

# LICENSEE EVENT REPORT (LER)

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TITLE (4) **RHR Reservoir Inoperable Due to Blocked Divisional Cross-Connect Line Results in Condition Prohibited by Technical Specifications**

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)						
MON	DAY	YR	YR	SEQUENTIAL NUMBER			REVISION NUMBER	MON	DAY	YR	FACILITY NAMES					
10	04	96	96	-	0	1	4	-	0	0	11	04	96	DOCKET NUMBER (5) <b>0 5 0 0 0</b>		

OPERATING MODE (9) <b>5</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)  <div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> 10 CFR 50.73(a)(2)(i)(B)</span> <span><input type="checkbox"/> OTHER - _____</span> </div> <p style="text-align: center;">(Specify in Abstract below and in text, NRC Form 366A)</p>
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LICENSEE CONTACT FOR THIS LER (12) <b>Ken Riches - Compliance Engineer</b>		TELEPHONE NUMBER AREA CODE <b>313</b> NUMBER <b>586-5529</b>
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs
X	B   S	V	J   0   1   0	N					

SUPPLEMENTAL REPORT EXPECTED (14) <input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	[X] NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (16)

On October 4, 1996, at 1111 hours, during shutdown of an electrical bus, a Division 2 Ultimate Heat Sink (UHS) cross-connect valve was de-energized. On October 4, 1996, at 1920 hours, operations personnel recognized that Technical Specification (TS) 3.7.1.5 Action c, to establish a cross-connect path between divisional reservoirs within eight hours, was required but had not been taken. Since the eight hours had been exceeded, both reservoirs were declared inoperable. On October 4, 1996, at 1941 hours, a valve in the redundant cross-connect line was opened from the control room, and the TS 3.7.1.5.c action statement was believed to be satisfied.

On October 5, 1996, at 1554 hours, the original de-energized valve was manually opened to allow stroking of the redundant line valves for inspection by a diver. After opening the redundant line, the reservoir levels were observed to be slowly equalizing, indicating a lack of flow through the UHS cross-connect path established the day before.

The cause of the valve not opening was a loose set screw on the valve operator spline bushing, resulting in the spline bushing disengaging from the operator bull gear. Failure to enter the action statement is due to personnel error by operations personnel.

Corrective actions include repair of the cross-connect valve, positive discipline and lessons learned for operations personnel, bus shutdown procedures will be evaluated to determine if more detail regarding component impacts should be added, and the UHS cross-connect valve surveillance procedures will be evaluated to determine the need for indication that a cross connect path is established.

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## Initial Plant Condition:

Operational Condition: 5 (Refueling)  
 Reactor Power: 0 Percent  
 Reactor Pressure: 0 psig  
 Reactor Temperature: 85 degrees Fahrenheit

## Description of the Event:

### A. Background

The Fermi 2 Ultimate Heat Sink (UHS)[BS] consists of two one-half capacity reinforced-concrete Residual Heat Removal (RHR) reservoirs [BS][RVR] of Category I construction, each with a capacity of 3,450,000 gallons of water. The reservoirs are connected by redundant valved lines to permit access to the combined inventory of the two reservoirs to either RHR division in the event of a failure of one of the RHR divisions. Each line contains two isolation valves [BS][ISV] of Category I construction that are remotely operable from the main control room.

Technical Specification (TS) 3.7.1.5 requires that the UHS, comprised of two one-half capacity RHR reservoirs with the capability of being cross-connected, shall be operable with a minimum volume of 2,990,000 gallons. Limiting Condition for Operation (LCO) "g" requires two reservoir cross-connect lines, each with two operable motor operated cross-connect valves. The TS 3.7.1.5.c action statement requires that with one or more reservoir cross-connect valves inoperable, within eight hours open and de-energize both valves in at least one cross-connect line and verify that these valves remain open and de-energized at least once per 7 days. Otherwise, declare both reservoirs inoperable and take the Action of "e." The TS 3.7.1.5.e action statement, when in operational condition 4 or 5, requires that the residual heat removal service water (RHRSW)[BS] system, the emergency equipment service water (EESW)[BI] system and the diesel generator cooling water system (DGSW)[LB] be declared inoperable and to take the action required by TS 3.7.1.1, 3.7.1.3 and 3.7.1.4.

The TS 3.7.1.1.c action statement requires that in operational condition 5 with the RHRSW subsystem(s), which is associated with an RHR loop required operable by TS 3.9.11.1 or 3.9.11.2, inoperable, declare the associated RHR system inoperable and take the action required by TS 3.9.11.1 or 3.9.11.2, as applicable (which includes suspending core alterations and activities with the potential to drain the reactor vessel [AC][RPV]).

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The TS 3.7.1.3 action statement requires that with one EESW system subsystem inoperable, declare the associated EECW system subsystem inoperable and take the action required by TS 3.7.1.2. The TS 3.7.1.2.b action statement requires that in operational condition 4 or 5, determine the operability of the safety related equipment associated with an inoperable EECW system subsystem and take any actions required by the applicable specifications.

