



Northern States Power Company

Prairie Island Nuclear Generating Plant

1717 Wakonade Dr. East
Welch, Minnesota 55089

May 31, 2000

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

**LER 2-00-02: Discovery that PORV/Block Valve Cable in Containment Does Not
meet Appendix R Separation Criteria**

The Licensee Event Report for this occurrence is attached. In the report, we made one new NRC commitment, indicated as the Corrective Action statement in italics. This event was reported via the Emergency Notification System in accordance with 10 CFR Part 50, Section 50.72, on May 2, 2000. Please contact us if you require additional information related to this event.

Joel P. Sorensen
Site General Manager
Prairie Island Nuclear Generating Plant

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

Attachment

IES2

LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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 Unit 2		DOCKET NUMBER (2) 05000 306	PAGE (3) 1 OF 7
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TITLE (4)
Discovery that PORV/Block Valve Cable in Containment Does Not meet Appendix R Separation Criteria

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
05	02	00	00	-- 02	-- 00	05	31	00	Prairie Island Unit 1	05000 282
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9) 6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
POWER LEVEL (10) 0	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)						
	20.2203(a)(1)	20.2203(a)(3)(i)	√ 50.73(a)(2)(ii)	50.73(a)(2)(x)						
	20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71						
	20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER						
	20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A						
	20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)							

LICENSEE CONTACT FOR THIS LER (12)

NAME Jeff Kivi	TELEPHONE NUMBER (Include Area Code) 651-388-1121
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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).	NO				

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

On May 2, 2000, while Unit 2 was in a refueling outage, plant personnel inspected cable routing in Unit 2 containment for Appendix R separation requirements and determined that cables associated with the Unit 2 PORV's and block valves were not separated by twenty feet. Prairie Island has exemptions from Appendix R Section III.G.2 for both Unit 1 and Unit 2 containments (Fire Areas 01 and 71). Those exemptions are based in part on the separation of redundant shutdown equipment, with the exception of Pressurizer Level Channel Cabling, by a minimum of 20 ft. The Pressurizer PORVs and opposite train PORV Block Valves are considered redundant equipment. The lack of twenty feet of separation between affected cables constitutes a condition outside the exemption bases.

The affected Unit 2 PORV cables in containment have been rerouted in individual conduits such that the lack of separation is no longer a concern.

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	00	-- 02 --	00	2 OF 7

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

EVENT DESCRIPTION

On May 2, 2000, while in a refueling outage, plant personnel inspected the cables for the primary reactor coolant system power operated relief valves¹ (PORVs) and the associated block valves². Based on a review of informal layout drawings (which are not drawn to scale), plant personnel (who were verifying Appendix R exemption bases) suspected that the affected cables might not meet separation criteria. Operability was assessed in accordance with Generic Letter 91-18 based on the information available at the time. The assessment determined the potential separation concerns represented a degraded, but operable, condition. Thus, the inspection of cable separation for the affected cables was not conducted until Unit 2 was in an outage to avoid unnecessary radiation dose to the inspectors. The inspection showed that the cables³ (in Unit 2 containment) that control these high/low pressure interface valves did not meet Section 50, Appendix R of Title 10 of the Code of Federal Regulations (10CFR50, Appendix R) Section III.G.2 or the approved exemption with respect to separation requirements for unprotected cables that lack 20 feet of separation with no intervening combustibles.

The scenario of concern is a fire in containment causing a sustained external hot short in the PORV circuitry which would result in the opening of a PORV, concurrent with the same fire causing a ground or open circuit in the Block Valve circuitry which would prevent closure of the associated block valve. Following the guidance of Generic Letter 86-10, since the PORV/Block Valve pair constitutes a Hi/Lo pressure interface, the scenario where a fire causes the requisite multiple circuit failures must be considered. If a PORV/Block Valve pair could not be closed, this would allow the Reactor Coolant System⁴ (RCS) to rapidly depressurize which could result in a loss of natural circulation and a failure of the Pressurizer Relief Tank⁵ (PRT) rupture disc⁶. Those consequences would result in the inability to meet the Appendix R Shutdown performance goals.

