Department of Energy
National Nuclear Security Administration
Washington, DC 20585

February 4, 2003

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 for Defense Nuclear Facilities Safety Board Recommendation 97-2, *Criticality Safety*, requires quarterly status reports. Enclosed is the Department of Energy's quarterly status report for the first quarter of Fiscal Year 2003.

The Implementation Plan contains 30 milestones, all of which have now been completed. Although all commitments have been met, stability of funding for the Nuclear Criticality Safety Program has been an ongoing concern. With the Secretary's decision for Defense Program to fully fund and manage the Nuclear Criticality Safety Program (NCSP) for Fiscal Year (FY) 2003 and beyond, stability of funding should be achieved. Although the continuing resolution has limited budget allocations to FY 2002 levels, I remain committed to providing adequate funding for the program once Congress approves a final FY 2003 budget. The FY 2004 budget request has been adjusted to provide sufficient funding to meet NCSP requirements.

The NCSP continues to sustain progress in all of the program task areas as reflected in the body of the enclosed report. In addition, I want to inform you about our completion of a Technical Report # 29, *Criticality Safety*, commitment that was made in a Secretarial letter to you on
May 30, 2001:

> "The Department will promulgate the Deputy Secretary's self-assessment criteria as a DOE Standard. Additional criteria will be added to address needs cited in Sections 3.b and 3.c above, and to address needs cited in Sections 5 and 8 below." [Section 3.b of the Enclosure to the Secretarial letter affirmed the preference for engineered controls over administrative controls; Section 3.c affirmed the need for performance metrics and the need to periodically assess engineered controls; Section 5 affirmed the need to establish a robust process for vertically tracing criticality controls; and Section 8 affirmed the need to formalize a common framework for contractor criticality safety self-assessment programs.]

Dr. Jerry McKamy transformed the Deputy Secretary's self assessment criteria into DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, which was published in November 2002. This new standard addresses all items cited in the commitment (above). Your staff participated in the review process and their comments were included in the final version of the Standard. With completion of this action, all Technical Report #29 commitments have been met.

If you have any questions, please contact me directly or have your staff contact Mike Thompson at 301-903-5648.

Sincerely,

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

Enclosure

cc (w/encl):
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QUARTERLY STATUS OF THE IMPLEMENTATION PLAN
FOR
DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 97-2
FIRST QUARTER OF FISCAL YEAR 2003

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 (Integral Experiments, Benchmarking, Analytical Methods Development and Code Maintenance, 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. The NCSP is being conducted according to the new Five-Year NCSP Plan which was finalized in September 2002.

The Criticality Safety Support Group (CSSG) is performing its chartered functions in support of the NCSP Manager's implementation of the NCSP according to the new Five Year Plan. During the fourth quarter of Fiscal Year (FY) 2002, the CSSG participated in several criticality safety related meetings held in conjunction with the November 2002, American Nuclear Society Meeting in Washington, DC. A workshop for authorization basis and criticality safety personnel to discuss 10 CFR 830 implementation was held on November 16th, and the NCSP meeting was held on November 22nd. The NCSP meeting was very productive and well attended (approximately 70 people). DNFSB Chairman John Conway, Commissioner Nils Diaz of the Nuclear Regulatory Commission, and Dr. David Crandall, NCSP Sponsor, spoke at this meeting about their perspectives on criticality safety and the NCSP. The remainder of the meeting was devoted to presentations on contractor qualification program best practices and open discussion about topics of interest to the community.

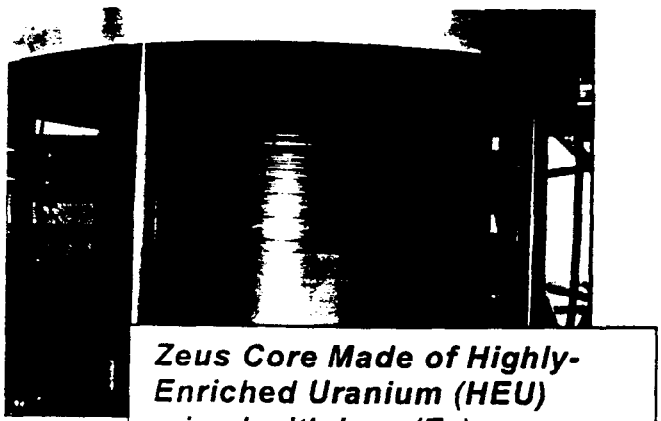
Because all 30 of the Recommendation 97-2 milestones are completed, this report will focus on the status of activities for each of the seven NCSP elements. Accomplishments and key issues in each of the program task areas which arose during the period are contained in the following sections of the report.

