January 8, 2001

The Honorable Madelyn R. Creedon
Deputy Administrator
for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Ms. Creedon:

In a letter to the Department of Energy (DOE) dated June 26, 2000, the Defense Nuclear Facilities Safety Board (Board) identified issues related to the quality and content of the authorization bases of defense nuclear facilities at Lawrence Livermore National Laboratory (LLNL). The Board is pleased to learn that LLNL management has taken positive steps to establish an Authorization Basis Section within the Support and Policy Division of the Hazards Control Department, staffed by technically competent individuals, to address some of these issues. The Board encourages DOE and LLNL to continue to maintain the institutional support and technical expertise of this new section at a heightened level to improve the quality of the site's authorization basis activities consistent with the Board's and DOE's expectations.

More recently, the Board's staff took a broader view of hazard identification and analysis at LLNL to encompass the emergency management hazard assessment, fire hazard analysis, and the site environmental impact statement. The enclosed staff report highlights significant deficiencies that merit your attention. The Unreviewed Safety Question Determination process established by DOE may need to be applied to some of these issues to determine the potential impact on the approved authorization basis of Building 332.

The Board believes that continuous upgrade and improvement of the authorization bases of defense nuclear facilities should include identification and assessment of all significant hazards, including the chemical hazards external to these facilities. Additionally, implementation of Integrated Safety Management principles at the site requires identification and analysis of hazards and preventive or mitigative measures to control their consequences. The weaknesses in the emergency preparedness program identified by the Board's staff could have an impact on the laboratory's ability to effectively implement protective actions in case of an incident. The emergency preparedness program is the last line of defense and mitigative measure, and as such needs to be comprehensive and well coordinated. The Board is aware of a similar review that was performed by DOE's Office of Emergency

Management Oversight
(OA-30) and the appropriate corrective actions that have been identified to be implemented.

The Board wishes to be briefed on DOE's corrective action plan in response to the OA-30 report and the observations of the Board's staff as reported herein. Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board would like to be briefed by DOE and its LLNL contractor on the improvements by March 30, 2001.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.
Ms. Camille Yuan Soo Hoo

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

December 14, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: F. Bamdad

SUBJECT: Integrated Hazard Analysis Review, Lawrence Livermore National Laboratory

This report documents observations made by the staff of the Defense Nuclear Facilities Safety Board (Board) during a review at Lawrence Livermore National Laboratory (LLNL) performed November 28–30, 2000. Staff members F. Bamdad, W. Andrews, C. Coones, J. Deplitch, M. Forsbacka, and M. Helfrich reviewed documents, walked down selected facilities, and discussed issues related to integration of hazard analyses and identification of controls in support of the safety bases, emergency management hazards assessment (EMHA), fire hazard analyses (FHAs), and environmental impact statement (EIS) for LLNL facilities. The purpose of this review was to evaluate the consistency of identification and analysis of hazards and controls, and to ensure that the on-site and off-site populations are adequately protected. Of particular interest was the potential impact of chemical hazards as external events on the operation of defense nuclear facilities.

Background. The Department of Energy's (DOE) requirements for performing hazard analyses for defense nuclear facilities are delineated in Orders 5480.23, *Nuclear Safety Analysis Reports;*151.1, *Comprehensive Emergency Management System*; 420.1, *Facility Safety*; and 451.1B, *National Environmental Policy Act Compliance Program*. The guidance provided in the corresponding standards and guides varies in detail and in the presentation of DOE expectations with regard to hazard analysis and identification and implementation of controls. Although some differences are expected to exist in the methodologies used to support various activities (depending on their application), the principles of Integrated Safety Management (ISM) require that hazards be identified and analyzed, and that controls to protect the public, workers, and the environment be identified and implemented for all nuclear and non-nuclear facilities and activities.

Discussion. The Board's staff noticed significant inconsistencies in the identification of hazards documented in different analyses. For example, hazards identified in the EIS differ from those indicated in the EMHA, and are inconsistent with the authorization basis of the same facility. The attachment to this issue report illustrates these inconsistencies in more detail.

Safety Bases—The current authorization bases of defense nuclear facilities at LLNL comprise a

set of documents that have been prepared during the past decade and vary significantly in quality and content. The staff's observations regarding the quality of LLNL authorization bases were documented in an issue report and transmitted to DOE with a letter from the Board on June 26, 2000. The issues raised with regard to the quality of the authorization bases were a main reason for establishing the Authorization Basis (AB) Section and recruiting subject matter experts to fulfill its responsibilities.

More recently, Livermore Site Office (LSO) requested the laboratory to prepare or upgrade authorization bases for all nuclear and hazardous non-nuclear facilities to meet the applicable requirements. LSO and LLNL have agreed that the authorization bases for all Hazard Category 2 and 3 nuclear facilities, as well as moderate-and high- hazard non-nuclear facilities, will be reviewed and approved by LSO. A complete list of these documents, any updates or upgrades necessary to improve their technical quality, and the associated schedule are to be prepared by December 31, 2000, and submitted to DOE-LSO for concurrence.

