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RA-22-0126

April 6, 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 270/2022-001, Revision 00 – Unit 2 Automatic Reactor Trip  
Due to Loss of Power to Reactor Coolant Pumps

Licensee Event Report 270/2022-001, 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 270/2022-001 Rev.00

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April 6, 2022  
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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  
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Mr. Adam Ruh (Acting)  
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/nureqs/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.

|  |                                       |                          |
|--|---------------------------------------|--------------------------|
| <b>1. Facility Name</b><br>Oconee Nuclear Station Unit 2 | <b>2. Docket Number</b><br>0500000270 | <b>3. Page</b><br>1 OF 4 |
|--|---------------------------------------|--------------------------|

**4. Title**  
Unit 2 Automatic Reactor Trip Due to Loss of Power to Reactor Coolant Pumps

| 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 |
| 02            | 05  | 2022 | 2022          | 001               | 00      | 04             | 06  | 2022 | NA                           | 05000         |
|               |     |      |               |                   |         |                |     |      | Facility Name                | Docket Number |
|               |     |      |               |                   |         |                |     |      | NA                           | 05000         |

|                                   |  |   |  |   |
|-----------------------------------|--|---|--|---|
| <b>9. Operating Mode</b><br><br>1 | <b>11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)</b> |   |  |   |
|                                   | <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)   |
| <b>10. Power Level</b><br><br>100 | <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<br>Sam Adams, Senior Nuclear Engineer, Oconee Regulatory Affairs | Telephone Number (Include Area Code)<br>(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 |
|-------|--------|-----------|--------------|--------------------|-------|--------|-----------|--------------|--------------------|
| X     | EA     | FU        | Eaton        | Y                  | N/A   |        |           |              |                    |

|  |  |
|--|--|
| <b>14. Supplemental Report Expected</b><br><input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date) <input checked="" type="checkbox"/> No | <b>15. Expected Submission Date</b><br>Month: _____ Day: _____ Year: _____ |
|--|--|

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

On February 5, 2021, Unit 2 was operating in Mode 1 at 100% reactor power. At 0343, all four Reactor Coolant Pumps tripped and Unit 2 Reactor Protective System (RPS) initiated an automatic reactor trip on Reactor Coolant Pump to Power trip function. The reactor trip was uncomplicated. Post-trip plant response was normal and plant conditions were controlled and maintained within the allowances of Technical Specifications with no safety system actuations.

Subsequent investigation revealed the direct cause of the reactor trip and loss of all four RCPs to be a mechanical failure of a fuse in the normal source (2T transformer) voltage sensing circuit to the 2TA and 2TB 6900V switchgear.

This event was reported to the NRC on February 5, 2021, in Event Notification (EN) number 55733, as a 4-hour notification under 10 CFR 50.72(b)(2)(iv)(B) - Reactor Protection System (RPS) Actuation – Critical (Automatic Reactor Trip). The event is also reportable under 10 CFR 50.73(a)(2)(iv)(A) as an actuation of the RPS.



**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 |                   |         |
|-------------------------------|------------------|---------------|-------------------|---------|
|                               |                  | YEAR          | SEQUENTIAL NUMBER | REV NO. |
| Oconee Nuclear Station Unit 2 | 0500000270       | 2022          | 001               | 00      |

**NARRATIVE**

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

**BACKGROUND**

The 6900V auxiliary power system [EA] at Oconee is designed to provide power to the plant's reactor coolant pump [P] motors. The 6900V system for each unit is arranged into two switchgear [SWGR] sections, designated as TA and TB. Each switchgear section contains four circuit breakers [BKR]. Two of the breakers in each section supply power to reactor coolant pump motors, one pump for each of the two reactor coolant [AB] loops. The other two breakers in each section are the normal and start-up incoming feeder breakers. Power for the 6900V switchgear on each unit is normally fed from the unit's auxiliary transformer [XFMR] through the normal incoming feeder breakers. During start-up, shutdown, or when the unit auxiliary transformer is unavailable for other reasons, power is provided through the unit's start-up transformer [XFMR] through start-up breakers. Undervoltage monitoring for the normal source is provided via a relay [27] that is fed from a line-side potential transformer (PT) [XPT].

The Reactor Coolant System [AB] for each Oconee unit is equipped with two once-through steam generators (OTSG) [SG]. During normal operation with Reactor Coolant Pumps providing forced reactor coolant circulation, feedwater from the Main Feedwater [SJ] system is provided to the shell side of the OTSG via the main feed ring in the lower portion of the OTSG. The OTSG are also equipped with emergency feed rings located at the upper portion of the OTSG. If OTSG are needed for decay heat removal and Reactor Coolant Pumps are not available to provide forced reactor coolant flow, feedwater flow is directed to the emergency feed rings to support natural circulation of reactor coolant. Feedwater from any of several emergency systems (Emergency Feedwater, Standby Shutdown Facility Auxiliary Service Water, or Protected Service Water systems) [BA] is always directed to the OTSG emergency feed rings. If Main Feedwater is available, the Integrated Control System (ICS) [JA] will automatically realign Main Feedwater flow from the main feed ring to the emergency feed ring upon trip of all Reactor Coolant Pumps.

