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DUKE POWER

October 12, 1990

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

Subject: McGuire Nuclear Station Units 1 and 2
Docket No. 50-369 and 50-370
Licensee Event Report 369/89-10-02

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/89-10-02 which clarifies information in the safety analysis which was submitted in LER 369/89-10 dated June 14, 1989. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B) and 10CFR Part 21. This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony L. McConnell

T.L. McConnell

DVE/ADJ/cbl

Attachment

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IE 28
1/1

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 1	0 5 0 0 0 3 6 9	1 OF 1 7

TITLE (4) Main Feedwater And Auxiliary Feedwater Isolation Valves Were Potentially Inoperable Because Of A Manufacturing Deficiency

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 5	1 5	8 9	8 9	— 0 1 0	— 0 2	0 6	1 4	8 9	McGuire Unit 2	0 5 0 0 0 3 7 0
										0 5 0 0 0

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)	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)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 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)	Part 21
		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
Alan Sipe, Chairman, McGuire Safety Review Group	7 0 4 8 7 5 - 4 1 8 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	

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 fifteen single space typewritten lines) (16)

On May 15, 1989, Station Management personnel determined that valves CF-126B, 127B, 128B, and 129B, Main Feedwater to Auxiliary Feedwater Nozzle Isolation, and valves CA-38B, 50B, 54AC, and 66AC, Auxiliary Feedwater Pump To Steam Generator, were potentially inoperable on Units 1 and 2 because uncorrelated testing and Design Engineering calculations had shown that these valves may not close under design differential pressure conditions. At 1600, valves CA-126B, 127B, 128B, and 129B were closed by Operations personnel and power was removed. On May 16, 1989, Operations personnel changed Emergency Procedures to stress that manual actions may be necessary to close valves CA-38B, 50B, 45AC, and 66AC. Valves CF-126B, 127B, 128B, and 129B were returned to operable status after a 95% torque switch bypass modification was performed on the Unit 2 valves on June 7, 1989 and the Unit 1 valves on June 8, 1989. The cause of the valves to fail to close under high differential pressure conditions has not been determined but is apparently a manufacturer's design deficiency. This event is assigned a cause of Manufacturing Deficiency. Unit 1 and Unit 2 were in Mode 1, Power Operation, at 100% power when the operability concern with these valves was determined.

EVALUATION:

Background

The Main Feedwater (CF) system [EIIS:SJ] supplies feedwater to all four Steam Generators (SGs) [EIIS:SG] during normal plant operation. During normal startup and shutdown operations, feedwater is routed to the upper nozzles [EIIS:NZL] of the SGs through valves CF-126B, 127B, 128B, and 129B below approximately 17% power. Above 17% power, feedwater is then routed to the lower nozzles of the SGs and valves CF-126B, 127B, 128B, and 129B are closed. The upper nozzles of the SGs are also called the Auxiliary Feedwater (CA) system [EIIS:BA] nozzles. Valves CF-126B, 127B, 128B, and 129B are Borg Warner 6 inch flexible wedge carbon steel gate valves Duke Item no. 6J-026. The actuators on these valves are manufactured by Rotork.

The CA system ensures a feedwater supply to the four SGs for decay heat removal if the CF system is unavailable. The CA system is provided with two Motor [EIIS:MO] Driven pumps [EIIS:P] and one Turbine [EIIS:TRB] Driven pump. Each of the Motor Driven pumps supplies feedwater to two SGs and the Turbine Driven pump supplies feedwater to all four SGs. There are four valves in series on the discharge of the Turbine Driven pump at each of the four SGs. These valves are an air operated flow control valve [EIIS:FCV], a manual isolation valve [EIIS:ISV], an electric isolation valve [EIIS:20], and a check valve [EIIS:V]. Valves CA-38B, 50B, 54AC, and 66AC are the electric isolation valves that serve to isolate flow to each of the four SGs when necessary. These valves are Borg Warner 4 inch flexible wedge carbon steel gate valves Duke Item no. 6H-102. The actuators on these valves are manufactured by Limitorque.

