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MAR 20 1984

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SUSQUEHANNA STEAM ELECTRIC STATION  
THIRD INTERIM REPORT ON A DEFICIENCY INVOLVING  
SEPARATION IN MULTIPLE DIVISION PULL BOXES &  
JUNCTION BOXES  
ER 100508  
PLA-2074

FILE 821-10

Docket No. 50-388

References: (1) PLA-1798 dated 8/18/83  
(2) PLA-1883 dated 9/30/83  
(3) PLA-2000 dated 12/27/83

Dear Dr. Murley:

This letter serves to provide the Commission with an interim report on a deficiency involving electrical separation inside multiple division junction and pull boxes. This deficiency was reported under 10CFR50.55(e) as potentially reportable by telephone to Mr. E. C. McCabe of NRC Region I by Mr. J. Saranga of PP&L on July 21, 1983.

The attachment to this letter contains a description of the problem, its cause, the safety implications, and the corrective action.

Since the details of this report provide information relevant to the reporting requirements of 10CFR21 for Unit 2, this correspondence is considered to also discharge any formal responsibility PP&L may have for reporting in compliance thereto.

We trust the Commission will find this report to be satisfactory. PP&L expects to provide a final report in June 1984.

Very truly yours,

N. W. Curtis  
Vice President-Engineering & Construction-Nuclear

Attachment

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Dr. Thomas E. Murley

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## INTERIM REPORT

### Attachment 1 to PLA-2074

#### SUBJECT

Divisional and energy level separation inside multiple division junction boxes and pull boxes.

#### DESCRIPTION AND CAUSE

FSAR commitments on separation criteria for raceway require a one-inch air space between enclosed conduits (with certain exceptions listed in Section 8.1.6.1.n7). Inside multiple division junction and pull boxes, this one-inch air space has been reduced to a single metal barrier. Additionally, gaps between the box covers and the barriers exist. The primary cause of this problem was a lack of clarity and definition in the design documents. The installation notes and details provide for a non-Q installation of a barrier for voltage separation but does not provide a clear reference to the barrier's applicability to divisional separation. Pull boxes are unscheduled and installed at the discretion of the field construction force. These multiple division junction and pull boxes are used for both high energy and low energy circuits at Susquehanna.

#### ANALYSIS OF SAFETY IMPLICATIONS

Without proper separation, in the worst case analysis, a single failure could conceivably cause loss of redundant safety related circuits or a failure in a non Class 1E circuit could propagate into a Class 1E circuit.

#### CORRECTIVE ACTION

Design basis criteria and barrier configurations have been established for multiple division junction and pull boxes for all voltage levels.

1. The following is a summary of the voltage level definitions and separation criteria for application to junction and pull boxes.

- a. Voltage Level Definitions:

- (1) Medium Voltage Power - 5kv and 15kv power circuits
- (2) Low Voltage Power - 480V ac, 120V ac, 125V dc and 250V dc power circuits
- (3) Control - 120V ac, 125V dc and 250V dc control and digital signal circuits
- (4) Instrumentation - Low Level signal circuits
- (5) High Energy Circuits - 5kv, 15kv and 480V ac power circuits, 120V ac, 125V dc, and 250V dc power circuits with a circuit rating of greater than 20 amperes.

b. Separation Criteria:

The separation criteria as applied to pull and junction boxes is summarized in Attachment 2 and is designed to meet FSAR raceway separation commitments. A "Q" voltage barrier (VB) is applied to cases where less than one inch air space is permitted per FSAR 8.1.6.1n7. This design approach has been assessed as acceptable via extrapolation of the analysis in Wyle Lab Test Report No. NE56719. The definition of high energy circuits for boxes is also conservatively chosen based on this same report. The "Q" high energy barrier has been designed to meet the intent of the requirement for one inch air space between enclosed conduits. This barrier will be applied in those cases where high energy cable is involved in either divisional or channel separation, or where required to meet the validity of separation exemptions for non-Class 1E annunciator and instrument cables per FSAR 8.1.6.1n7.

