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Serial No: RA-21-0293
November 10, 2021

10 CFR 50.73

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

Subject: Duke Energy Carolinas, LLC
McGuire Nuclear Station, Unit 2
Docket No. 05000370
Renewed License No. NPF-9, NPF-17
Licensee Event Report 2021-01, Revision 0
Nuclear Condition Report Number 02397398

Pursuant to 10 CFR 50.73 Section (a)(2)(iv)(A), attached is Licensee Event Report (LER) 2021-01, Revision 0, regarding valid actuations of the 2B Emergency AC Electrical Power System and B Train Auxiliary Feedwater (AFW) System.

This event is considered to have no significance with respect to the health and safety of the public. There are no regulatory commitments contained in this LER.

If questions arise regarding this LER, please contact Jeff Thomas at 980-875-4499.

Sincerely,

Thomas D. Ray
Site Vice President
McGuire Nuclear Station

Attachment

cc:

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NRC FORM 366 (08-2020) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2023

LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)
(See NUREG-1022, R.3 for instruction and guidance for completing this form
http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name	2. Docket Number	3. Page
McGuire Nuclear Station Unit 2	05000370	1 OF 5

4. Title

Valid Actuations of the Unit 2 B Train Emergency AC Power System and B Train Auxiliary Feedwater System

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
09	13	2021	2021	01	00	11	10	2021	Facility Name	Docket Number

9. Operating Mode	10. Power Level
Mode 5 Cold Shutdown	000

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)(i)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Jeff Thomas, McGuire Regulatory Affairs	980-875-4499

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS		Cause	System	Component	Manufacturer	Reportable to IRIS
B	JE	PL		Y						

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☒ No	☐ Yes (If yes, complete 15. Expected Submission Date)				

16. Abstract

On 9-13-21, at approximately 0011 hours, Unit 2 was in Mode 5 (Cold Shutdown), when valid actuations of the 2B Emergency AC Electrical Power System and 2B Auxiliary Feedwater (AFW) System occurred during Engineering Safety Features Actuation System (ESFAS) testing. During restoration from a portion of the test, the 2B Diesel Generator (DG) Load Sequencer blackout (BO) logic inadvertently actuated while resetting the 2B DG Load Sequencer. At the time, the 2B DG was operating in standby and the 2ETB Essential 4160 Volt Switchgear was energized by offsite power. The inadvertent BO circuitry actuation de-energized 2ETB which sealed in the load sequencer BO logic. 2ETB was load shed, the 2B DG breaker closed, and the BO loads, including the 2B Motor Driven AFW Pump, were loaded in their proper sequence. Offsite power was restored to 2ETB and the 2B DG and 2B Motor Driven AFW Pump were secured per procedure.

The DG Load Sequencer BO logic was inadvertently actuated prior to the blocking circuit preventing actuation due to a latent design error which introduced a design margin vulnerability within the load sequencer BO circuitry. This vulnerability is also applicable to the 1A, 1B, and 2A DG Load Sequencers. Engineering Changes (ECs) which eliminate the design margin vulnerability were implemented on the 2A and 2B DG Load Sequencers and are planned to be implemented on the 1A and 1B DG Load Sequencers. Also, a compensatory action was implemented on Unit 1 which mitigates the design margin vulnerability until the ECs are implemented. There was no impact on the health and safety of the public or plant personnel.

BACKGROUND

The following system and component 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 Nuclear Station unique system and component identifiers are contained within parentheses.

Engineered Safety Feature Actuation System, Diesel Generator Load Sequencer [JE] (EQB)

The engineered safety features actuation system includes the instrumentation and control components, modules, and other equipment that operates to maintain plant parameters within acceptable limits during a design basis event. Typically, the engineered safety features actuation system initiates emergency negative radioactivity insertion, post-accident heat removal, emergency core cooling, post-accident radioactivity removal, and containment isolation.

The Diesel Generator Load Sequencer System functions to energize the necessary blackout (BO) and/or safety injection (SI) loads in a prescribed sequence and in such a manner so as not to momentarily overload the diesel generator or auxiliary transformer. The Diesel Generator (DG) Load Sequencer has three modes of operation: SI concurrent with a BO, SI only, and BO only. During SI concurrent with a BO and SI only, the DG Load Sequencer BO logic should remain blocked to prevent inadvertent actuation.

