries for SCALE Version 6 by (August 31, 2008).

Maintain the RSICC ($460K):

Subtask 1 ($360K) - Assure that software supporting NCS is collected, packaged, and disseminated. User support is also provided.

Subtask 2 ($50K) - Perform daily maintenance and update of RSICC electronic notebooks for MCNP and SCALE.

Subtask 3 ($50K) - Continue the exchange with OECD-NEA Data Bank and Japan's Research Institute of Science and Technology to obtain software and updates of relevance to the NCSP.

Milestones:

1. Issue RSICC quarterly reports by (December 31, 2007; March 31, 2008; June 30, 2008; and September 30, 2008).
2. Issue the RSICC newsletter (Monthly).

ORNL Critical-Subcritical Experiment Design Team (C_edT) Technical Support ($150K):

Subtask 1 ($150K) - In support of the first critical experiments to be performed in the new Criticality Experiments Facility in Nevada, ORNL will perform sensitivity/uncertainty (S/U) analyses upon receipt of the Critical Experiment Decision (CED)-1 description for each experiment in support of the CED-2 final designs for final experiment approval. Subsequent to the experiment completion, S/U evaluations will be performed beyond FY 2008 for the CED-4 stage to examine results of the experiments relative to the expectations of the S/U analyses performed at the CED-2 stage.

Milestones:

1. Issue a letter report on the TSUNAMI applicability analysis performed on the proposed Institut De Radioprotection De Sûreté Nucléaire (IRSN) Structural Materials Program experiments by (November 10, 2007).
2. Issue a letter report on the TSUNAMI CED-1 analysis and design recommendations for the HEU spherical lattice experiment by (May 31, 2008).
3. Issue a letter report on the TSUNAMI CED-2 analysis for the HEU spherical lattice experiment by (September 30, 2008).

Implement S/U Capabilities for Multigroup KENO ($175K):

Subtask 1 ($175K) - Develop, test, and document production versions of multigroup TSUNAMI sensitivity analysis sequences based on the simultaneous adjoint and forward solution methods implemented under a FY 2007 subtask for KENO V.a and KENO-VI.

Milestones:

1. Test advanced multigroup TSUNAMI-3D with KENO V.a and KENO-VI by (April 30, 2008).
2. Publish documentation for advanced codes by (June 30, 2008).
3. Prepare finalized codes and documentation for release with SCALE 6 by (September 30, 2008).

Enhance, Test, and Verify TSURFER S/U Module, and Develop User Guidance and Training ($250K):

Subtask 1 ($250K) - Using the recently evolved generalized linear least squares methodology, perform testing and validation of the SCALE TSURFER module, extend TSURFER capabilities, and issue user guidance and training materials on the use of TSURFER.

Milestones:

1. Finalize the TSURFER module for release with SCALE 6 by (June 30, 2008).
2. Prepare and release user guidance by (June 30, 2008).
3. Develop training material for user classes by (September 30, 2008).
4. Participate in OECD Expert Group on Uncertainty Methods for NCS.

1.1.2.3 Proposed Future Subtasks (FY 2009 and Beyond)

Code maintenance and user support will continue. Maintenance of the rigor of these modern Monte Carlo codes cannot be performed on a "stagnant" system. Modest and continual code enhancements are a requirement for proper code maintenance.

1.1.2.4 Budget

Analytical Methods Development and Code Maintenance Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
ANL	500	510	520	530	540
LANL	720	734	749	764	780
ORNL	1,695	1,729	1,764	1,800	1,836
TOTAL	$2,915	$2,973	$3,033	$3,094	$3,156

1.1.3 Nuclear Data

1.1.3.1 Program Element Description

The Nuclear Data program element of the NCSP includes the evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to nuclear criticality safety

analyses. The low and intermediate energy (eV, keV) evaluations are performed primarily at ORNL with the SAMMY software. The high-energy evaluations (MeV) are performed primarily at LANL with the GNASH software. Nuclear modeling methods are being maintained and improved and the need for data uncertainty covariance files is being addressed.

The NCSP continues to improve coordination of nuclear data activities by fostering a strong collaborative effort among all of our national resources in this highly technical area. The objective is to solve the highest priority nuclear data problems relevant to criticality safety in a timely manner. This collaboration is accomplished through the NDAG. In addition, the NCSP continues to rely on the director of the National Nuclear Data Center at BNL for consultation regarding maintenance of nuclear reaction databases, covariance development, and CSEWG and international interactions.

Appendix D shows the sequence of activities necessary to update the official ENDF. The planned priorities, as established by the NDAG for the Nuclear Data work element, are also shown in Appendix D.

This program element is essential for the NCSP because it provides the nuclear cross-section data required by the Analytic Methods and Code Support program element. Additionally, S/U analyses demonstrate the importance of utilizing integral experiment data in assessing uncertainties for specific NCS applications, highlighting the strong linkages between the ICSBEP, Integral Experiments, and the Nuclear Data program element. Together these NCSP activities are vital for criticality safety practitioners in the performance of NCS evaluations. As such, this NCSP work element supports the reduction of safety risk and operational costs evidenced by improved understanding and utilization of nuclear data, the maintenance of unique technical capability, and the analytical capability to meet DOE compliance requirements (standards, orders, etc.) and external regulatory commitments (Defense Nuclear Facilities Safety Board, NRC, etc.).

1.1.3.2 Approved Subtasks (FY 2008)

ANL: Nuclear Data Support to the NCSP ($200K of FY 2008 funding plus $35K of carryover from FY 2007):

Subtask 1 ($235K) - Data testing utilizing a validation suite of (primarily ICSBEP) benchmarks in support of the data validation effort for ENDF/B-VII. Emphasis will be on testing and reporting performance of priority evaluations identified by the NDAG (e.g., ^{239}Pu, Ni, Cr and other structural and reflector materials, thermal scattering data). The priority in FY 2008 will be to continue to process and data test new evaluations developed for ENDF/B-VII.1, document their performance, and feedback results to the NDAG and CSEWG.

Milestones:

1. Organize and Chair NDAG meetings by (September 30, 2008).
2. Organize and respond to NDAG tasks from the NCSP Manager; contribute NDAG input to C_edT planning and execution of NCSP integral experiments by (September 30, 2008).

3. Participate in NCSP meetings and provide ANL inputs as requested by (September 30, 2008).
4. Participate in yearly CSEWG and Working Party on International Evaluation Cooperation (WPEC) meetings and include report of data validation activities by (September 30, 2008).
5. Finish low-fidelity covariance data generation and quality assurance by (September 30, 2008).

BNL: National Nuclear Data Center Support to the NCSP ($165K):

Subtask 1 ($15K) - Participate in NCSP and NDAG meetings as required.

Subtask 2 ($30K) - Ensure that NCSP-produced nuclear data evaluations are processed, reviewed, and included in the U.S. ENDF/B.

Subtask 3 ($35K) - Perform data verification and basic testing of new NCSP evaluations submitted for inclusion in the ENDF/B library.

Subtask 4 ($30K) - Continue in the effort to improve methodology to provide quality covariance data in the fast neutron region.

Milestones:

1. Make new NCSP evaluations available on the ENDF library website by (September 30, 2008).
2. Complete covariance data generation for 55Mn and 90Zr, including publication of these data by (June 30, 2008).

Subtask 5 ($55K) - Preserve Mughabghab's evaluation know-how and codes, currently used under the Open VMS system of the DEC Alpha machine that has not been maintained since 2005.

Milestones:

1. Move all codes written in FORTRAN 77 to modern Linux environment by (March 31, 2008).
2. Develop scripts and a graphical user interface (GUI) and make the codes easy to use by (June 30, 2008).
3. Integrate the codes, scripts, and GUI into the BNL EMPIRE code as its new resonance module by (September 30, 2008).

LANL: Nuclear Data Support to the NCSP ($475K):

Subtask 1 ($350K) - Produce improved evaluations for the five isotopes of Ti with "high-fidelity" covariance data, assess current nuclear data for V-51 in conjunction with results from ICSBEP-sponsored benchmarks from VNIITF and provide an updated evaluation if warranted, and begin to reanalyze experimental data for O-16.

Subtask 2 ($80K) - Conduct data testing using fast critical assemblies, supplemented by additional systems as appropriate.

Subtask 3 ($25K) - Perform modest maintenance and development of the software: GNASH, McGNASH, EDA, and KALMAN to accomplish the above subtasks.

Subtask 4 ($20K) - Participate in twice-yearly NDAG meetings, and yearly CSEWG and WPEC meetings.

Milestones:

1. Deliver updated evaluations of Ti isotopes including high-fidelity covariances to National Nuclear Data Center (NNDC) by (September 30, 2008).
2. Report on data testing and evaluation progress at CSEWG and NDAG meetings by (November 30, 2007 and June 30, 2008).

ORNL: Data Evaluations, Covariance Data Generation and SAMMY Nuclear Modeling ($1190K)

Subtask 1 ($760K) - Provide improved cross-section evaluations and uncertainty covariance data for nuclides identified in milestones below. As part of this subtask, ORNL will publish technical reports and journal articles on selected evaluations and continue efforts to improve the methods available for cross-section evaluation and covariance generation in the resonance energy region.

