Department of Energy
Washington, DC 20585

February 29, 2000

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 first quarter, Fiscal Year (FY) 2000.

The IP contains 30 milestones, 26 of which have been completed. All four of the remaining milestones are overdue. Recovery Plans, which were established to complete these milestones, are included in Attachment B to this report. The Management Team is working very hard to complete all remaining milestones and to continue implementing the Nuclear Criticality Safety Program.

Defense Programs (DP) understands the importance of adequate funding for the nuclear criticality safety program. Although full funding for these activities in FY 2000 has been delayed, I am pleased to report that this situation has been rectified, and DP plans to meet its commitment in FY 2000.

While the Department has not completed all Recommendation 97-2 Implementation Plan commitments, we have made significant progress and are working very hard to assure that the nuclear criticality safety program infrastructure is maintained for safe, secure, and efficient fissile material handling. We are committed to working with you in that regard.

Sincerely,

Joseph J. Mazzuca

for Gilbert G. Weigand
Deputy Assistant Secretary
for Research, Development and Simulation
Defense Programs

Enclosure

cc (w/encl):
M. Whitaker, S-3.1

QUARTERLY STATUS OF THE IMPLEMENTATION PLAN
FOR
DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 97-2
FIRST QUARTER FISCAL YEAR 2000

The Department of Energy (DOE) began implementing Defense Nuclear Facilities Safety Board 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 IP milestones and continued to provide justification necessary for maintaining funding support. Of particular note was CSSG participation in criticality safety program reviews at Oak Ridge Y-12, Los Alamos TA-55, and Savannah River FB-Line and H-Area outside tanks. This activity supported the Secretarial initiative aimed at strengthening Departmental criticality safety programs. Reviews are scheduled during the next quarter for the Hanford Plutonium Finishing Plant and Rocky Flats.

This quarterly report provides a status of activities for each of the seven NCSP elements, as well as Recommendation 97-2 IP Milestones and Recovery Plans. Only four IP milestones remain open. Recovery Plans for completion of these milestones are attached to this report. The NCSPMT is working very hard to complete all remaining milestones and to continue implementing the NCSP.

There are two attachments to this report: Attachment A is a table depicting the status of all IP Deliverables and Milestones, and Attachment B contains Recovery Plans for the four remaining milestones. This report outlines steady progress in six of the seven NCSP task areas. Work in the Benchmarking task area stopped in late November because Defense Programs was not able to provide the planned $1.5 million in Fiscal Year (FY) 2000 on a timely basis. This situation has been rectified, and funding was provided for the Benchmarking Task in February 2000. The $1.5 million shortfall in Benchmarking funding is part of a total $2.3 million shortfall in FY 2000. Impacts to other task areas from the funding shortfall are discussed in their respective sections. In January, Defense Programs resolved the FY 2000 NCSP funding issue and is considering alternatives to provide for stable funding in the out years. Work in all task areas impacted by the funding delay will be reinitiated as soon as possible. Accomplishments and key issues in each of the program task areas which arose during the period are as follows.

Critical Experiments

A status of experimental activities conducted during the period by critical assembly is as follows:

Flattop: Flattop free-run operations were performed during this quarter for the four criticality safety courses. In addition, several series of experiments in support of intrinsic neutron source strength measurements (i.e., measurement of the equivalent fundamental mode intrinsic neutron source strength) were performed. These experiments included use of both the Flattop Pu and U-235 cores, with and without neutron sources placed in the center of the cores.

Comet: Several proton recoil measurements were made this quarter using the Comet assembly loaded with the Zeus intermediate energy spectrum experiment. A revised accident analysis for this machine was completed and submitted to the DOE/Los Alamos Area Office in December 1999. The results of this revised analysis are being used to justify a request to increase the excess reactivity allowed to be loaded on the machine. Once this approval is received, the remaining Zeus intermediate energy spectrum experiments will be able to be performed.

SHEBA: Throughout October and November, several series of experiments were performed on SHEBA in preparation for future measurements of the CERES samples. (The CERES samples were developed by the French to represent spent fuel, and can therefore be used to experimentally determine the credit that can be taken for burn-up when calculating criticality safety limits of spent fuel shipping containers).

