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RA-18-0076

July 5, 2018 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 Numbers: 50-287
Renewed Operating Licenses: DPR-55

Subject: Licensee Event Report 287/2018-002, Revision 00 – Actuation of the Keowee Hydroelectric Station Due to Loss of AC Power to the Unit 3 Main Feeder Buses

Licensee Event Report 287/2018-002, 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.

If there are questions, or further information is needed, contact Stephen C. Newman, Lead Nuclear Engineer, Regulatory Affairs, at (864) 873-4388.

Sincerely,

Carrie T. Dunton
Director, Nuclear Site Support
Oconee Nuclear Station

Enclosure

IE22
NRR

cc (w/Enclosure):

Ms. Catherine Haney, Administrator, Region II
U.S. Nuclear Regulatory Commission
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NRC FORM 366 (04-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

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-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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/)

1. Facility Name	2. Docket Number	3. Page
Oconee Nuclear Station Unit 3	05000287	1 OF 4

4. Title

Actuation of the Keowee Hydroelectric Station Due to Loss of AC Power to the Unit 3 Main Feeder Buses

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
									N/A	05000
05	10	2018	2018	002	00	07	5	2018	Facility Name N/A	Docket Number 05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
6	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
000	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(ii)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(iii)
		☐ 50.73(a)(2)(i)(C)	☐ Other (Specify in Abstract below or in NRC Form 366A	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Stephen C. Newman, Lead Nuclear Engineer, Oconee Regulatory Affairs	(864) 873-4388

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
X	EL	RLY	S440	Yes					

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

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

On May 10, 2018, at 16:03, with Unit 3 in MODE 6 (refueling) with the unit's startup transformer (CT-3) carrying the unit's power loads, a CT-3 lockout occurred. With the transformer locked out, Unit 3 experienced a loss of all alternating current (AC) power to the unit's main feeder buses (MFBs) which subsequently resulted in an autostart of both Keowee Hydroelectric Station (KHS) Units. Approximately 18 seconds later, emergency AC power was restored to the MFBs via the KHS Unit 2 underground powerpath and CT-4 transformer. During the 38-second power outage, the Unit 3 decay heat removal and spent fuel cooling systems were unavailable; however, the MFB Monitoring Panel responded as designed to restore AC power.

This event was reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as a valid actuation of one of the systems listed in 10 CFR 50.73(a)(2)(iv)(B)(8), i.e., the Keowee Hydroelectric Station.

The cause of the CT-3 lockout was due to transient disturbances from external voltages/currents being impressed upon the direct current (DC) system due to an internal failure of the 62GZ relay concurrent with multiple DC grounds. A Cause Evaluation is ongoing to determine if planned corrective actions are warranted. The overall plant risk due to the event was insignificant and there was no impact on public health and safety.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Oconee Nuclear Station Unit 3	05000-287	2018	002	00

NARRATIVE

EVALUATION:

Background

During start-ups, shutdowns, and outage periods where the Auxiliary Transformer (3T on Unit 3) [EIIS: XFMR] is not available, power is supplied from the Switchyard through the Start-up Transformer (CT-3 on Unit 3). Emergency power can be provided to any or all three Oconee Nuclear Station (ONS) Units from the Keowee Hydroelectric Station (KHS)KHS [EIIS: EK]. There are two emergency power paths:

1. the overhead path, that includes the Start-up Transformer (CT-1, CT-2, or CT-3) on each ONS unit; and
2. the underground path, through CT-4.

In addition, there is an offsite powerpath from either the Central Switchyard or Lee Steam Station via transformer CT-5. Transformers 3T or CT-3 supply power at 6900 Volts (V).

DESCRIPTION OF EVENT

On May 10, 2018, at 16:03, with Unit 3 in MODE 6 (refueling) with the unit's startup transformer (CT-3) carrying the unit's power loads, a CT-3 lockout occurred. With the transformer locked out, Unit 3 experienced a loss of all alternating current (AC) power to the unit's main feeder buses (MFBs) [EIIS: BU]. Although not an Engineered Safeguards (ES) [EIIS: JE] generated signal, approximately 20 seconds after the MFB Monitoring Panel sensed a loss of power, it sent a signal to start the Keowee Units. Approximately 18 seconds later, emergency AC power was restored to the MFBs via the KHS [EIIS: EK] Unit 2 underground powerpath and CT-4 transformer. During the 38-second power outage, the Unit 3 decay heat removal [EIIS: BP] and spent fuel cooling [EIIS: DA] systems were unavailable.

