NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
McGuire Nuclear Station - Unit 2	0 5 0 0 0 3 7 0	1 OF 0 6

TITLE (4) MANUAL TURBINE TRIP FOLLOWED BY REACTOR TRIP DUE TO DECREASING STEAM GENERATOR LEVEL - FEEDWATER CONTROL VALVE CLOSED DUE TO FAILED AIR REGULATOR

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 1	1 2	8 8	8 8	— 0 0 1	— 0 0	0 2	1 1	8 8		0 5 0 0 0
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OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	XX 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 (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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
	AREA CODE
STEVEN E. LeROY - LICENSING	7 0 4 3 7 3 - 6 2 3 3

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	
B	S J	R G	N 1 7 4	Y							

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

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

On 01/12/88 at 0420, a Unit 2 Steam Generator (S/G) C Level Deviation Alarm was received in the Control Room. Operations (OPS) personnel noticed Main Feedwater (CF) flow to S/G C was decreasing while CF Flow Control to S/G C, valve 2CF-20, had an open demand signal. OPS reduced Turbine Generator load and operated both CF pumps in manual. S/G 2C level returned to normal. Shortly after, the level in S/G 2C began to decrease and valve 2CF-20 indicated it was closed. At 0425:01, OPS tripped the Turbine and Reactor. The decreasing level in S/G 2C was due to valve 2CF-20 failing in the closed position which was due to a loss of air supply to the valve. OPS implemented the Reactor Trip recovery procedure. The air regulators on all 4 S/G CF flow control valves were replaced. Unit 2 was returned to power operation on 01/13/88 at 0211. This event is assigned a cause of Design and Construction/Installation deficiency because the air regulator for valve 2CF-20 failed due to it being improperly mounted. The mounting bracket used was designed for a field mount model and adapted for a panel mount regulator. The Unit 1 regulators will be replaced. Controls will be developed to prevent panel mounted regulators being used in field applications. The Critical Valve List will be reviewed to identify air regulators critical to plant operation and an inspection will be performed to change out regulators as needed.

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U.S.GPO 1984-0-454-481/18759

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station - Unit 2	0 5 0 0 0 3 7 0	8 8	— 0 0 1	— 0 0	0 2 OF 0 6

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

INTRODUCTION:

On January 12, 1988 at 0420, a Unit 2 Steam Generator (S/G) 2C [EIIS:SG] Level Deviation Alarm [EIIS:LA] was received in the Control Room. Operations (OPS) personnel noticed that the Main Feedwater (CF) [EIIS:SJ] flow to S/G 2C was decreasing while Feedwater Flow Control to S/G 2C, valve 2CF-20, had a 100% open demand signal. OPS personnel attempted to control the transient by reducing Turbine [EIIS:TRB] Generator [EIIS:GEN] load and operating both CF pumps [EIIS:P] in manual. The level in S/G 2C returned to normal and the alarm cleared. Shortly after, the level in S/G 2C began to rapidly decrease toward the trip setpoint and the control station for valve 2CF-20 [EIIS:FCV] indicated the valve was closed. At approximately 0425:01, OPS manually tripped the Turbine and the Reactor [EIIS:RCT]. The decreasing level in S/G 2C was caused by valve 2CF-20 failing in the closed position which was caused by a loss of air supply to the valve.

OPS implemented the Reactor Trip recovery procedure to recover from the transient. Instrumentation and Electrical (IAE) personnel replaced the air regulators on all four Unit 2 S/G CF flow control valves. Unit 2 was returned to power operation on January 13, 1988 at 0211.

Unit 2 was in Mode 1, Power Operation, at 100% power level, at the time of the Reactor Trip.

This event has been assigned a cause of Design and Construction/Installation Deficiency because the air regulator for valve 2CF-20 failed due to it being improperly mounted. The air regulator is designed for a panel mount application and was used in a field mount application. The mounting bracket used was designed for the field mount model and adapted for this panel mount regulator. This adaptation did not contain any provisions for locking the top half of the regulator in place.

EVALUATION:

Background

The CF system is designed to provide adequate feedwater flow at the required pressure and temperature to the S/Gs for all unit operating conditions.

Individual S/G 2CF flow is controlled by valves 2CF-17, 2CF-20, 2CF-23 and 2CF-32 for S/Gs 2D, 2C, 2B, and 2A, respectively, using CF flow, S/G water level, and Main Steam system flow as control inputs. The air supply line of each control valve has two solenoid valves [EIIS:CSV] (Train A and Train B) in series. During normal operating conditions, both solenoid valves will be energized which allows a control station on the Unit 2 Main Control board to control the air signal. Each solenoid valve is provided with a separate DC voltage source. On a Feedwater Isolation signal or a loss of power to the Train A or B solenoid valve, the solenoid valves will close and block air flow to the CF flow control valves, and the flow control valves will fail closed. The flow control valves can be operated

automatically from the control signal or manually by a pushbutton on the control station.