Subtask 2 ($40K) - Participate in CSEWG activities, NDAG activities, and international working groups (IAEA and OECD-NEA).

Subtask 3 ($390K) - Maintain scientific/technical capability and develop new analysis capabilities for the SAMMY software that is an essential computational tool used to analyze measured nuclear data and prepare cross-section evaluations with covariance data. As part of this subtask, the nuclear modeling specialist performs ongoing maintenance, capability improvements, and software training for the SAMMY software. As part of this task, ORNL shall also develop a staffing succession plan to provide technical staff continuity in this highly specialized area.

Milestones:

1. Deliver evaluation to NNDC for ^{55}Mn by (March 31, 2008).
2. Complete File 32 to File 33 conversion and deliver new Pu and U evaluations with covariance data to NNDC by (January 31, 2008).
3. Complete ^{19}F evaluation and deliver to NNDC using available inelastic data by (September 30, 2008).
4. Complete ^{39,40,41}K evaluation with covariance data and deliver to NNDC by (March 31, 2008).
5. Submit journal articles to NS&E for ^{232}Th and ^{238}U evaluation work by (September 30, 2008).

6. Collaborate with ANL to develop and demonstrate more rigorous prototypic methodology to expand unresolved resonance region evaluations beyond single-level Breit-Wigner by (September 30, 2008).
7. Produce resolved-resonance evaluations (with covariances) for ^{52,53}Cr, ^{58,60}Ni, ^{60}Ni by (September 30, 2008).
8. CSEWG meeting, Mike Dunn, Chair of ENDF/B formats committee by (November 30, 2007).
9. NDAG meetings by (November 30, 2007 and June 30, 2008).
10. OECD-NEA/WPEC activities, annual meeting, Dunn participate as Subgroup 28 Chair and ENDF/B Formats Committee Chair by (May 31, 2008).
11. User support includes updates to SAMMY software to support ORNL data evaluation efforts by (December 31, 2007; March 31, 2008; June 30, 2008; and September 30, 2008).
12. Updated SAMMY software package delivered to RSICC by (September 30, 2008).
13. Participate in the ENDF CSEWG meeting by (November 30, 2007).

1.1.3.3 Proposed Future Subtasks (FY 2009 and Beyond)

Support of the Nuclear Data work element at each of the four national laboratories is a planned ongoing activity with priorities established by the NCSP Manager based on input from operational criticality safety programs and recommendations from the NDAG.

1.1.3.4 Budget

Nuclear Data Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
ANL	200	204	208	212	216
BNL	165	112	114	116	118
LANL	475	485	495	505	515
ORNL	1,190	1,214	1,238	1,263	1,288
TOTAL	$2,030	$2,015	$2,055	$2,096	$2,137

1.1.4 Differential Measurements

1.1.4.1 Program Element Description

The Differential Measurements program element of the NCSP supports the measurement of neutron cross-section data for nuclides of high importance to nuclear criticality safety analyses. Measurement priorities are established by the NCSP Manager based on input from operational criticality safety program and recommendations from the NDAG.

Currently, new measurements are performed at ORNL using the ORELA facility. Evaluation and data testing measured data are performed as described in the Nuclear Data Program Element subsection.

1.1.4.2 Approved Subtasks (FY 2008)

Subtask 1 ($350K) - ORELA Measurements: This subtask supports expert staff engaged in planning and performance of differential measurements (see milestones below) at the ORELA facility and general consultation on measurement techniques (see Appendix D for planned measurements).

Milestones:

1. ^{52,53}Cr transmission and capture measurements by (March 31, 2008).
2. Ti transmission and capture measurements by (September 30, 2008).
3. ^{58,60}Ni capture measurement by (September 30, 2008).
4. Develop measurement plan and cost estimate for ^{240}Pu and ^{237}Np by (March 31, 2008).
5. Provide recommendations and needs assessment for performing HF and SiO_2 thermal scattering measurements at ORELA by (September 30, 2008).

Subtask 2 ($620K) - ORELA Operations: Perform operation and maintenance tasks needed to keep ORELA operational for measuring high-priority nuclides needed for criticality safety analyses. This includes engineering and technician oversight, diagnostics, repair, accelerator testing, material procurement, and Environment, Safety and Health activities. Based on FY 2006 operating experience, the ORELA operation costs for performing measurements is $9K/day (i.e., includes facility operation costs and craft support).

Milestones:

1. Provide up to 700 hours of beam time as needed to complete Subtask 1 by (September 30, 2008).
2. Manufacture 2 electron guns by (September 30, 2008).

1.1.4.3 Proposed Future Subtasks (FY 2009 and Beyond)

NNSA funded substantial refurbishment of ORELA in FY 2006 that resulted in restoration of relatively reliable operation of the accelerator. However, NNSA cannot continue to provide this support in the future and has asked the DOE Office of Science (SC) to increase its support for ORELA to ensure operability and reliability. Unless SC or another sponsor provides funding for continued refurbishment that will assure ORELA reliability, NNSA will discontinue all ORELA support by the end of FY 2008. The NDAG will make a recommendation to the NCSP Manager on options for providing differential measurements in the absence of ORELA during FY 2008. This may necessitate the use of other facilities for differential measurements should they be deemed essential.

1.1.4.4 Budget

Differential Measurements Budget, Fiscal Years 2008 – 2012 (All ORNL Tasks)

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
TOTAL	$970	$357	$364	$371	$378

1.1.5 Integral Experiments

1.1.5.1 Program Element Description

The Integral Experiments program element of the NCSP maintains a fundamental capability for the DOE/NNSA to be able to perform critical mass measurements and 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 supports hands-on nuclear criticality safety training programs and various other programs for the DOE/NNSA and other government agencies. The other, non-NCSP related, activities include specific program requirements in the stockpile stewardship program, emergency response and counter terrorism program, and the non-proliferation and arms control program.

The Critical Experiments Facility (CEF) Project has been initiated to relocate LANL Technical Area (TA)-18 activities to the Device Assembly Facility (DAF) at the Nevada Test Site and is sponsored by Defense Programs. It received *Approval of Alternative and Cost Range* (Critical Decision 1) on June 14, 2004, *Approval of Performance Baseline* (Critical Decision 2) on December 2, 2005, and *Authorization to Start Construction in the DAF* on February 2, 2007. Construction is scheduled for completion in late 2009, and the current schedule indicates that the CEF will be operational by the end of the third quarter of FY 2010. Funding for the CEF project (current baseline is about $151M) is provided through a Congressional Line Item construction account.

As the CEF project prepares the DAF to accommodate TA-18 activities, interim operations will be conducted to maintain the capability to conduct integral experiments. LANL staff will conduct subcritical integral experiments at the DAF and participate in critical integral experiments at SNL and in Russia and France until the CEF is operational. Subtask 6 of this subsection reflects an investment in integral measurements being made in France as part of the IRSN Structural Materials Experiments Program. This will enable the NCSP to maintain some continuity of integral experiment capability and will ensure that technical staff members maintain some level of proficiency during the transition period. The NCSP is committed to make this transition as smooth as possible.

In March 2007, the NCSP Manager convened a multidisciplinary group to develop a structured approach for the proposal of integral experiments and their subsequent design, execution, and publication. The details of this process will be described in *The Critical-Subcritical Experiment Design Team (C_edT) Process Description Document,* and posted on the NCSP website during FY

2008. In summary, this process is similar to the DOE Order 413 construction project management process with planned stop points for management approval. The goal is to understand the data need well enough to design the experiment such that it addresses the need. The process is completed when the experiment is published in the International Handbook of Evaluated Criticality Safety Benchmark Experiments. At the kickoff C_edT meeting, the following experiments were prioritized:

1. Lucite and Nickel or Tungsten sub critical measurements in FY 2008;
2. HEU spherical lattice experiment;
3. Vanadium foils and plates experiment;
4. Uranium Processing Facility Borobond and ES-3100 experiments; and
5. Flat Top gap experiments.

1.1.5.2 Approved Subtasks (FY 2008)

LANL: Design, Maintenance, and Performance of CEF Operations ($1,795K)

Subtask 1 ($400K) - CEF Operational Support at the DAF: This subtask is in support of CEF operations at the DAF. DAF operations require the support of qualified and trained nuclear material handlers and operators. As the DAF continues to evolve and expand its operational status, facility maintenance and Technical Safety Requirement (TSR) surveillances need to be performed. Personnel will also need to be trained to perform these activities. This subtask also funds the infrastructure necessary to perform programmatic activities at the DAF.

Milestone:

1. Support all required TSR surveillances. This includes monthly, bi-annual, annual and biennial surveillances on all Safety Class and Safety Significant systems. This also includes supporting all monthly back-shift maintenance activities including fire suppression and door maintenance activities. The status of all TSR surveillances will be reported by (December 31, 2007; March 31, 2008; June 30, 2008; and September 30, 2008).

