

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Fermi 2												DOCKET NUMBER (2) 0 5 0 0 0 3 4 1 1 6						PAGE (3) 1 OF 6	
TITLE (4) Emergency Diesel Generator Cooling Water Function Potentially Lost Due to Ice Formation in the Pump Columns																			
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			DOCKET NUMBER (8)			
02	05	96	96	-	0	0	1	-	0	0	03	06	96				0 5 0 0 0		
OPERATING MODE (9) 1			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (11)																
POWER LEVEL (10) 0 9 6			<div style="display: flex; justify-content: space-between;"> X 10 CFR 10CFR50.73(a)(2)(v)(D), 50.73(a)(2)(ii)(B), and 10CFR50.73(a)(2)(vii)(D) </div> <div style="display: flex; justify-content: space-between;"> OTHER - (Specify in Abstract below and in text, NRC Form 366A) </div>																
LICENSEE CONTACT FOR THIS LER (12)																			
Mari Jaworsky - Compliance Engineer															TELEPHONE NUMBER				
															AREA CODE 313		586-1427		
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)												EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR			
[] YES (If yes, complete EXPECTED SUBMISSION DATE)												[X] NO							
ABSTRACT (16)																			
<p>On February 5, 1996 at 1431 during performance of a Diesel Generator Service Water (DGSW) surveillance test, DGSW pump C failed to develop normal discharge pressure, flow, and motor current. Based on this, Emergency Diesel Generator (EDG) #12 was declared inoperable and trouble shooting commenced. After several attempted starts and an air purge of the pump column, the pump was started at 2021 and operated normally after a short period of erratic operation. On February 6, 1996 it was concluded that ice had formed in the pump column where it is exposed to outside weather conditions. An operability assessment concluded that once the ice had cleared, the pump was operable based on satisfactory test results, including vibration data. Testing of the other pumps in the Residual Heat Removal (RHR) Complex was initiated to see if they were affected by ice. At 1926 DGSW pump B was started and operated erratically until normal operating conditions were developed after approximately 90 seconds. While this performance would not have adversely affected EDG #13 operation, the potential for common cause failure due to ice formation was recognized.</p> <p>During the initial design of the RHR Complex the affect of adverse winter conditions was not addressed as related to the section of pump columns below the floor and above the RHR reservoir level. These column sections are directly exposed to the outside conditions making them susceptible to freezing. As such the plant was considered to be outside its design basis. Interim administrative measures will ensure that freezing does not impede pump operability until a permanent solution is adopted.</p>																			

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Initial Plant Condition:

Operational Condition: 1 (Power Operation)
 Reactor Power: 96 Percent
 Reactor Pressure: 1038 psia
 Reactor Temperature: 540 degrees Fahrenheit

Description of the Event:

On February 5, 1996 at 1324 surveillance 24.307.34, "DGSW, DFOT and Starting Air Operability Test-EDG #11", was performed. As part of this surveillance Diesel Generator Service Water (DGSW) Pump A [LB][P] which supplies cooling water from the RHR reservoir [BS][RVR] to Emergency Diesel Generator (EDG) #11 [EK][DG] was run with no noted anomalies.

At 1431 DGSW Pump C which supplies cooling water from the RHR reservoir to EDG #12 was started while performing the above surveillance. When the pump was started, motor amps remained high. The pump was manually tripped and a Limiting Condition of Operation (LCO) Action for EDG #12 was entered. Approximately five minutes later, another attempt on DGSW Pump C was made. This attempt yielded no flow, no discharge pressure, and no load motor amps. At 1642 EDG #12 was placed in Maintenance Pullout. Later at 1700 another start attempt on DGSW Pump C was made yielding the same results as the previous start attempt. After this start, an attempt to manually rotate the pump was made. Although it did not spin as freely as pump A, pump C was rotated with a strap wrench.

At 1727 DGSW Pump C was started once more and a small flow rate was observed with motor amps increasing. However, at 1729 with full flow still not established and abnormally low motor running amps observed, the pump was manually tripped. An air purge of the pump column on the discharge of DGSW Pump C was initiated in an attempt to clear any obstruction in the column or pump inlet.

