



**Department of Energy**  
**National Nuclear Security Administration**  
Washington, DC 20585  
January 29, 2001

01-0000233

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DNF SAFETY BOARD

The Honorable John T. Conway  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue, NW.  
Suite 700  
Washington, D.C. 20004-2901

Dear Mr. Chairman:

On October 23, 2000, you transmitted to the Department of Energy the Board's concerns about two minority opinions involving lightning controls at the Pantex Plant and requested that we advise you within 30 days of receipt of your letter of our path forward and schedule for addressing these issues. One minority opinion expressed concern about the manner in which the Authorization Basis (AB) addressed the communication systems through which lightning warnings are transmitted. We believe the AB as currently approved is sufficient. Enclosure 1, Communication of Lightning Warnings, explains our position. The second minority opinion expressed concern about the effects of voltages induced by bonding wires in bays and cells. The Lightning Protection Nuclear Explosive Safety Master Study Post-Start Finding Corrective Action Plans, Enclosure 2, contain the path forward and schedule for the second minority opinion. The operating contractor and national laboratories have sufficient resources to complete these plans.

The accompanying staff issue report's comments on the Readiness Assessment (RA) and other points, as well as the Department of Energy's actions for these, are discussed in Enclosure 2, Readiness Assessments and Other Concerns. I share your concerns in these areas and am directing the Office of Operations and Readiness to include in its safety oversight plan specific measures to evaluate RAs at Pantex and to include its observations and conclusions in its quarterly reports to Defense Programs management during 2001.

If you have further questions, please contact me or have your staff contact Mr. David E. Beck at 202-586-4879 or Mr. Jeff Underwood at 301-903-8303.

Sincerely,

THOMAS F. GIOCONDA  
Brigadier General, USAF  
Acting Deputy Administrator  
for Defense Programs

2 Enclosures

cc w/enclosure:  
M. Whitaker, S-3.1



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## Communication of Lightning Warnings

The Department of Energy has recently completed the process of implementing lightning controls for Nuclear Explosive (NE) operations at the Pantex Plant. Those controls were derived from the Lightning Basis for Interim Operation (LBIO). The adequacy of those controls was evaluated through the process of preparing the Department's Safety Evaluation Report (SER) to approve the LBIO and as part of the LBIO Nuclear Explosive Safety Master Study (NESS). Implementation of lightning controls was evaluated through a Department of Energy (DOE) Readiness Assessment and as part of the NESS review.

The SER and NESS reports presented minority opinions. One SER team member asserted that the system used to notify workers of potential lightning should be included as part of the safety-class lightning warning and detection system. One LBIO NESS study group member asserted that the potential for bond inductance to create a voltage threat to NE had not been adequately considered and, as a result, controls in place for certain facilities were inadequate to support continued operations.

In an October 23 letter, the Defense Nuclear Facilities Safety Board (DNFSB) expressed support for the minority opinion in the SER and identified the NESS report minority opinion as an issue, which should be resolved. The DNFSB also supported the DOE's classification of the NESS issue as post-start due to the conservative nature of the controls already in place.

In the LBIO, the preferred method to protect NE from lightning-induced electrical input is to isolate the NE using engineered controls. The LBIO review and approval process identified uncertainty in the adequacy of some proposed engineered controls. For example, test equipment was expected to provide isolation from the voltage that could potentially be transmitted to NE through the surge suppressed electrical system of a NE facility; however, the effectiveness of that control could not be verified. As a result, an additional control was developed to disconnect test equipment during the time when lightning threatened the Plant. That control consisted of a system used to detect thunderstorms and lightning and actions by personnel to warn of the potential threat and discontinue operations.

The Lightning Detection and Warning System, LDWS (specified via a Limiting Condition of Operation in the Pantex Plant Technical Safety Requirements, (TSRs)) provides information on the location, speed, and direction of approaching thunderstorms and the location of lightning strikes in the vicinity of the Pantex Plant. That information is displayed in the operations center, which is occupied 24 hours a day. An Administrative Control (AC) in the TSRs establishes the criteria the Plant Shift Superintendent (PSS) or Assistant PSS must use to determine whether a lightning warning should be issued. When lightning warnings are necessary, a TSR AC specifies it is the responsibility of the PSS to make those notifications. The LBIO discusses the

variety of means available to the PSS for completing this action, including the Plant public address system (checked daily for operability and equipped with a battery backup), pagers, radios, and telephones. It is up to the PSS to choose which of those systems to use to ensure the warning has been effectively communicated. A feedback mechanism exists to assure the PSS is aware of any NE facility not receiving the warning. Administrative controls in the TSRs specify which operations must be suspended once the warnings are issued.

