



Department of Energy
National Nuclear Security Administration
Washington, DC 20585
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DNE SAFETY BOARD

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W.
Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

The Implementation Plan (IP) for Defense Nuclear Facilities Safety Board Recommendation 97-2 requires a quarterly status report. Enclosed is the Department of Energy's quarterly status report for the second quarter, Fiscal Year 2001.

The IP contains 30 milestones, and the final milestone, 6.6.3.4, *Department of Energy Field Elements will provide line management dates upon which contractors will have implemented qualification programs*, was met in April 2001. Although all commitments have now been met, stability of funding to implement Recommendation 97-2 remains an ongoing concern. The Nuclear Criticality Safety Program (NCSP) Management Team will work with program sponsors to review the NCSP, justify program requirements, achieve agreement on appropriate scope and level of necessary support, and establish a process which stabilizes funding support for the program. This effort will also yield an updated Five-Year Plan for the NCSP, and is targeted for completion in August 2001. I am committed to working closely with the affected program offices to stabilize funding for the NCSP prior to requesting closure of the Recommendation.

Sincerely,

David H. Crandall
Assistant Deputy Administrator
for Research, Development, and Simulation
Defense Programs

Enclosure

cc (w/encl):
M. Whitaker, S-3.1
C. Huntoon, EM-1
T. Gioconda, DP-1
J. Gordon, NA-1



QUARTERLY STATUS OF THE IMPLEMENTATION PLAN
FOR
DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 97-2
SECOND QUARTER FISCAL YEAR 2001

The Department of Energy (DOE) began implementing Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 97-2 in January 1998 by formally establishing the Nuclear Criticality Safety Program (NCSP). Each of the seven NCSP Tasks (Critical Experiments, Benchmarking, Analytical Methods, Nuclear Data, Training and Qualification, Information Preservation and Dissemination, and Applicable Ranges of Bounding Curves and Data) is dependent upon the others for a successful program. Implementation of the NCSP is being accomplished according to the Five-Year NCSP Plan which was published in August 1999.

The Nuclear Criticality Safety Program Management Team (NCSPMT) and the Criticality Safety Support Group (CSSG) are performing their respective chartered functions in supporting the Responsible Manager's execution of the Implementation Plan (IP). During the quarter, the NCSPMT and CSSG coordinated activities aimed at completing the remaining IP milestone and continued to provide justification necessary for maintaining funding support. Both groups were also instrumental in drafting a response to DNFSB Technical Report # 29, *Criticality Safety at Department of Energy Defense Nuclear Facilities*, which will be forwarded to the DNFSB in May 2001.

Regarding the Fiscal Year (FY) 2001 budget, the Office of Environmental Management restored about half of its \$720,000 shortfall, which allowed for continued acquisition of nuclear cross section data at the Oak Ridge Electron Linear Accelerator. Impacts of the remaining shortfall do not diminish capability, but rather involve delays in scheduled activities in the Analytical Methods and Nuclear Data tasks. The NCSPMT has met several times during the last quarter and is committed to working with contributing program offices to review the NCSP, justify program requirements, achieve agreement on appropriate scope and level of necessary support, and establish a process which stabilizes funding support for the program. This effort will also yield an updated Five-Year Plan for the NCSP. The target completion date for these activities is August 2001.

This quarterly report provides a status of activities for each of the seven NCSP elements, as well as Recommendation 97-2 IP Milestones. Steady progress is being made in all seven of the NCSP task areas. The final milestone, 6.6.3.4, *Department of Energy Field Elements will provide line management dates upon which contractors will have implemented qualification programs*, was met in April 2001. There is one attachment to this report: Attachment A is a table depicting the status of all IP Deliverables and Milestones.

Accomplishments and key issues in each of the program task areas which arose during the period are contained in the following sections of the report.

