United States Department of Energy

Nuclear Criticality Safety Program

Five-Year Plan

August 2006

Nuclear Criticality Safety Program Plan, August 2006.

Reviewed:

Adolf Garcia
Chairman
Criticality Safety Support Group

Recommend Approval:

Jerry McKamy
Manager
Nuclear Criticality Safety Program

Approved:

Michael Thompson
Director, Office of Facilities Operations
Defense Programs
National Nuclear Security Administration
Nuclear Criticality Safety Program Sponsor

TABLE OF CONTENTS

LIST OF ACRONYMS

AMPX	Nuclear cross-section processing computer code
ANL	Argonne National Laboratory
ANS	American Nuclear Society
ANSI	American National Standards Institute
ARH	Atlantic Richfield Hanford
AROBCAD	Applicable Ranges of Bounding Curves and Data
BNL	Brookhaven National Laboratory
CEF	Criticality Experiments Facility (Project)
CENTRM	Discrete Ordinates Transport Computer Code
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
DAF	Device Assembly Facility
DICE	Database for the International Criticality Safety Benchmark Evaluation Project
DOE	United States Department of Energy
EM	Office of Environmental Management
ENDF	Evaluated Nuclear Data File
FFTF	Fast Flux Test Reactor
FY	Fiscal Year
GLLSM	Generalized Linear Least Squares Method
GNASH[(2)]	A statistical nuclear model computer code
HCTLTR	High Core Temperature Lattice Test Reactor
HEU	Highly Enriched Uranium
ICNC	International Conference on Nuclear Criticality
ICSBEP	International Criticality Safety Benchmark Evaluation Project
INL	Idaho National Laboratory
KENO[(3)]	Monte Carlo criticality computer code
LACEF	Los Alamos Critical Experiments Facility

LANL	Los Alamos National Laboratory
LEU	Low Enriched Uranium
LLNL	Lawrence Livermore National Laboratory
LWBR	Light Water Breeder Reactor
MCNP	Monte Carlo N Particle (N currently equals 3) Computer Code
MOX	Mixed Oxide Fuel
MURR	Missouri University Research Reactor
NA-17	Assistant Deputy Administrator for Facility and Infrastructure Acquisition and Operation
NA-171	Office of Facilities Operations
NASA	National Aeronautics and Space Administration
NE	Office of Nuclear Energy, Science and Technology
NNSA	National Nuclear Security Administration
NCSET	Nuclear Criticality Safety Engineer Training
NCSP	Nuclear Criticality Safety Program
NERI	Nuclear Energy Research Initiative
NDAG	Nuclear Data Advisory Group
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
SAMMY[4]	A nuclear model computer code
S/U	Sensitivity and Uncertainty
SCALE[5]	Standardized Computer Analyses for Licensing Evaluation
SRS	Savannah River Site
VIM	Vastly Improved Monte Carlo Computer Code
WINCO	Westinghouse Idaho Nuclear Company
ZPPR	Zero Power Physics Reactor

ZPR Zero Power Reactor

(1) COG was originally developed to solve deep penetration problems in support of underground nuclear testing. Variance reduction techniques are very important to these problems and hence the name COG was chosen as in "to cog the dice" or cheat by weighting.
(2) GNASH is a pre-equilibrium, statistical nuclear model code based on Hauser-Feshbach theory (and additional models) for the calculation of cross sections and emission spectra, primarily in the epithermal and fast neutron energy ranges.
(3) KENO is a family of Monte Carlo criticality codes whose name came from an observation of the KENO game in which small spheres, under air levitation, arbitrarily move about in a fixed geometry.
(4) SAMMY is a nuclear model code, which applies R-Matrix theory to measured data and produces resolved and un-resolved resonance parameters in Reich-Moore and other formalisms. The name SAMMY was a personal choice of the author.
(5) SCALE is a system of well-established codes and data for performing nuclear safety (criticality, shielding, burn up-radiation sources) and heat transfer analyses.

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. This infrastructure includes key calculative tools, differential and integral data measurement capability, training resources, and web based systems to enhance information preservation and dissemination. The objective of operational nuclear criticality safety is to ensure that fissile material is handled in such a way that it remains subcritical under all normal and credible abnormal conditions to protect workers, the public, and the environment. A robust operational criticality safety program requires knowledgeable people and technical resources. The NCSP maintains these two key elements so the DOE can continue to do work safely and efficiently with fissile materials.

The NCSP is funded by the Assistant Deputy Administrator for Facilities and Infrastructure Acquisition and Operation (NA-17), Defense Programs, National Nuclear Security Administration (NNSA)[1]. Dr. Jerry McKamy, from the Office of Facilities Operations (NA-171) 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 (DOE Contractor Criticality Safety Representatives) regarding DOE Field criticality safety issues.

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 benchmarked 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.

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 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: the Criticality Experiments Facility (CEF) and the Oak Ridge Electron Linear Accelerator (ORELA). Figure ES-1 contains a flow chart that shows how the NCSP works and Figure ES-2 contains a NCSP organizational chart.

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 five-year plan along with budget, schedule, and a description of how each of the program elements contributes to the overall enhancement of operational criticality safety. The various NCSP task managers proposed tasks for fiscal year 2007 totaling approximately $17M during the annual planning cycle. All were considered, evaluated and prioritized by the CSSG and the NCSP Manager to determine the highest priority tasks in order to wisely allocate the limited funds available. A budget summary for the NCSP is contained in Table ES-1. DOE program specific applications of NCSP resources are coordinated by the NCSP Manager and costs are recovered wherever appropriate.

The program specific application section of this plan contains detailed information about scheduled and proposed work. In addition, the expertise resident within the CSSG is used to assist sites on a periodic basis and a structured communications/feedback process has been developed to support operational criticality safety programs. Details about these activities are contained in the NCSP Support section of the Plan.