2. The following is a summary of the characteristics and applications of the "Q" high energy barrier and the "Q" voltage barrier.

a. "Q" High Energy Barrier:

- (1) This barrier consists of two steel plates separated by a thermal insulating material equal or better than one inch of air space. The barrier detail provides an attachment to securely fasten the box cover at the barrier and provides instructions to seal any gaps between the barrier and the surface of the box. The steel plate barriers are the same gauge as the box.
- (2) This barrier will be used to provide separation of:
  - (a) High energy cables from any cables of incompatible separation groups.
  - (b) High energy cables from non-class 1E annunciator/instrumentation cables.

b. "Q" Voltage Barrier:

- (1) This barrier consists of a single steel plate.
- (2) This barrier is used to provide separation of:
  - (a) Control/instrumentation cables of incompatible separation groups.
  - (b) Class 1E high energy cables from instrumentation cables of compatible separation groups (for electromagnetic interference (EMI) considerations).



(c) Class 1E power (480 V) cables from non-class 1E control cables.

- (3) When this barrier is used and gaps between the barrier and the box or cover cause a violation of separation requirements, a non-metallic separation material (FSAR 8.1.6.1.n.14) will be applied to the cables of one or more separation groups in the box.

Attachment 2 to this letter provides additional information on the use of the "Q" high energy barrier and the "Q" voltage barrier.

As indicated in Reference (1), Bechtel was directed to walkdown all Unit 2 Class 1E conduits, locate all multiple division of energy level pull boxes and junction boxes, document and analyze the existing separation condition and required rework. Bechtel's Unit 2 Construction Force was also directed to stop the practice of installing multiple division unscheduled pull boxes.

PP&L reported in Reference (3) that Bechtel had completed its Unit II walkdown and analysis for divisional and channel separation. PP&L's review of the Bechtel report indicated that the Bechtel walkdown effort did not adequately cover all of the required aspects. Based on the report, PP&L did identify one pull box which was in a reportable configuration. This box contained redundant channel C and D circuits which were not sufficiently separated by an approved barrier. Additional walkdowns were initiated to provide adequate coverage to fully resolve all remaining concerns.

The status of these additional walkdown efforts is as follows:

#### Unit I

- (1) The Unit 1 walkdowns completed to date identified several instances where the separation criteria was not met. These configurations either have been modified or will be modified to insure proper separation. The configurations which have not been modified have been justified for interim operation. These justifications are contained in NCR 83-836. A schedule for when the modifications will be made will be provided in the final report.
- (2) Twelve Unit 1 junction boxes were identified recently by Bechtel which require corrective actions. These boxes contain non-class 1E 480V ac power cables along with annunciator or instrument cables. Modifications will be made to these boxes to assure proper separation. Justifications for interim operation are contained in NCR 83-836. A schedule for these modifications will also be provided in the final report.
- (3) Three rooms in Unit 1 could not be walked down due to radiation exposure concerns. These three rooms (R30, R31, R32) are located in the Radwaste Building (Area 37, Elev. 646). The three rooms contain non-Class 1E control conduits only, and all cables are non-Class 1E 120V ac control circuits fused at 6 amps. There are no annunciator or instrument circuits or cables in these rooms. Consequently, there is no possibility of any

divisional/channel separation problem, voltage problem, or special separation problem in these rooms.

## Unit II

- (1) Unit 2 walkdowns completed to date have identified several separation discrepancies. Most of the discrepant conditions have been modified to insure adequate separation. Any configurations not scheduled to be modified prior to Unit 2 fuel load have been justified for interim operation until initial criticality. The justifications and dispositions are contained in NCR 83-1396, NCR 84-231, and NCR 84-368.
- (2) Based on the following, PP&L considers this deficiency reportable under 10CFR50.55(e).
  - (a) One scheduled box (JB4265) and one unscheduled box (Z512) have been found to contain redundant Class 1E circuits. In the event of certain highly unlikely accident scenarios combined with a postulated fault in one of these junction boxes, there may be a degradation of redundant safety functions below that considered to provide acceptable design margins.
  - (b) JB4265 contains high energy cables supplying 125V dc control power for the 4.16kV circuit breakers in channel "A" 4.16kV switchgear 2A201 and in channel "C" 4.16kV switchgear 2A203. Loss of all cables within this box would prevent closure of 4.16kV circuit breakers for redundant emergency core cooling system pump motors (RHR and core spray).
  - (c) One pull box in room Z512 contains high energy cables supplying 125V dc control power for the 4.16kV circuit breakers in channel "C" 4.16kV switchgear 2A203 and in channel "D" 4.16kV switchgear 2A204. Loss of all cables within this box would prevent closure of 4.16kV circuit breakers for redundant emergency core cooling system pump motors (RHR and core spray).
- (3) Our recent review of pull box Z-512 has shown that although it contains Unit 2 cables for the "C" and "D" emergency diesel generators, the present configuration of the box does not present a safety concern for Unit 1 operation since these cables provide an alternate source of 125V dc control voltage for the engine/generator control panels (OC519C/D and OC521C/D) and are connected to the panels through a manual transfer switch. With the Unit 1 primary source connected, loss of these Unit 2 cables will not affect the operation of the diesel generators. The alignment of these manual transfer switches to the Unit 1 DC power supplies is being administratively controlled under NCR-83-836. Additionally, pull box Z512 is also presently protected against an exposure fire with thermo-lag material.

