



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-22-0049

January 26, 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 270/2021-002, Revision 00 – Actuation of the Keowee Hydroelectric Station Due to Loss of AC Power to the Unit 2 Main Feeder Buses

Licensee Event Report 270/2021-002, 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 "Steven M. Snider", written in a cursive style.

Steven M. Snider
Vice President
Oconee Nuclear Station

Enclosure: Licensee Event Report 270-2021-002 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
Mail Stop O-08B1A
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: 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
Actuation of the Keowee Hydroelectric Station Due to Loss of AC Power to the Unit 2 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
11	27	2021	2021	002	00	01	26	2022	Oconee Nuclear Station Unit 1	0500000269
									Facility Name	Docket Number
									NA	05000

9. Operating Mode 5	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)	
10. Power Level 000	<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)

12. Licensee Contact for this LER

Licensee Contact Sam Adams, Senior Nuclear Engineer, Oconee Regulatory Affairs	Telephone Number (Include Area Code) (864) 873-3348
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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
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)

On November 27, 2021 at 0519 EST, with Unit 2 in MODE 5 with the Unit 2 Start-up transformer (CT-2) carrying the unit's power loads, a CT-2 Lockout occurred. As a result, Unit 2 experienced a loss of alternating current (AC) power to the Main Feeder Buses (MFBs) resulting in the automatic start of both Keowee Hydroelectric Station (KHS) Units, initiated by the MFB Monitor Panel. Power was automatically restored to the Unit 2 MFBs from the CT-5 Transformer via the MFB Monitor Panel. During the power transfer, the operating Unit 2 Decay Heat Removal (DHR) pump stopped and then automatically restarted, as designed, with the restoration of power to the MFBs.

The direct cause of this event was an inaccurate procedure step that resulted in Start-up Bus Differential Relay Control Switches being out of the required alignment. Because of the switch lineup that existed at the time, the Unit 1 Start-up Transformer (CT-1) also locked out at the same time as CT-2, however Unit 1 loads were being supplied by the Unit 1 Auxiliary Transformer (1T) and not by CT-1, therefore Unit 1 did not experience a loss of AC power and did not initiate any actuation signal to the KHS Units.

This event was reported to the NRC on November 27, 2021, in Event Notification (EN) number 55612, as an 8-hour notification under 10 CFR 50.72(b)(3)(iv)(A) – Emergency AC Electrical Power System Actuation. It is also reportable as a 60-day written report under 10 CFR 50.73(a)(2)(iv)(A).



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

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Oconee Nuclear Station Unit 2	0500000270	2021	002	00

NARRATIVE

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

BACKGROUND

During start-ups, shutdowns, and outage periods where the Auxiliary Transformer (2T on Unit 2) [XFMR] is not available, offsite power [EA] is supplied to the Unit's Main Feeder Buses (MFB) [EB] from the 230 kV Switchyard through the Start-up Transformer (CT-2 on Unit 2) [XFMR] or from Central Switchyard through Transformer CT-5 [XFMR] via one or both Standby Buses [EB].

Emergency power [EB] can be provided to any or all three Oconee Nuclear Station (ONS) Units MFB from the Keowee Hydroelectric Station (KHS) [EK] from either of two emergency power paths:

1. The Overhead Path, that includes the Unit's Start-up Transformer (CT-1, CT-2, or CT-3) [XFMR] on each ONS unit
2. The Underground Path, through Transformer CT-4 [XFMR] and one or both Standby Buses.

Emergency onsite power may also be provided to any or all three ONS Units MFB from a Lee Combustion Turbine (LCT) [EK] on a dedicated 100kV transmission line through Transformer CT-5 via one or both Standby Buses.

The Main Feeder Bus Monitor Panel (MFBMP) [P] provides an automatic method of establishing safe and reliable power to the MFBs during non-Engineered Safeguards events. MFBMP detects low voltage on a Unit's MFB and initiates load shed logic, an emergency start of both KHS units, and permissive signals to permit automatically aligning the Unit's MFB to either the Unit's Startup Transformer energized from the Overhead Path or the Standby Buses energized by either Transformer CT-4 or Transformer CT-5.

EVENT DESCRIPTION

On November 27, 2021, Unit 1 was in MODE 1 operating at 100% reactor power with its MFB powered from the Unit 1 Auxiliary Transformer (1T) [XFMR]. Unit 2 was in MODE 5 with the Unit 2 Start-up transformer (CT-2) powering the unit's MFB. The Unit 2 Low Pressure Injection (LPI)[BP] system was providing Decay Heat Removal (DHR). Standby Buses were energized from Central Switchyard via CT-5 to provide an additional offsite power source for Unit 2 for outage defense in depth.

