



Tom Simril
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Catawba Nuclear Station

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RA-21-0199

10 CFR 50.73

June 29, 2021

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) 414/2021-002-00

Pursuant to 10 CFR 50.73(a)(1) and (d), attached is LER 414/2020-002-00, entitled "Valid Actuation of the Unit 2 Reactor Protection System and Auxiliary Feedwater System."
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 Sherry E. Andrews of Regulatory Affairs at (803) 701-3424.

Sincerely,

A handwritten signature in black ink that reads "Tom Simril". The signature is fluid and cursive, with a long horizontal stroke at the beginning.

Tom Simril
Vice President, Catawba Nuclear Station

Attachment

United States Nuclear Regulatory Commission
Page 2
June 29, 2021

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

K. Cotton
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



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/>)

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1. Facility Name
Catawba Nuclear Station, Unit 2

4

3. Page
1 OF 5

4. Title
Valid Actuation of the Unit 2 Reactor Protection System and Auxiliary Feedwater System

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
05	01	2021	2021	- 002 -	00	6	29	2021	Facility Name	Docket Number
										05000
										05000

9. Operating Mode
3

10. Power Level
0

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

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)	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)	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)	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

Sherry E. Andrews, Senior Engineer

Phone Number (Include Area Code)

(803) 701-3424

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

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)

At 0755 hours on May 1, 2021, during reactor coolant system temperature cross calibration testing activities, with Unit 2 in Mode 3 at 0 percent (not critical) power with all control rods fully inserted, Catawba Unit 2 received an automatic reactor trip signal on Overpower Delta Temperature. The trip was not complex, with all systems responding normally post-trip. As a result of the reactor trip signal, a feedwater isolation signal was generated. At 1013, on May 1, 2021, during feedwater recovery actions, with Unit 2 in Mode 3 at 0 percent power, the 2B Feedwater Pump Turbine tripped, which caused an actuation of the Auxiliary Feedwater (CA) system.

The cause of the reactor trip signal was due to inadequacies in the reactor coolant system temperature cross calibration testing equipment and procedure. The cause of the CA system actuation was due to inadequate oversight and standards adherence of the Unit 2 feedwater isolation recovery actions. Corrective actions include procedural revisions and personnel accountability actions.

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	05000-414	2021	- 002	- 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.

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. The protection and monitoring systems have been designed to assure safe operation of the reactor.

Each of the analyzed accidents and transients can be detected by one or more Reactor Trip System functions. One of the Reactor Trip System functions is Overpower Delta Temperature (OPDT). The OPDT trip function ensures that protection is provided to ensure the integrity of the fuel under all possible overpower conditions. This trip function also limits the required range of the Overtemperature Delta Temperature trip function and provides a backup to the Power Range Neutron Flux-High Setpoint trip. The OPDT trip function ensures that the allowable heat generation rate of the fuel is not exceeded. The OPDT trip function is calculated for each Reactor Coolant System loop, and Reactor Coolant System trip occurs if OPDT is indicated in two loops.

The Auxiliary Feedwater System (CA) [BA] is the assured source of feedwater to the steam generators during accident conditions. The primary safety function of the Feedwater System (CF) [SJ] to isolate the steam generators on a feedwater isolation signal. A feedwater isolation signal initiates isolation of each steam generator in order to:

1. rapidly terminate feedwater flow and steam blowdown inside the containment following a main steam or feedwater line break inside the containment,
2. prevent loss of steam generator water inventory due to a pipe rupture outside the containment, and
3. prevent overfilling the steam generators should the normal means of controlling steam generator level malfunction.



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BACKGROUND (continued)

Feedwater isolation is actuated by any one of the following signals:

1. safety injection,
2. reactor trip coincident with low reactor coolant average temperature,
3. steam generator level high-high.

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.

EVENT DESCRIPTION

Timeline of Events:

4/30/21 1944: Catawba Unit 2 in Mode 3, 0 percent power, commencing heat up activities for scheduled refueling outage number 24 (C2R24). All control rods were already fully inserted into the core (previous to the event). Both reactor trip breakers were also closed at this time. Reactor Coolant (NC) [AB] System temperature cross calibration testing activities at 340 degrees Fahrenheit generated a 2D OPDT trip signal, although the trip signal was not recognized as abnormal at the time.

5/1/21 0755: NC System temperature cross calibration testing activities at 450 degrees Fahrenheit generated a 2B OPDT trip signal. The 2/4 OPDT trip signals generated a Unit 2 Reactor Trip System actuation at this time, opening both reactor trip breakers. As a result of the Unit 2 reactor trip breakers opening, a feedwater isolation signal was generated. All systems responded normally post-trip.

5/1/21 1013: Control Room activities had placed the 2B main feedwater pump turbine (CFPT) in automatic, with main feedwater control valves isolated and in automatic. The bypass feedwater control valves were in manual and nearly closed. The 2B CFPT was in automatic and the main feedwater control valves in automatic, although procedurally isolated. With steam generator level lower than setpoint, 2B CFPT received a demand to raise speed which caused a 2B CFPT trip when the discharge pressure limiting circuit was unable to maintain pressure below the trip setpoint. The 2B CFPT trip resulted in an automatic start of the CA system.