Figure ES-1 How the Nuclear Criticality Safety Program Works

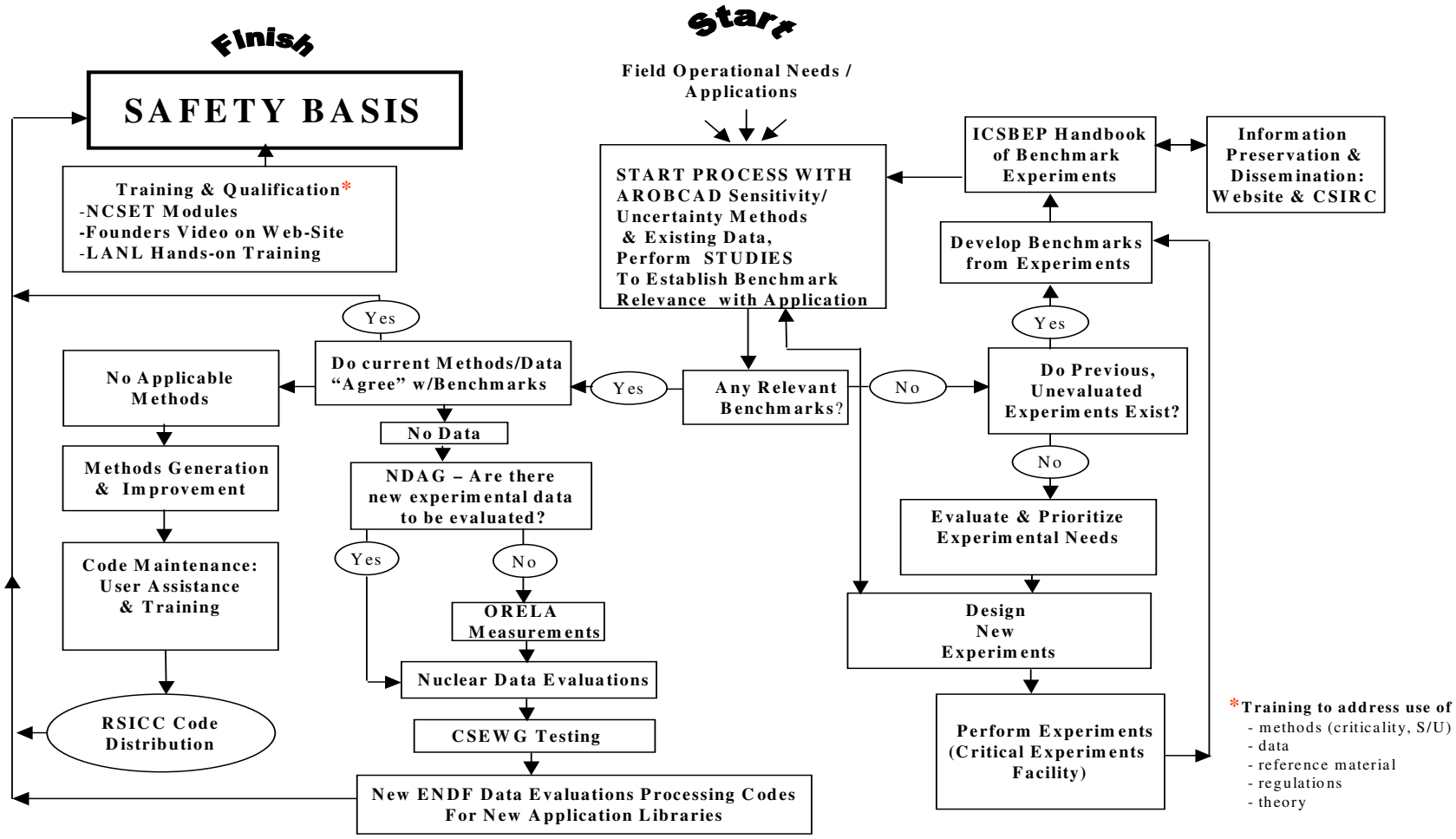

Figure ES-2: Nuclear Criticality Safety Program Organization

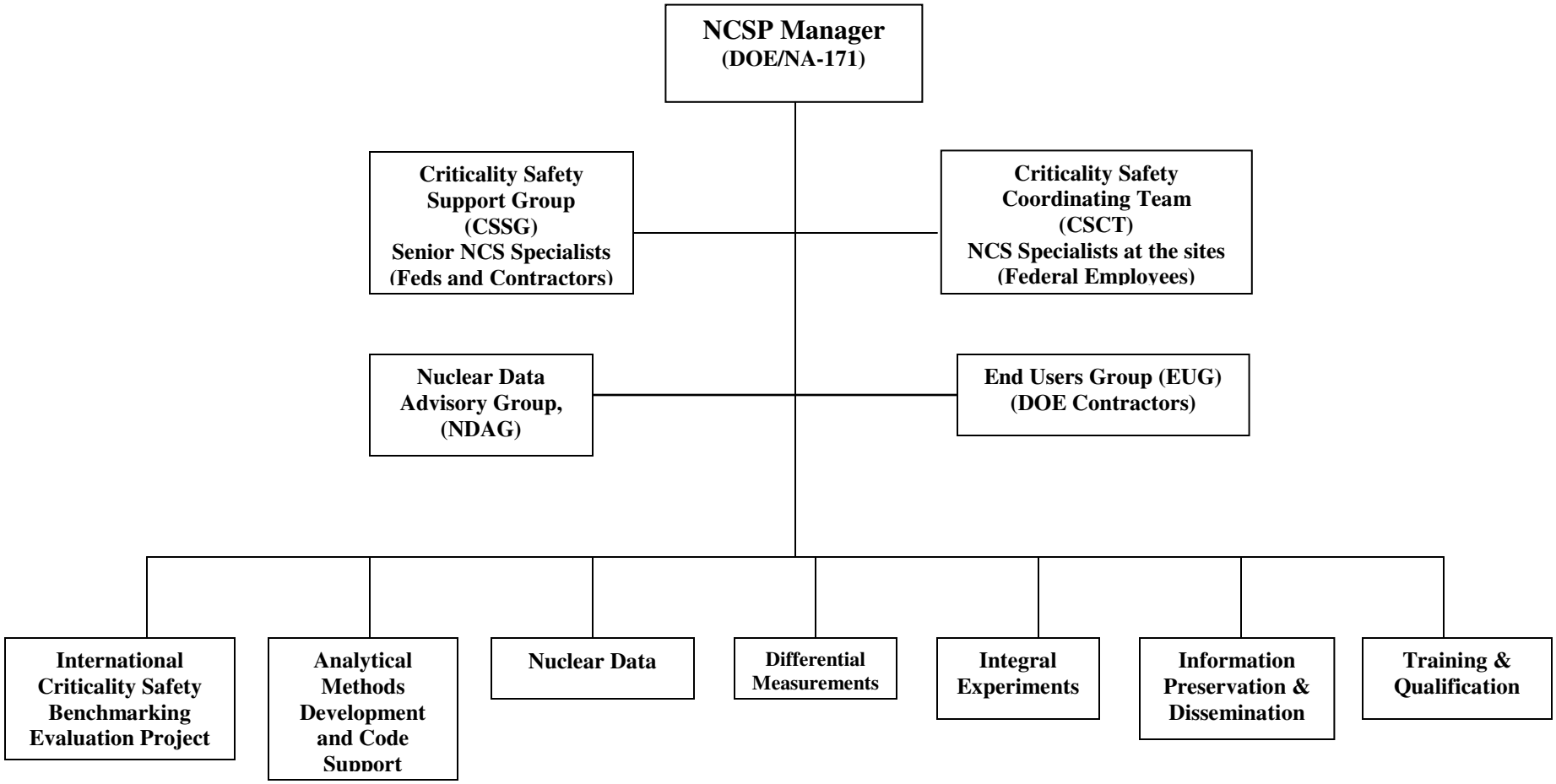

Table ES-1: Nuclear Criticality Safety Program Base Funding, Fiscal Years 2007 – 2011

	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
International Criticality Safety Benchmark Evaluation Project	1,935	1,975	2,015	2,055	2,095
Analytical Methods Development and Code Support	3,330	3,400	3,470	3,335	3,405
Nuclear Data	1,842	1,649	1,681	1,713	1,745
Differential Measurements	950	970	350	360	370
Integral Experiments	1,250	1,600	2,300	2,400	2,500
Information Preservation and Dissemination	233	239	245	251	257
Training and Qualification	300	285	270	365	375
NCSP Support	355	375	390	405	420
TOTAL	10,195	10,493	10,736	10,884	11,167

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

1. 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 of 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 calculative tools, differential and integral data measurement capability, training resources, and web based systems to enhance information preservation and dissemination. The objective of operational nuclear criticality safety is to ensure that fissile material is handled in such a way that it remains subcritical under all normal and credible abnormal conditions to protect workers, the public, and the environment. A robust operational criticality safety program requires knowledgeable people and technical resources. The NCSP maintains these two key elements so the DOE can continue to do work safely and efficiently with fissile materials.

The NCSP is funded by the Assistant Deputy Administrator for Facilities and Infrastructure Acquisition and Operation (NA-17), Defense Programs, National Nuclear Security Administration (NNSA)[1]. Dr. Jerry McKamy, from the Office of Facilities Operations (NA-171) 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 (DOE Contractor Criticality Safety Representatives) regarding DOE Field criticality safety issues.

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 benchmarked 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.

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 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 the seven technical program elements, two facilities provide nuclear data measurement capability for the NCSP: the Criticality Experiments Facility (CEF) and the Oak Ridge Electron Linear Accelerator (ORELA). Figure ES-1 contains a flow chart that shows how the NCSP works and Figure ES-2 contains a NCSP organizational chart.

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 five-year plan along with budget, schedule, and a description of how each of the program elements contributes to the overall enhancement of operational criticality safety. The various NCSP task managers proposed tasks for fiscal year 2007 totaling approximately $17M during the annual planning cycle. All were considered, evaluated and prioritized by the CSSG and the NCSP Manager to determine the highest priority tasks in order to wisely allocate the limited funds available. Approved tasks are included in each of their respective sections of this plan. A prioritized list of the unfunded tasks is included in Appendix F. A budget summary for the NCSP is contained in Table ES-1. DOE program specific applications of NCSP resources are coordinated by the NCSP Manager and costs are recovered wherever appropriate.

The program specific application section of this plan contains detailed information about scheduled and proposed work. In addition, the expertise resident within the CSSG is used to assist sites on a periodic basis and a structured communications/feedback process has been developed to support operational criticality safety programs. Details about these activities are contained in the NCSP Support section of the Plan.

2. International Criticality Safety Benchmark Evaluation Project (ICSBEP)

Program Element Description

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) was initiated in 1992 by DOE's Defense Programs, now 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 17 different countries. The ICSBEP is also an official activity of the Organization for Economic Cooperation and Development - Nuclear Energy Agency (OECD-NEA).

The purpose of 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 as a *capability maintenance* activity that helps reduce operational costs and inefficiency and provides necessary tools to ensure compliance with the American National Standards Institute (ANSI) American Nuclear Society (ANS) standards and the Nuclear Regulatory Commission (NRC) license requirements.

Approved Sub Tasks (FY 2007)

The ICSBEP is divided into three subtasks, ICSBEP Infrastructure, Laboratory Participation, and International Experiments. Infrastructure includes project management, project administration, a significant fraction of the 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. Laboratory Participation includes data evaluation; internal peer review; limited

independent peer review; and ICSBEP meeting preparation, participation, and travel by participants at each of seven national laboratories or sites: INL, LANL, LLNL, ORNL, ANL, SRNL, and the Hanford Site. SNL and Bettis Atomic Power Laboratory also participate at their own expense. 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. When possible LANL experimenters are given the opportunity to either participate in or observe the experiments.

Proposed Future Sub Tasks (FY-2008 and beyond)

Specific evaluations that are planned for FY-2007 through FY-2011 are provided in Appendix C. The lists of planned experiment evaluations given in Appendix C are dynamic and are not all-inclusive. Every planned benchmark shown in Appendix C has been placed there because of its importance to programs at one or more of the participating DOE Laboratories or sites.

Budget

Table 2-1: ICSBEP Budget, Fiscal Years 2007 – 2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
1. ICSBEP Infrastructure (INL)	885	941	996	1,051	1,061
2. National Laboratory Participation (All)	950	934	1,019	1,004	1034
3. International Experiments (Russia)	100	100	TBD	TBD	TBD
TOTAL	1,935	1,975	2,015	2,055	2,095

3. Analytical Methods Development and Code Support

Program Element Description

This program element provides for the development and maintenance of redundant, 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 Oak Ridge National Laboratory (ORNL). The NCSP software (codes and processed data) supported by the 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:

1) reducing safety risk and operational costs by providing rigorous and reliable software with associated technical information and training material needed to qualify users;
2) maintaining unique technical capability;
3) providing the analytical capability to meet DOE compliance requirements and external regulatory commitments.

This program element supports work at Argonne National Laboratory (ANL), Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), 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.

Beginning in FY 2007, the Applicable Ranges of Bounding Curves and Data (AROBCAD) work will be managed as a part of the Analytical Methods and Code Support program element. AROBCAD provides for the adaptation, extension, and use of software tools that enable sensitivity/uncertainty (S/U), optimization, and statistical methods to be applied in the study of nuclear criticality safety NCS technology issues (i.e., differential and integral experiment data needs) and in NCS evaluations. AROBCAD will gradually transition the developed tools to the SCALE code system, and provide training and guidance that can be used by the "Training and Qualification" program element to assure proper use of these tools by the NCS practitioner. The AROBCAD program element and tasks are directed at:

1) reducing safety risk by assuring a rigorous capability for selection of applicable benchmarks and determining computational biases and uncertainties for NCS evaluations;
2) reducing excess conservatisms through identification of experimental needs in both integral data (critical experiment benchmarks) and differential data (neutron cross section) measurements and evaluations;
3) improving efficiency and effectiveness of Integral Experiments by enabling improved design of critical experiments to meet identified needs; and
4) enhancing the "International Criticality Safety Benchmark Evaluation Project" program element capabilities for experiment evaluation.

