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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 94-003-00:on 940812,reactor tripped on loss of main feedwater.Caused by component failure due to aging.Valves gasket replaced & procedure revised.W/940912 ltr.

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PRIORITY 1 DOCUMENT

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DUKE POWER

September 12, 1994

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 287/94-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 287/94-03, concerning a reactor trip due to the loss of main feeedwater.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

J. W. Hampton
Vice President

/ftr

Attachment

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IE22

NRC FORM 366 (5-92) NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 3	05000 287	1 OF 6

TITLE (4)
Reactor Trip On Loss Of Main Feedwater Due To Equipment Failure

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	12	94	94	-- 03 --	00	09	12	94		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	42	20.402(b)	20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)		50.73(a)(2)(vii)		OTHER
		20.405(a)(1)(iii)	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iv)	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
		20.405(a)(1)(v)	50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
L. V. Wilkie, Safety Review Manager	(803) 885-3518

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
F	SJ	TRB	G080	YES						

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 August 12, 1994, Unit 3 was at approximately 42% full power and returning to full power operation at 3% per hour following a Unit trip. The 3B Main Feedwater Pump (MFDWP) was supplying feedwater and the 3A MFDWP was being warmed in preparation for placing it in service. At 0447 hours, an anticipatory Reactor trip occurred due to the loss of the MFDWP that was in service. The response of the operators and automatic systems brought the unit to stable hot shutdown conditions. An investigation into the cause of the Unit 3 Reactor trip revealed that a gasket connection on the 3B MFDWP Turbine, between the relay valve and the emergency governor lockout valve, had failed resulting in low hydraulic oil pressure. This coincident with low discharge pressure on the 3A MFDWP resulted in the Reactor trip. The root cause is a component failure due to aging. Corrective actions include replacing the valve gasket, revising the maintenance procedure, and contacting the vendor for other operating experience associated with this type equipment.

BACKGROUND

The Reactor Protective System (RPS)[EIIS:JC] monitors parameters related to the safe operation of the plant and protects against fuel clad damage and the Reactor Coolant System [EIIS:AB] against damage caused by high system pressure. There are four RPS channels, with two out-of-four logic to produce a reactor trip signal. One of the reactor trip signals is the loss of both Main Feedwater Pumps (MFDWP) Anticipatory Trip.

The Main Feedwater (MFDW) system [EIIS:SJ] delivers feedwater to the Steam Generators (SG) with two steam driven MFDWPs. The Integrated Control System (ICS) [EIIS:JA] controls the amount of flow by throttling two sets of control valves, one set for each SG, and by controlling MFDWP speed to ensure pump discharge pressure is sufficient to force water into the SGs.

The MFDWP hydraulic oil system is composed of an oil storage reservoir, two motor driven pumps and a shaft driven pump for supplying oil to the system. It also has pressure regulation valves and pressure switches for maintaining the pressure required for the MFDWP turbine control valves and the turbine lubrication.

The Emergency Feedwater System (EFDW) [EIIS:BA] is designed to start automatically upon the loss of MFDW. Both Motor Driven Emergency Feedwater pumps and the Turbine Driven Emergency Feedwater pump will automatically start on a loss of both MFDWPs. SG levels will be controlled automatically by the EFDW Control Valves.

EVENT DESCRIPTION

On August 12, 1994, Unit 3 was increasing power back to 100% following a Unit trip of August 10, 1994. Power was being increased at 3% per hour and the 3B Main Feedwater Pump was in service. The 3A MFDWP is not normally placed in service until approximately 65% full power. It had been reset and was being prepared for placing in service.

At 0447:55 hours, with Unit 3 at approximately 42% full power, a reactor trip occurred due to a combination of low hydraulic oil pressure on the 3B MFDWP and low discharge pressure on the 3A MFDWP.

All full length control rods [EIIS:ROD] fully inserted into the core and the reactor was shutdown.

