NRC FORM 366 (4-95) | U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Dresden Nuclear Power Station, Unit 2	05000237	1 of 5

TITLE (4)
Supplement to High Pressure Coolant Injection Declared Inoperable Due to Water in Lube Oil Reservoir From Lube Oil Cooler Tube Leakage

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
									N/A	N/A
11	27	96	96	018	01	11	20	98	N/A	N/A

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 LEVEL (10)	099		20.2203(a)(2)(i)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.405(a)(1)(ii)		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 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	TELEPHONE NUMBER (Include Area Code)
D. S. Smith, System Engineer	(815) 942-2920 ext 3087

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
X	BJ	CTW	G080	Y					

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 27, 1996, at 1315 hours, with Unit 2 in the run mode at 99 percent rated core thermal power, the High Pressure Coolant Injection (HPCI) system was declared inoperable due to suspected water in-leakage into the HPCI oil reservoir. The system was placed in a 7 day Limiting Condition of Operation (LCO) per Technical Specification 3.5.C.2.a. Subsequent investigation revealed that several tubes had failed on the lubricating oil cooler heat exchanger. Due to the higher head of the cooling water this allowed the cooling water to drain into the reservoir. The lubricating oil cooler heat exchanger was disassembled, inspected, and repaired (four tubes were plugged). The system was then tested per DOS 2300-03, "High Pressure Coolant Injection System Operability Verification", and declared operable on December 1, 1996. The safety significance of this event is minimal since all other emergency core cooling systems were available. In addition, since the heat removal capability of the heat exchanger and the lubrication capacity of the lube oil were not significantly impacted when the problem was identified, the HPCI system would still have been able to initially perform its safety function.

During refueling outage D2R15 the lube oil cooler was disassembled and eddy current tested. Eleven additional tubes showed indications of cracking. These eleven tubes, along with the four plugged tubes, were replaced. One additional tube, which had no indications of cracking, was also replaced so that it could be analyzed along with the tubes showing indication of cracking. A total of 16 tubes were replaced. The removed tubes were examined by the Commonwealth Edison System Materials Analysis Department (SMAD). The examination determined that the cracking was caused by inside diameter initiated transgranular stress corrosion cracking. The transgranular stress corrosion cracking of the tubes was caused by inadequate layup practices.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

PLANT AND SYSTEM IDENTIFICATION:

General Electric – Boiling Water Reactor – 2527 MWt rated core thermal power

Energy Industry Identification System (EIIS) Codes are identified in the text as [XX] and are obtained from IEEE Standard 805-1984, IEEE Recommended Practice for System Identification in Nuclear Power Plants and Related Facilities.

EVENT IDENTIFICATION:

Supplement to High Pressure Coolant Injection Declared Inoperable Due to Water in Lube Oil Reservoir From Lube Oil Cooler Tube Leakage

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: 11/27/96 Event Time: 1315 CST
Reactor Mode: 1 Mode Name: Run Power Level: 099
Reactor Coolant System Pressure: 1000 psig

No systems or components were inoperable or out of service at the start of this event which contributed to the event.

B. DESCRIPTION OF EVENT:

This issue is reportable pursuant to 10CFR50.73(a)(2)(v)(D) which requires that the licensee report any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

On Wednesday, November 27, 1996, at 1315 hours, the High Pressure Coolant Injection (HPCI)[BJ] system was declared inoperable due to water in-leakage into the HPCI lube oil reservoir.

The day before, Tuesday, November 26, a high oil level alarm was received in the Control Room. An operator was dispatched to the HPCI Room to investigate. He verified that the local indicator was indicating slightly high, but he was able to reset it and the Control Room annunciator cleared. At this time it was decided to periodically sample the oil with the auxiliary oil pump operating. The first sample indicated a water content of 0.25 percent. In consultation with the System Engineer and others, it was determined that HPCI was still operable.

A high oil level was again received in the Control Room early Wednesday. An operator was once again sent to investigate and this time the local indication appeared to indicate a higher level than previously noted; in addition the operator was unable to reset the local indicator. Additional samples taken and analyzed revealed an increase in water content. A sample was prepared for transmittal to the utility Central Testing Facility. At approximately 1500 hours the decision was made to declare the Unit 2 HPCI system inoperable retroactively to 1315 hours, November 27, 1996, based on water sample analyses and the appearance of the oil.