Critical Experiments

Experiments were conducted on three of the five Los Alamos Critical Experiments Facility (LACEF) assemblies during this quarter. In addition to performing these experiments, two criticality safety courses were also provided. A status of activities by critical assembly is as follows:

Flattop: Flattop was inoperable for this entire quarter due to a malfunction of the control rod drive system. A path forward for restart of Flattop, which includes replacement of the 50-year old control rod drive system and the performance of a full readiness assessment, has been developed and submitted to the Department of Energy Los Alamos Area Office (DOE/LAAO). DOE/LAAO has approved this path forward for restart, and it is anticipated that restart will take about 1 to 2 years.

Comet/Zeus: On March 7, 2001, LACEF received approval of a revised control set for the Zeus experiment from DOE/LAAO. This is a major accomplishment, as it will allow the Zeus series of experiments to proceed beyond the single configuration that has been measured so far. The Zeus core has been reconfigured twice this quarter. The first reconfiguration was to change from a 4-centimeter graphite/oralloy plate/4-centimeter graphite configuration to a 3-centimeter graphite/oralloy plate/3-centimeter graphite configuration. The second reconfiguration was to move the glory hole from the lower section of the core to the upper section of the core. This second reconfiguration will allow the installation and use of the sinusoidal actuator, which is the next significant change for Zeus. A total of eleven Zeus operations were performed this quarter to characterize these two configurations. A benchmark write-up on the 3-centimeter graphite/oralloy plate/3-centimeter graphite configuration will be initiated during the next quarter.

SHEBA: SHEBA remains inoperable as a result of failure of the cover gas system. It was discovered that the cover gas system, which is designed to sweep out the radiolytic gasses and pass them through the catalytic recombiner, was not performing at full capacity. This resulted in an Unusual Occurrence and termination of SHEBA operations. Repair of the cover gas system is currently under way.

Godiva: Eleven Godiva operations were performed this quarter in support of criticality safety courses, operator training, neutron dosimetry measurements for ESH-4 and ESH-17, and benchmarking of nuclear instrumentation for the emergency response program. In addition, DOE/LAAO approved neutron measurements with instruments in the glory hole which allows for add-on irradiation experiments.

Planet: Fifteen operations were performed this quarter in support of NCSP experimental activities, criticality safety courses, and operator training. Experimental activities with waste/tuff materials continue. Work also continues on documenting the results of these activities for the benchmark program. Two benchmarks have been drafted and are currently undergoing internal review.

Benchmarking

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) participants continued their efforts in evaluating and documenting additional data during the second quarter of FY 2001. There are now 38 new evaluations in progress of which 28 are expected to be completed in time for the next ICSBEP Working Group Meeting. About half of these evaluations are from outside the United States.

Plans for the next ICSBEP Working Group Meeting continued during the second quarter of FY 2001. The next Working Group Meeting will be held June 12-15, 2001, in Jackson Hole, Wyoming. The Organization for Economic Cooperation and Development (OECD) Task Force on Subcritical Measurements will meet on the morning of June 12, 2001, at the same location. A technical tour of the Zero Power Physics Reactor and Transient Reactor Test facilities at Argonne National Laboratory (ANL) is also being planned in conjunction with the working group meeting.

Significant progress was made on the joint OECD/ICSBEP effort to create a searchable database for the "International Handbook of Evaluated Criticality Safety Benchmark Experiments." Initial data entry is about 99 percent complete. An effort to provide an independent verification of the data entry process was initiated near the middle of March 2001 and will continue for the next several months. When completed, the users of the Handbook will be able to more easily select experimental configurations that are appropriate for their validation requirements.

Significant progress was also made on the calculation of neutron spectra characteristics for each configuration in the Handbook. These data are necessary to properly characterize each configuration and have become primary search elements in the database.

Analytical Methods

Staff at the Oak Ridge National Laboratory (ORNL) continued to maintain KENO software and assist the nuclear criticality safety community in the use of this software. In March, a SCALE/KENO-VI workshop, sponsored by the Department's Office of Materials Disposition, was conducted for nine Russians from several Russian nuclear institutes. In addition, the documentation of the SCALE/KENO criticality sequences was updated to include the new multi-cell option. This provides for the simultaneous treatment of multiple fuel types in the problem-dependent cross section processing. CENTRM documentation for the upcoming SCALE System version 5.0 is now in draft form. A new version of CENTRM, which features greatly improved computer memory management, is also under development. Work on modifying KENO-VI and the CSAS6 sequence software for implementation into SCALE 5.0 was completed.

