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September 2, 1992

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

Subject: McGuire Nuclear Station Unit 1
Docket No. 50-369
Licensee Event Report 369/92-06, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 369/92-06, Revision 1, concerning past inoperability of the Auxiliary Feedwater System. This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (v). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

T.C. McMeekin

TLP/bcb

Attachment

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IE22
1/1

LICENSEE EVENT REPORT (LER)

FACILITY NAME(1)	DOCKET NUMBER(2)	PAGE(3)
McGuire Nuclear Station, Unit 1	05000 369	1 OF 9

TITLE(4) The Unit 1 And 2 Auxiliary Feedwater Systems Were Past Inoperable Because Of A Design 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)
									McGuire, Unit 2	05000 370
04	30	92	92	06	1	05	29	92		05000

OPERATING MODE(9)	1	THIS REPORT IS SUBMITTED PURSUANT TO REQUIREMENTS OF 10CFR (Check one or more of the following)(11)							
POWER LEVEL(10)	98%		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
			20.405(a)(1)(i)		50.36(c)(1)	X	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)
			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	
Terry L. Pedersen, Manager, McGuire Safety Review Group	704	875-4487

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 April 8, 1992, Problem Investigation Report (PIR) 0-M92-0074 was issued by McGuire Engineering personnel to address the concern of air discovered in the Nuclear Service Water (RN) assured makeup piping associated with valves 1CA-161 and 1CA-162 (Auxiliary Feedwater [CA] Pump Suction Header RN Supply Isolations) and what effect this air had on the operability of the Unit 1 CA system. The CA system was determined to be past inoperable. The required notification was made to the NRC on April 30, 1992, at 1101. Further evaluation identified a similar operability concern on Unit 2 CA system. On May 2, 1992, Units 1 and 2 turbine driven (TD) CA pumps were isolated from the potential source of air from the RN discharge header and were declared inoperable. The required notification was made to the NRC on May 2, 1992, at 1443. At the time of the event discovery, Units 1 and 2 were in Mode 1 (Power Operation) at 98 and 100 percent power, respectively. The source of the air has been attributed to the process of off-gassing, (dissolved gases [nitrogen/oxygen] coming out of solution). This event is assigned a cause of Design Deficiency because the process of off-gassing was not recognized during the design phase. Continuous venting has been initiated at various high point locations in the RN discharge piping and additional vent valves will be installed to ensure the RN system is water solid at other high points following maintenance activities.

EVALUATION:

Background

The Auxiliary Feedwater (CA) system [EIIS:BA] is a nuclear safety related system which is designed to provide a means of dissipating heat from the Reactor Coolant (NC) system [EIIS:AB] if the Condensate (CM) system [EIIS:KA] and Main Feedwater (CF) system [EIIS:SJ] are not available through loss of power or other malfunction. The CA system is also used during normal startup and shutdown. The CA system is provided with two motor [EIIS:MO] driven pumps [EIIS:P] and one turbine [EIIS:TRB] driven (TD) pump. In addition to the three primary sources which supply the CA system suction, the Nuclear Service Water (RN) system [EIIS:BI] provides the nuclear safety related assured CA system suction source.

The RN system consists of RN Trains A and B which are normally aligned to Lake Norman [EIIS:BS]. The RN system assured suction source to the CA system is available to each of the 3 CA system pumps by independent flow paths. Three independent flow paths are also available to the Turbine Driven Auxiliary Feedwater (TDCA) pump. Each flow path is isolated by 2 valves [EIIS:V] in series. The normal supply valves are motor [EIIS:MO] operated and can be controlled either in the Control Room [EIIS:NA] or at local panels [EIIS:PL]. The assured suction isolation valves are designed to open for automatic suction swapover when CA pump suction pressure drops below 2 psig for 3 seconds. One of the assured CA system suction sources for the TDCA pump is controlled at the Standby Shutdown Facility (SSF).

