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AUG 1 5 2003

L-2003-174
10 CFR § 50.73

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

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2003-002-01
Date of Event: January 27, 2003
Manual Reactor Trip due to
Low Steam Generator Level

The attached supplemental Licensee Event Report 250/2003-002-01 is being submitted pursuant to the requirements of 10 CFR § 50.73(a)(2)(iv)(A) to document the root cause of the event and related corrective actions.

If there are any questions, please call Olga Hanek at (305) 246-6607.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

OH

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Turkey Point Unit 3	05000 0250	1 OF 6

4. TITLE

Manual Reactor Trip due to Low Steam Generator Level

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	27	2003	2003	- 02	- 01	08	15	03	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	1
10. POWER LEVEL	100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)	x	50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Olga Hanek – Licensing Engineer	(305) 246-6607

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	LD	CPU	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

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

On January 27, 2003, with the unit operating at approximately 100% reactor power, Unit 3 was manually tripped due to low steam generator level on the 3C steam generator. The low steam generator level was caused by a momentary loss of running instrument air compressors. The degraded instrument air pressure affected the air-operated main feedwater control valves, causing them to drift closed. The Control Room Operator took prompt procedurally driven actions to reduce power in response to the transient and to manually load the diesel driven instrument air compressors. Steam generator levels decreased, with the 3C steam generator level reaching approximately 12 percent, when the Unit 3 Control Room Operator initiated the manual trip of the unit. Following the manual reactor trip, all three turbine-driven auxiliary feedwater pumps started as expected and instrument air was restored. All control rods fully inserted. The plant was stabilized in Mode 3. This event is reported per the requirements of 10CFR50.73(a)(2)(iv)(A).

The cause of this event was a failure of the 4CM motor driven instrument air compressor, with the 3CM compressor out of service for maintenance. A contributing cause was the failure of the 3CD and 4CD diesel-driven compressors to autostart. Corrective actions included the installation of temporary instrument air compressors. Evaluation of the 4CM motor driven compressor failure and the 3CD and 4CD diesel-driven instrument air compressors failure to autostart was completed and corrective actions were implemented.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Turkey Point Unit 3	05000250	2003	- 002	- 01	Page 2 of 6

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

Event Description

On Monday, January 27, 2003, at approximately 0842 hours, a momentary loss of the running Instrument Air (IA) [LD:CPU] compressors occurred. The degraded instrument air pressure affected the steam generator [AB:sg] air-operated main feedwater control valves [SJ:fcv] causing them to drift closed. The Control Room Operator took prompt procedurally driven actions to reduce power in response to the transient and to manually start the diesel driven instrument air compressors. Steam generator levels decreased, with the 3C steam generator level reaching approximately 12 percent. A contributing factor to the 3C steam generator reaching this low level was the sluggish response of the turbine generator load limiter which may have delayed the power reduction. At 0845 hours, Unit 3 was manually tripped due to low steam generator level on the 3C steam generator. Following the manual reactor trip, all three turbine-driven auxiliary feedwater pumps started as expected and instrument air pressure was restored. All control rods fully inserted. The plant was stabilized in Mode 3. Unit 4 continued in Mode 1 operation.

Background

The Instrument Air (IA) System is a common system to Units 3 and 4, with 4 compressors; two motor driven (3CM for Unit 3 and 4CM for Unit 4) and two diesel driven compressors (3CD for Unit 3 and 4CD for Unit 4). Each unit has its own instrument air supply system comprised of one motor driven and one diesel driven compressor. The two (2) units' systems are normally cross-connected through a 4 inch cross-tie line, with a low pressure isolation feature. The IA system uses one motor driven compressor (3CM or 4CM) for its normal source of compressed air with the one compressor operating in LEAD and the other in LAG such that upon loss of pressure in one Unit, the opposite Unit's motor driven compressor will start and load and provide compressed air as required. Each diesel-driven compressor (3CD or 4CD) will start on a low-low air receiver tank pressure, a low voltage on the power busses to the motor driven compressors, or from a manual start switch at the compressor panel.