Staff at the Los Alamos National Laboratory (LANL) continued to maintain MCNP software and assist the nuclear criticality safety community in the use of this software. In addition, an Advanced MCNP class was taught at Los Alamos. During the quarter, a new version of MCNP, called MCNP4C2, was released to the Radiation and Shielding Information and Computational Center for the criticality safety community. The major new features in 4C2 include: interactive

plotting (including using DVF on a PC), substantial enhancements to the macrobody feature, improvements to the weight window treatment, photonuclear physics, revised summary tables, and the ability to plot a superimposed weight window mesh. Work continued on updates to the MCNP manual and to enhancements to the LANL Web pages. Also, the physics of sub-critical alpha calculations is being investigated, and results will be distributed during the next quarter. MCNP is being modernized, including the use of F90 and the Razor code development system. Some of the features of interest to the criticality safety community that are being worked on for the future are automatic source point generation for eigenvalue problems and improved source definition capability for repeated structure geometries.

Staff at ANL continued to maintain the VIM code and to perform the studies on fission source convergence. The VIM Criticality Safety Monte Carlo code package, including ENDF/B-IV, -V, -VI, and JEF2.2 libraries and on-line documentation, was sent to the Radiation and Shielding Information and Computational Center. The ANL analysis of the Monte Carlo fission source power iteration has been completed, and a journal article prepared for review and publication.

Nuclear Data

At ORNL, efforts were focused on various data reduction and evaluation tasks. Data reduction for the U-233 thick sample transmission measurements, the chlorine capture and transmission measurements, and the silicon capture measurements were completed. New evaluations for U-233, Al-27, and silicon (3 isotopes) have been submitted to Cross Section Evaluation Working Group (CSEWG) through the Nuclear Data Center at Brookhaven National Laboratory (BNL). Documentation of these evaluations is either published or in draft form. Evaluations in progress include Cl-35 and Cl-37. Blair Briggs from Idaho National Engineering and Environmental Laboratory is utilizing the new silicon evaluation as part of the ICSBEP Benchmarking effort. A new format has been added to ENDF/B for the O-16 evaluation, and appropriate modifications for processing have been made to NJOY and AMPX. Two documents on evaluation software enhancements were also published.

At LANL, efforts were focused on maintenance and enhancement of the NJOY cross section processing system and the generation and testing of new libraries for the MCNP transport code. Additionally, a new U-238 evaluation that makes some significant enhancements to the existing ENDF/B-VI evaluation has been released for testing at Los Alamos. Some of the notable changes/improvements are: new elastic and inelastic scattering information, based on coupled-channel optical model ECIS calculations, width-fluctuation compound nucleus reactions, and direct reaction calculations; new channel cross sections for reactions such as (n,n') , $(n,2n)$, and $(n,3n)$; and new fission cross section based on more recent LANSCE measurements. Based on LANL testing results, the evaluation may be further refined before it is submitted to the CSEWG. A number of minor corrections were assembled into a new release NJOY 99.32. The topic of Software Quality Assurance is becoming very important at Los Alamos, and new draft procedures have been circulating for evaluation and comment. A new web-based "issue tracker" was designed and put into place, thus giving NJOY users around the world access to the latest issues and their resolutions. During this quarter, a new version of the 80x24 multigroup library was

generated in several formats, including a new version of MATXS11 for use with the TRANSX codes. These data are suitable for use with the new multigroup MCNP option announced for the previous quarter. A revised version of URES, our MCNP library based on ENDF/B-VI that includes probability-table data, was also sent to the Radiation and Shielding Information and Computational Center during the quarter.