Although the TSRs do not specify the communication systems to be utilized by the PSS, those systems are discussed in the LBIO and, as a result, they must be properly maintained. Changes to those systems must be evaluated through the Unreviewed Safety Question process. The Department believes the current control measures to be adequate to assure lightning warnings will be effectively communicated.

The DNFSB noted in its recent letter an incident in which more than 2 hours elapsed between issuance of a lightning warning and appropriate actions being taken to isolate some NE. In that instance, the problem was an inadequate response to the lightning warning, not a failure to receive or understand the warning. The order to shut down the NE operation was given within minutes of issuance of the lightning warning. However, a MHC manager erroneously interpreted how much time was permitted to complete the shut down action. That problem has been corrected and the operations personnel responsible for directing shut down actions clearly understand the time requirements. This incident was not related in any way to the method by which the operators learned of the lightning warning.

**S E P A R A T I O N**

**P A G E**

## Readiness Assessments and Other Concerns

The staff issue report forwarded by the Defense Nuclear Facilities Safety Board (DNFSB) October 23 letter raised several issues concerning the DOE Readiness Assessment (RA) of the implementation of the Lightning Basis for Interim Operation (LBIO), including lack of experience of some members of the team with the RA process, conflict between team members' regular work assignments and assessment duties, inconsistencies between the scope of the DOE and contractor assessments, and changing status of control implementation.

- An appropriate training course for RA team members and team leaders has been developed. Amarillo Area Office (AAO) Procedure 115.1.0, *Startup and Restart of Pantex Plant Activities*, will be revised to incorporate a requirement for formal RA training for all team members and leaders.
- To address the concern related to conflicts in work assignments, AAO Procedure 115.1.0 will be revised to incorporate a requirement for formal assignment of team member responsibilities, with the clear expectation that review activities take precedence over day-to-day duties.
- To address the issue of inconsistencies in the scope of the DOE and contractor assessments, AAO Procedure 115.1.0 will be revised to incorporate a requirement for a review of contractor implementing documents prior to the development of RA plans of action and implementation plans to ensure the scope of the contractor readiness assessment .
- The issue related to the changing status of control implementation and documentation will be addressed by revising AAO Procedure 115.1.0 to incorporate a requirement for new controls to be fully implemented and documented before an assessment is performed.

These changes will be incorporated in AAO Procedure 115.1.0 by February 28, 2001.

The staff report repeated an earlier concern about Plant Shift Superintendent (PSS) support. With the implementation of the TSRs, the minimum staffing levels for the Operations Center are two PSS-trained personnel on all shifts. At least one of these individuals must be present at all times. The Department believes the requirement for two PSS-trained personnel on shift at all times adequately addresses the concern.

The staff issue report identified a concern with the lack of Design Agency information on weapon response to lightning strikes. The Design Agencies have provided supporting documentation for the limited number of the currently authorized operations in which weapon features are considered to be controls. To the extent practicable, lightning controls have been developed without regard to the protective capability of the weapon.

We re continuing to pursue weapon response information from the Design Agencies in order to fully quantify the risks from lightning.

The staff issue report referred to a need for improvements to the Lightning Detection and Warning System. Several actions are currently being taken to address this concern. A network analysis, to validate reliability of the Lightning Location and Protection System, has been performed by the vendor. The recommended adjustments to the Clarendon sensor are currently being processed through the configuration control system. The operating contractor is currently analyzing data from the Static Potential Monitoring System to determine the characteristics of static potential levels when lightning is imminent. This effort is being tracked through the Lightning Protection Authorization Basis Project Plan.

The staff issue report noted the backlog in the analyses identified in the LBIO that remain to be performed. Resources, both within DOE and without, to address the highly specialized issues of the LBIO are extremely limited. To optimally allocate these limited resources to the remaining lightning issues, AAO, the operating contractor, and Sandia National Laboratories (SNL) have developed a prioritized schedule for SNL technical support for the remaining issues from the Lightning Master Study and the LBIO. This schedule is periodically reviewed and updated to reflect new information.

## **Corrective Action Plan**

### **Nuclear Explosive Safety Master Study Lightning Protection System at US DOE Pantex Plant Finding No. 1**

#### **STATEMENT OF CONCERN:**

Lack of formality and consistency in the methodology and acceptance criteria for evaluation of Faraday cages (shipping and storage containers and transport carts).

