**[DNFSB LETTERHEAD]**

January 4, 1994

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

A Defense Nuclear Facilities Safety Board review team observed the W48 Dimethyl Sulfoxide Dissolution Process Nuclear Explosive Safety Study from November 30 to December 3, 1993. The team's observations are outlined in the enclosed report and provide supplemental information related to our letter of December 8, 1993 on the Nuclear Explosive Safety Study process.

Sincerely,

***John T. Conway***
***Chairman***

c:
RADM Charles Beers, DP-20
Dr. Tara O'Toole, EH-l
Mr. Mark Whitaker, Acting EH-6
Mr. Bruce Twining, Manager AOO

Enclosure

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

December 15, 1993

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director

**COPIES:** Board Members

**FROM:** William Von Holle, Senior Scientist

**SUBJECT:** Pantex Site - Nuclear Explosive Safety Study (NESS) for the W48 Dimethyl Sulfoxide (DMSO) Dissolution Process (November 30 - December 3, 1993)

1. Purpose: This trip documents the DNFSB technical staff (William Von Holle, David Lowe, and Matt Moury) observations of the Nuclear Explosive Safety Study Group (NESSG) review of the W48 DMSO dissolution process at Pantex.

2. Summary:

   a. The NESSG denied permission to proceed with operations because of many unresolved technical issues, including:

      (1) Criticality safety concerns associated with dissolved fissile material in DMSO/dissolved high explosive mixtures have not been resolved. Also, procedures are not adequate to deal with these potential criticality concerns.

      (2) Several safety studies on the hazards of the DMSO/dissolved high explosive mixtures are not complete.

      (3) A quantitative risk assessment is not complete as required by DOE Order 5610.11, Nuclear Explosive Safety.

      (4) Emergency response procedures are not complete.

   b. The following staff observations concern the conduct of the NESS:

      (1) DOE, Mason-Hanger, and Lawrence Livermore National Laboratory (LLNL) were aware that the W48 dissolution process was not ready for the NESS. However, they went forward with the premature review. The NESSG, in effect, acquired the line management function of directing the technical effort as opposed to conducting an independent safety review.

(2) It did not appear that the correct mix of technical expertise was represented on the NESSG, nor did they supplement their experience with subject matter experts.

3. Background: As a result of an incident during the hot water removal of high explosive from the W48 pit (Occurrence Report Number: ALO-AO-MHSM-PANTEX-1992-0068), a high explosive dissolution process using DMSO has been developed. All work on the W48 has been suspended until the process is approved by the NESSG. A DNFSB review of the process in October 1993 resulted in several concerns, including the need for broadening the scope of the risk assessment, coordinating the LLNL and the Pantex risk assessments, and adhering to DOE Order 5610.11, Nuclear Explosive Safety, Chapter IV, on plutonium dispersal prevention.

4. Discussion/Observations:

a. The DNFSB staff attended the W48 DMSO dissolution NESS meetings and demonstrations. Observations from the meeting are provided below:

(1) Studies to determine fissile material solubility in DMSO/high explosive mixtures have not been done. If fissile material does not dissolve in the solvent mixture, the potential for an inadvertent criticality accident is substantially reduced. LLNL is planning to conduct the tests in the January 1994 timeframe. The NESSG Chairman stated that the results would not be necessary to grant permission to proceed, as long as other positive measures to preclude criticality are adopted, e.g., adopting administrative controls to eliminate non-geometrically safe containers from the work area.

(2) Mason-Hanger has not completed several tests on the hazards presented by the DMSO/high explosive (HMX) mixture. The electrostatic build-up from the solvent spray was tested by Mason-Hanger and found to be negligible. The flammability of the DMSO aerosols also appears not to be a problem. However, final technical reports of these efforts were not available to the NESSG. Also, Mason-Hanger has not completed its experiments on the spark sensitivity of the solvent mixtures or the sensitivity of crystallized HMX. The concern is the potential for crystallized HMX to accumulate in the internals of the operating enclosure and equipment, and potentially explode.

