



Department of Energy
National Nuclear Security Administration
Washington, DC 20585

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DNF 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 first quarter, Fiscal Year (FY) 2001.

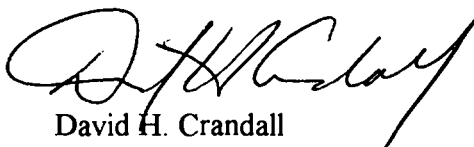
The IP contains 30 milestones, 29 of which have been completed. Two milestones were met during this quarter. Milestone 6.6.3.3, *Guidance to procurement officials specifying qualification criteria for contractor criticality safety practitioners*, was met in November 2000, when the Department promulgated a page change to DOE Order 420.1. This page change establishes a requirement for contractors to implement a criticality safety qualification program. Milestone 6.6.4.2, *DOE criticality safety personnel qualified*, was also met. At least one Federal employee at each site that has a criticality safety program has qualified in accordance with the DOE Federal Qualification Standard. Most sites plan to qualify at least one additional individual to provide depth of coverage. DOE Headquarters has two qualified individuals. With the completion of Milestone 6.6.4.2, the Department has completed all actions identified under Commitment 6.6.4 and proposes closure of this commitment. One remaining milestone, for DOE Field Offices to provide dates upon which contractors will have implemented qualification guidance, is overdue. A Recovery Plan, which was established to complete this milestone, is included in Attachment B to this report to chronicle progress. The Management Team is working very hard to complete this milestone and to continue implementing the Nuclear Criticality Safety Program.

Activities aimed at implementing the Secretary of Energy's decision to transfer Los Alamos Technical Area-18 (TA-18) capabilities to another location continued during the quarter. Activities included refinement of the TA-18 Program Requirements documentation and the pre-conceptual relocation program plan. Defense Programs is committed to an orderly transfer of capabilities to a new location, and care will be taken to assure continuity of Departmental programs and commitments. My staff is involved in these activities and will work to assure that Nuclear Criticality Safety Program needs are met throughout the relocation process.



Finally, stability of funding to implement Recommendation 97-2 remains an ongoing concern, and the Department is using the process defined in the Memorandum of Understanding, which was completed in August 1998, to address this issue. I am committed to working closely with the Office of Environmental Management to ensure essential program elements receive adequate funding, and I hope to report resolution of this issue shortly.

Sincerely,



David H. Crandall
Assistant Deputy Administrator
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 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 IP milestones and continued to provide justification necessary for maintaining funding support. Of particular note was a series of NCSP meetings which followed the November American Nuclear Society (ANS) meeting in Washington, D.C. The CSSG organized these meetings which included technical and programmatic presentations and round table discussions with members of the criticality safety community. Members of the DNFSB Staff also participated, and an address from Dr. Kouts was read by Dr. Tom Burns. Regarding the Fiscal Year (FY) 2001 budget, a \$750,000 shortfall in funding from the Office of Environmental Management exists. Impacts of a failure to resolve this shortfall accrue to the Analytical Methods and Nuclear Data tasks and are still being assessed. The NCSPMT is using the process defined in the Memorandum of Understanding to address this issue.

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. Steady progress is being made in all seven of the NCSP task areas and in completing the remaining milestone. Two milestones have been met during the first quarter. Milestone 6.6.3.3, *Guidance to procurement officials specifying qualification criteria for contractor criticality safety practitioners*, was met in November 2000 when the Department promulgated a page change to DOE Order 420.1. This page change establishes a requirement for contractors to implement a criticality safety qualification program. Milestone 6.6.4.2, *DOE criticality safety personnel qualified*, was also met. At least one Federal employee at each site that has a criticality safety program has qualified in accordance with the DOE Federal Qualification Standard. Most sites plan to qualify at least one additional individual to provide depth of coverage. DOE Headquarters has two qualified individuals. The Office of Environment, Safety and Health will help assure continuation of this capability by integrating oversight of this aspect of the field element nuclear criticality safety program into its ongoing oversight activities. Only one Milestone remains - Milestone 6.6.3.2, *DOE Field will provide line management dates by which contractors will have implemented qualification guidance*, is scheduled for completion in April 2001.