At ANL, follow-up activity from the November 2000 meeting of the CSEWG at BNL included: preparation and distribution of the minutes for the Data Validation Committee; interactions with the international data community regarding plans to improve and validate new data evaluations (in particular, current evaluation effort by LANL for U-238 and O-16); and participation in the electronic paper review for the 2001 Nuclear Data Conference. An extensive and systematic verification and validation activity utilizing benchmark assemblies from the ICSBEP handbook and the CSEWG Benchmark Specifications (ENDF-202) is in progress. This effort includes comparison of continuous-energy Monte Carlo results and libraries (using VIM and MCNP) and multigroup deterministic methods. Results, based on a diverse set of fast assemblies, have been completed and submitted for presentation at the Nuclear Criticality Safety Division Embedded Topical Meeting in Reno, Nevada, in November 2001.

Training and Qualification

This program element includes three sub-elements: (1) hands-on criticality safety training at Los Alamos; (2) training development; and, (3) criticality safety qualification program activities.

Hands-on criticality safety training continued at LANL during the quarter. One basic 5-Day Course (January 22-26) and a 3-Day Course (February 6-8) were conducted.

Regarding training development, the eighth Nuclear Criticality Safety Engineer Training module, "Hand Calculation Methods - Part 1, Buckling Conversion and Surface Density Methods," was completed and added to the NCSP web site. Initial plans were made to develop a module on the criticality safety of chemical separation processes. This effort will start as soon as the module details are finalized and personnel can be assigned.

Qualification program activities continued during the quarter. As stated above, the final Recommendation 97-2 milestone, 6.6.3.4, concerning contractor criticality safety qualification programs, was met in April 2001. The Office of Environment, Safety and Health will help assure continued implementation of contractor criticality safety qualification programs by integrating oversight of this aspect of the field element nuclear criticality safety program into its ongoing oversight activities.

Information Preservation and Dissemination

This program element currently contains two sub-elements: (1) the Criticality Safety Information Resource Center (CSIRC); and (2) NCSP web page development.

Regarding the CSIRC Program, the following progress has been made. Additional experimental logbooks were found at ORNL and were scanned. Scanning of logbooks and related, historical documents also continues at Lawrence Livermore National Laboratory (LLNL). Several requests for hard copies and CDs of the documents LA-10860, LA-12808, LA-13638, and their reference sets were filled. Bob Rothe continued to refine his History of the Rocky Flats Critical Mass Laboratory document, with publication planned later this year. Finally, minor editing of the Heritage Videos has begun.

The NCSP web site at LLNL is being maintained and improved. This web site provides technical information and latest information of interest to the criticality safety community. It also serves as a pointer to other web sites which are important to the NCSP. For the second quarter of FY 2001, the NCSP web site highlights included the following:

- (1) Updated entries to the web site registration database;
- (2) Released three versions of the new NCSP web site for limited review and testing;
- (3) Created a Java Applet announcement for Nuclear Criticality Safety Engineer Training module number 8;
- (4) Announced availability of the quarterly report, "QUARTERLY STATUS OF THE IMPLEMENTATION PLAN FOR DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 97-2 FIRST QUARTER FISCAL YEAR 2001" and included a copy of the report on the web page for download; and
- (5) Continued enhancing the LLNL technical reference database.

Applicable Ranges of Bounding Curves and Data

During the second quarter of FY 2001, three of the five technical program tasks were actively addressed. Emphasis was placed on moving software into production status, prior to the further development of guidance on its use and/or the performance of sensitivity/uncertainty studies.

Under subcontract extension, the University of California, Berkeley, continued to modify the SWANS code for performing geometric optimization.

Further work has been conducted on the development of the SEN1 and SEN3 computational sequences for producing sensitivity coefficients for criticality safety models within the SCALE code system. Methods have been implemented to compute the sensitivity of k-eff to the group cross section resonance processing with BONAMI and NITAWL-II. When combined with the previous techniques for predicting the sensitivity of k-eff to the group cross-sections, the accuracy of the calculation of the sensitivity coefficients is greatly improved for certain classes of systems. These new techniques have been tested with both SEN1 and SEN3.

