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RA-22-0346

10 CFR 50.73

December 23, 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) 414/2022-003-00

Pursuant to 10 CFR 50.73(a)(1) and (d), attached is LER 414/2022-003-00, entitled "Manual Reactor Trip and Auxiliary Feedwater System Actuation". 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 Tuckman of Regulatory Affairs at (803) 701-3771.

Sincerely,

A handwritten signature in black ink that reads "Tom Simril". The signature is written in a cursive, flowing style.

Tom Simril
Vice President, Catawba Nuclear Station

Attachment

United States Nuclear Regulatory Commission

Page 2

December 23, 2022

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

S. Williams

NRC Project Manager (CNS)

U.S. Nuclear Regulatory Commission

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NRC Senior Resident Inspector (without enclosure)

Catawba Nuclear Station



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/>)

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 FOIA, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollections.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk all: omb_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 Catawba Nuclear Station, Unit 2	2. Docket Number 05000414	3. Page 1 OF 4
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4. Title
Manual Reactor Trip and Auxiliary Feedwater System Actuation

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
10	24	2022	2022	- 003 -	00	12	23	2022	Facility Name	Docket Number
										05000
										05000

9. Operating Mode 1	10. Power Level 9%
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11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)				
<input checked="" type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input checked="" type="checkbox"/> 10 CFR Part 73
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.69(g)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input checked="" type="checkbox"/> 10 CFR Part 21	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(1)(i)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input checked="" type="checkbox"/> 10 CFR Part 50	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 73.77(a)(2)(ii)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	

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

12. Licensee Contact for this LER

Licensee Contact

Ari Tuckman, Lead Engineer

Phone Number (Include Area Code)

(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
D	N/A	N/A	N/A	Y					

14. Supplemental Report Expected

☒ No ☐ Yes (If yes, complete 15. Expected Submission Date)

15. Expected Submission Date

Month Day Year

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

On 10/24/2022 at 0857 EDT, with Unit 2 in Mode 1 at approximately 9% power, the reactor was manually tripped following procedural guidance due to a 2B train main feedwater pump trip. The trip was not complicated with all systems responding normally post-trip. The auxiliary feedwater system started automatically as expected.

The 2B main feedwater pump tripped on loss of condenser vacuum due to a deficiency in the unit startup procedure. The procedure did not ensure the water/condensate in the main steam equalization header was properly drained prior to opening the main steam supply to the feedwater pump turbine (CFPT) valve. This introduced water into the 2B main feedwater pump turbine condenser causing a loss of vacuum which resulted in the 2B CFPT trip and manual reactor trip.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A). There was no impact to the health and safety of the public.

**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.
Catawba Nuclear Station, Unit 2	05000414	2022	- 003	- 00

NARRATIVE**BACKGROUND**

The following information is provided to assist readers in understanding the event described in this LER. Applicable Energy Industry Identification [EII] system and component codes are enclosed within brackets. Catawba Nuclear Station 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), "Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)." The applicable 10 CFR 50.73(a)(2)(iv)(B) systems include the Reactor Protection System and the Auxiliary Feedwater System.

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. Whenever a direct process or calculated variable exceeds a setpoint the reactor will be shutdown 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 Reactor Trip System reaches a preset level. In addition to the automatic monitoring and actuation of the protection system, a manual actuation circuit is also available to initiate a reactor shutdown. The manual trip consists of two switches (one for Train A and one for train B) in the control room. There are no interlocks that can block this trip.

Auxiliary Feedwater System [BA] (CA)

The Auxiliary Feedwater System is the assured source of feedwater to the steam generators during accident conditions. The CA System is designed to start automatically in the event of loss of offsite electrical power, trip of both main feedwater pumps, safety injection signal, or low-low steam generator water level; any of which may result in, coincide with, or be caused by a reactor trip. The CA System will supply sufficient feedwater to maintain the reactor at hot standby for two hours followed by cooldown of the Reactor Coolant System to the temperature at which the Residual Heat Removal System may be operated.

Condenser Circulating Water [KE] (RC)

The Condenser Circulating Water System supplies cooling water to the main and feedwater pump turbine condensers to condense the turbine exhaust steam. The rejected heat from the condensers is dissipated to the ambient surroundings by the cooling towers while meeting all applicable chemical and thermal effluent criteria.

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EVENT DESCRIPTION

During refueling outage C2R25, External Department Guidance was provided to Operations to operate the RC system with an increased inlet temperature range in an attempt to maintain the turbine exhaust hood temperatures to support Main Turbine Actual Overspeed Tests. This reduced margin associated with the system's capability to maintain vacuum.

