DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 6, 1999

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585-0104

Dear Dr. Reis:

The Defense Nuclear Facilities Safety Board (Board) is encouraged by improvements in safety management at Lawrence Livermore National Laboratory's (LLNL) Building 332. The Board appreciated the recent briefing by LLNL on the status of improvements, lessons learned, and the path forward. It appears that a recent reorganization of LLNL management of Building 332 should improve the integration of programmatic efforts and facility operations aimed at identifying and developing the most effective and suitable controls early in a project.

Enclosed for your consideration is a report summarizing observations made by the Board's staff during a recent review of the resumption of operations at Building 332. The report indicates that although there have been significant improvements in work planning, authorization, and control, the facility has not completed efforts to address the safety issues that led to the criticality infractions in 1997 and has not yet fully implemented an Integrated Safety Management System (ISMS). The Board believes these staff observations will be useful to the Department of Energy and to the new Building 332 management team members as they prepare for the upcoming ISMS verification review. The Board and its staff will continue to follow closely the implementation of safety management at Building 332 and the rest of the Superblock.

Sincerely,

John T. Conway
Chairman

c: Dr. James Turner
Mr. Mark B. Whitaker, Jr.

Enclosure

99/1356

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

March 26, 1999

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: J. Deplitch

SUBJECT: Lawrence Livermore National Laboratory Building 332 Resumption of Operations

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) on the resumption of operations in Building 332 (B332), Plutonium Facility, at Lawrence Livermore National Laboratory (LLNL). W. Andrews, J. Deplitch and outside expert D. Boyd were at LLNL on March 8–11, 1999, to determine the extent to which the objectives of the B332 Activity Resumption Plan had been completed, the effectiveness of the improved work control practices, and the development and implementation of an Integrated Safety Management System (ISMS).

In summary, the Board's staff agrees with Department of Energy (DOE) and LLNL personnel that the compensatory actions of the resumption process should end. This will allow B332 personnel to focus on improving several key aspects of the standing programs that will be used long term to implement integrated safety management (ISM) at B332. Several key areas requiring attention are: (1) the need to integrate hazards analysis and controls identification early in the development of a new activity; (2) the need to ensure that safety-related practices and requirements flow down into all work affecting safety; and (3) the need to maintain a robust feedback and improvement process to ensure safety-related controls are reliably implemented. These areas of additional focus are discussed in more detail later in the report.

Background. After numerous criticality infractions, B332 went into standby mode in July 1997. A Safety Management Evaluation by the DOE's Office of Oversight and review by the Board's staff in November and December 1997, respectively, revealed deficiencies in work planning, authorization, and control practices in B332 and the lack of ISM. LLNL initiated the B332 Activity Resumption Plan in February 1998 to support safe resumption of specific operations (that had been authorized prior to the stand-down) under rigorous compensatory measures. The compensatory measures did not replace, but were a supplement to the responsibilities of B332 facility staff for safety management. The resumption process proceeded with activities being conducted and resumed incrementally and progressively. The compensatory measures included the following:

- Rigorous external review of the work scope and description, hazard analysis, identification of controls, and development of procedures. The review by the Resumption Review Panel involved a team of management personnel, external to the facility and including the DOE Livermore Site Office. The same team reviewed each work activity package. The work activity packages became progressively more comprehensive with each successively developed package, as a result of these reviews. The programmatic leads for the activities learned the extent to which the work should be described, hazards and controls identified, and procedures developed. The activity packages quickly became voluminous documents, some numbering hundreds of pages.

- Rigorous verification that each activity was ready to proceed (e.g., equipment, personnel, procedures, and controls) and verification that the activity was being conducted safely and as prescribed. A verification team, representing knowledge of the process technologies and the anticipated hazards, was selected for each resumption activity. The team became cognizant of the activity package, then verified that the controls were implemented, to include readiness of personnel, procedures, process systems and equipment, and facilities systems and equipment. The verification team observed demonstrations of representative operations without nuclear materials until readiness was demonstrated and at that time nuclear operations were allowed to proceed. During the nuclear operations of the activity, the team verified adherence to the approved procedures, verified sustained implementation of the controls, and verified adequate demonstration of operations of the related workstations to warrant approval for resumed operations.

