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CNS-14-014

February 10, 2014

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Catawba Nuclear Station, Unit 1
Docket No. 50-413
Licensee Event Report (LER) 413/2013-002-0

Pursuant to 10 CFR 50.73(a)(1) and (d), attached is LER 413/2013-002-0, entitled, "Technical Specification Limiting Conditions for Operation (LCOs) 3.6.3 and 3.7.3 Were Violated Due to the Isolation of Nitrogen Supply to Two Unit 1 Main Feedwater Isolation Valves".

This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B).

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 there are any questions on this report, please contact Paul Simbrat at (803) 701-3424.

Sincerely,

Kelvin Henderson
Vice President, Catawba Nuclear Station

PS/s

Attachment

IE22
NRR

xc (with attachment):

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NRC FORM 366 (01-2014) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Catawba Nuclear Station, Unit 1	05000413	1 OF 7

4. TITLE

Technical Specification Limiting Conditions for Operation (LCOs) 3.6.3 and 3.7.3 Were Violated Due to the Isolation of Nitrogen Supply to Two Unit 1 Main Feedwater Isolation Valves.

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
12	16	2013	2013	– 002	– 00	02	10	2014	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
100%	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Paul Simbrat, Regulatory Affairs	(803) 701-3424

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
A	SJ	ISV	B350	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On December 16, 2013, following the completion of an engineering evaluation, it was determined that main feedwater isolation valves (MFIVs) 1CF42 and 1CF60 had been unknowingly inoperable since the completion of the last Unit 1 refueling outage in December of 2012. The MFIVs have the possibility of becoming thermally bound or pressure locked following heat up of the feedwater system. To aid in opening the valves, they are procedurally "soft seated" by reducing the nitrogen pressure in the system. After the MFIV is opened, the nitrogen system is restored to its normal pressure. Following maintenance work to "soft seat" MFIVs 1CF33, 1CF42, 1CF51 and 1CF60 near the end of refueling outage 1EOC20, the nitrogen supply to 1CF33, 1CF42 and 1CF60 remained partially isolated. This condition went undetected until subsequent maintenance activities in November 2013 identified the issue. A review for the periods of time that the partial isolation existed identified that 1CF33 remained operable; however, during the time period of 7/13/13 - 11/8/13, 1CF-42 nitrogen accumulator pressure was below the operability limit for operation with the remote accumulator isolated and from 1/19/13 - 10/25/13, 1CF-60 nitrogen accumulator pressure was below the same limit. The cause is attributed to human errors related to inadequate job preparation and procedure use and adherence. The pre job brief was deficient and steps were inappropriately marked "not applicable" in the procedure. Planned corrective actions include updating model work orders used to plan this work to include a requirement to review corrective action program documents related to this event prior to performing this work and including this issue in the 2014 training covering operating experience for the Maintenance organization. There was minimal safety significance to this event. The closed system provided an inside containment isolation and the ability to perform at least one method of main feedwater isolation was maintained, therefore, this event did not affect the health and safety of the public.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO	
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NARRATIVE

BACKGROUND

This event is being reported under the following criteria:

10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications (TS).

Catawba Nuclear Station Unit 1 is a Westinghouse four-loop Pressurized Water Reactor (PWR) [EIIS: RCT]. The main feedwater isolation valves (MFIVs) [EIIS: ISV] isolate main feedwater [EIIS: SJ] flow to the secondary side of the steam generators [EIIS: SG] following a high energy line break (HELB). The safety related function of the main feedwater control valves (MFCVs) [EIIS: FCV] is to provide the second isolation of main feedwater flow to the secondary side of the steam generators following an HELB. Closure of the MFIVs and associated bypass valves or MFCVs and associated bypass valves terminates flow to the steam generators, terminating the event for feedwater line breaks (FWLBs) occurring upstream of the MFIVs or MFCVs. The consequences of events occurring in the main steam [EIIS: SB] lines or in the main feedwater lines downstream from the MFIVs will be mitigated by their closure. Closure of the MFIVs and associated bypass valves, or MFCVs and associated bypass valves, effectively terminates the addition of feedwater to an affected steam generator, limiting the mass and energy release for steam line breaks (SLBs) or FWLBs inside containment, and reducing the cool down effects for SLBs. The MFIVs also function to provide containment isolation.