Subtask 2 ($525K) - Conduct subcritical integral experiments at the DAF: Following the success of the first sub-critical experiment in FY 2007, two sub-critical measurements are proposed for FY 2008. The proposed experiments come directly from guidance provided by the NDAG from their November 2006 meeting and the first C_edT planning meeting. The first sub-critical experiment will involve the alpha-phase Pu sphere reflected with Lucite ($C_5O_2H_8$; also called Plexiglas or acrylic glass). A set of nesting shells of Lucite will have to be manufactured and the cost associated with this is included here. The second experiment will involve the alpha-phase Pu sphere reflected with either tungsten (W) or nickel (Ni). Once again, the cost associated with fabricating nesting shells of either W or Ni is included. This task contributes to the safe operation of sub-critical configurations in the field. It provides a means to benchmark and compare sub-critical calculations. It is also a maintenance of capability activity by engaging LANL and ORNL personnel in the performance of experimental activities. Deliverables for this subtask are experimental write-ups in accordance with the ICSBEP requirements for Section 1 of a standard benchmark. Ultimately all of these experiments will be evaluated and included in the

International Handbook of Evaluated Criticality Safety Benchmark Experiments. Support from ORNL personnel will be required to successfully achieve the goals of this subtask and their costs are not included here.

Milestones:

1. The first experiment will be completed by (March 31, 2008).
2. The second experiment will be completed by (June 30, 2008).
3. Experimental write-ups in accordance with the ICSBEP requirements for Section 1 of a standard benchmark for both experiments will be completed by (September 30, 2008).

Subtask 3 ($450K) - Maintain and train CEF Operations team members: This is a continuing subtask in support of maintaining proficiency for crew chiefs and crew members during the transition to DAF operations. To maintain proficiency, crew chiefs and crew members will participate in experiments and operational activities at U.S. and international facilities. In addition, this task will fund the development of a formal qualification and certification program for NNSA approval in time to support FY 2010 CEF startup of critical assembly operations.

Milestones:

1. Develop three modules of the CEF crew member certification program (e.g., neutron physics, reactor physics, and machine design) by (September 30, 2008).
2. Participation in two experimental collaborations with other organizations such as Sandia, White Sands or other international collaborators. Participation at U.S. facilities will be completed by (March 31, 2008) participation at foreign facilities will be complete by (September 30, 2008).

Subtask 4 ($300K) - Critical Experiment Decision (CED)-1 and CED-2 to support Critical Experiment Planning and Approval for FY 2010 Critical Experiments: Provide designs for the first two priority critical experiments in the CEF. During the week of March 12, 2007, a new highly systematic process for introducing, reviewing, validating and approving new integral experiments was conceived. This subtask will exercise this new process by developing the Conceptual Design (CED-1) and Final Design (CED-2) for one of the first priority critical experiments and conceptual design (CED-1) for the second critical experiment.

Milestones:

1. Provide CED-1 for the HEU spherical lattice experiment by (March 31, 2008).
2. Provide CED-1 for Vanadium foils and plates experiment by (September 30, 2008).
3. Provide CED-2 for the HEU spherical lattice experiment by (July 31, 2008).

Subtask 5 ($120K) - CEF Warehouse Maintenance: LANL is in the process of standing up a Security Category IV warehouse that will be used to store natural uranium, depleted uranium and thorium, as-well-as non-nuclear hardware and equipment that is necessary to support the CEF missions. This warehouse is required to be maintained in accordance with the requirements of National Fire Protection Association codes and standards. The cost of maintaining this warehouse (maintenance to be performed by the Nevada Test Site Maintenance and Operating contractor) has been estimated at $10K per month.

Milestone:

1. Perform monthly and annual maintenance and surveillances on the fire suppression system and other systems as required. The status of all surveillances will be reported by (December 31, 2007; March 31, 2008; June 30, 2008; and September 30, 2008).

INL: Continued Support of IRSN Structural Material Experiments ($500K)

Subtask 1 ($500K) - Continue the IRSN Structural Material Experiments: Continue the materials measurements phase that was initiated in 2007. Approximately $200K was allocated in FY 2007 to initiate this work and will be transferred to IRSN as soon as the contract is in place (anticipated in the Fall of 2007). Because the French go by calendar year (CY), not FY, this transfer may take place as late as December 2007 and still satisfy the commitment. The initial list of materials to be tested include: Large absorber screens of Concrete, Iron, Nickel, Lead, Zirconium, Aluminum, Copper, and Cast-Iron; thin plates of Iron, Nickel and Copper; and reflected experiments with Aluminum and SiO2 *(glass)*. The experiments are expected to be of high quality with the reactivity worth of the structural materials in excess of 4%. Uncertainties in the experimental k_{eff} values are expected to be lower than 0.2%.

Milestones:

1. Safety Documentation, Component Design and Experimental Device manufacturing by (December 31, 2007).
2. Experimental Device Assembly and Test Operations by (June 30, 2008).

1.1.5.3 Proposed Future Subtasks (FY 2009 and Beyond)

Future NCSP activities at the DAF include continuation of sub-critical reactivity measurements, maintaining the infrastructure necessary to handle SNM including job planning and safety reviews/approvals, reestablishment of hands-on criticality safety training courses for criticality safety engineers, and reestablishment of critical experiments using the critical assembly machines. The ramp up in out-year funding reflects the return to service of the machines and the expected increase in the number of integral measurements that can be carried out at the DAF.

The NCSP is also planning for re-establishing a Solution High Energy Burst Assembly (SHEBA) capability. The CSSG and NDAG responses to taskings issued in FY 2006 support the evaluation and planning efforts that are currently being carried out. The NCSP will not provide most of the funding support for re-establishment of a solution critical experiments capability. Alternative funding methods and sponsors are being sought to reestablish this capability.

1.1.5.4 Budget

Integral Experiments Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
LANL	1,795	2,300	2,500	3,060	3,121
INL	500	500	500	0	0
TOTAL	$2,295	$2,800	$3,000	$3,060	$3,121

1.1.6 Information Preservation and Dissemination

1.1.6.1 Program Element Description

The Information Preservation and Dissemination program element of the NCSP was established to preserve primary documentation supporting criticality safety and to make this information available for the benefit of the technical community. There are two major subelements within this program element:

1. The Criticality Safety Information Resource Center (CSIRC). CSIRC is tasked with collecting and preserving documents directly related to critical experiments and criticality safety. The collection effort includes both human (video taping) interviews and documentation assets. The information is distributed in various manners, DVDs, paper copies, or via CSIRC website download. CSIRC was created to reduce information loss as the complex and human resources age as well as to provide a centralized location for information storage and exchange in the complex.

2. The NCSP internet website (http://ncsc.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. The NCSP website serves as an efficient means for the DOE NCSP to disseminate information electronically to the entire criticality safety community. Extensive use is made of the hyper links to other DOE websites to point a user to the original data source to ensure accuracy and access to the most up-to-date information.

1.1.6.2 Approved Subtasks (FY 2008)

Fluor Hanford: CSIRC ($63K)

Subtask 1 ($63K) - Continue updating ARH-600.

Milestones:

1. Respond to results of the CritView beta test conducted in 2007 by (December 31, 2007).
2. An updated beta test version of the ARH-600 CritView application will be made available and will undergo a broader base of testing by (March 31, 2008).
3. Expand CritView Documentation (June 30, 2008).
4. Continue documentation and peer review of CritView data library by (September 30, 2008).
5. Expand parameter space included in the data library--additional codes, moderators, etc. by (September 30, 2008).

LLNL: NCSP Website ($175K):

Subtask 1 ($65K) - Operation and Maintenance of the NCSP Website. This subtask will monitor on-going operations, install monthly Operating System patches, upgrade web server software, perform monthly risk assessment required by NNSA cyber security policy, and maintain the computer operations.

Subtask 2 ($30K) - Information Coordination and Dissemination. This subtask will coordinate the implementation of the NCSP information from NCSP management, CSSG, CSCT, and the EUG onto the website; convert various document types into PDF files or web pages; and assist NCS users in solving access and printing problems.

Subtask 3 ($50K) - Upgrade the Website Contents and Improve User Interface. This subtask will continue to incorporate CSSG, CSCT, and End Users requests and feedback; enhance the LLNL bibliographic database, the Hanford NCTSP database, and the ARH-600 on-line features; publish the CEF web pages with the facility status report; and update the website contents. This subtask will also implement the new initiative of broadcasting of information of interest to the criticality safety community through email.

Subtask 4 ($10K) - Website Hardware and Software Maintenance. This subtask will buy new software to enhance operations in security and data management; and provides replacement electronic components such as power units in the event of component failures.

Subtask 5 ($10K) - Implement the New Multimedia CSET Modules onto the Website. This subtask will procure and install streaming video server software for the CSET modules to be provided by others and perform beta testing for quality assurance.

Subtask 6 ($10K) - Conduct the FY 2008 NCSP Website Survey. This subtask is to coordinate development of the survey questionnaires, conduct electronic survey, and compile survey results for the NCSP management team.

Milestones:

1. Conduct the NCSP Website Survey by (December 31, 2007).
2. Deploy Multimedia Server by (March 31, 2008).
3. Implement Multimedia Criticality Safety Engineer Training Modules by (May 31, 2008).