Integral Experiments

The following is a summary of experimental activities conducted at the Los Alamos Critical Experiments Facility (LACEF) during the first quarter of FY 2003. Experiments were conducted on four of the five LACEF assemblies during this quarter in support of the NCSP. In addition to performing these experiments, two internal Los Alamos (2-day) criticality safety courses were also provided.

Flattop: Five operations were performed during this quarter in support of criticality safety courses and general operator training. Flattop is the ideal critical assembly for these tasks because of its simplicity, reproducibility, safety, and general ease of operation. Students and trainees are permitted to operate Flattop under the direct supervision of two LACEF operators. This significantly enhances the content of the criticality safety courses because it gives the student an additional opportunity to gain some hands-on experience with multiplying systems.

Comet/Zeus: This was another quarter of significant accomplishment for the Zeus series of experiments on the Comet critical assembly. The first intermediate energy spectrum experiment using iron as the interstitial material was assembled and taken critical on October 8, 2002. This core consists of nearly 200 kg of highly enriched uranium and over a ton of iron. A second iron core that included 0.050-inch polyethylene shims to soften the neutron flux was also assembled and taken critical during this quarter. The Zeus iron core will be evaluated and published as part of the International Criticality Safety Benchmark Evaluation Project (ICSBEP) during the remainder of FY 2003.



Zeus Core Made of Highly-Enriched Uranium (HEU) mixed with Iron (Fe)

Godiva IV: The Godiva IV assembly remains operational. Multiple Godiva operations were performed this quarter in support of benchmarking neutron transport computer codes here at Los Alamos and general operator training. A new system for measuring burst yield using our existing photodiode and photocathode instruments is being designed and evaluated. The new system will use a modern digital oscilloscope to capture a Godiva IV pulse, perform various calculations, and display the data.

Planet: The Planet critical assembly also continues to be in high demand supporting various NCSP experimental programs. Experiments completed during this quarter include: (1) continuing the series of Np-237 critical mass experiments, (2) performing Rossi-α measurements on the Np-237 core, (3) the iron waste matrix critical mass experiment, (4) the aluminum-polyethylene waste matrix critical mass experiment, (5) neutron leakage spectrum measurements on the Np-237 core, and (6) a critical mass experiment using highly enriched uranium foils and Hastelloy-C (gadolineated Hastelloy). The Np-237 experiment, the iron and aluminum waste matrix experiments, and the Hastelloy critical mass experiment will all be evaluated and published as part of the ICSBEP during the remainder of FY 2003.

Solution High Energy Burst Assembly (SHEBA): SHEBA remains inoperable as a result of failure of the cover gas system; however, all corrective actions and restart actions are going through final completion. A readiness assessment for SHEBA's restart was completed during this quarter and all we are waiting on is final DOE/NNSA approval for SHEBA's restart. We are also initiating those changes necessary to get SHEBA authorized for burst mode operations.

Benchmarking

As a result of the continuing resolution in the United States, only $700K of a planned $1675K FY-2003 funding level has been allocated to the International Criticality Safety Benchmark Evaluation Program (ICSBEP) during the first quarter of FY 2003. Consequently, the contribution to the next ICSBEP publication from United States participants will be significantly less than originally projected. At most, only one benchmark can be anticipated from each of the participating United States laboratories.

Given the limited resources, United States participants have focused their efforts on the preparation of papers for a special issue of Nuclear Science and Engineering (NS&E) that will be devoted to the ICSBEP. Various ICSBEP authors prepared 20 of approximately 26 anticipated papers during the first quarter of FY 2003, and these papers were reviewed by an ICSBEP subgroup. Once all papers are received, reviewed, and properly formatted by the ICSBEP, they will be simultaneously submitted to NS&E for their formal review. Submission to NS&E is scheduled for February 2003.

Several ICSBEP participants attended and provided input to the Nuclear Data Advisory Group (NDAG) meeting that was held on November 4, 2002, at Brookhaven National Laboratory. Several participants also supported the NCSP meeting that was held on November 22, 2002, in Washington, DC.

Preliminary arrangements for the next ICSBEP Working Group Meeting were initiated during the first quarter of FY 2003. The meeting will be held in New Orleans May 19 through 22, 2003.

