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May 22, 2013

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station Units 1, 2, and 3
Docket Nos.: 50-269, 50-270, and 50-287
Licensee Event Report 269/2011-04, Revision 1
Problem Investigation Program No. O-11-00387, O-11-00388 and O-11-00016

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 269/2011-04, Revision 1, regarding a noncompliant condition where it was determined that the requirements of Technical Specification 3.4.15, "Reactor Coolant System (RCS) Leakage Detection Instrumentation," had not been met. Specifically, it was revealed that for the three Oconee Nuclear Station (ONS) units, the particulate radioactivity instrument used to detect RCS leakage and alarm in the applicable unit's main control room would not have been able to consistently provide the alarm for a one gallon-per-minute leak within one (1) hour in Modes 1, 2, 3, and 4, as required by the Technical Specification. Consequently, this report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B), as an operation prohibited by Technical Specifications. This report has been revised to include the complete LER content that was not available in Revision 0 of the report which was submitted on June 1, 2011.

There are no regulatory commitments contained in this report.

Any questions regarding the content of this report should be directed to Robert C. Meixell, Oconee Nuclear Station Regulatory Affairs Group, at 864-873-3279.

Sincerely,

Scott L. Batson
Vice President
Oconee Nuclear Station

Attachment

IE22
NRR

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INPO (Word File via E-mail)

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

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Inability to Detect RCS Leak Rate Using the Particulate Radiation Monitor

5. EVENT DATE			6. LER NUMBER					7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR		SEQ NO		REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
											Unit 2	05000 270
04	04	2011	2011	-	04	-	01	05	22	2013	FACILITY NAME Unit 3	DOCKET NUMBER 05000 287

9. OPERATING MODE

Unit 1 - 5
Unit 2 - 1
Unit 3 - 1

10. POWER LEVEL

Unit 1 - 000
Unit 2 - 100
Unit 3 - 100

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

NAME	TELEPHONE NUMBER (Include Area Code)
Robert C. Meixell, Oconee Regulatory Affairs Group	864-873-3279

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
D	IL	MON	S637	N					

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 April 4, 2011, it was determined that the requirements of Technical Specification (TS) 3.4.15, "Reactor Coolant System (RCS) Leakage Detection Instrumentation," had not been met for all three units. The Reactor Building Particulate Radiation Monitor (RIA-47) may not have been able to consistently detect a one gallon-per-minute (1 gpm) reactor coolant pressure boundary (RCPB) leak and alarm in the main control room (MCR), within one (1) hour, for all Modes of applicability required by TS 3.4.15. This TS requires RIA-47 to be Operable in Modes 1 through 4. The function of RIA-47 is to alert operators of excessive RCPB leakage via the MCR alarm. This adverse condition resulted because the setpoint methodology used to establish the RIA-47 alarm was determined to be non-conservative. An engineering change was performed that modified the setpoint methodology such that RIA-47 is able to consistently alarm for a 1 gpm RCPB leak within 1 hour during full power steady state operation. In Modes 2, 3, and 4, and Mode 1 less than full power, RIA-47 may still require greater than or equal to 1 hour to detect a 1 gpm RCPB leak and alarm in the MCR, because RCS activity is decreased due to improvements in fuel quality and improved filtration/clean-up processes used during reactor refueling. Revision 1 includes the complete LER content that was not available in Revision 0 of the report.

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17. NARRATIVE

BACKGROUND:

Leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure. Thus, an early indication or warning signal is necessary to permit proper evaluation of all unidentified leakage. The reactor coolant [AB] contains radioactivity that, when released to the reactor building (RB)[NH], can be detected by radiation monitoring instrumentation. This function is performed by particulate radioactivity indication and alarm monitor RIA-47, which composes part of the RB Airborne Activity Monitoring System [IL]. RIA-47 actuates an alarm in the main control room (MCR) to alert operators when above-normal particulate radioactivity levels exist in the RB. This monitor [MON] is required to be operable in Modes 1 through 4 as specified in Technical Specification (TS) 3.4.15, "Reactor Coolant System (RCS) Leakage Detection Instrumentation.

