

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) McGuire Nuclear Station, Unit 2	DOCKET NUMBER (2) 0 5 0 0 C 3 7 1 0 1	PAGE (3) 1 OF 0 1 7
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TITLE (4) A Unit 2 Containment Sump Isolation Valve Switchgear Logic Wire Was Incorrectly Wired Due to Personnel Error Causing ECCS Train Inoperability

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)
									N/A			0 5 0 0 0
0 6	2 7	8 8	8 8	0 1	0 0	1 0	1 2	8 8				0 5 0 0 0

OPERATING MODE (9) 0	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)				
POWER LEVEL (10) 0 1 0 1 0	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.406(c)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(b)	
	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.38(e)(1)	<input type="checkbox"/> 50.73(a)(2)(vi)	<input type="checkbox"/> 73.71(c)	
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.38(e)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text: NRC Form 366A)	
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)		
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ix)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)		
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME Steven E. LeRoy, Licensing	TELEPHONE NUMBER 7 1 0 4 3 7 1 3 1 - 6 1 2 1 3 1 3
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC

SUPPLEMENTAL REPORT EXPECTED (14) <input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15) MONTH: DAY: YEAR:
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On 06/15/88, Construction and Maintenance (CMD) personnel were implementing a Nuclear Station Modification (NSM) on the switchgear logic of valve 2NI-184B, B Train Safety Injection Containment Sump Isolation, and discovered a wire placed on the wrong terminal point on the valve actuator terminal block. CMD documented the as found position of the wire on the associated procedure. CMD personnel completed the NSM including relocating the misplaced wire. On 06/27/88, Quality Assurance (QA) discovered the discrepancy. After researching drawings for the switchgear logic for valve 2NI-184B, QA determined the required function of the switchgear logic was inoperable in the as found configuration. This event is assigned a cause of Personnel Error because a wire in the terminal block was placed on the wrong terminal point due to a lack of attention to detail. This event is also assigned a contributory cause of Design Deficiency, because the terminal block for the actuator for valve 2NI-184B was installed in a position which is difficult to access. The event is also assigned a contributory cause of Management Deficiency due to a breakdown in the Functional Verification Program. Appropriate Maintenance procedures will be revised and the Functional Verification program will be reviewed for improvements. Supervision will review this event with appropriate personnel.

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TEXT: If more space is required, use additional NRC Form 365A (11/77)

INTRODUCTION:

On June 15, 1988, Construction and Maintenance Division (CMD) personnel were implementing a Nuclear Station Modification (NSM) on the switchgear logic of valve 2NI-184B, B Train Safety Injection Containment Sump Isolation, and discovered a wire had been placed on the wrong terminal point on the valve actuator terminal block. CMD personnel documented the as found position of the wire on the procedure associated with the NSM. The same day, CMD personnel completed the NSM which included relocating the misplaced wire.

On June 27, 1988, during an audit of the NSM paperwork, Quality Assurance (QA) personnel discovered the discrepancy. After researching the associated drawings for the switchgear logic of valve 2NI-184B, QA determined the required function of the switchgear logic, automatic closure of valve 2ND-4B, B Train Isolation in Suction from Refueling Water Storage Tank, was inoperable in the as found configuration.

Unit 2 was in No Mode, with no fuel in the Reactor Vessel, at the time the event was discovered; however, Unit 2 operated in all modes during the time the wire was on the wrong terminal point.

This event has been assigned a cause of Personnel Error because a wire in the terminal block was placed on the wrong terminal point due to a lack of attention to detail. This event has also been assigned a contributory cause of Design Deficiency because the terminal block for the actuator for valve 2NI-184B was installed in a position which is difficult to access. This event has also been assigned a contributory cause of Management Deficiency because of a breakdown in the Functional Verification Program.

EVALUATION:

Background

During an actuation of the Emergency Core Cooling System (ECCS) the Safety Injection (SI) system [EIIS:SQ] provides emergency core cooling in the event of a Loss of Coolant Accident (LOCA) or a Main Steam system [EIIS:SB] break. During the short term (injection) mode following a LOCA, borated water from the Refueling Water Storage Tank (RWST) is injected into the Reactor Coolant (RC) system [EIIS:AB]. When the RWST is depleted, the Containment Sump is used as a source of emergency core cooling water for the long term (recirculation) mode.