There are two attachments to this report: Attachment A is a table depicting the status of all IP Deliverables and Milestones; Attachment B contains a Recovery Plan for the remaining milestone. The NCSPMT is working hard to complete the remaining milestone and to continue implementing the NCSP.

Accomplishments and key issues in each of the program task areas which arose during the period are as follows.

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, one five-day advanced criticality safety course was also conducted. Another major activity performed during this quarter, which occupied much of the LACEF staff for approximately one month, was the defueling of the shutdown Skua critical assembly.

A status of activities by critical assembly is as follows:

Flatop: Flatop was inoperable for this entire quarter due to a malfunction of one of the control rod drive systems and the subsequent declaration of a Technical Safety Requirement violation. A path forward for restart of Flatop, which includes replacement of the 50-year old control rod drive system and the performance of a full readiness assessment, has been developed and subsequently approved by the DOE/Los Alamos Area Office (LAAO). It is anticipated that restart could take as long as two years because of the magnitude of proposed modifications.

Comet/Zeus: Essentially, all of the measurements that can be made for the current experimental configuration have been completed. No new measurements will be made with Zeus until approval is received from the DOE/LAAO to proceed with the remaining experiments. A request to continue with these experiments and all of the supporting safety documentation was submitted to the DOE/LAAO in December of 1999. A total of seven Comet/Zeus operations were performed this quarter to verify previous measurements and maintain operator proficiency.

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 the declaration of an Unusual Occurrence and termination of SHEBA operations. The approval of the DOE/LAAO to proceed with repair of the system has been requested.

Godiva: The Godiva assembly remains operational. Approximately eight Godiva operations were performed this quarter in support of the criticality safety class, operator training, and neutron dosimetry measurements for ESH-4 and ESH-17. A request has been submitted to the DOE/LAAO to allow neutron measurements with instruments in the glory hole.

Planet: The Planet assembly remains operable. Approximately 25 operations were performed this quarter in support of Recommendation 97-2 experimental activities, the criticality safety class, and operator training. Experimental activities with waste/tuff materials continue. Work also continues on documenting the results of these activities for the benchmark program.

Benchmarking

International Criticality Safety Benchmark Evaluation Project (ICSBEP) participants continued evaluating additional data throughout the first quarter of FY 2001. There are now 34 new evaluations in progress. One of those evaluations, "U(93.2)O₂(NO₃)₂ in Large Diameter Cylinders," a Savannah River evaluation, has been submitted for external peer review. A second evaluation, "ZPR 3-41 Uranium, Metal, Aluminum, Stainless Steel Core," an Argonne National Laboratory evaluation, is nearing completion.

Plans for the next ICSBEP Working Group Meeting was initiated during the first quarter of FY 2001. The next Working Group Meeting will be held June 13, 14, and 15, 2001, in Jackson Hole, Wyoming. The OECD Task Force on Subcritical Measurements will meet on June 12, 2001 (one day prior to the ICSBEP Meeting) at the same location. A technical tour of the ZPPR and TREAT facilities at Argonne National Laboratory (ANL) - West is also being planned in conjunction with the working group meeting.

A presentation on the "Status of the ICSBEP" was prepared and given at the DOE NCSP Session at the ANS Winter Meeting in Washington D.C. Presentations on the status of the ICSBEP and on the SiO₂ experimental data from IPPE were also given at the Cross Section Evaluation Working Group (CSEWG) Meeting at Brookhaven National Laboratory (BNL). A similar presentation on the ICSBEP was given at the 3rd International Yugoslavian Nuclear Society Conference in Belgrade, Yugoslavia, during the first week of October 2000.