The Unit Start-up procedure contained steps to restore valves per the "Secondary Heatup Checklist" which included opening valve 2SP34 (main steam to the 2A and 2B CFPTs) on the Main Steam Equalization Header. Upon opening valve 2SP34, automatic downstream drain valves opened as the drain piping contained hot condensate/water. At 08:57 the 2B CFPT tripped on its low vacuum setpoint which required the Control Room Operators to manually trip the Unit 2 reactor due to loss of feedwater with reactor power > 5%. At the time the 2B main feedwater pump tripped, the 2A main feedwater pump had not been started, thus resulting in a loss of main feedwater and a subsequent automatic actuation of the Auxiliary Feedwater system.

CAUSAL FACTORS

A cause analysis was completed for the 2B main feedwater pump trip and subsequent manual reactor trip and auxiliary feedwater actuation.

The cause of the event was determined to be the operation of 2SP34, which drained water/condensate into the 2B CFPT condenser and raised condenser pressure higher than the 2B CFPT vacuum trip setpoint. A deficiency in the unit startup procedure did not adequately drain the main steam equalization header piping prior to alignment to the 2B CFPT condenser.

A potential cause was determined to be clogged continuous drain orifices on the main steam equalization header not allowing the steam header to properly drain. This cause could not be refuted without disassembling and inspecting.

CONTRIBUTING CAUSE

The RC System was being operated at a higher temperature in preparation for main turbine overspeed testing which requires elevated turbine exhaust hood temperatures per OEM warranty requirements. The higher RC temperature raised condenser pressure and lowered the margin to the 2B CFPT low vacuum trip setpoint. The action to re-open 2SP34 was implemented in parallel with other actions that were being taken to lower RC temperature but the impact of performing these two actions in parallel were not adequately assessed and contributed to the 2B CFPT trip.



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CORRECTIVE ACTIONS

1. Revise Secondary Heatup Checklist procedure enclosure to include steps to drain the water/condensate in main steam equalization header to a location other than the CFPT condenser prior to restoring valve 2SP34. Also include notes to closely monitor the Main Condenser and CFPT Condenser vacuum during restoration of 2SP34. (complete)
2. Revise Secondary Heatup procedure enclosure to cycle valve 2SP34 in order to remove any potential condensate prior to entering the Secondary Heatup Checklist. (planned)
3. Ensure work requests to inspect continuous drain orifices on the main steam equalization header are scoped into the next refueling outage. (planned)

SAFETY ANALYSIS

At 0857 [EDT] hours on October 24, 2022, with Unit 2 in Mode 1 at approximately 9 percent power, the 2B main feedwater pump tripped due to a loss of condenser vacuum. This resulted in an automatic actuation of the auxiliary feedwater system as well as requiring operators to initiate a manual reactor trip. The Unit 2 reactor trip did not impact the health and safety of the public and there was no safety or radiological consequence to this event. The trip was uncomplicated with all systems responding normally post-trip. Unit 1 was not affected.

This event did not result in a Safety System Functional Failure. All safety systems were capable of performing their safety function at all times during this event.

ADDITIONAL INFORMATION

There have been no previous Licensee Event Reports at Catawba Nuclear Station in the last three years with the same causal factors. A review of previous reportable events for the past three years identified the following LER events associated with a reactor trip at Catawba:

Catawba Unit 1 submitted LER 2020-001-01 for a valid actuation of the Unit 1 Reactor Trip System and CA system in February 2020. The cause of this reactor trip is the station did not establish and maintain an effective single point vulnerability preventative maintenance mitigation strategy for the turbine exciter.

Catawba Unit 1 submitted LER 2020-003-00 for a valid actuation of the Unit 1 RPS on OPDT and CA system actuation in September 2020. The cause of the reactor trip was a human performance error in which a performer did not perform self-checking prior to pulling a Nuclear Instrumentation System power range drawer.

Catawba Unit 2 submitted LER 2021-002-00 for a valid actuation of the Unit 2 RPS on OPDT and CA system actuation in June 2021. The cause of the reactor trip was due to temperature cross calibration testing equipment.

Catawba Unit 2 submitted LER 2022-001-00 for a manual reactor trip and auxiliary feedwater start due to misaligned control rods in April 2022. The cause of the control rod misalignment was high resistance connections in the rod control system due to inappropriate crimped lugs dating back to original construction.