#### **STATEMENT OF ACCEPTANCE:**

Mason Hanger Corporation and Sandia National Laboratories accepts the finding. Criteria will be established to evaluate containers, carts and trailers as a Faraday cage. Formal quantitative analysis and calculations for each individual shipping and storage container, transport cart, partial subassembly and protective cover, etc. is not considered necessary due to inherent similarities of construction and the associated discontinuities which have an effect on their Faraday cage attributes. SNL will document the applicable evaluation methodology and acceptance criteria, and will provide an evaluation tool for each type of equipment system such as a checklist for MHC personnel to assess and formally walkdown individual pieces of equipment to evaluate the Faraday cage attributes and establish associated in-service inspection requirements. A sampling of those evaluations will be reviewed by SNL to assure proper application of the criteria.

#### **CAUSE ANALYSIS:**

The level of detail varied from formal analysis to informal walk down and inspection activities based on the time allowed and the number of qualified personnel available to perform the task. For some systems, a formal analysis was conducted based on physical examination, measurement of various openings, penetrations, material properties, and calculations of voltage differences on the inside surfaces of the containers or carts or voltages induced in open-circuited loops. These were then compared to the breakdown voltage of the weapon program detonator cable insulation, which were provided by the responsible weapon system engineer or by the appropriate design laboratory. Walkdowns of other transportation carts and containers were conducted and all were judged to be adequate Faraday cages based on previous experience by SNL subject matter experts. No methodology or criteria was presented to the NESSG for evaluation of Safe Secure Trailer(SST) /Safeguards Transporter(SGT)/Hardened Utility Trailers (HUT).

#### **GENERIC IMPLICATIONS:**

Additional peer review of the subject processes, criteria, and methodologies for shipping and storage containers, transport carts, and trailers as required by NESS Finding No. 4 is

not considered necessary. An independent review of the outputs satisfying NESS Finding No. 2, which addresses facility Faraday cage evaluation methodologies, should also validate the basic evaluation process applied to shipping and storage containers, transport carts, and trailers. SNL will however document the extent of both internal and external reviews that have occurred prior to issuing the reports associated with evaluating shipping and storage containers, trailers, and transport carts.

## **TECHNICAL RATIONAL FOR CORRECTIVE ACTIONS:**

### **A. Confirm Funding and Commitment of Resources and Schedule**

Prepare a project plan with major milestones and completion dates and obtain concurrence of all parties involved. Each organization is to identify their own funding source and establish associated budgets for performing each of the tasks described below.

### **B. Develop and Document Uniform Evaluation Methodology**

The salient characteristics of shipping and storage containers, transport carts, and trailers that contribute to being declared a Faraday cage, will be documented in a formal report prepared by SNL. The methodology for evaluating each type of anomaly and for each type of system equipment will also be included. This task will also include the development of an evaluation tool for MHC, such as a checklist for evaluating shipping and storage containers, transport carts, protective covers, and transportation trailers. This will provide a uniform basis of evaluation for each type of equipment system.

### **C. Re-evaluate each type of equipment system**

Qualified MHC personnel will follow the prescribed methodology and re-evaluate all required items of each type of equipment system that were not formally analyzed previously. This shall include any additional required equipment systems not previously analyzed or walked down. A formal report will be prepared and shall include and document the calculations and bases for all conclusions. The tables below show which items that were formally analyzed, those walked down and which require additional evaluation, and those that were neither walked down or analyzed previously. SNL will selectively review the results of the walkdown efforts to ensure proper application of process and methodology.



## Shipping Containers

Weapon Program	Formal Analyses Available	Walked Down
W56		X
W62	X	
W76	X	
W78	X (See W62 analysis)	
W79		X
W80		X
W84		X
W87		X
W88		X
B53 Bomb Case w/J1 Connector Cover	X	
B61 Bomb Case	X (See B61 WSS)	X
B83 Bomb Case *	X (See B83 WSS)	X

## Transportation Carts

Weapon Program	Formal Analyses Available	Walked Down
W56	X	
W62	X	
W76	X	
W78		X
W79	X	
W80		X
W84		X
W87	X	
W88		X
B61 Bomb Case		X
B83 Bomb Case		X

## Partial sub-assembly transportation carts and protective covers

Weapon Program	Formal Analyses Available	Walked Down
W56		
W62		
W76		
W78		
W79		
W80		
W84		
W87	X	
W88	X	
B53	X	
B61		
B83		X

## Transport Trailers

Weapon Program	Formal Analyses Available	Walked Down
SSTs		X
SGTs		X
HUTs		X

- D. **Revise AB documents and prepare implementation plan.**
- E. **Issue revised AB documents and implement any new controls, if required.**

**CORRECTIVE ACTIONS:**

Task	Description	Completion Date	Responsible Org/Person
A.	<b>Confirm FY01 Funding and Commitment of Resources and Schedule.</b>	<b>January 15, 2001</b>	<b>MHC SNL</b>