On any 2 out of 4 Low-Low level signals from any one S/G, the Auxiliary Feedwater system [EIIS:BA] will automatically start and supply approximately 3% of maximum operating CF flow to the S/Gs.

Valve 2CF-20 is an 18 inch air operated globe valve manufactured by West/Copes. The old air regulator [EIIS:RG] for valve 2CF-20 before the trip was model No. 11-024-037 manufactured by Norgren.

Description of Event

On January 12, 1988, Unit 2 was in Mode 1, Power Operation, at 100% power level. All systems were in normal operating modes prior to the event.

On January 12, 1988, at 0420, a S/G 2C Level Deviation alarm was received in the Control Room. OPS noticed that CF flow to S/G 2C was decreasing while valve 2CF-20 had a 100% open demand signal. OPS began reducing Turbine Generator load at a rate of 15 MW/min with the Digital Electro-Hydraulic Turbine Control system [EIIS:JJ] in the auto mode. Turbine Generator load was reduced by approximately 80 MWe. OPS operated both CF pumps in manual to increase pump speed and increase CF discharge pressure and flow to S/G 2C. The level in S/G 2C returned to normal and the alarm cleared. Shortly after, the demand signal for valve 2CF-20 decreased to approximately 76-78%. OPS ceased to reduce Turbine Generator load. OPS sent a Nuclear Equipment Operator (NEO) to investigate valve 2CF-20. The NEO found air escaping through the top half of the air regulator. Before the NEO could make any adjustments to the top half of the air regulator, the regulator disassembled. S/G 2C level began to rapidly decrease, CF pressure increased and the control station for valve 2CF-20 showed the valve fully closed. CF flow to S/G 2C decreased, S/G 2C level rapidly decreased and at approximately 42% S/G level, OPS manually tripped the Turbine and the Reactor at approximately 0425. OPS implemented the Reactor Trip recovery procedure to recover from the transient. At approximately 0425, the Auxiliary Feedwater Motor [EIIS:MO] Driven Pumps 2A and 2B automatically started on a S/G 2C Low-Low Level signal. CF isolation occurred as designed at approximately 0426 on a Low T-ave signal coincident with a Reactor Trip signal.

OPS initiated an emergency priority work request to inspect all air regulators to CF flow control valves and CF flow control bypass valves. IAE found that the air regulator for valve 2CF-20 had disassembled. The three remaining Unit 2 air regulators threaded joints were found loose and one was very near failure. IAE installed four new air regulators on the CF flow control valves. The CF flow control bypass air regulators were not replaced because they were not the same type air regulator as was installed on the CF flow control valves and are not subject to the same failure. IAE completed the air regulator replacement at approximately 1152 on January 12, 1988.

Unit 2 entered Mode 1 at 0211 on January 13, 1988.

Conclusion

Valve 2CF-20 failed in the closed position. This event has been assigned a cause of Design and Construction/Installation Deficiency because this failure was attributed to improper installation. The top half of the air regulator vibrated loose and failed when the remaining threads could not hold the top half of the regulator in place. The three remaining Unit 2 CF flow control valve air regulators threaded joints were found loose and one was very near failure. The mounting of the air regulator appears to have created the problem. The air regulator used is designed for a panel mount rather than a field mount application. The mounting bracket used was designed for the field mount model and adapted for this panel mount regulator. The adaptation did not contain any provisions for locking the top half of the air regulator in place. The full weight of the air regulator was suspended from this bracket with the lower half restrained by tubing connections. Only 1.25 turns are required to remove the top half. All Unit 2 CF Flow Control valve air regulators were immediately replaced with an updated model which integrates with the existing bracket to add a locking feature. The replacement model, Norgren model No. B12-425-A3LA, is designed for field application. The replacement model requires 10-15 turns of thread engagement, a compression type O-ring to assure its integrity, and the bracket attaches to the body versus the top half of the regulator.

Unit 1 CF flow control valves currently have the panel mount regulator. They have been thoroughly inspected and sealant was added to seal the top half of the air regulator in place. Colorcoded match marks were added to the Unit 1 regulators to facilitate monthly monitoring of the movement of the upper and lower half of the air regulators. The Unit 1 air regulator replacement will be implemented during the next Unit 1 Shutdown.

IAE previously initiated a Problem Investigation because of a potential problem with inadequate air pressure via the Instrument Air system [EIIS:LD] for valve actuation and other instrument operation. Clogged instrument air lines due to inadequate filtering is highly suspect for causing this problem. The proposed resolution to this problem was to have Design Engineering (DE) review/investigate all instrument/valve actuator air filters for correct application, define critical filter applications where filter failures may impact plant availability/reliability, and then this information would be used to develop the Critical Valve List to determine the applicability of a Preventive Maintenance program. OPS would then review this information and identify the valves with air regulators that are critical to plant operation.

