



REGIS T. REPKO
Vice President
McGuire Nuclear Station

Duke Energy
MG01VP / 12700 Hagers Ferry Rd.
Huntersville, NC 28078

980-875-4111
980-875-4809 fax
regis.repko@duke-energy.com

March 26, 2010

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

Subject: McGuire Nuclear Station, Unit 2
Docket No. 50-370
Licensee Event Report 370/2010-001, Revision 0
Problem Investigation Process No. M-10-00260

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 370/2010-001, Revision 0, regarding the inability to initiate the Unit 2 Safety Injection Diesel Generator actuation safety function and the Unit 2 Containment Spray safety function due to a loose bus bar connection in an electrical panel board serving one train of vital equipment concurrent with maintenance on the redundant train.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(v)(D), "Event or Condition That Could Have Prevented Fulfillment of a Safety Function Needed to Mitigate an Accident". This event is considered to be of no significance with respect to the health and safety of the public. There are no regulatory commitments contained in this LER.

Please contact Julius Bryant at 980-875-4162 with any questions related to this report.

Very truly yours,

Regis T. Repko

Attachment

IEZZ
NRR

U.S. Nuclear Regulatory Commission

March 26, 2010

Page 2 of 2

cc: L. A. Reyes
Administrator, Region II
U.S. Nuclear Regulatory Commission
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303

J. H. Thompson
Project Manager (McGuire)
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738
Mail Stop O-8 G9A

J. B. Brady
NRC Senior Resident Inspector
McGuire Nuclear Station

B. O. Hall, Section Chief
North Carolina Department of Environment and Natural Resources
Division of Environmental Health
Radiation Protection Section
1645 Mail Service Center
Raleigh, NC 27699-1645

1. FACILITY NAME McGuire Nuclear Station, Unit 2	2. DOCKET NUMBER 05000- 0370	3. PAGE 1 OF 7
--	--	--------------------------

4. TITLE
Loose connection in a panel board serving a Solid State Protection System Train concurrent with redundant train maintenance could have prevented fulfillment of a safety function.

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	19	2010	2010	- 001	0	03	26	2010	None	

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)												
	10. POWER LEVEL 100		<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)
		<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
		<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Julius W. Bryant, Regulatory Compliance	TELEPHONE NUMBER (Include Area Code) 980-875-4162
--	--

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	JC	CON	N080	YES					

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

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

Unit Status: At the time of the event, Units 1 and 2 were in Mode 1 at 100% power.

Event Description: From approximately 1907 hours to 1938 hours on January 19, 2010, the Control Room received intermittent annunciators and bi-stable indications. Investigation determined this was due to power cycling off and on to some loads served by 120VAC Vital I&C panel board 2EKVA. One load affected was Channel 1 of Train A of the Unit 2 Solid State Protection System (SSPS). While power was removed from this Channel, Train A would have been incapable of generating an Engineered Safety Features Actuation System signal. Concurrent with the cycling of power to Channel 1 of Train A of Unit 2 SSPS, the 2B Train of Containment Spray (NS) and the 2B Diesel Generator (DG) were inoperable for scheduled maintenance. The above conditions could have delayed initiation of the Unit 2 safety injection DG actuation and the Unit 2 NS safety functions. McGuire is reporting this as a condition that could have prevented fulfillment of a safety function needed to mitigate the consequences of an accident.

Event Cause: Fabrication deficiency caused a loose bus bar connection in panel board 2EKVA which rendered Train A of Unit 2 SSPS inoperable concurrent with maintenance on the redundant train.

Corrective Actions: Moved Unit 2 SSPS Train A Channel 1 power to another 2EKVA breaker. Maintenance procedure for Unit 1 & 2 120VAC/125VDC Vital I&C panel boards was revised to ensure these panels are adequately inspected for loose bus bar connections. Inspections of panel connections are planned and, based upon results, replacement of these panel boards will be considered.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		OF	
McGuire Nuclear Station, Unit 2	05000370	2010	001	00	2	OF	7

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

BACKGROUND

The following information is provided to assist readers in understanding the event described in this LER. Applicable Energy Industry Identification [EIIS] system and component codes are enclosed within brackets. McGuire unique system and component identifiers are contained within parentheses.