1.1.6.3 Proposed Future Subtasks (FY 2009 and Beyond)

The NCSP will continue to preserve important criticality safety information through the CSIRC process. The NCSP will continue to improve its website to meet the needs of the criticality safety community.

1.1.6.4 Budget

Information Preservation and Dissemination Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
Fluor Hanford	63	64	65	66	67
LLNL	175	179	183	187	191
TOTAL	$238	$243	$248	$253	$258

1.1.7 Training and Qualification

1.1.7.1 Program Element Description

The Training and Qualification program element has two subtasks:

1. Continue to offer hands-on training courses as needed by DOE; and
2. Identify training needs and develop new resources in areas where no suitable materials exist.

The goal of this program element is to maintain the technical capabilities of criticality safety professionals and provide for the training and qualification of people entering the criticality safety discipline from related scientific fields.

1.1.7.2 Approved Subtasks (FY 2008)

LLNL: ($400K)

Subtask 1 ($400K) - Hands-On Training: Conduct 8 hands-on criticality safety classes.

Subtask 2 - Implement new class SNM storage strategy (use FY 2007 carry over funding and savings from implementation of new strategy: ~$120K)

Milestones:

1. Conduct classes according to negotiated schedule (transmit FY 2008 class schedule to NCSP Manager by (October 30, 2007).
2. Implement new storage strategy and transmit FY 2008 implementation schedule to the NCSP Manager by (October 30, 2007).

ORNL: ($75K)

Subtask 1 ($25K) - Finish development of the TSUNAMI Primer with NCSET module on the website (ongoing task from FY 2007). Provide a training manual for experienced KENO users who have no experience with TSUNAMI. The Primer would contain most of the material covered in the TSUNAMI workshop and would be similar in approach to the KENO V.a Primer.

Milestones:

1. Resolve export control issue by (June 30, 2008).
2. Draft report for internal review by (June 30, 2008).
3. Provide final report to RSICC for distribution and NCSET module on the NCSP website (subject to export control) by (September 30, 2008).

Subtask 2 ($50K) - Continue developing Nuclear Criticality Safety Engineer Training (NCSET) modules. For FY 2008 the NCSET Module will be a Primer for proper utilization of sub-critical noise measurements in criticality safety validation. Others being considered are Burn-up Credit for Criticality Safety and Advanced Fuel Cycle Criticality Safety Issues.

Milestone:

1. Post subcritical noise measurements NCSET module on the NCSP website by (September 30, 2008).

1.1.7.3 Proposed Future Subtasks (FY 2009 and Beyond)

The NCSP will continue to support hands-on training and NCSET module development based on the needs of the criticality safety community.

1.1.7.4 Budget

Training and Qualification Budget, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
ANL	0	51	52	53	54
LLNL	400	600	620	640	680
ORNL	75	0	0	0	0
TOTAL	$475	$651	$672	$693	$734

1.1.8 Nuclear Criticality Safety Program Support

1.1.8.1 Criticality Safety Support Group Activities

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. Complete information about the CSSG (membership, charter, taskings, etc.) can be found on the NCSP website.

1.1.8.2 Approved Subtask (FY 2008)

Subtask 1 ($400K) - CSSG funding. The NCSP budget provides some support for contractor CSSG members (9 CSSG members x $40K/member + $20K for the CSSG Chair + $20K for the CSSG Deputy Chair).

1.1.8.3 Criticality Safety Coordinating Team Activities

The CSCT is the group of federal staff providing line oversight for criticality safety at the field level. The NCSP Manager is also 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. There are no funded subtasks for the CSCT because the CSCT is comprised entirely of federal employees.

End-Users Group Activities

The EUG consists of contractor nuclear criticality safety personnel formed to advise the NCSP Manager on infrastructure needs of criticality safety practitioners and to provide feedback on the products of the NCSP. The End-Users participation in the NCSP improves efficiency of operations and enhances safety by ensuring the deliverables are useful and implementable. The INL Criticality Safety Section has agreed to provide a Chair for the End Users in FY 2008. There are no funded subtasks for the End Users.

1.1.8.4 Budget

NCSP Support Activities, Fiscal Years 2008 – 2012

SUBTASK	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)	FY 2012 ($K)
TOTAL (CSSG)	$400	$440	$449	$458	$467

Appendix A

Nuclear Criticality Safety Program Task Managers

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Appendix B

Work Authorization Statements for Nuclear Criticality Safety Program Funding for Execution Year (FY 2008) to be Provided to the NA-17 Budget Office in September 2007

Tasks: Nuclear Data, Analytical Methods Development and Code Maintenance and the Criticality Safety Support Group
Oak Ridge National Laboratory (ORNL): $4,050K

Funds are provided to ORNL to conduct criticality safety related nuclear data acquisition, evaluation, testing, and publication; to maintain criticality safety codes, including associated cross-section processing codes; to continue criticality safety related code distribution and user support through Radiation Safety Information Computational Center; and to develop Nuclear Criticality Safety Engineer Training materials as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Funds are also provided for Criticality Safety Support Group (CSSG) technical support to the NCSP Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

ORNL POC: Cecil Parks (865-574-5280)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Tasks: International Criticality Safety Benchmark Evaluation Project (ICSBEP), the Institut De Radioprotection et De Sûreté Nucléaire (IRSN) Structural Materials Experiments Program, and the Criticality Safety Support Group
Idaho National Laboratory (INL): $2,515K

Funds are provided to the INL to conduct the ICSBEP and the IRSN Structural Materials Experiments Program as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Funds are also provided for CSSG technical support to the NCSP Manager regarding planning and execution of the NCSP ($40K for WSMS). With approval of the NCSP Manager, the Criticality Safety Support Group (CSSG) may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

INL POC: Blair Briggs (208-526-7628)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Tasks: Integral Experiments, Analytical Methods Development and Code Maintenance, Nuclear Data Support, and the Criticality Safety Support Group
Los Alamos National Laboratory (LANL): $3,070K

Funds are provided to LANL to conduct nuclear criticality integral experiments, MCNP support, and Nuclear Data support as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Funds are also provided for Criticality Safety Support Group (CSSG) technical support to the NCSP Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

LANL POC: Robert Margevicious (505-606-0109)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Tasks: Analytical Methods Development and Code Maintenance, Nuclear Data Support, Training Development, and the Criticality Safety Support Group
Argonne National Laboratory (ANL): $760K

Funds are provided to ANL to continue supporting analytical methods and associated cross-section processing codes, and Nuclear Data activities, including chairing the Nuclear Data Advisory Group, as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Funds are also provided for chairing the Criticality Safety Support Group (CSSG) as it provides technical support to the NCSP Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

ANL POC: Richard McKnight (630-252-6088)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Tasks: Hands-On Training, Nuclear Criticality Safety Website, and the Criticality Safety Support Group
Lawrence Livermore National Laboratory (LLNL): $615K

Funds are provided to LLNL to conduct hands-on criticality safety training and maintain the DOE Nuclear Criticality Safety Program (NCSP) website, as delineated in the NCSP Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Funds are also provided for Criticality Safety Support Group (CSSG) technical support to the NCSP Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor

organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

LLNL POC: David Heinrichs (925-424-5679)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: ARH-600 Updating and the Criticality Safety Support Group
Fluor Hanford: $63K

Funds are provided to Fluor Hanford for the continued revision of ARH-600 as delineated in the and Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, and for Criticality Safety Support Group (CSSG) technical support to the NCSP Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other Department of Energy (DOE) and DOE Contractor organizations. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

Fluor Hanford POC: David Erickson (509-373-6500)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: Nuclear Data
Brookhaven National Laboratory (BNL): $165K

Funds are provided to BNL to continue Nuclear Data support as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan dated August 2007, or as directed by the NCSP Manager. Support will include shepherding new data evaluations through the Cross Section Evaluation Working Group process and subsequent publication of these data in the United States Evaluated Nuclear Data File. Quarterly reports on the status of all tasks shall be provided to the NCSP Manager no later than the last day of the month following the end of the quarter.