The distribution protocol for the "International Handbook of Evaluated Criticality Safety Benchmark Experiments" recently underwent significant review by DOE Idaho and recommendations were provided in October. Distribution of the 2002 Edition of the Handbook continued under the recommended protocol throughout the quarter. The goal of the ICSBEP is to freely distribute (within current United States export control guidelines) criticality safety data to legitimate users, worldwide. The exceptions are nonparticipating sensitive countries including nations under official United States embargo.

The Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) and the ICSBEP initiated efforts to expand participation in the ICSBEP. Efforts to involve China, South Africa, Germany, and Brazil will be actively pursued during the remainder of FY 2003. All of these countries either have or sponsor criticality experiments that could be contributed to the ICSBEP. Efforts to reestablish stable participation from the Russian Federation will also continue.

Analytical Methods Development and Code Maintenance

Under the continuing resolution, the SCALE/KENO code system and the Radiation Safety Information Computational Center (RSICC) work at the Oak Ridge National Laboratory has been funded at approximately 75 percent. Although FY 2003 funding for this NCSP work element has not been provided to Los Alamos and Argonne National Laboratories, some work was accomplished at both sites.

Oak Ridge National Laboratory (ORNL)

The Staff at ORNL continue to maintain the SCALE/KENO software and assist the nuclear criticality safety community in the use of this software. The ORNL staff provided direct ongoing assistance to code users in the performance of their analyses. Also, ORNL staff prepared and conducted a SCALE/KENO workshop at ORNL, in October 2002.

Work on the nuclear data libraries to be used in SCALE5 software is continuing. The initial investigation of the prototypic Evaluated Nuclear Data File (ENDF)/B-VI 238-group multigroup library has been completed. The identified problems will be corrected, and the multigroup library will be reevaluated later in FY 2003. Work on the CENTRM continuous energy library continued. Several inconsistencies have been identified and corrected. The SCALE5 CENTRM continuous energy library contains all the END/B-V nuclides and data, with the exception of the thermal data. The necessary codes to produce the thermal data used by CENTRM are still being developed. The point-wise thermal data are not necessary for the initial release of CENTRM.

Work is progressing on the verification and validation reports for KENO-VI and CENTRM. Input models of critical experiments are being developed and executed as time permits. This is an ongoing effort with the goal of having final reports finished by the end of FY 2003.

All the SCALE5 criticality safety codes are being modified and corrected as inconsistencies are identified. Several additional features have been added to KENO-V.a and KENO-VI software such as: a new method of calculating standard deviations using covariance data, upgrade of matrix data, and dynamically allocating geometry data. The SCALE5 documentation is also being updated to reflect the codes additional capabilities on an ongoing basis. Work is also in progress to prepare for the distribution of the SCALE5 code package.

RSICC fielded 165 questions regarding criticality safety codes from Defense Programs funded customers. Also, there were 36 MCNP4 Monte Carlo code packages and 3 VIM 4.0 Monte Carlo code packages sent to RSICC customers.

Los Alamos National Laboratory (LANL)

The staff in Group X-5 (Diagnostics Applications) continue to support the MCNP Monte Carlo code and assist the nuclear criticality safety community in the use of this software.

MCNP5 Testing: During this reporting period, the new version of MCNP (MCNP5) was sent to RSICC for testing. Release of the new version by RSICC should occur during the second quarter, FY 2003, after LANL completes the revisions to the code manual.

MCNP5 Verification: Work was completed and published on the verification of MCNP5 for criticality safety problems, radiation shielding problems and analytical criticality benchmarks.

MCNP5 Criticality Safety Edits: Coding was added to MCNP5 to produce edits of quantities important to criticality safety analysts -- energy corresponding to the average lethargy of neutrons causing fission, average energy of neutrons causing fission, fractions of fissions at low/medium/high energies, etc. These edits have been requested for years, and will aid in comparing MCNP to other codes.

MCNP5 Improved Perturbation Theory: With the help of a visiting scientist from the Japanese Atomic Energy Research Institute, the MCNP5 perturbation capability for criticality calculations was significantly improved. In the past, MCNP and all other Monte Carlo codes neglected the effects of changes in the fission source shape on the calculated reactivity change. A new method was developed and implemented in MCNP5 which take fission source shape changes into account. This can be a significant effect in some problems, greatly reducing the error in reactivity perturbations. In extreme cases, the error is reduced from 100-200 percent to a negligible value within statistics. The work will be published and presented at the April 2003 Mathematics and Computation meeting.

