



Northern States Power Company

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December 16, 1993

10 CFR Part 50
Section 50.73

U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Cable Separation at Main Control Board

The Licensee Event Report for this occurrence is attached. In the report, we made the following new NRC commitments:

The USAR will be updated during 1994 to recognize the existence of analyzed exceptions to the physical separation criteria.

This Licensee Event Report and associated safety evaluation will be distributed to the engineers responsible for reviewing the results of electrical maintenance work behind the Main Control Board. This is expected to emphasize the need to include cable separation in post-maintenance inspections. The distribution of this information will occur by January 15, 1994.

A detailed evaluation of the present fusing of the 121 Control Room Chiller and 121 Cooling Water Pump control circuits will be performed to determine whether improvements are required. These evaluations will be completed by March 31, 1994.

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This event was reported via the Emergency Notification System in accordance with 10 CFR Part 50, Section 50.72, on November 16, 1993. Please contact us if you require additional information related to this event.



Roger O Anderson
Director
Licensing and Management Issues

c: Regional Administrator - Region III, NRC
NRR Project Manager, NRC
Senior Resident Inspector, NRC
Kris Sanda, State of Minnesota

Attachment

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Prairie Island Nuclear Generating Plant U1	DOCKET NUMBER (2) 05000 282	PAGE (3) 1 OF 9
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TITLE (4) Cable Separation at Main Control Board

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
11	16	93	93	-- 14 --	00	12	16	93	Prairie Island U2	05000 306	
									FACILITY NAME	DOCKET NUMBER	
										05000	

OPERATING MODE (9) N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)										
POWER LEVEL (10) 100	20.402(b)			20.405(c)			50.73(a)(2)(iv)			73.71(b)	
	20.405(a)(1)(i)			50.36(c)(1)			50.73(a)(2)(v)			73.71(c)	
	20.405(a)(1)(ii)			50.36(c)(2)			50.73(a)(2)(vii)			OTHER	
	20.405(a)(1)(iii)			50.73(a)(2)(i)			50.73(a)(2)(viii)(A)			(Specify in Abstract below and in Text, NRC Form 366A)	
	20.405(a)(1)(iv)			X 50.73(a)(2)(ii)			50.73(a)(2)(viii)(B)				
20.405(a)(1)(v)			50.73(a)(2)(iii)			50.73(a)(2)(x)					

LICENSEE CONTACT FOR THIS LER (12)

NAME Arne A Hunstad	TELEPHONE NUMBER (Include Area Code) 612-388-1121
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO						

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On November 16, 1993, it was determined that control cables for redundant pressurizer power operated relief valves, found (several days earlier) to be touching behind the control board, violated criteria for physical separation of cables. The cables were repositioned and secured. Engineering evaluation concluded the cables were operable in the as-found condition. A complete inspection of the main control board was undertaken. Other instances of noncompliance with separation criteria were found. These have been analyzed and both the "as-found" and present configuration of the plant provide adequate protection for the operability of redundant equipment.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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TEXT (if more space is required, use additional copies of NRC Form 366A) (17)

EVENT DESCRIPTION

On November 16, 1993, it was determined that control cables for redundant pressurizer power operated relief valves found (several days earlier) to be touching behind the control board, violated criteria for physical separation of cables. The Updated Safety Analysis Report discusses physical separation of cables and control modules in the Control Room in Section 8.7.7 "Panel Wiring Separation." This section states that:

Control Modules on the Control Boards in the Main Control Room have a minimum center-to-center separation of 4-1/2" . . . The criteria for minimum separation between redundant cable is 4-1/2" except in cases where redundant cables enter the same Control Module where center-to-center separation is 3-1/4".

Contrary to this requirement, Train A and Train B control cables were found to be touching at a point in space behind the control board. On November 16, 1993, engineering evaluation concluded that 1) the cables are involved in the control of redundant Pressurizer Power Operated Relief Valves, and 2) the circuits were operable under the as-found conditions. The cables were repositioned on the same day to achieve compliance with Updated Safety Analysis Report (USAR) physical separation criteria, and were re-secured with cable ties.

A complete inspection of the Main Control Board was undertaken. Other instances were discovered in which physical separation of modules or cables deviated from USAR criteria.