Afterwards, Unit 2 normal feedwater was restored, and CA was returned to Mode 3 standby readiness alignment. The Unit 2 start up from C2R24 was completed successfully with no further feedwater control challenges.

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EVENT DESCRIPTION (continued)

On April 30, 2021, Catawba Unit 2 was in Mode 3 and was heating up and pressurizing toward full NC System pressure and temperature following the scheduled refueling outage, C2R24. All control rods were fully inserted into the core. Both reactor trip breakers were closed from having completed control rod movement testing in Mode 4. Once full temperature and pressure were achieved, control rod drop testing was scheduled to be performed which also requires reactor trip breakers to be closed.

NC System temperature cross calibration testing activities were scheduled to be performed during modes 4 and 3 on 4/30/21 and 5/1/21 with U2 NC System temperatures at 340, 450, and 530 degrees Fahrenheit. The NC System temperature cross calibration testing was performed while Catawba Unit 2 was in the unit startup procedure. At Catawba, the NC System temperature cross-calibration testing uses a newer style test equipment that connects into a resistance temperature detector (RTD) temperature signal that normally feed into the Reactor Protection System (IPE) [JC]. Core Exit Thermocouple signals are also used. The IPE uses the RTD signals to monitor OPDT and other setpoints. If the setpoints are exceeded on 2 out of 4 loops, a signal is sent to trip open the reactor trip breakers. RTD simulation had not been performed on the newer style test equipment for narrow range temperatures to prevent the input from seeing an open circuit condition. Further, the Control Room had not been briefed that an OPDT trip signal would be abnormal during this testing.

Data acquisition at the 340 degrees Fahrenheit reactor coolant temperature plateau was completed on 4/30/21, which generated a OPDT trip signal that went unrecognized as abnormal. The next plateau for data acquisition was being performed at a temperature of 420-470 degrees Fahrenheit in Mode 3. This activity generated a second OPDT trip signal which caused both reactor trip breakers to open. At this point in mode 3, all rods were already fully inserted. The reactor trip signal also caused a feedwater isolation. The Control Room team responded as expected and reset the feedwater isolation signal to reestablish feed flow capability to the Unit 2 steam generators.

Following realignment from the feedwater isolation signal, Operation's control of steam generator water level resulted in a challenge to the 2B CFPT discharge pressure limiting circuit. The 2A CFPT was not required to be in service at the time and was in a tripped condition. Control Room oversight was not adequate, and the focus of the crew shifted to outage status and upcoming evolutions rather than ensuring the steam generator level control system was returned to normal automatic control with steam generator levels within the program band. The 2B CFPT tripped when the discharge pressure limiting circuit was unable to maintain pressure below the trip setpoint. Due to the tripped condition of both CFPTs, the CA system started automatically.

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CAUSAL FACTORS

For each human performance related cause, the licensee shall discuss the cause(s) and circumstances.

A cause analysis was completed for both the Reactor Trip System and CA actuations.

The cause of the Reactor Trip System actuation was the temperature cross calibration testing equipment and procedure were not adequately designed to prevent an actuation of the Reactor Trip System. Additionally, the expected status of the loop OPDT bi-stables was not clearly communicated to or understood by the Control Room team during the testing.

The cause of the CA actuation was inadequate oversight of recovery actions associated with the Unit 2 feedwater isolation, along with breakdown in standards adherence and communication to identify a flawed decision to operate feedwater level control with the bypass feedwater control valves in manual and the 2B CFPT in automatic.

CORRECTIVE ACTIONS**Immediate Actions:**

1. Normal Unit 2 feedwater alignment was restored, and CA was placed into standby readiness.
2. Unit 2 NC System cross calibration activities were completed with the reactor trip breakers open.

Actions:

1. Revision to the cross calibration procedure such that a reactor trip signal is not processed by the Reactor Trip System circuitry, and clear direction is provided to the Control Room regarding indications that are providing signal status for a reactor trip.
2. Appropriate personnel corrective actions (complete), and training.

SAFETY ANALYSIS

At 0755 [EST] hours on May 1, 202, with Unit 2 in Mode 3 at 0 percent power, Catawba Unit 2 received a reactor trip signal which opened the reactor trip breakers. The Unit 2 control rods were already fully inserted into the core prior to the reactor trip signal. The Unit 2 reactor trip signal 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. Had the event occurred at full power, no issues were identified that would have prevented any of the safety systems from responding normally.

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SAFETY ANALYSIS (continued)

At 1013, on May 1, 2021, during feedwater recovery actions after the reactor trip signal on Unit 2, with Unit 2 in Mode 3 at 0 percent power, the 2B main feedwater pump turbine tripped, which caused an actuation of the CA system due to both main feedwater pump turbines being in a tripped condition. Afterward, normal Unit 2 feedwater alignment was restored, and CA was placed into standby readiness. Little to no load was placed on the steam generators at the time. The Unit 2 CA system actuation did not impact the health and safety of the public and there was no safety or radiological consequence to this event. Unit 1 was not affected.

Neither event discussed constitutes a Safety System Functional Failure. No system failures occurred, and all 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 3 years with the same causal factor as this issue.

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.

A review of previous reportable events for the past three years did not identify any additional similar LER events.