- Review of each completed activity to ensure that the full scope of activities for each workstation had been demonstrated and that controls and procedures were adequate for continued safe operations. The Resumption Review Panel reviewed the reports of each verification team and the final version of the work activity package. When the panel was satisfied that the activity would continue to operate safely, it recommended that the activity in the associated workstations be approved for resumed operations by the LLNL Associate Director for Defense and Nuclear Technologies Directorate (DNT).

In addition, the B332 Activity Resumption Plan incorporated corrective actions for work control, criticality safety, and safety management practices. It addressed seven safety concerns representing areas for improvement: (1) development of an adequate work scope statement, hazard assessment and control process tailored to the work; (2) criticality safety practices; (3) work authorization and control; (4) change control process; (5) training and qualification requirements; (6) supervision and roles and responsibilities; and (7) feedback and improvement process. The resumption process provided the facility management the opportunity to develop, test, progress, and institute work control and safety management processes.

During the past year, operations have resumed in most of the workstations of B332 under the compensatory measures of the B332 Activity Resumption Plan. DOE has provided significant mentor support. During the past 3 months, a DNT assessment team reviewed the progress made on the above seven safety concerns and assessed the state of completion of the resumption process. Recently, LLNL organized the Nuclear Materials Technology Program within DNT to facilitate integration and coordination between special nuclear material programs and the facility operations.

General Observations. There have been significant and continuous improvements in work planning, authorization, and control. The facility appears to be operating without undue risk of safety to workers, the public, or the environment. Training and qualification of fissile material handlers have been improved and appear effective. Criticality safety practices have been reevaluated and simplified. Organizational changes should result in safer operations through improved coordination between research and development programs and facility management, consolidated supervision of engineering support, and improved management and supervision of activities in B332. Also, DOE has had an increased presence and involvement in safe operations in the facility.

The B332 facility staff and DOE mentors believe that the objectives of the resumption of operations have been completed. The DNT assessment team recommended that normal operations in B332 be resumed (i.e., without the additional compensatory measures of the resumption process), although the team noted that many areas require further improvement and careful monitoring.

However, the Board's staff observed indications that the objectives of the B332 Resumption Plan have not been completely satisfied, and that the facility has not yet achieved its ultimate goal of implementing an adequate ISMS. The facility does not consistently and appropriately define the scope of work and identify the hazards and controls for new projects and does not assess activities for feedback and improvement. Details of the issues that the Board's staff feels need additional attention are provided below in this report.

The Board's staff agrees with DOE and LLNL that the efforts remaining to implement ISM at B332 fall outside the resumption process. The compensatory measures of the resumption process have been important to resuming operations and improving safety practices at B332. However, they do not appear to be providing further benefit to the facility, but instead appear to be impeding further improvements. The rigorous reviews, verifications, and follow-on reviews of the resumption process ensured that resumed work was adequately planned, authorized, and controlled and that an ISMS was developed. B332 does not appear to have adequate staff to continue that process, manage ongoing activities, and continue to improve enduring safety practices. The Board's staff believes that use of the new and evolving work control process and a more focused monitoring process would be appropriate as the facility completes the development and implementation of an ISMS. Based on the staff's comments and suggestions, the Nuclear Materials Technology Program leader plans to initiate a monitoring process. With a significant

amount of progress remaining to be achieved, the Phase I and II ISMS verification reviews scheduled for May and July 1999, respectively, should apprise DOE of the status of the remaining safety concerns and ISMS development and implementation.

Specific Issues of the Staff's Review. The Board's staff identified several potential issues that, upon further investigation, indicated that work falling outside the scope of the resumption efforts had not been adequately described, analyzed for hazards and controls, or reviewed. Evaluation of completed work packages indicated that personnel were not reviewing the work for unexpected problems and lessons learned, and that personnel performing assessments and walkthroughs were not fully qualified for the assessments.

