Tom Simril
Vice President
Catawba Nuclear Station

Duke Energy
CN01VP I 4800 Concord Road
York, SC 29745

o: 803.701.3340
f: 803.701.3221

RA-22-0182

10 CFR50.73

June 22, 2022

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Carolinas, LLC
Catawba Nuclear Station, Unit 2
Docket No. 50-414
Licensee Event Report (LER) 414/2022-001-00

Pursuant to 10 CFR 50.73(a)(1) and (d), attached is LER 414/2022-001-00, entitled "Manual Reactor Trip and Auxiliary Feedwater Start due to Misaligned Control Rods". This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter or its attachment.

This event is considered to be of no significance with respect to the health and safety of the public.

If questions arise regarding this LER, please contact Ari D. Tuckman of Regulatory Affairs at (803) 701-3771.

Sincerely,

Tom Simril

Tom Simril
Vice President, Catawba Nuclear Station

Attachment

xc (with attachment):

L. Dudes
Regional Administrator
U.S. Nuclear Regulatory Commission - Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, GA 30303

Z. Stone
NRC Project Manager (CNS)
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mailstop O-8G9A
Rockville, MD 20852

J. Austin (without enclosure)
NRC Senior Resident Inspector

NRC FORM 366 (08-2020) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 08/31/2023

LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name	2. Docket Number	3. Page
Catawba Nuclear Station, Unit 2	05000414	1 of 4

4. Title

Manual Reactor Trip and Auxiliary Feedwater Start due to Misaligned Control Rods

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
										05000
04	23	2022	2022	001	00	06	22	2022	Facility Name	Docket Number
										05000

9. Operating Mode	10. Power Level
1	100%

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)(i)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **Other** (Specify here, in Abstract, or in NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include Area Code)
Ari Tuckman	803-701-3771

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
B	JD	CON	W121	Yes					

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

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On April 23, 2022, at 0224 hours, with Unit 2 in Mode 1 at 100 percent power, two control rods partially dropped during control rod testing resulting in misalignment, which required a manual reactor trip in accordance with plant procedure. All control rods fully inserted into the core following the manual reactor trip. All safety systems functioned as expected. The Auxiliary Feedwater system actuated as designed to provide makeup flow to the steam generators. This event did not impact public health and safety.

The cause of the event was an intermittent high resistance connection in the rod control system moveable regulation circuitry resulting from insulation inappropriately inserted into a crimped lug connection. The connection was made during initial plant construction and degraded over time.

This event was reported to the NRC as a four-hour, non-emergency Event Notification Number 55856 on April 23, 2022 per 10 CFR 50.72(b)2(iv)(B), Actuation of the Reactor Protection System and an eight-hour non-emergency notification under the same Event Notification per 10 CFR 50.72(b)(3)(iv)(A), Specified Safety System Actuation.

BACKGROUND

The following information is provided to assist readers in understanding the event described in this LER. Applicable Energy Industry Identification [EIIS] system and component codes are enclosed within brackets. Catawba unique system and component identifiers are contained within parentheses.

This event is being reported under the following criterion:

10 CFR 50.73(a)(2)(iv)(A), for any event or condition that resulted in manual or automatic actuation of the reactor protection system and the PWR auxiliary feedwater system.

Rod Control System [JD](IRE):

The IRE system provides for reactor power modulation by manual or automatic control of full length control rod banks in a pre-selected sequence and for manual operation of individual banks. Alarms are provided to alert the operator in the event of a control rod deviation exceeding a preset limit.

Reactor Protection System [JC](IPE):

The Reactor Trip System automatically limits reactor operation to within a safe region by shutting down the reactor whenever the limits of the region are approached. The safe operating region is defined by several considerations such as mechanical/hydraulic limitations on equipment and heat transfer phenomena. Therefore, the Reactor Trip System keeps surveillance on process variables which are directly related to equipment mechanical limitations, such as pressure, pressurizer water level, and on variables which directly affect the heat transfer capability of the reactor. Other parameters utilized in the IPE system are calculated from various process variables. Whenever a direct process or calculated variable exceeds a setpoint, the reactor will be shut down in order to protect against either gross damage to fuel cladding or loss of system integrity, which could lead to release of radioactive fission products into the Containment.

