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ONS-2016-045

10 CFR 50.73

June 3, 2016

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station Unit 3
Docket No. 50-287
Licensee Event Report 287/2013-001, Revision 1
Corrective Action Program No.: NCR 01935275, 01905808, 01907317

Enclosed is License Event Report (LER) 287/2013-001, Revision 1 for Oconee Nuclear Station (ONS), Unit 3, describing an event in which ONS Unit 3 was manually tripped on October 24, 2013, due to Main Feedwater flow oscillations.

This LER revision provides supplemental information from Duke Energy's cause evaluation for a similar Oconee Unit 3 manual reactor trip that occurred on January 31, 2015, that was determined to be applicable to the 2013 event. (LER 287/2015-001, Revision 0, ML15098A472)

This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) "System Actuation."

There are no regulatory commitments contained in this LER.

Any questions regarding the content of this report should be directed to Bob Meixell of the ONS Regulatory Affairs Group, at (864) 873-3279.

Sincerely,

Scott L. Batson
Vice President
Oconee Nuclear Site

Enclosure

IEZZ
NRR

cc :

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Mr. Eddy Crowe
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Oconee Nuclear Station

INPO (Word File via E-mail)

1. FACILITY NAME Oconee Nuclear Station, Unit 3	2. DOCKET NUMBER 05000287	3. PAGE 1 of 4
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4. TITLE
Unit 3 Manual Reactor Trip Due to Main Feedwater Flow Oscillations

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	DOCKET NUMBER
10	24	2013	2013	001	01	06	03	2016	NA	5000
									NA	5000

9. OPERATING MODE 1	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 100	<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)(i)						
	<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)(ii)						
		<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 Bob Meixell, Senior Nuclear Licensing Specialist	TELEPHONE NUMBER (Include Area Code) (864) 873-3279
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO ICES	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO ICES
E	SJ	3FDW EP 0007	F012	Yes					

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 15 single-spaced typewritten lines)

This revision provides supplemental information, including a revised cause, discovered during the cause evaluation for a similar Unit 3 manual reactor trip on January 31, 2015.

On October 24, 2013, Oconee Unit 3 was at 100% power when Operators observed abnormal Main Feedwater flow oscillations. Manual control was unsuccessful in stabilizing the oscillations. The Control Room supervisor directed a manual trip at 0553 hours. Four main steam relief valves (MSRV) did not fully reseal. Post-trip procedures were used to reseal the MSRVs. All other post trip conditions were normal. The 2013 cause evaluation identified a failure of a bushing seal (o-ring) in the actuator for Main Feedwater Control Valve (MFCV) 3FDW-32 as the cause of the flow oscillations. The 2015 cause evaluation revealed the cause of the 3FDW-32 control problem was a latent defect which produced an intermittent fault in the voltage to pneumatic (E/P) converter. While the o-ring failure was a plausible cause in 2013, given new information from the 2015 event, the faulted E/P converter was determined to be the cause of the 2013 event. The E/P converter was tested in 2013, but due to the intermittent nature of the fault the E/P was refuted after satisfactory testing of 3FDW-32 controls.

This event is reportable under 10 CFR 50.73(a)(2)(iv)(A) as a manual actuation of the Reactor Protection System (RPS).

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EVALUATION:

Background

This LER revision provides supplemental information from Duke Energy's cause evaluation for a similar Oconee Unit 3 manual reactor trip that occurred on January 31, 2015, (LER 287/2015-001, Revision 0, ML15098A472) that was determined to be applicable to the 2013 event.

Main Feedwater Control Valve (MFCV) [EIS: FCV] 3FDW-32 is a pneumatically operated valve, that regulates feedwater flow to the 3A steam generator when reactor power is between approximately 15% and 100%. (3FDW-41 is the corresponding MFCV for the 3B steam generator.) The analog control signal for this valve is generated by the Integrated Control System (ICS) [EIS: JA] and transformed to a pneumatic signal via a voltage to pneumatic (E/P) converter [EIS: CNV]. Independent of the Main Feedwater control function, an Automatic Feedwater Isolation System (AFIS) circuit will automatically close the Feedwater control valves when a Main Steam Line Break (MSLB) is detected on the associated header.

Technical Specification (TS) 3.7.3 "Main Feedwater Control Valves.(MFCVs), and Startup Feedwater Control Valves (SFCVs)" Limiting Condition for Operation (LCO) 3.7.3 requires "Two MFCVs and two SFCVs shall be OPERABLE," while in MODEs 1, 2 and 3, except when all MFCVs and SFCVs are closed and deactivated or isolated by a closed manual valve. The safety function associated with this TS is to isolate main feedwater to the steam generators upon a steam line break inside containment.

When the reactor trip was initiated, Oconee Nuclear Station (ONS) Units 1 and 3, were operating in MODE 1 at approximately 100% power. Unit 2 was defueled for a scheduled refueling outage. No significant structures, systems or components were out of service such that they contributed to this event.