<u>Approved Sub Tasks (FY 2007)</u>

ANL:

Sub-Task 1 ($500k): ANL Methods Support including processing of ENDF/B-VII Library. Criticality safety specialists are forced to rely more heavily upon use of "rigorous" Monte Carlo methods for benchmarking and for performing criticality safety analyses. ANL maintains independent capability of processing the most recent releases of the ENDF (and JEFF and JENDL) files. NCSP supported (FY 2006) creation of ENDF/B-VII libraries that provide independent verification of the MCNP code and its data libraries. ANL will continue

verification of the new libraries (by direct inter-comparison of MCNP and VIM libraries), will produce a robust validation suite of integral experiment benchmarks (derived primarily from the ICSBEP Handbook), and will continue this verification / validation effort as new ENDF evaluations are released. This sub-task builds on the work of the Nuclear Data program element to provide validation of ENDF/B-VII evaluations enabling improved nuclear data for criticality safety specialists. ANL will continue to develop improved physics methods within the VIM code, both to maintain agreement with the physics of the MCNP code and to make improved methods available to the other NCSP-supported codes, e.g., extension of the current effort to improve treatment of data in the unresolved resonance region. ANL will contribute to the inter-code comparison to promote improvement and verification of the NCSP physics codes. The VIM code also plays an essential role in producing benchmark descriptions of the ANL Zero Power Reactor (ZPR)/Zero Power Physics Reactor (ZPPR) critical assemblies for the ICSBEP Handbook. ANL will continue to participate and to chair the OECD/NEA Expert Working Group on Source Convergence Methods, including publication of the "Guidance for Analysts" Report by the Expert Group.

LANL:

Sub-Task 1 ($500k): MCNP Maintenance and User Support. MCNP is a general-purpose continuous-energy Monte Carlo transport code. Criticality safety specialists heavily use MCNP for benchmarking and for performing criticality safety analyses. The NCSP provides support for ongoing maintenance of MCNP, including required attention to software quality assurance, code implementation on new platforms and compilers, and documentation. Supporting MCNP criticality safety users takes on many forms, including direct user consultation, assistance with code installation, and e-mail discussions. Also, several MCNP training courses and workshops are offered each year (the commitment is to conduct training courses in the second and fourth quarters of FY 2007 and to a workshop in the third quarter). In addition, the MCNP Criticality Primer will be updated to include additional examples emphasizing recent code enhancements. Finally, MCNP output will be substantially improved by providing HTML formatting and hyperlinks and an updated version of MCNP will be released to RSICC during Q4 of FY07.

Sub-Task 2 ($105k): NJOY Support and Development. NJOY is the most widely used nuclear data processing system in the world. NJOY creates data tables for MCNP and for various multi-group codes. The development feature of highest priority to criticality safety users is covariance processing. A new version of NJOY, to be released in the fourth quarter of FY 2007, will include capabilities such as those found in the ERRORJ module (or PUFF or SAMMY) for covariance processing.

Sub-Task 3 ($105k): ENDF/B-VII Library for MCNP. This sub-task involves creation, verification, and validation of an MCNP cross-section library based upon the latest version of ENDF, ENDF/B-VII that is scheduled to be released late in FY 2006. This sub-task builds on the work of the Nuclear Data program element to provide improved evaluations to the Cross Section Evaluation Working Group (CSEWG) for ENDF/B-VII. NJOY will be used to create the library, which is essential to allow MCNP users to take advantage of ENDF/B-VII.

Sub-Task 4 ($220k): MCNP Enhancements. Three efforts will be included in this Sub-Task. (I) Criticality safety end users have often requested that MCNP include a capability to access a library of standard materials and this will be completed in FY 2007. Users will have the option to specify materials by element or nuclide. (II) Requirements will be assessed and a plan (including milestones and costs) will be developed for integrating sensitivity / uncertainty capabilities in MCNP. If deemed acceptable, the plan will be implemented in FY 2008 - 2009. (III) Research indicates improved tests for convergence of both k_{eff} and the fission source distribution can be implemented in MCNP. Source entropy and robust statistical tests will be used to lessen the reliance on "user judgment." The results of efforts (I) and (III) will be included in the fourth quarter release of MCNP to RSICC. The documented plan from effort (II) will be delivered during the second quarter of FY 2007.

LLNL:

Sub-Task 1 ($100k): Analytical Methods Support. COG-ENDF/B-VII Library Cross-Section Processing including COG/PREPRO Maintenance and User Support. Continued support for the COG/PREPRO codes is necessary to allow for utilization of the latest cross section data.

ORNL:

Sub-Task 1 ($725K): SCALE/KENO Maintenance and User Support. Under this sub-task, ongoing maintenance, training and user assistance associated with the modules within the criticality safety sequences of the SCALE code system are provided. These functions have increased in effort with the addition of the TSUNAMI sensitivity software into the SCALE system. Also included are additional cross section and covariance data library generation and testing for the SCALE system.

Sub-Task 2 ($100k): AMPX Cross Section Processing Methodology. The AMPX software processes data produced from the Nuclear Data work element into continuous energy formulations and system-independent multi-group data for use by SCALE. During FY 2007, work will be performed in conjunction with RSICC for the packaging and public distribution of the advanced version of AMPX.

Sub-Task 3 ($560k): Radiation Safety Information Computational Center. Under this sub-task, the RSICC infrastructure is supported to assure that software supporting NCS ($240K) and software supporting NA-10 non-NCS programmatic needs ($320K) are collected, packaged, and disseminated. User support in software installation, export control administration, and interface with code developers is also provided.

Sub-Task 4 ($235k): Complete the development of compatible KENO V & VI adjoint solution. This task will extend the S/U capability within the TSUNAMI sequences of the SCALE code system to enable use with the KENO VI code. The extension will be completed by implementing a revised adjoint solution within KENO V that will be compatible with planned implementation of the technology within KENO VI. Such an approach has been conceived to simplify the input requirements, reduce the user expertise required for accurate results, and enable the S/U capability in KENO VI. Implementation of the S/U capabilities within KENO VI

will significantly extend the geometries where the S/U capabilities can be applied. The deliverables will be a revised prototypic version of TSUNAMI-3D-K5 (KENO V), a new prototypic version of TSUNAMI-3D-K6 (KENO VI), and associated draft documentation.

Sub-Task 5 ($180k): Test/validate TSURFER sequence and analytical methodology for development of user guidance. Using the recently evolved generalized linear least squares methodology, perform testing and validation of the SCALE TSURFER sequence and extend TSURFER capabilities to produce guidance in the use of TSURFER This capability extension, testing and validation is required to minimize safety risk in the application of TSURFER results interpretations and to engender user/regulator confidence in the application of a method to provide a mathematically rigorous and quantifiable basis to minimize compliance risk in establishing defensible margins of subcriticality for NCS evaluations to reduce operational cost/efficiency risk. Additionally, the active studying of theory and programming of the software for making cross-section adjustment estimates provides for capability maintenance of unique scientific/technical capabilities as they relate to nuclear criticality safety code enhancements, nuclear data evaluations, and critical experiment designs.

Proposed Future Sub Tasks (FY-2008 and beyond)

Code maintenance and user support will continue at all four laboratories. Maintenance of the rigor of these modern Monte Carlo codes cannot be performed on a "stagnant" system; that is, modest and continual code enhancements are a requirement for code maintenance. Therefore, several code enhancements should be pursued in the out-years.

- ANL will continue to develop and support improved physics within the NCSP-supported criticality safety codes.
- LANL will continue to pursue additional MCNP features that are of interest to the nuclear criticality safety community including: improved parallelization for eigenvalue problems; capabilities for a random geometry (e.g., pebbles), automated fission source point generation; eigenvalue convergence acceleration; depletion capabilities; ability to generate and use data libraries incorporating covariance information; updates to the MCNP criticality primer; enhanced visualization of fission source points; improved eigenvalue perturbation methodology; and enhanced code output to support user physics comprehension.
- At LLNL, COG is continuously being maintained with library cross-section processing capability to support ongoing data testing for benchmark and criticality safety applications. The COG/data processing web site, currently under development, will provide contact information for end-users and an opportunity to register to receive COG announcements.
- At ORNL, the inclusion of continuous energy (CE)-KENO (planned for release with SCALE 6.0 in early FY 2008) and the TSUNAMI software from the AROBCAD program element will require additional SCALE maintenance support in FY 2008 and beyond. Also proposed by ORNL are an improved SCALE quality assurance database and update process; extension of the Pitzer technique to include specification data for plutonium solutions; support for administration of the Analytical Methods program element; validation of the CE-KENO cross section libraries; and development of: 1) an

ENDF/B-VII cross section library, 2) automated fission source testing and convergence algorithms, 3) a parallel-processing version of KENO, and 4) guidance on transport methods for criticality accident alarm system analyses.

- Also at ORNL, proposed future AROBCAD work includes: processing ENDF/B-VI and VII data through S/U methodologies to provide and distribute a complete set of sensitivity files to the user community; transitioning S/U capabilities for CE KENO; developing user guidance documentation and training modules for group-wise and continuous energy versions of TSUNAMI and TSURFER SCALE sequences; developing guidance for subcritical margins applications; developing an approach for safe administrative margins of subcriticality; and updating GUIs for existing S/U codes.

Budget

Table 3-1: Analytical Methods Development and Code Maintenance Budget, Fiscal Years 2007–2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
ANL	500	510	520	530	540
LANL	930	950	970	990	1,010
LLNL	100	105	110	115	120
ORNL	1,800	1,835	1,870	1,700	1,735
TOTAL	3,330	3,400	3,470	3,335	3,405

4. Nuclear Data

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 Nuclear Data Advisory Group (NDAG). In addition, the NCSP continues to rely on the director of the National Nuclear Data Center at Brookhaven National Laboratory (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 U.S. Evaluated Nuclear Data File (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, sensitivity/uncertainty analyses demonstrate the importance of utilizing integral experiment data in assessing uncertainties for specific NCS applications, highlighting the strong linkages between the ICSBEP, AROBCAD methods, 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 (DNFSB, NRC, etc.).