OPS responded to the transient in a timely manner to stabilize the unit. There were a few anomalies noted during this Reactor Trip. There were no open computer indications received for Steam Dump to Condenser Valves 2SB-27 or 2SB-6. Also valve 2SB-15 failed to seat after opening. The other Steam Dump to Condenser valves operated properly. Performance initiated work requests to investigate and

repair valves 2SB-27 and 2SB-6. OPS initiated a work request to investigate and repair valve 2SB-15.

On the Operator Aid Computer (OAC) Alarm Summary program, the alarm times appear acceptable with respect to each other but are off approximately 13 minutes and 55 seconds from the Events Recorder which has been deemed correct. OPS initiated a work request to repair the internal timer on the OAC. Subsequently, IAE determined the cause of the problem to be a bad frequency relay.

All primary and secondary system key parameters, with the exception of those noted above, responded as expected during this Reactor Trip. Approximately 30 minutes after the Reactor Trip, Pressurizer [EIIS:PZR] level and pressure, S/G level and pressure, and Reactor Coolant system [EIIS:AB] temperature had all achieved stable no-load conditions.

A review of McGuire Licensee Event Reports revealed numerous Reactor Trips caused by component failures; however, there were no component failures involving a failed air regulator that were attributed to design or construction/installation deficiencies. Therefore, this event is not considered recurring.

This event is reportable to the Nuclear Plant Reliability Data System (NPRDS). A review of the NPRDS data base indicated there have been a number of air regulator failures. However, none of those reported relate to improper installation. The majority are related to dirty air filters and wear.

CORRECTIVE ACTIONS:

Immediate: OPS implemented the Reactor Trip recovery procedure.

Subsequent:

1) IAE replaced the air regulators on all four Unit 2 S/G CF flow control valves.

2) IAE visually inspected the Unit 1 air regulators. A sealant was added to seal the top half of the air regulator, and color-coded match marks were added to the air regulators to facilitate monthly monitoring of the movement of the upper and lower half of the air regulators.

Planned:

1) IAE will develop controls to prevent installation of panel mount regulators in field applications.

2) OPS will review the Critical Valve List developed by Design Engineering and identify to IAE the valves with air regulators that are critical to plant operation. IAE will perform an inspection and/or changeout of the air regulators for these valves.

3) The Unit 1 air regulator replacement will be implemented during the next Unit 1 Shutdown.

SAFETY ANALYSIS:

OPS manually tripped the Turbine and the Reactor above P-8 (48% power), in anticipation of a Reactor Trip on S/G Low-Low level. As such, the Reactor Trip initiating transient is classified as a Turbine Trip event in the McGuire FSAR Accident Analysis. The Accident Analysis for the Turbine Trip event assumes the reactor is not tripped until a Reactor Protection System [EIIS:JC] Setpoint is reached. However, the P-8 interlock initiates an automatic Reactor Trip with the Turbine Trip, thereby resulting in a less severe transient compared to the basis of the accident analysis.

Residual heat was removed by the Auxiliary Feedwater system, which auto-started (motor-driven pumps only) as level in S/G 2C reached the Low-Low level setpoint. The Main Feedwater Pumps remained available in the rollback hold mode following Feedwater Isolation on a Reactor Trip coincident with low T-ave. Residual heat was then dumped to the condenser, with atmospheric dumps and S/G PORVs [EIIS:RV] and safeties available as alternative means. S/G PORV 2SV-13 opened appropriately to accommodate the initial steam pressure peak at the time of the trip. All parameters responded as expected and all no-load conditions were achieved within 30 minutes after the Reactor Trip. The loss of feedwater to S/G 2C, caused by the closing of CF flow control valve 2CF-20, resulted in a delay in recovering level, but was at no-load conditions approximately 20 minutes after the Reactor Trip. Since the Turbine/Reactor tripped from full power, alternative conditions with respect to power level would be less severe. Manually tripping the turbine below 48% (P-8) power would not have resulted in an automatic Reactor Trip. Emergency core cooling and emergency electrical power were not required and were not actuated. The event presented no hazard to the integrity of the NC System or the Main Steam System [EIIS:SB].

There were no personnel injuries, personnel overexposures, or releases of radioactive material as a result of this event.

This event is considered to be of no significance with respect to the health and safety of the public.

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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

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February 11, 1988

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

Subject: McGuire Nuclear Station, Unit 2
Docket No. 50-370
Licensee Event Report 370/88-01

Gentlemen:

Pursuant to 10CFR 50.73 sections (a)(1) and (d), attached is Licensee Event Report 370/88-01 concerning a reactor trip that occurred on January 12, 1988. This report is being submitted in accordance with 10CFR 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,

Hal B. Tucker

Hal B. Tucker

SEL/224/jgc

Attachment

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