Godiva: The Godiva assembly was operated in burst mode on multiple occasions to support neutron dosimetry measurements and operator training. Sulfur pellet dosimetry [$^{32}S(n,p)^{32}P$] using Personnel Neutron Accident Dosimeters was used to characterize the absorbed dose from a 100°C Godiva burst starting at 10 cm from the assembly and working out. Both free air and phantom-reflected albedo absorbed doses were characterized.

Planet: Planet operations were performed for the four criticality safety classes conducted during this quarter. In addition to the criticality safety class operations, Planet experiments to characterize the reactivity worth of waste matrix materials continued. Specifically, Planet experiments were performed using the U-235 foils, and both Aluminum/Polyethylene and SiO_2/Polyethylene interstitial materials.

Benchmarking

During the first quarter of FY 2000, the limited FY 1999 carry over funding was used to continue/close out Benchmarking activities. Work in the Benchmarking task which had been curtailed will be resumed in February when funds are made available.

Analytical Methods

Staff at the Oak Ridge National Laboratory (ORNL) and the Los Alamos National Laboratory (LANL) continued to maintain KENO and MCNP software and assist the nuclear criticality safety community in the use of this software. At ORNL, this included further refinement of the software utilized by the new SCALE/CENTRM/KENO sequence to include the standard SCALE options for cross-section weighting (pin or cell) and fissile system analysis (1D Discrete Ordinates or 3D Monte Carlo). A final draft on SCALE/CENTRM validation for mixed oxides is in peer review. Preliminary design work to provide for resonance processing of more than one fissile mixture was performed. A fix was made on KENO-V.a and KENO-VI to terminate infinite-loop conditions when operating under UNIX control. A four-day KENO/SCALE Workshop was conducted at ORNL in early November for 18 attendees from industry, academia, and government agencies.

At LANL, the MCNP4XV code was completed. This is the fourth intermediate release between MCNP4B and MCNP4C. Four major new capabilities are included: (1) new sampling schemes for better representation of secondary particle angular distributions; (2) the capability to rigorously account for delayed neutrons with sampling of the spectra in time and energy; (3) enhancements for PC platforms; and (4) electron physics improvements. Numerous other minor new features, enhancements, and corrections were also included. MCNP4XV is anticipated to be the final intermediate version of MCNP prior to the completion of MCNP4C, which is scheduled for the second quarter of FY 2000.

At Argonne National Laboratory (ANL), the VIM web site has been established and is accessible from the DOE's Criticality Safety Program's web site. The site provides technical and programmatic information about VIM and the recently updated User's Guide. It also contains links back to the DOE site and to the ICSBEP web site.

The proposal to establish an OECD/NEA Task Force on Source Convergence in Criticality Safety Calculations was drafted and circulated electronically to the interested parties for comments. The comments were incorporated, and the final proposal was submitted to the OECD/NEA Nuclear Science Committee (NSC). The NSC approved that the Task Force on Source Convergence be established. A detailed proposal on the specific work to be accomplished will be presented at the Working Party on Nuclear Criticality Safety meeting in September 2000 and at the subsequent Nuclear Science Committee meeting.

Nuclear Data

Nuclear cross section data measurement activities: NS&E accepted the paper on fission cross-section measurements for U-233. Runs on Si were completed. Preparations for making low temperature transmission runs on thick U-233 sample are under way. A presentation on the measurement program at ORELA was made at the Cross Section Evaluation Working Group meeting in November.

