



David A. Wilson
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RA-24-0207

August 2, 2024

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 3
Docket Number: 50-287
Renewed Operating License: DPR-55

Subject: Licensee Event Report 287/2024-001, Revision 00 – Procedure Deficiency Results in Inadvertent Automatic Feedwater Isolation and Automatic Emergency Feedwater Actuation

Licensee Event Report 287/2024-001, 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.

If there are questions, or further information is needed, contact David Wilson, Nuclear Support Services Manager, at (864) 873-3451.

Sincerely,

A handwritten signature in black ink that reads "David A. Wilson". The signature is written in a cursive, flowing style.

David A. Wilson
Manager, Nuclear Support Services
Oconee Nuclear Station

Enclosure: Licensee Event Report 287-2024-001 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
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11555 Rockville Pike
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Mr. Nick Smalley
NRC Senior Resident Inspector
Oconee Nuclear Station



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

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1. Facility Name Oconee Nuclear Station Unit 3	<input checked="" type="checkbox"/> 050	2. Docket Number 00287	3. Page 1 OF 5
	<input type="checkbox"/> 052		

4. Title
Procedure Deficiency Results in Inadvertent Automatic Feedwater Isolation and Automatic Emergency Feedwater Actuation

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
06	03	2024	2024	001	00	08	02	2024	<input type="checkbox"/> 050	
									Facility Name	Docket Number
									<input type="checkbox"/> 052	

9. Operating Mode 3	10. Power Level 000
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11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)

<input type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 10 CFR Part 50	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 73.1200(a)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	<input type="checkbox"/> 73.1200(b)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	<input type="checkbox"/> 73.1200(c)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 73.1200(d)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 10 CFR Part 21	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 10 CFR Part 73	<input type="checkbox"/> 73.1200(e)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.69(g)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.77(a)(1)	<input type="checkbox"/> 73.1200(f)
<input type="checkbox"/> 20.2203(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(2)(i)	<input type="checkbox"/> 73.1200(g)
<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(ii)	<input type="checkbox"/> 73.1200(h)
<input type="checkbox"/> 20.2203(a)(2)(v)		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)		

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

12. Licensee Contact for this LER

Licensee Contact David A. Wilson	Phone Number (Include area code) (864) 873-3451
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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
NA									

14. Supplemental Report Expected

<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date)	15. Expected Submission Date	Month	Day	Year
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16. Abstract (Limit to 1326 spaces, i.e., approximately 13 single-spaced typewritten lines)
 At 00:51 Eastern Daylight Time on 6/3/2024, with Oconee Nuclear Station Unit 3 in Mode 3 at 0 percent power, an actuation of the emergency feedwater system (EFW) occurred as main steam (MS) pressure was being lowered as part of reactor coolant system cooldown for a planned shutdown. MS pressure was lowered below the actuation setpoint for the Automatic Feedwater Isolation System (AFIS) prior to bypassing AFIS, resulting in trip of the operating main feedwater pump and subsequent auto-start of the 3A and 3B motor driven EFW pumps on low steam generator level circuit. All systems operated as designed, no equipment failures occurred or contributed to the event, and there was no release of radioactive material to the environment. The cause of the event was a change to the unit shutdown procedure that did not include appropriate barriers to consistently prevent an inadvertent AFIS actuation. An additional cause for the event was inadequate oversight of operator monitoring of MS pressure and bypass of AFIS. Corrective actions include revising unit shutdown procedures to ensure barriers to AFIS actuation and improvements to operator and oversight training.

This event was reported to the NRC on 6/3/2024 (Event Notification 57159), as an 8-hour notification under 10 CFR 50.72(b)(3)(iv)(A) - Specified System Actuation (EFW) and is also reportable under 10 CFR 50.73(a)(2)(iv)(A) as an EFW system actuation.



**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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1. FACILITY NAME Oconee Nuclear Station Unit 3	<input checked="" type="checkbox"/> 050	2. DOCKET NUMBER 00287	3. LER NUMBER		
	<input type="checkbox"/> 052		YEAR 2024	SEQUENTIAL NUMBER 001	REV NO. 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) [SG] using the FDW main and startup control valves. The two FDW pumps [P] and control valves [FCV] are controlled by the Integrated Control System (ICS) [JA]. When the unit is shutdown with any Reactor Coolant Pump (RCP) [P] operating or the unit is at low reactor power, ICS modulates FDW flow to maintains SG levels at a constant setpoint (approximately 25 inches).