(3) A quantitative risk assessment required by DOE Order 5610.11, Chapter IX, is not complete. Mason-Hanger (Battelle) and LLNL are conducting independent risk assessments, and the results are

uncoordinated and incomplete. The M & H qualitative risk assessment consists of a task analysis, hazard analysis and failure modes effects analysis in support of the facility unreviewed safety question determination (USQD). The LLNL risk assessment was presented to the NESSG and provides a qualitative ranking of the operational risks. The analysis included a discussion of basic uncertainties, which the NESSG agreed was helpful, but contained no quantitative analysis. The DOE Albuquerque Operations Office (DOE-ALO) risk assessment program manager explained that this was consistent with DOE' s methodology of doing qualitative risk assessments to identify dominant risk contributors and then conduct a quantitative analysis for only the dominant risk contributors. This process is still preliminary and has not been finalized. The LLNL team leader stated that they had only five weeks to complete the study and that they had commitments to other programs (e.g., W79 program).

(4) Emergency and abnormal condition procedures were inadequate or non-existent. Procedures must be developed and personnel trained (DOE Order 5610.11, Chapter II) for all credible accident scenarios (e.g., explosion, fire, and criticality). An example of an abnormal condition is having a partially dissolved high explosive-pit assembly due to a pump failure during an operation. Procedures covering expected abnormal conditions were not available.

b. In addition the DNFSB staff had the following observations with regard to the conduct of the NESS:

(1) The NESS was premature; line management had not yet fully developed the technical justification for startup of this process. Since this was the case, the NESS served as an adjunct to line management. An important element of defense-in-depth was jeopardized -- the independent safety review. Specific examples include:

(a) Several technical reports were not available to the NESSG. In some cases, the laboratory work was complete, but the analysis was ongoing. In other cases, the laboratory work had not been conducted.

(b) Technical documents were not available to the NESSG prior to the start of the NESS in order to enable an in-depth technical review. DOE-ALO Supplemental Directive 5610.11, Nuclear Explosive Safety, Chapter V, requires that technical inputs be provided to the NESSG no later than 30

days prior to the NESS convening date.

(c) The quantitative risk assessment required by DOE Order 5610.11 was not complete. The reason provided by LLNL was that there was not enough time to conduct a quantitative risk assessment; therefore, a qualitative hazard assessment was performed, but it was also in a draft form.

(d) A required USQD for the process was not complete.

(e) Several equipment upgrades were in process. The equipment used for the process demonstration performed for the NESSG was not characteristic of the equipment that is intended to be used during actual operations.

(2) Based on the questions asked and technical areas pursued and not pursued by the NESSG, it did not appear that the proper mix of expertise and background for this operation was resident in the NESSG. No subject matter experts supplemented the NESSG. The NESSG Chairman asked some demanding questions and adequately led the group discussions, but he did not have the technical support in some areas, including: electronics, criticality safety (although some good ideas came out of the NESSG), high explosive chemistry, and risk assessment. For example, the NESSG discussed DMSO/HMX liquid solution handling safety, but there was no NESSG member with knowledge of these materials. The NESSG eventually requested that the Pantex Explosive Technology Division Leader brief the NESSG.

(3) The program's approach to criticality safety is an example of poor coordination. Two independent analyses were conducted by Pantex and LLNL. The criticality safety expert from LLNL presented his analysis which found no major deficiencies, but LLNL's analysis was based on an outdated procedure and equipment configuration. Nevertheless, LLNL outlined several "recommendations" to the NESSG, which provided preferred levels of safety in order to comply with DOE Order 5480.24, Nuclear Criticality Safety. For example, Pantex should reevaluate the requirement for a criticality alarm system.

(4) The NESSG did not appear familiar with the reasons for the switch to the DMSO dissolution process. It was apparent that some members were not aware of the basis for the LLNL recommended pit surface temperature limit of 150

5. Recommended Staff Actions:

   a. Observe the W48 NESS continuation scheduled for February 3-4, 1994 and the W79 NESS scheduled for March 16, 1994.

   b. Observe the W48 Qualification Evaluation for Dismantlement (QED).

   c. Review the various technical reports and risk assessments when complete.