BNL POC: Pavel Oblozinsky (631-344-2814)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Appendix C

International Criticality Safety Benchmark Evaluation Project
Planned Benchmarks

Table C-1. Argonne National Laboratory

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN ARGONNE NATIONAL LABORATORY	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
ZPR-LMFR-RESR-001 CRIT-BUCK-SPEC-REAC-RRATE	ZPR-6 Assembly 7: A Cylindrical Assembly With Mixed (Pu,U)-Oxide Fuel and Sodium with a Thick Depleted-Uranium Reflector (MIX-COMP-FAST-001)
ZPR-LMFR-RESR-002 CRIT-SPEC-REAC	ZPR-6 Assembly 7 with High Pu-240: A Cylindrical Assembly With Mixed (Pu,U)-Oxide Fuel and Sodium with a Thick Depleted-Uranium Reflector (MIX-COMP-FAST-001)
FY 2009	
HEU-COMP-FAST-004	ZPR-3 Assembly 14: A Clean HEU (93% ^{235}U) Carbide Core Reflected by Depleted Uranium
FY 2010	
IEU-MET-FAST-011	ZPR6-1 All Aluminum - 14% Enriched
FY 2011	
IEU-MET-FAST-015	ZPR-3 Assembly 6F: A Clean Cylindrical Core with a ^{235}U-to-^{238}U Ratio of 1, Reflected by Depleted Uranium
FY 2012 and Beyond	
PU-COMP-FAST-003	ZPR-9 Assembly 31: The Plutonium Carbide Benchmark Assembly Reflected by Depleted Uranium
PU-COMP-FAST-004	ZPR-3 Assembly 48: A Clean Cylindrical Pu Carbide Core, Reflected by Depleted Uranium
IEU-COMP-FAST-003	ZPR-6 Assembly 5: A Large, Clean, Cylindrical Uranium Carbide Benchmark Assembly Reflected by Depleted Uranium
IEU-COMP-FAST-004	ZPR-3 Assembly 12: A Large, Clean, Cylindrical Uranium (21% ^{235}U)Carbide Benchmark Assembly Reflected by Depleted Uranium
IEU-COMP-FAST-005	ZPR-3 Assembly 11: A Large, Clean, Cylindrical Uranium (12% ^{235}U) Carbide Benchmark Assembly Reflected by Depleted Uranium
IEU-COMP-FAST-006	ZPR-3 Assembly 25:A Large, Clean, Cylindrical Uranium (9% ^{235}U) Carbide Benchmark Assembly Reflected by Depleted Uranium
MIX-COMP-FAST-002	ZPR-9 Assembly 29: Normal and Flooded Configurations of Mixed (Pu/U)-fueled GCFR Assembly
Others	To Be Determined

Table C-2. FLUOR Hanford / PNNL

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN FLUOR HANFORD / PNNL	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
SUB-MIX-COMP-THERM-001	Subcritical Waste Drums Measurements
Provide Information to INL	FFTF Fuel Criticals in Water
FY 2009	
Others	To Be Determined
FY 2010	
Others	To Be Determined
FY 2011	
Others	To Be Determined
FY 2012 and Beyond	
MIX-COMP-FAST-004	FFTF Fuel Approach to Critical in Liquid Na Critical
MIX-COMP-FAST-005	FFTF Core Demonstration Experiment
PU-COMP-THERM-003	PCTR Graphite Moderated Pu-Al Fuel Rods
PU-MET-THERM-005	PRTR Plutonium Rods in Water
PU-MET-THERM-006	PRTR Pu Rods in Water and PuO_2 / MgO
HEU-COMP-THERM-020	Uranium Carbide Experiments
HEU-MET-THERM-023	Uranium, Chromium, Water Mixtures - Measurements Needed
HEU-MET-THERM-024	Uranium, Cerium, Water Mixtures - Measurements Needed
LEU-COMP-THERM-072	Max k_∞ for UO_3 in Water for 1.0 $^{w}/o$ ^{235}U Enrichment
LEU-COMP-THERM-073	Max k_∞ for UNH for 2.1 $^{w}/o$ ^{235}U Enrichment
LEU-COMP-THERM-074	Max k_∞ for UF_4 Paraffin for 2.0 $^{w}/o$ ^{235}U Enrichment
LEU-MET-THERM-010	PCTR Experiments - Graphite Mod. 2.1 w/o Enriched LEU with Li Targets
LEU-MET-THERM-011	HCTLTR Experiments
LEU-MET-THERM-012	PCTR Experiments with Graphite and LEU
LEU-MET-THERM-013	Graphite Moderated, Air-Cooled 305 Test Pile
LEU-MET-THERM-014	PCTR U-Th Supercells in Graphite Moderator
SUB-LEU-MET-THERM-002	Subcritical 2.1 $^{w}/o$ Enriched Uranium Rods in Water Intermixed with Cd
SUB-LEU-MET-THERM-003	Subcritical LEU Metal Rods in Water for 3.0 w/o ^{235}U Enrichment
SUB-LEU-MET-THERM-004	Subcritical LEU Metal Tubes in Water with 1.25 $^{w}/o$ ^{235}U Enrichment
SUB-LEU-MET-THERM-005	Subcritical LEU Metal Tubes in Water with 0.95 w/o ^{235}U Enrichment
SUB-LEU-MET-THERM-006	Subcritical LEU Metal Tube-Rod in Water
SUB-LEU-MET-THERM-007	Subcritical 1.44 w/o Enriched LEU Tubes in Water

Table C-3. Idaho National Laboratory

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN IDAHO NATIONAL LABORATORY	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
HEU-MET-THERM-033 (Joint INL/LANL)	Polyethylene Reflected And Moderated Highly-Enriched Uranium System With Rhenium (Ellis / Hutchinson)
LEU-COMP-THERM-028	Water-moderated U(4.31)O2 fuel rods in triangular lattices with boron, cadmium, and gadolinium as soluble poisons
LEU-MISC-THERM-003	U(4.31)O2 fuel rods in uranyl nitrate solution containing gadolinium
MIX-COMP-THERM-017	FFTF Fuel Criticals in Water
FY 2009	
IEU-COMP-THERM-007	Power Burst Facility – Water Moderated 18.5% Enriched Uranium Ternary Oxide Fuel Pin Lattice
U233-COMP-THERM-002	LWBR $^{233}UO_2$-ThO_2 Detailed Cell Experiments -- Work For Others
FY 2010	
IEU-COMP-THERM-006	Critical Experiments with BORAX-V Boiling and Superheater Fuel Assemblies
U233-COMP-THERM-003	LWBR $^{233}UO_2$-ThO_2 BMU Experiments -- Work For Others
FY 2011	
PU-MET-FAST-042	Plutonium Hemishells in Oil - Part II
PU-MET-FAST-043	Plutonium Hemishells in Oil - Part III
HEU-COMP-THERM-019	Critical Experiments with BORAX-V Superheater Fuel Assemblies
FY 2012 and Beyond	
LEU-COMP-THERM-071	Loss of Fluid Test Reactor – Water Moderated Array of 4% Enriched Uranium PWR Fuel Assemblies
Others	To Be Determined

Table C-4. Los Alamos National Laboratory

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN LOS ALAMOS NATIONAL LABORATORY	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
(Section 1)	Subcritical Measurements of the Nickel Reflected Plutonium Sphere
HEU-MET-FAST-086 Rev.	Pulsed Godiva-IV (Mosteller) Transient
FY 2009	
Others	To Be Determined
FY 2010	
Others	To Be Determined
FY 2011	
Others	To Be Determined
FY 2012 and Beyond	
PU-MET-INTER-003	SM4/SM6, Pu Reflected with Graphite and Beryllium
PU-MET-INTER-004	SM5, Pu Reflected with D_2O
PU-MET-FAST-046	NASA Related Programs Part IV – Re/Graphite
PU-MET-THERM-002	P022, Pu / Si / Poly (2x2)
PU-MET-THERM-003	P023, Pu / Al / Poly
PU-MET-THERM-004	P024 / P025, Pu / MnO / Poly (1x1 and 2x2)
HEU-MET-INTER-011	SM1, Special Moderator HEU/Graphite
HEU-MET-INTER-013	Z013/Z014, ZEUS (HEU) Intermediate Energy Spectrum with SiO_2
HEU-MET-INTER-014	SM3, HEU Reflected by Beryllium
HEU-MET-INTER-017	NASA Related Programs Part II – Nb – 1Zr / Graphite
HEU-MET-FAST-059	NASA Related Programs Part III – Ta-2.5W/Graphite
HEU-MET-FAST-074	Critical Mass of Oralloy Shells
HEU-MET-THERM-017	P012, Waste Matrices HEU / Ca / Poly
HEU-MET-THERM-019	PO13, Waste Matrices HEU / Zr / Poly (1x1)
HEU-MET-THERM-020	P016, HEU / Concrete / Poly (2x2)
HEU-MET-THERM-021	P017/P018, HEU / Al_2O_3 / Poly (1x1 and 2x2)
MIX-MET-FAST-014	P019, Pu(δ) /HEU
SPEC-MET-FAST-005	Replacement Measurements Performed with Am-241
SPEC-MET-FAST-006	Replacement Measurements Performed with Am-243
SPEC-MET-FAST-009	NP001/NP002 Neptunium/HEU Critical (natural uranium reflected)
SPEC-MET-FAST-010	NP003, Neptunium/HEU/Be Reflected
SPEC-MET-FAST-012	NP006, Neptunium Reflected with Tungsten
SPEC-MET-FAST-013	NP005, Neptunium/HEU Reflected with Beryllium
SUB-SPEC-MET-FAST-001	SUB2, Bare and HEU Reflected ^{237}Np Spheres
Others	To Be Determined

