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 RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 90-003-01:on 900220,SFP cooling pump 3B shaft failure  
 resulted in damage to pump mechanical seal.

W/9 ltr.

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L-90-334  
10 CFR 50.73


U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

Gentlemen:

Re: Turkey Point Unit 3  
Docket No. 50-250  
Reportable Event: 90-003-01  
Date of Event: February 20, 1990  
Spent Fuel Pool (SFP) Cooling Pump 3B Shaft Failure Resulted  
In Damage To The Pump Mechanical Seal And Release Of Borated  
Contaminated Water To The SFP Building

The attached Licensee Event Report is being provided pursuant to the requirements of 10CFR50.73 to provide supplemental information on the subject event.

Very truly yours,

  
K. N. Harris  
Vice President  
Turkey Point Nuclear Plant

KNH/DRP/dwh

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, Region II, USNRC  
Senior Resident Inspector, USNRC, Turkey Point Plant

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PDR ADOCK 05000250  
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## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Turkey Point Unit 3										DOCKET NUMBER (2) 0 5 0 0 0 2 5 0										PAGE (3) 1 of 0 5																																																					
TITLE (4) Spent Fuel Pool (SFP) Cooling Pump 3B Shaft Failure Resulted In Damage To The Pump Mechanical Seal And Release of Borated Contaminated Water To The SFP Building																																																																									
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

At 1120, on February 20, 1990, with Unit 3 in Mode 6 (Refueling), Control Room personnel were notified that a mechanical seal failure had occurred on the 3B Spent Fuel Pool (SFP) Cooling Pump (EIIS:DA, Component:P). Approximately three inches of borated contaminated water had accumulated in the Unit 3 SFP heat exchanger room and the Unit 3 cask wash area. The 3B SFP Cooling Pump shaft sheared as the result of fatigue failure. Abnormal operating stresses led to the fatigue failure. When the pump shaft failed, the impeller and that portion of the pump shaft up to the fracture point continued to rotate without radial or axial support. This resulted in failure of the mechanical seal. The Auxiliary Building drains are designed to accommodate approximately 70 gallons per minute (gpm) total system leakage. The 3B SFP Cooling Pump mechanical seal failure is estimated to have created an 18 gpm leak. Partially clogged drain lines in the Auxiliary Building led to the water accumulation. No radioactive liquid effluent was released to the environment or to an unrestricted area. The effects on the SFP and Unit 3 refueling cavity water level were negligible. The 3A SFP cooling pump (Goulds) has been aligned as the primary SFP cooling pump. Permission of the Operations Superintendent must be obtained before the Ingersol-Rand SFP cooling pumps (3B and 4A) may be operated.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104  
EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Turkey Point Unit 3	0 5 0 0 0 2 5 0	9 0	- 0 0 3	- 0 1	0 2	OF	0 5

TEXT (If more space is required, use additional NRC Form 368A's) (17)

DESCRIPTION OF THE EVENT

At 1120, on February 20, 1990, with Unit 3 in Mode 6 (Refueling), a Nuclear Operator (NO) notified Control Room personnel that a mechanical seal failure had occurred on the 3B Spent Fuel Pool (SFP) Cooling Pump (EIIIS:DA, Component:P). Approximately three inches of contaminated borated water had accumulated and was contained in the Unit 3 SFP heat exchanger room and the Unit 3 cask wash area as a result of the mechanical seal failure and partially clogged drain lines. The 3B SFP Cooling Pump was stopped and isolated. Maintenance Department personnel were notified of the mechanical seal failure.

At 1140, the 3A SFP Cooling Pump was placed in service to re-establish cooling water flow to the Unit 3 SFP. Partially clogged floor drains in the Auxiliary Building were unblocked and the remaining water drained to the Waste Holdup Tanks for processing. The spill was contained in the Auxiliary Building. Release of contaminated borated water to the environment or to an unrestricted area did not occur.

At 1150, the Unit 3 reactor cavity (connected to the Unit 3 SFP) water level was verified to be within Technical Specification level limits. No significant decrease in the Unit 3 SFP water level or increase in water temperature was noticed during this event.

At 1532, voluntary notification of a significant event was made to the NRC Operations Center concerning the 3B SFP Cooling Pump mechanical seal failure. This notification was made because of expected news media interest. Subsequently, a news release was made by FPL.

This Licensee Event Report is being submitted on a voluntary basis. A similar event reported in LER 50-251/88-011-01 resulted in an uncontrolled liquid effluent release to the environment.

CAUSE OF THE EVENT

The 3B SFP Cooling Pump shaft sheared as the result of fatigue failure. The fatigue failure of the pump shaft is due to the formation of a notch which acted as a stress intensifier. Although the notch magnified stresses locally, operating stresses were higher than desirable due to the following factors:

- a. Inadequate available Net Positive Suction Head (NPSH) to the pump will result in cavitation at the impeller. This produces axial and radial loads which would not normally be seen by the



## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER				
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pump. FPL Engineering performed calculations which show sufficient NPSH for the 3A/4B SFP pump (Goulds) and the 3B/4A SFP pump (Ingersol-Rand (I/R)). However, the smaller sized suction piping and shorter length of transition piping to the pump inlet for the I/R pumps results in increased hydraulic resistance. This design is conducive to higher than desirable inlet flow velocities and turbulence which can result in the onset of cavitation.

- b. During disassembly of the pump, the impeller cap nut was observed to be loose, allowing the impeller to have some play. When the impeller has this type of play, vibration typical of an alignment problem will occur. During discussions with the pump vendor, the impeller cap nut was identified to be part of an assembly that included a nylock insert. The nylock insert works like a set screw and is designed for one time use. This assembly was not replaced during previous pump overhauls.