The 3A and 3B Motor Driven Emergency Feedwater Pumps (MDEFWP) and the Turbine Driven Emergency Feedwater Pump automatically started at 0448 hours.

Operators took manual actions per the Emergency Operating Procedure (EP/3/A/1800/001). After verifying that the MDEFWPs were meeting Emergency Feedwater requirements, the TDEFWP was stopped per procedure, at 0512 hours. Normal make-up to the Letdown Storage Tank was accomplished.

Post trip parameters remained within acceptable limits. Reactor Coolant System (RCS) [EIIS:AB] pressure decreased to a minimum of 1882 psig and then increased to a maximum of 2171 psig before controlling at approximately 2130 psig. Pressurizer [EIIS:PZR] inventory varied from a high of 223 inches, at the time of the trip, to a low of 83.6 inches before controlling at approximately 105 inches. RCS temperature converged smoothly to approximately 553 F. Steam Generator (SG) A pressure increased to 1075.5 psig following the trip, then the operators decreased and controlled pressure at approximately 965 psig. SG B pressure increased to 1074 psig before the operators decreased and controlled pressure at 965 psig. SG A and B levels decreased to minimum of 22.3 and 23 inches respectively, momentarily increased to 38.1 and 37.9 inches respectively, before controlling at approximately 28 inches.

The 3A MFDWP was started and at 0852 hours, the 3A and 3B MDEFWPs were stopped and placed in automatic after verifying the 3A MFDWP was properly operating and supplying feedwater to the SGs.

An investigation began into the cause of the Unit 3 Reactor trip. Operations found the 3B MFDWP reset (i.e. not tripped) but the control valves were shut. Instrument and Electrical Maintenance Support (MS) personnel began trouble-shooting the 3B MFDWP. They checked the hydraulic oil pressure on the 3B MFDWP header and found approximately 180 psig (the expected pressure with the auxiliary oil pump in service). A test gauge was installed at pressure switch (PS-1) to check the oil pressure at this point. The function of PS-1 is to break the reset circuit when the stop valves are reset. The oil pressure was approximately 110 psig (the expected pressure should have been the same as the header pressure). For comparison, the 3A MFDWP header pressure and PS-1 pressure were monitored and found to be equal at approximately 200 psig (the expected pressure with the shaft oil pump in service). The 70 psid on the 3B MFDWP indicated that a problem in the hydraulic oil system existed such that the oil pressure had likely dropped to the point of switch actuation and then increased to a value greater than the trip setpoint. The MS personnel considered the possibility that the Relay Valve (RV) or Emergency Governor Lockout Valve (EGLV) may have malfunctioned.

The inspection revealed that the oil pressure problem did not exist on the 3A MFDWP and the decision was made to start-up the Unit using the 3A MFDWP while the investigation of the 3B MFDWP continued. Also, the proper operation of the 3A MFDWP was confirmed, as it had been supplying feedwater since 0852 hours.

The reactor was returned to criticality at 2212 hours.

On August 13, 1994, the connected RV and EGLV were removed from the oil reservoir, partially disassembled, and inspected. No problems were evident after the internals had been inspected. Engineer A contacted vendor personnel who suggested the possibility that the gasket between the RV and EGLV might be deteriorated. When the RV body and EGLV body were separated, the gasket fell apart. A new gasket was installed and the valves were reassembled and reinstalled into the oil reservoir.

The 3B MFDWP hydraulic oil pressure was checked with the header and PS-1 gauges both indicating 180 psig (i.e. 0 PSID). The demand to the MFDWP controls was increased and the oil pressure at PS-1 reflected a slight decrease of only 4 psig which is considered acceptable. Operations began preparations for placing the 3B MFDWP in service.

On August 14, 1994, at 1431 hours, the Unit was returned to 100% full power.

CONCLUSIONS

The root cause of this event is determined to be failure due to aging of the gasket between the Relay Valve (RV) and the Emergency Governor Lockout Valve (EGLV) associated with the Main Feedwater Pump (MFDWP) hydraulic oil system. The gasket material had deteriorated over time, leaked, and caused the oil pressure to drop.

