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RA-22-0061

February 7, 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 270/2021-004, Revision 00 – More Than One Axial Power  
Shaping Rod Not Aligned within Technical Specification Limits

Licensee Event Report 270/2021-004, 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 270-2021-004 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](mailto: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](mailto: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

## 4. Title

More Than One Axial Power Shaping Rod Not Aligned within Technical Specification Limits

## 5. Event Date

Month	Day	Year
12	9	2021

## 6. LER Number

Year	Sequential Number	Rev No.
2021	004	00

## 7. Report Date

Month	Day	Year
02	07	2022

## 8. Other Facilities Involved

Facility Name	Docket Number
NA	05000
Facility Name	Docket Number
NA	05000

## 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 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 checked="" 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

073

## 12. Licensee Contact for this LER

Licensee Contact

Sam Adams, Senior Nuclear Engineer, 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
N/A					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)

On 12/8/21, Unit 2 was in Mode 1 in power ascension following a refueling outage with power stable at 73% with Power Imbalance Detector Correlation (PIDC) testing in progress when acceptance criteria were not met. Following troubleshooting and recalibration of Nuclear Instruments (NIs), PIDC testing was reperformed on 12/9/21 with similar unacceptable results. Power ascension was halted pending resolution of the PIDC testing issue and all Axial Power Shaping Rods (APSR) were fully inserted at 1943 on 12/9/21. On 12/13/21, continued investigation confirmed that the unacceptable PIDC test results from 12/8/21 and 12/9/21 were due to two of the eight APSRs remaining fully inserted when APSRs were withdrawn as part of startup activities. Therefore, the Technical Specification (TS) 3.1.6 requirements for APSR alignment and maximum number of misaligned APSRs in Modes 1 and 2 were exceeded. Furthermore, identification of more than one APSR misaligned requires the reactor to be placed in Mode 3 within 12 hours, Mode 4 within 18 hours, and Mode 5 within 37 hours in accordance with LCO 3.0.3. While APSRs were all aligned (fully inserted) at the time of discovery on 12/9/21, these LCO 3.0.3 actions were not completed within the required time based on elapsed time from Unit 2 entering Mode 2 with APSRs misaligned (unknown at the time Unit 2 entered Mode 2 and Mode 1) until the time APSRs were fully inserted on 12/9/21. Additionally, these Mode changes with APSRs not properly aligned represents a violation of LCO 3.0.4. Based on the failures to meet LCO 3.0.3 and LCO 3.0.4 requirements, this event is reportable to the NRC under 10 CFR 50.73(a)(2)(i)(B) for an Operation or Condition Prohibited by TS.

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

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Oconee Nuclear Station Unit 2		0500000270		YEAR	SEQUENTIAL NUMBER	REV NO.
				2021	004	00

**NARRATIVE**

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

**BACKGROUND**

The Oconee reactor cores are designed with sufficient excess reactivity to yield the desired cycle length. Excess reactivity is controlled by a combination of soluble boron, lumped burnable poison, and control rods (full-length and partial-length). The full-length control rods are assigned to seven control rod groups (Groups 1 to 7) and the partial-length Axial Power Shaping Rods are assigned to Group 8. Groups 1 to 4 are designated safety banks and are maintained out of the core during operation. Groups 5 to 7 are designated control banks and may be inserted to pre-established limits. APSRs do not insert upon reactor trip and are used for axial power shaping and can be used to dampen axial xenon oscillations and adjust axial power imbalance.

Control rod and APSR position and alignment of the individual control rods and APSR rods to their Group average positions is an assumption in safety analyses. Two methods of control rod and APSR position indication are provided in the Rod Drive Control System. The two means are by absolute and relative position indicator instrumentation. The absolute position indicator transducer consists of a series of magnetically operated reed switches mounted in a tube parallel to the control rod drive mechanism (CRDM) [DRIV] motor tube extension. Switch contacts close when a permanent magnet mounted on the upper end of each control rod and APSR assembly (CRA) leadscrew extension comes near. As the leadscrew and control rod or APSR move, the switches operate sequentially, producing an analog voltage proportional to position. The relative position indication is processed by a Programmable Logic Controller (PLC) [PMC] that produces a signal proportional to control rod or APSR position, based on the electrical pulse steps that drive the CRDM.

During power ascension following a refueling outage, Power Imbalance Detector Correlation (PIDC) testing is performed to calibrate the reactor axial power imbalance as measured by the out-of-core power range nuclear instrumentation (2NI-5, -6, -7, and -8) [DET] to that measured by incore detectors.