The Solid State Protection System [JC] (SSPS) consists of two trains (A and B), each consisting of four input channels (I, II, III, and IV), a logic train, and an output train. In response to SSPS input signals satisfying the applicable SSPS logic, slave relays in SSPS will actuate as needed a reactor trip and the following safety functions via an Engineered Safety Features Actuation System [JE] (ESFAS) signal:

- Safety Injection [BQ] (NI), including emergency diesel generator [EK] (DG) actuation
- Containment Spray [BE] (NS)
- Phase A and Phase B Containment Isolation
- Containment Ventilation Isolation
- Steam Line Isolation
- Main Feedwater Isolation
- Steam Dump Interlock
- Turbine Generator Trip
- Auxiliary Feedwater Automatic Start
- Automatic Switchover of Emergency Core Cooling Water to the Containment Sump
- Containment Air Return and Hydrogen Skimmer Fans

SSPS also provides Control Room annunciator, status light, and computer input signals which indicate the condition of bistable input signals, partial trip and full trip functions and the status of the various blocking, permissive and actuation functions.

Each SSPS Train is powered through fuses from the appropriate 120 VAC Vital I&C [EF] (EPG) panel board. The EPG panel board supply for Channel 1 of SSPS Train A provides power for the A Train slave relays. The EPG panel board supply for Channel 4 of SSPS Train B provides the power for the B Train slave relays.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
McGuire Nuclear Station, Unit 2	05000370	2010	001	00	3	OF 7

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

EVENT DESCRIPTION

On January 15, 2010 at approximately 1629 hours, the Control Room received ten annunciators and bi-stable lights. These indications cycled on and off for a period of approximately ten minutes and then remained off. During the period of time these indications were cycling on and off, no abnormal plant or equipment transients occurred. A failure investigation team was established to perform troubleshooting, evaluate plausible failure modes, and determine the failure cause.

On January 19, 2010 at approximately 1907 hours, during troubleshooting related to the January 15, 2010 indications, the Control Room received twelve annunciators and bi-stable lights. These indications cycled on and off until approximately 1938 hours and then remained off. Ten of these annunciators and bi-stable lights were identical to the indications received on January 15, 2010. During the period of time these indications were cycling on and off, no abnormal plant or equipment transients occurred.

On January 20, 2010, based upon evidence gathered to date, including the fact that the annunciators and bi-stable lights were associated with circuits receiving power from Unit 2 EPG panel board 2EKVA, the failure investigation team measured voltages and currents, performed thermography scans, and implemented visual inspections of panel board 2EKVA. Although these activities did not identify any abnormalities, they did identify a common bus bar connection on both the line side and the neutral side of panel board 2EKVA breakers 3 and 4. A thorough inspection of this connection was hampered since these breakers were energized and the connection was difficult to see.

On January 21, 2010, a critical activity plan was approved which provided for isolating power to Unit 2 EPG panel board 2EKVA breakers 3 and 4 to facilitate a thorough inspection of the common bus bar connection identified on January 20, 2010. As part of this inspection, this connection was to be checked for tightness.

On January 22, 2010 at 1312 hours, while preparing to implement the critical activity plan, the Control Room received multiple annunciators and bi-stable lights similar to those received on January 15, 2010 and January 19, 2010. These indications cycled on and off until approximately 1324 hours. During the period of time these indications were cycling on and off, no abnormal plant or equipment transients occurred.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
McGuire Nuclear Station, Unit 2	05000370	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 7	
		2010	- 001	- 00		

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

On January 22, 2010, while performing inspections of Unit 2 EPG panel board 2EKVA breakers 3 and 4 as per the critical activity plan, it was observed that the neutral connection under breaker 4, between the main bus bar and the bus connector piece for breakers 3 and 4 was significantly loose. The screw associated with this connection had backed out to the point that the bus bar connector piece was no longer making firm contact with the main bus bar.