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. There are multiple automatic circuits that can initiate EFW pump operation. One of these circuits starts the two MDEFW pumps upon sensing low water level in either SG after a time delay to prevent spurious actuations (≤ 21 inches for ≥ 30 seconds). Once EFW is initiated, the SG Level Control System (SGLCS) [JB] provides automatic SG water level control while EFW is supplying feedwater to the SGs. To prevent control system conflict with ICS SG level control, the SGLCS controls SG level at a higher setpoint (approximately 30 inches when any RCP operating).

A Main Steam Line Break (MSLB) inside containment [NH] can lead to containment overpressure, unacceptable thermal stresses to the SG tubes, and significant core [AC] overcooling. Main FDW and EFW must be promptly isolated to limit the effects of a MSLB. In Modes 1-3 with main steam (MS) [SB] header pressure >= 700 psig, the Automatic Feedwater Isolation System (AFIS) [JE] provides automatic termination of feedwater flow to the affected SG by tripping both Main FDW pumps, closing the affected steam generator's FCVs and block valves, and trips the TDEFW pump on low SG pressure (≤ 550 psig for two seconds on at least two of four MS header pressure sensors on a SG). AFIS also automatically terminates MDEFW pump flow to the affected SG on low SG pressure concurrent with high depressurization rate (>= 3 psi/second). Manual overrides for the TDEFW pump and the MDEFW pumps are provided to allow the operator to subsequently start EFW pumps if necessary for decay heat removal. During plant shutdown and cooldown, once the SG pressures have decreased to below 700 psig, the AFIS function can be bypassed to avoid actuation during normal unit cooldowns.

The design of ONS provides diversity of sources of feedwater to any unit's SG. While the three units are provided with separate EFW systems, the discharge header of each EFW system can be cross-connected making each system capable of supplying any unit. In addition, the Standby Shutdown Facility (SSF) Auxiliary Service Water (ASW) system and the Protected Service Water System serve as other alternate means of providing feedwater to any unit's SGs for decay heat removal. SSF ASW and PSW are single-train standby systems for use under emergency conditions when main FDW and EFW are not available. Each system has its own suction source in the embedded Unit 2 Condenser Circulating Water (CCW) [KE] piping and discharges into the SGs of each unit via the EFW system headers. The raw water is vaporized in the SGs, removing residual heat, and is dumped to the atmosphere via the Main Steam Relief Valves [RV] or Atmospheric Dump Valves. These systems are sized such that either system can provide enough water flow to the SGs to support decay heat removal for all three ONS units simultaneously.

(04-02-2024)



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NARRATIVE

EVENT DESCRIPTION

Beginning in 2022, an initiative was undertaken to simplify the shutdown procedures for the ONS Units, beginning with the shutdown procedure for Unit 3. The new simplified shutdown procedure for Unit 3 was issued 5/4/2022. Prior revisions of the shutdown procedure included plateaus where cooldown of the RCS was stopped to complete various actions. One of these plateaus was at 500-505 degrees Fahrenheit (F) RCS temperature. One of the actions initiated before proceeding on to the next plateau was to bypass AFIS when MS header pressure was 625-675 psig, followed by checks to ensure other required plant alignments and actions are complete. The 500-505 degrees F RCS temperature plateau results in MS header pressures being in the required band for bypassing AFIS. The revised simplified Unit 3 shutdown procedure moved the steps for bypassing AFIS to after RCS cooldown to 500-505 degrees F was complete and after the step to begin RCS cooldown to 450-455 degrees F. At the completion of RCS cooldown to 450-455 degrees F, MS header pressures would be at or below 420 psig, meaning MS header pressure would reduce below the AFIS actuation setpoint during this section of the shutdown procedure. The procedure intent was to have operators perform the AFIS bypass early in this portion of the shutdown procedure while RCS cooldown was in progress.

The revised simplified shutdown procedure was successfully utilized for shutdowns for Unit 3 refueling outages on 5/7/2022 and 5/4/2024.