The SEN3 methods have been updated for inclusion in version 5 of SCALE. This update involved including the flux moment and angular flux calculation techniques into the FORTRAN 90 version of KENO V.a and updating the SEN3 control module and SAMS module for compatibility with SCALE 5. Numerous features and optimizations were also implemented during this update.

Work continued in the development of both SEN1 and SEN3. SEN1 is undergoing transition to SCALE 5, and SEN3 is being optimized to reduce memory requirements to allow easier use of the 238 group neutron cross-section library of SCALE.

A draft Nuclear Science and Engineering journal article describing the Sensitivity and Uncertainty AROBCAD studies was completed in late CY 2000, with peer reviews completed in the January-February 2001 period. In the month of March, the suggestions by the peer reviewers were incorporated into the document. Final editing and review are currently under way with submittal to the ANS publications review expected sometimes early during the next reporting period.

ATTACHMENT A: IP COMMITMENT AND DELIVERABLE/MILESTONE STATUS

Commitment	Deliverable/Milestone	Due Date	Status
6.1 Assess critical experiments program	1. Assessment report of criticality research program	March 1998	Completed
6.2.1 Perform CSIRC pilot program	1. Identify an experiment to archive	November 1997	Completed
	2. Archive logbook(s) and calculation(s) for that experiment	December 1997	Completed
	3. Videotape original experimenters	January 1998	Completed
	4. Digitize data and calculations	February 1998	Completed
	5. Publish data and calculations	April 1998	Completed
6.2.2 Continue to implement the CSIRC program	1. Collocate logbooks (copies or originals) from all U.S. critical mass laboratories	December 1998	Completed
	2. Screen existing logbooks with original author/experimenter	December 1998	Completed
	3. CSIRC program plan	December 1998	Completed
6.3 Continue and expand work on ORNL sensitivity methods development	1. Technical program plan	July 1998	Completed
	2. Document initiation of priority tasks from the program plan in the quarterly report to the Board	January 1999	Completed
6.4 Make available evaluations, calculational studies, and data by establishing searchable databases accessible through a DOE Internet web site	1. DOE criticality safety web site	March 1998	Completed
	2. Y-12 evaluations on DOE web site	June 1998	Completed
	3. Calculations compiled by the Parameter Study Work Group on DOE web site	September 1998	Completed
	4. Nuclear Criticality Information System Database on DOE web site	March 1999	Completed
6.5.1 Revise and reissue DOE-STD-3007-93	1. Revise DOE-STD-3007-93	September 1998	Completed
6.5.2 Issue a guide for the review of criticality safety evaluations	1. Departmental guide for reviewing criticality safety evaluations	May 1999	Completed

Commitment	Deliverable/Milestone	Due Date	Status
6.6.1 Expand training course at LACEF	1. Expanded LACEF training course	July 1998	Completed
6.6.2 Investigate existing additional curricula in criticality safety	1. Assessment of additional training needs and review of available supplementary curricula	June 1998	Completed
	2. Initiate a program which addresses identified needs	December 1998	Completed
6.6.3 Survey existing contractor site-specific qualification programs	1. Report on the review of site qualification programs	June 1998	Completed
	2. Guidance for site-specific criticality safety training and qualification programs	September 1998	Completed
	3. Guidance to procurement officials specifying qualification criteria for contractor criticality safety practitioners	September 1998	Completed
	4. DOE Field will provide line management dates upon which contractors will have implemented guidance in Deliverable #2, above	March 1999	Completed
6.6.4 Federal staff directly performing criticality safety oversight will be qualified	1. Qualification program for Departmental criticality safety personnel	December 1998	Completed
	2. DOE criticality safety personnel qualified	December 1999	Completed
6.7 Each site will conduct surveys to assess line ownership of criticality safety	1. Individual sites issue report of findings	June 1998	Completed
6.8 The Department will form a group of criticality safety experts	1. Charter for Criticality Safety Support Group approved by the NCSPMT	January 1998	Completed
6.9 Create NCSPMT charter and program plan	1. NCSPMT charter	January 1998	Completed
	2. NCSPMT program plan	June 1998	Completed