On January 22, 2010, a modification was implemented which moved the electrical power cables previously connected to Unit 2 EPG panel board 2EKVA breakers 3 and 4 to previously spare breakers 24 and 9 on panel board 2EKVA.

On January 25, 2010, a reportability evaluation was initiated after investigation determined the intermittent annunciators and bi-stable indications received on January 15, 2010, January 19, 2010, and January 22, 2010 occurred concurrent with power to Channel 1 of Train A of Unit 2 SSPS cycling off and on as a result of the loose bus bar connection common to Unit 2 EPG panel board breakers 3 and 4.

On January 26, 2010, it was discovered that while power to Channel 1 of Train A of Unit 2 SSPS was cycled off, none of the slave relays associated with Train A would have been capable of generating an ESFAS signal if needed, which would have prevented initiation of the Unit 2 Train A ESFAS related safety functions.

On January 26, 2010, a review was performed to identify Unit 2 Train B equipment that was inoperable during the periods of time on January 15, 2010, January 19, 2010, and January 22, 2010 when power to Channel 1 of Train A of Unit 2 SSPS was cycling off and on. This review identified that, due to scheduled maintenance, the Unit 2 NS Train B safety function and the Unit 2 Train B safety injection DG actuation safety function were inoperable during the period of time on January 19, 2010 when power to Channel 1 of Train A of Unit 2 SSPS was cycling off and on (approximately 1907 hours to 1938 hours). During this period of time, if SSPS had attempted to initiate the Unit 2 NS safety function and the Unit 2 safety injection DG actuation safety function while Channel 1 of Train A power was cycled off, fulfillment of these safety functions would have been delayed for a period of time that would not support the assumptions and conclusions of the applicable safety analyses. This represented a condition that could have prevented the fulfillment of a safety function needed to mitigate the consequences of an

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
McGuire Nuclear Station, Unit 2	05000370	2010	- 001	- 00	5	OF 7

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

accident, which is reportable as per the requirements of 10 CFR 50.73(a)(2)(v)(D). Note, when power to Channel 1 cycled back on, SSPS contacts associated with the Unit 2 NS Train A safety function and the Unit 2 Train A safety injection DG actuation safety function would have latched in and these functions would have initiated. Upon latch in, these Train A safety functions would have continued as needed even if power to Channel 1 of Train A of Unit 2 SSPS had cycled back off.

CAUSAL FACTORS

The cause of the intermittent loss of power to Channel 1 of Train A of Unit 2 SSPS was a manufacturer fabrication deficiency. Specifically, a degraded connection under EPG panel board 2EKVA breaker 4, between the main bus bar and the breaker to bus bar connector for breakers 3 and 4, had developed an intermittent loose connection. This loose connection occurred when the connecting screw that holds the bus connector piece to the main bus bar backed out of the threaded hole in the main bus bar. Either the screw was not tightened properly initially or it was not designed/fabricated with sufficient locking mechanisms to prevent it from backing out over time. This connection is inaccessible without removing the breakers and it is difficult to see. This screw loosened to the point where the electrical continuity of the bus bar connection was lost, thereby causing a loss of power to Channel 1 of Train A of Unit 2 SSPS. Upon losing electrical continuity, the increased resistance across the degraded bus bar connection caused temperature to increase, restoring the electrical continuity of the connection which restored the power supply to Channel 1 of Train A of Unit 2 SSPS. Subsequent load fluctuations resulted in a decrease in resistance across the bus bar connection causing the temperature of the connection to drop causing the bus bar connection to lose electrical continuity, again causing a loss of power to Channel 1 of Train A of Unit 2 SSPS. This cyclic loss and restoration of electrical continuity at the bus bar connection for EPG panel board 2EKVA breaker 4 resulted in the intermittent loss of power to Channel 1 of Train A of Unit 2 SSPS.