The Standby Shutdown System (SSS) is designed to mitigate the consequences of certain postulated fire incidents by providing capability to maintain Hot Standby conditions and by controlling and monitoring vital systems from locations external to the main Control Room. The SSS is intended to respond to low probability fire and/or sabotage events.

Technical Specification (TS) 3.7.1.2 requires that at least 3 independent CA pumps and associated flow paths shall be operable in Modes 1 (Power Operation), 2 (Startup), and 3 (Hot Shutdown). The TDCA pump is required to be operable in Mode 3 with secondary steam pressure >/= 900 pounds. With 1 CA pump inoperable, it must be restored to operable status within 72 hours or the unit shall be in at least Hot Standby within the next 6 hours and in Mode 4 (Hot Shutdown) within the following 6 hours.

Final Safety Analysis Report (FSAR) Chapter 16, Selected Licensee Commitments 16.9-7 states, in part, with the SSS inoperable for more than 7 days, prepare and submit a report to the Commission within the next 30 days outlining the cause of the inoperability, corrective actions being taken, and plans for restoring the system to operable status.

Description of Event

On March 27, 1992, air was discovered to be present at inspection port valve 1RN-1058 (SSF Assured Makeup Inspection Port) by McGuire Engineering personnel, in the RN assured makeup flow piping to the CA system. Valve 1RN-1058 is upstream of valves 1CA-161 and 1CA-162, (CA Pump Suction Header RN Supply Isolations). These valves allow the assured makeup flow from the RN system to the CA system and are controlled from the SSF. McGuire Engineering personnel were implementing procedure TT/1/A/9100/399, Inspections Of Assured Makeup Piping To The Auxiliary Feedwater From Nuclear Service Water For GL (Generic Letter) 89-13, at the time of the discovery. These inspections were being done in response to the flushing and flow testing recommendations of Action I of GL 89-13. McGuire Engineering personnel reported this discovery to the Operations (OPS) manager and the McGuire Engineering supervisor, recognizing that the air could be a potential problem. OPS and McGuire Engineering personnel began checking for possible sources of air inleakage. These sources included the Control Area Ventilation and Chilled Water (VC/YC) system [EIIS:VI/KM] vacuum breakers [EIIS:VACB].

On April 1, 1992, Train 1B VC/YC vacuum breakers were inspected. The vacuum breakers did not show signs of air inleakage. On April 3, 1992, OPS and McGuire Engineering personnel made another inspection of valve 1RN-1058 and again discovered air venting from the valve. On April 6, 1992, Train 1A VC/YC vacuum breakers were inspected by the same personnel. Again, there was no sign of air inleakage. Other possible sources of air inleakage checked included, but were not limited to, the Upper Containment Ventilation (VU) vacuum breakers, and the Auxiliary Building Ventilation (VA) vacuum breakers. During this time interval, the concern with CA operability had not been raised, since it was felt the air in the RN discharge piping was the result of maintenance activities. The following day, April 7, 1992, air was discovered to be present at valves 1CA-163 (CA Suction Header RN Supply Tell Tale) and 1RN-840 (RN Crossover High Point Vent). The air problem was discussed with additional OPS personnel and it was determined that there was a concern over CA operation since the possibility of air being introduced into the CA system pumps could render the pumps inoperable or degraded. Subsequently, an Operability Evaluation form was issued per Station Directive 2.8.2, and compensatory measures were initiated by OPS personnel. The compensatory measures included venting at valves 1CA-163 and 1RN-840, twice a shift.

