UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 30, 2014

Mr. Scott Batson
Site Vice President
Oconee Nuclear Station
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2 AND 3, ISSUANCE OF AMENDMENTS REGARDING USE OF REVERSE OSMOSIS SYSTEM (TAC NOS. ME9877, ME9878, AND ME9879)

Dear Mr. Batson:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment Nos. 385, 387, and 386 to Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55, for the Oconee Nuclear Station (ONS), Units 1, 2, and 3, respectively. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated October 30, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12307A219), as supplemented by letters dated January 21,[1] June 11,[2] September 3,[3] October 21,[4] and December 2, 2013.[5]

These amendments revise the ONS, Units 1, 2, and 3 TSs to allow operation of a reverse osmosis system during normal plant operation to purify the water in the borated water storage tanks and the spent fuel pools. Automatic isolation valves will be installed in the Spent Fuel Pool Cooling (SFPC) system upstream of the Reverse Osmosis (RO) system borated water storage tank suction connections.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

1 ADAMS Accession No. ML13025A254
2 ADAMS Accession No. ML13172A043
3 ADAMS Accession No. ML13268A423
4 ADAMS Accession No. ML13308A319
5 ADAMS Accession No. ML13339A742

If you have any questions, please contact Mr. Randy Hall at 301-415-4032.

Sincerely,

Richard V. Guzman, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosures:
1. Amendment No. 385 to DPR-38
2. Amendment No. 387 to DPR-47
3. Amendment No. 386 to DPR-55
4. Safety Evaluation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-269

OCONEE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 385
Renewed License No. DPR-38

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the Oconee Nuclear Station, Unit 1 (the facility), Renewed Facility Operating License No. DPR-38, filed by Duke Energy Carolinas, LLC (the licensee), dated October 30, 2012, as supplemented by letters dated January 21, June 11, September 3, October 21, and December 2, 2013, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-38 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 385, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility
Operating License No. DPR-38
and the Technical Specifications

Date of Issuance: April 30, 2014

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-270

OCONEE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 387
Renewed License No. DPR-47

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the Oconee Nuclear Station, Unit 2 (the facility), Renewed Facility Operating License No. DPR-47, filed by Duke Energy Carolinas, LLC (the licensee), dated October 30, 2012, as supplemented by letters dated January 21, June 11, September 3, October 21, and December 2, 2013, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-47 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 387, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility
Operating License No. DPR-47
and the Technical Specifications

Date of Issuance: April 30, 2014

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-287

OCONEE NUCLEAR STATION, UNIT 3

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 386
Renewed License No. DPR-55

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the Oconee Nuclear Station, Unit 3 (the facility), Renewed Facility Operating License No. DPR-55, filed by Duke Energy Carolinas, LLC (the licensee), dated October 30, 2012, as supplemented by letters dated January 21, June 11, September 3, October 21, and December 2, 2013, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-55 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 386, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility
Operating License No. DPR-55
and the Technical Specifications

Date of Issuance: April 30, 2014

ATTACHMENT TO LICENSE AMENDMENT NO. 385

RENEWED FACILITY OPERATING LICENSE NO. DPR-38

DOCKET NO. 50-269

AND

TO LICENSE AMENDMENT NO. 387

RENEWED FACILITY OPERATING LICENSE NO. DPR-47

DOCKET NO. 50-270

AND

TO LICENSE AMENDMENT NO. 386

RENEWED FACILITY OPERATING LICENSE NO. DPR-55

DOCKET NO. 50-287

Replace the following pages of the Renewed Facility Operating Licenses and the Appendix A Technical Specifications (TSs) with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages	Insert Pages
Licenses	Licenses
License No. DPR-38, page 3	License No. DPR-38, page 3
License No. DPR-47, page 3	License No. DPR-47, page 3
License No. DPR-55, page 3	License No. DPR-55, page 3
TSs	TSs
Table of Contents Page iv	Table of Contents Page iv
- -	Page 3.7.19-1
- -	Page 3.7.19-2
- -	Page 3.7.19-3
- -	Page 3.9.8-1

A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 385 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

Any particular bulk power supply transaction may afford greater benefits to one participant than to another. The benefits realized by a small system may be proportionately greater than those realized by a larger system. The relative benefits to be derived by the parties from a proposed transaction, however, should not be controlling upon a decision with respect to the desirability of participating in the transaction. Accordingly, applicant will enter into proposed bulk power transactions of the types hereinafter described which, on balance, provide net benefits to applicant. There are net benefits in a transaction if applicant recovers the cost of the transaction (as defined in ¶1 (d) hereof) and there is no demonstrable net detriment to applicant arising from that transaction.

1. As used herein:

(a) "Bulk Power" means electric power and any attendant energy, supplied or made available at transmission or sub-transmission voltage by one electric system to another.

(b) "Neighboring Entity" means a private or public corporation, a governmental agency or authority, a municipality, a cooperative, or a lawful association of any of the foregoing owning or operating, or proposing to own or operate, facilities for the generation and transmission of electricity which meets each of

A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 387 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

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A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 386 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

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   (b) "Neighboring Entity" means a private or public corporation, a governmental agency or authority, a municipality, a cooperative, or a lawful association of any of the foregoing owning or operating, or proposing to own or operate, facilities for the generation and transmission of electricity which meets each of

3.7 Plant Systems

3.7.19 Spent Fuel Pool Cooling (SFPC) Purification System Isolation from Borated Water Storage Tank (BWST)

LCO 3.7.19 a. Two SFPC Purification System BWST automatic isolation valves shall be OPERABLE.
b. SFPC Purification System branch line manual valves shall be closed and meet Inservice Testing Program leakage requirements.

