

## LICENSEE EVENT REPORT (LER)

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

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FACILITY NAME (1)

Clinton Power Station

DOCKET NUMBER (2)

05000461

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TITLE (4)

Improper Assembly of Motor Causes Degradation of Bearings in Two Divisions of Shutdown Service Water System

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
01	29	1999	1999	- 001	- 00	03	01	1999	None	05000
									FACILITY NAME	DOCKET NUMBER
									None	05000
OPERATING MODE (9)		4	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 LEVEL (10)		000	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)		X	50.73(a)(2)(vii)	

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Bob Maher, Engineering Supervisor, Nuclear Station Engineering Department

TELEPHONE NUMBER (Include Area Code)

(217) 935-8881, Extension 3080

## 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
A	BI	MO	S188	Y					

## SUPPLEMENTAL REPORT EXPECTED (14)

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

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

On January 29, 1999, it was determined that the Division 1 and 2 shutdown service water (SX) pump motors could both have suffered similar upper guide bearing failures prior to fulfilling their design basis heat removal functions. The cause of this event could not be positively identified. The most likely cause of this event was determined to be improper assembly of the bearing thermocouple and bearing insulating gasket. This improper assembly allowed shaft currents to flow to the bearings resulting in bearing damage. The damaged bearings for both SX motors were repaired and reassembled. Corrective actions for this event include: revising vendor manuals and procedures to address shaft current concerns for susceptible motors, evaluating operating and maintenance history for susceptible motors to determine other potentially affected motors, developing a training seminar describing why and how components are insulated to protect against shaft currents and the importance of maintaining the insulating properties, and conducting a briefing to maintenance planners on this issue.

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

## DESCRIPTION OF EVENT

On January 8, 1999, at 1652 hours, operations personnel started the Division 1 shutdown service water [BI] (SX) pump [P] as part of surveillance procedure CPS No. 9069.01, "Shutdown Service Water Operability Test." This surveillance procedure satisfies several Technical Specification and Inservice Testing requirements including measurement of motor [MO] vibration. At 1827 hours, the Division 1 SX pump was shutdown. At 1942 hours, CPS No. 9069.01 was completed. Review of the results of the motor vibration reading taken during the performance of CPS No. 9069.01 disclosed that two of the three points required by the test were above the required action range for the motor as defined by the inservice test program. Action Request F04489 was written to investigate and repair the high vibration. The Division 1 SX pump was already inoperable at the time of the discovery of the high vibration readings as the result of a planned outage.

On January 9, 1999, at 0400 hours, CPS No. 9069.01 was reperformed because it was believed that the vibration probes used to take the vibration measurements may not have been properly attached during the performance of the test on January 8, 1999. At 0555 hours Division 1 SX pump was shutdown as required by CPS No. 9069.01. At 0657 hours CPS No. 9069.01 was complete. The results of the test revealed that the vibration readings for two of the three points required by the test were above the required action range for the motor.

On January 13, 1999, the Division 1 SX motor disassembly was started to determine the cause of the high vibration measurements. This disassembly was conducted with the assistance of a representative from the motor supplier. The disassembly revealed that the upper guide bearing of the motor had degraded. Small pits were observed on the thrust bearing shoes and on the balls and races of the lower motor guide bearings. During the disassembly, two electrical ground paths were discovered between the thrust bearing and the motor housing. The first ground path consisted of metal shavings that were lodged in the insulating gasket beneath the thrust bearing creating a ground path to the thrust bearing.

The second ground path observed was on the upper bearing temperature thermocouple probe. The probe was bent and touched the sides of the motor housing and oil cooler creating a ground path to the thrust bearing. This is believed to have caused shaft currents which eroded away the guide bearing until it could no longer support an oil wedge. A thorough motor inspection was performed including the lower bearing, no additional damage was found, and all degraded components were replaced. This ensured the degraded condition was restricted to the upper bearing. The Division 1 SX pump was repaired and returned to service on January 23, 1999.

A review of the maintenance history of this pump and motor was performed. The most likely time for the ground paths to be created was during November 1996, when the oiler cooler [CLR] for the motor upper bearing was removed, repaired, and reinstalled.