Instances were found in which redundant cables had less than 4-1/2" physical separation. These were all corrected by repositioning and re-securing the cables. The following instances were found:

Unit 1

- Pressurizer PORV Control Switch and Overpressurization Protection System Switch Cables
- Loop A MSIV Control Switch Cables

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

- Boric Acid Transfer Pump Control Switch & Speed Control Switch Cables for #11 and #12 Boric Acid Transfer Pumps
- Loop A MSIV (Train B) and Loop B MSIV (Train A) Control Switch Cables
- Loop A MSIV (Train B) and Loop B MSIV Equalization Valve (Train A) Switches
- 121 Control Room Chiller Reset Switch and 122 Control Room Chiller & Pump Switches
- Steam Exclusion System Control Switch Cables
- Boric Acid Tank Selector Switch
- 121 Motor Driven Cooling Water Pump Switch and 12 Diesel Driven Cooling Water Pump Switch Control Cables

Unit 2

- Boric Acid Supply Isolation to SI Pumps Control Cables
- Reactor Trip Breaker Switch Control Cables

Instances were found on both units in which separate control modules are positioned with center-to-center distances less than 4-1/2". These have undergone engineering evaluation, as discussed below. The following instances were found on both units:

- Reactor Trip Breaker Indicating Light Modules
- SI Reset Pushbuttons
- Turbine Driven Aux Feedwater Pump Steam Supply Valve Switches

A condition exists in which a switch installed during original construction deviates from the control module design requirements. The Boric Acid Tank Selector Switch has cables connected to it from both trains of both units.

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The switch separates cables of the two trains by only 1-1/2" center-to-center rather than the required 3-1/4", and provides 1" airspace between the cables.

Engineering evaluations of these installations have been performed, and are discussed below. All instances of noncompliant separation have been evaluated for operability. Cables were repositioned to comply with cable separation criteria. Where cables are connected to the same control module, the cables have been separated upon exiting that module to achieve and maintain the required 4-1/2" separation between trains, consistent with minimum cable bend radius requirements and the requirement to maintain separation from other opposite-train cables in the vicinity.

CAUSE OF THE EVENT

Cable Separation

The control cables behind the control board typically have from seven to twelve conductors of #16 AWG tinned copper, and most have teflon insulation and jacket. As such they have a slippery surface and are somewhat resilient. They are terminated at the module end with cable connectors, extend backwards from the control modules, and are tied with nylon cable ties to the nearest support. In some cases the cables may travel several feet before reaching a support where they can be secured. Therefore the physical separation of the cables is determined by the path from the modules to the control board structure, and by the routing of other cables which are secured in the vicinity of the same control board structural member. Cable separation is maintained by the awareness of the separation issue by site technical staff during post-work inspections.

Given the number of instances of noncompliant separation found, it appears that this issue has not received sufficient attention during modification and maintenance activities.

Module Separation

The original configuration of the Main Control Board deviated from the physical separation criteria for control modules in the installation of the

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Steam Supply to Turbine Driven Aux Feedwater Pumps and the Reactor Trip Breaker Indicating Lights. These deviations were not noted in the FSAR section on separation.

Major portions of the main Control Board were redesigned and replaced under the Human Factors Re-engineering of the Control Room (modifications 84Y535 and 85Y586). The USAR separation criteria were discussed in the design criteria documents for the projects. The safety evaluations for the modifications also stated that the design would meet the same criteria as the original design. Engineers recognized that the original control board design contained deviations from USAR module separation criteria. The resulting control board layout enhanced the functionality of the control board, but failed to meet the module-to-module separation criteria. In re-design the SI Reset pushbuttons were installed closer together than they had originally been, but used dimensions consistent with other original deviations from module separation criteria. It appears that in the development and review of these modifications there was not sufficient sensitivity to the need for evaluation of deviations from control module separation requirements, which may have been aggravated by the deviations from module separation criteria found in the original design.

Module Design

The Boric Acid Tank Selector switch was supplied by Westinghouse as part of the original safeguards system scope. Although its design deviated from the 3-1/4" cable connector center-to-center separation criterion, this switch was part of the original design. We believe this was known and discussed at that time, based on historical inspection documents and FSAR wording. We believe this deviation is acceptable and should have been noted in the Final Safety Analysis Report, but was not.

ANALYSIS OF THE EVENT

Cable Separation

The circuits involving cables found with noncompliant physical separation have been analyzed for the safety significance of that situation. The purpose of the physical separation of the control cables is to protect the

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functionality of redundant equipment. The following design features relate to the protection from damage in the as-found condition: 1) The control cables evaluated for this issue are insulated and jacketed in teflon, and are rated for 200°C, and 2) The control circuits are designed for safety-related functions and, with two exceptions, are conservatively fused. The first exception is the 121 Control Room Chiller control circuit. This circuit contains a Reset pushbutton switch which is used to re-energize several control relays. Given the infrequent use required of the switch and its momentary operation, there is a very low risk of either a fault or sustained overload while the switch is depressed. However, if a fault or overload occurred while operating the switch, the possibility of damage to the #16 AWG control cable exists, creating the possibility of damage to the redundant cable because of the noncompliant separation. The other exception is the 121 Cooling Water Pump control circuit. A postulated fault in this circuit is cleared by the fuse at approximately 9 seconds, while the time required to damage the #16 AWG control cable is conservatively calculated at 5 seconds. Although the cable damage calculation is conservative, it raises the possibility of damage to the #16 AWG control cable, which in turn creates the possibility of damage to the redundant cable because of the noncompliant separation.