Work Control Process—It did not appear that the new work control process will adequately capture current or future B332 projects. The facility and program groups for research and development activities did not consistently define the scope of work and identify the hazards of the work adequately and did not fully understand the value of initiating these essential elements of an ISMS for developing and implementing appropriate controls at the beginning of the project. For example, there has been no systematic hazard assessment to identify and integrate controls for a significant, complex new project, the Strategic Materials Application Program, for which LLNL is preparing. The project involves the conversion of plutonium and uranium metal alloy zero power physics reactor (ZPPR) fuel into an oxide for immobilization. Although hazards had not been fully identified, several work requests and work activities have been initiated in the facility. In fact, the new glovebox where this hazardous work will be performed has already been designed and fabricated and will be delivered to the laboratory in April. Because of the lack of a hazard analysis and subsequent identification of controls, LLNL has lost a rare opportunity to design in engineered controls, rather than instituting administrative controls at a later date. Indeed, problems with administrative controls resulted in the recent stand-down.

LLNL management did not appear to be aware of this lost opportunity. Thus, it appears that a hazard analysis will not be performed early on for future programs at the facility to systematically identify controls, engineer those controls into the equipment and process during development, and avoid less efficient and effective retrofitting of controls. The facility's new work control process captures the day-to-day ongoing work adequately, but appears to be failing for larger, newer projects.

The staff reviewed the four work requests and associated documentation for preparation of the B332 room for the Strategic Materials Application Program activities. The staff assessed the process and the implementation of guidance contained in the B332 Work Control/Design Change Control Process Manual. The manual was developed during the resumption process for all facility work planning, authorization, and control. The review revealed inadequate communication and coordination between the facility and the program; e.g., the facility expected to perform an engineering design review for new equipment (like the glovebox) before it was approved for procurement. The manual did not adequately address new projects and emphasize essential elements of safety management. And there was inadequate review of the work requests

and work permits to ensure that safety questions were evaluated, work was properly authorized, lessons learned were captured, and follow-up corrective actions were taken.

Pressure Safety Program—Work involving the installation of a nitrogen gas (N_2) line, a future building safety system, indicated weaknesses in work planning, authorization, and control; supervision; and training and qualification. There were inconsistencies in pressure requirements for the system between the laboratory standard and the facility safety documentation. The craftsman installing the N_2 line was not aware of any laboratory standard that applied to installation of the pressurized line and was installing the line at a third and apparently undocumented pressure. Although the B332 Safety Analysis Report (SAR) and Facility Safety Procedure identify the N_2 system as a safety-significant system, a building safety system, and under Technical Safety Requirements (TSR) control, no specifications for the system were provided in the work permit. There appears to be no requirement for this building safety system to be inspected, tested, or labeled by a qualified LLNL pressure inspector. Some qualification criteria would be anticipated for a system identified by the facility as a building safety system.

Fire Protection and Combustible Loading—The staff observed a number of examples of unnecessary collections of combustibles and waste that indicated the facility did not have an effective program for controlling combustible materials, self-assessments and walkthroughs were ineffective, and housekeeping was weak.

There is a combustible loading limit in the SAR and a requirement to control combustibles in the TSRs, LLNL Health and Safety Manual, and B332 Housekeeping Policy. In spite of the LLNL and facility requirements, there appeared to be no adequate combustible loading program or mechanism for implementing the requirements for B332. Additionally, no assessment against the combustible loading limit had been performed for several years.

Facility assessments indicated weaknesses in feedback and improvement, an essential element of integrated safety management. Some assessments and walkthroughs did not make note of unnecessary combustibles and waste. The assessors did not appear adequately prepared or trained to perform the assessments. Also, it commonly appeared to take the facility operators weeks to respond to observations resulting from the fire protection engineer's periodic walkthroughs with regard to excess combustible loading.

Conclusion. During the resumption process B332 made significant improvements to planning, authorizing, and controlling activities in the facility. However, further improvements remain to consistently implement work control and monitor implementation of safety requirements.