Since the most likely source of water was from the oil cooler, preparations were begun to take the oil cooler out of service and disassemble it for inspection. The water side (tube side) channel head cover was removed and the inlet and outlet tube sheets inspected. This inspection revealed no obvious flaws; however, the channel head cover was found to be rotated one bolt hole and a rag was found in the cooling water inlet side. The rag exhibited an appreciable amount of contamination and since the oil cooler had not been disassembled since construction, it was concluded that both conditions had existed since startup of the plant with no apparent adverse affect on oil cooler performance.

The cooler was then pressurized with oil (shell side), at normal system pressure, and the tubes visually inspected for oil leakage. Three tubes were found to leak oil, one on the inlet and two on the outlet. All three were located on the bottom of the tube bundle. The rear bonnet of the cooler was then removed to verify that no oil leakage was occurring from any different tubes not detectable from the channel end.

In addition, an air test was performed on each tube at 70 psig as a second check for tube leakage. This test revealed an additional leaking tube at the inlet side, bottom, for a total of four failed tubes. The four failed tubes were plugged after an evaluation by the vendor, General Electric, that determined that a maximum of seven tubes could be plugged without a detrimental affect on oil cooler performance.

During reassembly, a garlock gasket was used in place of the original asbestos flexitallic gasket at the channel end. Additionally, a replacement Buna-N O-ring packing, 0.250" in diameter, fabricated for the floating end of the tube bundle after evaluation by Materials Engineering and Plant Engineering was used.

Upon reassembly of the oil cooler and after the water contaminated oil had been replaced, the HPCI unit was placed on turning gear, the control valves stroked, and the turbine tripped to flush any moisture out, as recommended by the vendor, General Electric. This sequence was repeated several times.

The HPCI system was then successfully operated per DOS 2300-03, "High Pressure Coolant Injection System Operability Verification ". The oil was then sampled to verify water content was acceptable (less than or equal to 0.1 percent) and the HPCI System declared operable on Sunday, December 1, 1996.

No structures, systems, or components were inoperable at the start of or during this event which could have contributed to this event. In addition, no manual or automatic engineered safety features (ESF) actuation occurred as a result of this event.

During refueling outage D2R15, the Unit 2 HPCI lube oil cooler was disassembled and eddy current tested. Eleven additional tubes showed indications of cracking. These eleven tubes, along with the four plugged tubes, were replaced. One additional tube, which had no indications of cracking, was also replaced so that the removed tube could be analyzed along with the tubes showing indication of cracking. A total of 16 tubes were replaced. Upon reassembly, the lube oil cooler was satisfactorily pressure tested.

Dye penetrant, low power magnification, and metallographic examinations were performed on the removed tubes by the Commonwealth Edison System Materials Analysis Department (SMAD). The examination determined that the cracking was caused by inside diameter initiated transgranular stress corrosion cracking.

C. CAUSE OF EVENT:

The purpose of the HPCI lube oil cooler heat exchanger is to remove heat from the HPCI turbine lube oil to keep it at an acceptable temperature in order for it to perform its design function. The lube oil heat exchanger utilizes HPCI booster pump discharge water or Condensate Storage Tank (CST) water as the cooling medium. In the standby condition, the lube oil cooler heat exchanger is aligned to the CST. The CST is approximately 25 feet above the lube oil heat exchanger.

Tube failures in the heat exchanger allowed the CST water to gravity drain into the lube oil heat exchanger and ultimately into the lube oil reservoir. A review of the work history for the lube oil coolers indicates that the oil side (shell side) has been opened up before due to other problems with the oil system. There is no record that indicates the water side (tube side) has ever been disassembled and inspected. This is the first known tube leak with these heat exchangers.

Since this is the first time this heat exchanger has been disassembled on the tube side, it is believed that the gasket mis-orientation and Foreign Material Exclusion (FME) conditions have been present from construction. Based on the location of these deficiencies, and the location of the tube failures, it is believed that these conditions had no affect on the tube degradation.