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. Two SCALE/KENO-V.a workshops were conducted in October and November. The SCALE/KENO criticality sequences were enhanced with a multi-cell option. This provides for the simultaneous treatment of multiple fuel types in the problem-dependent cross section processing. It is operational with the NITAWL-Nordheim resonance shielding or with the more rigorous CENTRM treatment. The theoretical basis for the neutron scattering treatment in CENTRM was published in an NS&E journal article. CENTRM documentation for the upcoming SCALE System version 5.0 is in preparation. Work on modifying KENO-VI and the CSAS6 sequence software for implementation into SCALE 5.0 is under way. Significant assistance was rendered to the SCALE/KENO user community. ORNL staff participated in the functions of the NCSP Criticality Safety Support Group, including making presentations at the general NCSP review conducted in conjunction with the ANS Winter Meeting in Washington, D.C. Technical support

was provided in the development and maintenance of international and national consensus standards on nuclear criticality safety.

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. An Advanced MCNP class was taught in Oak Ridge, Tennessee, during the quarter. Substantial progress was made on the next released version of MCNP, called MCNP4C2. 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. Version 4C2 is scheduled to be released to the Radiation Shielding Information and Computing Center (RSICC) during the second quarter of FY 2001. MCNP is also being modernized, including the use of F90 and the Razor code development system. Among 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.

At ANL, work continued on maintaining and enhancing the VIM code for criticality safety applications. The code was upgraded to treat subcritical multiplication properly and to fix a minor bug in the unresolved resonance treatment of a few ENDF/B-VI nuclides. It was extensively tested in preparation for export to the RSICC.

Nuclear Data

At ORNL, effort focused on Oak Ridge Electron Linear Accelerator (ORELA) measurements and various data reduction and evaluation tasks. The ORELA capture measurements for chlorine were completed. Due to funding reductions, the data measurements for fluorine and potassium have not been initiated. Data reduction for the U-233 thick sample transmission measurements, the chlorine capture and transmission measurements, and the silicon capture measurements were performed. The U-233 data are being used for the unresolved resonance analysis. The chlorine and silicon data are used for analyzing the resolved resonance regions.

Various evaluations were presented at the CSEWG meeting at BNL. They are: the U-233 resolved resonance evaluation; the U-235 unresolved resonance evaluation, the Al-27 resolved resonance evaluation, and the O-16 resolved resonance evaluation. Also, covariance data have been generated for these evaluations. To enable processing these new evaluations, some modifications to the processing codes NJOY and AMPX were made.

Evaluations in progress include: Cl-35, Cl-37, Si-28, Si-29, and Si-30. The silicon evaluation is nearly completed. Blair Briggs from the Idaho National Engineering and Environmental Laboratory is utilizing the new silicon evaluation using as part of the ICSBEP effort. A report on the O-16 evaluation was completed: ORNL/TM-2000/212, R-Matrix Evaluation of O-16 Neutron Cross Section up to 6.3 MeV.

At LANL, effort 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. A few additional bug fixes were made in NJOY99 during this period. The only one that affects criticality calculations is a patch to process some of the fission products in JENDL-3.2 that contain an unresolved resonance range with no corresponding resolved range. NJOY2000 (which will be renamed NJOY2001) is a recoding of the NJOY system into a modern modularized free-form Fortran-90 style. Its capabilities are about the same as NJOY99, but it should be more robust, easier to maintain, and more transportable to other platforms. The coding work was finished during this period, and what remains is additional testing and the establishment of a revision control scheme.