At 0519 EST, Unit 2 was starting the 2B2 Reactor Coolant [AB] Pump (RCP) Motor [MO] for an uncoupled run. When the 2B RCP switch was placed to the Start position, CT-1 and CT-2 lock out [86] occurred. Unit 1 was operating with the unit being powered from 1T and therefore did not lose power when CT-1 locked out. The CT-2 lockout, however, did result in a loss of AC power to the Unit 2 and MFBMP initiated an automatic start of both KHS Units. KHS emergency start completed and CT-4 was energized by KHS. However, since CT-5 was already energizing the Standby Buses, power was automatically restored to the Unit 2 MFBs from CT-5 by MFBMP. During the MFBMP power transfer, the operating Unit 2 DHR pump stopped and then automatically restarted, as designed, with the restoration of power to the Unit 2 MFBs.

Reportability

This event was reported to the NRC on November 27, 2021, in Event Notification (EN) number 55612, as an 8-hour notification under 10 CFR 50.72(b)(3)(iv)(A) – Emergency AC Electrical Power System Actuation. It is also reportable as a 60-day written report under 10 CFR 50.73(a)(2)(iv)(A).

EN 55612 also reported a loss of safety function of the DHR system. After additional review, it has been determined that a loss of safety function did not occur as both DHR trains were capable of being powered via the automatic power switching logic and all the associated equipment to support cooling was available. Incoming power source swapping is part of the design of the system. As such, this event is not reportable per 10 CFR 50.72(b)(3)(v) or 10 CFR 50.73(a)(2)(v).



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NARRATIVE

CAUSAL FACTORS

A Prompt Investigation Response Team (PIRT) was convened to determine why the procedure failed to ensure the transfer switches were in the correct positions. The PIRT identified the direct cause to be an inaccurate procedure step related to positioning/verifying Start-up Bus Differential Relay Control switches.

The causes for the inaccurate procedure step are:

1. Procedure revision generated with technical errors in the procedure.
2. Procedure revision reviewed with technical errors in the procedure and not identified and corrected by the reviewers.

CORRECTIVE ACTIONS

Immediate:

1. Units 1 and 2 were restored to the appropriate power alignment.
2. The inaccurate procedure was revised.

Planned:

1. Revise all labeling associated with the Start-up Transformer Differential Relay transfer switches to improve human factors.
2. Reinforce procedure change development requirements and expectations for use of human error reduction tools for procedure writers.
3. Reinforce procedure review and validation requirements and expectations for use of job aids and human error reduction tools with procedure reviewers and validators.
4. Conduct procedure review process training.

SAFETY ANALYSIS

A qualitative risk evaluation was performed to consider the potential impacts of this event on plant safety. The CT-1 and CT-2 Lockout Event on 11/27/2021 affected Unit 1 and Unit 2 but did not have any impact on public health and safety.

For Unit 1, the event did not cause a plant transient and remained online with internal electrical loads continuing to be supplied from the normal power source (Auxiliary Transformer 1T). If the normal power source had been lost, electrical loads would have transferred automatically to the alternate offsite power source fed from Transformer CT-5. Additionally, the Keowee Emergency Power System started automatically and was running in standby and was available to supply loads via the underground power path to Transformer CT-4. As a result, the lockout event had a negligible impact on Unit 1 core damage risk since there was no transient, the AC power support function was maintained, and there was no loss of mitigating equipment.

Unit 2 was shut down in Mode 5 beginning the process of unit start-up following a refueling outage when the lockout occurred. The LPI System was running in decay heat removal mode when power from CT-2 was lost. However, power was restored automatically from the Standby Buses (via CT-5 offsite power) and the running pump automatically restarted and resumed decay heat removal circulation without operator action. Both Keowee units



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		2021	002	00

automatically started and were running in standby and available to restore power if offsite power from Transformer CT-5 had failed. Given the low decay conditions present on Unit 2, significant time was also available for additional operator recovery actions if they had been needed. Therefore, given the significant defense-in-depth and time available for recovery actions, this event is judged to have a very low risk of core damage.

With no loss of normal cooling, emergency power available from Keowee, and significant time available for additional recovery actions, the loss of CT-2 event had an insignificant impact on Unit 2 core damage risk.

Thus, it is concluded that the impact of the CT-1/CT-2 lockout 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 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.