The TS 3.7.1.4 action statement requires that with one or more DGSW subsystems inoperable, declare the associated diesel generator inoperable and take the action required by TS 3.8.1.1 or TS 3.8.1.2, as applicable.

## B. Description of Event

On October 4, 1996, at 1111 hours, Bus 72ED [ED][BU] was shutdown, removing power from valve E1150F602B, "Division 2 RHR Reservoir Cross-Connect Valve." Loss of power to this valve renders it inoperable. At 1920 hours, the operations shift crew determined that the E1150F602B valve should have been declared inoperable in accordance with TS 3.7.1.5. Since at the time of discovery, Action "c" of TS 3.7.1.5 had already expired, Action "e" was entered, and both RHR reservoirs were declared inoperable. Since the plant was in operational condition 5 (refueling), action statements for TS 3.7.1.1, 3.7.1.3, and 3.7.1.4 were also entered and the non-interruptible air system (NIAS)[LE] was declared inoperable. Since there were no core alterations or activities with the potential to drain the reactor vessel in progress at this time, TS 3.9.11.1 was the most limiting TS, requiring that with no RHR shutdown cooling mode loop operable, within one hour and at least every 24 hours thereafter, verify operability of at least one alternate method capable of decay heat removal. With the plant in operational condition 5 with the cavity flooded, the spent fuel pool gates removed, and NIAS inoperable, action statements were entered for secondary containment [NG](TS 3.6.5.1.b.2), standby gas treatment [BH](TS 3.6.5.3.b), control center heating, ventilation and air-conditioning [VI](CCHVAC, TS 3.7.2.c.3), D.C. sources [EJ](TS 3.8.2.2.a), A.C. sources [EA](TS 3.8.1.2.a) and electric power (TS 3.8.3.2.a/b) systems. In accordance with TS 3.6.5.1.b.2 and TS 3.8.1.2.a, control room operators verified that there were no core alterations, handling of irradiated fuel, or crane operations over the spent fuel pool [DB] in progress at the time or had been performed since the bus was de-energized, and directed that core alterations or activities in secondary containment with the potential to drain the reactor vessel were not to be performed until authorized.

On October 4, 1996, at 1941 hours, the redundant cross-connect line was opened, remotely operating valve E1150F601A from the control room, and valves E1150F601A and E1150F601B (already open) were then de-energized, satisfying the TS 3.7.1.5 and associated cascading TS action requirements.

At this time, since the one hour action requirement of TS 3.9.11.1 was believed to have been met, a condition prohibited by TS did not exist.

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Shortly after the E1150F601A valve was remotely opened from the control room, licensed control room personnel identified that the strip chart recorder [BS][LR] for the RHR Reservoir levels indicated approximately a 12-inch level differential with no change in their indications after the E1150F601A valve was opened. E1150F601A and E1150F601B were verified to indicate open by local valve position [BS][V][ZI] and local reservoir level indicated 92% on three out of four indicators. The fourth indicator (E11R802) was out of calibration and had a pending corrective maintenance work request.

On October 4, 1996, at 2314 hours, a four-hour non-emergency 10 CFR 50.72(b)(2)(iii)(B) notification was made to the NRC Operations Center. This condition was reported as an event or condition that alone could have prevented the fulfillment of the Fermi 2 decay heat removal function because both RHR loops were technically inoperable. Further investigation determined that a loss of divisional power to the redundant cross-connect line would also have been necessary to lose the decay heat removal function. A single failure beyond the identified condition does not meet the "alone" stipulation of the 10 CFR 50.72(b)(2)(iii)(B) criteria, therefore the notification was not required.

On October 5, 1996, at 1349 hours, water was added to the Division I reservoir with no noticeable change on the E11R802 indicator. On October 5, 1996, at 1549 hours, in order to support RHR Reservoir inspection by divers, the E1150F602B valve was manually opened and the E1150F601A valve was closed. At 1624 hours, the Division I RHR reservoir filling operation was secured. At approximately 1700 hours, control room personnel observed that the chart recorder showed the Division I RHR Reservoir level was increasing and the Division 2 RHR Reservoir level was decreasing. Therefore, the determination was made that the cross-connect line associated with the E1150F601A/B valves was not providing a flow path between the reservoirs. The valves were last visually inspected by divers in June 1994. Detroit Edison determined that the original action requirements of TS 3.7.1.5 and cascading TS 3.9.11.1 had not actually been met, and the plant was in a condition prohibited by TS.

On October 6, 1996, at 1359 hours, a four-hour non-emergency 10 CFR 50.72(b)(2)(iii)(B) notification was made to provide a status update with the new information for the October 4, 1996, 2314 hours notification.

On October 6, 1996, diver inspection of E1150F601A verified that the ball valve was maintained in the closed position when the valve was remotely operated from the control room and the control room indication showed the valve as being open. A historical review of E1150F601A was performed, no indications of recent trends that would have been a sign of incipient failure were identified.