CAUSE OF THE EVENT

The cause of the event was an oversight with respect to considering the PORVs and block valves when the Safe Shutdown Analysis was updated to implement the guidance of Generic Letter 86-10. The additional guidance issued with Generic Letter 86-10 was not applied with respect to the PORV/Block Valve Hi/Lo pressure interface (and the requisite circuit failure assumptions).

¹ (EIS Component Identifier: RV)² (EIS Component Identifier: V)³ (EIS Component Identifier: CBL)⁴ (EIS System Identifier: AB)⁵ (EIS Component Identifier: TK)⁶ (EIS Component Identifier: RPD)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3	OF 7
		00	-- 02	-- 00		

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

ANALYSIS OF THE EVENT

Field measurement indicates that the 10CFR50, Appendix R exemption basis of twenty feet of separation between redundant cables was not met in the case of cables for the PORV and block valves in Unit 2 containment. Thus, this event is reportable per 10CFR 50.73(a)(2)(ii) as a condition outside of the design bases for 10CFR50, Appendix R.

Operability

This operability evaluation applies to both Units 1 and 2 because drawing reviews indicate similar separation issues could apply to Unit 1 PORV/block valve cables.

Combustible Loading

The fire areas of concern are Unit 1 and Unit 2 containments (Fire Areas FA-01 and FA-71). In Situ combustible loading in these areas is very light, the total in situ fuel loads are 23,882 BTU/ft² for Unit 1 and 24,229 BTU/ft² for Unit 2. Combustibles in these fire areas consist primarily of cable insulation and Reactor Coolant Pump⁷ (RCP) lubricating oil.

The lubricating oil for the RCPs (two RCPs per Unit) represents approximately 40% of the total fuel load in each of the fire areas and makes up the largest concentrations of combustibles. The RCPs are equipped with a seismically qualified oil drainage system such that, should a leak occur, the oil would drain directly to the containment sump. For this evaluation the specific area of concern in FA-01 and FA-71 are the points where the PORV cables are routed in tray⁸ (and are therefore subject to external hot shorts) within 20ft of cables associated with the redundant block valves. In both FA-01 and FA-71 this area is the far North wall of containment at the 733' elevation. In both Units the RCPs and RCP lube oil reservoirs⁹ are separated from that area by vault walls. The walls are 3.5 feet thick reinforced concrete, and extend more than 20ft above the area of concern. The containments have high ceilings which would allow for the stratification of any hot gasses. Given this configuration it is unlikely a fire igniting the RCP lube oil would affect the PORV/Block Valves cables.

The other primary combustible existing within the two fire areas is cable insulation. All cables in both containments are qualified to IEEE-383, so the cabling has a high resistance to flame propagation and excellent flame retardant qualities. The cable insulation represents a fuel load of 11,210 BTU/ft² with no areas of concentrated combustibles in FA-01 and a fuel load of 11,489 BTU/ft² with no areas of concentrated combustibles in FA-71. This fuel, if totally consumed, would correspond to a fire severity of approximately 8.4 minutes on the ASTM E-199 Standard temperature curve for FA-01 and a fire severity of 8.6 minutes for FA-71.

⁷ (EIS Component Identifier: P)
⁸ (EIS Component Identifier: TY)
⁹ (EIS Component Identifier: RVR)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	YEAR 00	SEQUENTIAL NUMBER -- 02 --	REVISION NUMBER 00	4	OF 7

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

The PORV cabling has been analyzed and it has been determined that any internal shorts will not provide enough voltage to open the valve. The specific circuit failures that must occur to render the PORV/Block Valve pair inoperable would be an external sustained hot short in the PORV circuitry which would open and keep open a PORV concurrent with a ground or open circuit in the redundant block valve circuitry which would prevent closure of the block valve

Fire Detection and Suppression

Fire Detection is provided in both these areas by ionization smoke detectors¹⁰ on all floor levels with alarms to the control room. When the respective unit is at cold shutdown, fire suppression in these areas consists of standpipe hose stations on each level and CO2 and dry chemical fire extinguishers.