Table C-5. Lawrence Livermore National Laboratory

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN LAWRENCE LIVERMORE NATIONAL LABORATORY	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
HEU-MET-THERM-028	SPADE Experiments -- BeO Moderated Oy with Materials such as Iridium, Rhenium, Hafnium, Silver, Tantalum, Hastalloy, Indium, Cadmium, Tungsten, Niobium, Gold, or Aluminum in a Central Slot (~250 Configurations) – Part I
HEU-MET-THERM-030	SNOOPY Experiments -- Graphite Moderated HEU Foils – Part III(C/U = 2340)
HEU-MET-MIXED-013	SNOOPY Experiments -- Graphite Moderated HEU Foils – Part II (C/U = 1200)
FY 2009	
HEU-MET-THERM-029	SPADE Experiments Special Materials – Part II
FY 2010	
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part I. Plutonium
FY 2011	
HEU-MET-FAST-056	Graphite – Oy – D2O System (C/U: 500 – 35000)
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part II. Beryllium
FY 2012 and Beyond	
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part III. TBD
Neutron Transmission	LLNL (Bramblett & Czirr) ^{235}U and ^{239}Pu Plate Transmission Measurements
Others	To Be Determined

Table C-6. Oak Ridge National Laboratory

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN OAK RIDGE NATIONAL LABORATORY	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
LEU-MET-THERM-007	U(4.89) Metal Rods in Water or Uranyl Fluoride Solution
SUB-HEU-SOL-THERM-002	WINCO Slab Tanks with HEU Uranyl Nitrate Solution
FY 2009	
IEU-COMP-MIXED-001	Cronin UF4-CF2 from 12.5 to 37.5% ^{235}U (ORNL-2968)
IEU-MET-THERM-001	Cronin U(37.5) Metal Experiments, Recently Unclassified
LEU-COMP-THERM-067	Cronin Sterotex U(4.89) Blocks, H/U from 0 to 37, ORNL-2986
FY 2010	
IEU-MET-FAST-018	Polyethylene Reflected and Unreflected Cuboids of U(37.5) Metal
FY 2011	
LEU-MET-THERM-008	Libby Johnson U(4.89) Metal Rods, Various Interstitial Absorbers
FY 2012 and Beyond	
MIX-COMP-INTER-004	Cooperative Analysis of ^{238}U MOX Experiment with LANL
HEU-MET-FAST-081	GROTESQUE: A U(93.2) Metal Assembly [Table 5, CAS23]
HEU-SOL-THERM-048	HEU Uranyl Fluoride Solution (82 g U/l) in Slab Arrays (ORNL/CF-56-7-148)
LEU-SOL-THERM-026	U(4.89)O2F2 Solution in Cylinders, Spheres, and Boxes, H/X from 524 to 1009 (ORNL-2968)
U233-MET-INTER-001	Critical Measurements on the ^{233}U ZPPR Plates in the LANL ZEUS Assembly
	Critical assemblies pertinent to reactor design & fuel cycle materials processing associated with the Generation-IV reactor concepts for nuclear energy generation, the advanced high temperature reactor concepts for hydrogen production and the space applications of nuclear energy. In this historical period, critical experiments pertinent to these applications were performed in Oak Ridge and elsewhere.

Table C-7. Sandia National Laboratories

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN SANDIA NATIONAL LABORATORIES	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
LEU-COMP-THERM-080	Water-Moderated Square-Pitched U(6.91)O_2 Fuel Rod Lattices
FY 2009	
FY 2010	
FY 2011	
FY 2012 and Beyond	

Table C-8. Savannah River National Laboratory (Washington Safety Management Solutions, LLC)

INTERNATIONAL CRITICALITY SAFETY BENCHMARK EVALUATION PROJECT FIVE-YEAR PLAN SAVANNAH RIVER (WASHINGTON SAFETY MANAGEMENT SOLUTIONS, LLC)	
IDENTIFIER	**DRAFT TITLE**
FY 2008	
HEU-MET-FAST-076 Revision 1	Addition of Simplified Model
HEU-MET-THERM-034 (Joint WSMS/LANL)	Polyethylene Reflected And Moderated Highly Enriched Uranium System With Ni-Cr-Mo-Gd Alloy
U233-COMP-THERM-004	Bettis U233-Th Lattice Physics Experiments, Judd Hardy, et.al.
FY 2009	
HEU-COMP-INTER-007	HEU Space Reactors
SUB-PU-MET-FAST-002 (Joint WSMS/LANL)	Nickel-Reflected Plutonium Metal Sphere Subcritical Noise Measurements
SUB-PU-MET-THERM-001	Arrays of Pu-Al Alloy Rods in H2O [UCNI]
FY 2010	
SUB-HEU-MET-THERM-002	Subcritical (Exponential) SRS Fuel Assemblies (Mk XVIB and Mk XIIA)[UCNI]
SUB-LEU-MET-THERM-008	Subcritical (Exponential) SRS Fuel Assemblies (Mk V and Mk 15) 0.95 to 1.1% Enriched
FY 2011	
FY 2012 and Beyond	
Others	To Be Determined

Appendix D

Nuclear Data Needs

NDAG Review: Priority Needs / Additional Needs	Thermal scattering (BeO, HF, D_2O, SiO_2, CH_2, C_2F_4, $C_5O_2H_8$, etc.), ^{239}Pu, Cr, ^{237}Np, Pb, W, ^{55}Mn, Ti, ^{240}Pu, Fe, ^{58}Ni, ^{60}Ni / ^{233}U, Th, Be, ^{63}Cu, ^{65}Cu, ^{51}V, Zr, F, K, Ca

Activity	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012†
Differential Measurements (ORNL)	^{240}Pu, ^{237}Np, Ti, Be, Ca, ^{51}V, W, assess thermal scatt (HF, SiO_2)	Li, thermal scatt (HF, SiO_2)	Assess ^{185}Re, ^{187}Re, ^{56}Fe, Zr, thermal scatt data	Possibly higher actinides if priority for reprocessing	Possibly higher actinides if priority for reprocessing
Integral Measurements (LANL)	Subcriticals: $C_5O_2H_8$, Ni W (VNIITF) Al, Cu, Fe, Ni, Pb, Zr, SiO_2 (IRSN)	Subcriticals: W, Cu TBD (VNIITF) Ti (IRSN)	Subcriticals: Pb, ^{55}Mn, Ca, Zr, Mo Criticals: HEU spherical lattice, V foils, V plates	Subcriticals: TBD Criticals: UPF Borabond & ES3100, Flattop gap experiment	Subcriticals: TBD Criticals: TBD
Evaluation	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (RR), ^{52}Cr, ^{53}Cr, ^{55}Mn (UR), thermal scat. graphite, LANL: ^{51}V, Ti isotopes	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (UR); ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V (RR) LANL: ^{240}Pu, ^{16}O, ^{55}Mn	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V (UR) ; Li, ^{138}Ce ^{140}Ce, ^{142}Ce (RR) LANL: W isotopes	ORNL: Zr isotopes LANL: Cu, Be	ORNL: TBD LANL: TBD
Covariance Generation (New evals and retroactive covariance generation)	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (RR), ^{52}Cr, ^{53}Cr, ^{55}Mn (UR) LANL: Ti isotopes	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (UR); ^{237}Np, Ti, Be, Ca, ^{51}V (RR), W LANL: ^{240}Pu, ^{16}O, ^{51}V, ^{55}Mn	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V (UR) ; Li, ^{138}Ce ^{140}Ce, ^{142}Ce (RR) LANL: W isotopes	ORNL: Zr isotopes LANL: Cu, Be	ORNL: TBD LANL: TBD
ENDF Evals delivered to NNDC	ORNL: ^{55}Mn, ^{52}Cr, ^{53}Cr LANL: Ti isotopes	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu LANL: ^{240}Pu, ^{55}Mn, ^{16}O, ^{51}V	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V LANL: W isotopes	ORNL: Zr isotopes LANL: Cu, Be	ORNL: TBD LANL: TBD
CSEWG Testing	Beta Versions of -VII.1 evaluations, including covariance data	Beta Versions of -VII.1 evaluations, including covariance data	Beta Versions of -VII.1 evaluations, including covariance data	Beta Versions of -VII.1 evaluations, including covariance data	Beta Versions of -VII.1 evaluations, including covariance data
Processed Libraries	Beta Versions of -VII.1	Beta Versions of -VII.1	Beta Versions of -VII.1	Beta Versions of -VII.1	Beta Versions of -VII.1

† FY 2012 effort is anticipated to include measurements (differential and integral) and evaluations of the isotopes to address the data needs for advanced fuel cycles.