At 2021 DGSW Pump C was again started. Three to five seconds after the start signal an erratic discharge pressure was noted. However, after that short period of time, pump flow, discharge pressure, and motor running amps were normal. Subsequently, on February 6, 1996 at 0332 to 0520 Pump A was successfully run to complete surveillance 24.307.34. Based on the satisfactory performance of pump C during surveillance 24.307.34 and 24.307.35 for EDG #12, EDG #12 was placed in remote. EDG #12 was considered available, but not declared operable since the operability determination for pump C was not yet completed.

After the initial failure of pump C, a team had been assembled to evaluate the problem and perform a 24 hour operability determination. Following the successful pump run, the team focused on identifying the cause of the problem and performing an operability determination for pump C. The team assembled and evaluated data with respect to pump C operation during each of the pump starts as well as

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troubleshooting the nature of the problem. After extensive troubleshooting, evaluation, and discussion, at 1500 on February 6, 1996 it was concluded that the most probable cause was ice formation on one or both bearing support pieces or other obstruction.

On February 6, 1996 at 1321 DGSW Pump C was successfully run again to confirm its operability and obtain confirmatory vibration data by completing surveillance 24.307.35 for EDG #12. At 1910 on that day, the LCO was exited when DGSW Pump C was declared operable following the completion of the operability determination which included vibration checks to verify that the pump showed no sign of internal damage.

On February 6, 1996 at 1926 DGSW Pump B which supports EDG #13 in Division 2 was started to verify its operability. DGSW pump B also showed no flow, no pressure, and low amperage for the first 30 seconds. The pump was allowed to run and after approximately 90 seconds normal flow, discharge pressure and motor current were achieved. Because this was similar to the problems experienced with the start of pump C, it was concluded that freezing inside the pump column could have also caused these problems. The remaining safety related service water pumps in the RHR Complex [NB] were successfully run.

Since both Division 1 and Division 2 pumps in the RHR Complex were subject to the similar freezing conditions, there was a potential for a common cause failure which is reportable under 10CFR50.73(a)(2)(v)(D) and 10CFR50.73(a)(2)(vii)(D).

Cause of the Event:

The DGSW pumps as well as others in the RHR Complex all are deep draft pumps. Although reservoir water temperatures were maintained greater than 41 degrees F per Technical Specifications, an engineering evaluation following the failure to start DGSW pump C determined the cause of the pump failure to start was a buildup of ice around the shaft and the spider bearing. The evaluation determined that the buildup of ice resulted from the unusually cold weather and prevailing westerly winds experienced coincident with leakage past the pump discharge check valve [LB][V]. Part of the pump column and two of the linear guide bearings of the DGSW pump are located above the water level and are exposed to the ambient conditions of the air space above the water. The outside air ambient temperature had been below freezing for many days. Potential freezing of water in the pump column above the air space is an inadequacy in the design of the Ultimate Heat Sink (UHS) [BS]. This problem had not been recognized prior to this event and is considered to be outside the plant design basis as described in the Updated Final Safety Analysis Report (UFSAR). Reporting criterion 10CFR50.73(a)(2)(ii)(B), therefore, applies to this aspect of the event.

The affected pumps suffered no mechanical or electrical damage. Once the temporary obstruction, i.e. the ice, was removed, the pumps were able to meet the normal surveillance acceptance criteria and were considered operable.

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Analysis of the Event:

Although an initial cause investigation revealed several potential reasons for the anomaly, in retrospect, Detroit Edison management recognizes that a more conservative course of action should have been pursued during the initial investigation of this event. Higher priority should have been given to considering the possibility of a common cause failure and testing of all the pumps to ascertain whether they were capable of starting and providing their safety function should have occurred earlier. Based on the fact that by design the pump columns above the RHR reservoir should be dry; the past satisfactory performance of these pumps; no evidence of past icing concerns; the fact that the air space below the pump room in Division 2 was 6 degrees F higher; and the fact that DGSW pump A had run without a problem immediately prior to the problem with DGSW pump C, the possibility of additional icing problems was judged unlikely until problems were found with DGSW pump B. However, Detroit Edison staff should be more sensitive to any potential for common cause failure mechanisms and take appropriate actions expeditiously to confirm system and component operability in both divisions.