Redundant Train Susceptibility to Fire

The conduit drawings for the containments are essentially layout drawings and are not precisely drawn to scale, so exact distances cannot be determined strictly from drawing review. Based on what is shown on the drawings however, for Unit 2 the minimum distance between the portion of the A-Train PORV cabling in tray and B-Train Block Valve cabling appears to be on the order of 12 feet, the distance between the portion of the B-Train PORV cabling in tray and A-Train Block Valve cabling appears to be on the order of 18 feet.

On May 2, 2000, field measurements were taken inside Unit 2 Containment. The separation associated with both PORV/Block Valve pairs were outside the exemption basis of a minimum 20 feet. Train A PORV cabling in open tray was found to be 13 ft away from Train B Block Valve Cables, Train B PORV cabling in open tray was found to be 18 ft away from Train A Block Valve Cables.

For Unit 1, the minimum distance between the portion of the A-Train PORV cabling in tray and B-Train Block Valve appears to be on the order of 3 feet. The drawing review indicated more than 20 feet separation between the B-Train PORV and A-Train Block valve cables. In all cases intervening in-situ combustibles between the PORV and redundant block valve cables consists solely of other IEEE 383 qualified cables. The PORV/Block Valve cabling routing meets USAR train separation criteria, no like cables are routed in tray with both PORV and redundant block valve cabling.

Safe Shutdown Procedures

For a fire in containment the following actions would be taken per Prairie Island procedure F5 Appendix D "Impact of Fire Outside Control/Relay Room":

¹⁰ (EIS Component Identifier: DET)
NRC FORM 366A (4-95)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	5	OF 7
		00	-- 02 --	00		

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

- The block valves are closed then the block valve circuits are de-energized. Once closed with power isolated, it would take hot shorts (of the proper polarity) on all three phases of the steel armored power cable in containment to re-open a block valve.
- The PORV circuits are de-energized. Once de-energized it would take a minimum of two hot shorts of the proper polarity, or one hot short concurrent with multiple fire induced grounds, to open the PORVs. This makes the event even less likely to occur, however per the guidance in GL 86-10 it must be considered.
- Instrument air is isolated from containment. The PORVs fail closed on loss of air, however they are fed from a local instrument air accumulator¹¹. After air is isolated to containment, in the event of intermittent hot shorts (more likely than sustained hot shorts) the PORV would open and close until the accumulator bled out, once the accumulator bled out circuit failures could not re-open the PORV.

In the unlikely event there was a fire in containment which caused the requisite circuit failures to maintain the PORV/Block Valve pair open, the plant would not be in an unanalyzed condition. Essentially the PORV/Block Valve opening would mimic a LOCA, for which the plant has been analyzed. A preliminary Operations department review concluded that existing emergency procedures could be used to achieve shutdown without core damage (Safety Injection¹² (SI), Charging¹³, Auxiliary Feedwater¹⁴ (AFW), and Residual Heat Removal¹⁵ (RHR) are available for a containment fire). Thus, even though the Appendix R performance goals would not be achieved, all equipment needed to mitigate the equivalent design basis accident would be available.

Existing Personnel and Administrative Controls in the Area

During power operations, access is restricted to containment due to existing high radiation fields and other safety considerations (e.g., heat stress concerns). During power operations transient combustibles are not normally allowed in containment. When transient combustibles are permitted in containment at power, administrative controls require, as a minimum, a dedicated fire watch armed with a fire extinguisher. When not at power, transient combustibles are tracked to ensure fire loading does not outsize the capability of the suppression systems. Any work activities in containment involving fire hazards (ignition sources and/or flammable material in access of 2 gallons) are required to go through the site Combustible Use Permitting process which evaluates the need for additional fire protection controls (dedicated fire watches, etc.) on the basis of specific work activities.