The MFIVs and associated bypass valves isolate the nonsafety related portions of the main feedwater system from the safety related portions. In the event of a secondary side pipe rupture inside containment, the valves limit the quantity of high energy fluid that enters containment through the break, and provide a pressure boundary for the controlled addition of auxiliary feed water [EIIS: BA] to the intact loops.

One MFIV and associated bypass valve, and one MFCV and its associated bypass valve, are located on each main feedwater line, outside but close to containment. The MFIVs and MFCVs are located on different supply lines from the auxiliary feedwater injection line so that auxiliary feedwater may be supplied to the steam generators following MFIV or MFCV closure.

The MFIVs are gate valves with pneumatic-hydraulic actuators. Thrust is delivered to the gate valve from a piston cylinder assembly connected to the valve stem. The actuator nitrogen system delivers high pressure nitrogen to the closing (top) side of the piston. The hydraulic system delivers high pressure hydraulic fluid to the opening (bottom) side of the piston. The hydraulic system utilizes solenoid valves in conjunction with a hydraulic pump to charge or vent the hydraulic system. The nitrogen system is a passive accumulator system consisting of two nitrogen accumulators and a pressure transmitter with their associated isolation valves. The nitrogen system is always in contact with the piston cylinder such that a loss of hydraulic system pressure will result in valve closure. The nitrogen system provides the safety related closing force for the feedwater isolation valves.

Based on operating experience, the MFIVs have the possibility of becoming thermally bound or pressure locked following heat up of the feedwater system. To aid in opening the valves, the valves are procedurally "soft seated" by reducing the nitrogen pressure in the system. After the MFIV is opened, the nitrogen system is restored to its normal alignment and pressure.

TS 3.6.3, "Containment Isolation Valves" includes requirements for the containment isolation function provided by each MFIV. Each containment isolation valve is required to be operable in Modes 1, 2, 3 and 4. Condition C is applicable to each MFIV based on the system configuration (one containment isolation valve (the MFIV) outside containment and a closed system inside containment). With one or more penetration flow paths with one containment isolation valve inoperable the affected penetration flow path must be isolated by use of at least one closed and de activated automatic valve, closed manual valve, or blind flange within 72 hours (Required Action C.1) and the affected penetration flow path must be verified isolated once every 31 days (Required Action C.2). If any of these Required Actions are not accomplished within their specified Completion Times (Condition F), the affected unit must be placed in Mode 3 within 6 hours (Required Action F.1) and in Mode 5 within 36 hours (Required Action F.2).

TS 3.7.3, "Main Feedwater Isolation Valves (MFIVs), Main Feedwater Control Valves (MFCVs), Associated Bypass Valves and Tempering Valves" delineates requirements for the main feedwater isolation valves. Four MFIVs are required to be operable in Modes 1, 2, 3 except when a MFIV, the associated bypass valve, or tempering valve is closed and de activated or isolated by a closed manual valve. With one or more MFIVs inoperable (Condition A), the inoperable MFIV must be closed or isolated within 72 hours (Required Action A.1) and the inoperable MFIV must be verified closed or isolated once every 7 days (Required Action A.2). If two valves in the same flow path are inoperable (Condition D), the affected flow path must be isolated within 8 hours (Required Action D.1) . If any of these Required Actions are not accomplished within their specified Completion Times (Condition E), the affected unit must be placed in Mode 3 within 6 hours (Required Action E.1) and in Mode 4 within 12 hours (Required Action E.2).