The injection continues until the low level set point of the RWST is reached, at which time Operations (OPS) personnel verify the ECCS system alignment to the recirculation mode. This is partially accomplished by automatic opening of valve 2NI-184B and 2NI-185A, A Train Containment Sump Isolation [EIIS:ISV], in the containment sump suction lines to the Residual Heat Removal (RHR) system

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TEXT of this report is prepared, use additional NRC Form 365A's (17)

[EIIS:BP] pumps [EIIS:P] and automatic closure of valves 2ND-19A and 2ND-4B, A Train Isolation in Suction From FWST, [EIIS:ISV]. This action realigns the ND system suction from the FWST to the Containment Sump. Control Room indications of water level in the containment sump and in the FWST, and associated level alarms from the FWST provides ample warning to OPS personnel to terminate the injection mode while the operating pumps taking suction from the FWST still have adequate net positive suction head.

Technical Specification (TS) 3.5.2 requires that two independent ECCS subsystems shall be operable with each subsystem comprised of:

- a. One operable centrifugal charging pump;
- b. One operable safety injection pump;
- c. One operable ND heat exchanger;
- d. One operable ND pump; and,
- e. An operable flow path capable of taking suction from the FWST on a safety injection signal and **automatically** transferring suction to the containment sump during the recirculation phase of the operation.
[Emphasis Added]

This TS is applicable in Modes 1 (Power Operation), 2 (Hot Standby), and 3 (Hot Shutdown).

The action statement for TS 3.5.2 states that with one ECCS subsystem inoperable, the inoperable subsystem must be restored to operable status within 72 hours, or the unit must be placed in at least Hot Standby within the next 6 hours and in Hot Shutdown within the following 6 hours.

Description of Event

On June 15, 1988, CMD personnel were implementing NSM MG-20658 on the switchgear logic for valves 2NI-185A and 2NI-184B. The NSM included changing the wiring configuration on the terminal block of these valves. CMD personnel performed the modification on valve 2NI-185A, and then began work on valve 2NI-184B. During the removal of the wiring on the terminal block for valve 2NI-184B, CMD personnel discovered wire no. 16 was connected to terminal no. 42 instead of terminal no. 44. The connection diagram CMD personnel were using indicated that wire no. 16 was supposed to be connected to terminal no. 44. CMD personnel documented the incorrect placement of wire no. 16 on Procedure IP/0/A/3090/02, Instrument and Electrical Troubleshooting. CMD personnel informed their supervisor of the misplaced wire. The CMD supervisor stated that he then informed the CMD Electrical Technical Support personnel of the misplaced wire; however, the CMD Electrical Technical Support personnel do not remember being informed about the misplaced wire. CMD Electrical Technical Support personnel did state that the documentation of the incorrectly placed wiring should have been discovered during a review of the NSM paperwork prior to it being sent to Quality Assurance (QA) personnel for review. The modification included placing wire no. 16 on terminal no. 31 as a part of the modification to the switchgear logic. This change corrected the wiring error.

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TEXT (if more space is required, use additional NRC Form 388A (9-82))

On June 27, 1988, during an audit of the NSM paperwork, QA personnel discovered the documentation of the discrepancy. QA personnel researched the drawing for the switchgear logic of valve ZNI-184B and determined that the switchgear logic to automatically close valve ZND-4B would not have operated with wire no. 16 connected to terminal no. 42. The misplaced wire made the automatic switchgear inoperable resulting in a violation of TS 3.5.2. On June 27, 1988, at 1000, QA personnel initiated a Problem Investigation Report (PIR) concerning the incorrect wiring. On July 22, 1988, Design Engineering (DE) personnel issued a memorandum addressing past operability concerns. DE personnel determined that the failure of valve ZND-4B to close automatically on switch over from the FWST to the containment sump did not constitute an operability concern.

Conclusion

This event has been assigned a cause of Personnel Error because CMD personnel apparently connected wire no. 16 to terminal no. 42 instead of terminal no. 44 on the actuator terminal block for valve ZNI-184B, because of a lack of attention to detail.

During this investigation, Work Request (WR) 94732 was determined to be the last WR that included work on the actuator terminal block of valve ZNI-184B and specifically wire no. 16. The WR was part of NSM package MG-20700 Rev. 2 which moved the Torque Switch Bypass from primary switches to the add-on-pack, and also replaced all jumper wires with environmentally qualified wire. WR 94732 was worked on between May 29, 1987 and June 6, 1987. The work was performed by Instrumentation and Electrical (IAE) CMD Support Technicians A and B.