<b>B.</b>	<b>Develop and Document Uniform Faraday Cage Evaluation Methodology in final report.</b>	<b>March 15, 2001</b>	<b>SNL</b>
<b>C.</b>	<b>Re-evaluate each type of equipment system, perform walkdowns and issue reports.</b>	<b>September 30, 2001</b>	<b>MHC</b>
<b>D.</b>	<b>Revise AB documents if required, prepare implementation plan, and confirm readiness.</b>	<b>December 1, 2001</b>	<b>MHC</b>
<b>E.</b>	<b>Issue revised AB documents and implement any new controls, if necessary .</b>	<b>December 15, 2001</b>	<b>MHC</b>

**COMPLETION CRITERIA:**

- A. Initiation of "Uniform Evaluation Methodology" development**
- B. Publish "Uniform Transportation Container, Transport Cart, and Transport Trailer Evaluation Criteria and Methodology" including checklists.**
- C. Issue final evaluation reports (with SNL "spot check" results included).**
- D. Declaration of Readiness letter**
- E. Operations under revised controls if req'd.**

**REFERENCE DOCUMENTS:**

1. Nuclear Explosive Safety Master Study of the Lightning Protection System at the US DOE Pantex Plant
2. Listing of Selected Reference Documents for the Lightning Protection Basis for Interim Operation (L-BIO) /Module RPT-MNL - 273039 Rev. ) May 25, 2000.



## **Corrective Action Plan**

### **Nuclear Explosive Safety Master Study Lightning Protection System at US DOE Pantex Plant Finding No. 2**

#### **STATEMENT OF CONCERN:**

The criteria for evaluating Faraday cage features of Pantex facilities has not been formalized and documented.

#### **STATEMENT OF ACCEPTANCE:**

Mason Hanger Corporation and Sandia National Laboratories accepts the finding. However, it should be noted that the methodology used to evaluate the maximum lightning-induced voltages in the assembly areas was formally transmitted to MHC and the DOE by technical memorandum, which was peer-reviewed at three levels. The memorandum documents not only the results of the analysis, but also demonstrates the process used: it identifies the dominant coupling mechanism for each facility, provides the assumptions behind the models, and gives simple analytical formulas showing explicitly the dependence of the voltages on the specific features of the geometry. It is true, however, that the process is not prescriptive in its current form, nor does it give guidelines for maintenance of the essential features of the lightning protection system.

#### **CAUSE ANALYSIS:**

A Faraday cage lightning protection system is being implemented at the Pantex Plant. Complete and formal documentation for the design basis, design assumptions, implementation, evaluation, and maintenance, of the lightning protection system was not presented.

Design Guide-like documentation was not provided to assure consistency for items such as: specific features that were evaluated for each facility, what features were found to be essential for each nuclear explosives facility, what evaluation methods were used, what results were obtained, what surveillance will be required, and how the required surveillance will be accomplished.

#### **GENERIC IMPLICATIONS:**

Any additional peer review of the subject processes, criteria, and methodologies required as a result of NESS Finding No. 4 must be coordinated with the Corrective Action Plans and associated schedule of outputs from the documentation of evaluation and analyses criteria required to satisfy NESS Master Study Finding No. 2. However, SNL will

document the extent of normal process peer review that has occurred prior to issuing the reports associated with evaluating facility Faraday cages and prior to requesting any additional peer review. Therefore the output from the development and documentation of evaluation processes will be grouped and packaged to maximize efficiency in conducting additional independent review.

It is particularly important that documentation be developed because there are no accepted national guides or standards for a Faraday cage protection system. It is also important that guidance be available that assures consistency in future evaluations for facility Faraday cage features.

#### **TECHNICAL RATIONAL FOR CORRECTIVE ACTIONS:**

##### **A. Confirm Funding and Commitment of Resources and Schedule**

Prepare a project plan with major milestones and completion dates and obtain concurrence of all parties involved. Each organization is to identify their own funding source and establish associated budgets for performing each of the tasks described below.

##### **B. Develop and Document Process used for evaluating Faraday cage features of Pantex Facilities in a formal report.**

A complete and formal documentation of the design basis, design assumptions, implementation, evaluation, and maintenance, of the lightning protection system is necessary. The following items need to be formally documented for each facility:

1. Specific features that were evaluated, what features were found to be essential for each nuclear explosives facility.
2. What evaluation methods and criteria were used.