Approved Sub Tasks (FY 2007)

ANL:

Sub-Task 1 ($230k): Nuclear Data Support. ANL will continue to process and data test new evaluations related to the upcoming release of ENDF/B-VII. ANL will also focus on implementation of new covariance methodologies to augment covariance data available in ENDF. This capability is anticipated to be available in FY 2007 at which time ANL expects to contribute 1-2 full nuclear data evaluations to the ENDF project. The focus of this small evaluation effort will be guided by priorities determined by the NDAG. Several ANL data experts will participate in twice-yearly NDAG meetings, and yearly CSEWG and WPEC meetings. These meetings are not only required for gathering priorities and communication with other experts, but also leverage NCSP resources through international collaboration and lead to the final data product (ENDF) for the criticality safety community. ANL will continue to harvest existing measured neutron data to support new evaluations. Three retirees who are internationally-recognized experts in the fields of data evaluation, covariance theory, and resonance modeling will continue to make contributions (for minimal costs) and provide some training to next generation experts.

Sub-Task 2 ($75k): Low Fidelity Covariance Data. Nuclear data experts from ANL, BNL, LANL, and ORNL will collaborate to produce a complete set of low fidelity covariance data in a standard ENDF/B format for all ENDF/B-VII isotopes. Although extremely crude approximations will be used to produce these data, there is general agreement that the resultant low fidelity covariance data will be a substantial improvement. Because of the approximate nature of the covariance data, they will not be made available as part of a general-purpose ENDF/B release, but rather used by knowledgeable personnel to exercise AROBCAD.

BNL:

Sub-Task 1 ($105k): NCSP Manager / NDAG Support: Support includes: participation in the Spring NCSP Technical Review and two NDAG meetings per year to provide advisory support for NCSP nuclear data activities; shepherding nuclear data evaluations of interest to the NCSP through the CSEWG process and ensuring timely publication in the ENDF; providing quarterly reports on status of the ENDF library, highlighting matters of importance to the NCS Community for posting on the NCSP Web site; performing data verification and basic testing of fission product evaluations in ENDF/B-VII for 219 materials. [These evaluations are either new or taken from other evaluated libraries (mostly JENDL-3.3), representing a massive improvement of existing ENDF/B-VI evaluations that are 30-35 years old. Improved fission product cross sections are essential for calculating burn-up credit.].

Sub-Task 2 ($75k): Low-Fidelity Covariance Data. Same as ANL Sub-Task 2, above.

LANL:

Sub-Task 1: ($475k) Nuclear Data Support. The NDAG prioritizes neutron evaluations for criticality safety applications that need to be improved. LANL will partner with ORNL to develop such improved evaluations. In FY 2007 LANL will deliver improved evaluations for U-235 inelastic scattering and Np-237 capture and fission and initiate improvements to the Ti isotopic evaluations, in conjunction with an ICSBEP-sponsored benchmark experiment from VNIITF. The NDAG has also identified development of covariance data as a high priority. In FY 2007, LANL will deliver "high-fidelity" covariance data for U-233. Data testing has proven essential to make improvements in neutron evaluations. LANL will continue to focus on data testing using fast critical assemblies related to the upcoming release of ENDF/B-VII. Several LANL data experts will continue to participate in twice-yearly NDAG and CSEWG meetings, and yearly WPEC meetings. These meetings are required for gathering priorities and communication with other experts.

Sub-Task 2: ($75k): Low-Fidelity Covariance Data. Same as ANL Sub-Task 2, above.

ORNL:

Sub-Task 1: ($782k): Data Evaluations and Uncertainty Covariances. This subtask engages expert staff to utilize information from differential measurements, integral measurements, and nuclear modeling codes to obtain improved data evaluations and uncertainty covariances for selected nuclides. FY 2007 efforts will focus on the completion of the ^{19}F evaluation with a new evaluation provided to NNDC for inclusion in ENDF/B. The SAMMY software will be used to complete resolved-resonance parameter evaluations for ^{55}Mn, ^{39}K, ^{40}K, and ^{41}K. Covariance evaluations for χ(E) and $\bar{\nu}$ will be completed for ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu. Resonance parameter covariance evaluations will be performed for ^{55}Mn, ^{39}K, ^{40}K, and ^{41}K.

Sub-Task 2 ($25k) Low-Fidelity Covariance Data: Same as ANL Sub-Task 2, above.

Proposed Future Sub Tasks (FY-2008 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.

Budget

Table 4-1: Nuclear Data Budget, Fiscal Years 2007 – 2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
ANL	305	235	240	245	250
BNL	180	107	109	111	113
LANL	550	485	495	505	515
ORNL	807	822	837	852	867
TOTAL	1,842	1,649	1,681	1,713	1,745

5. Differential Measurements

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 Oak Ridge Electron Linear Accelerator (ORELA) Facility. Evaluation and data testing measured data are performed as described above in the Nuclear Data Program Element.

Approved Sub Tasks (FY 2007)

ORNL:

Sub-Task 1: ($330k): ORELA Measurements. This subtask supports expert staff engaged in planning and performance of differential measurements at the ORELA facility and general consultation on measurement techniques. (See Appendix D for planned measurements).

Sub-Task 2: ($620k): ORELA Operations. This subtask provides funding that partially supports the operation and staff of the ORELA facility.

Proposed Future Sub Tasks (FY-2008 and beyond)

NNSA funded substantial refurbishment of ORELA in FY 2006 that resulted in positive results. 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. 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. This may necessitate the use of other facilities for differential measurements should they be deemed essential.

Budget

Table 5-1: Differential Measurements Budget, Fiscal Years 2007 – 2011 (All ORNL Tasks)

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
TOTAL	950	970	350	360	370

6. Integral Experiments

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 is 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. These other, non-NCSP related, activities include specific program requirements in the stockpile stewardship program, emergency response and counter terrorism program, the non-proliferation and arms control program, and the space nuclear power program.

The Critical Experiments Facility (CEF) Project has been initiated to relocate LANL Technical Area (TA)-18 activities to the DAF at the Nevada Test Site and is sponsored by Defense Programs. It received an Approval of Alternative and Cost Range (Critical Decision 1) memorandum on June 14, 2004 and Approval of Performance Baseline (Critical Decision 2), on December 2, 2005, and is scheduled for completion in late 2009. Funding for the CEF Project (current baseline $145,202,926) 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 and hands-on training. LANL staff will conduct subcritical integral experiments at the DAF and participate in critical integral experiments in the Russian Federation funded under the ICSBEP task. 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. Also, the NCSP plans to conduct four to eight training courses per year at Lawrence Livermore National Laboratory until the DAF is fully operational and can assume this mission. The NCSP is committed to make this transition as smooth as possible.

Approved Sub Tasks (FY 2007)

Sub-Task 1 ($350k): CEF Operational Support at the DAF: This is a new sub-task in support of CEF operations at DAF. The DAF operational support is not currently funded by the CEF project. As the DAF is brought up into operational status, facility maintenance and Technical Surveillance Requirements need to be performed. People will also need to be trained to perform these activities. This sub-task also funds the infrastructure necessary to perform programmatic activities at DAF.

Sub-Task 2 ($350k): Conduct sub-critical integral experiments at the DAF: This subtask is a continuation of FY 2006 activities to establish sub-critical integral experimental operations at the DAF. The first sub-critical integral experiment at DAF will involve an alpha-phase Pu sphere surrounded by polyethylene nesting shells. Subsequent experiments will involve the alpha-phase Pu sphere reflected with Be, Cu, W and other high-Z reflector materials. This task contributes to the safe operation of sub-critical configurations in the field. It provides means to benchmark and compare sub-critical calculations. It is also a capability maintenance 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.

Sub-Task 3 ($350k): Maintain and train CEF team members: This is a new subtask in support of maintaining proficiency for crew chiefs and crew members during the transition to DAF. In order to maintain proficiency, crew chiefs and crewmembers will participate in experiments and operational activities at various U.S and international facilities. Under this task, new personnel will also be hired and trained to replace members who have left the program. 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 activities.

Sub-Task 4 ($200k): Identify and ship non-nuclear materials to DAF: This is a follow up to an existing task that began in FY 2006. In FY 2006, non-nuclear materials from Warehouse 1 and CASA 1 were shipped to DAF following a resource-loaded schedule. In FY 2007, non-nuclear material will be shipped to DAF from CASA 2 and Warehouse 2.

Proposed Future Sub Tasks (FY-2008 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, re-establishment of hands-on criticality safety training courses for criticality safety engineers at the DAF, and eventually, re-establishment 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 measurements that can be carried out at the DAF.

The NCSP plans to examine the potential for re-establishing a SHEBA capability. CSSG and NDAG taskings issued in FY06 will support evaluation and planning efforts that may be carried out in future years. The NCSP will not provide the funding support for re-establishment of a solution critical experiments capability. Alternative funding methods and sponsors will be sought if there is a need for the capability.

Budget

Table 6-1: Integral Experiments Budget, Fiscal Years 2007 – 2011 (All LANL Tasks)

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
TOTAL	1,250	1,600	2,300	2,400	2,500

7. Information Preservation and Dissemination

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 sub elements 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, 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 site (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 others sites containing criticality safety information resources. The NCSP web site 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 web sites to point a user to the original data source to ensure accuracy and access to the most up-to-date information.

Approved Sub Tasks (FY 2007)

CSIRC (Hanford; $63k):

Sub-Task 1: Continue the revision of Atlantic Richfield Hanford (ARH)-600.

NCSP Website (LLNL; $170k):

Sub-Task 1: ($60k): Operation and Maintenance of the NCSP Website. This subtask will install monthly Operating System patches, upgrade web server software, perform daily and monthly backup, monitor daily hackers attempts, and perform monthly risk assessment required by NNSA cyber security policy.
Sub-Task 2: ($27k): Information Coordination and Dissemination. This subtask will coordinate via email and/or telephone NCSP information from CSSG and End Users and CSCT, convert various types of documents into PDF files or web pages, and solve NCS personnel's accessing and printing problems.
Sub-Task 3: ($43k): Improve user interface and contents at the NCSP Website: This subtask will continue to incorporate CSSG and End Users requests and feedbacks, continue to improve the LHS menu, enhance LLNL bibliographic database and Hanford NCTSP database (searching by Value Index, Document date, OSTI document number, and Category), update and release new version of the web site users registration information, continue to improve CEF web pages with facility specific information and training modules.
Sub-Task 4: ($10k): NCSP website hardware and software maintenance: This subtask will buy new hardware and software to create a NCSP backup web server and provide contingency to replace electronic components such as power units in the case of component failures, and to serve as the NCSP beta test website so new features and computer security fixes can be tested without interrupting the functions of the production web server.
Sub-Task 5: ($30k): Continue to develop multimedia training modules for the website: All current training modules are text based and could be done better based upon current available technology.