On December 16, 2013 when this issue was determined to be reportable, Unit 1 was in Mode 1 at 100% power. Unit 1 remained in Mode 1 throughout the periods of time that the MFIVs were determined to be inoperable. During the period that the MFIVs were determined to be inoperable no other structures, systems, or components were out of service that would have prevented at least one method of main feedwater isolation from providing the required safety function. During this period the main feedwater closed system inside containment remained intact as evidenced by confirmation of no primary to secondary leakage, ensuring an inside containment isolation existed.

EVENT DESCRIPTION

Date/Time	Event
(Some event times are approximate.)	
12/19/12	Nitrogen pressure was reduced on the four main feedwater isolation valves (MFIVs) on Unit 1 near the end of refueling outage 1EOC20 to "soft seat" the valves. Work Orders 2020362 (1CF33), 2020363 (1CF42), 02020364 (1CF51) and 2020365 (1CF60) were performed to reduce nitrogen pressure. The Maintenance technicians performing the venting stopped at the request of Operations personnel on the procedure step that established the necessary nitrogen pressure on each valve. Steps to restore the isolated remote nitrogen accumulator tank on each valve were not performed at this time.
12/28/12-12/29/12	MFIVs 1CF33, 1CF42, 1CF51 and 1CF60 were opened by Operations. The Outage Command Center (OCC) notified Maintenance to close out the paperwork for the valves. The Maintenance technicians performing the work were told by Operations personnel that the MFIVs were open and that the nitrogen pressure on each valve was satisfactory, except for 1CF51. A technician from another Maintenance team was used to perform the charging

of the nitrogen supply for 1CF51. The nitrogen supply for 1CF51 was charged to an acceptable pressure and this technician was released back to his crew . The technicians originally assigned the task determined they could close out the work orders since all the nitrogen pressures were now satisfactory. All four W/O packages were closed out with no further actions performed. Charging of the nitrogen supply to 1CF51 restored the remote nitrogen accumulator tank, however it was unrecognized at this time that the remote nitrogen accumulator tanks on 1CF33, 1CF42 and 1CF60 remained isolated, reducing the volume of nitrogen available to assist with closing of these valves.

11/08/13/1453 Maintenance work under work order 2125269 was initiated to charge the nitrogen accumulators associated with MFIV 1CF42 due to an existing slow leak.

11/08/13/1645 Problem Investigation Process (PIP) C-13-10910 was generated. This PIP was written to document that Maintenance found valve 1CFIV0421 for the remote nitrogen accumulator tank closed on the MFIV 1CF42. The expected position for 1CFIV0421 was open.

Operations Shift Manager implemented the management procedure for Operational Response to Acts Directed Against Plant Equipment and determined this valve misposition to be an inadvertent/accidental act. 1CFIV0421 was returned to the open position. An extent of condition was performed for the same valves associated with MFIVs for the other three steam generators on Unit 1 and all four steam generators on Unit 2. One other remote nitrogen accumulator, for MFIV 1CF33, was found isolated. PIP C-13-10913 was written to document the 1CF33 issue.

11/21/13/1830 During engineering staff review of nitrogen pressure trends for all Unit 1 main feedwater isolation valves, it was identified that the remote nitrogen accumulator tank on MFIV 1CF60 may have been isolated by valve 1CFIV0601 around the same time that the remote nitrogen accumulator tanks were isolated to MFIVs 1CF33 and 1CF42 in December 2012. It was further determined that 1CF60 had its nitrogen system recharged on 10/25/13 under W/O 2123343. The procedure steps involved directed the technicians to ensure 1CFIV0601 was OPEN prior to charging the system. Potentially the remote nitrogen accumulator tank valve could have been put into the correct position during this activity. PIP C-13-11492 was written to document this possibility.