This event was reported as a 4-hour notification to the NRC on October 24, 2013, in Event Notification (EN) number 49471 under 10 CFR 50.72(b)(2)(iv)(B) - RPS Actuation - Critical. This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as a manual actuation of the Reactor Protection System (RPS).

EVENT DESCRIPTION

On October 24, 2013, Oconee Unit 3 was operating at 100% power in Mode 1 when Control Room operators noticed that Unit 3 Main Feedwater flow indicators were oscillating beyond normal parameters. Control Room operators attempted to stabilize the oscillations by taking manual control of the Integrated Control System (ICS). When these efforts were recognized to be ineffective, the Control Room supervisor made the decision to manually trip Unit 3 at 0553 hours. During plant response monitoring after the reactor trip, four main steam relief valves (MSRV) were identified as not being completely reseated. Procedural guidance was utilized to reseat the MSRVs by reducing main steam pressure. All other post trip conditions and system performance were normal and expected.

An investigation of the event determined that the feedwater flow oscillations were caused by failure of a bushing seal (o-ring) in the actuator for MFCV 3FDW-32 due to actuator piston rod and extension shaft linear misalignment. The investigation for a subsequent (2015) Unit 3 reactor trip revealed the cause for failure to properly control feedwater flow for MFCV 3FDW-32 was a latent defect in the E/P converter, 3FDW EP 0007. The latent defect produced an intermittent fault in the E/P converter. While

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the o-ring failure was a plausible cause in 2013, given new information from the 2015 event, the faulted E/P converter was determined to be the cause of the 2013 event. The E/P converter was tested in 2013, but due to the intermittent nature of the fault the E/P was refuted after satisfactory testing of 3FDW-32 controls.

CAUSAL FACTORS

The 2015 cause investigation determined that the feedwater flow oscillations for the 2013 and 2015 events were caused by a failure of the current to pneumatic (I/P) converter (a subcomponent of the E/P converter) to properly control feedwater flow for MFCV 3FDW-32. The E/P converter (3FDW EP 0007) contains a voltage to current (E/I) converter and an I/P converter. The cause of the failure was a manufacturing defect within the I/P converter that resulted in intermittent malfunction of the E/P converter.

The condition that caused the failure of 3FDW-32 control function was determined to potentially apply to the MFCVs, SFCVs and other components on Oconee Units 1, 2 and 3 that use the same model E/P converter. The extent of condition was addressed in the final root cause evaluation.

The 2015 root cause evaluation concluded the following:

Root Cause:

An intermittent failure of the I/P converter (a subcomponent of the E/P converter) due to a manufacturing defect, resulted in failure to properly control feedwater flow for MFCV 3FDW-32 for the 2013 and 2015 events.

Corrective actions are from the 2015 cause evaluation.

The components of the E/P converter are not safety related; therefore, 10 CFR Part 21 reportability does not apply.

CORRECTIVE ACTIONS

Immediate:

1. Prior to restarting Unit 3 from the 2015 event, the E/P converter, the Positioner and Filter Regulators for the E/P converter were replaced on 3FDW-32, the E/P converter, and Filter Regulators for the E/P converter were replaced on 3FDW-41, and successful checks and calibrations were performed on 3FDW-32 and 3FDW-41.

Completed:

1. Replaced the existing MFCV E/P converters with upgraded converters on all 3 units.
2. Increased the replacement frequency for the E/P converters to 4 years.

Planned:

1. Modify the MFCV controls to provide a more fault tolerant design.

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SAFETY ANALYSIS

The Oconee Unit 3 trip on October 24, 2013, is considered to be an uncomplicated reactor trip event with no significant impact on public health and safety. Although oscillations in Main Feedwater flow forced the unit offline, the Main Feedwater system continued to provide flow to the steam generators through the startup header and allowed operators to conduct an otherwise normal controlled shutdown. It was noted that four main steam relief valves failed to fully reseal at the normal expected pressures; however, the steam leakage was relatively small, no safety limits were challenged and no safety system actuations occurred. The valves were subsequently reseated by following procedural guidance to lower steam generator pressure incrementally. All four MSRVs seated within allowed procedural limits. A post-trip 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 plant systems or equipment important to Unit 3 at the time of the trip. Therefore it is concluded that the conditional core damage probability for the Unit 3 reactor trip was very low and did not cause a significant increase in risk to the public.

ADDITIONAL INFORMATION

A search of the Oconee Corrective Action Program (CAP) database was conducted for the preceding five (5) year period. Similarly, a review of industry Operating Experience (OE) databases was conducted using applicable keyword searches, i.e. "feedwater oscillations," etc., to ascertain other reported events. This LER revision supplements LER 287/2013-001, Revision 0 (NRC ADAMS - ML 13358A336) for the event that occurred on October 24, 2013. This revision incorporates information from the cause evaluation for the subsequent (2015) Unit 3 reactor trip (LER 287/2015-001, ML15098A472) that occurred on January 31, 2015. No other similar events were identified.

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX]. This event is considered INPO Consolidated Events System (ICES) Reportable. There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.