APPLICABILITY: MODES 1, 2, 3 and 4 when the SFPC Purification System is not isolated from the BWST

ACTIONS

----------NOTES----------
1. SFPC Purification System flow path from the BWST may be unisolated intermittently under administrative controls.
2. Separate Condition entry allowed for each SFPC Purification System branch line manual valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One automatic isolation valve inoperable.	A.1 Isolate the flow path by use of at least one closed and de-activated automatic valve, one closed and de-activated non-automatic power operated valve, closed manual valve, or blind flange.	4 hours
	AND	
	A.2 Verify the flow path is isolated.	Once per 31 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Two automatic isolation valves inoperable.	B.1	Isolate the flow path by use of at least one closed and de-activated automatic valve, one closed and de-activated non-automatic power operated valve, closed manual valve, or blind flange.	1 hour
C. Required SFPC Purification System branch line manual valve not closed or not meeting leakage requirements.	C.1	Isolate the flow path by use of at least one closed and de-activated automatic valve, one closed and de-activated non-automatic power operated valve, closed manual valve, or blind flange.	1 hour
	AND		
	C.2	Verify the flow path is isolated.	Once per 31 days
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1	Be in MODE 3.	12 hours
	AND		
	D.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.19.1	Verify SFPC Purification System branch line manual valves that are not locked, sealed, or otherwise secured in position are closed.	In accordance with the Surveillance Frequency Control Program
SR 3.7.19.2	Verify SFPC Purification System branch line manual valves meet Inservice Testing Program Leakage Requirements.	In accordance with the Inservice Testing Program
SR 3.7.19.3	Verify SFPC Purification System BWST automatic isolation valves are OPERABLE in accordance with the Inservice Testing Program.	In accordance with the Inservice Testing Program
SR 3.7.19.4	Verify each SFPC Purification System BWST automatic isolation valve that is not locked, sealed, or otherwise secured in position, actuates to the isolation position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program

3.9 REFUELING OPERATIONS

3.9.8 Reverse Osmosis (RO) System Operating Restrictions for Spent Fuel Pool (SFP)

LCO 3.9.8 The RO System shall be isolated from the spent fuel pool by breaking the siphon from the SFP.

APPLICABILITY: During movement of irradiated fuel assemblies in the SFP,
During movement of cask over the SFP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RO System not isolated	----------NOTE---------- LCO 3.0.3 is not applicable ----------	
	A.1 Suspend the movement of irradiated fuel assemblies in the SFP	Immediately
	AND	
	A.2 Suspend the movement of cask over the SFP	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.8.1	Verify RO System is isolated by breaking the siphon from the SFP.	In accordance with the Surveillance Frequency Control Program

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 385 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-38

AMENDMENT NO. 387 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-47

AND

AMENDMENT NO. 386 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-55

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By application dated October 30, 2012[1] (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12307A219), as supplemented by letters dated January 21 (ADAMS Accession No. ML13025A254), June 11 (ADAMS Accession No. ML13172A043), September 3 (ADAMS Accession No. ML13268A423), October 21 (ADAMS Accession No. ML13308A319), and December 2, 2013 (ADAMS Accession No. ML13339A742), Duke Energy Carolinas, LLC (Duke Energy, the licensee), submitted a license amendment request (LAR) for the Oconee Nuclear Station, Units 1, 2, and 3 (ONS 1/2/3) to operate a reverse osmosis (RO) system to remove silica from the borated water storage tanks (BWSTs) and the spent fuel pools (SFPs) and to operate the BWST recirculation pump for BWST boron concentration sampling during power operation. The proposed change creates new Technical Specification (TS) 3.7.19, "Spent Fuel Pool Cooling (SFPC) Purification System Isolation from Borated Water Storage Tank (BWST)" and TS 3.9.8, "Reverse Osmosis (RO) System Operating Restrictions for Spent Fuel Pool (SFP)." By letter dated September 3, 2013, Duke Energy updated its proposed LAR and committed to installing automatic isolation valves in the SFPC system upstream of the RO system borated water storage tank suction connections.

The supplemental letters dated January 21, June 11, September 3, October 21, and December 2, 2013, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC)

[1] In its application dated November 15, 2010 (ADAMS Accession No. ML103220101), the licensee originally requested the approval of the reverse osmosis system for Oconee Nuclear Station. The licensee withdrew this request and resubmitted a new application with added Technical Specification details addressing various issues raised by the NRC staff.

staff's proposed no significant hazards consideration determination as published in the *Federal Register* on November 26, 2013 (78 FR 70591).

2.0 REGULATORY EVALUATION

The regulatory requirements and guidance which the NRC staff considered in assessing the proposed TS change are as follows.

Title 10 of the *Code of Federal Regulations* Section 50.67 (10 CFR 50.67), "Accident source term," which states that an applicant's analysis must demonstrate with reasonable assurance that: (1) an individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 25 roentgen equivalent man (rem) total effective dose equivalent (TEDE), (2) an individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release during the entire period of its passage, would not receive a radiation dose in excess of 25 rem TEDE, and (3) adequate radiation protection is provided to permit access to and occupancy of the control room (CR) under accident conditions without personnel receiving radiation exposures in excess of 5 rem TEDE for the duration of the accident.

10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," which establishes the minimum requirements for the principle design criteria of nuclear power plants. General Design Criterion 19 (GDC-19), "Control Room" states, in part, that adequate radiation protection shall be provided to permit access and occupancy of the CR under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. GDC-2, "Design Bases for Protection Against Natural Phenomena," requires, in part, that the structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes.

In 10 CFR 50.36, "Technical Specifications," the NRC established its regulatory requirements related to the content of Technical Specifications (TSs). Pursuant to 10 CFR 50.36, TSs are required to include items in the following five specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls. The regulation is applicable since the proposed amendment concerns new TSs and TS Bases that impose requirements for RO system operation and isolation requirements.

Information Notice 2012-01 (IN 2012-01),"Seismic Considerations – Principally Issues Involving Tanks," which communicated operating experience involving operability of the refueling water storage tank (RWST) at Shearon Harris Nuclear Power Plant. The seismically qualified RWST was aligned to the non-seismically qualified fuel pool purification system for purification of the RWST contents, creating a breach of the seismically qualified boundary and resulting in the inoperability of the RWST. The plant credited operator action, if needed, to close the open valve at the seismically qualified boundary and declared the RWST operable for the duration of the planned purification activity. It was determined by the NRC staff that, while entry into a TS action statement is allowable for maintenance or surveillances, the TS does not allow compensatory measures to be credited for periods longer than the TS completion time unless the TS expressly

allows operation in that condition. IN 91-56, "Potential Radioactive Leakage to Tank Vented to Atmosphere," communicated that the isolation valves for the emergency core cooling system (ECCS) recirculation lines may leak to tanks that vent to the atmosphere, such as the RWST. ECCS leakage into tanks vented to atmosphere could result in an unanalyzed release path for radionuclides during a design basis accident.

Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Rev. 0, July 2000, which provides the methodology for analyzing the radiological consequences of several design basis accidents to show compliance with 10 CFR 50.67. RG 1.183 provides guidance to licensees on acceptable application of alternate source term (AST) methodology, including acceptable radiological analysis assumptions.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Rev. 0, July 2000, which provides review guidance to the NRC staff for the review of AST amendment requests. SRP 15.0.1 states that the NRC reviewer should evaluate the proposed change against the guidance in RG 1.183.

License Amendment Nos. 338, 339, and 339 to Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55 for ONS 1/2/3, respectively, dated June 1, 2004 (ADAMS Accession No. ML041540097), which implemented the AST methodology for analyzing the radiological consequences of the design-basis loss of coolant accident (LOCA) and fuel handing accident (FHA) using RG 1.183. The regulatory requirements from which the NRC staff based its acceptance are the reference values in 10 CFR 50.67, and the accident specific guideline values in Regulatory Position 4.4 of RG 1.183, and Table 1 of SRP Section 15.0.1.

10 CFR 50.55a(f), "Inservice testing requirements," which requires, in part, that certain American Society of Mechanical Engineers (ASME) Class 1, 2, and 3 components must meet the requirements of the ASME Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code), except where alternatives have been authorized pursuant to paragraphs (a)(3)(i) and (a)(3)(ii) of 10 CFR 50.55a.

ASME OM Code, para. ISTA-1100, *Scope*, which requires, in part, that valves that are required to perform a specific function in mitigating the consequences of an accident be tested and examined to assess their operational readiness in accordance with the applicable requirements established in the OM Code.

The proposed change involves the processing of BWST or SFP water through an RO system intended to remove silica from the water contained in these structures. The RO system consists of a skid mounted unit and piping and valves that are able to draw water from the BWST or SFP, process the water through the unit, and return the processed water to the BWST or SFP. The skid mounted unit contains a low Net-Positive Suction Head (NPSH) booster pump, a high pressure feed pump, and a series of membranes selected to resist the passage of dissolved silica and enhance the passage of borated water. Operators manually set the flow through the unit by throttling a valve downstream of the feed pump and upstream of the membranes. A certain amount of reject flow that collects the concentrated dissolved silica solution from the upstream side of the membranes is also manually set by the operators. The reject flow goes to the

miscellaneous waste holdup tank in the auxiliary building, and the processed flow to the BWST or SFP from which it was drawn.

The processing could affect the quantity of water in the BWST and SFP structures and the boron concentration of the water. The BWST supports the Emergency Core Cooling System (ECCS) by providing a source of borated water for ECCS pump operation. In addition, the BWST supplies borated water to the refueling canal for refueling operations. The SFP contains borated water that provides cooling and contributes to criticality prevention.

Section 3.1 of the ONS Updated Final Safety Analysis Report (UFSAR) addresses station design conformance with the NRC General Design Criteria (GDC). The principal design criteria for ONS 1/2/3 were developed considering the GDCs for Nuclear Power Plant Construction Permits proposed by the Atomic Energy Commission (AEC) in a proposed rulemaking for 10 CFR Part 50 that was published in the *Federal Register* on July 11, 1967 (ADAMS Accession No. ML043310029). The AEC criteria relevant to the proposed license amendment relate to the design of the SFP, the design of the BWST, and the protection afforded by design against failures of piping systems similar to that proposed for the RO system. The following AEC criteria are relevant:

> Criterion 2, "Performance Standards," specifies that systems and components of reactor facilities essential to the prevention or mitigation of accidents shall be designed, fabricated, and erected to performance standards that will enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena. Section 3.4.1.1.1, "Current Flood Protection Measures for the Turbine and Auxiliary Buildings," of the ONS UFSAR addresses protection provided against failures of piping located in the auxiliary building that had not been evaluated to withstand seismic accelerations. The ONS UFSAR contains a description that the non-seismic high pressure service water system, the non-seismic portions of the low pressure service water system and the plant drinking water system had been isolated or flow limited to allow operators sufficient time to identify and isolate the source of potential flooding. The licensee had determined that other piping systems within the auxiliary building would withstand seismic accelerations, and the licensee postulated no failures in this piping.
>
> Criterion 4, "Sharing of Systems," specifies that reactor facilities shall not share systems or components unless the sharing does not impair safety. Duke Energy has proposed to share the RO System between ONS 1/2/3.
>
> Criterion 43, "Accident Aggravation Prevention," specifies that engineered safety features shall be designed so that any action of the engineered safety features would not accentuate the adverse after-effects of the loss of normal cooling. Section 3.1 of the ONS UFSAR described that sources of necessary post-accident cooling water are monitored for boron concentration to prevent coolant additions that could dilute boron concentration.
>
> Criterion 66, "Prevention of Fuel Storage Criticality," specifies that physical systems or processes shall prevent criticality in spent fuel storage, and means such as geometrically safe configurations shall be emphasized over procedural controls. Section 9.1.2.3.2, "Criticality Analysis," of the ONS UFSAR describes that soluble boron was fully

considered in the evaluation of accident conditions and a soluble boron concentration of 430 parts per million was considered in demonstrating that the effective neutron multiplication factor would be less than 0.95 during normal fuel storage conditions. Therefore, soluble boron must be retained under normal and accident conditions.

Criterion 67, "Fuel and Waste Storage Decay Heat," specifies that a reliable Decay Heat Removal System (DHRS) shall be designed to prevent damage to the fuel in storage facilities. Section 3.1, of the ONS UFSAR describes that this criterion is met in part by the design of the Spent Fuel Cooling System (SFCS), which incorporates provisions to maintain water level. Furthermore, Section 9.1.3.4, "Safety Evaluation," of the ONS UFSAR describes that the cooling system is arranged so that loss of fuel pool water by piping or component failure is highly improbable.

In addition to the physical changes associated with operation of the RO system, the licensee listed the following changes to the facility UFSAR in Section 2.2 of its November 15, 2010 LAR:

UFSAR Section 3.1.4, Sharing of Systems, specifies that reactor facilities shall not share systems or components unless safety is not impaired by the sharing. Duke Energy's evaluation concluded that safety is not impaired by sharing the RO System between ONS Units 1, 2, and 3. The table, which lists shared systems that do not impair safety, will be revised to list the RO System as shared between Units 1, 2, and 3.

