

LICENSEE EVENT REPORT (LER)

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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 20545-0001, 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 1

DOCKET NUMBER (2)

05000 282

PAGE (3)

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TITLE (4)

Containment to RHR MOV's Appendix R Safe Shutdown Analysis Issues

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
08	27	98	98	-- 15	-- 0	09	25	98	Prairie Island Unit 2	05000 306
									FACILITY NAME	DOCKET NUMBER
										05000
OPERATING		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)			20.2203(a)(2)(v)			50.73(a)(2)(i)	50.73(a)(2)(viii)
POWER		100	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

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)

<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE).	NO	EXPECTED	MONTH	DAY	YEAR
			10	26	98

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

On August 27, with both units operating at 100% power, site staff was prompted to review the susceptibility of the redundant containment sump to RHR pump suction MOVs to multiple failures due to a single fire. At the time it was unclear whether a postulated fire-induced spurious opening of the MOVs would drain the refueling water storage tank to containment, thereby causing a loss of the sole credited source of reactor coolant makeup for this postulated fire.

Appropriate compensatory measures will be maintained in the affected fire areas until the status of the subject MOV's is resolved with respect to 10CFR50, Appendix R.

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EVENT DESCRIPTION

On August 27, 1998, while both units were operating at 100% power, a question from the Fire Protection Functional Inspection (FPFI) team (Question FP-1072) prompted Prairie Island Nuclear Generating Plant (PINGP) staff to review the susceptibility of the redundant containment sump B to Residual Heat Removal¹ (RHR) pump suction motor operated valves² (MOV's) to multiple failures due to a single fire. This review was completed via NCR 19982008. As discussed in FPFI question FP-1072, Unit 1 MOV's MV-32075, MV-32076, MV-32077, and MV-32078, and Unit 2 MOV's MV-32178, MV-32179, MV-32180, and MV-32181 were not on the Appendix R safe shutdown list.

These MOV's are the Containment Sump B suction valves to the RHR system and are arranged such that two Train A valves in series are in parallel with two Train B valves in series. The MOV's are located in the Containment Spray Pump rooms, with one of the MOV's in each series flowpath inside a "can" that forms an extended containment boundary. A postulated fire could cause both MOV's in a train to spuriously open, thereby providing a drain path from the refueling water storage tank³ (RWST) to Containment Sump B via the RHR System. The MOV's inside the cans are not available for local manual repositioning following a spurious actuation.

CAUSE OF THE EVENT

This event was caused by an oversight during the completion of the current safe shutdown analysis (SSA, revised in 1997). Namely, the spurious operation assumption (at the time the current SSA was initiated) was that only one spurious operation would result from a fire in any one Fire Area. Using that assumption, the valves in question would not be required for safe shutdown. During the course of the completing the current SSA, subsequent interpretations of the requirements of GL 86-10 determined that spurious operations are not limited to one per fire, but that multiple spurious actuations must be considered. Thus, if one spurious operation were assumed to occur, a second spurious operation would have to be prevented from impeding the ability to achieve and maintain safe shutdown. The spurious operation assumptions of the SSA were subsequently changed and those portions of the analysis, where the original erroneous assumption was credited, were revised. However, this particular flow diversion path was overlooked during this process and was not included in the current SSA.

¹ (EIS System Identifier: BP)² (EIS Component Identifier: V)³ (EIS Component Identifier: TK)

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ANALYSIS OF THE EVENT

The preliminary circuit analyses for MOV's MV-32075, MV-32076, MV-32077, MV-32078, MV-32178, MV-32179, MV-32180, and MV-32181 indicates that these MOV's could be subject to spurious operation for fires in the Relay Room (Fire Area 18), Control Room (Fire Area 13), or Auxiliary Building 695' elevation (Fire Area 58/73). Each pair of series MOV's in a train are powered from the same motor control center⁴ (MCC's 1K1, 1KA2, 2K1 and 2KA2) with their breakers in the same stack. Separate power and control cables are routed from the MCC's to the respective MOV's. However, a common control cable is routed from an MCC to the Relay Room for each trained pair of MOV's.

A preliminary walkdown determined that the subject Unit 2 MOV cables⁵ are not protected. The Unit 1 MOV cables are partially protected with Kaowool from the MCC toward the riser to the Relay Room.