On April 8, 1992, Problem Investigation Report (PIR) 0-M92-0074 was issued by McGuire Engineering personnel to address the concern of the air discovered in the RN assured makeup piping associated with valves 1CA-161 and 1CA-162, and what effect this air had on the operability of the CA system. While the Operability Evaluation was being performed by McGuire Engineering personnel, it was conservatively decided by OPS, and McGuire Engineering personnel to remove supply power from 1CA-161 with the valve closed, thereby, rendering the SSS inoperable. Removing supply power from valve 1CA-161 prevents automatic and manual

opening of the valve from the SSF, on low CA pump suction pressure and thereby eliminates 1 of the 3 the assured sources of RN to the CA system (Inplant Review 92-05); however, this action would ensure the RN assured makeup source would not introduce air into the CA pump suction causing damage to the TDCA and Motor Driven pumps 1A and 1B, thus ensuring present operability of the CA system. The SSS was logged in the TS Action Item Logbook (TSAIL), item 22245, at 1225, on April 9, 1992, by OPS Control Room personnel.

Extensive review and evaluation of the RN system piping layout and vents was conducted by McGuire Engineering and OPS personnel to determine potential air sources. Additionally, past operability of the SSS and CA system was being evaluated by McGuire Engineering personnel. During this time, air continued to show up at locations identified for venting, leading personnel involved in the event to believe they were not dealing with a finite amount of air introduced by maintenance activities. In an attempt to alleviate the air problem, McGuire Exempt Variation Notice (MEVN) 3188 was issued on April 13, 1992, to install a vent valve [EIIS:VTV] (1RN-1060, RN Assured Makeup To CA High Point Vent), on the RN assured piping upstream of valve 1CA-161. The installation was completed on April 15, 1992.

On the same day, at the request of McGuire Engineering personnel, Chemistry management began evaluating the possibility of oxygen/nitrogen off-gassing (dissolved gases coming out of solution) from Lake Norman. The possibility of off-gassing became more probable as the possible sources of air leakage were eliminated. An evaluation of possible modifications to eliminate this problem was pursued by personnel involved with this event.

On April 23, 1992, 3 options were identified as possible solutions:

1) The installation of several continuous vents which would be routed to the Groundwater Sump (WZ) system (EIIS:WH), along with the installation of vents on high point sections of RN piping which are currently unventable.

The continuous vents will be installed as a Temporary Modification and will be evaluated after installation to determine if they are functional.

2) Reorienting the current RN makeup piping within the current valve boundary. This may be pursued if option 1 is unsuccessful.

The RN assured makeup connection branches off the top of a diagonal section of the 36 inch RN discharge header and is likely to accumulate air which is entrained in the RN discharge header flow.

3) Installation of a new assured makeup source on the 1A RN supply header.

While examining the options to return the SSS to an operable condition, McGuire Engineering personnel determined, through extensive piping and configuration evaluation, there were certain sections of RN piping susceptible to the formation of air pockets. The air was forming in high points of the RN discharge piping, and was capable of being introduced into the CA system through the RN system assured makeup branch connections, under certain abnormal operating conditions.

During an event where the RN assured makeup is required to supply the CA system, flow can come from the RN discharge header as well as either trains Diesel Generator Cooling Water (KD) heat exchanger (Hx) [EIIS:HX] discharge (KD Hx is supplied by the RN Essential Supply Header). The KD Hx discharge flow is approximately 900 gpm. The TDCA pump design flow is 900 gpm, while the Motor Driven pump design flow is 450 gpm. Normally, Train A Essential Discharge Header supplies assured flow to the TDCA pump and Motor Driven pump A via the KD Hx discharge. Depending on the demand, flow can also be supplied by the RN discharge header, which was found to contain air that has collected in the high points in the piping.

Evaluation of past operability of the Unit 1 CA system by McGuire Engineering personnel, due to the potential for the entry of air through the SSF assured makeup piping, was completed on April 30, 1992. The CA system was conservatively determined to have been past inoperable prior to removing the supply power from valve 1CA-161 on April 9, 1992. The required notification was made to the NRC on April 30, 1992, at 1101.