A new ACE library for MCNP4C was prepared during the previous quarter based on ENDF/B-VI Release 5. This library contains 659 materials, 316 of them being at room temperature, and the rest being at elevated temperatures up to 2,000K. There are 45 distinct isotopes in the temperature-dependent set, mostly heavier materials where resonance broadening is most important. All the materials with valid unresolved data are provided with probability tables, and recent versions of the scattering kernel information for moderators are included. This extensive library includes 1.7GB of Type-1 ACE data. (Also, an abbreviated MCNP4C library based on JENDL-3.2 was prepared that only includes room-temperature data and adds unresolved tables.) During this period, the validation of this library continued by computing a set of critical assemblies using MCNP4C. The results of this testing were reported at the CSEWG meeting in November.

At ANL, effort focused on code upgrades and data testing. In the resolved resonance processing code, new coding was added to properly treat both negative spin-states and missing spin states in ENDF/B-VI data. The affected nuclides, Cr-53, Fe-56, Fe-57, Fe-58, Ni-60, Cu-63, Cu-65, Pb-206, and Pb-207, were processed with the new codes and placed in the production library. The new ORNL Al evaluation was also processed.

Participation in the November 2000 meeting of the CSEWG at BNL produced a number of valuable contributions related to criticality safety. Of particular interest was the discussion of the Physor 2000 paper by Bernnat et al that resulted in several suggested improvements in the ^{238}U data. Presentations were given reviewing the status of the ICSBEP and highlights of new benchmarks included in the 2000 Edition of the handbook. The ANL presented benchmark analysis of two Uranium/Aluminum assemblies (ZPR-3 Assemblies 23 and 41) which included results with ENDF/B-V and -VI and the new ORNL evaluation for aluminum.

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 Advanced five-day course was conducted.

Late in the last quarter of FY 2000, work was started on two new Nuclear Criticality Safety Engineer Training (NCSET) modules: Criticality Accident Analysis Methods and Hand Calculation Methods, Part 1. Comments from reviewers are being incorporated into the first-hand calculation methods module, and it should be posted on the web site soon. Work on the criticality accident module continued during the first quarter of FY 2001. Work has recently been completed on advanced hand calculation methods at LANL, and arrangements have been made to convert the results of that work into one or more NCSET modules at some point in the future.

Regarding qualification activities, the page change to DOE O 420.1, *Facility Safety*, was issued in November 2000. This change establishes requirements for training and qualification programs for Nuclear Criticality Safety Staff and completes IP Milestone 6.6.3.3. Contractors are working toward implementing the guidance and will notify DOE of dates upon which criticality safety qualification programs will be implemented (see Recovery Plan for IP Milestone 6.6.3.4 at Attachment B).

Milestone 6.6.4.2, *DOE criticality safety personnel qualified*, was also met. At least one Federal employee at each site that has a criticality safety program has qualified in accordance with the DOE Federal Qualification Standard. Most sites plan to qualify at least one additional individual to provide depth of coverage. DOE Headquarters has two qualified individuals. The Office of Environment, Safety and Health will help assure continuation of this capability 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 have been located at ORNL and will be scanned. Scanning of logbooks and related, historical documents continues at LANL. Requests for hard copies and CDs of the documents LA-10860, LA-12808, LA-13638, and their reference sets are being filled. Bob Rothe continued to refine his History of the Rocky Flats Critical Mass Laboratory document, with publication planned later this year. Minor editing of the Heritage Videos has begun.

The NCSP web site at Lawrence Livermore National Laboratory 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. For the first quarter of FY 2001, the NCSP web site highlights included the following:

- (1) Added twenty eight new users to the web site registration database;
- (2) Designed new NCSP web site navigational buttons for the frame base html as suggested by the user survey input;

- (3) Announced availability of Dr. Kout's remarks presented by Dr. Tom Burns at the NCSP Meeting following the ANS Winter Meeting in Washington D.C.;
- (4) Updated Nuclear Criticality Safety Engineer Training Module number 2; and
- (5) Announced availability of the quarterly report, "QUARTERLY STATUS OF THE IMPLEMENTATION PLAN FOR DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 97-2 FOURTH QUARTER FISCAL YEAR 2000" and included a copy of the report on the web page for download.