Nuclear cross section data evaluation activities: Resolved resonance evaluations for 233U up to 600 eV and for 27Al cross section up to 850 keV were completed. Documentation of these evaluations is under way, and both were accepted by the Cross Section Evaluation Working Group (CSEWG) for the next revision to ENDF/B-VI. Multigroup covariance data for Si-28, Si-29, and Si-30 were regenerated with the computer code SAMMY up to 1.8 MeV and provided to the AROBCAD Task. For the U-235 unresolved region, a refinement of the capture-to fission ratio was performed in the energy range 10 keV to 300 keV neutron energy in order to reproduce with a better accuracy the non-statistical structures in the experimental data. The new evaluation was presented at the CSEWG meeting. The paper on the U-235 total cross section in the unresolved range and SAMMY/FITACS analysis of the experimental total, fission and alpha has been modified and should be ready for review in the beginning of January. Oxygen-16 cross sections values generated from the ORNL Reich-Moore resonance parameter representation have been used with excellent success for the thermal reactor benchmarks ORNL L-7 to L-11. A presentation on the O-16 evaluation was made at the November CSEWG meeting.

Evaluation development activities: The next release of SAMMY will have the capability to analyze data where charged particles in an exit channel contribute to the reaction cross section. A SAMMY users' group has been organized through the auspices of the NEA DB. A format change proposal (using ±J to indicate channel spin) was presented to and approved by CSEWG with slight modifications.

The Fission Product Review Report: A draft of the report ORNL/TM-13723 "REVIEW OF ENDF/B-VI FISSION-PRODUCT CROSS SECTIONS" has been reviewed and revised for publication.

Finally, at ANL, work on resonance theory has focused on improved treatment of the probability table methods in the unresolved resonance energy range. The treatment for zero temperature has been done by analytical means and the coding for numerical treatment is in progress. ANL will also continue to provide covariance information to be used for ENDF/B-V cross sections used in the AROBCAD Task. The new list of materials for FY 2000 is: Cu, Cd, Ca, K, 234U, 238Pu, 243Am, 143Nd, 149Sm, 103Rh, 151Sm, 133Cs, 99Tc, 152Sm, 154Gd, 153Eu, 145Nd, 147Sm, 150Sm, 95Mo, 109Ag, 101Ru, 154Eu, and 155Eu. Covariance information for these files will be generated using techniques used during FY 1999 for an earlier set of materials, as described in ANL/NDM-148.

Training and Qualification

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

Hands-on criticality safety training continued at LANL. Three-Day Nuclear Criticality Safety classes were held in October, November, and December, and a Basic Five-Day Nuclear Criticality

Safety course was held in October. The new advanced 5-day course, which was scheduled for December, had to be postponed until February 2000 because it was scheduled for the week after the Thanksgiving holiday and under subscribed. The lesson learned is not to schedule courses in such proximity to holidays. Eight additional training courses are scheduled for the remainder of Fiscal Year 2000.

Training development activities continued at a reduced level this quarter due to the lack of funding. One additional training module, Module 6, Diffusion Theory, was reviewed and reformatted for the World Wide Web, and the exercises were revised to provide more information to the reader. The final module, now in draft form, that will be reviewed as time permits is Module 7, Monte Carlo Methods.

Both Federal and Contractor Qualification Standards can be found on the Department's Home Page.

Federal: http://cted.inel.gov/cted/qualstd/critsafety/
Contractor: http://tis.eh.doe.gov/techstds/.

DOE criticality safety personnel are working towards qualification by December 2000 (see IP Recovery Plan for Milestone 6.6.4.2.1). The Department is developing a Notice that will contain a requirement for criticality safety engineer training and qualification programs (see IP Recovery Plan for Milestone 6.6.3.3)

Information Preservation and Dissemination

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

Minimal progress has been made during this quarter in all CSIRC task areas due to lack of funding. CSIRC work will continue when funding is provided in the early Spring.

Regarding web site development, the NCSP web site at Lawrence Livermore National Laboratory (http://ncsc.llnl.gov:8080/) is being maintained and improved. This web site provides technical information and serves as a pointer to other web sites which are important to the NCSP. During the first quarter, FY 2000, web site improvements included:

(1) A sixth Nuclear Criticality Safety Engineer Training Module, "Introduction to Diffusion Theory," was added in December.

(2) The DOE-STD-1135-99, "Guidance for Nuclear Criticality Engineer Training and Qualification" banner announcement and link were created.

(3) The DOE-STD-1134-99, "Review Guide for Criticality Safety Evaluations" was added.