Valves CF-126B, 127B, 128B, and 129B close automatically after initiation of a Safety Injection signal and serve to isolate CF flow in the case of a high energy line break. Technical Specification (TS) 3/4.6.3, Containment Isolation Valves, requires that these valves be capable of closing within 10 seconds. TS 3/4.3.2, Engineered Safety Features Actuation System Instrumentation, requires that a feedwater isolation be accomplished within 9 seconds. Valves CA-38B, 50B, 54AC, and 66AC serve to isolate CA flow to a faulted SG to prevent excess water addition to that SG. These valves must be closed within 15 minutes to prevent exceeding the Containment Building [EIIS:ME] peak pressure allowed by the accident analysis.

Valves CF-126B, 127B, 128B, 129B, CA-38B, 50B, 54AC, and 66AC are motor operated valves designed to close to perform the specified safety function. The motor actuator for these valves is sized to provide the necessary thrust to fully close and seat the valves under maximum design differential pressure conditions. A torque switch [EIIS:WIS] is provided to automatically stop the motor when a specified amount of motor torque is reached. This torque should be sufficient to fully close the valve against the design differential pressure. The amount of torque necessary to close the valve is calculated using three factors. The Packing Load is that force caused by frictional resistance on the valve stem from the valve packing. The Stem Rejection Load is that force caused by the fluid pressure acting to push the valve stem out of the valve body. The Differential Pressure Seat Load is determined by a combination of the valve seat area, the differential pressure across the valve disk, and the Valve Factor. For high differential pressures, this

load has the largest effect on the amount of thrust required to operate a gate valve. The Valve Factor represents the coefficient of sliding friction between the valve disk and seat. This factor can be different for the opening and closing directions. The required actuator torque is then calculated by multiplying the required thrust by the stem factor. The flexible wedge gate valves supplied by Borg Warner were specified to have a Valve Factor of 0.3.

Description of Event

On March 14, 1988, at Catawba Nuclear Station (CNS), a Borg Warner (Duke Item Number 6J-219) gate valve failed to close completely during a routine flush operation. Subsequent investigation did not find any physical damage to the valve. The torque switch setting on the valve actuator was increased, and the valve was retested to ensure full closure capability. During November, 1988, further testing of other Borg Warner 6J-219 valves was conducted at CNS on Unit 1. All four valves tested failed to close completely under high differential pressure conditions. However, only 1 of the 4 valves failed to stop flow. During March, 1989, 4 Unit 2 CNS Borg Warner 6J-219 valves were tested under high differential pressure conditions. All four valves failed to completely close and three of the four valves failed to stop flow. Closing valve factors derived from stem thrust signatures taken during this testing were determined to be from 0.38 to 0.74 for these valves.

During April 1989, Design Engineering personnel determined that there may be an operability concern with some Borg Warner flexible wedge gate valves at McGuire that were similar in design to the CNS valves. These were valves CF-126B, 127B, 128B, 129B, CA-38B, 50B, 54AC, and 66AC on Unit 1 and Unit 2. Because these valves were a different model than the valves at CNS, there was a concern that they could pass enough flow to invalidate the safety analysis if they failed to completely close during design differential pressure conditions.

On May 15, 1989, at 1530, Operations personnel declared valves CF-126B, 127B, 128B, and 129B inoperable on Unit 1 and Unit 2. They closed and removed power from the valves because this action was required by TS 3.6.3 to place the valves in the safety position. At 1615, Operations personnel declared the Turbine Driven CA pumps on Unit 1 and Unit 2 inoperable as a compensatory action until it could be proven whether discharge flow from the Turbine Driven CA pumps could be manually isolated within 15 minutes as required by the safety analysis.

On May 16, 1989, Operations personnel proved that the manual isolation valves on the discharge of the Turbine Driven CA pumps could be closed in approximately 8 minutes, if necessary. Operations personnel have placed valve wrenches and valve location descriptions in a conspicuous place in the Control Room [EIIS:NA] to assist in this compensatory action if necessary. The Turbine Driven CA pumps were returned to operable status at 1842, and Operations personnel implemented changes to appropriate Emergency Procedures that provided detailed steps necessary to manually close these isolation valves.