Applicable Ranges of Bounding Curves and Data

During the first quarter of FY 2001, several of the five technical program tasks (TPP) were actively addressed. Various technical reports were produced as well as a tutorial session at the ANS Winter Meeting.

TPP Task 1 - *Implement use of optimization techniques for establishing bounding values.* The final report, ORNL/TM-1999/274(UCBNE-4226), *SWANS: A Prototypic SCALE Criticality Sequence for Automated Optimization Using the SWAN Methodology,* a one-dimensional material-optimization code was published. The issuance of the code is projected to occur by the end of 2001 with the release of the updated SCALE system. As the result of subcontract extension last quarter, the University of California, Berkeley, continues to modify the code for geometric optimization routines.

TPP Task 2 - *Investigate means to resolve or incorporate anomaly and discrepancy effects into bounding values.* The final technical report on "*Further Investigations of NIST Water Sphere Discrepancies,*" ORNL/TM-2000/173 was published.

TPP Task 3 - *Investigate utilization of sensitivity and uncertainty (S/U) and statistical methods for identifying experimental needs.* Seven full-paper presentations/tutorials were provided at the November 2000 ANS Nuclear Criticality Safety Division's special invited session on "Sensitivity and Uncertainty Analysis Methods for Establishing Area of Applicability and Subcritical Margins." Additionally, a related S/U full paper was sponsored by the US Nuclear Regulatory Commission (NRC) entitled "Value Rankings of Selected Critical Experiments for Burnup Credit Validations." The NRC-sponsored work required the use of the ORNL S/U codes.

TPP Task 4 - *Develop guidance for interpolating and extrapolating bounding values.* Effort on this subtask continued 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 the Generalized Linear Least Squares Method. This subtask will progress as further relevant information is generated and evaluated using the results of TPP Task 3 and TPP Task 5.

TPP Task 5 - *Develop guidance for establishing bounding margins of subcriticality.* No work was conducted during the first quarter of FY 2001 on the draft assessment report of the United States nuclear criticality safety community (commercial and contractor) practices and methods for establishing bounding margins of subcriticality. Final drafting of this report will be completed during the third quarter of FY 2001.

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 2. Archive logbook(s) and calculation(s) for that experiment 3. Videotape original experimenters 4. Digitize data and calculations 5. Publish data and calculations	November 1997 December 1997 January 1998 February 1998 April 1998	Completed Completed Completed Completed Completed
6.2.2 Continue to implement the CSIRC program	1. Collocate logbooks (copies or originals) from all U.S. critical mass laboratories 2. Screen existing logbooks with original author/experimenter 3. CSIRC program plan	December 1998 December 1998 December 1998	Completed Completed Completed
6.3 Continue and expand work on ORNL sensitivity methods development	1. Technical program plan 2. Document initiation of priority tasks from the program plan in the quarterly report to the Board	July 1998 January 1999	Completed 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 2. Y-12 evaluations on DOE web site 3. Calculations compiled by the Parameter Study Work Group on DOE web site 4. Nuclear Criticality Information System Database on DOE web site	March 1998 June 1998 September 1998 March 1999	Completed Completed Completed 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
6.6.1 Expand training course at LACEF	1. Expanded LACEF training course	July 1998	Completed

Commitment	Deliverable/Milestone	Due Date	Status
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	Overdue: Expected completion date is April 2001 - See Recovery Plan in Attachment C.
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

ATTACHMENT B: RECOVERY PLAN FOR OVERDUE MILESTONE

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 3/99).

<u>Action</u>	<u>To Be Completed By</u>	<u>Responsibility</u>
1. MA releases approved Page Change (Action #7 of Recovery Plan for Milestone 6.6.3.3).	October 2000	Completed
2. Contractors inform DOE Field as to dates by which they will have implemented site specific training and qualification programs.	April 2001	Field
3. Field reports status to DP-10.	April 2001	Field