Diesel Generator Control System [EK] (EQC)

The Diesel Generator Control System consists of the electrical controls and instrumentation necessary for starting and operating each of the four emergency diesel generators at McGuire Nuclear Station. The DGs provide power to the train specific 4160 Volt bus in the event of a loss of power to the bus.

Also, during a SI actuation, the DGs are operated in standby in case a BO occurs. The 4160 Volt bus provides power to equipment essential for safe shutdown of the plant during a design basis event. McGuire has two emergency DGs per unit.

Auxiliary Feedwater System [BA] (CA):

The Auxiliary Feedwater System (AFW) automatically supplies feedwater to the steam generators (S/Gs) to remove decay heat from the Reactor Coolant System upon the loss of normal feedwater supply. The AFW System mitigates the consequences of any event with loss of normal feedwater. The design basis of the AFW System is to supply water to the Steam Generators (SGs) to remove decay heat and other residual heat by delivering at least the minimum required flow rate to the SGs.

NARRATIVE

The AFW Motor Driven Pumps will automatically provide feedwater when initiated on any of the following conditions:

- Trip of both main feedwater pumps
- AMSAC Actuation (AMSAC - Anticipated Transient Without Scram (ATWS) Mitigation System Activation Circuitry)
- Two out of four (2/4) low-low level alarms in any one SG
- Initiation of a SI signal
- Loss of power to the 4160V essential bus (BO)

The Turbine Driven AFW Pump will automatically provide feedwater when initiated on any of the following conditions:

- Two out of four (2/4) low-low level in any two SGs
- One out of one (1/1) low-low level in any two SGs (SSF Instrumentation)
- Loss of power to the 4160V essential bus (BO)

The Turbine Driven AFW Pump will not start on a BO signal coincident with or while a SI signal is present.

EVENT DESCRIPTION

At the time of this event, Unit 1 was operating in Mode 1 at approximately 100 percent power. Unit 2 was in Mode 5 (Cold Shutdown) during a planned refueling outage and Periodic Test PT/2/A/4200/009 B, Engineered Safety Features Actuation Periodic Test Train B, was in progress. There were no structures, systems, or components out of service at the time of this event that contributed to this event.

Review of the Operator Aid Computer (OAC) event log revealed that the BO logic was inadvertently actuated during load sequencer reset from both the SI concurrent with a BO portion of the test and the SI only portion of test.

During performance of the SI only portion of the test on September 13, 2021, at approximately 0011 hours, the 2ETB Essential 4160 Volt Switchgear was being energized by offsite power. The 2B DG was running due to the SI actuation but was not aligned to 2ETB. During reset of the 2B DG Load Sequencer, the BO logic inadvertently actuated while resetting the 2B DG Load Sequencer. The inadvertent BO circuitry actuation de-energized the 2ETB Switchgear which sealed in the load sequencer BO logic. The 2ETB Switchgear was load shed, the 2B DG breaker closed, and the BO loads, including the 2B Motor Driven AFW Pump, were loaded in their proper sequence. Offsite power was restored to the 2ETB Switchgear and the 2B DG and the 2B Motor Driven AFW Pump were secured by procedure.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
McGuire Nuclear Station Unit 2	05000- 370	2021	01	00

NARRATIVE

Further review of the OAC event log during performance of the causal evaluation revealed that the BO Logic was inadvertently actuated during performance of the SI concurrent with a BO portion of the test on September 12, 2021. At approximately 2216 hours, the 2ETB Incoming Breakers were already open and 2ETB was being energized by the 2B DG. Since 2ETB was being energized by the 2B EDG, a blackout of 2ETB did not occur. However, Turbine Driven Auxiliary Feedwater Steam Supply Valves 2SA-48ABC and 2SA-49AB opened when the 2B DG Load Sequencer was reset, indicating that the BO logic was inadvertently actuated.

There were no issues associated with the actuation function of the 2B DG Load Sequencer during the SI concurrent with BO portion or the SI only portion of the test. Actuation of the 2B Emergency AC Electrical Power System and the AFW System occurred while resetting the 2B DG Load Sequencer following performance of those portions of the test.