<u>Proposed Future Sub Tasks (FY-2008 and beyond)</u>

CSIRC:
Sub-Task 1: Review and index ORNL logbooks (LANL).
Sub-Task 2: Review and index ZPPR logbooks (LANL).
Sub-Task 3: CSIRC website redesign and software upgrades (LANL).
Sub-Task 4: Continue website maintenance (LANL).
Sub-Task 5: Continue to update the Hanford Database (Hanford).
Sub-Task 6: Continue to enhance ARH-600 (Hanford).

Website (LLNL):
Sub-Task 1: Web server Internet connection, hardware maintenance, and daily backup.
Sub-Task 2: Provide user feedback to the NCSP to resolve issues about NCSP web site contents, navigation, and accessibility.
Sub-Task 3: Perform periodic cyber security checks on the NCSP web site to prevent unauthorized modification of contents.

Sub-Task 4: Add, modify, validate links, and perform maintenance of the registration database, the LLNL bibliographical database, the Hanford parametric database, the archival files, and the search engines.
Sub-Task 5: Continue to enhance the navigational menus using submenus to divide the website into subsections for each category (i.e., NCSP Home Page, CEF, NCSP information, CSCT, CSSG, End Users, NCS information, Bibliography, Computer Codes, High-Level Links, and Training) to reduce website clutter, improve clarity and efficiency.
Sub-Task 6: Provide dedicated search capability of the relevant DOE regulations and Standards related to NCS
Sub-Task 7: Develop and create online training with multi-media streaming capabilities

Budget

Table 7-1: Information Preservation and Dissemination Budget, Fiscal Years 2007 – 2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
1. CSIRC (Hanford)	63	64	65	66	67
2. NCSP website operations and maintenance (LLNL)	170	175	180	185	190
TOTAL	233	239	245	251	257

8. Training and Qualification

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.

Approved Sub Tasks (FY 2007)

Hands-On Training:

Sub-Task 1 ($200k): Hands-On Training. LLNL will provide up to eight four-day classes. These classes will include both classroom lectures and hands-on subcritical measurements. The syllabus of the training class includes: 1) Fundamentals of Criticality Safety, 2) DOE Requirements and National Standards, 3) Hand Calculations and Computational Methods, 4) Criticality Safety Evaluations, 5) Nuclear Instrumentation, 6) Hands-on Subcritical Measurements with the TACS (Training Assembly for Criticality Safety), and 7) Criticality Accidents and Emergency Response.

Training Development:

ANL:

Sub-Task 1 ($50k): Development of Nuclear Criticality Safety Engineer Training (NCSET) modules. Develop additional Nuclear Criticality Safety Engineer Training modules that will be posted on the NCSP web site as a training resource for the complex. Proposed modules for FY07 are: Hand Calculation Methods – Part II (with LANL staff); and Burnup Credit for Criticality Safety.

ORNL:

Sub-Task 1 ($50k): Development of NCSET module. Begin developing a TSUNAMI Nuclear Criticality Safety Engineer Training (NCSET) TSUNANI module at ORNL.

<u>Proposed Future Sub Tasks (FY-2008 and beyond)</u>

Hands-On Training:

Sub-Task 1: Redesign hands-on training courses to conduct them at the DAF.
Sub-Task 2: Redesign and upgrade course materials (notebooks).
Sub-Task 3. Conduct eight four-day courses per year at LLNL and/or the DAF.

Training Development:

As an integral part of maintaining capability through training of criticality safety specialists, training modules will continue to be developed at the rate of approximately one to two per year.

Budget

Table 8-1: Training and Qualification Budget, Fiscal Years 2007 – 2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
1. Hands-on Training (LLNL)	200	205	210	0	0
2. Hands-on Training (LANL)	0	0	0	300	305
3. Training Development (ANL)	50	55	60	65	70
4. Training Development (ORNL)	50	25	0	0	0
TOTAL	300	285	270	365	375

9. NCSP Support

Criticality Safety Support Group (CSSG) Activities

The CSSG is comprised of recognized criticality safety experts from DOE offices and contractor organizations (see Appendix A for CSSG members). The primary function of the CSSG is to provide operational and technical expertise to the Department of Energy through the Nuclear Criticality Safety Program (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 its support role, the CSSG responds to requests from the NCSP manager for information, technical reviews, and evaluations of criticality safety issues throughout the complex. The CSSG charter has recently been revised to include a membership policy and work instructions and can be found on the NCSP Website. The CSSG began providing technical assistance to site offices during FY 2004. These site visits are expected to continue in accordance with the new policy for base lining and subsequent monitoring of operational criticality safety programs.

Approved Sub Task (FY 2007)

Sub-Task 1: ($325k): CSSG funding. The NCSP budget provides some support for contractor CSSG members (10 CSSG members x $30k/member + $25k for the CSSG Deputy Chair).

Criticality Safety Coordinating Team (CSCT) Activities

The CSCT is the group of federal staff providing line oversight for criticality safety at the field level. The NCSP Manager also Chairs 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 assist visits. There are no funded subtasks for the CSCT due to the fact that the CSCT is comprised entirely of federal employees.

End Users Activities

The End Users Group is a group 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 Chairman for the End Users in FY 2007.

Approved Sub Task (FY 2007)

Sub-Task 1: ($30k): End User Feedback Coordination. The End Users Group Chairman will organize conference calls to be held at least 4 times a year. In consulting with the End Users Group, the Chairman will set the agenda beforehand and distribute the telephone conference call results to all interesting parties. The End Users Group Chairman will organize and chair the two NCSP End Users Group workshops (the two Friday meetings after the American Nuclear Society (ANS) conferences). To ensure orderly preparation of the workshops and provide meaningful dialogues and input, the Chairman will perform the following coordination tasks.

a. Maintain the End Users Group roster to include key active participants from each site for the End Users Group.
b. Coordinate with the End Users Group to formulate the main End Users Group need areas for the purposes of forming working groups to handle them.
c. Work with the NCSP Manager, CSSG Chair, and the End Users Group to formulate the NCSP End Users Workshop agendas, breakout working group sessions, discussions, and presentations.
d. Compile meaningful feedback from these workshops for the NCSP Manager.

Finally, the End Users Chairman will attend CSSG meetings (no more than two if held away from the ANS annual meetings), and if necessary, the End Users Group Chairman will convene an End Users Group conference.

Proposed Future Subtasks (FY-2008 and beyond):

Same as above with a different site providing the Chairman (potentially).

Budget

Table 9-1: NCSP Support Activities, Fiscal Years 2007 – 2011

SUBTASK	FY 2007 ($K)	FY 2008 ($K)	FY 2009 ($K)	FY 2010 ($K)	FY 2011 ($K)
1. CSSG Activities	325	340	350	360	370
2. End Users Activities	30	35	40	45	50
TOTAL	355	375	390	405	420

10. Program Specific Applications

This section describes those activities aligned with the tasks and infrastructure capabilities maintained by the NCSP but 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.

ICSBEP

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 5 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 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-2007.

2. Sandia National Laboratory plans to perform and evaluate an experimental series involving water-moderated square-pitched U(6.93)O2 fuel rod lattices during Calendar Years 2006 to 2007, contingent upon the availability of funding from the Office of Nuclear Energy. The cost of the experiments is estimated to be nearly $3M of which approximately $50K to $60K would be used for the ICSBEP evaluation.

3. Plans have also been initiated to perform additional burn-up credit type experiments at Sandia National Laboratory in the 2007 to 2008 time frame. These experiments are intended to be follow-on to the Nuclear Energy Research Initiative (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

1. In FY06, EM-22 is supporting ORNL in the preparation of S/U training materials for the latest version of the TSUNAMI S/U methodology. SCALE version 5.1 workshop visuals and sample problems are being prepared as part of this training material.

2. In FY06, EM-22 is supporting ORNL to perform a survey of nuclear criticality safety technology needs at all of the EM sites which have fissionable-material operations. This effort includes updating the survey of SRS, INL and Hanford operations, and performing additional surveys at the balance of the appropriate EM sites.

3. Enhancement and maintenance of the non-criticality portions of the SCALE code system continue with collaborative funding from the NRC. A year-end report on these activities is provided to all SCALE sponsors, including the NCSP, at the end of each FY.

Regarding the AROBCAD development effort, the following work is relevant:

1. The DOE office of Civilian Radioactive Waste (RW) is applying the AROBCAD computational capabilities into burn-up credit for radioactive waste applications. Although this is independent of the AROBCAD work, the sensitivity/uncertainty methods are indirectly benefiting from the application-specific knowledge gleaned from this work.

2. Additional three-site assistance with sensitivity/uncertainty (S/U) methods: the ORNL staff is continuing to assist the SRS, INL and Hanford NCS evaluation teams in the performance of site-dependent S/U studies.

Nuclear Data

1. At ORNL in FY06, EM-22 is supporting the evaluation of the Mn-55 resonance data as well as the performance of quality assessments on cross section data for titanium, neptunium, iron, chromium, vanadium and plutonium-240.