EDG #11 and EDG #12 are the Emergency Diesel Generators that supply onsite emergency AC electrical power to the Division 1 emergency loads. EDG #13 and EDG #14 are the Emergency Diesel Generators that supply onsite emergency AC electrical power to the Division 2 emergency loads.

At the time of entry into the LCO for EDG #12, Division 1 of on-site emergency AC power was degraded. Division 2 of onsite emergency AC power was believed to be operable and capable of supplying emergency AC power to the Division 2 emergency loads should a loss of offsite power have occurred. This is based on the fact that approximately 90 seconds after DGSW Pump B was started, observed pump operating parameters were as expected. If EDG #13 were to have been automatically started and loaded, service water flow during the first 90 seconds of engine operation would not have been assured. However, according to the manufacturer, diesel generator operation with emergency loads and no cooling water flow for three minutes could occur prior to reaching the thermal conditions that might be considered to be deleterious to the diesel generator. Therefore, Detroit Edison believes that Division 2 of onsite emergency AC power was not inoperable coincident with the inoperability of EDG #12 in Division 1.

Furthermore, the alternate AC power source (Combustion Turbine Generator 11-1) [EK][TG] was continuously available and operable during the time EDG #12 was considered inoperable. CTG 11-1 connects with the 120 kV grid which is the offsite power source [FK] for the Division 1 emergency loads. Therefore, even had all four of the diesel generators become inoperable, the CTG 11-1 was available to supply essential Division 1 loads.

Fermi 2 has reviewed meteorological data for the past four years and has found that the combination of extreme low temperature and a strong westerly wind are uncommon. Furthermore, based on the review of the surveillance history, such a problem, i.e. pumps not starting appropriately due to ice buildup, has not been observed previously.

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The plant HVAC systems are designed based on ambient temperatures from -10 degrees F to 95 degrees F. Category 1 structures are designed to withstand a 90 mph fastest mile sustained wind velocity, 30 feet above ground level. The weather at the time of this event was within the design discussed in the Updated Safety Analysis Report (UFSAR).

The potential for reservoir freezing has been previously addressed. In December of 1983 prior to licensing and power operation, the RHR reservoir experienced freezing. A study was performed at that time to determine the correct solution to preclude any future events. The optimum solution was to maintain a Technical Specification minimum temperature for the reservoir to be 41 degrees F (alarm setpoint at 43 degrees F). This was considered to have solved the problem. However, the fact that the temperature could drop to below freezing in the airspace below the pump room floor thus freezing any water in the pump columns which could leak past the check valves was not considered.

Icing in service water pumps was not adequately addressed in the design of the RHR Complex. The icing that occurred resulted in loss of the function of one emergency diesel generator. However, Detroit Edison has concluded that under some credible meteorological conditions the functions of both divisions could have been affected.

The health and safety of the public were not adversely affected by this actual event, since only one division of onsite emergency AC power was unable to perform its function and no transient occurred during this period requiring use of onsite emergency AC power.

Corrective Actions:

An operability determination was performed on DGSW pumps B & C. The evaluation concluded that there was no damage to the pumps/motors and that the pumps are operable.

Administrative controls are currently in place in the form of Night Orders to monitor the temperatures in the air space below the RHR Complex pump rooms on a per shift basis. The monitoring of the air space will be initiated whenever outside temperature falls below 36 degrees F. Should the temperature in a division falls below 36 degrees F for three consecutive shifts, then all service water pumps in the affected division will be run. These controls will be replaced by procedural changes by March 29, 1996. These procedure changes will remain in effect until any design changes are made.

Design changes to prevent freezing in the safety-related service water pumps in the RHR Complex are being evaluated. The results of the evaluation will be in place by next winter.

A memorandum from the Senior Vice President has been distributed to Operations, Engineering, Licensing, and Training to discuss the event and the questions that should be asked in such an event. Each staff member in the departments mentioned above was requested to personally acknowledge reading and understanding this memorandum. Discussions covering the information in the

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memorandum have been held with the operating shifts. Training will be prepared and conducted for appropriate personnel, their organizational unit heads, and their senior management by June 28, 1996. This training will focus on increasing staff sensitivity to potential common mode failures and on a better understanding of when plant conditions may be outside the design basis.

Additional Information:

A. Failed Components

None, because the inability of the pump to perform its function was due to external conditions.

B. Previous LERs on Similar Problems

None