##### **C. Conduct, as necessary, additional subcontractor peer review of formal report. (See NESS Finding No. 4)**

##### **D. Prepare and issue addendums, as necessary, to final report for use by Pantex personnel and others involved in executing surveillance and maintenance activities.**

**CORRECTIVE ACTIONS:**

<b>Task</b>	<b>Description</b>	<b>Completion Date</b>	<b>Responsible Org/Person</b>
<b>A.</b>	<b>Confirm Funding and Commitment of Resources and Schedule</b>	<b>January 1, 2001</b>	<b>MHC SNL</b>
<b>B.</b>	<b>Develop and Document Process, including previous internal and external peer review, used for evaluating Faraday cage features of Pantex Facilities and issue final report.</b>	<b>March 15, 2001</b>	<b>SNL</b>
<b>C.</b>	<b>Conduct, as deemed necessary by the AAO, a subcontractor peer review of subject report (See NESS Finding No. 4)</b>	<b>June 1, 2001</b>	<b>MHC, SNL, Subcontractor</b>
<b>D.</b>	<b>Prepare and issue addendums, if required, to final report for use by Pantex personnel and others involved in executing surveillance and maintenance activities.</b>	<b>July 31, 2001</b>	<b>SNL MHC</b>

**COMPLETION CRITERIA:**

- A. Initiate documentation of criteria used for evaluating Faraday cage features of Pantex Facilities.**
- B. Issue evaluation process document.**
- C. Conduct an additional subcontractor peer review, as required by the AAO.**
- D. Issue addendums to final report for use by Pantex personnel and others.**

**REFERENCE DOCUMENTS:**

1. Nuclear Explosive Safety Master Study of the Lightning Protection System at the US DOE Pantex Plant
2. Listing of Selected Reference Documents for the Lightning Protection Basis for Interim Operation (L-BIO) /Module RPT-MNL - 273039 Rev.0) May 25, 2000.





## **Corrective Action Plan**

### **Nuclear Explosive Safety Master Study Lightning Protection System at US DOE Pantex Plant Finding No. 3**

#### **STATEMENT OF CONCERN:**

Information was presented for nuclear explosives facility bond inductance that has not been considered or applied in calculations of lightning stand-off distances for NE operations.

#### **STATEMENT OF ACCEPTANCE:**

Mason Hanger Corporation and Sandia National Laboratories accepts the finding.

#### **CAUSE ANALYSIS:**

The maximum credible threat voltage for a facility is determined from assumptions about the lightning current, from the structure and continuity of the rebar that surrounds the facility, and by the nature and bonding of penetrations that enter the facility. Sandia National Laboratories has performed calculations of the voltages that could be induced in nuclear explosives facilities at the Pantex Plant using analytical models and techniques that were available at the time of publication of their technical memorandum and initial recommendations. Because this is a work in progress, some well-known physical mechanisms have not been accounted for, one of which is the inductance associated with engineered bonds.

Based on the information presented to the NESSG, the maximum voltages that could be induced by lightning in nuclear explosives facilities did not consider, among other mechanisms, the voltage developed across engineered bonds. Therefore, NE facility lightning stand-off distances may have to be modified.

#### **GENERIC IMPLICATIONS:**

Additional peer review of the subject processes, criteria, and methodologies required as a result of NESS Finding No. 4 must be coordinated with the Corrective Action Plans and associated schedule of outputs from the documentation of evaluation and analyses criteria required to satisfy NESS Master Study Finding No. 3. However, SNL will document the extent of normal process peer review that occurs prior to issuing the report associated with evaluating bond wire inductance and effect on facility Faraday cage voltage. Therefore the output from the development and documentation of all evaluation processes (See NESS Finding No. 2) will be grouped and packaged to maximize efficiency in conducting any additional peer review as deemed necessary by the AAO.

A simple calculation of the inductance of the specified bond yields values as large or larger than the "Maximum Voltage" shown in Section 3, Table 3-2 of the Lightning BIO for all but two of the sixteen facilities listed.

The estimates for the inductance through 12 inches of wire and the resultant voltage across this inductance for the postulated lightning threat current were discussed. The SNL subject-matter-expert commented that the geometry of penetration bonds is more complex than that of a straight wire in free space and that a detailed calculation of bond inductance is needed.

The SNL subject-matter-expert provided the information on the conservatisms incorporated into the analyses and identified several assumptions. The assumptions, because they could not be quantified or controlled in accordance with current standards, were considered, but not formally credited as mitigating features. These included intrinsic bonding, alternate diversion paths, effective dielectric strength, and parallel conductance. None of the cited features have been formally evaluated against the lightning threat relative to inductance in bonds. The Lightning Protection Project Team considered these conservatisms along with the 2:1 safety factor for lightning stand-off. They judged that the threat from bond inductance was not a significant contributor to the electrical threat that could result from a lightning strike.

#### **TECHNICAL RATIONAL FOR CORRECTIVE ACTIONS:**

##### **A. Confirm Funding and Commitment of Resources and Schedule**

Prepare a project plan with major milestones and completion dates and obtain concurrence of all parties involved. Each organization is to identify their own funding source and establish associated budgets for performing each of the tasks described below.