Further evaluation identified the same concern on Unit 2. On May 2, 1992, Units 1 and 2 TDCA pumps were isolated from the potential source of air from the RN discharge header and were declared inoperable. Even though the TDCA pumps were technically inoperable, they were capable of automatic actuation, of receiving water from the normal CA system supply and from RN Train B Essential Header. Isolating The TDCA pumps also prevented the possibility of pulling air into Motor Driven pump A on either unit, thus assuring the operability of Motor Driven pumps A and B. Units 1 and 2 Motor Driven pump B and TDCA pump supplied by RN Essential Header Train B, were not affected since the piping configuration is different. The required notification was made to the NRC on May 2, 1992, at 1443.
Units 1 and 2 were in Mode 1 (Power Operation), at 98 and 100 percent power, respectively.

To return the CA systems to operable status, a conditional operability statement was issued on May 4, 1992 by McGuire Engineering personnel to prevent the possibility of air entrainment into the CA system pumps from the RN Train A header of Unit 1 or Unit 2.

1) Vent valves 1RN-835 (Essential Header 1A Return High Point Vent) and 2RN-815 (Essential Header 2A Return High Point Vent) will be throttled to continuously vent air from the RN Train A headers.

2) Operation procedures will be modified for swapover of RN Train 1A or 2A from Lake Norman to the Standby Nuclear Service Water Pond to preferentially use RN Train B for the TDCA pump suction. Alternately, if RN Train B should fail, ensure total CA system flow from RN Train A is less than the KD system [EIIS:LB] Hx RN discharge flow. The total CA system flow would be throttled to less than the RN Train A to KD Hx flow. This assumes RN Train A pump is operating since it would be necessary only if RN Train B discharge header failed.

Continuous venting of 1RN-835 and 2RN-815 was achieved on May 5, 1992, while revisions were made to procedure AP/1,2/5500/20, Loss Of RN, on May 4, 1992. With these compensatory measures in place, Units 1 and 2 CA systems were returned to conditional operable status on May 5, 1992 at 0615.

Conclusion

This event has been assigned a cause of Design Deficiency because of the system configuration and functional design. Off-gassing was determined to be the source of the air found in the RN discharge header. The process of off-gassing in the RN discharge header was not recognized during the design phase. Dissolved gases, (nitrogen /oxygen), are coming out of solution as the RN water temperature increases while removing heat from various plant components. The dissolved gases are migrating to high points in the RN discharge piping where flow velocities are low. Additionally, the RN assured makeup connections tie in at the top of the RN piping, thus allowing air (dissolved gases) to accumulate in this piping. Even though the system contains vents, these vents were installed during plant construction for startup and maintenance activities and were not required to be open for the purpose of continuous venting.

To initially correct the problem, the supply power was removed from normally closed valve 1CA-161 to prevent the introduction of air into the CA system piping from the RN assured makeup source controlled from the SSF. OPS personnel began routinely venting the RN assured makeup piping twice a shift.

Subsequent actions included the installation of valve 1RN-1060 on April 15, 1992, on the RN assured makeup piping to the CA system controlled from the SSF, to facilitate venting of the piping. An extensive pipe configuration review was conducted to identify possible sources of air inleakage and additional venting locations. Continuous venting was set up on vent valves 1RN-835 and 2RN-815 which are on the RN discharge header. Procedure changes were made to AP/1,2/5500/20, to ensure RN supply during realignment to the Standby Nuclear Service Water Pond does not contain air that could affect CA pump operation.

The planned corrective actions include permanent piping of the continuous venting system on valves 1RN-835, and 2RN-815; the installation of a permanently piped continuous venting system on 1RN-1060; development of an RN system venting procedure; and the installation of additional vents to ensure the RN system is water solid at other high points following maintenance activities. The installation of a permanent piping continuous venting system at valve 1RN-1060 will allow the supply power to be restored to valve 1CA-161, restoring the SSS to operable status.

A review of the Operating Experience Program database for 24 months prior to this event did not reveal any LERs with a root cause of a Design Deficiency which would have affected the mitigation of the consequences of an accident. This event is therefore, considered to be nonrecurring.

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

There were no personnel injuries, radiation overexposures, or uncontrolled releases of radioactivity to the environment as a result of this event.