Sequence of Events

Prior to the event, the 3CM IA compressor was out of service for maintenance, and the 4CM IA compressor was running in lead. At 0840 hours, on January 27, 2003, the 4CM IA compressor tripped on breaker thermal overload. Both the 3CD and 4CD IA diesel-driven compressors attempted to autostart but tripped. The local diesel compressor annunciator panel indicated low compressor oil pressure. Operations manually restarted both 3CD and 4CD IA diesel-driven compressors and pressure in the IA system was restored. The degraded IA pressure affected the main feedwater control valves causing them to drift closed. Operations initiated a manual turbine load reduction in response to the reduction in main feedwater flow, caused by the repositioning of the main feedwater control valves. Unit 3 was manually tripped when the 3C SG reached a level of approximately 12%. A contributing factor to the 3C steam generator reaching this low level was the sluggish response of the turbine generator load limiter which may have delayed the power reduction. The main turbine [TA] automatically tripped in response to the manual reactor trip. All rods [AA:rod] inserted, all systems responded as designed and instrument air pressure was restored. Unit 3 was stabilized in Mode 3 (Hot Standby) with decay heat being removed through the steam dump to atmosphere. Unit 3 was returned to 100% power at 0200 hours on January 31, 2003.

Since the IA system is common to both units, Unit 4 was also affected by the momentary degradation of IA pressure. Unit 4 reactor operators responded to the reduction in Unit 4 main feedwater flow by initiating a

manual turbine power reduction. The 4B steam generator level reached a minimum of 24%. Unit 4 was stabilized at approximately 89% reactor power after IA was recovered. Unit 4 was returned to 100% reactor power at 1400 hours on January 27, 2003.

This event is reported per the requirements of 10CFR50.73(a)(2)(iv)(A) due to a manual reactor trip.

Causes of Event

4CM Motor Driven Instrument Air Compressor Failure

The cause of this event was a failure of the 4CM motor driven instrument air compressor. The 4CM IA compressor motor grounded. The cause of the failure was a loose sheet metal internal baffle in the motor rubbing against the aluminum rotor fan blades. Constant rubbing created aluminum dust and caused pieces of the baffle to break off. This led to the winding insulation being abraded to the point that a short circuit developed in the motor when bare copper was exposed. The baffle became loose due to the loss of two of the four #10-24 screws used to secure the baffle. The 4CM IA compressor motor had never been disassembled for maintenance; therefore, the cause of the loose screws is attributed to a manufacturing problem. A review of industry failure history for the 4CM GE motor did not identify any failures. A review of historical plant records revealed that the 4CM motor had operated without any failures since installation in 1996, therefore, the 4CM motor failure is considered a random isolated incident.

Generic Implications

The 3CM motor driven instrument air compressor is equipped with a Westinghouse electric motor whose design is not susceptible to the problem experienced by the GE motor. The Westinghouse electric motor was installed in March 2003.

3CD and 4CD Diesel-Driven Compressors Failure to Autostart

A contributing cause of the event was the failure of the 3CD and 4CD diesel-driven compressors (CDs) to autostart as designed. These compressors are the installed backup to the 3CM and 4CM IA motor driven compressors. Both compressors received the start signal but failed to autostart. The local annunciator panel indicated compressor low oil pressure.

The 3CD and 4CD diesel-driven IA compressors were assembled by Tide-Air Inc. using Atlas Copco. compressors and Detroit diesels. The autostart failure of the 3CD and 4CD diesel-driven instrument air compressors is attributed to the deficiencies in the design of the control logic scheme, specifically the starting and loading logic. Three non-standard logic schemes in the start and control logic design were identified. This logic design is intolerant of deviations from ideal starting conditions.

1. The start logic of the CDs is a single 15-second crank signal which provides power to the starter when the CDs receive a start signal. During the 15 seconds, the starter will crank the engine until the engine oil pressure reaches the engine low oil pressure reset of 26 PSI. Simulated testing performed as part of the root cause evaluation showed that on several occasions the engine oil pressure reached the 26 PSI reset setpoint and disengaged the starter before the engine was ready to run. The standard signal for standby diesel

engines is a speed-based crank-disconnect switch set at 400 to 600 RPM to ensure the engine is running prior to disengaging the starter.

2. The single 15-second crank signal was identified as a logic scheme that can lead to minor engine problems preventing the diesel from starting. The normal setup for cranking controls should provide four to six 15-second crank signals divided by 15-second rest periods. This setup provides the engine with additional crank attempts that would allow a sluggish starting diesel to start. During nine simulated start attempts, the engine cranked for a total of 57 seconds before starting. The normal standard logic design would provide 60 to 90 seconds of cranking with one auto start signal, allowing the diesel engine to start successfully.
3. The design of the CDs load permissive allows the compressor to load 5 seconds after engine oil pressure reaches 26 PSI. This design does not insure that the diesel is in a condition where it is ready to accept a load prior to allowing the compressor to load. Simulated testing showed that the engine started and ran sluggishly at low RPMs and loaded while at low RPMs causing the engine to shutdown shortly after due to overload at low RPMs. The normal setup for a load permissive logic is an RPM signal set to the engine speed where the engine is expected to load successfully.