Wire no. 16 was not part of the jumper wire change, but was disconnected and subsequently reconnected after the jumper wires were replaced with environmentally qualified wire. All the wires in the terminal block were removed to facilitate the jumper wire change out and subsequently replaced to ensure the wires in the terminal block were neatly arranged and not bent or crimped. CMD personnel used the Implementation of Independent Verification procedure, which shows wire no. 16 was removed from terminal no. 44, independently verified, subsequently reconnected to terminal no. 44, and independently verified. IAE CMD Support Technicians A and B stated that they did not remember the individual wiring but that it was possible that they could have made the wiring error. IAE CMD Support Technician B stated the working conditions were difficult and could have contributed to the error. NSM MG-20700 Rev. 2 was performed on night shift at approximately 0300. The shift started at 1900. IAE CMD Support Technicians A and B had been at work approximately eight hours at the time of the error.

IAE CMD Support Technicians A and B were Employee Training Qualification System qualified to perform the assigned task and routinely work on terminal blocks.

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TEXT IF MORE SPACE IS REQUIRED, USE ADDITIONAL NRC Form 388A (17)

This event has also been assigned a contributory cause of Design Deficiency because of a poor man/equipment interface. Valve ZNI-184B is located in the Unit 2 Auxiliary Building 716' elevation Mechanical Penetration room. The area is radioactively contaminated and is a High Radiation area. The terminal block is oriented with the cover facing towards the floor, approximately 18 inches from the floor. This location required IAE CMD Support Technicians A and B to work on the terminal block lying on their backs. Because the terminal block was facing the floor, lighting was poor. IAE CMD Support Technicians A and B used two flashlights to provide light to perform the work. Based upon the difficult conditions encountered, it is very likely IAE CMD Support Technicians A and B.

On October 3, 1988, IAE CMD Support Technician E submitted a Station Problem Report (SPR) concerning valve ZNI-184B, to request DE personnel to evaluate reorienting the actuator for valve ZNI-184B to make the terminal block more accessible.

This event has also been assigned a contributory cause of Management Deficiency because of a breakdown in the Functional Verification Program, Maintenance Management Procedure (MMP) 1.3. The existing Functional Verification Program did not clearly define the minimum functional verification requirements for a particular component. The functional verification for valve ZNI-184B consisted of a valve stroke timing test, and observing the valve indication while the valve was being cycled from the Control Room. The functional verification did not include testing of any interlocks. If the functional verification had included testing of the associated interlocks, the wiring error would have been discovered and the TS violation would not have occurred.

In April of 1987, INPO issued a finding concerning the Functional Verification Program at McGuire Nuclear Station. Maintenance personnel developed a new MMP section 1.6 to supersede MMP 1.3 in response to the finding. MMP 1.6 was approved in May of 1988 and implemented on October 1, 1988.

A review of McGuire Licensee Event Reports (LER) and station incident investigation reports revealed many past incidents involving TS violations attributed to Personnel Error because of a lack of attention to detail, Design Deficiency because of a difficult man/equipment interface, or Management Deficiency because of a lack of, or inadequate policy or directive. This event is, therefore, recurring. Also, there have been past incidents involving the Functional Verification Program. Station incident report M87-22-1 involved a short circuit in a valve actuator which was not detected by functional verification testing. IAE personnel have since modified their post-maintenance retest procedures for Rotork motor operated valves to check for short circuits on the terminal block. Also, LERs 369/86-12, 369/87-20, 369/87-27, and 369/88-06 involved components that underwent maintenance without a subsequent retest. The corrective actions were specific to the events and would not have prevented this event from occurring. Two reportable events (incident investigation nos. M88-052-1 and M88-054-1), currently under investigation possibly involve an inadequate Functional Verification Program.

LICENSEE EVENT REPORT (LER) TELETYPE CONTINUATION

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TEXT (if space is required, use additional NRC Form 266A's) (7)
This event is not reportable to the Nuclear Plant Reliability Data System (NPRDS).

CORRECTIVE ACTIONS:

Immediate: None

- Subsequent:
- 1) Based upon this incident and two other associated incidents, Project Services personnel reviewed all McGuire NSM packages to determine if adequate functional verification was performed. This action was completed and temporary test procedures where appropriate were written and additional functional verifications were performed as necessary.
 - 2) Maintenance personnel replaced MFG 1.3 with MMP 1.6, which defines the minimum functional verification requirements for a particular component. This was effective October 1, 1988.
 - 3) IAE CMD Support Technician B submitted an SPF to evaluate reorienting the actuator and terminal block for valve 2NI-184B on October 3, 1988.