CORRECTIVE ACTIONS:

Immediate:

1) The supply power was removed from valve 1CA-161 to prevent the introduction of air into the CA system piping from the RN assured makeup source controlled from the SSF.

2) OPS personnel began routinely venting the RN assured makeup piping on a set frequency.

Subsequent

1) Valve 1RN-1060 was installed under MEVN 3188 to facilitate venting of the RN assured makeup piping to the CA system controlled from the SSF.

2) An extensive piping configuration review was conducted by McGuire Engineering and OPS personnel to identify possible sources of inleakage and additional venting locations.

3) McGuire Engineering personnel set up continuous venting systems on valves 1RN-835 and 2RN-815 which are located at high points of the RN discharge header.

4) Procedure changes were made to AP/1,2/5500/20, Loss Of RN, by OPS personnel to ensure the RN supply remains air free during realignment to the Standby Nuclear Service Water Pond.

Planned:

1) McGuire Engineering personnel will coordinate the installation of a permanent continuous venting system at 1RN-1060.

2) OPS personnel will develop procedures for the venting of the RN systems for both units prior to reaching Mode 3 on the applicable unit.

3) Additional vents will be installed by McGuire Engineering personnel to ensure the RN system is water solid at other high points following maintenance activities.

4) McGuire Engineering personnel will permanently pipe the continuous venting system on valves 1RN-835 and valve 2RN-815.

SAFETY ANALYSIS:

The CA system is required as an accident mitigation system for cooling water supply to the steam generators (SGs) [EIIS:SG] for all design basis accidents requiring use of SGs for cooling. TS 3.7.1.2 requires at least 3 independent CA pumps and associated flow paths shall be operable.

Normal supply for the CA pumps is from the CA Condensate Storage Tank [EIIS:TK], the Upper Surge Tank, or the Condenser [EIIS:COND] Hotwell. Should these supplies of water be exhausted or become unavailable, the RN assured make up would be available to the CA pumps.

This event was initiated when air was discovered in the RN assured makeup piping in the vicinity of valves 1CA-161 and 1CA-162. The RN discharge piping contained air that could affect the operation of CA Motor Driven pump 1A and the TDCA pump. The same problem existed on Unit 2. Because of the difference in pipe configuration, the RN assured makeup piping to Motor Driven pump 1B and the TDCA pump is unaffected by this problem. However, prior to the discovery and the current compensatory actions in place, the potential existed where Motor Driven pump 1B and the TDCA pump could have been affected.

The worst case scenario would involve an earthquake coincident with events requiring CA system flow to aid in plant cooldown. The events requiring the CA system flow to aid in long term core cooling include, but are not limited to, loss of non-emergency AC power, loss of normal feedwater, feedwater line break, and small break loss of coolant accident (SBLOCA). An earthquake would potentially result in damage to the non-seismically qualified main feedwater and normal condensate sources rendering them unavailable as a CA water supply. With normal condensate sources lost, automatic switchover to the assured water source should take place when the suction pressure of the CA pumps falls below 2 psig. It is postulated that because of the piping configuration and the high CA suction flow, air could be drawn

into the suction header of the CA pumps. It is assumed these pumps would fail if subjected to this air. There would not be sufficient flow to the SGs to remove decay heat. Without the necessary heat sink available, procedure EP/1,2/A/5000/13.1, Response To Loss Of Secondary Heat Sink, would direct the operators to establish feed and bleed cooling in the Reactor Coolant (NC) system [EIIS:AB] using the Pressurizer [EIIS:PZR] Power Operated Relief Valves (PORVs) as a relief path. The feed and bleed process would supply cooling water to the reactor core to prevent fuel damage due to uncovering of the core. The cooling water would also supply a heat sink to remove heat from the core. This would allow OPS personnel time to take action to return the CA or CF pumps to service.

Prior to discovering air in the RN discharge piping, no events occurred which required the use of the RN assured sources to supply makeup to the CA system pumps.

The health and safety of the public were not affected by this event.