Potential Materials by Application for NDAG Review and/or Utilization of NCSP Nuclear Data Infrastructure-Supported Resources

DOE/EM & NNSA Criticality Safety Materials	
Priority Needs Additional Materials - DOE & EM McKamy Report (Quality Assessment)	Pb, W, Fe, Cr, Mn, ^{240}Pu, Ti, Thermal data (HF, CH_2, $C_5O_2H_8$) / Np, V, C, N, Zr, Ni, F, Cu, Ce, Ca, K, FP's, higher actinides, nu-bar and multiplicity distribution

Space Reactor Design Materials	
Priority Materials (JIMO Design) Additional Materials - Various Concepts (Quality Assessment)	^{185}Re, ^{187}Re, Ta, Mo, ^{9}Be, W, ^{93}Nb, ^{151}Eu, ^{153}Eu, O, ^{14}N, Hf, ^{6}Li, ^{7}Li / Zr, Fe, Ni, Cr, Mn, Na, K, Gd, ^{10}B, ^{11}B, C, thermal data (ZrH_2, BeO, YH_2, ^{7}LiH)

DOE/RW Yucca Mountain Materials	
Priority Nuclides / Additional Fission Products / Additional Nuclides	^{149}Sm, ^{143}Nd, ^{103}Rh, ^{151}Sm, ^{133}Cs, ^{155}Gd, ^{155}Eu / ^{152}Sm, ^{99}Tc, ^{145}Nd, ^{147}Sm / Ni, Fe, Cr, ^{55}Mn, ^{235}U, ^{238}U, ^{239}Pu, higher actinides, tuff, concrete, Thermal data (SiO_2, NaCl)

Space Reactor Shielding Materials	
Priority Materials (SP-100 Design) / Additional Materials - Various Concepts	^{7}Li, ^{6}Li, ^{9}Be, ^{1}H, W / ^{11}B, ^{10}B, C, Ti, Fe, Ni, Cr, Zr, lunar regolith (O, Si, Al, Ca, Fe, Mg, Na, Ti)

AFCI, GEN-IV, NGNP Materials	
Priority Materials (Palmiotti & Salvatores) / Additional Materials - Various Concepts – Workshop Minutes (Ti), Forsberg's MSFR (Rb)	^{232}Th, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{242m}Am, ^{243}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm, ^{245}Cm, Pb, Bi, ^{56}Fe, ^{57}Fe, ^{58}Ni, ^{52}Cr, Zr, ^{15}N, Si, C, O, Na, ^{10}B ^{1}H / Ti (5 isotopes), ^{85}Rb, ^{87}Rb, Thermal data (graphite, SiC)

Appendix E

FY 2008 Projected Foreign Travel Requests

International Criticality Safety Benchmark Evaluation Project

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) is an international program involving 19 different countries and the OECD-NEA. As such, annual project Technical Review Group meetings are generally held outside the United States every other year. Approximately 15 - 20 participants from the United States (including Review Group Members, evaluators, independent reviewers, and administrative support) are required to travel to these meetings. One individual, the project administrator, is also expected to travel to the host country several months in advance to meet with the local hosts and finalize the meeting arrangements. The FY 2008 ICSBEP Meeting is currently scheduled to be held in the Prague, Czech Republic. Other meetings outside the United States are planned for 2010 and 2012.

The Chair of the ICSBEP is expected to attend OECD-NEA Working Party on Nuclear Criticality Safety (WPNCS) Meeting on an annual basis where a report on ICSBEP activities is made. This meeting is typically held at NEA headquarters in Paris, France in September.

Programmatic trip to the Russian Federal Nuclear Center Institute of Technical Physics (VNIITF) in Snezhinsk, Russian Federation or to the Commissariat à l'Énergie Atomique (CEA) Valduc Centre, near Dijon, FRANCE to participate in or observe some of the experiments that are being performed under the ICSBEP International Experiments Subtask will be scheduled as needed. The dates of these possible trips are yet to be determined.

The International Conference on the Physics of Reactors (PHYSOR'08) will be held 14-19 September 2008 in Interlaken, Switzerland and the International Conference on Nuclear Data for Science and Technology (ND-2010) will be held in Korea in 2010. The ICSBEP Project Manager and Project Administrator are typically called upon to present a paper on the status of integral benchmark activities and distribute copies of the ICSBEP and IRPhEP Handbooks at these meetings.

Periodically, data are identified in nonparticipating countries and these countries are invited to contribute their data. In some cases, an information/training meeting in the new participating country is deemed appropriate. In addition, the manager of the ICSBEP is occasionally (typically once per year) invited to make presentations at various meetings and conferences on the status and progress of the Project.

The cost for all trips, except for student travel, includes travel expenses and labor. Student travel is limited to travel expenses only.

FY 2008 PROJECTED FOREIGN TRAVEL FOR ICSBEP*

Requested Travel	Dates	Location	No.	Justification
Annual ICSBEP Technical Review Meeting	5-9 May, 2008	Prague, Czech Republic	16 to 18	Manager of ICSBEP (J. Blair Briggs)
				ICSBEP Publication Manager and Project Administrator (Lori Scott)
				ICSBEP Independent Reviewer and Evaluator (Virginia F. Dean)
				ICSBEP Independent Reviewer and Evaluator (A. Nichole Ellis)
				ICSBEP Representative from SRNL paper (Fitz Trumble)
				ICSBEP Evaluator from SRNL (Raymond Reed)
				ICSBEP Representative from ANL (Richard D. McKnight)
				ICSBEP Representative from ANL (Robert Schaefer)
				ICSBEP Representative from LLNL (David Heinrichs)
				ICSBEP Evaluator from LLNL (Soon Sam Kim)
				ICSBEP Representative from ORNL (Calvin M. Hopper)
				ICSBEP Evaluator from ORNL (Ed Blakeman)
				ICSBEP Evaluator from INL (Chad Pope)
				ICSBEP Representative from LANL (Rene Sanchez)
				ICSBEP Representative from LANL (Skip Kahler)
				ICSBEP Representative from Hanford (David Erickson)
				TBD
				TBD

*The cost for all trips, except for student travel, includes travel expenses and labor. Student travel is limited to travel expenses only.

FY 2008 PROJECTED FOREIGN TRAVEL FOR ICSBEP (Continued)*

Requested Travel	Dates	Location	No.	Justification
Working Party on Nuclear Criticality Safety	September 2008	Paris, France	1	The Chair of the ICSBEP is expected to attend the annual OECD-NEA Working Party on Nuclear Criticality Safety (WPNCS) Meeting on an annual basis where a report on ICSBEP activities is made. (J. Blair Briggs)
PHYSOR 2008	14 – 19 September	Interlaken, Switzerland	2	ICSBEP Project Manager (J. Blair Briggs) will be presenting a paper on the status of integral benchmark activities and is a member of the Technical Program Committee. The ICSBEP Publications Manager / Project Administrator (Lori Scott) is responsible for the NEA Booth and will be distributing copies of the ICSBEP and IRPhEP Handbooks.
Programmatic visit to Valduc, France – IRPhEP Mtg. In Paris	TBD 2008	Dijon, France	4	Observe or Participate in IRSN Structural Material Experiments (TBD)
NCSP Experiments that are being performed at VNIITF	TBD 2008	Snezhinsk, Russia	4	Observe VNIITF Experiments (TBD)

*The cost for all trips, except for student travel, includes travel expenses and labor. Student travel is limited to travel expenses only.

Analytical Methods Development and Code Maintenance

1. Trip to IRSN in France to discuss ORNL applicability analysis of IRSN structural material experiments: 2 ORNL staff members.
2. Attendance at PHYSOR 2008 in Interlaken, Switzerland to present latest developments on SCALE, MCNP and VIM: 5 staff members (2 ORNL, 2 LANL, and 1 ANL).
3. Attendance at OECD-NEA Working Party on Nuclear Criticality Safety (Paris, France) in September 2008 to attend planned expert group meetings on sensitivity/uncertainty, source convergence, and burn-up credit: 4 staff members (2 ORNL, 1 LANL, and 1 ANL).
4. Attendance at OECD-NEA Working Party Nuclear Criticality Safety (Paris, France) inaugural meeting of the expert group on Uncertainty Methods for NCS: 1 ORNL staff member.

Nuclear Data

1. Participate in the 4th Workshop on Neutron Measurements, Evaluations and Applications Nuclear Data Needs for GEN-IV and Accelerator Driven Systems October 16-18, 2007 (Prague, Czech Republic) and in the meeting of WPEC Subgroup 26 to plan nuclear data and covariance data needs and priorities: 4 staff members (1 each from BNL, LANL, ORNL and ANL).
2. Travel to IPEN (Nuclear Energy Research Institute) in December 2007 to provide invited talk on utilization of integral benchmark data in nuclear data evaluation application and discuss cooperative efforts to use Brazilian integral data to support NCSP activities for covariance data development: 1 ORNL staff member.
3. Attend PHYSOR 2008 in Interlaken, Switzerland to present latest ORNL/NCSP activities on differential data measurements, nuclear data evaluations, covariance data development, and data validation: 5 staff members (2 ORNL, 2 LANL, 1 ANL).
4. Attend the OECD-NEA WPEC (Paris, France) in June 2008 to assure continued international collaboration on nuclear data evaluation, formatting, and covariance development: 7 staff members (2 ANL, 2 LANL, 2 ORNL, 1 BNL).

Integral Experiments

Two LANL staff members to Valduc, France for training (two trips for each individual for two weeks each trip).

Information Preservation and Dissemination

None projected.

Training and Qualification

None Projected.