##### **B. Develop and document processes used for evaluating and /or calculating the "bond wire inductance" contribution to the maximum postulated facility voltage for Pantex Facilities.**

The SNL subject-matter-expert provided the information on the conservatisms incorporated into the analyses and identified several assumptions. The assumptions, because they could not be quantified or controlled in accordance with current standards, were considered, but not formally credited as mitigating features. These included intrinsic bonding, alternate diversion paths, effective dielectric strength, and parallel conductance. None of the cited features have been formally evaluated against the lightning threat relative to inductance in bonds.

- C. Conduct a subcontractor peer review, as required, of updated evaluation processes, criteria, and methodologies. (See NESS Finding No. 4 Corrective Action Plan)
- D. Prepare and issue addendums, if required, to a final report(s) for use by Pantex personnel.
- E. Revise AB Documents and prepare implementation plan and confirm readiness.
- F. Issue revised AB documents and implement any new controls , if required.

**CORRECTIVE ACTIONS:**

Task	Description	Completion Date	Responsible Org/Person
A.	Confirm FY01 Funding and Commitment of Resources and Schedule	January 1, 2001	MHC SNL
B.	Develop and document processes used for evaluating and /or calculating the "bond wire inductance" contribution (including internal peer reviews) and provide an updated maximum postulated voltage for each facility.	March 15, 2001	SNL
C.	Conduct, as deemed necessary by the AAO, a subcontractor peer review of subject documentation for a set of representative facility types. (See NESS Finding No. 4)	June 1, 2001	MHC, SNL, subcontractor
D.	Prepare and issue addendums, if required, to final report for use by Pantex personnel	July 31, 2001	MHC
E.	Revise AB documents, prepare implementation plan, and confirm readiness.	December 1, 2001	MHC
F.	Issue revised AB documents and implement any new controls, if necessary	December 15, 2001	MHC

**COMPLETION CRITERIA:**

- A. Initiate the development and documentation of criteria used for evaluating and /or calculating the "bond wire inductance" contribution.
- B. Issue a report that documents criteria used for evaluating and/or calculating the "bond wire inductance" contribution, including internal peer reviews.
- C. Peer review comments document, as deemed necessary by the AAO.

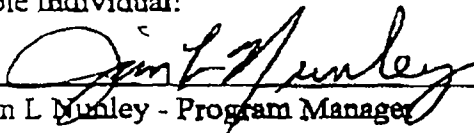
- D. Issue a revised report with peer review comments incorporated.**
- E. Issue a final report.**
- F. Issue Declaration of Readiness letter**
- G. Operations under revised controls, if necessary.**

**REFERENCE DOCUMENTS:**

1. Nuclear Explosive Safety Master Study of the Lightning Protection System at the US DOE Pantex Plant
2. Listing of Selected Reference Documents for the Lightning Protection Basis for Interim Operation (L-BIO) /Module RPT-MNL - 273039 Rev. ) May 25, 2000.

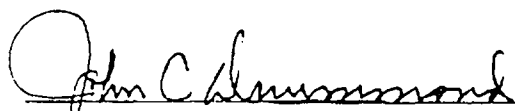
**APPROVALS - MHC**

Responsible Individual:

  
\_\_\_\_\_  
Jim L. Nunley - Program Manager 12/4/00  
Date:

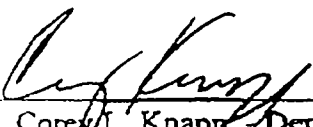
Responsible Business Group Manager:

  
\_\_\_\_\_  
Don Swanson - ABD & M Manager 12/7/00  
Date:

  
\_\_\_\_\_  
for Larry Eppler - Senior Technical Advisor 12-8-00  
Date:

**APPROVALS - SNL**

Responsible Senior Manager:

  
\_\_\_\_\_  
Corey L. Knapp - Deputy Director 12-5-00  
Stockpile Assessment and Support Program Date:

## **Corrective Action Plan**

### **Nuclear Explosive Safety Master Study Lightning Protection System at US DOE Pantex Plant Finding No. 4**

#### **STATEMENT OF CONCERN:**

Peer reviews are not being utilized for the Faraday cage analyses and resulting controls.