On 6/2/2024 at 18:45 Eastern Daylight Time (EDT), ONS Unit 3 began a shutdown from 74% full power for a planned maintenance shutdown. At 21:00, with reactor power at approximately 29% full power and lowering, the 3B main FDW pump was secured as planned per the unit shutdown procedure. At 22:13 EDT, with ONS Unit 3 at approximately 19% full power, the main turbine generator [TA, TB] was shut down as planned per the unit shutdown procedure. Following main turbine generator shut down, the Unit 3 reactor was manually shut down from approximately 19% as planned per the unit shutdown procedure and Unit 3 entered Mode 3 at 22:31 EDT. At 23:11 EDT, RCS cooldown commenced with RCS heat removal being accomplished by MS being discharged to the main condenser [SG] via the turbine bypass valves [JI]. On 6/3/24 at 00:11 EDT, operators secured the 3A2 and 3B2 RCPs, leaving one RCP operating in each RCS loop. At 00:25 EDT, RCS temperature had been reduced to 500 degrees F and at 00:38 EDT, RCS cooldown to 450-455 degrees F was initiated. Indicated MS header pressures were between 638 psig and 650 psig and both SG levels were automatically being maintained at approximately 26 inches by main FDW. At approximately 00:47 EDT, 3A MS header pressure was lowered below the AFIS low SG pressure actuation setpoint resulting in an AFIS actuation. AFIS actuation logic tripped the 3A main FDW pump and closed the 3A SG FCVs and block valves. SG levels for both SGs began slowly lowering due to loss of main FDW flow and continued MS discharge to the main condenser via the Turbine Bypass Valves. At approximately 00:49 EDT, 3B MS header pressure lowered below the AFIS low SG pressure actuation setpoint resulting in a second AFIS actuation. This resulted in closure of 3B SG FCVs and block valves. Subsequently, at approximately 00:51 EDT, the 3A and 3B MDEFW pumps actuated on low SG level circuit. Following start of the MDEFW pumps, levels in both SGs were automatically raised to and maintained at the expected EFW level control setpoint by SGLCS. Following EFW actuation, the Control Room Supervisor (CRS) directed Reactor Operators (ROs) perform Emergency Operating Procedure (EOP) Immediate Manual Actions (IMAs) and symptoms check. No equipment problems were identified and EOP actions for loss of main FDW were completed successfully. Operators then exited the EOP and returned to the normal shutdown procedure. At 04:11 EDT, a main FDW pump was restarted and at 07:28 EDT, the MDEFW pumps were secured. No other system actuations occurred, no safety system trains were inoperable, and all other systems operated as expected. SSF ASW, PSW, and EFW cross-connects were available but were not required to be used. Operations continued the planned shutdown and, following completion of the planned outage work scope, Unit 3 was returned to 100% full power on 6/19/2024 20:36 EDT.



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NARRATIVE

REPORTABILITY

This event was reported to the NRC on 6/3/2024 (Event Notification 57159), 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 an EFW system actuation.

CAUSAL FACTORS

The direct cause of the loss of main FDW and resultant EFW actuation was due to operators lowering MS header pressures below the AFIS actuation setpoint without first bypassing AFIS.

The first cause was a change to the unit shutdown procedure that sequenced the steps to bypass AFIS to be performed while the RCS cooldown was in progress and written to allow RCS cooldown to continue without bypassing AFIS. While this version of the procedure had been performed twice before without issue, the procedure did not contain adequate step wording and other supplemental notes or guidance needed to ensure AFIS would be consistently bypassed before MS pressure was lowered to the AFIS actuation setpoint during RCS cooldown. The other cause for this event was inadequate oversight of operator monitoring of MS pressures and bypass of AFIS. The CRS briefed the operating crew on RCS cooldown and depressurization, including bypass of ES and AFIS. The CRS then ensured the operating crew was closely monitoring RCS temperature, RCS pressure, and RCS cooldown rates and ensured the operating crew bypassed ES appropriately prior to continuing RCS depressurization. The CRS did not ensure that the monitoring of MS pressure was adequate to ensure AFIS was bypassed prior to approaching actuation setpoints.

CORRECTIVE ACTIONS

Complete:

- Revised unit shutdown procedures for all three Units to ensure AFIS is bypassed before MS pressure is lowered to the AFIS actuation setpoint.

Planned:

- Establish guidance for critical parameters to be monitored during plant shutdown and startup to ensure consistent oversight.
- Provide simulator training for oversight of operators performing critical steps that requires the oversight to recognize and correct execution errors.
- Share learnings with Operations procedure developers to convey importance of procedure structure and wording for consistently achieving intended results when procedures are performed.

(04-02-2024)



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NARRATIVE

SAFETY ANALYSIS

AFIS and EFW responded as expected to actual low MS pressures and an actual low SG level signal, respectively. All safety systems operated as designed and no equipment failures occurred or contributed to the event. There was not a significant change in plant parameters since the reactor had already entered Mode 3 in the process of a normal plant shutdown and the event did not result in any releases to the environment. Additional defense-in-depth to maintain safe shutdown was available from EFW cross connects from Units 1 and 2, SSF ASW, and PSW, and portable FLEX equipment. No Emergency Core Cooling System (ECCS) [BP, BQ] or other automatic safety system actuations occurred in response to this event. 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. It has been determined this event had a negligible impact on nuclear safety.

ADDITIONAL INFORMATION

A review of Duke Energy's Corrective Action Program did not identify any Oconee LERs or events in the last three years that involved the same causes 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.