¹¹ (EIS Component Identifier: ACC)

¹² (EIS System Identifier: BQ)

¹³ (EIS System Identifier: CB)

¹⁴ (EIS System Identifier: BA)

¹⁵ (EIS System Identifier: BP)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	6	OF 7
		00	-- 02	-- 00		

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

Compensatory Measures for the Area

The existing administrative controls and procedural guidance already in place are adequate to reduce the probability and consequences of a fire in containment. Additional compensatory measures are not considered necessary.

Unit 1 Interim Operability

At this time, there is reason to believe Unit 1 PORV and block valve cables have separation issues similar to those found in Unit 2. However, the operability analysis documented above is valid for both Unit 1 and Unit 2. As noted above, the existing administrative controls and procedural guidance already in place are adequate to reduce the probability and consequences of a fire in containment and additional compensatory measures are considered unnecessary.

Prairie Island staff do not plan to field measure cable separation until the next Unit 1 refueling outage. At this time, making such field measurements at power is not warranted because, though the PORV/Block Valve cables may not meet Appendix R separation requirements, they are considered operable.

Safety System Functional Failure Assessment

The as-found condition of the Unit 2 PORV/Block Valve cables has been evaluated for operability. Although the PORV/Block Valve cables did not meet 10CFR50, Appendix R separation criteria, no system, structure or component is considered to have been inoperable. Therefore, this event does not represent a safety system functional failure.

Significance Determination

The Prairie Island IPEEE was reviewed to determine whether fires inside containment were determined to be significant contributors to plant risk. Section B.2.5.1 states:

“The analysis found that a significant fire in the containment is not likely given its combustible loading and physical configuration. Much of the combustible material located in the containment is lube oil for the reactor coolant pumps. An oil collecting system that collects the oil in the event of a spill is installed. The remaining combustible material, electrical cable, located in these areas is fire retardant (IEEE-383 rated). Because of these factors, a significant fire within the containment is not expected to occur. The EPRI FIVE methodology recognizes the unlikely occurrence of a containment fire and does not provide an ignition source frequency for this area.”

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
Prairie Island Nuclear Generating Plant Unit 2	05000 306	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	7	OF 7
		00	-- 02	-- 00		

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

Based on the above reasoning, the Unit 1 and Unit 2 containment fire areas were qualitatively screened from further consideration in the IPEEE.

Even if an external ignition source was present with energy great enough to ignite the IEEE-383 cabling, a sustained hot short of the PORV control cabling of the type required to maintain the PORV open would be an unlikely occurrence (fire-related failures involving open circuits are much more likely). In addition, emergency operating procedures and safeguards equipment designed to provide inventory makeup and long term decay heat removal following a small LOCA event would be available to mitigate the event. Therefore, the core damage frequency expected due to this postulated event is well below 1E-6 per year. Per PRA guidelines, this is considered non-risk significant. This indicates that the configuration could be maintained on Unit 1 for at least a year until design changes can be performed to correct the condition. Unit 1 is scheduled to have a refueling outage within that time period.

CORRECTIVE ACTION

1. Unit 2 PORV/Block Valve cables were modified to bring the affected cables back into compliance with 10CRF50 Appendix R (as modified by the approved exemption) by routing the affected PORV cables in individual conduits (thus protecting them from fire-induced external hot shorts.)
2. ***Unit 1 PORV/Block Valve cables will be inspected during the next scheduled Unit 1 refueling outage. If Unit 1 cables are found to lack adequate separation, NSP will issue a supplement to this LER to address corrective actions for Unit 1.***

FAILED COMPONENT IDENTIFICATION

None.

PREVIOUS SIMILAR EVENTS

Previous LER's have been submitted in instances where other fire areas did not meet the approved bases for exemption from the requirements of 10CFR50, Appendix R. Refer to Prairie Island LER's 1-98-12, 1-98-14, and 1-98-15. This issue was identified as a direct result of Appendix R exemption compliance review activities that were initiated in response to the previous LER's.