#### **STATEMENT OF ACCEPTANCE:**

Sandia National Laboratories do not concur with the finding. However, MHC proposes independent review of only the methodology used to determine the voltage that can be developed on the interior of a structure/container used as a Faraday cage. That methodology would (or has formed) the basis for all Faraday cage analyses. Current and future SNL analyses (which is, or will be based on that methodology) receives internal peer review in the normal course of producing approved technical documents. The analysis and recommendations are reviewed by members of SNL's Independent Assessment Department, Nuclear Surety, and by engineers of all affected weapon programs. The Lightning Protection Project Team reviewed some of the earlier analyses used as a basis for the existing lightning related safety controls. Internationally recognized specialists in the fields of lightning protection codes and practice, shielding theory, and arc physics were specifically charged with reviewing the philosophy, approach, models, and controls of the Faraday cage / Isolation lightning protection system during the DOE-sponsored lightning protection symposium. As a result, independent review of products based on reviewed methodologies is not considered necessary.

#### **CAUSE ANALYSIS:**

The extent and rigor of the many layers of peer review that have been done in support of the lightning protection upgrade were not among the topics that were requested and formally presented at the Lightning Protection Master Study. The NESS members were not provided with information to judge the adequacy of the peer review process.

#### **GENERIC IMPLICATIONS:**

The independent review of the subject evaluation processes, criteria, and methodologies must be coordinated with the Corrective Action Plans and associated schedule of outputs from the re-evaluation of processes, criteria, and methodologies to satisfy NESS Master Study Findings 2 and 3. Findings 2 and 3 require additional evaluation and analyses of facility Faraday cage evaluations. Therefore the output from the new evaluation processes, criteria, and methodologies will be grouped and packaged to maximize

efficiency in conducting the independent review.

#### **TECHNICAL RATIONAL FOR CORRECTIVE ACTIONS:**

##### **A. Confirm Funding and Commitment of Resources and Schedule**

Prepare a project plan with major milestones and completion dates and obtain concurrence of all parties involved. Each organization necessary to support this effort is to identify their own funding source and establish associated budgets for their organization as well as identify and budget for any subcontract costs for performing each of the tasks described below.

##### **B. Conduct independent review of processes and methodologies, perform comment resolution, and include any resulting changes into documented processes and methodologies in concert with the outputs from NESS Master Study Findings No. 1- 3.**

#### **CORRECTIVE ACTIONS:**

<b>Task</b>	<b>Description</b>	<b>Completion Date</b>	<b>Responsible Org/Person</b>
<b>A.</b>	<b>Confirm FY01 Funding and Commitment of Resources and Schedule.</b>	<b>January 15, 2001</b>	<b>MHC SNL</b>
<b>B.</b>	<b>Conduct independent review on processes, criteria, and methodologies for a set of representative facility types; perform comment resolution; and include any resulting changes into documented processes and methodologies as provided and derived from CAPs for Findings No. 2 and 3.</b>	<b>See CAPs for NESS Findings No. 2 &amp; 3</b>	<b>MHC Subcontractor</b>

#### **COMPLETION CRITERIA:**

- A. Acceptance of CAPs for NESS Findings No. 2 and 3 and determination of the extent of the required subcontractor services to provide independent review.**
- B. Peer review reports consistent with deliverables and schedules identified in CAPs for Findings No. 2 and 3, as determined by the AAO.**

#### **REFERENCE DOCUMENTS:**

1. Nuclear Explosive Safety Master Study of the Lightning Protection System at the US DOE Pantex Plant
2. Listing of Selected Reference Documents for the Lightning Protection Basis for

Interim Operation (L-BIO) /Module RPT-MNL - 273039 Rev. ) May 25, 2000.

**APPROVALS - MEC**

Responsible Individual:

  
\_\_\_\_\_  
Jim L. Nanley - Program Manager 12/4/00  
Date:

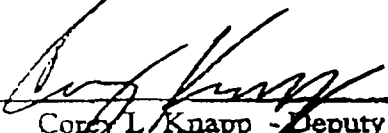
Responsible Business Group Manager:

  
\_\_\_\_\_  
Don Swanson - ABD & M Manager 12/7/00  
Date:

  
for \_\_\_\_\_  
Larry Eppler - Senior Technical Advisor 12-8-00  
Date:

**APPROVALS - SNL**

Responsible Senior Manager:

  
\_\_\_\_\_  
Corey L. Knapp - Deputy Director  
Stockpile Assessment and Support Program 12-5-00  
Date:



## **Corrective Action Plan**

### **Nuclear Explosive Safety Master Study Lightning Protection System at US DOE Pantex Plant Finding No. 5 and No. 6**

#### **STATEMENT OF CONCERN:**

##### **Finding No. 5 - Fire Initiated by Lightning Strike**

There were no data presented to address the threat of fire initiated by a lightning strike; therefore, the NESSG did not evaluate the adequacy of controls to mitigate this threat.

##### **Finding No. 6 - Spalling**

There were no data presented concerning the effects of lightning-induced spalling on a nuclear explosive; therefore, the NESSG did not evaluate the adequacy of controls to mitigate this threat.