Contributing Causes:

A contributing cause to this event was inadequate preventive maintenance on Unit 2 EPG panel board 2EKVA. A preventive maintenance (PM) procedure for the panel board provided for periodic inspection of the panel board for loose connections. However, the PM procedure did not provide specific inspection instructions for connections that were difficult to see, or not

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2010	- 001	- 00	6 OF 7

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

shown on the applicable vendor documents, as in the case of the degraded bus bar connection common to breakers 3 and 4 of EPG panel board 2EKVA. Therefore, whenever the PM was performed on panel board 2EKVA, the connection common to breakers 3 and 4, which was difficult to see, was not inspected for a loose connection.

CORRECTIVE ACTIONS

Immediate:

1. Implemented a modification which moved the power supply for Channel 1 of Train A of Unit 2 SSPS from breaker 4 on Unit 2 EPG panel board 2EKVA to previously spare breaker 9 on that panel board. As part of this modification, the tightness of the breaker 9 bus bar connections was verified prior to placing the breaker back in service.

Subsequent:

1. The PM procedure which provides for periodic inspection of the Unit 1 & 2 120VAC/125VDC Vital I&C panel boards was revised to ensure bus bar connections (including those bus bar connections that are inaccessible, difficult to see, or not shown on the applicable vendor documents) are adequately checked for loose connections.

Planned:

1. Starting with Unit 1 outage 1EOC20 (currently in progress) and the next Unit 2 outage (2EOC20), inspections of bus bar connections on the Unit 1 & 2 120VAC/125VDC Vital I&C panel boards for loose connections are planned. To date, 1EOC20 inspections of panel board bus bar connections have not identified any findings of significance.
2. Based upon results of the planned bus bar inspections of the Unit 1 & 2 120VAC/125VDC Vital I&C panel boards, modifications to replace these panel boards will be considered. If these modifications are implemented, bus bar connections in the new panel boards will be designed and fabricated to prevent loosening, or designed for better accessibility or viewing.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
McGuire Nuclear Station, Unit 2	05000370	2010	001	00	7	OF 7

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

SAFETY ANALYSIS

On January 19, 2010, from approximately 1907 hours to 1938 hours, if Unit 2 SSPS had attempted to initiate the Unit 2 NS safety function and the Unit 2 safety injection DG actuation safety function while Channel 1 of Train A of Unit 2 SSPS power was cycled off, fulfillment of these safety functions would have been delayed for a period of time which would not support the assumptions and conclusions of the applicable safety analyses. Note, when power to Channel 1 cycled back on, SSPS contacts associated with the Unit 2 NS Train A safety function and the Unit 2 Train A safety injection DG actuation safety function would have latched in and these functions would have initiated. Upon latch in, these Train A safety functions would have continued as needed even if power to Channel 1 of Train A of Unit 2 SSPS cycled back off. The longest period of time that power to Channel 1 of Train A of Unit 2 SSPS was cycled off between 1907 hours and 1938 hours on January 19, 2010 was approximately 2.25 minutes. This represents the longest duration of time on that date where fulfillment of the Unit 2 NS safety function and the Unit 2 safety injection DG actuation safety function would not have occurred if needed.

A risk-informed approach was used to determine the significance associated with unavailability of Train A of Unit 2 SSPS and coincident unavailability of the Unit 2 NS Train B and the Unit 2 B Train DG. Conservatively, the unavailability duration used in this analysis was assumed to be 31 minutes (from approximately 1907 hours to 1938 hours on January 19, 2010). Due to the short duration of unavailability of Train A of Unit 2 SSPS, the Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) associated with this event are negligible, based on being less than 1E-8 and 1E-9, respectively.

Given the above, this event is considered to be of no significance with respect to the health and safety of the public.

ADDITIONAL INFORMATION

To determine if a recurring or similar event exists, a search of the McGuire Problem Identification Process (PIP) database was conducted for a time period covering 5 years prior to the date of this event. Based on Duke's definition of a recurring event, similar significant event with the same cause code, no recurring events were identified.