JAMES R. MORRIS
Vice President

Duke Energy Corporation
Catawba Nuclear Station
4800 Concord Road
York, SC 29745

803-701-4251
803-701-3221 fax

December 15, 2010

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Catawba Nuclear Station, Unit 2
Docket No. 50-414
Licensee Event Report 414/2010-002

Pursuant to 10 CFR 50.73(a)(1) and (d), attached is Licensee Event Report 414/2010-002, Revision 0 entitled, "Technical Specification Violation Involving Mode Change with Inoperable Auxiliary Feedwater System Train Due to Closed Pump Discharge 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 L.J. Rudy at (803) 701-3084.

Sincerely,

James R. Morris

LJR/s

Attachment

IE22
NRR

xc (with attachment):

L.A. Reyes
Regional Administrator
U.S. Nuclear Regulatory Commission - Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, GA 30303-1257

J.H. Thompson (addressee only)
NRC Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop 8-G9A
11555 Rockville Pike
Rockville, MD 20852-2738

G.A. Hutto, III
NRC Senior Resident Inspector
Catawba Nuclear Station

INPO Records Center
700 Galleria Place
Atlanta, GA 30339-5957

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(10-2010)

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Technical Specification Violation Involving Mode Change with Inoperable Auxiliary Feedwater System Train Due to Closed Pump Discharge 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
10	17	2010	2010	– 002	– 0	12	15	2010	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE
4

10. POWER LEVEL
0%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 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)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 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)
L.J. Rudy, Regulatory Compliance	(803) 701-3084

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
				No					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On October 17, 2010 at 0209 hours, during startup following the completion of the End of Cycle 17 Refueling Outage, Unit 2 entered Mode 4 with the required motor driven train (manually-actuated) of the Auxiliary Feedwater (AFW) System inoperable. The required train's (2A or 2B) pump discharge valve was not in the correct position (open) as required by plant Technical Specifications (TS) and plant procedures. The affected valves were discovered to be in the closed position at 1330 hours. Following the discovery of this event, the affected valves were repositioned to the correct position. The root cause of this event was determined to be that the procedure for AFW System operation was not structured to provide clear guidance to the operators for the status of AFW System alignments for Mode 4 and Mode 3. The affected procedure will be revised to provide clear guidance for the determination of AFW System alignments for entering these modes. Throughout this event, the affected valves were capable of being manually positioned according to plant procedures in the unlikely event of a plant transient requiring a manual start of the AFW System in Mode 4. This event was limited to plant operation in Mode 4 only. The health and safety of the public were not adversely affected by this event.

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NARRATIVE

BACKGROUND

This event is being reported under the following criterion:

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 2 is a Westinghouse four-loop Pressurized Water Reactor (PWR) [EIIS: RCT].

The Auxiliary Feedwater (AFW) System [EIIS: BA] (Duke Energy designation "CA") supplies feedwater to the steam generators [EIIS: SG] to remove decay heat from the Reactor Coolant System [EIIS: AB] upon the loss of normal feedwater supply. The AFW pumps [EIIS: P] take suction through suction lines from the Condensate Storage System (CSS) [EIIS: KA] and pump to the steam generator secondary side. The normal supply of water to the AFW pumps is from the condensate system. The supply valves [EIIS: V] are open with power removed from the valve operator. The assured source of water to the AFW System is supplied by the Nuclear Service Water System (NSWS) [EIIS: BI]. The turbine and motor driven pump discharge lines to each individual steam generator join into single lines outside containment. These individual lines penetrate the containment and enter each steam generator through the auxiliary feedwater nozzle. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the Main Steam Safety Valves (MSSVs) [EIIS: SA] or the steam generator Power Operated Relief Valves (PORVs) [EIIS: SA]. If the main condenser [EIIS: COND] is available, steam may be released via the steam dump valves [EIIS: JI] and recirculated to the hotwell.

The AFW System consists of two motor driven AFW pumps and one steam turbine driven pump configured into three trains. Each of the motor driven pumps supplies 100% of the flow requirements to two steam generators, although each pump has the capability to be realigned to feed other steam generators. The turbine driven pump provides 200% of the flow requirements and supplies water to all four steam generators. Travel stops are set on the steam generator flow control valves [EIIS: FCV] such that the pumps can supply the minimum flow required without exceeding the maximum flow allowed. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system. Each motor driven AFW pump is powered from an independent Class 1E power supply. The steam turbine driven AFW pump receives steam from two main steam lines upstream of the Main Steam Isolation Valves (MSIVs) [EIIS: SB]. Each of the steam feed lines will supply 100% of the requirements of the turbine driven AFW pump.

The AFW System is capable of supplying feedwater to the steam generators during normal unit startup, shutdown, and hot standby conditions. One turbine driven pump at full flow is sufficient to remove decay heat and cool the unit to Residual Heat Removal (RHR) [EIIS: BP] entry conditions. During unit cooldown, steam generator pressures and main steam pressures decrease simultaneously. Thus, the turbine driven AFW pump with a reduced steam supply pressure remains fully capable of providing flow to all steam generators. Thus, the requirement for diversity in motive power sources for the AFW System is met.