2. Under a NERI project sponsored by NE-20, thermal neutron scattering kernels in the S(alpha, beta) formulation are being developed experimentally and analytically. This effort, being led by North Carolina State University, involves the generation of scattering law data for graphite, Be, BeO, ZrH, ThH, polyethylene, and light water. Experimental measurements at several

temperatures will be performed with ORELA. The NDAG will follow progress on this work to ensure that the results are transmitted to the NNDC for inclusion in ENDF/A or ENDF/B-VII. This will allow data testing and use by criticality safety practitioners

Appendix A

Points of Contact for the Seven Technical NCSP Elements and CSSG Members

ICSBEP

DOE-ID Program Monitor:

Adolf Garcia
United States Department of Energy
Idaho Operations Office
Idaho Falls, ID 83401-1226
Telephone: 208-526-4420
Facsimile: 208-526-7245
E-Mail: Adolf.Garcia@nuclear.energy.gov

Contractor Program Element Manager:

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

Analytical Methods Development and Code Maintenance

Contractor Program Element Manager and ORNL Task Manager:

R. Michael Westfall
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6170
Telephone: 865-574-5269
Facsimile: 865-574-3527
E-Mail: rwe@ornl.gov

AROBCAD Sub-Tasks Manager:

Calvin Hopper
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6170
Telephone: 865-576-8617
Facsimile: 865-576-3513
E-Mail: hoppercm@ornl.gov

ANL Task Manager:

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

LANL Task Manager:

Robert Little
Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, New Mexico 87545
Telephone: 505-665-3487
Facsimile: 505-665-3046
E-Mail: rcl@lanl.gov

Nuclear Data

Contractor Program Element Manager and ORNL Task Manager:

R. Michael Westfall
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6370
Telephone: 865-574-5267
Facsimile: 865-574-3527
E-Mail: rwe@ornl.gov

ANL Task Manager:

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

LANL Task Manager:

Robert Little
Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, New Mexico 87545
Telephone: 505-665-3487
Facsimile: 505-665-3046
E-Mail: rcl@lanl.gov

BNL Task Manager:

Pavel Oblozinsky
National Nuclear Data Center
Bldg. 197D
PO Box 5000
Brookhaven National Laboratory
Upton, NY 11973-5000
Telephone: 631-344-2814
Facsimile: 631-344-2806
E-Mail: oblozinsky@bnl.gov

Differential Measurements

Contractor Program Element Manager and ORNL Task Manager:

R. Michael Westfall
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6370
Telephone: 865-574-5267
Facsimile: 865-574-3527
E-Mail: rwe@ornl.gov

Integral Experiments

Contractor Project Manager:

David Hayes
Los Alamos National Laboratory
P.O. Box 1663, MS J562
Los Alamos, New Mexico 87545
Telephone: 505-667-4523
Facsimile: 505-665-9849
E-Mail: dkhayes@lanl.gov

Information Preservation and Dissemination

Contractor Task Managers:

CSIRC (LANL)
Shean Monahan
Los Alamos National Laboratory
P.O. Box 1663, MS F691
Los Alamos, NM 87545
Telephone: 505-665-7567
Facsimile: 505-665-4970
E-Mail: spm@lanl.gov

CSIRC (Hanford)
David Erickson
Fluor Government Group
P.O. Box 1050
MSIN T5-54
Richland, WA 99352
Telephone: 509-373-6500
Facsimile: 509-373-2752
E-Mail: David.Erickson@fluor.com

Web Site
David Heinrichs
Lawrence Livermore National Laboratory
Mail Stop L-128
7000 East Ave.
Livermore, CA
94550-9234
Telephone: 925-424-5679
Facsimile: 925-423-2854
E-Mail: heinrichs1@llnl.gov

Training and Qualification

Contractor Task Managers:

Hands-On Training
David Heinrichs
Lawrence Livermore National Laboratory
Mail Stop L-128
7000 East Ave.
Livermore, CA
94550-9234
Telephone: 925-422-5679
Facsimile: 925-423-2854
E-Mail: heinrichs1@llnl.gov

Training Development
James Morman
Argonne National Laboratory
9700 S. Cass Ave.
Argonne, IL 60439
Telephone: 630-252-6076
Facsimile: 630-252-4500
E-Mail: jamorman@anl.gov

NCSP Manager and Federal Qualification Program Manager	Jerry McKamy U.S. Department of Energy National Nuclear Security Administration NA-171 19901 Germantown Road Germantown, MD 20874 Telephone: 301-903-8031 Facsimile: 301-903-8056 E-Mail: jerry.mckamy@nnsa.doe.gov

CSSG Members

NAME	PHONE	E-MAIL ADDRESS
Adolf S. Garcia (Chair)	208-526-4420	Adolf.Garcia@nuclear.energy.gov
James A. Morman (Deputy Chair)	630-252-6076	jamorman@anl.gov
Richard E. Anderson	505-667-6912	randerson@nis6.lanl.gov
David G. Erickson	509 373-6500	David_G_Erickson@rl.gov
Dave Heinrichs	925-424-5679	heinrichs1@llnl.gov
Calvin M. Hopper	423-576-8617	hoppercm@ornl.gov
Thomas P. McLaughlin	505-667-7628	tpm@lanl.gov
Davis Reed	865-576-6359	reedda@ornl.gov
Hans Toffer	509-376-5230	hans toffer@rl.gov
Robert M. Westfall	423-574-5267	rwe@ornl.gov
Robert E. Wilson	303-966-9681	robert.wilson@rf.doe.gov
Ivon Fergus (ad Hoc)	301-903-6364	ivon.Fergus@oa.doe.gov

Emeritus Members

Jerry McKamy	301-903-8031	jerry.mckamy@nnsa.doe.gov
Thomas A. Reilly	803-208-0801	mimtar@aol.com

Appendix B

Work Authorization Statements for Nuclear Criticality Safety Program Funding for Execution Year (FY 2007) Provided to NA-17 Budget Office in September 2006.

Tasks: Nuclear Data, Analytical Methods Development and Code Maintenance, and Criticality Safety Support Group
Oak Ridge National Laboratory (ORNL): $3,697K

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 RSICC; and to continue selected Applicable Ranges of Bounding Curves and Data development activities, as delineated in the NCSP (NCSP) Five-Year Plan, dated August 2006, 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 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: Mike Westfall (865-574-5267) and Calvin Hopper (865-576-8617)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: International Criticality Safety Benchmark Evaluation Project
Idaho National Laboratory (INL): $1,965K

Funds are provided to the INL to conduct the International Criticality Safety Benchmark Evaluation Project (ICSBEP) and provide End Users Group Support as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan, dated August 2006, or as directed by the NCSP Manager. 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)
Todd Taylor (208-526-9656)
DOE-ID POC: Adolf Garcia (208-526-4420)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: Integral Experiments, Analytical Methods Development and Code Maintenance, Nuclear Data Support, and Criticality Safety Support Group
Los Alamos National Laboratory (LANL): $2,790K

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 2006, 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. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other 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: David Hayes (505-667-4523), Shean Monahan (505-665-7567), and Robert Little (505-665-3487)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: Analytical Methods Development and Code Maintenance, Nuclear Data Support, Training Development, and Criticality Safety Support Group
Argonne National Laboratory (ANL): $910K

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 2006, or as directed by the NCSP Manager. Funds are also provided to continue development of Nuclear Criticality Safety Engineer Training materials 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 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) and Jim Morman (630-252-6076)
DOE POC: Jerry McKamy, NNSA (301-903-8031)

Task: Hands-On Training, Nuclear Criticality Safety Web Site, Analytical Methods, Criticality Safety Support Group, and End Users Group Support
Lawrence Livermore National Laboratory (LLNL): $500K

Funds are provided to LLNL to conduct hands-on criticality safety training, maintain the DOE Nuclear Criticality Safety Web Site, and maintain cross section processing codes, as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan, dated August 2006, 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. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other 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: Validation and Reissue of ARH-600, Updating of the Hanford Data Base, and Criticality Safety Support Group (CSSG) support
Fluor Hanford: $123K

Funds are provided to Fluor Hanford for the continued revision of ARH-600 and CSSG technical support to the Nuclear Criticality Safety Program (NCSP) Manager regarding planning and execution of the NCSP. With approval of the NCSP Manager, the CSSG may also provide technical assistance to other 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): $180K

Funds are provided to BNL to continue Nuclear Data support as delineated in the Nuclear Criticality Safety Program (NCSP) Five-Year Plan, dated August 2006, 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

ICSBEP FIVE-YEAR PLAN ARGONNE NATIONAL LABORATORY	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
HEU-COMP-FAST-004	ZPR-3 Assembly 14: A Clean HEU (93% ^{235}U) Carbide Core Reflected by Depleted Uranium
IEU-MET-FAST-011	ZPR6-1 All Aluminum - 14% Enriched
FY-2008	
IEU-COMP-FAST-004	ZPR-3 Assembly 12: A Large, Clean, Cylindrical Uranium (21% ^{235}U)Carbide Benchmark Assembly Reflected by Depleted Uranium
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-2009	
PU-COMP-FAST-004	ZPR-3 Assembly 48: A Clean Cylindrical Pu Carbide Core, Reflected by Depleted Uranium
MIX-COMP-FAST-002	ZPR-9 Assembly 29: Normal and Flooded Configurations of Mixed (Pu/U)-fueled GCFR Assembly
FY-2010	
PU-COMP-FAST-003	ZPR-9 Assembly 31: The Plutonium Carbide Benchmark Assembly Reflected by Depleted Uranium
IEU-COMP-FAST-003	ZPR-6 Assembly 5: A Large, Clean, Cylindrical Uranium Carbide Benchmark Assembly Reflected by Depleted Uranium
FY-2011 and Beyond	
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
Others	To Be Determined

ICSBEP FIVE-YEAR PLAN FLOUR HANFORD / PNNL	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
MIX-COMP-FAST-004	FFTF Fuel Approach to Critical in Liquid Na Critical

FY-2008	
SUB-MIX-COMP-THERM-001	Subcritical Waste Drums Measurements
FY-2009	
LEU-COMP-THERM-072	Max k_∞ for UO_3 in Water for 1.0 ^{w}/o ^{235}U Enrichment
FY-2010	
LEU-COMP-THERM-073	Max k_∞ for UNH for 2.1 ^{w}/o ^{235}U Enrichment
FY-2011 and Beyond	
MIX-COMP-FAST-005	FFTF Core Demonstration Experiment
MIX-COMP-THERM-017	FFTF Fuel Criticals in Water
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-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