In addition, the Oconee Nuclear Station (ONS) utilizes leak-before-break (LBB) technology in three piping applications, one of which is a portion of Core Flood (CF) System [BP]/Low Pressure Injection (LPI) System [BP] piping inside the RB (i.e., passive LPI cross-connection). One of the LBB analysis requirements for the passive LPI cross-connection piping is that the RCPB leak detection system must be able to detect leakage of one gallon-per-minute (1 gpm) within one (1) hour. When the NRC approved LBB technology for the passive LPI cross-connection piping (September 29, 2003 for Unit 1; February 5, 2004 for Unit 2; and September 2, 2004 for Unit 3), this RCPB leak detection system requirement became part of the ONS licensing basis. However, it has since been determined that due to low RCS radioactivity levels, RIA-47 may not be able to consistently detect a 1 gpm RCPB leak rate and alarm in the MCR, within 1 hour, for all Modes of applicability required by TS 3.4.15. Thus, the condition is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B), "Operation or Condition Prohibited by TS."

At the time that this adverse condition was discovered (January 12, 2011), Unit 1 was shutdown in Mode 5, and Units 2 and 3 were operating in Mode 1 at approximately 100% power. No structures, systems, or components were out of service at the time that this condition was determined that contributed to this event. Revision 0 of this LER was submitted on June 1, 2011.

EVENT DESCRIPTION:

On January 12, 2011, it was determined that the RB Atmosphere Particulate Radioactivity Monitor (i.e., RIA-47), specified in TS Limiting Condition for Operation (LCO) 3.4.15.b, may not have been able to consistently detect a 1 gpm RCPB leak and alarm in the MCR, within 1 hour, when operating in Modes 1, 2, 3, and 4. This adverse condition is based on (1) the methodology utilized for establishing RIA-47's alarm setpoint was non-conservative and (2) since ONS initial operation, reactor fuel integrity and RCS cleanup processes during refueling have improved, which has reduced the RCS radioactivity concentration and resulted in longer response times for RIA-47. RCS activity is normally low during initial reactor startup, and for a few weeks thereafter, until activated corrosion products have formed in the RCS. As a result, greater RCPB leakage must occur for RB radiation levels to reach the levels at which RIA-47 is designed to respond. This adverse condition applies to all three units.

On April 4, 2011, during the corrective action program reportability review for this adverse condition, it was determined that this condition has existed for over three years and is reportable as an operation or condition prohibited by Technical Specifications.

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RIA-47 is currently considered Operable but Nonconforming with TS 3.4.15 as documented in the Immediate Determination of Operability (IDO).

CAUSAL FACTORS:

A cause evaluation was performed for the adverse condition described in this LER and it determined that there were two causes for this condition. One cause is that ONS personnel had an incorrect interpretation of TS 3.4.15 requirements and Regulatory Guide 1.45 recommendations. This cause is based on ONS TS Bases 3.4.15 which states "Reactor coolant radioactivity levels will be low during initial reactor startup and for a few weeks thereafter until activated corrosion products have been formed and fission products appear from fuel element cladding contamination or cladding defects." Since the TS Bases did not specify a required response time for RIA-47, ONS personnel believed RIA-47 still met the TS requirements for Operability in Modes 2, 3, and 4 by having the required detector sensitivity. Thus, ONS did not initiate a change to TS 3.4.15 similar to TS changes made at other sites that eliminated the Operability requirement for a RB Atmosphere Particulate Radioactivity Monitor in Modes 2, 3, and 4.

The second cause is that personnel did not address the non-conservative aspects of the methodology chosen for establishing RIA-47's alarm setpoint and the consequences of it. The historical approach to setting the alarm setpoint was to review the archive curve of RIA-47 counts and select the highest peak (not including spikes or abnormalities) as the baseline, and add 277 counts (counts expected following a 1 gpm RCPB leak after 1 hour as specified in the calculation used to estimate the response of RIA-47 resulting from a 1 gpm RCPB leak). However, the 'highest peak baseline' is generally above the expected background during periods when there was low RCS activity (i.e., in Modes 2, 3, and 4, and in Mode 1 when less than full power). Thus, RIA-47 would not normally be able to detect a 1 gpm RCPB leak within 1 hour when in Modes 2, 3, and 4, and in Mode 1 when less than full power.

CORRECTIVE ACTIONS:

Completed Actions:

- The procedure used to establish RIA-47 setpoints was revised to establish the appropriate alarm setpoint.
- An engineering change was implemented that modified how alarm methodology was applied.
- The Process Monitoring and Control (PMC) system computer [CPU] archive compression limits for RIA-47 in each Unit were adjusted accordingly to provide better quality historical data.

Planned Actions:

- Actions are established in the Corrective Action Program to resolve the non-conforming condition by implementing long-term solution(s) including potential License Amendment Request (LAR) to revise the TS, and/or a plant modification.