The deteriorated gasket connecting the RV and EGLV had not been detected during the regularly scheduled preventive maintenance (PM) because it is not required to separate the valve bodies to perform the required PM. The MFDWP turbine manufacturer's manual does not contain PM recommendations for this gasket.

There have been recent events involving the MFDWPs preventive maintenance and equipment problems. LER 270/94-02 involved a unit 2 trip due to a problem with loose gears on the 2B MFDWP Main Shaft Oil Pump and a loose set screw on the Motor Gear Unit. Unit 1 had a similar problem in November 1993 that did not result in a unit trip. The corrective actions involved changes to the preventive maintenance procedure.

There were four other events (LER's 270/92-04, 269/93-10, 269/94-02, and 287/94-01) over the past two years involving reactor trips with root or contributing causes of equipment failure. Therefore, this event is considered to be recurring.

Two of the events involved different equipment and modes of failure. Two of the events (LER 269/93-10 and LER 287/94-01) involved the same mode of failure (component aging) but the equipment was different. In LER 269/93-10 a wire termination lug failed inside the terminal box of a Main Steam Stop Valve. In LER 287/94-01 a Moisture Separator/Reheater level switch degraded. The corrective actions addressed the failures and other applications where the specific equipment is used. Since the failure in

this event did not involve similar components, the corrective actions from the previous events could not have prevented this equipment failure.

The failure of the MFDWP turbine is NPRDS reportable. The MFDWP turbine was supplied by General Electric and is a Type DRV631, six stage, dual inlet.

There were no personnel injuries, radiation overexposures, or releases of radioactive materials associated with this event.

CORRECTIVE ACTIONS

Immediate

1. Operators took manual actions per procedure to bring the unit to stable hot shutdown conditions.

Subsequent

1. The 3B Main Feedwater Pump Turbine (MFDWPT) Relay Valve to Emergency Governor Lockout Valve gasket was replaced.

2. Tests were performed on the hydraulic oil system to verify the gasket replacement had corrected the low oil pressure condition.

Planned

1. Remove and replace the Relay Valve to Emergency Governor Lockout Valve gasket on the 3A MFDWPT and the MFDWPTs on Units 1 and 2.

2. Revise the MFDWPT maintenance procedure (MP/0/B/1320/002) to check the hydraulic oil pressure at the outlet. Revise procedure (MP/0/B/1320/013) to replace the gaskets.

3. Obtain manufacturer experience related to MFDWPT problems. Verify current preventive maintenance procedures have addressed the concerns and if not, revise the procedures as necessary to include the appropriate measures.

SAFETY ANALYSIS

Loss of Main Feedwater (MFDW) is an anticipated transient and is described in Section 10.4 of the Final Safety Analysis Report. Loss of MFDW initiates a reactor trip and starts the Emergency Feedwater (EFDW) System to provide decay heat removal. In this event, all the systems and equipment operated as designed to mitigate the consequences of the loss of MFDW. Instrumentation detected the loss of MFDW and the Main Turbine and

initiated the Reactor trip and provided the start signal to the EFDW system. The Turbine Driven Emergency Feedwater Pump Turbine and both Motor Driven Emergency Feedwater Pumps (MDEFDWP) started. The unit was stabilized at hot shutdown.

If the affected unit's EFDW pumps had not started, the Emergency Operating Procedures (EOP) and Abnormal Procedures (AP) direct operators to align EFDW from one of the other two Oconee units. The EOP and AP also includes the use of High Pressure Injection forced cooling and/or use of the Standby Shutdown Facility Auxiliary Service Water pump. Analyses have been performed to verify that sufficient time is available for an operator to line up these systems before any core damage would occur.

There were no releases of radioactive materials, radiation over-exposures, or personnel injuries associated with this event. The health and safety of the public was not affected by this event.