



Steven M. Snider
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RA-22-0215

July 1, 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 287/2022-002, Revision 00 – Automatic Actuation of Emergency Feedwater System due to Malfunctioning Startup Feedwater Control Valve

Licensee Event Report 287/2022-002, 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 Sam Adams, Regulatory Affairs, at (864) 873-3348.

Sincerely,

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

Steven M. Snider
Vice President
Oconee Nuclear Station

Enclosure: Licensee Event Report 287-2022-002 Rev.00

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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
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Rockville, MD 20852-2738

Mr. Jared Nadel
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/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: oir_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 3

2. Docket Number

0500000287

3. Page

1 OF 4

4. Title

Automatic Actuation of Emergency Feedwater System due to Malfunctioning Startup Feedwater Control Valve

5. Event Date

Month	Day	Year
05	06	2022

6. LER Number

Year	Sequential Number	Rev No.
2022	002	00

7. Report Date

Month	Day	Year
07	01	2022

8. Other Facilities Involved

Facility Name	Docket Number
NA	05000
Facility Name	Docket Number
NA	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)
<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)	

10. Power Level

0

12. Licensee Contact for this LER

Licensee Contact

Sam Adams, Oconee Regulatory Affairs

Telephone Number (Include Area Code)

(864) 873-3348

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	SJ	CNV	M422	Y	N/A				

14. Supplemental Report Expected

☐ Yes (If yes, complete 15. Expected Submission Date) ☒ No

15. Expected Submission Date

Month	Day	Year

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

At 2310 Eastern Daylight Time (EDT) on 5/6/2022, with Oconee Nuclear Station (ONS) Unit 3 in Mode 3 in the process of entering a refueling outage, an actuation of the Emergency Feedwater (EFW) system occurred. All 3 EFW pumps automatically started as designed when all Main Feedwater (FDW) pumps tripped on a steam generator (SG) overflow protection signal that was received due to a high level in the 3B SG. 3B SG Startup Feedwater Control Valve (SFCV) 3FDW-44 malfunctioned resulting in excessive feedwater flow leading to a high level in the 3B SG. Subsequent investigation of the malfunctioning SFCV identified that the valve was unable to be throttled closed less than approximately 67% automatically or manually. Troubleshooting of 3FDW-44 identified a failed current-to-pneumatic (I/P) transducer within the voltage-to-pneumatic signal (E/P) converter in the valve position control circuit. The failure caused 3FDW-44 to not go full closed despite the demand signal from the Integrated Control System (ICS). The faulted I/P transducer was replaced and Operations transitioned back to Main Feedwater for completing the Reactor Coolant System (RCS) cooldown. Units 1 and 2 were not affected by this event.

This event was reported to the NRC on May 7, 2022, in Event Notification (EN) number 55888, 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.

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

(See NUREG-1022, R.3 for instruction and guidance for completing this form
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1. FACILITY NAME		2. DOCKET NUMBER		3. LER NUMBER		
Oconee Nuclear Station Unit 3		0500000287		YEAR	SEQUENTIAL NUMBER	REV NO.
				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 flow control valves [FCV]. The SFCVs control flow at low power and are fully open at 50% power and above. The FDW pumps and control valves 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 analog control signal for the main FCVs and SFCVs are generated by ICS and transformed to a pneumatic signal via a voltage-to-pneumatic (E/P) converter [CNV]. Each E/P contains a voltage-to-current converter (E/I) and a current-to-pneumatic transducer (I/P). Each I/P is made of three basic assemblies: Electronic Control Module, Magnet Assembly, and Booster Assembly.

SG overfill protection plays an important role in the mitigation of FDW overfill events that could lead to Pressurized Thermal Shock (PTS). SG overfill protection is provided through the ICS to terminate FDW when the SG high level setpoint is reached. Two transmitters per steam generator monitor steam generator water level. Protection is provided by 2 out of 2 logic on either steam generator which actuates two trip devices on each FDW pump. Upon indications of high level in either SG, the logic generates a trip signal to both FDW pumps.

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 (MDEFWP) pumps and one turbine-driven EFW pump (TDEFWP), 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). Both Main Feedwater Pumps will automatically trip upon receipt of a high SG level trip signal.

Similar I/P transducers are used in several applications on all three ONS Units, such as Turbine Bypass Valves (TBV), FDW main FCVs and SFCVs, and High Pressure Injection (HPI) RCS normal makeup system [CB] control valves for RCS makeup, RCS letdown, and RCP seal injection flow.

There were no structures, systems, or components that were known to be inoperable at the start of the event and that contributed to the event.

