



Steven M. Snider
Vice President
Oconee Nuclear Station

Duke Energy
ON01SC | 7800 Rochester Hwy
Seneca, SC 29672

o. 864.873.3478
f. 864.873.5791
Steve.Snider@duke-energy.com

RA-22-0132

April 14, 2022

10 CFR 50.73

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2746

Duke Energy Carolinas, LLC
Oconee Nuclear Station Unit 2
Docket Number: 50-270
Renewed Operating Licenses: DPR-49

Subject: Licensee Event Report 270/2022-002, Revision 00 – Automatic Actuation of
Emergency Feedwater System due to Main Feedwater Pump Malfunction

Licensee Event Report 270/2022-002, Revision 00, is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

There are no regulatory commitments associated with this LER.

There are no unresolved corrective actions necessary to restore compliance with NRC requirements.

If there are questions, or further information is needed, contact Laura Boyce, Regulatory Affairs, at (864) 873-6774.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven M. Snider", written in a cursive style.

Steven M. Snider
Vice President
Oconee Nuclear Station

Enclosure: Licensee Event Report 270/2022-002 Rev.00

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Page 2

cc (w/Enclosure):

Ms. Laura Dudes, Administrator, Region II
U.S. Nuclear Regulatory Commission
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, GA 30303-1257

Mr. Shawn Williams, Project Manager
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop O-08B1A
Rockville, MD 20852-2738

Mr. Adam Ruh (Acting)
NRC Senior Resident Inspector
Oconee Nuclear Station



LICENSEE EVENT REPORT (LER)

(See Page 2 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/nureqs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oira_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. Facility Name Oconee Nuclear Station Unit 2	2. Docket Number 0500000270	3. Page 1 OF 4
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4. Title
Automatic Actuation of Emergency Feedwater System due to Main Feedwater Pump Malfunction

5. Event Date			6. LER Number		7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name
02	13	2022	2022	002	00	04	14	2022	NA
									Docket Number 05000
									Facility Name NA
									Docket Number 05000

9. Operating Mode 3	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)
	<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(x)
10. Power Level 0	<input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> 73.77(a)(1)
	<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)(D) <input type="checkbox"/> 73.77(a)(2)(ii)
	<input type="checkbox"/> 20.2203(a)(2)(vi) <input type="checkbox"/> 50.73(a)(2)(i)(B) <input type="checkbox"/> 50.73(a)(2)(vii) <input type="checkbox"/> 73.77(a)(2)(iii)
	<input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> Other (Specify in Abstract below or in NRC Form 366A)

12. Licensee Contact for this LER	
Licensee Contact Laura Boyce, Senior Nuclear Engineer, Oconee Regulatory Affairs	Telephone Number (Include Area Code) (864) 873-6774

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
N/A					N/A				

14. Supplemental Report Expected <input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date) <input checked="" type="checkbox"/> No	15. Expected Submission Date Month: Day: Year:
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Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

At 16:25 Eastern Standard Time on 2/13/2022, with Oconee Nuclear Station (ONS) Unit 2 in Mode 3 at 0 percent power and plant heat up to normal operating temperature in progress, an actuation of the Emergency Feedwater (EFW) system occurred. The 2A and 2B motor driven Emergency Feedwater (MDEFW) pumps automatically started as designed when the "low steam generator level" signal was received for the 2A and 2B Steam Generators (SG). The 2A Main Feedwater (FDW) pump speed controller failed to raise pump speed as Main Steam (MS) system pressure increased during plant heat up. A fault state in the 2A FDW pump speed controls prevented the pump from responding to demand inputs from the Integrated Control System, resulting in the pump operating at a constant speed. Following reset of the 2A FDW pump speed controls, the MDEFW pumps were secured, and Unit 2 startup was resumed. Procedure improvements were identified to include specific checks for FDW pump speed control faults prior to placing each FDW pump in service. Units 1 and 3 were not affected by this event.

This event was reported to the NRC on March 23, 2022, in Event Notification (EN) number 55800, as a 8-hour notification under 10 CFR 50.72(b)(3)(iv)(A) – Specified System Actuation (EFW). The event is also reportable under 10 CFR 50.73(a)(2)(iv)(A) as an EFW system actuation.



**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/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oira_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Oconee Nuclear Station Unit 2	0500000270	2022	002	00

NARRATIVE

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].

BACKGROUND

The Main Feedwater (FDW) system [SJ] receives water from the Condensate System [SD], increases the water's pressure using the turbine driven FDW pumps [P], increases the water's temperature using the high-pressure feedwater heaters, and controls the FDW flow supplied to the Steam Generators (SG) using the FDW main and startup control valves. The FDW pumps [P] and control valves [FCV] are controlled by the Integrated Control System (ICS) [JA]. FDW pump speed is controlled automatically by the ICS to maintain a constant differential pressure across the FDW main and startup control valves.

The Emergency Feedwater (EFW) [BA] system automatically supplies feedwater to the SG to remove decay heat from the Reactor Coolant System (RCS) [AB] upon the loss of FDW. The EFW system consists of two motor driven EFW (MDEFW) pumps [P] and one turbine driven EFW (TDEFW) pump [P], any one of which can provide the required heat removal capability. The three EFW pumps are started automatically upon a loss of both FDW pumps or a signal from the Anticipated Transient Without Scram (ATWS) Mitigation System Actuation Circuitry (AMSAC). The two MDEFW pumps are also started automatically upon a "low steam generator level" signal [JB].