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On October 21, 1996, diver inspection observed the drive shaft at the upper end near the floor penetration as the valve was manually stroked. No motion was observed which left the portion of the drive mechanism located in the floor penetration, up to the actuator, as the suspected failure. In addition, the lower shaft extension thrust bearing was found degraded, but is not believed to have contributed to the failure of the valve to stroke. The thrust bearings are being replaced on all four RHR reservoir cross-connect valves.

On October 22, 1996, the actuator was removed and the spline bushing was found to be disengaged from the drive spline. Investigation revealed that the spline bushing, which is held in the longitudinal position by a set screw, had worked its way down the shaft to the point where it was no longer engaged with the drive spline of the valve operator bull gear. The spline bushing transmits torque from the actuator to the upper extension shaft.

### Cause of the Event:

The cause of the valve not opening was a loose set screw on the valve operator spline bushing, resulting in the spline bushing becoming disengaged from the drive spline of the operator bull gear. The cause of the failure to enter the appropriate action statement is due to personnel error in that the operations personnel (licensed and non-licensed) that prepared the LCO tracking sheet believed that the cross-connect function was available since the other division of power was available, and therefore did not pay the proper attention to the LCO requirement.

### Analysis of the Event:

As discussed in Fermi 2 License Amendment No. 51 (Reference 2), the Fermi 2 Ultimate Heat Sink is divided into two one-half capacity reservoirs in order to minimize the impact of a below grade breach of the reservoir structure. Detroit Edison believes that this event is extremely unlikely for the Category I structure. Further, the loss of water is limited by the site ground water level. The TS does not prohibit operation with the reservoirs either cross-connected or not cross-connected. Operation can continue indefinitely if it is assured that the reservoirs are cross-connected and thus can fulfill the design goals of the Ultimate Heat Sink as a single water source.

Further, adequate time for compensatory measures is available. The Ultimate Heat Sink capacity can be readily supplemented by pumping water from Lake Erie or other close-by water sources. Procedures for ensuring continued cooling availability are available.

The ability to cross-connect the reservoirs was demonstrated on October 5, 1996, when the E1150F602B valve was manually opened. The cross-connected path was verified open by diver inspection on October 6, 1996.

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A loss of coolant accident with a loss of offsite power is the worst-case condition for reservoir water usage because the main condenser is unavailable for decay heat removal, the diesel generators run at the highest loads, and the emergency equipment cooling water system is in operation. The heat load into the suppression pool as a function of time for the first 24 hours post-LOCA and assuming a 102 percent pre-accident reactor power level is used to determine the necessary inventory. The inventory in the UHS is such that either reservoir is capable of providing adequate cooling for the initial 24 hour post-LOCA period. Subsequent to the 24 hour initial accident period, UHS reservoir level control room indications would alert operators low reservoir levels and a cross-connect path would be established as necessary. The reactor had been shutdown for approximately seven days at the cross-connect path should have been established in accordance with TS 3.7.1.5 and the decay heat within the reactor was not significant.

Therefore, the health and safety of the public were not adversely impacted by this condition.

### Corrective Actions:

#### A. Immediate Corrective Actions

1. A cross-connect path was established on October 5, 1996, at 1549 hours when E1150F602B was manually opened.
2. The E1150F601A valve operator will be repaired prior to restart from the fifth refueling outage by providing a small recess for the spline bushing set screw and the set screw will be secured in place. The other cross-connect valves will also be modified with the set screw recess.

#### B. Corrective Actions to Prevent Recurrence

1. The appropriate operations personnel involved in this event received discipline in accordance with Detroit Edison's Positive Discipline Program.
2. Operations will prepare a lessons learned document and discuss this event with shift operations personnel by December 19, 1996.
3. The bus shutdown procedures will be evaluated to determine if more detail regarding specific component impacts should be added. The bus shutdown procedures will be revised, if necessary, prior to the start of the sixth refueling outage.
4. The UHS cross-connect valve surveillance procedures will be evaluated to determine the need to provide positive indication that a cross connect path is established when the associated cross-connect path valves are in the open position as indicated in the control room. These procedures will be revised, if necessary, prior to the next quarterly performance of the surveillance after restart from the fifth refueling outage.

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## Additional Information:

### A. Failed Components

Component: RHR Reservoir Cross-Connect Valve (E1150F601A)

Description: 10-inch motor operated (Limatorque SMB-000) ball valve  
with 34-foot extension

Manufacturer: Jamesbury

Model Number: DFS

### B. Previous LERs on Similar Problems

LER 94-008: On November 8, 1994, RHR Service Water Pump C was removed from service for maintenance. The operators did not recognize entry into TS Action 3.7.1.1.b. The event occurred because the operators failed to adequately review all of the applicable TS. Poor shift communication and inadequate use of the job impact statement contributed to this event. Corrective actions for the event included counseling of the involved individuals and lessons learned were presented to other operating shifts. For the event described in this LER, the operations personnel reviewed the applicable TS, but had a mind set that precluded recognition of the action statement requirement.