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Based on the information obtained during the disassembly of the Division 1 SX pump and knowledge that the oil cooler for the Division 2 SX motor was removed, repaired, and reinstalled in January 1997, it was determined that it was prudent to inspect the Division 2 SX motor for similar damage. The Division 2 SX motor was disassembled for inspection starting on January 23, 1999. Inspection of its upper guide bearing disclosed that it was in the early stages of degradation. The thrust bearing thermocouple was found to have a damaged insulation sleeve causing a ground path which could create shaft currents. There was no visible pitting on the thrust shoes or lower guide bearing rollers as had been seen on the Division 1 SX motor. A thorough motor inspection was performed, including the lower bearing, and no additional damage was found, all degraded components were replaced. This ensured the degraded condition was restricted to the upper bearing. The Division 2 SX pump was returned to service on January 29, 1999.

On January 29, 1999, a review of the results of the SX pump motor inspections determined that the condition of the bearings was such that it could not be conclusively determined that the SX pump motors would be able to operate for thirty days as required in a loss of coolant accident. Based on this information the condition was determined to be reportable in accordance with 10CFR50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors," and 10CFR50.73, "Licensee Event Report System." When this determination was made the plant was in Mode 4 (Cold Shutdown) with the reactor [RCT] level being maintained between 70 and 100 inches and temperature was being maintained between 95 and 115 degrees Fahrenheit. Reactor pressure was atmospheric.

No automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No equipment or components were inoperable at the start of this event to the extent that their inoperable condition contributed to this event.

## CAUSE OF THE EVENT

The cause of this event could not be positively identified. The most likely cause of this event was determined to be improper assembly of the motor bearing thermocouple and bearing insulating gasket. This allowed shaft currents to flow to bearings resulting in bearing damage. The cause could not be positively identified due to the inability to determine a current path through the damaged guide bearing. The current path identified on each of the motors was through the thrust bearing which is electrically isolated from the guide bearing.

## CORRECTIVE ACTIONS

The damaged bearings for both SX motors were repaired and reassembled. Prior to returning the motors to service, the upper motor bearings were checked to ensure that they were electrically isolated. The Division 3 SX pump motor was not inspected as it is a different design and is not as susceptible to shaft current damage.

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A list of motors that are most susceptible to shaft currents was developed. The procedures and vendor manuals associated with these motors will be revised, as necessary, to ensure that the insulating requirements are identified (including recording as-found and as-left resistance levels), precautions necessary to avoid damaging insulation during maintenance are included, and instructions are provided on how to verify the integrity of insulation after completion of maintenance on the component. The operating and maintenance history for the susceptible motors was evaluated to determine if any other motors needed to be inspected. This evaluation concluded that no other safety-related motors required further inspection. Also, a training seminar describing why and how components are insulated to protect against shaft currents and the importance of maintaining their insulating properties will be prepared and presented to maintenance personnel. Prior to completion of the maintenance training seminar, and the procedure and vendor manual revisions, a briefing on this issue will be given to maintenance planners.

## ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(vii) as an event where a single cause or condition caused two independent trains to become inoperable in a single system designed to: shutdown the reactor and maintain it in a safe shutdown condition, remove residual heat, or mitigate the consequences of an accident. The potential failure of both SX motors from two different independent trains due to bearing degradation satisfies this definition.

The SX pumps are designed to provide cooling water to safety-related equipment and heat exchangers in the plant in the event of a loss of coolant accident or loss of offsite power.

The design basis requires these pumps to operate for thirty days following an event that requires their operation. If the Division 1 SX pump had been required to operate for a loss of coolant accident or loss of offsite power and the vibration of the motor increased to the point of failure then the Division 2 SX pump would normally have been available to support the redundant Division 2 components. However, given the as-found condition of the Division 2 SX motor, it is uncertain that this motor would have supported continuous operation for thirty days as required by the design basis.

## ADDITIONAL INFORMATION

A review of previous Licensee Event Reports submitted in the last two years reveals that there were no other reports submitted for motor bearing failures or degradation.

The bearing was contained in Siemens-Allis motor model number 119.

For further information on this event contact Bob Maher, Engineering Supervisor, Nuclear Station Engineering Department, at (217) 935-8881, extension 3080.