UFSAR Section 3.4.1.1.1, Current Flood Protection Measures for the Turbine and Auxiliary Buildings, will be revised to indicate that the RO System is considered a new source that, if not isolated, could flood the Auxiliary Building if the non-seismic piping ruptured. Note: The approved licensing basis . . . for Flood Protection Measures for the Turbine and Auxiliary Buildings, adds a paragraph that addresses Auxiliary Building flooding from three sources. This information is to be added to the UFSAR; however, the UFSAR has not been updated to reflect this approval. The new source will be added to this paragraph.

UFSAR Section 3.6.1, Postulated Piping Failures in Fluid Systems Inside and Outside Containment, will be revised to list the new RO System as a high energy system outside containment . . . .

The proposed implementation could affect the minimum required BWST volume, which would further affect the Low Pressure Injection (LPI) pump operation and Reactor Building Spray (RBS) pump. The BWST supports the ECCS and the RBS System by providing a source of borated water for ECCS and RBS pump operation. The minimum required BWST volume is also needed to support continued LPI pump operation after the manual transfer to recirculation occurs. When LPI pump suction is transferred to the sump, there must be sufficient water in the sump to ensure adequate NPSH for the LPI and RBS pumps. The amount of water that enters the sump from the BWST and other sources is one of the input assumptions of the NPSH calculation at ONS.

The minimum water level in the Unit 1 & 2 SFP must be maintained higher than the TS Limiting Condition for Operation (LCO) 3.7.11 during the time period directly after an outage. The SFP is also used as a source of borated water for the Standby Shutdown Facility (SSF) Reactor Coolant (RC) Makeup System. The SSF is designed to maintain the reactor in a safe shutdown condition

following postulated fire, sabotage, and flooding events. On loss of normal makeup to the RCS, the SSF RC makeup system uses the SFP to provide RC Pump Seal cooling and makeup to the RCS. The higher level is required to support TS LCO 3.10.1 for SSF RC Makeup System operability. The system will also alter SFP boron concentration and temperature.

3.0 TECHNICAL EVALUATION

3.1 Description of the Proposed Change

The proposed change would allow the non-seismically qualified RO system to be connected to the seismically qualified spent fuel pool cooling (SFPC) purification system during power operation in order to remove silica from the BWSTs and SFPs. The proposed change would also allow operation of the BWST recirculation pump for BWST boron concentration sampling during power operation. The proposed change would add new TS 3.7.19, "Spent Fuel Pool Cooling (SFPC) Purification System Isolation from Borated Water Storage Tank (BWST)" to control operability of the automatic isolation valves between the BWST and the SFPC purification system and manual valves on branch lines off of the SFPC purification system. The proposed change would also add new TS 3.9.8, "Reverse Osmosis (RO) System Operating Restrictions for Spent Fuel Pool (SFP)" to control movement of spent fuel while the RO system is connected to the SFP. The NRC staff's evaluation addresses the impact of the proposed change on previously analyzed design basis accident radiological consequences.

ONS has three units. Units 1 and 2 share a single SFPC purification system, while Unit 3 has its own SFPC purification system. All three units share a common RO system. Therefore, one connection is proposed to connect the Units 1 and 2 SFPC purification system to the RO system, and another connection is proposed to connect the Unit 3 SFPC purification system to the RO system in order to remove silica from the BWSTs. In order to remove silica from the SFPs, two connections are proposed between each SFP and its respective SFPC purification system; and two connections are proposed between the two SFPC purification systems and the single RO system. The LAR dated October 30, 2012, proposed to connect the RO system supply piping from the BWSTs to the SFPC purification system using a single safety-related seismic isolation valve and a flow limiting orifice. As discussed in Section 3.2.1 of this safety evaluation, the licensee revised the design of the connection from the BWSTs to the RO system by letter dated September 3, 2013. The proposed change would add redundant automatically actuated, safety-related, seismic isolation valves between the RO system supply piping and the BWSTs. These automatically actuated isolation valves would also isolate the BWST recirculation pump from the BWST.

The LAR states that the suction piping from each SFP will be connected to the SFPC purification system using "candy cane" piping which will be lowered into the SFP from above and requires priming in order to establish flow to the RO system. The LAR also states that RO system return piping will be connected to the SFPC purification system through a safety-related seismic check valve.

3.2 Radiological Impacts of the Proposed Change

3.2.1 Single Failures and Manual Operator Actions

The licensee's AST analysis for a large break LOCA assumes that radioactive sump water leaks into the BWST during the recirculation phase of the LOCA. The licensee's AST analysis also assumes that the SFPC purification and RO systems are isolated from the BWST prior to beginning the recirculation phase; therefore, no leakage of post-LOCA fluids can occur from the SFPC purification or RO systems during the recirculation phase even though post-LOCA fluids are assumed to leak into the BWST. The licensee's AST analysis did not analyze the impact of leakage of radioactive fluids into the RO system.

The proposed change allows operation of the RO system to remove silica from the BWST during Modes 1-4. In order to remove silica from the BWST, an open flowpath must be established between the BWST and the RO system (through the SFPC system). Since the RO system is not seismically qualified, any radioactive fluid in the RO system must be assumed to leak out of the RO system (to the building or environment) during an accident. Leakage of radioactive sump water through this open flowpath during recirculation was not accounted for in the licensee's AST analysis. Therefore, the proposed change introduces a previously unanalyzed release path for post-LOCA fluids to exit containment during recirculation, if the RO system isolation valves are not closed prior to initiating the recirculation phase. In order to ensure the initial conditions established in the licensee's AST analysis are met, the RO system isolation valves must be closed prior to initiation of recirculation.

Per SRP 15.0.1, the NRC staff evaluated the proposed change against the guidance in RG 1.183. RG 1.183, Regulatory Position 5.1.2 states:

> Credit may be taken for accident mitigation features that are classified as safety-related, are required to be operable by technical specifications, are powered by emergency power sources, and are either automatically actuated or, in limited cases, have actuation requirements explicitly addressed in emergency operating procedures. The single active component failure that results in the most limiting radiological consequences should be assumed.