Fire Hazard Analyses—The Board's staff reviewed the FHAs for Buildings 332 and 251, the Safety Analysis Reports (SARs), applicable Technical Safety Requirements (TSRs), and the EMHA, and made the following observations:

- The DOE-approved SAR for Building 332 classifies the fire detection and suppression systems, fire barriers, fire dampers, and fire doors as safety-class structures, systems, and components (SSCs) that require TSR-level controls. Review of the current TSRs indicates that interior fire walls, floors, doors, and dampers have not been included, nor has the wet-pipe fire suppression system in the building and inside the ducts. The fire alarm system is identified in the SAR as a safety-significant SSC. The building fire alarm system is typically the operating system for smoke detectors in the area that operates the fire dampers. It is not clear how the fire alarm system, designated as safety-significant, can provide power and control for the safety-class room smoke detectors and fire dampers. The Board's staff believes the TSRs do not adequately reflect the SAR requirements.

- The May 1998 FHA for Building 332 carries forward a 10-year-old exemption to the National Fire Protection Association (NFPA) 110, Section 3-10.2, requirement for a minimum emergency generator fuel supply of 96 hours. On the basis of this exemption, the requirement is reduced to 50 hours. The SAR takes credit for two emergency diesel generator sets that provide redundancy in the event of the loss of any one generator. Each has a 2,000-gallon fuel capacity, which the SAR states will provide approximately 50 hours of power under full load conditions. The TSR surveillance requirement, however, is to verify that each tank is at least 50 percent full. Thus if one generator fails, the remaining one will provide only 25 hours of power—inconsistent with the SAR requirement.

- The two FHAs sampled were highly variable in their approach and technical content. Furthermore, instead of being input documents to the safety bases (as required by DOE Order 420.1 and its implementation guide), the FHAs reference sections of the SARs. In addition, LLNL's approach to preparation of FHAs uses a template with a simple adequate/deficient conclusion in each evaluation section, this to be justified by technical discussion in the bases. Often in the FHA for Building 332, the section was marked adequate with no explanation or basis. Consequently, configuration management of the FHA is greatly complicated because the basis for acceptability cannot be determined. For example, building details, such as fireproofing on structural steel in the basement, qualification of unlisted flammable liquid cabinets, and details of the fire protection systems, could not be found in the FHA.

Emergency Management—LLNL's emergency management with respect to hazard assessment, emergency action levels (EALs), and protective action recommendations (PARs) is inadequate and does not meet fundamental requirements as prescribed in DOE Order 151.1. Although other areas of emergency management at LLNL were not subjects of this review, evaluation by the Office of Emergency Management Oversight (OA-30) indicated that other areas are deficient also. Because these deficiencies have been identified by recurring evaluations over the past few years, follow-up of corrective actions appears to be particularly important.

LLNL is required to perform a systematic hazard analysis of all significant hazards and potential accident scenarios for nuclear and non-nuclear facilities on site. The results of this effort are to be documented in the EMHA. The current EMHA for LLNL references the existing safety bases of the facilities for identification of the worst-case scenarios and their potential consequences. This would be a positive attempt to integrate identification and analysis of the hazards if the facilities had comprehensive hazard analyses as part of their safety bases. Laboratory representatives stated that the EMHA was to be revised by spring 2001 and will use more up-to-date information when it becomes available as part of the authorization basis upgrade program at the site. Several deficiencies or weaknesses, however, were noted by the Board's staff that may need to be considered in the EMHA upgrade program:

- The EMHA does not address the full scope of hazards and scenarios to identify potential emergencies that could impact facility and collocated workers and the public. The EMHA needs to be more comprehensive for identification of all site hazards than any specific facility safety analysis, and also consider malevolent acts and external hazards to the site. The EMHA is used to prepare EAL procedures, emergency planning zone (EPZ), and ultimately action PARs for timely protection of workers and the public.

- The EALs are insufficiently developed and do not coincide with the EMHA. The EALs are used to determine the degree of an accident and the release of hazardous materials as well as the event emergency classification. LLNL's EALs do not provide for these requirements. The EMHA does not support the development of adequate EALs.

- LLNL apparently has no documented PARs. Protective actions are important aspects of emergency management. PARs identify the measures needed for the appropriate level of protection and are prepared in advance to provide for timely notification.

- An EPZ does not appear to exist for LLNL even though there are some scenarios that may have potential for off-site consequences (see attachment). Identification of an EPZ would aid the LLNL emergency preparedness program in being better coordinated with off-site agencies in advance of a real event, and thus improving their response capability.

- The current emergency preparedness program relies on the incident response commander to declare the emergency classification while he is responding to an event. This may result in some inefficiency in the response and overwhelm the incident response commander with too much responsibility.