- Planned:
- 1) IAE Management personnel will review this incident with all IAE personnel. Good work practices and strict adherence to procedures will also be stressed.
 - 2) IAE Management personnel will review all WRs which involved safety related motor operated valve actuator work since the last Engineered Safety Features test on both Unit 1 and Unit 2 for documentation of adequate functional verifications. For deficient functional verification documentation, IAE personnel will initiate a WR to verify the components in question.
 - 3) IAE Management personnel will head a task force to study the McGuire Retest and Functional Verification Programs to ensure no gaps exist between them.
 - 4) IAE Management personnel have submitted changes to procedure IP/0/A/3066/02A, Installation, Removal, and Set-up of Rotork Actuators, including sign off requirements for all limit switches and associated interlocks and/or automatic signals and to state the method used to functionally verify each individually.

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TEXT (if more space is required, use additional NRC Form 268A 2/17)

- 5) CMD Management personnel will review this incident with CMD electrical and electrical technical support personnel. Importance of proper reporting of discrepancies will be stressed.

SAFETY ANALYSIS:

The ND system automatic switch over sequence from the injection mode to the cold leg recirculation mode causes valve 2NI-184B to open, then automatically initiates closure of valve 2ND-4B. This operation isolates the FWST and aligns ND pump suction to the containment sump. The incorrectly wired interlock would have prevented the automatic closure of valve 2ND-4B.

The failure of valve 2ND-4B to close automatically on switch over does not constitute a safety concern since the resulting rate of emptying the FWST is bounded by the worst case failure which was assumed in calculating the FWST level set points. McGuire Final Safety Analysis Report (FSAR) Table 6.3.2-3B indicates the switch over from FWST injection to cold leg recirculation would begin at the low level set point of the FWST. The volume remaining in the FWST at this time is 117,094 gallons. With both trains of the ND pumps, Containment Spray [EIIS:BE] pumps, Chemical and Volume Control [EIIS:CB] pumps, and Safety Injection pumps taking suction from the FWST it would take approximately six minutes for the FWST to be drained to the low-low level set point of 13,121 gallons. OPS personnel should have ample time to complete the switch over manually from the Control Room.

To verify the switch over, OPS personnel using procedure EP/2/A/5000/2.3, Transfer To Cold Leg Recirculation, would verify the ND pump suction was aligned to the containment sump. The procedure directs OPS personnel to manually close valve 2ND-4B if it has not closed automatically. If valve 2ND-4B cannot be closed, the Transfer To Cold Leg Recirculation procedure directs OPS personnel to stop pump ND 1B and close valve 2NI-184B. The procedure subsequently directs OPS personnel to close valve 2FW-27A, FWST supply to ND, isolating the FWST upstream of valve 2ND-4B.

Although automatic switch over from the injection mode to cold leg recirculation was inoperable, OPS personnel would initiate action to close valve 2ND-4B. Therefore, the safety injection function remained operable. [Emphasis Added]

During the time the wire was on the wrong terminal point, there were no activations of the EOCs.

There were no personnel injuries, radiation 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.



DUKE POWER

October 12, 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 370/88-10

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 370/88-10 concerning a Unit 2 containment sump isolation valve switchgear logic wire being incorrectly wired. This report is being submitted in accordance with 10CFR 50.73(a) (2) (i) (B). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

A handwritten signature in cursive script that reads "Hal B. Tucker".

Hal B. Tucker

SEL/347/rmf

Attachment

xc: Dr. J. Nelson Grace
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta St., NW, Suite 2900
Atlanta, GA 30323

INFO Records Center
Suite 1500
1160 Circle 75 Parkway
Atlanta, GA 30339

M&M Nuclear Consultants
1221 Avenue of the Americas
New York, NY 10020

American Nuclear Insurers
c/o Dottie Sherman, ANI Library
The Exchange, Suite 245
270 Farmington Avenue
Farmington, CT 06032

Mr. Earl Hood
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Mr. P.K. Van Doorn
NRC Resident Inspector
McGuire Nuclear Station

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bx: P.M. Abraham
B.W. Bline
D.R. Bradshaw
R.M. Dulin
H.E. Edwards
R.C. Futrell
R.M. Glover (CNS)
G.W. Hallman
C.L. Harlin (ONS)
A.D. Harrington (PSD)
J.J. Maher
R.P. Ruth (MNS)
A.R. Sipe (MNS)
R.O. Sharpe (MNS)
J.E. Thomas
J.B. Turner
J.L. Weber
QA Tech. Services NRC Coordinator (EC 12/55)
S.S. Kilborn (W)
R.L. Gill
S.A. Gewehr
P.B. Nardoci
MC-815-04
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