EVENT DESCRIPTION

On 5/6/2022, Unit 3 was in Mode 3 while performing a shutdown entering a planned refueling outage. FDW flow was being provided by the 3A FDWP only as directed by unit shutdown procedure. At 23:01:28 EDT the reactor was manually tripped from approximately 19 percent power per procedure as part of the planned shutdown. At 23:04 EDT, Operators identified that 3FDW-44 (3B Loop SFCV) indicated throttled OPEN and the 3B SG Level was rising. Operators placed 3FDW-44 in Hand and attempted to manually throttle 3FDW-44 closed with no response. Subsequently, at 23:10:07 EDT, Operators initiated closure of 3FDW-42 (3FDW-44 inlet block valve) to stop the 3B SG overfeed condition. At 23:10:12, while 3FDW-42 was closing, 3B SG level increased to the actuation setpoint for SG overfill protection and the 3A FDW pump tripped resulting in a loss of all FDW pumps. All Unit 3 EFW pumps started on indications of loss of all FDW pumps. Following actuation, the EFW system operated as designed.

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Oconee Nuclear Station Unit 3		0500000287		YEAR	SEQUENTIAL NUMBER	REV NO.
				2022	002	00

NARRATIVE

Maintenance personnel investigated and identified that the E/P converter for 3FDW-44 had failed with an elevated zero condition and would not output less than ~67% output. The E/P was replaced, and proper operation was verified. Operations then transitioned back to Main FDW and continued RCS cooldown for the outage.

This event was reported to the NRC on May 7, 2022, in Event Notification (EN) number 55888, 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.

Units 1 and 2 were not affected by this event.

CAUSAL FACTORS

The cause of this event was a manufacturing deficiency within the Moore I/P transducer resulting in a faulted E/P converter that prevented the 3FDW-44 SFCV from responding to automatic and manual demand inputs.

CORRECTIVE ACTIONS**Immediate:**

1. Replaced 3FDW-44 E/P.
2. Sent failed I/P to the vendor for analysis.
3. Replaced TBV I/P transducers on all 3 Units with units manufactured by the vendor with Lessons Learned incorporated.
4. Replaced HPI I/P transducers on Unit 3 with units manufactured by the vendor with Lessons Learned incorporated.

Planned:

1. Replace FDW I/P transducers on Unit 1 with units manufactured by the vendor with Lessons Learned incorporated. (Note: Unit 2 and 3 replacements were completed in most recent outages for each unit.)
2. Replace HPI I/P transducers on all Units 1 and 2 with units manufactured by the vendor with Lessons Learned incorporated.
3. Evaluate alternatives to improve the reliability of the E/P units.

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		YEAR	SEQUENTIAL NUMBER	REV NO.
Oconee Nuclear Station Unit 3	0500000287	2022	002	00

NARRATIVE**SAFETY ANALYSIS**

Following the trip of the 3A MFW pump as described earlier, all three EFW pumps automatically started as designed to restore and maintain SG levels for heat removal. There was not a significant plant transient since the reactor had already entered Mode 3 in the process of a normal plant shutdown. Additional defense-in-depth to maintain safe shutdown was available from EFW via cross connect lines from Units 1 or 2, 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.

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 identified 4 related Oconee LERs since 2013 that involved similar underlying concerns or reasons as this event. This review revealed three similar Duke Energy events that occurred at ONS on April 12, 2018, January 31, 2015, and October 24, 2013, wherein E/P converter failures occurred. These previous events were reported in LER 269/2018-001 (ML18165A145), LER 287/2015-001 (ML15098A472) and LER 287/2013-001 (ML13358A336). Additionally, in the summer of 2021, a trend of TBV E/P converter failures was identified. As a result of the TBV failures, the vendor discovered some workmanship concerns and established corrective actions to prevent recurrence. Also, because of the TBV failures, 3FDW-44 was identified to be within the extent of condition, and it was scheduled to be replaced during the May 2022 Unit 3 outage. The failure mode of the 3FDW-44 E/P is similar to one that was discovered during Oconee's trend of TBV failures.

One corrective action identified in the 2015 report was a planned corrective action to modify the FCV controls with a more fault tolerant design. The modifications have been completed for the FCV E/Ps on all 3 Units. The SFCVs were not included in the scope of that action and thus do not have the redundant E/P controls design that the FCVs have. As such, the previous corrective action from the 2015 report could not have prevented the SFCV E/P failure documented in this LER. Corrective actions from the 2018 report, which also documented a cause of a failed I/P, did replace the I/Ps on the Unit 3 SFCVs, however due to the manufacturing deficiency noted in the cause of the 3FDW-44 failure documented in this LER, that action was not able to prevent recurrence.

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