On May 20 and 21, 1989, Nuclear Production Department personnel tested two Borg Warner 6 inch carbon steel flexible wedge gate valves at Oconee Nuclear Station

(ONS). The valves at ONS were identical to the McGuire valves in design and would provide a better correlation of valve behavior at McGuire. These valves were tested against a differential pressure of approximately 1330 psi. This is slightly greater than the approximately 900 psi that would be expected at McGuire. The valves were tested to determine a closing Valve Factor. The closing Valve Factor ranged from 0.46 to 0.49 and was consistent between the two valves.

On May 26, 1989, Instrumentation and Electrical (IAE) personnel tested valves CF-126B, 127B, 128B, and 129B on Unit 1 and Unit 2 using the Valve Operation Testing and Evaluation System (VOTES) method. Design Engineering personnel subsequently determined from the VOTES data that a modification could be made to the torque switch to allow for valve closing capability. The modification would bypass the torque switch to allow full actuator motor thrust to close the valve until the valve reached the close limit switch [EIIS:33] (approximately 0.22 inches off the seat). At this point the torque switch would be reinstated by the contacts in the close limit switch and stop valve movement to prevent motor burnup. Full actuator motor thrust would be enough to close the valves under design differential pressure conditions assuming a Valve Factor of 0.49 and this modification would ensure valve operability. This modification is commonly referred to as 95% torque switch bypass.

On June 3 and June 4, 1989, IAE personnel completed the 95% torque switch bypass modification for valves CF-126B, 127B, 128B, and 129B on Unit 2. Valve CF-126B was tested to determine motor stall thrust. The thrust was measured at approximately 37,000 pounds. Design Engineering personnel had determined that with a Valve Factor of 0.49, 18,000 pounds of thrust would be necessary to close these valves under design differential pressure conditions.

On June 7, 1989, Operations personnel returned valves CF-126B, 127B, 128B, and 129B on Unit 2 to operable status. The valves will remain closed with power removed until it is necessary to use these valves to shutdown for the Unit 2 Refueling Outage starting in July, 1989.

On June 7 and June 8, 1989, IAE personnel performed the 95% torque switch bypass on valves CF-126B, 127B, 128B, and 129B on Unit 1. On June 8, 1989, Operations personnel returned these valves to operable status.

Conclusion

This event is assigned a Cause of Manufacturing Deficiency because Borg Warner supplied a valve that had a Valve Factor higher than that specified or claimed. Actual tested close Valve Factors ranged from 0.38 to 0.74. The cause of the higher Valve Factor could not be determined. The valves at CNS were dismantled and no internal defects or damage were found. The only speculation at this time for the cause of the higher Valve Factors is that Borg Warner may have never tested these valves under actual field conditions to determine a Valve Factor and relied on industry accepted calculation methods to determine the Valve Factor. On April 6, 1989, Design Engineering personnel notified Borg Warner personnel of the higher than expected Valve Factors and at this time Borg Warner personnel have not responded with any further information.

Valves CF-126B, 127B, 128B, and 129B on Unit 1 and Unit 2 have been returned to operable status because of the 95% torque switch bypass modification. Valves CA-38B, 50B, 54AC, and 66AC on Unit 1 and Unit 2 are operable because manual compensatory actions can be accomplished within the time frame allowed by the safety analysis if the valves fail to isolate flow under design differential pressure conditions.

A search of McGuire LERs of the previous 12 months revealed two other LERs that documented degraded safety caused by a Design or Manufacturing Deficiency. LERs 369/89-06 and 369/88-28 both documented cases of the components of a valve actuator being installed incorrectly. However, this event is not considered recurring because the past LERs were attributed to Duke Power Company discrepancies and this LER is attributed to deficiencies external to Duke Power Company.

This event is not Nuclear Plant Reliability Data System (NPRDS) reportable.

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

CORRECTIVE ACTIONS:

Immediate:

1) Valves CF-126B, 127B, 128B, and 129B on Unit 1 and Unit 2 were closed and power was removed.

2) The Turbine Driven CA pumps on Unit 1 and Unit 2 were declared inoperable until Operations personnel could verify that the discharge flow path could be manually isolated within 15 minutes.

Subsequent:

1) Operations personnel proved they were able to manually isolate the discharge flow path of the Unit 1 Turbine Driven CA pump in 8 minutes and returned the Turbine Driven CA pumps to operable status.