11/24/13/1947 Maintenance staff discussion with the maintenance technicians that performed the work under W/O 2123343 found that it was plausible that the remote nitrogen tank accumulator valve was found closed and repositioned open during the work. The technicians remembered opening a valve they had found closed during the work, but were unsure as to which valve. PIP C-13-11538 written.

11/26/13 - 12/17/13 Cause analysis performed for PIP C-13-11538. Cause analysis documented that a qualified maintenance technician found 1CFIV0601 closed during work on 10/25/13 and utilized a procedure step to ensure it was open.

11/08/13 – 12/16/13 Engineering and Regulatory Affairs continued to review this issue and determined that it was LER reportable. The remote nitrogen accumulators were installed in 2000 under CN-11393/00. With the remote tank being isolated on 1CF33, 1CF42 and 1CF60, this effectively reverted the nitrogen system back to its pre modification configuration of a single nitrogen accumulator. Calculation CNC-1205.41-00-0005 references an operability

evaluation performed in PIP C-97-2212 for design basis margin prior to the implementation of the modification. Through this PIP, testing on the spare actuator was performed and compared to required thrust calculation. This determined an operability pressure of 2050 psig was to be used when considering just the small accumulator volume. Once the pressure dropped below 2050 psig in the accumulator system, the valve would be outside the conditions set forth in the calculation. A review of nitrogen pressure for the periods of time that the remote nitrogen accumulators were isolated for 1CF33, 1CF42 and 1CF60 identified that 1CF33 remained operable; however, during the time period of 7/13/13 - 11/8/13, 1CF-42 nitrogen accumulator pressure was below the operability limit for operation with the remote accumulator isolated and from 1/19/13 - 10/25/13, 1CF-60 nitrogen accumulator pressure was below the operability limit for operation with the remote accumulator isolated.

CAUSAL FACTORS

The apparent cause team concluded that the supervisor and technicians did not exhibit the characteristic traits of an engaged thinking organization:

1. A review of the procedure and the actions to be completed in the procedure should have been discussed during the pre-job brief and therefore, the technicians would have understood the actions necessary to be performed in order to complete the task successfully. The pre-job brief was led by the supervisor.
2. Neither the individual assigned to perform the procedure nor the verifier reviewed the procedure to identify what actions were necessary to complete the procedure prior to performing the work. The individuals inappropriately marked as not applicable (N/A) both the conditional and non-conditional steps in the procedure and only focused on the "Follow Up Section" of the procedure. The involved individuals removed pages in the procedure that contained steps that should have been performed.
3. The technicians, both the performer and the verifier assigned to this task, failed to review the procedure to verify/validate the necessary steps to be performed prior to performing the task.

CORRECTIVE ACTIONS

Immediate:

1. An extent of condition was performed for all other main feedwater isolation valves on Unit 1 and Unit 2 to verify the nitrogen supply was not isolated. The nitrogen supply to main feedwater isolation valve 1CF33 for the 1A steam generator was also found to be isolated. The nitrogen supply was opened for valve 1CF33.

Subsequent:

1. Work was completed to recharge the nitrogen supply to the main feedwater isolation valve 1CF42 for the 1B steam generator.

Planned:

1. Administer appropriate level corrective action for involved individuals.

2. Update model work orders used to plan this work to include requirement to review corrective action program documents related to this event prior to performing this work.

3. Include this issue in the 2014 training covering operating experience for the Maintenance organization.

There are no NRC commitments contained in this LER.

SAFETY ANALYSIS

There was minimal safety significance to this event. The feedwater isolation arrangement includes three means for stopping feedwater flow. In addition to isolation by the main and bypass feedwater control valves in each loop, a redundant safety grade feedwater isolation valve is required in series with the feedwater control valves. The third means for stopping flow consists of tripping all main feedwater pumps. Normally, two means are required for accomplishing a safety related function in order to meet the single failure criterion. However, three means are required to accomplish feedwater isolation in the standard Westinghouse arrangement discussed above because failure of one of the means for isolating feedwater is postulated as the initiating event for one of the accidents considered.