In the LAR dated October 30, 2012, ONS proposed to credit a single safety-related seismically qualified valve to isolate the seismically qualified BWST and SFPC purification systems from the non-seismically qualified components in the RO system. However, the proposed change did not include sufficient information for the NRC staff to determine how failure to close the single seismically qualified isolation valve impacts the analysis of the limiting single active component failure assumed in the AST analysis, as discussed in RG 1.183, Regulatory Position 5.1.2. In addition, ONS proposed a manual time critical operator action (TCOA) to ensure the RO system isolation valves from the BWST are closed before recirculation is initiated to prevent the potential release of post-LOCA fluids, in lieu of automatically actuated isolation valves. However, the proposed change did not include sufficient information for the NRC staff to evaluate whether the proposed TCOA is adequate to prevent an inadvertent release of post-LOCA fluids in lieu of automatically actuated valves, as discussed in RG 1.183, Regulatory Position 5.1.2.

By email dated December 21, 2012, and letters dated April 12, 2013, and July 18, 2013, the NRC staff requested that the licensee provide additional information regarding the impact of a single failure of the isolation valve, including failure of the operator to perform the TCOA, and the basis for how the proposed TCOA is adequate in lieu of automatically actuated valves to ensure the RO system isolation valves are closed before initiation of recirculation if a LOCA were to occur.

By letter dated September 3, 2013, the licensee revised the LAR to include two automatically operated, safety-related, seismically qualified, in-series isolation valves on each of the RO system supply piping connections from the BWSTs to the SFPC purification systems The isolation valves also isolate the BWST from the BWST recirculation portion of the SFPC purification system, which is used to perform TS required BWST boron sampling. The licensee stated that the isolation valves will automatically close before switchover to recirculation based on actuation signals from redundant BWST pressure monitoring devices installed on the BWST recirculation header. By letter dated October 21, 2013, the licensee stated that position indication for the valves will be included on the Operator Aid Computer in the control room. By letter dated December 2, 2013, the licensee stated that the isolation valves are spring-close, air-to-open valves that are designed to fail closed on loss of power or loss of air. The licensee included operability and leakage testing requirements for the isolation valves in proposed TS 3.7.19, submitted by letter dated October 21, 2013. Proposed TS 3.7.19 also includes actions to ensure all other SFPC purification system branch line manual valves are closed and meet leakage requirements when the SFPC purification system is not isolated from the BWST, in order to ensure no unanalyzed leak paths exist.

The NRC staff finds that addition of redundant automatically operated, safety-related, seismically qualified isolation valves which will close prior to initiation of the recirculation phase meets the criteria in Regulatory Position 5.1.2 of RG 1.183 for acceptable accident mitigation features and therefore that the proposed change does not result in an unanalyzed release path for post-LOCA fluids. The NRC staff also finds that addition of redundant automatically operated, safety-related, seismically qualified isolation valves eliminates the isolation valves as a potential limiting single active component failure because the single failure of any of the in-series valves would be mitigated by the other valve.

3.2.2 Valve Leakage

The licensee's AST analysis for a large break LOCA assumes back-leakage of five gallons per minute (gpm) of radioactive sump water into the BWST and a total of 12 gallons per hour (gph) leakage from the ECCS into the auxiliary building during the recirculation phase. However, the AST analysis does not assume there is any back-leakage of post-LOCA fluids into the SFPC purification or RO systems, or any leakage to the environment from the SFPC purification or RO systems.

Per SRP 15.0.1, the NRC staff evaluated the proposed change against the guidance in RG 1.183. RG 1.183, Regulatory Position 5.0 states:

> ESF [Engineered Safety Features] systems that recirculate sump water outside of the primary containment are assumed to leak during their intended operation. This release source includes leakage through valve packing glands, pump shaft seals, flanged connections, and other similar components. This release source may also

include leakage through valves isolating interfacing systems (Ref. A-7) [IN 91-56, "Potential Radioactive Leakage to Tank Vented to Atmosphere," September 19, 1991]. The radiological consequences from the postulated leakage should be analyzed and combined with consequences postulated for other fission product release paths to determine the total calculated radiological consequences from the LOCA.

Since the RO system takes suction from the BWST using piping that may be exposed to post-LOCA fluids during recirculation, the proposed change introduces an unanalyzed release path for post-LOCA fluids to exit containment during recirculation through any non-seismically qualified components in the RO system. However, the LAR did not include any limitations or controls on the amount of leakage past the RO system isolation valves or an evaluation of the impact of that leakage on its 10 CFR 50.67 doses. Therefore, the proposed change did not include sufficient information for the NRC staff to determine the impact of leakage through the RO system isolation valves on the licensee's design basis accident analysis. By email dated December 21, 2012, the NRC staff requested that the licensee provide an analysis of the impact of any leakage past the isolation valves.

By letter dated January 21, 2013, the licensee stated that its AST analysis assumes a total of 12 gph of ECCS leakage into the auxiliary building, which is doubled in the AST dose calculations in accordance with RG 1.183. The licensee also stated that ONS currently limits ECCS leakage to two gph, which results in a margin of 10 gph from the current limit to the assumptions in the AST analysis. The licensee further stated that the release path for the RO system is the auxiliary building or the BWST, and that any release from the BWST vent is bounded by assuming all of the release is from the auxiliary building. By letter dated September 3, 2013, the licensee stated that it would revise proposed TS 3.7.19 to require leak rate testing for the RO system isolation valves and other normally closed potential leakage paths that branch off the SFPC purification system upstream of the isolation valves and that a maximum of six gallons per hour (gph) of leakage will be allowed from these valves. By letter dated October 21, 2013, the licensee revised proposed TS 3.7.19 to require leak rate testing for the RO system isolation valves and other normally closed potential leakage paths that branch off the SFPC purification system upstream of the isolation valves.

The NRC staff finds the licensee's approach acceptable because total leakage from the ECCS, SFPC purification, and RO systems is bounded by the ECCS leakage assumed in its NRC-approved AST analysis, which is consistent with Regulatory Position 5.0 of RG 1.183. The NRC staff's acceptance is based on the normally closed potential leakage pathways being isolated by safety-related, seismically-qualified valves that are subject to leakage testing requirements, as stated in proposed TS 3.7.19.