Theoretical Work on Monte Carlo Eigenvalue Calculations: This work has continued, with further analysis of methods for detecting stationarity (i.e., convergence), improved methods for estimating confidence intervals in the presence of correlation, and Monte Carlo calculation of the dominance ratio. A total of 6 papers were published on these topics. These new methods will be incorporated into MCNP5 this year, providing some unique Monte Carlo analysis techniques.

The LANL X-5 Monte Carlo team continues to be very active in providing Monte Carlo classes and communicating to the criticality safety community through papers and talks at professional meetings. Six papers were presented at the 2002 American Nuclear Society (ANS) Winter meeting in November; five have been submitted to the 2003 ANS Mathematics and Computation Topical meeting; and several papers will be submitted to the 2003 International Conference on Nuclear Criticality Safety.

Argonne National Laboratory (ANL)

ANL staff provided major leadership in the international efforts on fission source convergence, coordinated through the OECD NEA Expert Group on Source Convergence in Nuclear Criticality Safety Analysis, chaired by R. Blomquist. The annual meeting of the group was held in conjunction with the ANS Winter Meeting in Washington, DC, obviating foreign travel by all United States participants. The process of identifying additional source convergence benchmark

problems useful to criticality safety analysts and code developers was begun; some benchmark results were presented; and the future directions of the Expert Group were established. At the ANS meeting, the results of some of the technical work carried out by the participants were presented at a special session organized by Blomquist, including seven papers that included three of the four convergence benchmark problems, Monte Carlo and deterministic methods, and relevant statistical tests.

Work at ANL on the unresolved resonance probability table method, aimed at improving the accuracy of the tables (especially for U^{238}), was suspended until FY 2003 program funds are received. The work involves a more accurate numerical integration scheme and a more rigorous treatment of "competitive" cross sections (inelastic for U^{238} in the upper half of the unresolved range).

Work was also suspended (pending receipt of FY 2003 program funds) on development of a more automated code and nuclear data library Quality Assurance record system intended to simplify and speed up implementation of improvements and changes without sacrificing any rigor in the associated records. The new system will be applied to the VIM Monte Carlo code, its supporting nuclear data processing codes, and its libraries.

Nuclear Data

ORNL

Under the Continuing Resolution budget process, the Nuclear Data work at ORNL was funded at approximately 75 percent of the NCSP Five-Year Plan budget level. Work was performed in the following Nuclear Data Tasks:

Evaluation:

U-233 unresolved resonance: the SAMMY code was used for evaluating the cross section from 600 eV to 40 keV. This evaluation was sent to LANL where it will be merged with their high-energy evaluation. Benchmark calculations to assess the new evaluation are planned.

U-235 unresolved resonance: the SAMMY code was used for evaluating the cross section from 2.25 keV to 25 keV. Several tests to find out the best energy limit for the unresolved resonance representation are being performed. Tests have indicated that the upper limit of 25 keV may not be adequate since there are still some observed cross section structures above 25 keV.

F-19 resolved resonance: the SAMMY code has been used to fit the F-19 cross sections from thermal up to 1 MeV. A technical paper about this work will be presented at the Summer ANS Meeting in San Diego, June 2003.

ENDF library generation:

Resonance parameters obtained in the evaluations have been converted to the ENDF/B format. Computer codes available at Brookhaven National Laboratory (BNL) will be used to confirm that the ENDF/B formatted library created is correct.

Benchmarking:

For F-19, the ENDF cross section library was processed with a NJOY cross section processing code version developed at ORNL to generate MCNP cross section library for benchmark calculation. For U-233 and U-235, the NJOY97.114 and AMPX cross section processing code systems were used for processing the cross sections. Prior to the MCNP calculation, various tests were performed to guarantee that the MCNP generated library is correct. In addition to the MCNP calculations, benchmark calculations were also performed with KENO code. The AMPX/NJOY codes are used to generate a 238-group cross-section library for use in the KENO calculations. Calculations were also performed with the SEN3 code, to determine sensitivity of the benchmark multiplication factor as a function of the energy for each individual isotope.

Covariance Data generation with the SAMMY code:

At the NDAG meeting at BNL in November 2002, it was agreed that ORNL would generate covariance data for use in the evaluation of benchmark calculations performed at Savannah River. Savannah River provided the MCNP and KENO input for the benchmark. The SAMMY code was modified to generate covariance data (FILE 32) directly from ENDF and is being used to generate covariance data. The next step will be the incorporation of the covariance data into the benchmark calculations of the effective multiplication factors.