The Reactor Protective System (RPS) [JC] initiates a reactor trip to protect against violating the core fuel design limits and the Reactor Coolant System (RCS) [AB] pressure boundary during anticipated transients. The RPS consists of four separate redundant protective channels that receive inputs of neutron flux, RCS pressure, RCS flow, RCS temperature, RCS pump status, reactor building [NH] pressure, main feedwater pump turbines status, and main turbine [TA] status. Regarding RCS pump status, the Reactor Coolant Pump to Power trip provides protection for changes in the reactor coolant flow due to the loss of multiple RCPs. Each RCP has a RCP Power Monitor (RCPPM), which monitors the electrical power and breaker status of each pump motor to determine if it is running. The RCPPM will initiate a reactor trip if fewer than three reactor coolant pumps are operating and reactor power is greater than approximately 2% rated full power.

**EVENT DESCRIPTION**

On 2/5/22, Unit 2 was operating in Mode 1 at 100% reactor power. At 0343, all four Reactor Coolant Pumps tripped and Unit 2 RPS initiated an automatic reactor trip on Reactor Coolant Pump to Power trip function. Subsequent investigation revealed the direct cause of the reactor trip and loss of all four RCPs to be due to mechanical failure of a fuse [FU] in the normal source (2T transformer) voltage sensing circuit to the 2TA and 2TB 6900V switchgear.

The post-trip response was as expected. With no RCPs operating, normal Pressurizer spray was unavailable to reduce RCS pressurization. As RCS pressure increased, a pressurizer safety valve (2RC-67) [RV] lifted to relieve steam from the Pressurizer [PZR]. The relief valve reseated as designed as pressure decreased. There was no water relief through the relief valve and no leakage from the relief valve once reseated. The relief valve was replaced following the trip with a spare. The removed relief valve was tested and found to be performing within operability limits.



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On trip of the RCPs, ICS, as designed, realigned Main Feedwater flow to the emergency feed ring. This resulted in Main Feedwater at elevated temperature (>400 degrees F) being directed to the OTSG emergency feed ring through standby emergency feedwater system piping located in the Unit 2 West Penetration Room (WPR). Coatings applied to the exterior of this piping in 2001 were not rated for potential main feedwater temperatures (>400 degrees F) and rapidly degraded, producing a significant amount of smoke, but no fire. This smoke caused fire detectors in the WPR to activate at 0347 and also led to declaration of an Unusual Event (UE) at 0357. Onsite fire brigade, assisted by offsite fire department personnel, searched the WPR and determined no fire occurred and the UE was exited at 0811. All affected pipe coatings were abated prior to restart of Unit 2.

Immediately following the Unit 2 reactor trip, the Unit 2 Main Vent Stack radiation monitor (2RIA-45) [IL] indications momentarily increased. Subsequent confirmatory readings by onsite Radiation Protection personnel determined no release had occurred. Engineering investigation of the response of 2RIA-45 determined the momentary increase in indicated radiation was invalid and was caused when the detector lost power momentarily following the reactor trip. There was never a release of radiation for this event.

Reportability

This event was reported to the NRC on February 5, 2021, in Event Notification (EN) number 55733, as a 4-hour non-emergency notification under 10 CFR 50.72(b)(2)(iv)(B) - Reactor Protection System (RPS) Actuation – Critical (Automatic Reactor Trip) and a 1-hour emergency notification for the UE classification. The event is also reportable under 10 CFR 50.73(a)(2)(iv)(A) as an actuation of the RPS.

**CAUSAL FACTORS**

The cause of the loss of power to all RCPs was the mechanical failure of an indicating fuse in the PT circuit feeding the under voltage relay for the 6900V normal source power to the RCPs. Failure of the fuse resulted in deenergizing the line-side PT which caused the under voltage relay to drop-out. This sent trip signals to normal source feeder breakers (2TA-2 and 2TB-5), therefore leading to de-energization of the 6900V switchgear 2TA and 2TB.

**CORRECTIVE ACTIONS**

Immediate:

- Replaced Unit 2 6900V normal and startup source PT circuit fuses.

Planned:

- Improve the fuse or relay circuit design to eliminate or better mitigate this vulnerability in the 6900V undervoltage sensing circuit.



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| Oconee Nuclear Station Unit 2 | 0500000270       | 2022          | 001               | 00      |

**NARRATIVE**

**SAFETY ANALYSIS**

A risk evaluation was performed and determined that the subject U2 Reactor Trip event did not have an impact on public health and safety.

The initial post-trip response was as expected with main feedwater flow realigning to the steam generators through the startup control valves to establish natural circulation since the loss of all 4 RCPs caused a loss of forced RCS circulation flow. Additional defense-in-depth to ensure safe shutdown was available from the Emergency Feedwater (EFW) System [BA], 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.

The High Pressure Injection [BQ] system response was as expected. Pressurizer Safety Valve 2RC-67 lifted one cycle in steam relief to control an increase in RCS pressure. There were no equipment failures or other problems that required unusual operator actions. Although the smoke generated in the Unit 2 West Penetration Room was a distraction, Unit 2 operations staff investigated and resolved the issue with assistance from Unit 1 personnel and did not interfere with the orderly shutdown of Unit 2.

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 important plant systems or equipment at the time of the trip. 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 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.