(4) A VIM code banner announcement for NCS users to access through the Radiation Safety Information Computational Center at Oak Ridge National Laboratory and links were created.

(5) The links have been changed to reflect the new DOE web site Web Page locations to the following DOE standards:

DOE-STD-3009-94, Preparation Guide for U.S. DOE Non-reactor Nuclear Facility Safety Analysis Reports,

DOE-STD-1027 CH.2, Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports (49 pages),

DOE-STD-1066-97, Fire Protection Design Criteria (85 pages),

DOE-STD-3007-93 CH.1, Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities,

DOE-STD-3013-96, Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage (33 pages),

DOE-STD-0100T-93, Licensed Reactor Nuclear Safety Criteria Applicable to DOE Reactors,

DOE-STD-1036-93, Guide to Good Practices for Independent Verification (33 pages),

DOE-STD-1057-93, Guide to Good Practices for the Selection, Training, and Qualification of Shift Technical Advisers. (91 pages),

DOE-STD-1061-93, Guide to Good Practices for the Selection, Training, and Qualification of Shift Supervisors. (105 pages),

DOE-STD-1063-93, Establishing and Maintaining a Facility Representative Program at DOE Nuclear Facilities. (30 pages),

DOE-STD-1128-98, Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities (432 pages),

DOE-STD-3006-95, Planning and Conduct of Operational Readiness Reviews, and

DOE G 421.1-1, DOE GOOD PRACTICES GUIDE

(6) The NCSP web site was patched with the Vendor's latest security fixes to satisfy DOE OSE computer security requirements.

Applicable Ranges of Bounding Curves and Data

The five tasks of the AROBCAD program address 97-2 commitments to develop technically justifiable methodologies and user tools for validating bounding data and calculations in areas where benchmark data is unavailable or excessively sparse and to aid in the selection or design of appropriate benchmarks, thereby providing greater confidence in the calculational validation. During the first quarter of FY 2000, four of the five tasks were addressed.

TPP Task 1 - Implement use of optimization techniques for establishing bounding values.

The prototypic SWAN-SCALE one-dimensional material-optimization code has been completed and incorporated into an ORNL SCALE driver system. The user manual that was reviewed by ORNL staff and revised accordingly by University of California Berkeley (UCB) staff, has been reviewed by ORNL staff once again and will require one more iteration of revision by UCB before editorial review and approval for printing. Printing is projected by the end of the third quarter of FY 2000. The issuance of the codes is still not projected to occur before the end of 2001.

TPP Task 2 - Investigate means to resolve or incorporate anomaly and discrepancy effects into bounding values.

LANL has supplied ORNL with the historic computational input decks for the National Institutes of Standards and Technology (NIST) experiments for re-evaluation/comparison with ORNL 1-D models and documentation. Completion of the draft technical report on the investigation of discrepancies in the NIST experiments is now expected to occur in the third quarter of FY 2000. This schedule has resulted from the need to consolidate additional investigative work that has been performed at ORNL.

TPP Task 3 - Investigate utilization of sensitivity and uncertainty (S/U) and statistical methods for identifying experimental needs.

Sensitivity and uncertainty studies were performed on a previously proposed sludge transfer from the Hanford K-Basin to Tanks. The studies included the S/U analyses of critical experiment benchmarks and key safety evaluations. Also, S/U studies were performed on potential National Spent Nuclear Fuel (SNF) disposal parameters as compared to a suite of approximately 400 benchmarks. The draft report of results for both the Hanford and the SNF sensitivity and uncertainty analyses has been delayed to incorporate recent preliminary experimental results from the LANL SiO_2 – polyethylene – U(93) critical experiment and recent preliminary experimental results from the IPPE experiments performed under the DOE International Criticality Safety Benchmark Experiments Program. It is now anticipated that the draft report will be completed by the third quarter of FY 2000.