Other activities:

Abstracts and full papers are being prepared for three upcoming meetings: MC2003 (April), ANS (June), and the International Conference on Nuclear Criticality (ICNC) October 2003. ORNL is also supporting the ICSBEP in its negotiations with Brazil to obtain benchmark experiments for criticality safety applications.

LANL

NDAG Activities:

LANL participated in the November NDAG meeting and led the coordination of the evaluation working group. This included several activities. A study of the status of the Gd capture cross sections for all isotopes was conducted. This involved comparisons with all measured data, and allowed for assessment of priorities for future evaluation work. LANL also coordinated priorities among the laboratories for performing nuclear data evaluation work in the NCSP to be

accomplished over the next three years. Results for our the new ^{233}U evaluation were also made available (see below).

LANL completed the evaluation of n + ^{233}U nuclear reactions from 0.01 to 30 MeV. The new unresolved parameter evaluation was obtained from ORNL and combined with the evaluation above the resonance region (E > 0.04 MeV). This new evaluation is now in the testing stage, where its performance is being studied in fast critical assemblies for k_{eff} and for spectral indices. Feedback from MCNP simulations will lead to minor modifications of certain evaluated quantities (eg nubar, fission cross section). When this is completed, LANL will port the new evaluation to ORNL and to the Lawrence Livermore National Laboratory for more testing, especially for the lower energy data with the thermal solution criticals.

New MCNP Libraries:

Concurrent with the release of MCNP Version 5 to the RSICC will be an updated release of MCNP data libraries. This will be a major update, with five new data libraries included. Two are of particular interest to the criticality safety community. The first, ENDF66, is a continuous-energy neutron library for 173 isotopes based upon ENDF/B-VI Release 6. The second, SAB2002, is a modern thermal S(alpha, beta) library for MCNP based on the most recent ENDF/B evaluations and includes scattering data for 15 moderators. Both of these libraries under went final production and testing during the quarter and will be shipped to RSICC during the next quarter for testing, packaging, and release to MCNP users.

ANL

Under the continuing resolution FY 2003 budget, ANL has received no funding for the NCSP Nuclear Data Task. Therefore, effort on this task was restricted to a minimum.

ANL participated in the NDAG and the Cross Section Evaluation Working Group (CSEWG) meetings held at BNL in November 2002. Richard McKnight (ANL) chaired the Data Validation Committee meeting at the CSEWG meeting (which included two ANL presentations of new Zero Power Reactor (ZPR) benchmarks prepared included in the 2002 ICSBEP Handbook) and wrote summary minutes of the meeting for distribution by BNL. He also chaired the NDAG meeting and presented results of ANL sensitivity analysis for the plutonium/gadolinium studies. McKnight presented a brief overview of the NDAG, its mission, structure and activities at the November NCSP meeting, held in conjunction with the ANS Winter meeting in Washington, DC.

Work was suspended on validation calculations performed for a series of benchmark assemblies in conjunction with the inter-comparison effort for the VIM and MCNP libraries. In particular, ANL, in collaboration with LANL, reviewed the effects of processing the probability tables for the unresolved resonance region. Questions regarding the sensitivity of the results to these data will be further investigated upon receipt of program funds.

Training and Qualification

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

Hands-on criticality safety training continued at LANL during the fourth quarter of FY 2002. Two internal Los Alamos (2-day) courses were provided during the quarter.

Regarding Training Development, work on the Nuclear Criticality Safety Engineer Training (NCSET) module on the preparation of criticality safety evaluations has continued at a slow pace due to personnel commitments to other projects. This module is expected to be completed in the second quarter of FY 2003. The second of two NCSET modules on hand calculations, dealing with the more advanced methods that were introduced in the first hand calculation methods module, is still being written by personnel in the criticality safety group at LANL. This is expected to be completed in early FY 2004.

There is no new information on qualification activities to report at this time.

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, LANL accomplished the following:

(1) The contract is now in place for DVD reproduction of the Heritage 2000 conference films. Production is scheduled to begin March 10, 2003.
(2) Work has begun on providing a backup capability for the Los Alamos CSIRC website.
(3) The report on fission physics in support of ANS-8.15 has been composed and is now in the publication phase.
(4) Distribution of the video tapes for Heritage 2000 conference is complete. Over sixty complete sets have been shipped, including four sets to UK, three sets to Russia, five sets to Japan, and two sets to France.
(5) The Russian language version of the joint accident report is finished and presently in classification review.