Appendix F

FY 2008 Prioritized Unfunded Tasks

T&Q-1(1) ANL/LLNL	Multi-Media NCSET Module Development on Nuclear Instrumentation	**Subtask:** Develop a multimedia training module entitled "Nuclear Instrumentation" adapted from Module 5 in the Nuclear Criticality 4-Day Training Course at LLNL. This module is presented by a very senior and well-recognized instrumentation expert at LLNL and has received many positive compliments from the course attendees. It is a 90 minutes lecture covering radiation, detectors, and the accompanying electronics. Applications are discussed that include detector responses for various experiments including sub critical measurements. This task consists of videotaping the lecture and the speaker's presentation materials, then developing a multimedia training module that can be streamed from the NCSP website. This task will be performed by the LLNL training section, coordinated by the LLNL criticality safety section in conjunction with the ANL criticality safety section. **Milestone:** The module will be implemented on the NCSP website (30 September 2008)	$20K
IP&D-6	Phase I: Evaluate viability of generating a criticality safety standard for 55-gallon waste drums	**Subtasks:** 1. Document steps that will be taken to identify data needs and the approach used to perform the other activities outlined below ($10K) 2. Obtain review from end users on data needs and approach to gather data. Use data gathering approach to obtain data from other sites ($10K) 3. Organize the data into a compilation that will support an evaluation of the viability of establishing a standard for managing and/or analyzing 55-gallon waste drums ($10K) 4. Determine if the available data would support the development of a standard for managing and/or analyzing 55-gallon waste drums ($10K) 5. Document a recommendation for the development of a standard for managing and/or analyzing 55-gallon waste drums. To support the standard development, an approach equivalent to the ANSI/ANS PINS will be used to obtain consensus on the objectives for the analysis standard ($10K) **Milestones:** 1. Draft the approach (November 1, 2007) 2. Poll the End Users (January 15, 2008) 3. Consolidate/Evaluate the End User Data (March 15, 2008) 4. Evaluate the viability of such a standard (May 15, 2008) 5. Document the path forward (July 15, 2008)	$50K

Integral Experiments-6 ORNL	Subcritical Experiment Measurement and Analysis Support	**Subtask:** Provide additional training/mentoring and expert consultation to LANL CEF Operations staff in the setup, performance, and data reduction of sub critical noise analysis measurements. **Milestone:** Participate in one more subcritical measurement and data reduction exercise in FY 2008 (June 30, 2008).	$30K
Integral Experiments-7 ORNL	Cf Source Detector for Subcritical Experiments	**Subtask:** This subtask will provide the Cf source/detector needed to perform sub critical experiments scheduled for CEF in FY09. The subtasks consist of producing the required quantity (at least 1.35 micro-grams) and purity (remove potential non-Cf contaminant sources) of Cf-252 needed. Prior to commencing the task, ORNL will work with LANL to assess sub critical experiment plans and CEF handling capabilities to help assure the Cf source size is sufficient to remain viable for sub critical experiments through FY12. **Milestones:** 1. Obtain list of planned sub critical experiments from C_EDT and assess size of needed Cf source (March 31, 2008). 2. Produce Cf source and source detector (August 31, 2008). 3. Ship new source and source detector to CEF (September 30, 2008)	$75K
Integral Experiments-8 ORNL	Software Quality Assurance (SQA) for the Subcritical Noise Analysis Experiments Interpretive Software	**Subtask:** Conduct SQA for the subcritical noise analysis experiments interpretive software. **Milestone:** Provide SQA document for subcritical noise analysis experiments interpretive software (September 30, 2008)	$35K
T&Q-6 ORNL	Subcritical Measurement Training and Qualification	**Subtask:** Develop training materials to qualify personnel for computational analysis of subcritical noise analysis experiments and interpretation of the measured results. **Milestone:** Complete the training package (September 30, 2008)	$35K
ND-1 LLNL	Nuclear Data Support	**Subtask:** Process and test the latest cross-data, participate in national and international code inter-comparison studies and conferences, including cross-section and integral data testing in support of ENDF/B-VII. **Milestones:** (dates to be determined if task is funded) 1. Produce a PREPRO processed and tested point wise (continuous) ENDF/B-VII (Release 0) library. 2. Release (via RSICC) of this new state-of-the-art library in the COG code. 3. Participation in CSEWG, IAEA, NDAG, and OECD-NEA activities.	$100K
ND-6 BNL, LANL, & ORNL	Complete Low-Fidelity Covariance Data	**Subtasks and Milestones:** (to be determined if task is required)	$75K

Methods-4(11) ORNL	Low-Fidelity Covariance Data Testing	**Subtask:** Perform detailed testing and use of the multi-laboratory low-fidelity covariance data. The expectation is that the low-fidelity covariance data will be produced with limited application testing. This task will enable ORNL to use the TSUNAMI software with the low-fidelity covariance data to perform sensitivity/uncertainty analyses of benchmark critical experiments and criticality applications of interest. **Milestones:** Documentation of covariance library testing (date to be determined if task is approved)	$75K
Methods-3 LANL	MCNP Sensitivity and Uncertainty Capability	**Subtasks:** 1. Incorporate the Wielandt acceleration technique for k_{eff} problems into MCNP. 2. Research the capability to calculate adjoint (importance) functions during a standard, forward criticality calculation. 3. Develop the capability to convey nuclear data uncertainties or covariances to MCNP for use in uncertainty analyses. Define and document MCNP data library format extensions for uncertainty and covariance data and initiate development of methods to create such data. **Milestones:** (Milestones and dates to be determined if task is approved)	$220K
Methods-4(14) ORNL	Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers	**Subtask:** Expand the Pitzer capability to include binary uranium and plutonium systems, including selected absorbers, using data obtained from literature searches and chemistry experiments. **Milestone:** Insert new uranium and plutonium solution algorithms in the SCALE material input processor (date to be determined if task is approved)	$280K

Appendix G

Program-Specific Applications

This section describes those activities aligned with the tasks and infrastructure capabilities maintained by the NCSP that are not officially part of the NCSP Five-Year Plan. This information is provided for information and completeness, as the tasks described below are contingent upon funding and management decisions outside the purview of the NCSP Manager. As such, the tasks and deliverables mentioned in this section are not NCSP commitments.

International Criticality Safety Benchmark Evaluation Project

The following ICSBEP related program-specific activities have been proposed and will be accomplished if the additional funding, delineated below, is provided:

1. ICSBEP participation of scientists from up to five weapons-related institutes in the Russian Federation has been proposed to NNSA's office of Nuclear Non-Proliferation at a cost of $300K per year. Scientists from the Russian Federation joined the ICSBEP in 1994 and are the second largest contributor; however the level of their participation has declined significantly since 1997 because of lack of funding. Inclusion of these scientists in the ICSBEP naturally supports the DOE Office of Nuclear Nonproliferation's mission in that it provides meaningful safety-related work for former weapons scientists from Russia and Kazakhstan. In addition, DOE receives high-quality criticality safety related data and the expertise developed in the Russian Federation. This is an ongoing proposal with the hope of obtaining funding beginning in FY 2008.

2. SNL plans to perform and evaluate an experimental series involving water-moderated square-pitched U(6.91)O2 fuel rod lattices during CY 2008 to 2009 as part of a Nuclear Energy Research Initiative (NERI) Project. The cost of the experiments is estimated to be nearly $3M of which approximately $50K to $60K would be used for the ICSBEP evaluation of the resultant benchmarks.

3. Plans have also been initiated to perform additional burn-up credit type experiments at SNL in the 2008 to 2011 time frame. These experiments are intended to be follow-on to the NERI, DOE Office of Nuclear Energy, Science and Technology (NE)-20 sponsored burn-up credit experiments that were evaluated and approved by the ICSBEP in FY 2005. The cost of the program is several million dollars and is subject to availability of funding from the Office of Civilian Radioactive Waste Management.

Program-specific applications are typically integrated with the annual ICSBEP working group meeting or publication schedule. When necessary, extra effort is made to advance program-specific applications through the independent review process and make the unofficial information available to the customer prior to formal publication. This information is subject to revision after the international review and approval process is completed.

Analytical Methods Development and Code Maintenance

ORNL is working with ISOTEK through both the Office of Environmental Management and NCSP funding to provide assistance for them to use the S/U capabilities of TSUNAMI within their criticality safety evaluation being prepared for U-233 operations at ORNL. ORNL has also worked with the NRC to implement a prototypic, continuous energy version of SCALE/KENO that is planned for release within SCALE 6.0. Similarly, the NRC has requested development of a new SCALE analysis sequence that can be used to assess the adequacy of criticality accident alarm systems. A year-end report discussing all FY 2008 SCALE development and maintenance activities and the sponsor will be provided to the NCSP Manager.

Nuclear Data

ORNL continues to work with the European Union's Institute for Reference Material and Measurements in Belgium and Rensselaer Polytechnic Institute to assure collaboration on differential data measurements and their use in current and planned data evaluations. ORNL is also working with Brazil to obtain integral experiment data that can support improved covariance data verification. ORNL is also working with the European nuclear data community to leverage work efforts to address data issues for tungsten, which is a structural material important for criticality applications and fusion applications. The international collaborators are planning high-energy cross-section evaluation work for tungsten that will complement the NCSP differential measurement and evaluation effort in the resonance region for tungsten.

BNL, LANL, ORNL, and ANL are working to engage the DOE Global Nuclear Energy Partnership (GNEP) sponsors to help expand the scope and technical rigor applied to the development and testing of covariance data. Proposals are being submitted to the advanced reactor programs to fund the further development of covariance data evaluation methodologies and the generation of covariance data for priority nuclides for these applications. If funded, these efforts would help to meet the NCSP requirements for these data.