The AFW System is designed to supply sufficient water to the steam generators to remove decay heat with steam generator pressure at the lowest setpoint of the MSSVs plus 3% accumulation. Subsequently, the AFW System supplies sufficient water to cool the unit to RHR entry conditions, with steam released through the steam generator PORVs or MSSVs.

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The motor driven AFW pumps actuate automatically on steam generator water level low-low in one out of four steam generators by the Engineered Safety Features Actuation System (ESFAS) [EIIS: JE]. The motor driven pumps also actuate on loss of offsite power, safety injection, and trip of all Main Feedwater (MFW) [EIIS: SJ] pumps. The turbine driven AFW pump actuates automatically on steam generator water level low-low in two out of four steam generators and on loss of offsite power.

TS 3.7.5 governs the AFW System. Limiting Condition for Operation (LCO) 3.7.5 requires three AFW trains to be operable in Modes 1, 2, and 3. In Mode 4 when the steam generator(s) are relied upon for heat removal, only one AFW train, which includes a motor driven pump, is required to be operable. Since the ESFAS instrumentation that actuates the AFW System is not required to be operable in Mode 4, manual actuation of the required AFW train in this mode is sufficient.

LCO 3.0.4.b allows mode changes into Modes 2, 3, and 4 with an inoperable AFW train; however, LCO 3.0.4.b is not applicable when entering Mode 1.

Condition E states that with the required AFW train inoperable in Mode 4, action must be immediately initiated to restore the AFW train to operable status.

Surveillance Requirement (SR) 3.7.5.1 requires a verification that each AFW manual, power operated, and automatic valve in each water flow path, and in both steam supply flow paths to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position. The SR is modified by a Note that states that it is not applicable to automatic valves when thermal power is $\leq$ 10% rated thermal power. The SR has a Frequency of 31 days.

Procedure OP/2/A/6250/002, "Auxiliary Feedwater System", governs the operation of the Unit 2 AFW System. The procedure contains a number of enclosures, several of which are relevant to the event described in this LER. These are Enclosure 4.1, "Placing the CA System in Standby Readiness", Enclosure 4.3, "Manual Operation of the Motor Driven Auxiliary Feedwater Pumps When Aligned For Standby Readiness", and Enclosure 4.5, "Manual Operation of the Motor Driven Auxiliary Feedwater Pumps When Not Aligned For Standby Readiness".

On October 17, 2010, when this event occurred, Unit 2 was in Mode 4 at 0% power operation, in the process of starting up following the completion of the End of Cycle (EOC) 17 Refueling Outage (RFO).

EVENT DESCRIPTION

Date/Time	Event
10/15/2010/0438	Operations began the pre-Mode 4 AFW valve verification for startup following completion of the EOC 17 RFO.
0530	The 2A and 2B motor driven AFW pump breakers were racked in.
1000	The 2A and 2B motor driven AFW pump discharge valves were opened per OP/2/A/6250/002, Enclosure 4.1.

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1011	A log entry was made that the AFW System was in standby readiness.
1052	The pre-Mode 4 checklist was completed.
1900	The secondary execution Senior Reactor Operator (SRO) mistakenly concluded that the motor driven AFW pumps were not in standby readiness following a review of OP/2/A/6250/002, Enclosure 4.1.
1930	The secondary execution SRO conducted a task preview of OP/2/A/6250/002, Enclosure 4.5 with a Nuclear Equipment Operator (NEO).
2103	The balance of plant Reactor Operator (RO) ran the 2A and 2B motor driven AFW pumps.
2104	The balance of plant RO received concurrent verification for closing the 2A and 2B motor driven AFW pump discharge valves and closed the valves. The Regulatory Guide (RG) 1.47 bypass panel alarmed.
2200	The control room SRO approved the completion of OP/2/A/6250/002, Enclosure 4.5.
10/15 or 16/2010/*	The pre-Mode 4 checklist RG 1.47 bypass panel step was signed off. (The AFW System conditions necessary for the signing of this step were not met at the actual time of Mode 4 entry.)
10/16/2010/0600	Shift turnover occurred. The closed valves were not identified.
1800	Shift turnover occurred. The closed valves were not identified.
*	Mode 4 checklist and unit startup procedural steps were signed off.
10/17/2010/0209	Unit 2 entered Mode 4.
0630	Shift turnover occurred. The closed valves were not identified.
1100	Operations began the pre-Mode 3 AFW valve verification.
1330	The 2A and 2B motor driven AFW pump discharge valves were discovered closed during preparation for AFW autostart alignment per OP/2/A/6250/002, Enclosure 4.1 (Mode 3 alignment portion). This rendered both motor driven AFW trains inoperable (only one train was required to be operable for Mode 4, however).
1408	The 2A motor driven AFW train was restored to operable status by opening its pump discharge valve.
1414	The pre-Mode 3 AFW valve verification was completed.