REPORTABILITY

The unplanned actuations of the 2B Emergency AC Electrical Power System and the 2B AFW System were reported within 8 hours of discovery in accordance with 10 CFR 50.72(b)(3)(iv)(A), "Any event or condition that results in valid actuation of any of the systems listed in paragraph (b)(3)(iv)(B) of this section except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation." Furthermore, this LER satisfies the corresponding 60 day reporting criteria specified in 10 CFR 50.73 (a)(2)(iv)(A), "Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)." The applicable 10 CFR 50.73(a)(2)(iv)(B) systems include the Emergency AC Electrical Power System and the Auxiliary Feedwater System.

CAUSAL FACTORS

The DG Load Sequencer BO logic inadvertently actuated during the load sequencer reset prior to the blocking circuit preventing BO actuation during the SI concurrent with a BO portion of the test and the SI only portion of test. The cause was determined to be a latent design error which introduced an unrecognized design margin vulnerability within the load sequencer BO circuitry. Specifically, the sequencing between the SI blocking reset and BO circuitry reset only provided approximately 5 milliseconds of margin. During the Unit 2 Spring 2020 refueling outage, the original EE(TRB3t) D87 timer was replaced per Equivalency Engineering Changes (EQVR-ECs 416095 & 417012). The original part was a Cutler-Hammer D87 timer and the replacement part was a Curtiss-Wright D87 timer. As part of the causal determination process, the pickup times for an original Cutler-Hammer D87 timer and new Curtiss-Wright D87 timers were determined using a high-speed recorder bench testing. The output of the original Cutler-Hammer D87 timer was instantaneous with no delay between the input and output of the timer. The new Curtiss-Wright D87 timer had a delay of approximately 15 milliseconds between the input and output of the timer. The lack of design margin and longer pickup time of the new Curtiss-Wright D87 timer resulted in the blackout logic inadvertently actuating during reset from a SI concurrent with a BO or SI only.

NARRATIVE

CORRECTIVE ACTIONS

Once the latent design error was identified, Engineering Change (EC) 420097 was developed to resolve the design vulnerability. A contact from reset relay EB(RRB) was added to the blackout circuitry which resolved the design margin issue and eliminated the reliance of the EE(TRB3t) pickup time. This eliminates the relay race when resetting the sequencer by providing a direct circuit for contact opening to prevent the BO logic from being satisfied when the Load Sequencer Reset Push Button is depressed. EC 420097 was implemented on the 2A and 2B DG Load Sequencers during the Fall 2021 Refueling Outage and EC 420121 is planned to be implemented on the Unit 1 (1A and 1B) DG Load Sequencers. Furthermore, a compensatory action has been implemented for the 1A and 1B DG Load Sequencers until EC 420121 is implemented. The compensatory action opens and re-closes the load sequencer control power breaker instead of pressing the Load Sequencer Reset Pushbutton. The compensatory action mitigates the design margin vulnerability in the load sequencer blackout circuitry.

SAFETY ANALYSIS

The safety system actuations had no actual adverse impacts to the plant since the 2B ESFAS train was out of service for testing. If an actual SI event had occurred, the load sequencer would have actuated as designed and applied the SI loads. Due to the identified sequencer reset circuitry problem, when Operations reset the sequencer it would have load shed the essential buses and loaded the blackout-related loads. In accordance with Emergency Procedures, Operations would have de-energized the sequencer to gain control of equipment and would have manually started (or stopped) the SI loads.

The impact of the load sequencer reset problem has been evaluated to be low risk. The evaluation included Loss of Coolant Accidents, Steam Generator Tube Ruptures and Spurious SI actuations which would result in reliance on emergency DGs post-sequencer reset as the essential buses would not be connected to the normal offsite power supply. However simultaneous loss (failure) of both emergency DGs is unlikely and operators can reconnect the bus to normal plant power sources, if needed. As a result, the increase in CDF is estimated to be less than 1E-06/year. Therefore, it is concluded that this event did not impact the health and safety of the public or plant personnel.

ADDITIONAL INFORMATION

A review of the McGuire corrective action program was conducted to determine if this was a recurring event (i.e., similar event with the same cause code). No previous similar events were identified within the past five years associated with system actuations caused by a design margin vulnerability. Therefore, this is not considered a recurring event.