An estimate, based on RWST flow rate curves developed for severe accident management guidelines (SAMG), indicates that the RWST would drain to containment (reach equilibrium) in approximately one hour from the Technical Specification low level limit. An estimate based on calculation indicates that from the Technical Specification minimum of 70% (200,000 gallons), the RWST level will equalize with Containment water level at approximately 701' elevation.

For a fire requiring alternate shutdown (i.e., a Control Room or Relay Room fire), the 12 (22) Charging Pump⁶ taking suction from the RWST is relied on for hot shutdown inventory control. A PINGP calculation determined that adequate net positive suction head (NPSH) for charging pump operation at 55 gpm is provided down to the 696.5 foot elevation. Thus, approximately 4.5 feet (or 17,766 gallons) of inventory is available for charging pump inventory control. Assuming reactor coolant pump (RCP) seal failures, approximately 42 gpm leakage from the reactor coolant system⁷ (RCS) would exist. Thus, approximately 7 hours of inventory is available. Due to system arrangements, there is no direct suction path from the containment sump to the charging pumps; thus, the water in containment is not available as RCS make-up for hot shutdown. There is no analyzed, credited equipment to either refill the RWST, or provide another water supply to the charging pumps for postulated fires in the Control Room or Relay Room.

For most fires in the Auxiliary Building (695 foot elevation), the 12 (22) safety injection (SI) pump (taking suction from the RWST) is relied on for inventory control. An estimate based on a PINGP calculation indicates that 28.4 feet of NPSH is available for SI pump operation with RWST level at the 701 foot elevation. The NPSH required is 17 feet for SI pump operation at 700 gpm. Since the top of the SI

⁴ (EIS Component Identifier: MCC)

⁵ (EIS Component Identifier: CBL)

⁶ (EIS Component Identifier: P)

⁷ (EIS System Identifier: AB)

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suction connection is at the 697.1 foot elevation, approximately 4 feet or 16,200 gallons of water would be available from the RWST. Assuming RCP seal⁸ failure, approximately 42 gpm leakage from the primary would exist. Thus, approximately 6.4 hours of inventory is available. Due to system arrangements, there is no direct suction path from the containment sump to the SI pumps; thus, the water in containment initially will not be available as inventory for hot shutdown. As above, there is no analyzed, credited equipment to either refill the RWST, or provide another water supply to the SI pumps for postulated fires in the Auxiliary Building.

While there are no specifically analyzed makeup sources, other normally available sources may be unaffected by the fire. For the charging pumps, normal methods of refilling the VCT may be viable options for providing inventory. The Boric Acid Storage tank may be available for the SI pump operation. Normal means of refilling the RWST may be available to support either charging pump or SI Pump operation. A flowpath is available from Containment Sump B, through the RHR System, to the SI Pump to reclaim the water in containment.

Based on the above, sufficient inventory would be available in the RWST to allow time following the fire to establish another make-up source or to pump the water in containment back to the RWST.

A. Deterministic Evaluation of the Safety Significance of the Non-compliance

An evaluation of the sequence that could have occurred if a fire had affected these MOV's is being performed. The purpose of the evaluation is to determine the safety significance of the non-compliance with respect to the ability to achieve and maintain shutdown.

This evaluation will be provided in a supplement to this LER by October 26, 1998.

B. Risk Significance Evaluation

An investigation was performed during the fire IPEEE analysis of the risk significance of spurious actuation of MOV's. As part of this analysis, valve pairs MV-32075, MV-32077 (Train A) and MV-32076, MV-32078 (Train B) were addressed. Although not explicitly modeled, the analysis also applies to Unit 2 valve pairs MV-32178, MV-32180 (Train A) and MV-32179, MV-32181 (Train B).

- The frequency of fires that may result in spurious actuation of either of these two valve pairs is low.
- For the valve pairs in question, two spurious actuations are required (since the valves are in series) to open the flowpath to the containment sump.

⁸ (EIS Component Identifier: SEAL)

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- Even in this unlikely event, which would potentially fail normal RHR capability, the auxiliary feedwater (AFW) system⁹ would remain free of fire damage. Operation of AFW would allow the plant to remain at hot shutdown indefinitely while any repair activities needed to progress to cold shutdown are made. If the fire is in the main control board RHR panel¹⁰, and is large enough to require evacuation of the control room, all controls necessary for operation of the AFW system and control of steam generator level are available at the Hot Shutdown Panel.