* Exact time unknown

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CAUSAL FACTORS

The root cause of this event was determined to be that procedure OP/2/A/6250/002 was not structured to provide clear guidance to the operators for the status of AFW System alignments for Mode 4 and Mode 3. Specifically:

- Enclosure 4.1 did not include clear direction as to when the system is aligned for standby readiness for Mode 4 and that the remaining steps will align AFW for Mode 3.
- Enclosure 4.3 did not clarify that the enclosure can be used when Enclosure 4.1 is performed to the point of aligning AFW for Mode 4.
- The title of Enclosure 4.5 did not have the word "Not" in all capitals, bold, and underscored as required by the Procedure Writer's Manual.
- Enclosure 4.5 did not include an initial condition to verify the system is not aligned for standby readiness per Enclosure 4.1.

Per TS 3.7.5, there are different requirements for standby readiness for Mode 4 as opposed to Mode 3. Mode 4 requires one motor driven AFW train aligned with manual start capability, whereas Mode 3 requires both motor driven AFW trains aligned with automatic start capability. Enclosure 4.1 contained the configuration for both Mode 4 standby readiness and for Mode 3 standby readiness without a clear delineation as to when the Mode 4 alignment was completed. Without this clear delineation, the selection of the correct enclosure for manual operation of the motor driven AFW pumps depended upon the knowledge of the individual.

There were several contributing causes which contributed to this event and several missed opportunities to prevent this event from occurring. These included failure of control room personnel to exercise appropriate human performance tools, incorrect conclusion regarding the status of the motor driven AFW pumps by the secondary execution SRO, failure of the balance of plant RO to complete an appropriate turnover on the night of the motor driven AFW pump runs, and failure of control room personnel to conduct an adequate review of the RG 1.47 bypass panel during shift turnover and immediately prior to changing modes.

CORRECTIVE ACTIONS

Immediate:

1. The affected valves were opened to satisfy TS and procedural requirements.

Subsequent:

1. Information concerning this event, including lessons learned, was disseminated to affected personnel.

2. An Operations Guide was issued to provide Operations Shift Manager (OSM) oversight of activities associated with AFW System alignments and expectations for RG 1.47 bypass panel review.

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Planned:

1. Procedure OP/2/A/6250/002 (as well as the corresponding Unit 1 procedure) will be revised to provide clear guidance for the determination of AFW System alignments for entering Mode 4 and Mode 3. The revisions will address the bulleted items discussed above.

2. The pre-outage briefing and Operations training will be revised to include the importance of performing pre-job briefs and post-job reviews, RG 1.47 bypass panel reviews with relation to plant status, and control room personnel verification and validation of work originated by other groups.

3. A procedure change will be made to ensure that a verification is performed immediately prior to entering Mode 4 that no annunciators on the RG 1.47 bypass panel indicate an inoperable system preventing Mode 4 entry.

There are no NRC commitments contained in this LER.

SAFETY ANALYSIS

This event had no safety significance. The Catawba TS require automatic actuation capability of the AFW System in Modes 1, 2, and 3 only. In Mode 4, manual actuation capability of one motor driven AFW train is all that is required. Throughout this event, the control room operators had the ability to manually start the motor driven AFW pumps had AFW initiation been necessary. The operators would have manually aligned the motor driven AFW pump discharge valves to establish flow to the steam generators had it been needed. The operators have the ability to open the discharge valves and the flow control valves from the control room. While unlikely, the following events could have theoretically occurred while in Mode 4, resulting in the need for AFW System operation:

- Loss of feedwater
- Reactor trip or inadvertent safety injection below the P-11 permissive
- Loss of normal power
- Loss of control room
- Loss of coolant accident

Manual operation of the motor driven AFW pump discharge valves in response to these events would have been accomplished in accordance with existing procedural guidance had it been required. During this event while the discharge valves were in the closed position, the valves were powered, there was no maintenance being performed on the valves, and there were no administrative impediments (e.g., tags) that would have prevented the operators from opening the valves at any time while in Mode 4. All other AFW System valves were aligned properly to allow flow to the steam generators without additional operator intervention.

This event did not affect the health and safety of the public.

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ADDITIONAL INFORMATION

Within the previous three years, there have been other LER events involving TS violations; however, the specific circumstances surrounding those events and the corrective actions taken in response to those events could not have prevented this event from occurring. This event is therefore considered to be non-recurring.

Energy Industry Identification System (EIIS) codes are identified in the text as [EIIS: XX]. This event is not considered reportable to the Equipment Performance and Information Exchange (EPIX) program.

This event is not considered to constitute a Safety System Functional Failure. The affected AFW trains remained capable of manual actuation throughout this event. There was no release of radioactive material, radiation overexposure, or personnel injury associated with the event described in this LER.