ANL has provided covariance data files to ORNL for 233-U, 236-U, Zr, Mg, Gd, Hf, 235-U, and 238-U. Comparison assessments using the ANL supplied covariance data files and existing ENDF/B-V covariance data files were performed this quarter. The comparison assessments show

differences as large as 10 percent in calculated k_{eff} uncertainties for well moderated, very low enriched uranium systems where thermal-neutron ^{238}U capture and ^{235}U fission predominate. These differences are being evaluated. During this first quarter of FY 2000, ORNL has provided ANL with an additional prioritized list of desired nuclides for the AROBCAD program development.

TPP Task 4 - Develop guidance for interpolating and extrapolating bounding values.

Effort on this subtask currently continues at ORNL considering various methods for evaluating computational biases and uncertainties due to cross section and experimental benchmark measurements using various integral parameters derived from S/U information and Generalized Linear Least Squares Method - GLLSM. This subtask will progress as further relevant information is generated and evaluated using the results of AROBCAD Task 3 and the results from TPP Task 5.

TPP Task 5 - Develop guidance for establishing bounding margins of subcriticality.

The draft assessment report of the US nuclear criticality safety community, commercial and contractor, practices and methods for establishing bounding margins of subcriticality is in writing and is expected to be completed during the second quarter of FY 2000.

FUNDING STATUS: The proposed $700K FY 2000 budget for this intended DOE DP and EM co-funded NCSP task is the level of funding necessary to address the above TPP tasks. For FY 2000, DOE/EM has funded the AROBCAD Project at $450K. Defense Programs plans to provide its share of the $700K FY 2000 funding in the Spring following approval of a reprogramming action.

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	Overdue: Expected completion date is Feb 2000 - See Recovery Plan in Attachment B
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	Overdue: Recovery Plan to be submitted when completed.
	4. DOE Field will provide line management dates upon which contractors will have implemented guidance in Deliverable #2, above	March 1999	Overdue: Recovery Plan to be submitted when 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	Overdue: Expected completion date is December 2000 - See Recovery Plan in Attachment B
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

ATTACHMENT B: RECOVERY PLANS FOR OVERDUE AND DELAYED MILESTONES

OVERDUE MILESTONES

Recovery Plan for IP Milestone 6.6.1.1: Expand Criticality Safety Training at LACEF (due July 1998).

Action	To Be Completed By	Responsibility
Conduct upgraded course	February 2000	LANL

Recovery Plan for IP Milestone 6.6.3.3: Guidance to procurement officials specifying qualification criteria for contractor criticality safety practitioners (was due in September 1998).

Action	To Be Completed By	Responsibility
1. MA issues Notice to Field Management Counsel (FMC) for initial review.	March 2000	DP-10
2. FMC comments received; FMC approves release for review and comment.	March 2000	DP-10
3. FMC comments incorporated	March 2000	DP-10
4. MA issues draft Notice for 60-day for review and comment	April 2000	DP-10
5. Comments due; EH-31 starts comment resolution	April 2000	NCSPMT
6. EH-31 completes comment resolution; forwards final draft to MA	June 2000	NCSPMT
7. MA releases approved Notice	July 2000	DP-10

Recovery Plan for IP Milestone 6.6.3.4: DOE Field will provide line management dates upon which contractors will have implemented guidance in Milestone 6.6.3.2 (was due in March 1999).

Action	To Be Completed By	Responsibility
1. MA releases approved Notice (Action #7 of Recovery Plan for Milestone 6.6.3.3)	July 2000	DP-10
2. Contractors inform DOE Field as to dates by which they will have implemented site specific training and qualification programs.	September 2000	Field
3. Field reports status to DP-10	September 2000	Field

Recovery Plan for IP Milestone 6.6.4.2: DOE criticality safety personnel qualified (due by the end of December 1999).

Action	To Be Completed By	Responsibility
1. DP will inform the FMC about the Federal Qualification Program	June 1999	Completed
2. Publish Federal Qualification Standard	November 1999	Completed
3. Lead Program Secretarial Officers (LPSOs) Task Field Managers	March 2000	DP-10
3. Fed Qual Plans Submitted to LPSOs	May 2000	Field
4. All Federal employees qualified	December 2000	Field[1]

(1) Although no official guidance has yet to be issued, most Federal employees who must qualify according to the Standard are actively working to do so.