- The incident command center relies on satellite operations, such as the Hazards Control and Health Services Departments, to take proper action in responding to an emergency. These satellite operations are scattered throughout the site and are located in buildings that are not environmentally protected. Loss of communication systems or forced evacuation of these satellite offices would significantly hamper the emergency response activities.

Environmental Impact Statement—As discussed in the attachment to this report, the staff noted a number of inconsistencies for individual facilities in the hazards identified in the EMHA, the facility's authorization basis, and the EIS. These inconsistencies were discussed as part of the staff's on-site review. The recently generated Supplemental Analysis (SA) to the EIS was presented by LLNL personnel as having identified inconsistencies among the various hazard analyses and updated the bounding scenarios in the EIS as appropriate. During the course of the discussions, however, it became apparent that the focus of the SA had been to document increases in the consequences of bounding scenarios (i.e., resulting from higher inventories of specific materials). At least one of the inconsistencies noted by the staff during its review of the various documents was the result of a significant decrease in the on-site inventory of a chemical (in this case chlorine). LLNL personnel indicated that the reduction of inventories and resulting lowering of consequences were not documented in the SA. A potential problem with this approach is that while the consequences of decisions to increase inventories in a particular location can be compared with the bounding scenarios of the "accepted" risk at the site, there is no guarantee that the bounding scenarios accurately reflect the "actual" risk under which the site is currently operating, Therefore, the actual risk could be increased, while still remaining below the accepted risk. In addition, not fully updating (i.e., lowering as well as raising) the inventories of bounding scenarios in the EIS and its supporting documentation increases the likelihood of inconsistencies between the EIS and other hazard analysis documents and reduces the ability to integrate the EIS with other safety programs.

LLNL Reorganization—Recently, the Support and Policy Division of the Hazards Control Department at LLNL was reorganized to allow for establishment of a new Authorization Basis Section to

improve the quality of hazard analyses at the site and integrate the associated activities. The AB Section comprises about 15 full-time employees and additional support contractors, and is chartered to establish site standards, assist line management in preparation of safety bases, and review authorization basis documents for nuclear and non-nuclear facilities. The information provided in this issue report reflects the observations of the Board's staff based on the current status of the documents at LLNL. The staff believes the newly established AB Section should be able to redress the weaknesses at the laboratory if institutional support and technical expertise continue to be maintained at a heightened level.

Attachment

Examples of Inconsistent Hazards Identification

The following discussion is based on the contents of documents provided by Lawrence Livermore National Laboratory (LLNL) to the staff of the Defense Nuclear Facilities Safety Board (Board) during its review and discussions with laboratory representatives held November 28–30, 2000.

Emergency Action Levels (EALs) are identified in Tables 3 and 4 of the emergency management hazards assessment (EMHA).[1] These EALs are identified for all facilities containing hazardous material, based on the type of hazard and the consequences at some predetermined locations on and off site. The hazards are identified using the safety bases of these facilities, which vary in quality and completeness.

The environmental impact statement (EIS) for LLNL also presents the estimated consequences of potential accidents that could occur at the site and addresses the hazards and their consequences in its Accident Analysis (Appendix D). Sections D.2 and D.3 review the significant radiological and chemical hazards, respectively, for all facilities on site.

A brief comparison of the type of hazards and the expected amount of material at risk provided in these documents reveals significant discrepancies. For example:

- Table D.3-3 of the EIS shows 1,100 pounds of chlorine in Building 518, whereas the EMHA has no indication of chlorine in this building, but identifies 96 pounds of hydrogen fluoride as the chemical hazard.

- The EIS shows about 450 pounds of ammonia in Building 131, whereas the EMHA shows only uranium as the hazardous material in the building.

- The EIS indicates that Building 166 contains about 2 pounds of arsine, whereas the EMHA has no indication of hazardous material, and consequently does not identify any emergency action levels for this building.

- The hazardous material identified in the EIS for Building 151 is 5 pounds of hydrogen chloride, but the EMHA shows about 260 pounds of hydrogen fluoride in this building.

Inconsistencies also exist in the estimated consequences at the site boundary. For example, Table

[1] *Emergency Management Hazards Assessment of Lawrence Livermore National Laboratory*, Draft November 8, 1999, redacted November 13, 2000.

D.3-11 of the EIS indicates that release of chlorine from Building 518 would result in site boundary concentrations of a lethal dose (at 37 meters from the building). In fact, Table D.3-11 indicates that the concentration at 600 meters away from the site boundary may still be lethal. Table 3g of the EMHA, however, indicates that the worst releases from Building 518 would result only in an "Alert," which provides no more protection than what is needed for immediate facility workers. It is difficult to conclude that hazardous activities in these facilities are controlled adequately and that the emergency response to any potential accident would adequately protect the public and workers if the hazards (as shown above) are not consistently identified and analyzed.