The following factors contributed to the 3B SFP Cooling Pump shaft failure:

- a. During disassembly and inspection of the pump, 1-2 cubic inches of foreign material was recovered from the oil return passageways in the bearing housing. This debris was determined to be metallic fragments from previous bearing and oil seal failures. The plugged passages resulted in oil with entrained metallic particles coming in contact with the elastomeric oil seal. Maintenance Procedure MP 3507.2, "Spent Fuel Pit Pump - Disassembly, Repair and Assembly (Ingersol-Rand)," requires that the bearing housing be cleaned upon disassembly of the pump. The oil return passageways in the bearing housing may not have been cleaned during the previous pump disassembly.
- b. Parallel circumferential scratches and a V-shaped notch approximately 10 mils in depth in the vicinity of the inboard elastomeric oil seal and pump shaft fracture plane were observed by visual examination. Additionally, the lodging of debris between the elastomeric oil seal and the pump shaft may have provided the source to create a stress intensifier at the fatigue location. Debris may have hindered lubrication of the elastomeric oil seal at the failure site, causing a heat rise that accelerated deterioration of the elastomeric oil seal.

When the pump shaft failed, the impeller and that portion of the pump shaft up to the fracture point continued to rotate with no radial or axial support. This resulted in impeller-to-pump casing damage (wear and scratches), wiping of the mechanical seal, and destruction of the inboard oil seal ring.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1)  Turkey Point Unit 3	DOCKET NUMBER (2)  0   5   0   0   0   2   5   0	LER NUMBER (6)						PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER						
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The Auxiliary Building floor drains are designed to accommodate total system leakage of approximately 70 gallons per minute (gpm). The leakage experienced due to the 3B SFP Cooling Pump mechanical seal failure is estimated to have been approximately 18 gpm. Partial clogging of the floor drains in the Auxiliary Building hindered water drainage to the Waste Holdup Tanks. The source of the floor drain blockage could not be determined. FPL believes either foreign debris or boric acid solution entered the floor drain system.

### ANALYSIS OF THE EVENT

Borated contaminated water from the 3B SFP Cooling Pump mechanical seal failure was contained within the Unit 3 SFP heat exchanger room and the Unit 3 cask wash area. No borated contaminated water was released to the environment or to an unrestricted area. Air samples taken in the Unit 3 SFP heat exchanger room and the Unit 3 cask wash area revealed airborne radioactivity levels to be a fraction of the Maximum Permissible Concentrations (MPCs) for radionuclides required for declaring the areas as airborne radioactivity areas.

Two Operations Department personnel received contamination of their clothes. One of these individuals received minor contamination on the bottom of his left foot. These two individuals were whole body counted. No internal contamination was found.

The Spent Fuel Pool Cooling System consists of two normally available fuel pool cooling pumps and a separate emergency fuel pool cooling pump. The design of the Spent Fuel Pool Cooling System is such that either normally available fuel pool pump can provide adequate flow to maintain the fuel pool temperature. The emergency fuel pool cooling pump can provide limited cooling of the fuel pool. Following loss of all pumps, an extended period is available prior to the fuel pool temperature increasing from its normal temperature of 127 degrees Fahrenheit (F) to the established limit of 180 degrees F to restore cooling flow. Within approximately 20 minutes of identifying the mechanical seal failure on the 3B SFP Cooling Pump, the 3A SFP Cooling Pump was started to restore cooling water flow to the Unit 3 SFP. No decrease in the Unit 3 SFP water level or increase in water temperature was identified as a result of the 3B SFP Cooling Pump mechanical seal failure.





## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)			
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER					
Turkey Point Unit 3	0 5 0 0 0 2 5 0	9 0	0 0 3	0 1	0 5	OF	0 5		

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

CORRECTIVE ACTIONS

1. The 3A SFP Cooling Pump (Goulds) has been aligned as the primary SFP cooling pump.
2. Clearances against the Ingersol-Rand SFP Cooling Pumps (3B and 4A) require permission of the Operations Superintendent prior to operation.
3. Maintenance Procedure MP 3507.2, "Spent Fuel Pit Pump - Disassembly, Repair and Assembly (Ingersol-Rand)," has been revised to address cleaning the oil return passageways in the bearing housing and installation of a new impeller cap nut.
4. Requests for Engineering Assistance (REAs) 90-281 and 90-282 have been generated to upgrade the Ingersol-Rand SFP pumps. The REAs have been approved by the FPL Change Review Team. Resulting Plant Change/Modifications will be worked in accordance with the Integrated Schedule.
5. A temporary leak detection monitoring system has been installed in the Unit 3 and 4 SFP heat exchanger rooms. This system will remain installed until such time that FPL determines it is no longer necessary.
6. Preventive Maintenance Mechanical procedure 0-PMM-061.1, "Auxiliary Building Floor and Containment Building Roof Drains Inspection and Cleaning," has been revised to provide specific guidance on the order of drain flushing.
7. A step has been added to the Precautions/Limitations section of Operating Procedure 0-OP-046, "CVCS - Boron Concentration Control." This step requires that extreme care be used to prevent boric acid from entering the floor drain system. If boric acid enters the floor drain system, a Plant Work Order should be initiated to have the applicable drain(s) cleaned and flushed.

ADDITIONAL INFORMATION

The 3B SFP Cooling Pump is a Model 6X13LP centrifugal pump manufactured by Ingersol-Rand. The 3A SFP Cooling Pump is manufactured by Goulds. The Emergency SFP Cooling Pump is manufactured by Worthington.

A similar event was reported in LER 50-251/88-011-01.