ICSBEP FIVE-YEAR PLAN IDAHO NATIONAL LABORATORY	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
HEU-MET-FAST-084	HEU Metal Cylinders Reflected by Ti, W, Be, Mg, Fe, Ni
HEU-MET-FAST-085	HEU Metal Cylinders with Ta, W, Fe, Ni diluents

FUND-NIST-CF-MULT-FISS-002	NIST Water Spheres -- U-238, U-235, PU-239, NP-237 Fission – Cadmium Shielded
FY-2008	
HEU-COMP-THERM-019	Critical Experiments with BORAX-V Superheater Fuel Assemblies
U233-COMP-THERM-002	LWBR $^{233}UO_2$-ThO_2 Detailed Cell Experiments -- Work For Others
U233-COMP-THERM-003	LWBR $^{233}UO_2$-ThO_2 BMU Experiments -- Work For Others
FY-2009	
PU-MET-FAST-042	Plutonium Hemishells in Oil - Part II
IEU-COMP-THERM-006	Critical Experiments with BORAX-V Boiling and Superheater Fuel Assemblies
FY-2010	
PU-MET-FAST-043	Plutonium Hemishells in Oil - Part III
IEU-COMP-THERM-007	Power Burst Facility – Water Moderated 18.5% Enriched Uranium Ternary Oxide Fuel Pin Lattice
FY-2011 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

ICSBEP FIVE-YEAR PLAN LOS ALAMOS NATIONAL LABORATORY	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
PU-MET-FAST-038	Pu Sphere Reflected by Be
HEU-MET-FAST-086	Pulsed Godiva-IV (Mosteller)
HEU-MET-THERM-032 Section 1 Only	1x1 HEU/polyethylene reflected and moderated by polyethylene
HEU-MET-THERM-033 Section 1 Only	2x2 HEU/Re reflected and moderated by polyethylene
HEU-MET-THERM-034 Section 1 Only	HEU/Gd Alloy 2
FY-2008	
Others	To Be Determined
FY-2009	
Others	To Be Determined
FY-2010	
Others	To Be Determined
FY-2011 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

ICSBEP FIVE-YEAR PLAN
LAWRENCE LIVERMORE NATIONAL LABORATORY

IDENTIFIER	*DRAFT TITLE*
	FY-2007
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)
HEU-SOL-THERM-046 (Joint French/LLNL)	Proserpine Experiments: Part II. Aqueous Uranium Solutions Reflected by Beryllium Oxide and Graphite
	FY-2008
HEU-MET-THERM-029	SPADE Experiments Special Materials – Part II
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part I. Plutonium (Luisa Hansen)
	FY-2009
HEU-MET-FAST-056	Graphite – Oy – D2O System (C/U: 500 – 35000)
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part II. Beryllium
	FY-2010
Neutron-Time-of-Flight	LLNL Pulsed Spheres: Part III. TBD
Neutron Transmission	LLNL (Bramblett & Czirr) ^{235}U and ^{239}Pu Plate Transmission Measurements

FY-2011 and Beyond	
Others	To Be Determined

ICSBEP FIVE-YEAR PLAN OAK RIDGE NATIONAL LABORATORY	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
IEU-MET-FAST-018	Polyethylene Reflected and Unreflected Cuboids of U(37.5) Metal (Contributed)
IEU-MET-THERM-001	Cronin U(37.5) Metal Experiments, Recently Unclassified (Contributed)
IEU-COMP-MIXED-002	Unreflected UF4-CF2 Blocks with 12.5, 18.5, 25, and 30% Effective Enrichment
SUB-MET-THERM-001 Revision 1	MURR Fuel – Revision with additional configurations
SUB-MET-THERM-002	MURR Fuel with Strong Neutron Absorbing Materials
FY-2008	
SUB-HEU-SOL-THERM-002	WINCO Slab Tanks with HEU Uranyl Nitrate Solution
LEU-COMP-THERM-067	Cronin Sterotex U(4.89) Blocks, H/U from 0 to 37, ORNL-2986
LEU-MET-THERM-007	U(4.89) Metal Rods in Water or Uranyl Fluoride Solution
LEU-MET-THERM-008	Libby Johnson U(4.89) Metal Rods, Various Interstitial Absorbers
FY-2009	
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)
SUB-HEU-SOL-THERM-003	Subcritical PNL Slab Tanks with HEU Uranyl Nitrate Solution
LEU-SOL-THERM-026	U(4.89)O2F2 Solution in Cylinders, Spheres, and Boxes, H/X from 524 to 1009 (ORNL-2968)
FY-2010	
LEU-MET-THERM-009	Libby Johnson U(3.85) Annular Metal Billets (7.62 cm OD)
FY-2011 and Beyond	
U233-MET-INTER-001	Critical Measurements on the ^{233}U ZPPR Plates in the LANL ZEUS Assembly
MIX-COMP-INTER-004	Cooperative Analysis of ^{238}U MOX Experiment with LANL
	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.

ICSBEP FIVE-YEAR PLAN SANDIA NATIONAL LABORATORIES	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
LEU-COMP-THERM-080	Water-Moderated Square-Pitched U(6.93)O_2 Fuel Rod Lattices
FY-2008 and beyond	

ICSBEP FIVE-YEAR PLAN SAVANNAH RIVER (WASHINGTON SAFETY MANAGEMENT SOLUTIONS, LLC)	
IDENTIFIER	***DRAFT TITLE***
FY-2007	
PU-MET-FAST-044	Pu Metal Sphere with Different Metal+Polyethylene Reflectors (Table IIIA2 of LA-3067-MS)
HEU-MET-FAST-TBD	HEU LANL Ti Reflector (from Brewer Spreadsheet)
HEU-MET-TBD	ORNL HEU Metal Annuli filled with Be
U233-COMP-THERM-004	Bettis U233-Th Lattice Physics Experiments, Judd Hardy, et.al.
FY-2008	
HEU-COMP-INTER-007	HEU Space Reactors
HEU-COMP-TBD	Enriched Uranium-hydride systems (from Table IIF2 of LA-3067MS)
SUB-HEU-MET-THERM-002	Subcritical (Exponential) SRS Fuel Assemblies (Mk XVIB and Mk XIIA)[UCNI]
FY-2009	
SUB-PU-MET-THERM-001	Arrays of Pu-Al Alloy Rods in H2O [UCNI]
SUB-LEU-MET-THERM-008	Subcritical (Exponential) SRS Fuel Assemblies (Mk V and Mk 15) 0.95 to 1.1% Enriched
FY-2010	
FY-2011 and Beyond	
Others	To Be Determined

Appendix D

Nuclear Data Needs

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

Activity	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010[†]
Differential Measurements (ORNL)	^{55}Mn, K LANL: ^{19}F (inelastic)	^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu	^{240}Pu, ^{237}Np, Ti, Be, Ca, ^{51}V, assess thermal data (HF, SiO_2)	Li, thermal data (HF, SiO_2)	assess ^{185}Re, ^{187}Re, ^{56}Fe, Zr, thermal data
Integral Measurements (LANL)	None	Sub-Criticals: ^{55}Mn, Ni, Cu *Ti, V (VNIITF)*	Sub-Criticals: Pb, W, Ca, Zr, Mo	Begin start-up	Np, Ca
Evaluation	ORNL: ^{55}Mn (RR), ^{238}U (UR), Th, ^{231}Pa, ^{233}Pa, ^{39}K, ^{40}K, ^{41}K, LANL: ^{9}Be, ^{235}U(capture)	ORNL: ^{55}Mn, (RR), ^{19}F (inelastic) LANL: ^{235}U (inelastic), Np (capture & fission)	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (RR), ^{55}Mn (UR) 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	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V (UR) ; Li, ^{138}Ce ^{140}Ce, ^{142}Ce (RR) LANL: W isotopes
Covariance Generation (New evals and retroactive covariance generation)	ORNL: ^{233}U, ^{235}U, ^{238}U, ^{19}F, ^{35}Cl, ^{37}Cl LANL: ^{235}U, ^{238}U, ^{239}Pu	ORNL: ^{55}Mn, ^{39}K, ^{40}K, ^{41}K, ^{19}F (RR) LANL: ^{233}U MULTI-LAB: Low Fidelity Covariance Files	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (RR), ^{55}Mn (UR) LANL: Ti isotopes, ^{55}Mn	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu (UR); ^{237}Np, Ti, Be, Ca, ^{51}V (RR) LANL: ^{240}Pu, ^{16}O, ^{51}V	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V (UR) ; Li, ^{138}Ce ^{140}Ce, ^{142}Ce (RR) LANL: W isotopes
ENDF Evals delivered to NNDC	^{28}Si, ^{29}Si, ^{30}Si, ^{35}Cl, ^{37}Cl, ^{239}Pu, ^{235}U, ^{238}U, other U isotopes, ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{208}Pb, Be	^{19}F, ^{39}K, ^{40}K, ^{41}K, ^{235}U, Be, Np, ^{233}U, [Th, ^{231}Pa, ^{233}Pa, ^{234}U (CRP)]	ORNL: ^{55}Mn LANL: Ti isotopes, ^{54}Fe, ^{56}Fe	ORNL: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu LANL: ^{240}Pu, ^{16}O, ^{51}V	ORNL: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V LANL: W isotopes
CSEWG Testing	Beta Versions of ENDF/B-VII.0 evaluations, including covariance data	Beta Versions of ENDF/B-VII.1 evaluations, including covariance data	^{55}Mn, ^{233}U	^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu	^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V
Processed Libraries	Beta Versions of ENDF/B-VII.0	ENDF/B-VII.0 distributed; Beta Versions of ENDF/B-VII.1	Beta Versions of ENDF/B-VII.1	Beta Versions of ENDF/B-VII.1	Beta Versions of ENDF/B-VII.1

[†] FY2011 effort is anticipated to include measurements (differential and integral) and evaluations of the W isotopes to address the poor performance of current evaluated data for tungsten.

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, SiO_2) / Np, V, C, N, Zr, Ni, F, Cu, Ce, Ca, K, FP's, higher actinides, multiplicity distrib.