The various reactor trip circuits automatically open the reactor trip breakers whenever a condition monitored by the IPE system reaches a preset level. Station operators may elect to actuate the reactor trip switchgear manually (manual reactor trip) using either of two control board switches. The manual trip consists of two switches, one for train A and one for train B, in the control room. Operating a manual trip switch removes the voltage from the corresponding undervoltage trip coil and energizes the shunt coil while actuating the associated Reactor Trip Breaker.

Auxiliary Feedwater System [BA](CA):

The CA System provides an emergency feedwater supply to the Steam Generators [SG](SG) in the event of a loss of the respective Unit's Feedwater System [SJ](CF) to remove energy stored in the core and primary coolant. This ensures the capability to transfer fission product decay heat and other residual heat loads from the Reactor Coolant System [AB](NC) during both normal operation and accident conditions. Three CA pumps are provided, powered from separate and diverse power sources. Two motor driven pumps are powered from two separate trains of emergency on-site power, each supplying feedwater to two steam generators. One turbine driven pump, supplying feedwater to all four steam generators is driven by steam from either the B or C steam generators. These pumps will automatically start upon receipt of a signal satisfying the logic for automatic start of the respective pump, or each pump can be manually started from the control room.

EVENT DESCRIPTION

At approximately 0224 on April 23, 2022, Operations was performing the quarterly rod control movement test. The first bank to be tested was Control bank D (CBD). Operators selected CBD and began moving rods inward. Rods correctly inserted a few steps and then CBD Group 1 began dropping into the core. Operations noted the dropping rods and released the in-hold-out switch which stopped demand for rod motion. The rods from CBD Group 1 were subsequently caught at heights near the bottom of the core. Operations verified through alternate indications that two rods had partially dropped and then manually tripped the reactor per plant procedures.

Catawba is designed to isolate feedwater during all reactor scrams and start auxiliary feedwater to provide core cooling until it is determined that main feedwater will be aligned. In the case of the Unit 2 scram on April 23, 2022, it was not desired to restore main feedwater via a normal timeline to preserve rod control failure evidence. There were no complications cooling the core with auxiliary feedwater during this time. When operations restored main feedwater, there was no evidence of any damage or equipment failure that would have prevented aligning main feedwater per normal post-trip response procedures.

CAUSAL FACTORS

Troubleshooting determined the cause of the event was an intermittent high resistance connection in the rod control system moveable regulation circuitry. This high resistance was the result of insulation that was inappropriately inserted into a crimped lug connection lessening the effectiveness of the electrical connection. The bad crimp resulted in a loss of power to the moveable grippers causing them not to engage the control rods. The connection was made during initial plant construction and degraded over time.

A cause evaluation determined the direct cause of the inadequate connection was inadequate work practices performed by the vendor at the time of construction. During that time, adequate work instructions and standards did not drive excellent craftmanship and instead relied on skill of the craft. Current work practices and qualifications by both the vendor and site personnel follow rigorous procedures and work practices to ensure electrical connections are adequately constructed.

CORRECTIVE ACTIONS

1. Replace inadequate wire crimp discovered during initial troubleshooting (complete).
2. Ensure adequate standards and work instructions to support flawless execution of crimping connections (complete).
3. Update single point vulnerability strategy for affected cards to reflect the crimped connection failure mode and take actions as necessary to ensure the failure mode is effectively managed (planned).
4. Revise Long Term Asset Management risk matrix to reflect the risk of operation with single point vulnerability installed (planned).

SAFETY ANALYSIS

The manual Catawba Unit 2 reactor trip described in the event report is considered to be an uncomplicated reactor trip event with no significant impact on public health and safety. A post-trip review found no critical procedure or human performance issues with the operator response to the event. Therefore, it is concluded that the conditional core damage probability for the Unit 2 reactor trip was very low and did not cause a significant increase in risk to the public. The plant was returned to Mode 1 on April 26, 2022. No equipment important to plant safety was out of service at the time of the reactor trip. There was no radioactive release to the atmosphere during this event.

ADDITIONAL INFORMATION

There have been no previous Licensee Event Reports at Catawba Nuclear Station in the last 3 years with the same causal factor as this issue.