EVENT DESCRIPTION

On 2/13/2022, Unit 2 was in Mode 3 at 0 percent power and plant heat up to normal operating temperature in progress. 2A FDW pump was in service operating at minimum speed with speed control in automatic generating approximately 800 psig discharge pressure. With RCS heat up to normal operating temperature in progress with Turbine Bypass Valves [JI] closed, Main Steam (MS) [SB] pressures were gradually increasing as expected. At 16:20 Eastern Standard Time, with MS pressure approaching 800 psig, SG levels began lowering. FDW control valve demand was increasing in response to the lowering SG. However, there was no corresponding increase in FDW flow to the SG. At 16:25 Eastern Standard Time, actuation of both MDEFW pumps occurred due to "low steam generator level" signal for the 2A SG. Following actuation, the EFW system operated as expected and maintained level in both SG at required setpoint.

Subsequent investigation identified a malfunction in the 2A FDW pump speed controls [JK] as the cause of the event. As RCS heat up progressed and MS pressure increased, the differential pressure across the FDW control valves decreased. 2A FDW pump speed should have increased to maintain the FDW control valve differential pressure constant. However, due to the malfunction of the 2A FDW pump speed controls, the pump continued to operate at a constant speed. When MS pressure increased above 2A FDW pump discharge pressure, feedwater was no longer being supplied to the SG and level began to lower due to boil off of feedwater inventory in the SG.

Troubleshooting found that a fault state in the 2A FDW pump speed controls existed at the time of the event which prevented the 2A FDW pump from responding to demand inputs from ICS, resulting in the pump operating at a constant speed. No immediate cause of the fault state was identified. A knife switch in the 2A FDW pump speed control circuit was found slightly lifted from the closed position, but still maintaining electrical connection. To eliminate a potential vulnerability, the conservative decision was made to replace the knife switch; even though it was found making proper electrical contact. Following replacement of the knife switch, the 2A FDW pump speed controls were reset, all fault states were verified cleared, and the 2A FDW pump speed controls were verified to be responding as expected. The MDEFW pumps were then secured, and Unit 2 startup was resumed.

Subsequent investigation by Engineering determined that the 2A FDW pump speed control logic was reporting a faulted state prior to operators placing 2A FDW pump in service. There are numerous parameters that the controller constantly monitors that can place it into a fault state. When a fault is detected, the controller will halt servo movement. This response is by design to prevent a fault condition from causing erroneous servo movement. Because the 2A FDW pump was put in service with a fault



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NARRATIVE CONTINUED

state, the pump operated at minimum speed which was at that time adequate to allow steam generator level to be maintained. However, as speed demand from ICS increased, the 2A FDW pump speed control was unable to respond. This fault state was not visible to the operators when placing the FDW pump in service. Procedure changes were identified include specific checks for FDW pump speed control faults prior to placing each FDW pump in service.

Units 1 and 3 were not affected by this event.

Reportability

This event was reported to the NRC on March 23, 2022, in Event Notification (EN) number 55800, as an 8-hour notification under 10 CFR 50.72(b)(3)(iv)(A) – Specified System Actuation (EFW). The event is also reportable under 10 CFR 50.73(a)(2)(iv)(A) as a valid EFW system actuation.

CAUSAL FACTORS

The cause of this event was a fault state on the 2A FDW pump speed controls which prevented the pump from responding to demand inputs from ICS.

CORRECTIVE ACTIONS

Immediate:

1. Replaced knife switch in 2A FDW pump speed control servo circuit
2. Reset 2A FDW speed controls and verified no fault conditions present
3. Restored 2A FDW pump to service

Planned:

- Revise FDW pump startup procedures for all three ONS Units to include instructions to ensure no FDW pump speed control faults are present prior to placing a FDW pump in service.

SAFETY ANALYSIS

The ONS Unit 2 EFW actuation on February 13, 2022, was an uncomplicated event that had no impact on public health and safety.

Following the malfunction of the 2A FDW pump speed controls, the 2A and 2B MDEFW pumps automatically started as designed to restore and maintain SG levels for heat removal. There was not a significant plant transient since the reactor was in startup (Mode 3) and subcritical. Additional defense-in-depth to maintain safe shutdown was available from the TDEFW Pump, EFW via cross connects from Units 1 or 3, Protected Service Water (PSW) System, the Standby Shutdown Facility (SSF), and portable FLEX equipment. No Emergency Core Cooling System (ECCS) or other automatic safety system actuations occurred in response to this event.



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NARRATIVE CONTINUED

A post-event review found no procedural or human performance issues with the operator response to the event. There were no maintenance or other safety significant activities being conducted on any of the defense in depth plant systems or equipment at the time of the event. Therefore, it is concluded that the impact on core damage risk was very low, and the event had no impact on public health and safety.

ADDITIONAL INFORMATION

A review of Duke Energy's Corrective Action Program did not identify any Oconee LERs or events in the last 3 years that involved the same underlying concerns or reasons as this event.

This event is considered INPO IRIS Reportable. There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.