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, 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

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

Appendix E

FY-2007 Foreign Travel Requests

International Criticality Safety Benchmark Evaluation Project (ICSBEP)

The ICSBEP is an international program involving 17 different countries and the OECD NEA. As such, annual project Working Group meetings are generally held outside the United States every other year. Approximately 15 - 20 participants from the United States (including Working 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-2007 ICSBEP Meeting is currently scheduled to be held in the United States. Meetings outside the United States are planned for 2008 and 2010.

The chairman 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. This meeting is typically held at NEA headquarters in Paris, France.

The International Conference on Nuclear Criticality Safety (ICNC 2007) will be held in St. Petersburg, Russian Federation in May of FY-2007. Approximately 8 individuals from the various participating national laboratories and subcontractors are expected to attend this meeting, including the project administrator who is responsible for the OECD NEA booth at which ICSBEP and International Reactor Physics Experiment Evaluation Project (IRPhEP) materials will be distributed.

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. 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.

Analytical Methods Development and Code Maintenance

From this NCSP program element, two ORNL staff members participate in the annual OECD/NEA nuclear criticality safety meetings. This includes a United States Representative to the Working Party on Nuclear Criticality Safety (WPNCS) and a membership on the Fission-Source Convergence Working Group. Additionally, five ORNL presentations and several LANL presentations on nuclear criticality safety technology will be made at the International Conference on Nuclear Criticality 2007 (ICNC'07) meeting in June, 2007. The AROBCAD Sub-Task will not require foreign travel in FY07, however several trips are planned for FY 2008.

Nuclear Data

The Nuclear Data program element annually supports one ORNL staff participant in the OECD/ NEA Working Party on Evaluation and Cooperation meetings (WPEC) meetings. This is the

major activity involving international cooperation on the development and evaluation of nuclear data. A major forum for presentations on nuclear data is the triennial series of International Conference on Nuclear Data to be held in France in 2007. Three ORNL staff members and one LANL staff member will participate in this conference. The IAEA funds the direct costs for the ORNL nuclear modeling specialist to make the SAMMY presentations at the biennial Workshop on Nuclear Reaction Data and Reactor Physics. The 2007 IAEA trip may require NCSP foreign travel approval.

Integral Experiments

The integral experiments program element will require at least 5 foreign trips next year: 2 trips per year to the Russian Federation and 1 trip per year to France to participate in experimental activities, 1 trip to Istanbul, Turkey to attend the 13th International Conference on Emerging Nuclear Energy (ICENES2007) and 1 trip to St. Petersburg, Russia to attend the 8th International Conference on Criticality Safety (ICNC2007).

Information Preservation and Dissemination

The Information Preservation and Dissemination Program Element plans on presenting training and communication papers in the International Conference on Criticality Safety to be held in St. Petersburg, Russia in 2007.

Training and Qualification

No projected foreign travel.

Appendix F

Summary of Prioritized Un-Funded FY-2007 Tasks

PROGRAM ELEMENT	TASK	COST	NDAG PRI	COMMENT/ RANKING
Nuclear Data	ORNL DATA-2: Nuclear Modeling (Continuing Sub-task)	$390k	8	3a NOTE: This is legitimately a NCSP Infrastructure Support Task Required for Co-Variance Improvements; If not picked up by SC or NE, may have to move up to a priority 2 task
LLNL NCSP Support	LLNL DATA-1: LLNL participation in CSEWG, IAEA, NDAG, and OECD/NEA activities and meetings and support to universities. (New Sub-task)	$40k	9	3b
ORNL NCSP Support	ORNL NCSP – 1 New Task: Provide ongoing NCSP support to AROBCAD, input to CSWEG, OECD, NDAG, ICSBEP, and nuclear data testing in support of ICSBEP and QA for SCALE using new data evaluations	$150k		3b
Information Preservation and Dissemination	IPD-2: Hanford Database Maintenance (Continuing Sub-task)	$32k		3c
Information Preservation and Dissemination	IPD-5: LANL CSIRC Tasks Including Maintenance of CSIRC Website	$100k		3c
Information Preservation and Dissemination	IPD-4: CSIRC ORCEF Heritage (ORNL) Video Completion	$30k		3c
Diff. Experiments/ORELA	ORNL DATA-5: ORELA Refurbishment (Continuing Sub-task)	$475k	12	3d **NOTE: Must be Picked up by SC or NE**
AROBCAD	AROBCAD-3: Develop approach for establishing safe Administrative Margins of subcriticality	$200k		3e
AROBCAD	AROBCAD-4: Investigate, develop, and justify the process for organizing, formatting and distributing criticality benchmark	$140k		3e

	sensitivity data files of existing and subsequent NCS benchmarks. Prepare and distribute critical experiment TSUNAMI S/U files using ENDF/B-VI/VII data/39			
Nuclear Data	ORNL DATA-8: Maintain Scientific/Technical Capability by Transitioning Knowledge/Expertise of SAMMY Model Specialist to New Model Specialist (Extension of an Existing Sub-task)	$150k	11	3f
	SUB-TOTAL OF ALL PRIORITY 3 TASKS	**$1707k**		
	END OF CREDIBLE FUNDING RANGE	**$11,902k**		
Operations Support	OPS SUPPORT-1: Hanford/LLNL Waste Container Criticality Safety System (New Sub-task: FY-07: $60k Hanford; $30k LLNL. This task would continue through FY-11 with the following proposed funding profile: FY-08: $300k; FY-09: $400k; FY-10: $300k; and FY-11: $150k)	$90k		
Analytical Methods	LLNL METHODS-1: PREPRO/COG support (Continuing Sub-task that includes cross-section processing and a modest level of support for COG maintenance and user support.)	$160k		
Integral Experiments	INTEGRAL EXP-4: Establish Hand-stacking capability at LANL (Continuing Sub-task)	$200k		
AROBCAD	AROBCAD-5: Develop and Update GUIs for existing S/U codes/43	$120k		
Analytical Methods	ORNL METHODS-8: Improved Software Quality Assurance – Periodic, Automated Verification (New Sub-task in an Existing Category: SCALE/KENO Maintenance)	$100k		
Analytical Methods	ORNL METHODS-5: Continuous Energy KENO (CE-KENO) – Validation of Cross Section Libraries (Extension of an Existing Sub-task: Generation of CE-KENO Library in FY06)	$150k		
Analytical Methods	ORNL METHODS-4: Automated Pitzer Solution Solver Data – Plutonium Solutions (Extension of the existing sub-task that is addressing uranium solutions)	$180k		
Training and Qualification	T&Q-2: Criticality Safety/Accident Training Simulator (New Sub-task)	$300k		
Analytical Methods	ANL METHODS-3: VIM2KENO / VIM2COG software (Enhancement: Develop Codes to translate VIM plate input files to KENO and COG.)	$50k		

Training and Qualification	T&Q-6: ORNL/LANL/LLNL Multi-Lab Permanent/Long-Term Training Plan That Emphasizes Methods and Practices for Preparing Criticality Safety Evaluations AND Involves Students in Hands-On Critical Experiments	$110k		
Analytical Methods	ORNL METHODS-6: Automated Fission Source Testing & Convergence Algorithms (New Sub-task in Existing Category: Source Convergence Studies at ANL & LANL)	$150k		
Analytical Methods	ANL METHODS-5: Source Convergence (Enhancement: Implement Ueki's entropy convergence test methods in VIM and test.)	$75k		
Training and Qualification	T&Q-5: LLNL Criticality Safety Intern Program (New Sub-task)	$50k		
Analytical Methods	ORNL METHODS-9: Parallel KENO – Parallelization Strategy Demonstration & Implementation (New Sub-task in an Existing Category: SCALE/KENO Maintenance)	$120k		
Analytical Methods	ORNL METHODS-11: Quality-Assured Access to NCSP Software Tools. (New Sub-task in a Existing Category: RSICC Services)	$30k		
Analytical Methods	LLNL METHODS-2: GUI Development/Demonstration (Enhancement)	$60k		
Analytical Methods	ORNL METHODS-10: Guidance on Stochastic Criticality Accident Alarm System Analyses as Verified with High-Order Deterministic Transport Methods. (New Sub-task in a New Category: CAAS Evaluation)	$150k		
Nuclear Data	INL DATA-1: Intense Pulsed Neutron Source (IPNS) differential cross section measurements of fission and radiative capture reactions on ^{240}Pu, ^{241}Pu, and ^{242}Pu. ^{240}Pu would be measured first. This proposal spans 3 years at $1,200k per year, total. Proposed funding split is NE: $800k/year; NNSA: $400k/year. NE commitment is required to proceed. (New Sub-task)	$400k (contingent upon NE commitment)	15	
Nuclear Data	ORNL DATA-9: Investigate Feasibility for Using ORNL/NCSU Approach for Generating S(α, β) Data for 2-3 Thermal Moderators Needed for Criticality Safety Applications (New Sub-task)	$150k	16	Worth further consideration
Nuclear Data	ORNL DATA-7: Develop and Test ENDF/B-VII Continuous-energy (CE) CENTRM and Multigroup (MG) Libraries with Approximate Covariance Data for SCALE (New Sub-task)	$300k	13	

Nuclear Data	BNL DATA-2: Production of a new nuclear decay data library for improved decay heat calculations (New Sub-task)	$75k	14	
Analytical Methods	ANL METHODS-4: Physics Enhancements (Enhancement: Document physics enhancements and validation results.)	$75k		
Training and Qualification	T&Q-7: LLNL Hands-On Training	$1330k		
Nuclear Data	ORNL DATA-6: Nuclear Data Administration (Continuing Sub-task)	$70k	10	Subsumed by new NCSP support task in Cat 3 above
Analytical Methods	ORNL METHODS-7: Analytical Methods Administration – Planning, Coordination, Reporting (Continuing Sub-task)	$80k		Subsumed by new NCSP support task in Cat 3 above
AROBCAD	AROBCAD-6: AROBCAD Administration/42	$120k		
Integral Experiments	INTEGRAL EXP-3: Finalize the design for the new SHEBA (Continuing Sub-task)	$200k		Costs will be borne by the project.