DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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July 17, 2001

Mr. David E. Beck
Acting Deputy Administrator
for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Mr. Beck:

The staff of the Defense Nuclear Facilities Safety Board (Board) has reviewed the safety basis for the Joint Actinide Shock Physics Experimental Research (JASPER) facility at the Nevada Test Site. The enclosed report on JASPER by the Board's staff is provided for your use and information. The staff found that the preliminary hazard categorization of the facility as Hazard Category 3 has been reduced to Radiological. This change in the hazard categorization was achieved by applying design and operational features of the facility components to mitigate a release without identifying those features as a Technical Safety Requirement (TSR). These components rely on active engineered systems and administrative controls to properly function as described in the JASPER Hazard Analysis Report.

A preliminary review of the existing safety basis indicates that mitigating components are adequately designed and proceduralized to ensure safety. However, because these components are not formally credited as safety related components controlled by a TSR, it is not clear that they will be maintained to the same level of quality over time. The Board believes that a configuration and operational control system such as the Department of Energy's TSR process, as mandated by the Nuclear Safety Management rule, needs to be implemented to avoid degradation and potential reduction in safety.

The Board requests a briefing on the hazard categorization of the JASPER facility. If the TSR process is not to be used, as in the current safety basis, this briefing should also address the configuration and operational control of mitigating components.

Sincerely,

John T. Conway
Chairman

c: Ms. Kathleen A. Carlson
Mrs. Camille Yuan-Soo Hoo
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

June 4, 2001

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: J. Deplitch

SUBJECT: Joint Actinide Shock Physics Experimental Research Facility

This report documents a review of the Joint Actinide Shock Physics Experimental Research (JASPER) facility at the Nevada Test Site (NTS), performed by the staff of the Defense Nuclear Facilities Safety Board (Board). The Board's staff has been reviewing the preparations, identification and analysis of hazards and controls, and development of a safety basis for the facility during the past year. Members of the staff F. Bamdad, J. Blackman, J. Deplitch, and T. Huntley participated in the review.

Background. The JASPER facility is being developed and will be operated by Lawrence Livermore National Laboratory (LLNL) at NTS to conduct shock physics experiments on special nuclear material and other actinide materials. JASPER will use a two-stage, light-gas gun to shoot projectiles at actinide materials to study fundamental physical properties of the materials. Projectile velocities will range from 1 to 8 kilometers per second, inducing pressures of up to 6 megabars. The project will support the Stockpile Stewardship Program by providing physics data necessary to meet milestones in campaigns of the Department of Energy's (DOE) Office of Defense Programs, including: primary certification, dynamic materials properties, and material lifetimes.

The JASPER facility is located at Able Site in Area 27 of NTS. Construction and facility modifications started in April 1999 and were completed in September 1999. The gas gun, systems, and components were installed in 2000. Prestart testing of the gas gun, support systems, and diagnostics began in March 2001. The facility is expected to be operational around August 2001.

Hazard Category. A number of radionuclides—including plutonium-238; plutonium-239; various isotopes of uranium; and, to a lesser degree, other actinides may be used as target materials in the shock physics experiments. The experiments will use up to 2.5 grams of plutonium-238 and 50 grams of plutonium-239; the threshold values for a Hazard Category 3 nuclear facility in DOE standard 1027-92 are 0.036 and 8.4 grams, respectively. A preliminary hazard analysis of JASPER determined the facility to be Hazard Category 3. The DOE standard, however, allows that if the form, location, dispersibility, and interaction with available energy sources can reduce the unmitigated release of plutonium below the threshold values, the facility may be categorized as a Radiological nuclear facility.

As documented in the JASPER Hazard Analysis Report (HAR), LLNL has determined that the JASPER facility is a Radiological facility based on the existence of a secondary confinement system and several procedural controls. The HAR takes advantage of components of the gas gun, such as the primary target chamber and the secondary confinement chamber, to mitigate a release. LLNL treats these components as passive barriers. However, the HAR and documents available to the Board's staff do not demonstrate the reliability of these components to mitigating a release, mainly because the systems are not categorized as safety systems, and sufficient configuration control is not provided to demonstrate their claimed reliability. Additionally, these components rely upon several support systems, such as gas systems, a computer control system, and administrative controls, to function as designed. The HAR also inappropriately applies a leak path factor to the components to mitigate a release from these apparent design features. Based on the current analysis, the hazard categorization does not appear to be appropriate.

Hazards and Controls. The JASPER HAR does not adequately analyze hazards and identify and analyze controls. The HAR applies the "what-if" technique to identify possible accident scenarios. Several possible failure modes of the primary target chamber, secondary confinement chamber, and support systems, as well as the resulting consequences, have not been addressed. For example, it is not adequately demonstrated that a projectile would not penetrate the primary target chamber and result in a release of the radioactive material in excess of the analyzed scenarios. Credit is taken for controls that are not identified as safety systems to prevent the potential for such events. The probability of accidents does not appear to be adequately supported by data. The contractor believes the equipment relied upon for confining the hazards would prevent such events; as mentioned earlier, however, these components are not designated as safety systems. Additionally, the adequacy and reliability of controls is not addressed sufficiently.

Safety Basis. LLNL has determined that the HAR and the collection of system design descriptions (SDDs) constitute the safety basis for JASPER. However, the HAR and SDDs do not adequately describe the hazards, accident scenarios, and controls associated with the operation. Additional technical support documents are needed to adequately verify the analysis of hazards and accident scenarios, and to identify the controls relied upon for safety and their pertinent system design specifications and criteria.

No Technical Safety Requirements have been identified for this hazardous operation. As currently categorized, the operation is exempt from compliance with Subpart B of the Nuclear Safety Management rule (i.e., Safety Analysis Report, Unreviewed Safety Question, Technical Safety Requirements). DOE review and approval of the safety basis for this activity will not be required. However, DOE is expected to review safety management practices at JASPER and to authorize the scope of activities at the facility through the Real Estate/Operations Permit. It is prudent before DOE readiness assessment reviews proceed for: (1) the contractor to identify the controls that are relied upon for safety of the operation in a TSR document to be made part of the authorization basis of the facility, and (2) for DOE to assess and approve the adequacy of the controls and their configuration management.