3.2.3 Reverse Osmosis System Return Line Back-leakage

The licensee's AST analysis for a LOCA assumes five gpm back-leakage of sump water into the BWST during the recirculation phase. The LAR states that the RO system return piping is isolated from the BWST using a single safety-related check valve. It was unclear to the NRC staff whether failure of or leakage past the safety-related check valve on the return piping could create an unanalyzed release path for BWST water. By letter dated April 12, 2013, the NRC staff requested

that the licensee describe the impact of failure of or leakage past the check valve on the ECCS leakage considered in the licensing basis accident analysis and the resulting consequences.

In addition, the NRC staff requested that the licensee (a) correct a formatting error related to the proposed TS LCO 3.9.8 logical connectors, and (b) provide the engineering judgment by which the licensee determined that the Surveillance Frequencies for the seismic boundary valve and verification of RO system isolation should be 31 days and 7 days, respectively.

In its response dated June 11, 2013, the licensee stated that the check valve's only function is to preserve the pressure boundary of the SFPC purification system and that the SFPC purification system is not contaminated with post-LOCA fluids during recirculation. By letter dated July 18, 2013, the NRC staff requested that the licensee explain why the SFPC purification system will not become contaminated with post-LOCA fluid back-leakage since the SFPC purification system connects to the BWST. By letter dated September 3, 2013, the licensee stated that the return line from the RO system discharges to the top of the BWST above the water level present during recirculation and therefore will not become contaminated with post-LOCA fluid back-leakage.

The NRC staff finds the licensee's response acceptable because the RO system return piping is not exposed to post-LOCA fluid back-leakage for the duration of the accident (30 days) and the impact of back-leakage of post-LOCA fluids into the BWST has been previously analyzed in the licensee's AST analysis. Therefore, failure of the check valve would not create an unanalyzed release path for BWST water. The NRC staff also finds that the licensee's June 3, 2013, Request for Additional Information (RAI) response corrected the formatting error identified in the staff's RAI and provided sufficient engineering evaluation for the concerned valve's surveillance frequencies.

3.2.4 Spent Fuel Pool Connection to Reverse Osmosis System

The LAR states that the suction piping for the RO system from each SFP will be connected to the SFPC purification system using "candy cane" piping which will be lowered into the SFP from above and requires priming in order to establish flow to the RO system. The licensee proposed TS 3.9.8 to prohibit movement of irradiated fuel assemblies in the SFP and casks over the SFP when the RO system is in operation. Proposed TS 3.9.8 requires that the siphon from the SFP be broken prior to movement of irradiated fuel or casks. The NRC staff finds the licensee's approach for controlling the suction from the SFP to the RO system acceptable because the RO system must be isolated from the SFP in order to move irradiated fuel or casks, which prevents any design basis accidents from occurring in the SFP when it is connected to the RO system.

3.3 Structural Integrity

The proposed RO System consists of a single RO unit, with supply and return piping from the BWSTs and SFPs. The single RO unit is shared by all three ONS units and is capable of being aligned to the common Unit 1 and 2 SFP, the Unit 3 SFP, the Unit 1 BWST, the Unit 2 BWST, or the Unit 3 BWST. RO System piping and the existing Spent Fuel Purification Loop piping are used for these alignments. Only one BWST or SFP will be aligned to the RO System for treatment at a time.

3.3.1 Postulation of Piping Failures

The licensee determined that the only high-energy (HE) piping associated with the RO System is contained in the RO skid. The licensee also determined that there are no direct effects resulting from pipe whips or jet impingements on equipment needed for the safe shutdown of the ONS, Units 1, 2, and 3. In addition, the licensee indicated that there is no safety-related equipment near the RO unit.

The NRC staff reviewed the licensee's evaluation related to the postulation of HE pipe failures from the RO system and their dynamic effects. The NRC staff notes that according to the ONS UFSAR, the current licensing basis of ONS requires protection only from postulated pipe failures of high-energy lines. Based on the above information and its independent review, the NRC staff finds that potential HE pipe failures do not impact the structural integrity of SSCs important to safety.

Additionally, the licensee evaluated the impact of existing postulated HE pipe failures on the RO system since damage to the RO system could result in release of radioactivity. The licensee noted that areas of concern involved the routing of the non-HE RO system piping through the Hot Machine Shop, the Unit 3 purge ventilation equipment room, and the Unit 3 west penetration room. The licensee determined that there are no postulated HE line breaks in these areas that could impact the RO system piping.

The NRC staff reviewed the licensee's evaluation of any potential impacts from postulated HE pipe failures on the RO system. Based on this review and information provided by the licensee, the NRC staff finds that the licensee has adequately addressed the impact of existing plant postulated pipe failures on the structural integrity of the proposed RO system.

3.3.2 Piping Design and Structural Evaluation

The new RO system contains piping, which is classified as Duke Energy Class C (seismic), Class D (seismic), and Duke Energy Class E (non-seismic). The licensee used its current licensing and design basis to analyze this new seismic and non-seismic piping, including connections to existing piping, seismic to non-seismic boundary overlap considerations and effects of non-seismic over seismic piping (2 over 1). Additionally, the suction from each SFP is accomplished with "candy cane" type piping, which is inserted in the water above the SFP. The flow from the SFP to the RO unit occurs through this piping and starts via vacuum priming. This piping is designated Duke Class E, non-seismic. The licensee noted that this "candy cane" piping is seismically supported to prevent it from falling into the SFP.

The NRC staff reviewed the licensee's evaluations for the seismically designed portions of the RO system and the seismically designed supports to prevent the "candy cane" piping from falling in the SFP in the event of an earthquake. The NRC staff also audited the licensee's structural piping evaluation (Calculation No. OSC-10167, Revision 2) of the seismically designed RO piping routed through the Hot Machine Shop, which demonstrated that the piping met the design basis applicable, B31.1 code stresses. Based on the review of the licensee's evaluations and the audit of Calculation No. OSC-10167, Revision 2, the NRC staff finds that the seismic design of the new RO system piping, including supports for the "candy cane" piping, is acceptable.

3.3.3 Seismic Qualification of the RO Unit and Antimony Capture Vessel

The RO unit is located in the Unit 2 pipe trench area room (Room 349) and will be shared by all three ONS units. The antimony capture vessel, which is part of the RO system and which contains a special resin to remove antimony from the waste stream, is located in the Hot Machine Shop, which is part of the Auxiliary Building. The licensee identified that the RO unit and the antimony capture vessel are not seismically designed or seismically mounted and stated that there are no safety-related equipment near the RO unit or the antimony capture vessel that could be damaged if the RO unit or antimony vessel were to become loose during an earthquake.

