

[DNFSB LETTERHEAD]

September 12, 1997

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, DC 205850104

Dear Dr. Reis:

The Defense Nuclear Facilities Safety Board (Board) and its staff have been following closely the developments related to protection against accidents that might be initiated by lightning at the Department of Energy's (DOE) Pantex Plant. The adequacy of protection against lightning at Pantex is an important issue given the reliance on systems for preventing certain potentially high-consequence accidents from lightning. This matter has been the subject of considerable attention by DOE, Mason & Hanger Corporation (MHC), and Sandia National Laboratories (SNL).

The Board's staff has briefed the Board on observations presented in Enclosure 1. The Board wishes to share these observations with you. In addition, the Board has benefited from a briefing on the subject by SNL specialists, who have been advising MHC and DOE at Pantex.

After discussing the issue for several weeks, DOE, MHC, and SNL appear to have reached a general agreement on the nature of the threat posed by lightning to nuclear explosive operations at Pantex. To date, however, there still has been no comprehensive technical analysis of the ability of existing (or proposed) engineered design features and administrative controls to mitigate that threat.

Consequently, the Board requests that DOE develop a detailed technical report describing the approach taken to ensure the adequacy of those engineered design features and administrative controls which provide lightning protection for operations involving collocated high explosives and nuclear material at Pantex. This report should contain a comprehensive, technically detailed analysis of the threat from lightning, the controls necessary to mitigate that threat, the technical basis for concluding that these controls will be effective, and the path forward for implementation and preservation of those controls. The Board believes it is important that this report be completed and submitted within 90 days of the receipt of this letter.

Enclosed for your information and use are observations of the Board's staff regarding the recent discussions between MHC and SNL, as well as the staff's past observations on the adequacy of lightning safety at Pantex. If you need any further information, please let me know.

Sincerely,

John T. Conway
Chairman

c: Mark B. Whitaker, Jr.

Status of Lightning Safety at the Pantex Plant

Pantex currently uses two types of lightning protection systems for nuclear explosive facilities. The oldest systems consist of air terminals, down conductors, and a continuous buried ground ring electrode (counterpoise) around the perimeter of the building. Newer systems consist of poles and overhead wires grounded to a counterpoise. Sandia National Laboratories (SNL) reviewed these lightning protection systems and the effects of lightning at Pantex in 1993 and concluded that nuclear weapon assembly at Pantex is extremely safe from the abnormal lightning environments (K. O. Merewether and K. C. Chen, *Evaluation of the Electromagnetic Effects Due to Direct Lightning to Nuclear Explosive Areas at Pantex*, November 1993). The following are staff observations on the analysis done by the Mason & Hanger Corporation (MHC) and SNL to characterize the lightning threat to nuclear explosives, the controls developed to mitigate that threat, and the implementation and preservation of those controls.

Analysis of the Hazard to Nuclear Explosive Operations from Lightning. Although SNL completed an analysis in 1993 of the lightning threat at Pantex, the underlying assumptions made in this SNL analysis were not fully communicated to MHC. According to a later memorandum (K. Merewether [SNL] to D. Miller [MHC], June 16, 1997), the conclusions in the 1993 report were based on the following assumptions: (1) that Pantex could take credit for a Faraday cage/isolation scheme in which reinforcing bars in the concrete structures provide a partial Faraday cage (this Faraday cage limits the interior voltages in the bays and cells), (2) that adequate bonding of electrical penetrations into the bays and cells existed, and (3) that weapon operations at Pantex allowed a large enough standoff distance to preclude current flowing or arcing into the weapon. Assumptions (2) and (3), however, were not valid for most facilities at Pantex.

MHC was not aware of the full implications of the above basic assumptions made by SNL. The lack of knowledge concerning the bonding condition of electrical penetrations into nuclear explosive areas was discussed in the 1997 memorandum, which stated that the Faraday cage/isolation scheme (which allows Pantex to consider a potential lightning threat of only 10 kV and 900 A) is valid only if all conducting penetrations are bonded to the Faraday cage at their points of entry.

After discussing the issue for several weeks, DOE, MHC, and SNL appear to have reached a general agreement on the nature of the threat posed by lightning to nuclear explosive operations at Pantex. To date, however, there still has been no comprehensive technical analysis which outlines the nature of the threat posed by lightning at all nuclear explosive facilities and the ability of existing (or proposed) engineered design features and administrative controls to mitigate that threat.

Development of Controls. A draft SNL report, *Interim Lightning Safety at Pantex*, documents conclusions from its analyses to date and gives Pantex specific interim guidelines for controls applicable to some weapons, namely the B83, W79, W88, B615, and W62. MHC agreed to identify unbonded penetrations into active bays and cells, and to bond them at their entry points when possible. In addition to the weapons bays and cells cited above, the bays and cells used for W69 dismantlement also received attention as MHC prepared for those operations.

Implementation and Preservation of Controls. Based on a review of existing surveillance practices at Pantex for lightning suppression systems, the Board's staff is concerned that the implementation and preservation of the design features and administrative controls in place at Pantex to mitigate the threat from lightning are not commensurate with the potential hazards of lightning and the longterm mission of the facilities. These staff observations are summarized below.

- The latest drafts of Safety Analysis Reports (SARs) for nuclear explosive facilities in Zones 4 and 12 reviewed by the staff do not consider the lightning protection systems to be safety controls. The design of the explosives and the facilities in which they are housed are assumed to provide the primary protection from lightning strikes. However, there are no technical safety requirements or equivalent controls which clearly outline the design parameters and administrative controls important to lightning safety and the surveillance requirements necessary for adequate maintenance.

Although various controls for certain nuclear explosive operations have been identified as a result of recent discussions between SNL and MHC on lightning safety, there has been insufficient effort to provide uniform formalization of these controls in authorization basis documents.

- The frequencies of visual and electrical preventive maintenance inspections of systems, structures, and components providing lightning protection at Pantex do not conform to the recommendations made in National Fire Protection Association (NFPA) 780 for structures housing explosive materials. NFPA 780 recommends visual inspection of lightning protection systems every 7 months for corrosion, broken wires, or broken connections. It also recommends electrical tests, such as continuity and ground resistance tests, every 14 months. M&H, however, performs visual inspections annually and electrical inspections every 47 months. The SNL assertion that lightning safety at Pantex is dependent on proper bonding of electrical penetrations points to the need at Pantex for more inspection and testing of systems, structures, and components associated with lightning safety.