Due to the above considerations, the frequency of core damage from this event was found to be less than 1E-8/rx-yr. This is well below the risk contribution of other scenarios in the affected fire areas and substantially less than the IPEEE reporting criteria. Also, this does not credit further actions such as the potential for manual and automatic fire suppression availability and attempted local operation of the outside-containment MOV (or other valves in the flowpath that could be used) to stop the RWST drainage.

C. Compensatory Measures Established

Continuous Fire Watch: Considering the issues identified in this NCR, coupled with other compliance concerns in the Auxiliary Building 695' elevation and the investigation required to determine other appropriate compensatory measures, a continuous fire watch was established in addition to the existing hourly roving fire watch as a compensatory measure. Upon implementing procedural compensatory measures (discussed below), the continuous fire watch was discontinued and the hourly roving fire watch was maintained.

Roving Fire Watch: As part of the resolution program for Thermo-Lag issues, Special Order SO-236, was put in effect and remains in effect. This special order maintains the roving hourly fire watches and will remain in effect until resolution of the exemption request associated with the use of Rockbestos Firezone R cable, as well as other related Appendix R/Fire Protection related issues. In addition, NCR 19981794 (IN 92-18 MOV Hot Shorts -- submitted to NRC as LER 1-98-10) also has compensatory measures in place for this area which consists of the roving fire watch under SO-236. The adequacy of the hourly fire watch was evaluated and justified as part of the assessment of NCR 19981794.

Procedural Guidance: Temporary Change Notices (TCN's) were issued against the guidance in PINGP Plant Safety Procedures F5, Appendix B and F5, Appendix D to address the potential for spurious operation of these MOV's. Current manual actions are proceduralized in F5, Appendix B and F5, Appendix D to provide guidance to operators that the MOV's are vulnerable to

⁹ (EIS System Identifier: BA)¹⁰ (EIS Component Identifier: PL)

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spurious operation for fires in the Relay Room, Control Room and the Auxiliary Building 695' elevation. These TCN's were reviewed by the Operations Committee on September 10, 1998 and implemented September 11, 1998.

Operator Awareness: A PINGP 1224 Crew Meeting Review was issued September 10, 1998 to explain the concerns to the operating crews.

The RHR Sump B valves, which isolate the Refueling Water Storage Tank from Sump B, are not protected from spurious operation during a fire. This condition could lead to the RWST (the sole credited source of reactor coolant makeup) being drained into containment thereby impacting the ability to maintain RCS inventory. Therefore, this condition is reportable per 10CFR50.73(a)(2)(v) as a condition that could affect the ability to safely shutdown the reactor and per 10CFR50.73(a)(2)(ii)(B) as being outside the PINGP Appendix R design basis.

CORRECTIVE ACTION

- Compensatory actions that have been established in each affected fire area shall remain in effect until all corrective actions for this event have been implemented or have been determined to be unnecessary.** The following specific corrective actions for this event are 2 and 3 below:
- Include MOV's MV-32075, MV-32076, MV-32077, MV-32078, MV-32178, MV-32179, MV-32180, and MV-32181 in the Appendix R safe shutdown equipment list. Complete the circuit analysis packages for the valves with recommendations to provide assurance of maintaining the flow diversion path closed.**
- Evaluate the valves for IN 92-18 damage concerns. If the valves could be mechanically damaged during spurious operation, circuit modifications will be performed as required under the IN 92-18 program. Results of this evaluation will be provided in a Supplement to LER 1-98-10.**
- Review the Appendix R safe shutdown list against the appropriate flow diagrams to ensure that all other flow paths vulnerable to diversion were included in the SSA.**
- Implement modifications and/or administrative controls to resolve this issue (and any other flow diversion issues identified in 4, above).**

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FAILED COMPONENT IDENTIFICATION

None.

PREVIOUS SIMILAR EVENTS

Cases of missing Appendix R Fire Barriers have been identified previously. Refer to Unit 2 Licensee Event Report (LER) 98-03 and Unit 1 LER's 98-12 and 98-14. Unit 1 LER 98-10 addresses the related issue of MOV hot shorts and spurious operation.