As previously discussed, examination of the removed tubes indicated that the cracking was due to inside diameter initiated transgranular stress corrosion cracking. Transgranular stress corrosion cracking can occur when a susceptible material is exposed to threshold tensile stresses in a corrosive environment. The inside diameter of the HPCI lube oil cooler tubes is exposed to demineralized water from the contaminated condensate storage tanks. It is likely that a corrosive environment was created during extended plant shutdowns in 1995 and 1996 prior to the lube oil cooler leak due to improper lube oil cooler layup practices. During these extended shutdowns, the lube oil cooler remained full of water without periodic flushing or system operation, or was partially drained.

The Unit 2 HPCI lube oil cooler leak was due to transgranular stress corrosion cracking of the tubes caused by inadequate layup practices. [NRC Cause Code E]

D. SAFETY ANALYSIS

Up until the system was declared inoperable due to the water intrusion, it is believed that the HPCI system would have operated as designed. This is based on observations made during previous surveillances for both Unit 2 and Unit 3.

During performance of the operability surveillance, in order to keep the lubricating oil within its allowable temperature band, throttling of the cooling water is required. During an actual system initiation the throttling valve would be full open. Therefore it is concluded that even with the conditions found on the Unit 2 heat exchanger, its heat transfer performance would not have been impacted.

In discussion with the lube oil vendor, it was determined that although the oil had water in it, for the application (low pressure-200 psig) and amount of time the condition was present, the lubrication function would not be adversely impacted. The condition was detected via the tank level monitoring system before water level had increased to where the lubrication system could not perform.

Because the heat removal capability of the heat exchanger and the lubrication capacity were not significantly impacted when the problem was identified, the HPCI system would still have been able to perform its safety function. Had an event occurred that required HPCI to operate, and it was not available, the Automatic Depressurization System and the Isolation Condenser would have been available to reduce pressure to within the capacity of the Low Pressure Coolant Injection system, and remove decay heat while providing cooling water as designed. As a result, the safety significance is minimal.

E. CORRECTIVE ACTIONS:

1. The lube oil heat exchanger was disassembled, inspected, and repaired. Four tubes were found to have leaks and plugged. The water-contaminated oil was removed and replaced. The system was flushed to remove any moisture and the oil sampled. (Complete)
2. The Unit 3 HPCI lube oil heat exchanger tube side was drained and internally inspected. This was performed on December 6, 1996, utilizing a boroscope. The tube side inlet cavity and the interface of the head and partition plate were inspected. No abnormalities were detected on the Unit 3 heat exchanger. There has not been any indication of a tube leak on the Unit 3 heat exchanger. (Complete)
3. Both Unit 2 and Unit 3 HPCI lube oil heat exchangers were placed in the Station's heat exchanger reliability program. This will insure that the heat exchangers are monitored in a systematic and cost effective way to assure their operation for the life of the respective unit. (Complete)

4. The Unit 3 heat exchanger was disassembled and inspected during refueling outage D3R14. All testing and inspections were satisfactory. (Complete)

5. The Unit 2 heat exchanger was disassembled during refueling outage D2R15, and inspected. Sixteen tubes were replaced. (Complete)

6. Due to previously identified FME problems from historical maintenance practices, various Unit 3 systems and components were inspected during D3R14 for FME intrusion. (Complete)

7. A preventive maintenance task has been established to flush the HPCI system heat exchangers (lube oil cooler and gland seal leak off condenser) on a periodic basis to prevent conditions that are conducive to the formation of a corrosive environment. (Complete)

8. The need for a process to ensure that the HPCI system heat exchangers are adequately maintained during prolonged lay-up or outage periods when flushing is not possible will be evaluated and implemented as necessary. This process will be consistent with lay-up requirements for other heat exchangers at the station. (NTS #2371809601805S1).

F. PREVIOUS OCCURRENCES:

There have been no previous failures of the HPCI lube oil heat exchangers at Dresden Station.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number
General Electric	Heat Exchanger	MHTP-2-S(4)-STL