NOTE: The completed actions addressed the nonconforming condition at 100 percent steady state operation (Mode 1). This would encompass the majority of the time the plant is in the TS mode of applicability. The planned actions will address the nonconformance for MODES 2, 3 and 4 and MODE 1 (less than 100 percent steady state operation.)

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EXTENT OF CONDITION:

A review of the setpoint methodology for radiation monitors that are TS and Selected Licensee Commitment (SLC) related was performed. RIA setpoint bases were reviewed and the following effluent radiation monitors were identified with potentially non-conservative setpoint bases:

- RIA-33, Rad. Waste Facility Liquid Discharge
- RIA-35, Low Pressure Service Water Discharge
- RIA-37/38, Gaseous Waste Discharge
- RIA-54, Turbine Building Sump Discharge

Formal Functionality Assessments were performed. Basis changes were required for RIA-35 and RIA-54. The basis changes were incorporated into the RIA setpoint procedure.

These issues were entered into the corrective action program and were determined not to be reportable to the NRC.

SAFETY ANALYSIS:

Duke Energy used a qualitative approach to determine the risk significance associated with the Technical Specification 3.4.15 Reactor Coolant System (RCS) Leakage Detection Instrumentation nonconformance. The nonconformance is associated with not being able to detect RCS leakage of one gallon per minute within one hour via the Reactor Building Particulate Radiation Monitor (RIA-47). During Modes 1, 2, 3 and 4 of operation, RIA-47 may not have alarmed in accordance with the one hour requirement for a one gallon per minute leak. However, it was concluded that the risk increase associated with this issue is negligible for the following reasons:

- First, alternate means of detecting small leaks were available. During Modes 1 and 2, the Control Room operators frequently monitor Letdown Storage Tank (LDST) and containment normal sump level indications as a part of normal plant monitoring. These indications are formally checked during operator shift rounds (3 times per shift) and at shift turnover. The Operations shift also performs a formal RCS Leak Rate calculation once per day.

- The containment sump level indication is credited in Technical Specification 3.4.15 Bases as a diverse measurement means for rapidly detecting small leaks and was available during the time period reviewed for this LER. Because leakage into the normal sump is typically very low, an abnormal RCS leakage of a few gallons per minute would be expected to be quickly recognized. For example, the sump has a capacity that equates to 15 gallons per inch of height. For a 1 gpm liquid flowrate into the sump, a 4 inch increase in sump level would be indicated in approximately an hour (Note: an exact estimate of the detection time is not readily available because the RCS leak will be in the form of steam and it is not known how long it would take for the steam to condense and drain to the normal sump). At higher leakage rates, the detection time would be proportionately reduced. Also, Operations personnel are intermittently in the Reactor Building during Modes 3 and 4 and would likely identify RCS leakage equal to or greater than one gallon

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per minute from a single source. Specifically, Operations personnel perform a Mode 3 containment closeout inspection as part of normal startup that would likely identify RCS leakage equal to or greater than one gallon per minute from a single source.

- Secondly, RCS leaks of this very small magnitude are not risk significant in the Oconee PRA. The RCS leakage rates at issue are well within the capacity of normal make-up pump flowrates and are not expected to challenge the capability of plant systems to achieve an otherwise normal and safe plant shutdown.

- Third, the likelihood of a loss of coolant accident (LOCA) initiating event is not measurably increased by the loss of detection sensitivity. This issue does not change the likelihood that a piping flaw, human error, corrosion, or other material degradation could lead to a loss of pressure boundary integrity. The 1gpm leak detection requirement was originally applied as a condition for implementation of the Leak-Before-Break (LBB) methodology for determining LOCA break size and location in UFSAR Chapter 15 accident analysis. The LBB methodology applies a very conservative set of criteria that demonstrates that for a crack that produces a 10 gpm leak, there is no chance of catastrophic failure using conservative loads and material properties for the RCS piping.

As a result, the event is considered to be of minimal safety significance during the timeframe the detector system was in a degraded state.

ADDITIONAL INFORMATION:

To determine if a recurring or similar event exists, a search of the ONS corrective action program database was conducted for a time period covering five years prior to the date of this event. Based on this search, one event was discovered, from March 2006, which is similar to the subject event. This event identified that ONS credited RIA-47 with the required sensitivity of detecting a 1 gpm RCPB leak in 1 hour, but the corrective actions did not fully resolve the condition. No other recurring event was discovered by the corrective action program database search.

Energy Industry Identification System (EIIS) codes are identified in the text within brackets [ ].

There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.

This event is not considered reportable under the Equipment Performance and Information Exchange (EPIX) program.