#### **STATEMENT OF ACCEPTANCE:**

Mason Hanger Corporation accepts the finding as presented. It should be noted that in the Safety Evaluation Report dated April 17, 2000 it was recognized that other hazards that could be associated with lightning strike such as direct impact, were not evaluated in the LBIO. In the lightning BIO, MHC has committed to evaluate those hazards as part of the SAR development and implementation program.

#### **CAUSE ANALYSIS:**

##### **Finding No. 5 - Fire initiated by a lightning strike.**

Line management at the Pantex Plant and DOE decided that the SIID for the study would not address fire initiated by lightning. This decision was discussed during the SIID adequacy review. The NESSG agreed to this limitation with the understanding that a discussion of it would be included in the NESS report.

The information presented in the Single Integrated Input Document and the presentations did not address fires initiated by a lightning strike and that could impact NEOs. The DOE Safety Evaluation Report recognized that the Lightning Basis for Interim Operation did not address all threats to operations from lightning strikes. However, there was not a condition of approval issued by the SER which would ensure this deficiency is addressed in a revision to the Lightning BIO or by any other BIO.

Finding No. 6 Spalling

Given a direct lightning strike to a nuclear explosive area, the NESSG noted the postulated scenario whereby concrete on the inner surfaces of the facility would spall. The hazard of concern is that spalled masses of concrete could have kinetic energy sufficient to cause shock-initiation of the main charge high explosives or high explosive detonator(s).

Case history indicates that spalling may have led to severe damage to a munitions storage bunker in Austria.

## GENERIC IMPLICATIONS:

NONE.

## TECHNICAL RATIONAL FOR CORRECTIVE ACTIONS:

- A. The lack of consideration of "fire initiated by lightning strike" and "spalling" in the LBIO was intentional. The Fire Basis of Interim Operation (FBIO) was intentionally scoped by Pantex management as the most appropriate document to include consideration of fire caused by lightning (natural phenomena). Likewise the LBIO was intentionally scoped to exclude spalling to eliminate duplication. It was also determined that the Bays, Cells, and Special Purpose Facilities BIO modules should address spalling due to lightning along with other natural phenomena related hazards and consequences.

## CORRECTIVE ACTIONS:

A.	Submit FBIO for DOE approval	January 1, 2001	MHC
B.	Conduct NESS Master Study on FBIO	TBD	DOE
C.	Submit Bays Module and associated "lightning induced spalling" evaluation for DOE approval.	January 1, 2001	MHC
D.	Conduct NESS Master Study on Bays Module	TBD	DOE
E.	Submit Cells Module and associated "lightning induced spalling" evaluation for DOE approval.	January 31, 2001	MHC
F.	Conduct NESS Master Study on Cells Module	TBD	DOE

G.	<b>Submit six each Special Purpose Facilities Modules and associated "lightning induced spalling" evaluations to DOE for approval.</b>	<b>From 2<sup>ND</sup> QTR 02 to 3<sup>RD</sup> QTR 03</b>	<b>MHC</b>
H.	<b>Conduct NESS Master Study on Special Purpose Facilities Module</b>	<b>TBD</b>	<b>DOE</b>

**COMPLETION CRITERIA:**

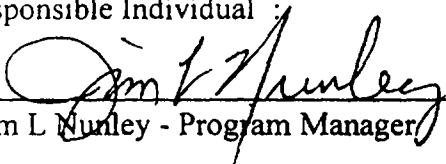
- A. **Submittal letter to DOE**
- B. **Final NESS Master Study Report - FBIO**
- C. **Submittal letter to DOE**
- D. **Final NESS Master Study Report - Bays Module (Spalling)**
- E. **Submittal letter to DOE**
- F. **Final NESS Master Study Report - Cells Module (Spalling)**
- G. **Submittal letters to DOE**
- H. **Final NESS Master Study Report - Special Purpose Facilities (Spalling)**

**REFERENCE DOCUMENTS:**


1. Nuclear Explosive Safety Master Study of the Lightning Protection System at the US DOE Pantex Plant
2. Listing of Selected Reference Documents for the Lightning Protection Basis for Interim Operation (L-BIO) /Module RPT-MNL - 273039 Rev. ) May 25, 2000.

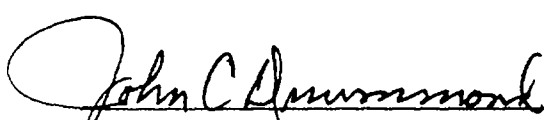
APPROVALS -MHC

Responsible Individual :

  
Jim L Nunley - Program Manager 12/4/00  
Date:

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Don Swanson - ABD & M Manager 12/7/00  
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for Larry Eppler - Senior Technical Advisor 12-8-00  
Date: