



Nuclear Management Company, LLC
Prairie Island Nuclear Generating Plant
1717 Wakonade Dr. East • Welch MN 550

December 1, 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

**Inoperability of Safeguards Cooling Water (Essential Service Water) Pumps
Caused by Unqualified Lubricating Water Supply to the Pump Shaft Bearings**

The Licensee Event Report for this occurrence is attached. In the report, we have made three new NRC commitments as indicated in the "Corrective Action" section statements in bold italics.

This event was reported via the Emergency Notification System in accordance with 10 CFR Part 50, Section 50.72, on November 1, 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

IE 22

NRC FORM 366 (6-1998)				U.S. NUCLEAR REGULATORY COMMISSION				APPROVED BY OMB NO. 3150-0104 EXPIRES 6/30/01				
LICENSEE EVENT REPORT (LER)								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 (MNEB 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.				
(See reverse for required number of digits/characters for each block)												
FACILITY NAME (1) PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNIT 2						DOCKET NUMBER (2) 05000 - 282		PAGE (3) 1 OF 7				
TITLE (4) Inoperability of Safeguards Cooling Water (Essential Service Water) Pumps Caused by Unqualified Lubricating Water Supply to the Pump Shaft Bearings												
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	01	00	00	04	0	12	01	00	Prairie Island U2	05000-306		
									FACILITY NAME	DOCKET NUMBER		
										05000		
OPERATING MODE (9)		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				20.2203(a)(1)		20.2203(a)(3)(i)		X 50.73(a)(2)(ii)		50.73(a)(2)(x)		
LEVEL (10)		100		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)		X 50.73(a)(2)(v)		(Specify in Abstract below and in Text, NRC Form 366A)		
				20.2203(a)(2)(iv)		50.36(c)(2)		X 50.73(a)(2)(vii)				
LICENSEE CONTACT FOR THIS LER (12)												
NAME Jack Leveille						TELEPHONE NUMBER (Include Area Code) 612-388-1121						
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)												
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX			
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)
NCR FORM 366 (6-1998)

On November 1, 2000, at 1:40 PM CST, three safeguards vertical cooling water pumps¹ were declared inoperable for lack of qualified source of line shaft bearing water (called Filtered Water). The Filtered Water had been originally designated as safety-related but had been downgraded in 1977 and subsequent physical changes did not maintain the original quality level. It was thought at the time that this independent source of water was not necessary for pump operability. Because of the downgrade, continued operation of the water supply could not be assured during certain design basis events and the cooling water pumps were administratively declared inoperable though still functional. Appropriate compensatory measures were developed and put in place. By November 13th installation was completed on a temporary modification which restored a qualified Filtered Water supply to two of the three pumps, restoring their operability (only two pumps are required to be operable). Another temporary modification is planned to restore operability to the third pump.

¹ EIS System Identifier: BI; Component Identifier: P

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

EVENT DESCRIPTION

On November 1, 2000, at 1:40 PM CST, three safeguards vertical cooling water pumps² were declared inoperable for lack of qualified source of line shaft bearing water (called Filtered Water). The Filtered Water had been originally designated as safety-related but had been downgraded in 1977 and subsequent physical changes did not maintain the original quality level. Because of this, continued operation of the water supply could not be assured during certain design basis events and the cooling water pumps were administratively declared inoperable though still functional. There is no TS action statement in the Limiting Conditions for Operation for this condition, so the plant entered TS 3.0.C (the "motherhood") which allows one hour to prepare for and six hours to place the affected units in hot shutdown conditions and 30 hours to place the affected units in cold shutdown conditions. Appropriate compensatory measures were developed and presented to the NRC by a phone conference beginning at 3:15 PM. At the conclusion of the conference call the NRC granted permission to continue plant power operation for 14 days in order to install a temporary modification which restored a qualified Filtered Water supply to two of the three pumps.

Background

In 1977 a safety evaluation was performed which downgraded the quality level of the Filtered Water supply, based on the assumption that the Filtered Water supply was unnecessary for operation of these pumps. The reasons for this belief are not completely retrievable. There is reference to a previous conclusion reached by the plant's on-site review committee but documentation of the basis of that conclusion has not been located. It is known that a belief was that this water supply was for flush only and was included to extend the life of the bearings but not necessary to preserve normal bearing life. However, the "lineshaft" bearing water supply is needed for lubrication due to the specific configuration of these pumps, utilizing a sealed lineshaft enclosing tube. This requirement is easily misunderstood because this make and model of pump (Worthington QL) is manufactured in 3 configurations (all three models are discussed in the technical manual), with the most common configuration (unlike the PI pumps) utilizing discharge flow lubricated bearings.

A consequence of this downgrading was that, during system modifications over the years, not all of the design specifications were maintained (e.g., the requirement that the Filtered Water supply piping survive a design basis earthquake or that it survive a fire in the area).

The question of need for separate lubricating water supply was asked at least twice over the years. In response, two of the three pumps were operated with the bearing water supply isolated. In 1988, the pumps were run for more than an hour following isolation and water was

² EIS System Identifier: BI; Component Identifier: P
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observed to flow from the packing gland. This indicated that the pump will supply its own bearing lubrication in the event of a loss of Filtered Water.

During the recent NRC Cooling Water Inspection, the plant staff was asked to provide information to support operation of the pumps without the bearing water supply. In response to this request, the plant staff began researching the historical information and evaluating it. An interim operability determination was made based on the historical information and more conclusive information and/or analysis was pursued. This pursuit led to the conclusion on November 1, 2000 that the pumps indeed need the Filtered Water supply which no longer met the necessary qualifications and, therefore, declared all three cooling water pumps inoperable.

While this determination was taking place, it was also identified that the water supply to the bearings was dependent on an electrical supply. Strainers in the bearing water supply system require backwashing to prevent clogging and the backwash function requires electrical power. However, the power supply is not from a safeguards source and would not have been available in the event of a loss of offsite power (LOOP) event.

CAUSE OF THE EVENT

As discussed above the cause of the event was originally determined to be the incorrect assumption (that the pumps do not require the Filtered Water supply) which was incorporated into the safety evaluation which allowed modifications to be performed without maintaining critical original design requirements. Potentially contributing to this assumption was that the technical manual for the pumps contained information for other models of the same make pump; whether or not the pump's line shaft has a sealed cylinder affects whether the pump provides its own lubricating water or needs a separate source. The original bid evaluation for these pumps states: "The upper bowl sleeve bearing and the line-shaft sleeve bearings are lubricated by the pumped water via an annular passage between a shaft enclosing tube and the shaft." Reading this statement together with the technical manual could have led to the belief that a separate lubricating water supply was unnecessary.

The design that included a non-safeguards power supply was traced back and it was determined that a safeguards power supply had never been provided for the backwash function; this was the original plant configuration, it was not due to the 1977 downgrade of the system.

The root cause analysis has not been completed; if its conclusions result in significantly different insights, a supplemental LER will be submitted.

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ANALYSIS OF THE EVENT

This event is being reported pursuant to the following:

- 10CFR50.73(a)(2)(ii)(B), as a condition that is outside the design basis of the plant,
- 10CFR50.73(a)(2)(v)(B), as a condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to: (B) remove residual heat and (D) mitigate the consequences of an accident, and
- 10CFR50.73(a)(2)(vii), as an event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems or two independent trains or channels to become inoperable in a single system designed to: (B) remove residual heat and (D) mitigate the consequences of an accident.

Significance Determination

This event falls within the scope of the Power Operations and Shutdown Operations Significance Determination Processes. A risk significance evaluation has been performed regarding the condition that had existed, the following discussion addresses a quantitative evaluation for a LOOP and qualitative evaluations for a seismic event and a fire in the area of the Filtered Water system. These are the events that were considered as possible initiators of the loss of the Filtered Water system, the other design events for which the system is required to continue to operate do not functionally challenge the system.

The Filtered Water system, even though downgraded in 1977, has remained in place and functional throughout plant operation. The filters in the system are in the plant Preventive Maintenance program. The system was modified in 1988 to tie in well water; at this time, PVC piping was installed in portions of the system. This was done to provide a very clean source of water to the bearings to prolong bearing life.

Earthquake: When the necessity of the Filtered Water system was being discussed during the recent NRC Cooling Water Inspection a walkdown of the system was done to assess its overall condition. A pipe stress analyst has made a evaluation, taking into consideration the interactions of this section of pipe with surrounding interferences. He observed that, due to the pipe supports and the flexibility of the PVC, the frequency of oscillation would be low and the movements would be slow. He concluded that the pipe would survive a seismic event, that the stress levels would be only 60% of allowable for the design basis earthquake loadings, and that "... the PVC section of the filtered water system piping below and above El. 695' in the Screenhouse is judged to be operable during and after a Design Basis Earthquake."

Fire: Since there is a portion of the Filtered Water system that is PVC pipe in the lower level of the screenhouse, this area was reviewed for the effects of a fire. The Fire Hazards analysis classifies

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the fire load rating in this area as Very Light (less than 30 minute fire severity). There is operable fire detection and suppression equipment. The suppression will actuate at 212F. The PVC pipe is not affected until approximately 395F. Therefore, the PVC pipe is expected to survive the effects of a fire.

LOOP: Based on the results of the quantified evaluation, it was concluded that (using very conservative assumptions) the vertical cooling water pump bearing water dependency has a significant impact on the risk of the plant. This is primarily due to the greatly increased likelihood of loss of all cooling water on a dual-unit loss of offsite power (LOOP) event which will cause loss of Filtered Water in a LOOP, due to clogging of the Filtered Water strainers. Without the cooling water system, the Unit 1 diesel generators eventually will fail, as well as the component cooling water system and instrument air for both units. Reactor coolant pump seal injection will continue, since the CVCS charging pumps do not depend on the cooling water system for operation. However, without instrument air available, CVCS letdown will be isolated and Volume Control Tank (VCT) will eventually drain (the normal automatic makeup supply to the VCT from the reactor makeup pumps depends on the availability of offsite power and instrument air). The charging pump suction supply for both units will automatically swap to the refueling water storage tank (RWST). However, if any additional failures should occur that would cause the failure of the swapover to occur (for example, failure of the RWST to charging motor-operated valve to open, or failure of power to the valve) then all means of RCP seal cooling will be lost. Eventually the RCP seals will fail, resulting in a LOCA that cannot be recovered from due to loss of ECCS equipment (due to the loss of component cooling water). The impact of the inclusion of Filtered Water system dependency on the overall plant core damage frequency is 9.06E-5/year, raising the overall plant core damage frequency from 2.34E-5/year to 1.14E-4/year.

Performance Indicators Assessments

This event impacts two of the performance indicators, Safety System Functional Failures and Safety System Unavailability, associated with the Mitigating Systems cornerstone in the Reactor Safety strategic performance area of the risk-informed regulatory oversight process.

Because this event is reportable under 10CFR50.73(a)(2)(v), it represents a safety system functional failure.

This event contributes time to the Safety System Unavailability of the auxiliary feedwater (AFW), residual heat removal (RHR), safety injection (SI), and emergency AC systems, because the cooling water system was declared inoperable. These safety systems have the following relationships to the cooling water system. Cooling Water provides a backup safety related water supply for the AFW in the event of a loss of the condensate tanks and removes heat from the Unit 1 emergency diesel generators (D1/D2) and the component cooling system heat exchangers. The component cooling heat exchangers remove heat from the RHR pump shaft seal water heat exchanger, the RHR pump

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stuffing box jacket cooler, the SI pump lube oil heat exchanger, and the SI pump mechanical seal water heat exchanger.

No failure has actually occurred and, at all times, the Filtered Water system has been capable of performing their intended function and, therefore, this event is considered to have had no adverse impact on the health and safety of the public.

CORRECTIVE ACTION

Following the determination of inoperability, compensatory measures were established:

- To provide added confidence that a fire would not adversely impact the Filtered Water system, an hourly fire watch was established for the lower level of the screenhouse. This was an individual other than the dedicated operator (below) for the standby bearing water supply.
- A PRA evaluation was performed to identify accident sequences that had the potential for increased risk. The important equipment in addition to Filtered Water and cooling water were identified. This equipment was on a protected equipment list. These components were only to be removed from service for essential corrective maintenance.
- A dedicated operator was stationed in the screenhouse for the purpose of providing a backup bearing water supply. If the Filtered Water supply of bearing water was lost, an alarm in the control room would have alerted the operator. The control room operator would direct the dedicated operator in the screenhouse to implement the backup bearing water supply. The backup supply consisted of a hose that was connected to the safety related cooling water system, tools to allow connection of the hose to the bearing supply piping, and procedural guidance.
- The dedicated operator was the same operator that was concurrently stationed in the screenhouse for compensatory measures regarding the air/vacuum valve (see LER 1-00-03). This was acceptable because the actions required for the air/vacuum valve would have been immediately upon pump start and consisted only of notification of the control room. Our engineering judgement, based on discussions with a bearing vendor, pump vendor and INPO operating experience, was that the pump would be able to operate for at least an hour without bearing flow. During this time frame, the bearings would degrade (wear down faster), but there would not be catastrophic damage to the pump. Once the standby bearing supply was in place, the pump would have been expected to operate properly.

A temporary modification has been installed which provides a qualified water supply to the two safeguards diesel driven cooling water pumps. The safeguards motor driven pump does not have this

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temporary modification; therefore, this pump will not be declared operable until a qualified water source has been provided.

Plans are being prepared for a permanent upgrade to the water supply to all three pumps.

The safety evaluation that downgraded the water supply will be revised to correct the determination of the quality level required for the water supply; the Q-list will also be revised.

All safety evaluations which have downgraded components will be re-reviewed.

The design documentation will be reviewed and revised as necessary, including the technical manual.

CR 20005653 has been initiated to consider the general issue of ambiguities in technical manuals caused by multiple models of the "same" equipment.

PREVIOUS SIMILAR EVENTS

There have been other events caused by design features that could have prevented completion of safety functions. One of those affecting the safeguards cooling water pumps was reported in Licensee Event Report 1-00-03.