Prior to and at the time of the lockout, Oconee personnel were conducting electrical testing following the implementation of a protective relaying upgrade project. This testing was determined not to be the direct cause of the lockout; however, the testing did energize the 62GZ relay [EIIS: RLY]. Evidence indicates that the 62GZ relay had existing internal degradation that occurred at some time prior to the outage. The cause of this prior degradation is unknown.

Reportability

This event was reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as a valid actuation of one of the systems listed in 10 CFR 50.73(a)(2)(iv)(B)(8), i.e., the Keowee Hydroelectric Station (KHS).

Pursuant to 10 CFR 50.72 requirements and the guidance provided in NUREG-1022 (R3), the KHS start signal was a valid actuation.

Additionally, the loss of power to the MFBs resulted in an Emergency Plan declaration of an Unusual Event at 16:25 per Emergency Action Limit CU2.1, "AC power capability, Table C-3, to essential 4160 V buses MFB-1 and MFB-2 reduced to a single power source for greater than or equal to 15 minutes AND Any additional single power

source failure will result in loss of all AC power to SAFETY SYSTEMS." Oconee Units 1 and 2 were unaffected by this event.

CAUSAL FACTORS

The cause of the CT-3 lockout was due to transient disturbances from external voltages/currents being impressed upon the DC system due to an internal failure of the 62GZ relay concurrent with multiple DC grounds.

CORRECTIVE ACTIONS

Immediate:

1. Stopped the relay functional testing and entered the appropriate abnormal operating procedures.
2. Restored decay heat removal and spent fuel cooling capability.
3. Closed the unit 3 equipment hatch.

Subsequent:

1. The damaged 62GZ control relay was replaced.
2. DC grounds were isolated and repaired.

Planned:

1. A Cause Evaluation is ongoing to determine if planned corrective actions are warranted.

SAFETY ANALYSIS

A qualitative risk evaluation was performed to consider the potential impacts of this event on plant safety.

ONS-3 was in Mode 6 when a CT3 lockout actuation occurred on May 10, 2018, resulting in a loss of AC power to the Unit 3 Main Feeder Busses (MFBs). The MFB Monitor Panel initiated a Keowee start signal. All required KHS equipment responded as designed and power was restored in approximately 38 seconds. The temporary loss of AC power resulted in a loss of decay heat removal that was automatically restored from KHS Unit 2. The Oconee Unit 3 Spent Fuel Pool (SFP) cooling flow was also lost but was manually restored by procedure in approximately 6 minutes.

As documented on the May 10, 2018, Defense-in-Depth Status Sheet, the "time to core boiling" was approximately 66 minutes based on the expected heat load for the number of days after shutdown. This time available supports that operators could have reliably performed necessary recovery actions if automatic restoration of power or LPI flow had failed. Similarly, the "time to boil" for the SFP was approximately 28 hours.

Procedural actions available to recover from a potential failure of KHS Unit 2 include alignment of backup power from Transformer CT-5, swapping the KHS Unit 1 alignment from overhead path to underground path, alignment of 4160V cross-tie from Unit 2 Startup Transformer CT-2, and alignment of gravity flow from the Borated Water Storage Tank to the core. Although the containment equipment hatch was open at the time of the lockout, containment closure was reestablished in approximately 22 minutes providing significant margin prior to core boiling.

Based the reliability of the Keowee power system, diverse power sources, and redundancy of cooling systems, the impact of this event on plant risk was very low when available recovery actions are considered. Thus, it is concluded that the impact of this event on overall plant risk is insignificant and had no impact on public health and safety.

ADDITIONAL INFORMATION

A review of Duke Energy's Corrective Action Program and industry Operating Experience (OE) databases was conducted using applicable keyword searches, i.e., "CT-3, KHS, KHU, lockout, actuation," identified one (1) similar Oconee LER that occurred in 2006. LER 287/2006-01, Rev. 0, reported an event involving a KHS actuation because of a CT-3 lockout on Unit 3. In that instance, it was concluded that the differential relays which precipitated the lockout were very sensitive to mechanical impact/jarring. The corrective actions associated with that LER would not have prevented the current lockout event.

Energy Industry Identification System (EIIS) 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.