The NCRs discussed in this report will be provided to the NRC Resident Inspectors for their review. Changes to drawings E41, "Numbering System Description"; E47, "Junction Box Schedule & Details"; E49, "Conduit & Cable

Tray Notes & Details"; and E60, "Electrical Separation Description" will be made to prevent recurrence of this problem. Changes to the FSAR are currently under consideration (FSAR Change Notice No. 1199). These FSAR changes are for clarification and will not change existing commitments.

A final report will be provided in June 1984 which will address all actions to prevent recurrence of this problem. A summary of the status of any physical modifications remaining as a result of this deficiency will also be included.

## Attachment 2

Separation Methods and Requirements Within Junction Boxes and Field  
Installed Pull Boxes

Separation Between		Separation Group (1)	Separation Method
1E HE	1E HE	Non-Compatible Ch/Div.	HB
1E HE	N-1E HE	Non-Compatible Ch/Div.	HB
1E INST	1E HE	Compatible Ch/Div.	VB(4)
1E INST	1E HE	Non-Compatible Ch/Div.	HB
1E INST	N-1E HE	Non-Compatible Ch/Div.	HB
N-1E INST	1E HE	Non-Compatible Ch/Div.	HB
N-1E INST	N-1E HE	-	HB
1E INST	1E CNTRL	Compatible Ch/Div.	-
1E INST	1E CNTRL	Non-Compatible Ch/Div.	VB(2)
1E INST	N-1E CNTRL	Non-Compatible Ch/Div.	VB(2)
1E INST	1E INST	Non-Compatible Ch/Div.	VB(2)
1E INST	N-1E INST	Non-Compatible Ch/Div.	VB(2)
N-1E INST	1E CNTRL	Non-Compatible Ch/Div.	VB(2)
N-1E INST	N-1E CNTRL	-	-
1E CNTRL	1E HE	Compatible Ch/Div.	-
1E CNTRL	1E HE	Non-Compatible Ch/Div.	HB
1E CNTRL	1E CNTRL	Non-Compatible Ch/Div.	VB(2)
1E CNTRL	N-1E HE	Non-Compatible Ch/Div.	HB
N-1E CNTRL	1E HE	Non-Compatible Ch/Div.	VB/HB(3)
N-1E CNTRL	N-1E HE	-	- / HB(3)

Abbreviations: CNTRL - Control or Low Energy Power Circuit

HE - High Energy Circuit: 5kV and 480Vac power circuits, 120Vac, 125Vdc, and 250Vdc circuits with a circuit rating of greater than 20 amperes.

VB - Voltage Barrier: A single steel plate separating circuits of different voltage levels or separating non-high energy circuits of non-compatible separation groups.

HB - High Energy Barrier: Two steel plates separated by a thermal insulating material equivalent to one inch of air space.

- Notes: 1. Compatibility is per FSAR Table 8.3.10.
2. Steel Barrier is preferred, non-metallic barrier per FSAR Section 8.1.6.1.n.14 permissible (except for RPS) where physical restraints make a steel barrier installation infeasible. Where a voltage barrier is used, compliance to the 6 inch separation criteria of FSAR Section 8.1.6.1.n.14 is required.
3. High energy barrier required where non-Class 1E control cable is an annunciator circuit.
4. Electromagnetic Interference.