The NRC staff reviewed the information provided by the licensee and found that it was acceptable that the RO unit and the antimony capture vessel were not seismically designed or mounted, since physical separation exists, which prevents impacts between these items and SSCs required for plant safe shut down.

3.4 Proposed Implementation of the Reverse Osmosis System

3.4.1 Spent Fuel Pool Boron Concentration

The licensee states that the potentially adverse condition of SFP deboration will be addressed by procedural controls. The TS Surveillance Requirement (SR) 3.7.11.1 requires verification of SFP water level every 7 days. TS SR 3.7.12.1 requires the verification of SFP Boron concentration every 7 days. The NRC staff asked the licensee in an RAI to provide a quantitative evaluation of dilution potential to allow the NRC staff to assess whether the current surveillance interval would be adequate to satisfy the requirements of 10 CFR 50.36. In their October 21, 2013 letter, the licensee provided the following:

> Both the BWST and SFP are specified by TS requirements to have minimum levels/volumes and boron concentrations. The BWST also has TS requirements for temperature. Prior to RO System operation, procedures will require the minimum required initial boron concentration and initial level/volume to be adjusted. Additionally, they will require the RO System operation to be restricted to a specified maximum time period before readjusting volume and boron concentration prior to another RO session. This ensures that the TS specified boron concentration and level/volume limits for both the SFP and the BWST are not exceeded during RO System operation. Thus, the design functions of the BWST and the SFP will continue to be met during RO System operation.

The NRC staff finds these procedural controls to be acceptable to address the potential for SFP deboration.

3.4.2 Spent Fuel Pool Coolant Inventory

The licensee states that the RO system will be in operation during normal operation of ONS. The licensee states that the SFP is not used to mitigate a LOCA but is used as the source of borated water for SSF RC makeup. A LOCA will not impact the SFP water level. The licensee described the RO suction as a "candy cane" shaped rigid suction pipe that is seismically mounted. The shape of the suction pipe ensures retention of enough SFP water level inventory remaining in the

SFP to support spent fuel cooling as well as makeup to the RCS in SSF events. Analysis by the licensee indicates that the SFP is currently designed to withstand tornado and seismic loads. The RO system is not designed to withstand seismic loads. The licensee indicates that administrative controls are in place to shutdown and isolate the RO system in case of a tornado watch or warning at ONS. Based on the above, the staff finds that operation of the RO system during normal operation of ONS will not negatively affect SFP coolant inventory.

3.4.3 Borated Water Storage Tank

The licensee states there is one BWST for each unit. The BWST provides a source of borated water to the High Pressure Injection (HPI), LPI, and RBS pumps. As such, the BWST provides Reactor Building Cooling and depressurization, core cooling, and replacement inventory and is a source of negative reactivity for reactor shutdown. TS SR 3.5.4.2 and SR 3.5.4.3 require BWST volume to be $\geq$ 350,000 gallons and boron concentration to be $\geq$ 2220 ppm, respectively. Sufficient deliverable volume must be available during a LOCA prior to the transfer to the reactor building emergency sump for recirculation. The minimum required BWST volume is also needed to support continued LPI pump operation after the manual transfer to recirculation occurs. When LPI pump suction is transferred to the sump, there must be sufficient water in the sump to ensure adequate NPSH for the LPI and RBS pumps. The amount of water that enters the sump from the BWST and other sources is one of the input assumptions of the NPSH calculation. Since the BWST is the main source that contributes to the volume of water in the sump following a LOCA, the calculation does not take credit for more than the minimum volume of usable water from the BWST. The NRC staff asked the licensee in an RAI to provide a quantitative evaluation of dilution potential to allow the NRC staff to assess whether the current surveillance interval would be adequate to satisfy the requirements of 10 CFR 50.36. In the October 21, 2013 letter, the licensee provided the following:

> The BWST is used for mitigation of Steam Generator Tube Rupture (SGTR), Main Steam Line Break (MSLB), and Loss of Coolant Accidents (LOCAs). The SGTR and MSLB are bounded by the small break (SBLOCA) analyses with respect to the performance requirements for the [HPI] System. In the normal mode of Unit operation, the BWST is not an accident initiator. The SFP is evaluated to maintain acceptable criticality margin for all abnormal and accident conditions including FHAs and cask drop accidents. Both the BWST and SFP are specified by TS requirements to have minimum levels/volumes and boron concentrations. The BWST also has TS requirements for temperature. Prior to RO System operation, procedures will require the minimum required initial boron concentration and initial level/volume to be adjusted. Additionally, they will require the RO System operation to be restricted to a specified maximum time period before readjusting volume and boron concentration prior to another RO session. This ensures that the TS specified boron concentration and level/volume limits for both the SFP and the BWST are not exceeded during RO System operation. Thus, the design functions of the BWST and the SFP will continue to be met during RO System operation.
>
> The proposed TS will require the RO system to be isolated (by breaking the siphon) from the SFPs during fuel handling activities and will require the automatic isolation valves between the BWST and the SFPC Purification System, upstream

> of the branch line to the RO System branch line, be OPERABLE in MODES 1, 2, 3, and 4. The TS will also require manual valves in branch lines upstream of the SFPC Purification System automatic isolation valves to be closed and meet in-service Testing (IST) Program leakage requirements.

The licensee states that the boron level will be increased as necessary before the operation of the RO system. The BWST level will also be increased prior to the operation of the RO system. The licensee also states that a time limit on operation will be enforced on the time of operation. Based on the above, the staff finds that operation of the RO system during normal operation of ONS will not negatively affect BWST coolant inventory

3.4.4 Auxiliary Building Flooding

In its October 21, 2013 letter, the licensee discusses its evaluation of auxiliary building flooding for the RO system that was provided in an earlier LAR and supplements, with references to those documents. By reference in the October 21, 2013 letter, the licensee re-states its earlier evaluation as applicable to the current amendment. The licensee states that a rupture in the RO System creates a new flooding source to the Auxiliary Building. An evaluation of the effects of a failure of the RO System piping was performed to demonstrate that adequate measures can be taken to mitigate an Auxiliary Building flood prior to it affecting SSCs important to safety. Water from piping in the RO system has the potential to be released in the Auxiliary Building if a rupture were to occur. The licensee provided the following evaluation in its November 15, 2010 LAR:

> Certain portions of High Pressure Service Water (HPSW) are not considered flood sources based on the results of realistic seismic analyses that demonstrate the pipes and supports will not fail during a seismic event. The remaining portions of the non-seismic HPSW system, the non-seismic portions of the Low Pressure Service Water (LPSW) system and the plant drinking water system are isolated or flow limited to allow operators sufficient time to identify and isolate the source. Flooding by these sources will be detected through procedural response to a seismic event or high level alarm sensors (non-seismic) in the auxiliary building sumps.