2) Nuclear Production Department personnel tested two six inch Borg Warner flexible wedge gate valves at ONS to determine Valve Factors.

3) Operations personnel changed Emergency Procedures EP/1 and 2/5500/02, High Energy Line Break Inside Containment, EP/1 and 2/A/5500/03, Steam Line Break Outside Containment, EP/1 and 2/A/5500/14.1, Response To Anticipated Pressurized Thermal Shock Condition, and EP/1 and 2/5500/14.2, Response To Imminent Pressurized Thermal Shock Conditions, to more clearly define manual closure of valves CA-38B, 50B, 54AC, and 66AC on Unit 1 and Unit 2.

4) A 95% torque switch bypass modification was performed on valves CF-126B, 127B, 128B, and 129B on Unit 1 and Unit 2 and the valves were returned to operable status.

Planned: A revision to this LER will be written that will include long term corrective actions for valves CA-38B, 50B, 54AC, and 66AC on Unit 1 and Unit 2.

SAFETY ANALYSIS: Valves CF-126B, 127B, 128B, and 129B isolate feedwater flow to the SGs and/or Containment Building atmosphere in the case of a faulted SG. If the valves had failed to close completely when needed, some flow may have been allowed to pass. This flow would have been much less than full flow but would have added more water/steam than that assumed by the safety analysis. Emergency Procedures have a step to verify feedwater isolation and to manually close the valves, if necessary. Operations personnel would have been able to identify immediately any valve that failed to close and manually closed the valve in less than 15 minutes. This would have minimized the amount of extra steam/water added to the SGs and Containment Building atmosphere.

Valves CA-38B, 50B, 54AC, and 66AC isolate the discharge flow of the Turbine Driven CA pump. These valves are closed by pushbutton from the Control Room if it is necessary to isolate a faulted SG. If the valves had failed to close when needed, some flow may have been allowed to pass. Operations personnel would have immediately observed the failure and been able to take action. The air operated flow control valve or the manual isolation valve could have been used to isolate flow. This action could have been accomplished within 15 minutes. The safety analysis for a feedwater line break event allows 15 minutes for these valves to close.

There have not been any events of a faulted SG on Unit 1 or Unit 2 when these valves have failed to close completely when required.

This event did not affect the Health and Safety of the public.

ADDITIONAL INFORMATION:

The following information addresses the Planned Corrective Action which was to revise this LER to include long term corrective actions for valves CA-38B, 50B, 54AC, and 66AC on Unit 1 and Unit 2.

On May 16, 1989, a Station Problem Report was written for Unit 1 and Unit 2 stating the valve factor on some Borg-Warner valves was 0.74 instead of the expected standard of 0.3. Due to this increase in the valve factor, the presently installed limitorque actuators were not capable of developing enough thrust to close off these valves under full differential pressure conditions.

On June 16, 1989, McGuire Exempt Variation Notices (MEVNs) were initiated for Unit 1 and Unit 2 (MEVN-1877 and MEVN-1878) to modify the internal valve actuator wiring for CA-38B, 50B, 54AC, and 66AC to ensure approximately 95 percent of the closure stroke is controlled by the limit switch and the final 5 percent of the closure stroke is controlled by the torque switch. The implementation was documented on work request numbers 96788 through 96791 and numbers 96792 through 96795 for Units 1 and 2, respectively.

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

The modification for Unit 1, MEVN-1877, was completed in the field on February 13, 1990, and the affected drawings were completed by Design Engineering on May 10, 1990. The modification for Unit 2, MEVN-1878, was completed in the field on August 30, 1989, and was completed by Design Engineering on November 7, 1989.

The modification performed by these MEVNs will allow actuators to develop full thrust during the majority of the closing cycle to ensure the valve disk completely blocks the valve port under accident conditions. The final positioning of the valve disk to its seat is controlled by the actuator torque switch. No changes were made to the opening circuits for valves CA-38B, 50B, 54AC and 66AC on Unit 1 and Unit 2. This modification was to ensure that these CA valves perform their designed function, therefore, preventing the station from having to conduct compensatory actions when CA system operation is necessary.