Some contributing causes identified include deficiencies in the CDs diesel-driven fuel system design:

1. The fuel supply check valves had minor back leakage causing sluggish engine starts.
2. The fuel supply system did not have fuel return relief check valves installed to ensure the system stayed primed.
3. The fuel tank design did not include a suction strainer to prevent debris from entering the check valve area. Debris in the seating area caused the fuel supply check valve back leakage.

Generic Implications

The 3CD and 4CD IA compressors were assembled by Tide-Air Inc. using Atlas Copco. compressors and Detroit diesels, and are unique to Turkey Point. The auto-start and load design logic deficiencies of the 3CD and 4CD based on engine oil pressure is unique to the Turkey Point IA system, therefore, there are no generic implications related to this failure.

Turbine Generator Load Limiter

A contributing factor to the 3C steam generator reaching 12% was the sluggish response of the turbine generator load limiter which may have delayed the power reduction. The load limiter was inspected and found to have a slight misalignment of load limit motor to load limit controllers, which caused the sluggish response.

Analysis of Safety Significance

In the January 27, 2003 event, the momentary loss of the running instrument air compressor affected the main feedwater control valves causing them to drift closed. A manual turbine load reduction was initiated to reduce the steam generator feedwater flow/steam flow mismatch caused by the drift of the steam generator main feedwater control valves. The event was a reduction of normal feedwater flow and is bounded by the total loss of normal feedwater flow event analyzed in the Updated Final Safety Analysis Report (UFSAR)(Section 14.1.11.1).

The UFSAR analysis assumes a total loss of normal feedwater to all steam generators, due to the loss of the non-safety feedwater pumps or valve malfunction. A total loss of normal feedwater results in a reduction in capability of the secondary system to remove heat generated in the reactor core. In the January 27 event, feedwater flow was not lost completely; therefore, an automatic turbine runback due to loss of a main feedwater pump did not occur. A manual turbine load reduction was initiated by the reactor operator in accordance with Off-Normal Operating Procedures. All steam generators were affected by the reduction in feedwater flow. In the analysis, the reactor trip is expected to occur due to a Low-Low Level in any steam generator or Steam/Feedwater Flow Mismatch Coincident with Low Level in any steam generator. In the January 27, 2003 event, neither trip occurred, since operator actions manually tripped the reactor prior to reaching the steam generator Low-Low Level setpoint or the Steam/Feedwater Flow Mismatch Coincident with Low Level setpoint in any steam generator. The analysis does not credit turbine runback as a result of the loss of a feedwater pumps or valve malfunction. The analysis shows that following a loss of normal feedwater, the Auxiliary Feedwater (AFW) System is capable of removing the stored and residual heat, thus preventing either overpressurization of the reactor coolant system or loss of water from the reactor core. The analysis also assumes only one AFW pump is available due to a single active failure. In this event the AFW system automatically actuated on steam generator Low-Low level and all three AFW pumps started as designed. The plant's response was bounded by the UFSAR analysis. Thus, this event did not compromise the health or safety of plant personnel or the general public.

Risk Significance

A scoping risk assessment assuming loss of instrument air system without restoration yielded a conditional core damage probability of less than 1.0E-6. A more realistic estimate would yield a smaller value as instrument air could be restored. The risk associated with the event was not significant.

Corrective Actions

The following corrective actions have been completed:

1. Temporary instrument air compressors, consisting of two diesel driven portable air compressors for each unit, were installed under the Temporary System Alteration process.
2. A GE replacement motor was installed in the 4CM motor driven compressor and returned to service. Before installation, the baffle screws in the motor were secured with Loc-Tite and RTV.
3. The main turbine load limiter was inspected, aligned and returned to service.
4. Design changes were implemented modifying the cranking and loading logic for the 3CD and 4CD to:
   a) insure starter is not disengaged until the engine reaches a certain RPM, eliminating the engine oil pressure permissive for starter engagement from the logic,
   b) change the single 15 second crank attempt to six 15 second crank attempts divided by 15 second periods of inactivity.

5. Fuel return check valves were installed on the 3CD and 4CD to ensure positive pressure is maintained on the fuel system when the engine is shutdown.
6. A fuel supply strainer was installed on the 3CD and 4CD to prevent debris from entering the fuel supply check valve.
7. The fuel supply check valves installed in the 3CD and 4CD were replaced to prevent back leakage when the engine is not running.

Additional Information

There are no other events reported related to degraded instrument air pressure.

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE component function identifier, second component function identifier (if appropriate)]. There have been no previous similar events at Turkey Point Units 3 and 4.