As failure of one of the above means is assumed to be an initiating event, a review of TSAIL (Tech Spec Action Item Log) was performed during the period which nitrogen pressure was below the operability limit for valves 1CF42 and 1CF60 to ensure a means of feedwater isolation existed. No entries documenting loss of function were identified. It is expected that the equipment would operate as desired/designed during an event requiring feedwater isolation. This is a reasonable assumption based on equipment performance as well as outage testing. Engineering staff reviewed the most recent outage testing of the feedwater isolation function and confirmed that all acceptance criteria were met.

A review of primary to secondary leak rate calculations performed during the period the MFIVs were inoperable was completed. The main feedwater closed system inside containment remained intact as evidenced by confirmation of no primary to secondary leakage, ensuring an inside containment isolation existed.

Therefore, this event is considered to have no significance with respect to the health and safety of the public.

ADDITIONAL INFORMATION

Within the previous three years, the following LERs were submitted which have been evaluated against this LER for recurring event similarity:

LER 413/2011-003, Revision 0, "Technical Specification Required Shutdown of Unit 1 and Unit 2 and Associated Technical Specification Violation Involving Notice of Enforcement Discretion Due to Two Inoperable Trains of the Control Room Area Chilled Water System". One of the root causes of this event was determined to be insufficient maintenance procedural guidance for alignment of a chilled water pump.

LER 413/2012-001, Revisions 0 and 1, "Unit 1 Automatic Reactor Trip Due to Faulted Reactor Coolant Pump Motor Cable Resulted in Zone G Relay Lockout and Subsequent Loss of Offsite Power and Emergency Diesel Generator Automatic Start for Both Units". One of the root causes of this event was determined to be inadequate design input specification and insufficient control over vendor outsourcing in conjunction with a Zone G relay modification.

NARRATIVE

LER 414/2012-001, Revision 0, "Diesel Generator (DG) 2B Was Unknowingly Inoperable from 09/28/12 to 10/23/12 Due to Failed Tachometer Relay Power Supply'. The root cause of this event was determined to be an inadequate technical evaluation following a DG 2B engine tachometer malfunction.

LER 413/2012-003, Revision 0, "Technical Specification (TS) Limiting Conditions for Operation (LCOs) 3.0.4 and 3.7.5 Were Violated due to Unit 1 Entering Mode 3 with Turbine Driven Auxiliary Feedwater (AFW) Pump Unknowingly Inoperable". The cause of this event was determined to be human performance error. In addition, a procedure was deficient in that it lacked detail concerning the required orientation of the drive coupling when performing the installation process, which resulted in this task being performed as "skill of the craft".

LER 413/2013-001, Revision 0, "Each Diesel Generator (DG) Was Determined to be Unknowingly Inoperable During its Monthly Surveillance Test Due to Technical Specification (TS) Surveillance Requirement (SR) 3.8.1.17 not being Met". The cause of this event was determined to be an inadequate original design.

These events all involved entering or operating in a plant mode with an inoperable TS required component. LER 413/2012-003 was determined to be caused by a human performance error. The human performance error was related to the failure to match mark components for reassembly whereas the human errors being reported in this LER are related to inadequate job preparation and procedure use and adherence. The pre job brief was deficient and steps were inappropriately marked "not applicable" in the procedure. The specifics of the root causes and corrective actions associated with the other events were also different. Therefore, Duke Energy concludes that the event being reported in this LER is considered to be non-recurring in nature.

Energy Industry Identification System (EIIS) codes are identified in the text as [EIIS: XX]. This event is considered reportable to the INPO Consolidated Event System (ICES) (formerly called the Equipment Performance and Information Exchange (EPIX) program).

This event is not considered to constitute a Safety System Functional Failure. There was no release of radioactive material, radiation overexposure, or personnel injury associated with the event described in this LER.