As for ANL CSIRC activities, no progress was made on scanning the potentially contaminated ANL ZPR materials since the retired technician who was doing the scanning left for an extended period. He has been contacted to arrange a date to resume this work. The scheduled scanning of uncontaminated logbooks by the outside contractor, Cover to Cover, was completed this quarter. The items scanned by Cover to Cover include drawer masters for Zero Power Physics Reactor (ZPPR) Assemblies 7-21, the matrix loading records for ZPPR Assemblies 3-21, ZPR-C Memos 1-198 and ZPR-I Memos 1-465 (except a few missing memos that are being located).

The NCSP web site at the Lawrence Livermore National Laboratory is being maintained and improved under technical direction of the NCSP manager. This web page provides technical information for the criticality safety community and serves as a hyperlink to other web sites that are important to the NCSP. During the first quarter of FY 2003, web site improvements included:

(1) Added 3,443 new entries of Hanford Nuclear Criticality Technology Safety Project database onto the NCSP web site and added a new search engine index;
(2) Updated three users' records and added one user to the registration database;
(3) Converted and published the viewgraphs used in the Endusers meeting onto the NCSP web site;
(4) Updated the new Endusers organization and its roster;
(5) Presented the methodology of implementing the pass word protection features to the NCSP meeting at the 2002 ANS Winter Conference to solicit criticality safety community input; and
(6) Worked on implementing the password protection on features on the user registration database.

Applicable Ranges of Bounding Curves and Data

Under the Continuing Resolution process, this NCSP work element received first quarter funding at approximately 75 percent of the Five-Year Plan budget and work level. Work focused on the basic physics studies and sensitivity/uncertainty methods development, both technical infrastructure tasks. The applied work on the Gd-Pu study for the Office of Environmental Management (EM)/Savannah River Site (SRS) was continued at a low level, in anticipation of eventual EM funding of this program specific application. The EM decision on major funding for this work has been delayed by the Continuing Resolution process.

During the first quarter of FY 2003, emphasis continued on moving software into production status prior to the further development of guidance on its use and/or the performance of sensitivity/uncertainty studies.

Follow-on support of the work on advanced geometric optimization methodology software that is under development at the University of California, Berkeley, has been delayed further until resolution of budget issues in FY 2003.

Development of sensitivity and uncertainty analysis tools for SCALE5 has continued in this quarter. Significant improvement in the memory usage of the SAMS sensitivity analysis module has been realized that allows for the analysis of highly complex models that previously exceeded dynamic core storage capacities for most machines. The theory of generating sensitivity data from resonance-self-shielding codes has been updated, and necessary changes have been implemented for the appropriate codes in SCALE5. Numerous improvements have been added to the user interface and the output in the CANDE software.

To address the validation problems with individual isotopes in nuclear systems, a new method was developed and implemented in the CANDE code. The problem was first formally posed by the Nuclear Regulatory Commission (NRC) to determine how well the computer code and the cross-section library is validated for a specific isotope, and how important that isotope is in the system that is being used in the validation. The newly developed parameter addresses the validation question by assigning an integral index (designated as *g value*) to a specific isotope-reaction pair. This index, along with the sensitivity of the system to that isotope-reaction pair, is used to assess the validation of the isotope of interest. The new method and the parameter have been successfully applied to a problem posed by the NRC that involved use of boron absorbers in the transportation casks. Efforts are under way to address the issues with validation of gadolinium in the gadolinium-plutonium glass log project that was presented by the SRS. A paper will be presented at the ANS summer meeting about the new parameter and its integration into the Applicable Ranges of Bounding Curves and Data methodology.

Calculations have been performed to determine the minimum critical values for mass, volume, radius of spheres and cylinders, slab thickness, concentration, and enrichment for some selected simple systems. These systems include UO_2-H_2O, UNH, PuO_2-H_2O, and PuNH systems with varying enrichments and full water reflection. The results, which are obtained using the SCALE 238-group ENDF/B-V neutron cross-section library, are collected to prepare a database to be used as basis for criticality safety considerations. This task has been performed for the Expert Group on Minimum Critical Values formed by the OECD/NEA Nuclear Science Committee Working Party on Nuclear Criticality Safety.

Two journal articles have also been submitted for publication. One article details the methods for generating sensitivity data with Monte Carlo techniques, and the other article details the derivation and application of sensitivity and uncertainty analysis for criticality code validation.