**EVENT DESCRIPTION**

On 12/5/21, Unit 2 was in Mode 3 with refueling outage startup activities in progress. At 0515, all APSRs were withdrawn to 35% as specified in unit startup procedures. On 12/7/21, Unit 2 entered Mode 2 at 0921 and Mode 1 at 1131. On 12/8/21, Unit 2 was in power ascension with reactor power stabilized at approximately 73% for performance of PIDC testing. At 1654, Reactor Engineering reported PIDC test acceptance criteria was not met. This condition was entered into the Corrective Action Program and the power range Nuclear Instruments (NIs) were re-calibrated. PIDC testing was reperformed on 12/9/21 with similar unacceptable results. At 0443 on 12/9/21, a decision was made to hold power at 73% until PIDC testing issues were resolved. With investigation continuing, recommendation was made on 12/9/21 at approximately 1800 to fully insert all APSRs. This recommendation was based on comparison of incore response data to computer models showing incore detector response was as expected when APSRs were fully inserted and diverged from model predictions as APSRs were withdrawn. APSR insertion was completed on 12/9/21 at 1943. On 12/13/21, with APSRs still fully inserted, continued investigation determined the unacceptable PIDC test results from 12/8/21 and 12/9/21 were due to two (2) apparently fully inserted APSRs in core locations F-12 and L-12, despite multiple diverse APSR rod positions indications to the contrary. Based on available data and incore instrumentation response during movement of APSRs, the conclusion was made that those two APSRs were apparently fully inserted and did not withdraw as indicated when the other APSRs were withdrawn during the Unit 2 refueling outage startup and power ascension. Therefore, the Technical Specification (TS) 3.1.6 requirements for APSR alignment and maximum number of misaligned APSRs in Modes 1 and 2 were exceeded. Furthermore, identification of more than one APSR misaligned requires the reactor to be placed in Mode 3 within 12 hours, Mode 4 within 18 hours, and Mode 5 within 37 hours in accordance with LCO 3.0.3. While APSRs were all aligned (fully inserted) at the time of discovery on 12/9/21, these LCO 3.0.3 actions were not completed within the required time based on elapsed time from Unit 2 entering Mode 2 with APSRs misaligned (unknown at the

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CONTINUATION SHEET**

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time Unit 2 entered Mode 2 and Mode 1) until the time APSRs were fully inserted on 12/9/21. Additionally, these Mode changes with APSRs not properly aligned represents a violation of LCO 3.0.4.

Based on the failures to meet LCO 3.0.3 and LCO 3.0.4 requirements, this event is reportable to the NRC under 10 CFR 50.73(a)(2)(i)(B) for an Operation or Condition Prohibited by TS.

**CAUSAL FACTORS**

It is suspected that the 2 APSRs at locations F-12 and L-12 are uncoupled from there CRD and therefore were always fully inserted during the Unit 2 startup from the refueling outage.

A Cause Evaluation is ongoing to determine the cause for the 2 APSRs being uncoupled. However, it is not possible for all causal factors to be determined until the next Unit 2 outage when visual inspections can be completed.

**CORRECTIVE ACTIONS****Immediate:**

1. All APSRs were confirmed fully inserted to ensure alignment and operability of the APSRs.
2. Nuclear Fuels Engineering evaluated operation of Unit 2 with all APSRs fully inserted through 100EFPD and compared against the analyses of record to ensure all alarm and operational limits and safety analyses remained valid.
3. Operational evidence that the core was performing as expected was collected on 12/14/21 with the first full-power core power distribution measurement.

**Planned:**

1. Perform analysis for the remainder of the Unit 2 operating cycle with all APSRs fully inserted.
2. Complete a Cause Evaluation for the uncoupled rods.
3. Perform Inspections of F-12 and L-12 Fuel Assemblies and APSRs.

**SAFETY ANALYSIS**

An evaluation of the core design (O2C31) in its current configuration (Group 8 at 0% withdrawn) shows that all alarm and operational limits and safety analyses remain valid for at least the first 100 Effective Full Power Days (EFPD) of the current operating cycle. With the APSRs fully inserted, there is an expected positive shift in imbalance during steady-state operation, but this shift has been shown to have small and acceptable impacts to design margins. No changes are required to current RPS or operational power imbalance setpoints, quadrant power tilt setpoints, rod index setpoints, or other parameters presented in the current COLR for this period of time to ensure continued safe operation of the core. Therefore, it is concluded that the failure to meet the requirements of LCO 3.0.3 and LCO 3.0.4 had no impact on core damage risk and no impact on public health and safety.



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## NARRATIVE

## 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.