For the other circuits which deviated from physical separation criteria, it has been demonstrated that a postulated fault is cleared by the fuse before the temperature of the cable reaches its short circuit temperature rating. Therefore damage to the cable in the faulted circuit would not occur and there would be no challenge to the functionality of adjacent equipment.

Module Separation

The circuits involved in the instances of noncompliant separation of control modules have been analyzed. The purpose of the physical separation of separate control modules is to protect the functionality of one set of safety-related control equipment in the event that the redundant equipment experiences a fault and is damaged. The following design features relate to the protection from damage in the existing condition: 1) The control modules themselves are enclosed in a fire resistant housing, and 2) The control circuits are designed for safety-related functions and are conservatively fused.

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For the cases evaluated, if a fault or overload occurs in the control circuit, the fire resistant construction of the module, the air space between redundant modules, and the fusing of the circuit would prevent damage to the adjacent module. Therefore, a fault or extended overload would not impair the functionality of adjacent redundant equipment.

Single Module Design

The circuit involved in the control switch module which had cable connection points that deviate from the USAR criteria has been analyzed. The switch was provided by Westinghouse as part of original components designed and supplied for safety-related systems. As the cables leave the switch module they are separated by less than 3-1/4" center-to-center. The circuits are conservatively fused for the functions of all of the circuits using these cables. It has been shown that the cables are protected from potential faults such that neither the cable with the faulted equipment nor the adjacent cable is damaged.

This event is reportable pursuant to 10CFR50.73(a)(2)(ii)(B) since USAR separation criteria were not met. Based on the above analyses, there is reasonable assurance that safety-related equipment would function to mitigate the consequences of postulated accidents, and that there was minimal safety significance associated with this event.

CORRECTIVE ACTIONS

Immediate Corrective Actions

1. The components and cabling between the back of the Main Control Board and the cable penetrations exiting the Control Room have been inspected for compliance with USAR separation criteria.
2. Instances in which the design of individual components or the physical spacing of Main Control Board modules fail to comply with the USAR separation criteria have been documented and evaluated to show continued operability of related equipment and to demonstrate the safety of the as-built configuration.

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3. Instances in which separation of redundant trained cables failed to comply with the USAR separation criteria have been identified and corrected. The cables were firmly secured with cable ties. All such instances which were identified now have "as-left" physical separation of cables that is consistent with the USAR criteria. Each instance has been evaluated to demonstrate that the "as-found" condition was operable and that equipment was adequately protected.
4. A safety evaluation (#366) has been prepared to document the results of the evaluations of components, module separation, and representative cable separation deviations.

Long Term Corrective Actions

Since the Human Factors Redesign of the Main Control Board was prepared, there have been three developments which relate to this event, and heighten the awareness of design engineers to separation issues:

1. The electrical sections of a site Engineering Manual (issued September 15, 1992) have been developed and provide a comprehensive reference addressing construction issues, including those relating to cable and component separation.
2. A Design Basis Document addressing Electrical Design topics has been issued (January 6, 1993) which also discusses cable separation criteria.
3. Modification review procedures have been prepared which call for review of all modifications for compliance with documented design bases and applicable codes and standards. The present revisions of these procedures are dated April 6, 1993 and May 29, 1992.

The following additional actions will be taken:

4. The USAR will be updated during 1994 to recognize the existence of analyzed exceptions to the physical separation criteria.
5. This Licensee Event Report and associated safety evaluation will be

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distributed to the engineers responsible for reviewing the results of electrical maintenance work behind the Main Control Board. This is expected to emphasize the need to include cable separation in post-maintenance inspections. The distribution of this information will occur by January 15, 1994.

6. A detailed evaluation of the present fusing of the 121 Control Room Chiller and 121 Cooling Water Pump control circuits will be performed to determine whether improvements are required. These evaluations will be completed by March 31, 1994.

These actions are expected to prevent recurrence of deviations from physical separation criteria.

FAILED COMPONENT IDENTIFICATION

None.

PREVIOUS SIMILAR EVENTS

No previous similar events have been reported at Prairie Island.