Section 3.4.1.1.1, "Current Flood Protection Measures for the Turbine and Auxiliary Buildings," of the ONS UFSAR addresses protection provided against failures of piping located in the auxiliary building that had not been evaluated to withstand seismic accelerations. The UFSAR contains a description that the non-seismic high pressure service water system, the non-seismic portions of the low pressure service water system and the plant drinking water system had been isolated or flow limited to allow operators sufficient time to identify and isolate the source of potential flooding. The licensee states that the only high energy piping associated with the RO System is contained on the RO skid inside the Unit 2 Pipe Trench Area Room (Room 349). By reference in its October 21, 2013 letter, the licensee provided the following information from earlier analysis as applicable to this LAR:

> Any leakage from the RO System piping will be collected by the floor drains or will run over the floor until another pathway is found to lower levels if a floor drain is not directly available. The floor drains are likely to be the path of choice because of their number and location throughout the auxiliary building. If there is no or little

water that flows through a floor drain, the impact on safety-related equipment due to flooding is also less. This is because the safety-related equipment at the lowest elevation is located in the LPI/BS Pump Rooms, and also because a smaller leakage rate is implied. The main way that water can reach these rooms (in all ONS Units) is through the floor drain system. The access to these pump rooms is protected by curbs such that the water would have to pond several inches before overflowing the curbs. Since there is a large floor area outside of the curb, this large area would have to contain the leakage before the water level could exceed the curb height.

Ruptures were postulated on all high energy piping exceeding 1-inch nominal pipe size. The licensee concluded that there were no direct effects resulting from pipe whips or jet impingements on equipment needed for safe shutdown.

AEC criterion 2 specifies that systems and components of reactor facilities essential to the prevention or mitigation of accidents shall be designed, fabricated and erected to performance standards that will enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena. Based on the minimal effects of a rupture of the RO system and the minimal impacts of the ensuing flood in the Auxiliary Building, the NRC staff finds the proposed changes acceptable.

3.4.5 Sharing of the Reverse Osmosis System between Units

UFSAR Section 3.1.4, Sharing of Systems, specifies that reactor facilities shall not share systems or components unless safety is not impaired by the sharing. Duke Energy's evaluation concluded that safety is not impaired by sharing the RO System between ONS Units 1, 2, and 3. The table, which lists shared systems that do not impair safety, will be revised to list the RO System as shared between Units 1, 2, and 3. The licensee provides a number of measures to ensure that there is no significant impact on safety from the sharing of the RO System between ONS units. Some of these procedures include that the RO system can be aligned with only one of the following systems at any given one time:

- Unit 1 BWST
- Unit 2 BWST
- Unit 3 BWST
- Unit 1 & 2 SFP
- Unit 3 SFP

The licensee also adds that ONS procedures will include restrictions regarding the cumulative time that the RO System can be aligned to the BWSTs and SFPs over an operating cycle as well as a maximum time period that the RO System can be continuously operated prior to verifying (with adjustments as necessary) that boron concentration, volume, and temperature are within TS limits. These procedures will also require the water level and boron concentration to be increased, as necessary, prior to RO System operation to ensure that TS limits will be met at the end of any RO System process period. ONS procedures will prohibit RO System operation (i.e., the RO System will be isolated from the Unit 1 & 2 SFP) during the time period directly after an outage when the SFP level is required to be maintained above the TS LCO 3.7.11 level requirement to support TS LCO 3.10.1 operability requirements for the SSF RC Makeup System. Based on the

minimal effect that the RO system has on safety based on the sharing of the system between the SFP and BWST combined with administrative controls to ensure TS compliance, the NRC staff finds the proposed changes acceptable.

3.5. Conclusion

The NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess the radiological impacts of the proposed change to operate the RO system to remove silica from the BWSTs and SFPs and operate the BWST recirculation system to sample the BWST during power operation. The NRC staff finds that the licensee has used methods consistent with the regulatory requirements and guidance identified in Section 2.0 above. The NRC staff concludes that there is reasonable assurance that the licensee's estimates of the exclusion area boundary, low-population zone, and control room doses will continue to comply with these criteria. Therefore, the NRC staff finds the proposed change acceptable with regard to the radiological consequences of postulated design basis accidents.

The NRC staff also determined that the licensee has adequately addressed the structural integrity aspects of the new RO system, described in the proposed LAR. Based on the above, the NRC staff further concludes that the licensee has demonstrated that RO SSCs important to safety are structurally adequate to meet the applicable requirements and design criteria identified in Section 2.0 above. Therefore, the NRC staff concludes that the proposed RO system LAR is acceptable with respect to the structural integrity of SSCs important to safety.

Finally, the NRC staff has reviewed the proposed implementation of the operation of the RO system and has determined that proposed implementation of the system would not significantly impact the function of the SFP, the BWST, or other important to safety equipment and, therefore, finds the changes acceptable. Regarding the SFP, AEC Criterion 67 specifies that a reliable DHRS shall be designed to prevent damage to the fuel in storage facilities. AEC Criterion 66 specifies that criticality in spent fuel storage shall be prevented by physical systems or processes, and means such as geometrically safe configurations shall be emphasized over procedural controls. Based on the TS regulated sampling and testing for the boron concentration in the SFP and the provisions in place to ensure that appropriate inventory levels are maintained, the NRC staff concludes that the proposed TS changes are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the South Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding, which was published in the

Federal Register on November 26, 2013 (78 FR 70591). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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Date: April 30, 2014

If you have any questions, please contact Mr. Randy Hall at 301-415-4032.

Sincerely,

/RA/

Richard V. Guzman, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosures:
1. Amendment No. 385 to DPR-38
2. Amendment No. 387 to DPR-47
3. Amendment No. 386 to DPR-55
4. Safety Evaluation

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