



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

June 21, 2016

Mr. John Eltnisky
Senior Vice President
Governance, Projects and Engineering
Duke Energy Carolinas, LLC
P.O. Box 1006
Mail Code EC07H
Charlotte, NC 28201-1006

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, AND CATAWBA NUCLEAR STATION, UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS REGARDING USE OF OPTIMIZED ZIRLO™ (CAC NOS. MF6631, MF6632, MF6633, AND MF6634)

Dear Mr. Eltnisky:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 288 to Renewed Facility Operating License No. NPF-9 and Amendment No. 267 to Renewed Facility Operating License No. NPF-17 for the McGuire Nuclear Station (MNS), Units 1 and 2, and Amendment No. 284 to Renewed Facility Operating License No. NPF-35 and Amendment No. 280 to Renewed Facility Operating License No. NPF-52 for the Catawba Nuclear Station (CNS), Units 1 and 2, respectively. The amendments consist of changes to the technical specifications (TSs) in response to your application dated August 20, 2015.

The amendments revise TS 4.2.1, "Fuel Assemblies," and TS 5.6.5.b, "Core Operating Limits Report (COLR)," which will allow the use of Optimized ZIRLO™ fuel cladding material in both CNS, Units 1 and 2, and MNS, Units 1 and 2. Additionally, the amendment modifies TS 5.6.5.b to add associated methodologies for determining the limits in the COLR. These amendments are also supported by an exemption from certain requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models," for CNS and MNS. The NRC addressed the requested exemption in separate correspondence (Agencywide Documents Access and Management System Accession No. ML16105A320).

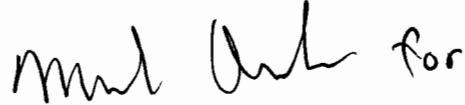
A copy of the related Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

J. Elnisky

-2-

If you have any questions, please contact me at 301-415-1119 or Ed.Miller@nrc.gov.

Sincerely,

Handwritten signature of G. Edward Miller in black ink.

G. Edward Miller, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370, 50-413,
and 50-414

Enclosures:

1. Amendment No. 288 to NPF-9
2. Amendment No. 267 to NPF-17
3. Amendment No. 284 to NPF-35
4. Amendment No. 280 to NPF-52
5. Safety Evaluation

cc w/enclosures: Distribution via Listserv



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

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-369

MCGUIRE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 288
Renewed License No. NPF-9

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to the McGuire Nuclear Station, Unit 1 (the facility), Renewed Facility Operating License No. NPF-9, filed by Duke Energy Carolinas, LLC (licensee), dated August 20, 2015, 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.

Enclosure 1

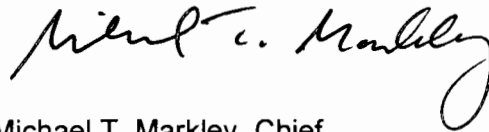
2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-9 is hereby amended to read as follows:

- (2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 288, are hereby incorporated into this renewed operating 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 120 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-9
and the Technical Specifications

Date of Issuance: June 21, 2016



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

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-370

MCGUIRE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 267
Renewed License No. NPF-17

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to the McGuire Nuclear Station, Unit 2 (the facility), Renewed Facility Operating License No. NPF-17, filed by the Duke Energy Carolinas, LLC (the licensee), dated August 20, 2015, 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.

Enclosure 2

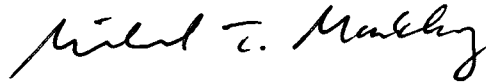
2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-17 is hereby amended to read as follows:

- (2) Technical Specifications

- The Technical Specifications contained in Appendix A, as revised through Amendment No. 267, are hereby incorporated into this renewed operating 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 120 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-17
and the Technical Specifications

Date of Issuance: June 21, 2016

ATTACHMENT TO
LICENSE AMENDMENT NO. 288
RENEWED FACILITY OPERATING LICENSE NO. NPF-9
AND LICENSE AMENDMENT NO. 267
RENEWED FACILITY OPERATING LICENSE NO. NPF-17
DOCKET NOS. 50-369 AND 50-370

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

License pages
NPF-9: 3
NPF-17: 3

TS pages
4.0-1
5.6-4

Insert

License pages
NPF-9: 3
NPF-17: 3

TS pages
4.0-1
5.6-4

- (4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components;
 - (5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproducts and special nuclear materials as may be produced by the operation of McGuire Nuclear Station, Units 1 and 2, and;
 - (6) Pursuant to the Act and 10 CFR Parts 30 and 40, to receive, possess and process for release or transfer such byproduct material as may be produced by the Duke Training and Technology Center.
- C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:
- (1) Maximum Power Level

The licensee is authorized to operate the facility at a reactor core full steady state power level of 3469 megawatts thermal (100%).
 - (2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 288, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.
 - (3) Updated Final Safety Analysis Report

The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on December 16, 2002, describes certain future activities to be completed before the period of extended operation. Duke shall complete these activities no later than June 12, 2021, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

The Updated Final Safety Analysis Report supplement as revised on December 16, 2002, described above, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following issuance of this renewed operating license. Until that update is complete, Duke may make changes to the programs described in such supplement without prior Commission approval, provided that Duke evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

- (4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components;
 - (5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproducts and special nuclear materials as may be produced by the operation of McGuire Nuclear Station, Units 1 and 2; and,
 - (6) Pursuant to the Act and 10 CFR Part 30 and 40, to receive, possess and process for release or transfer such byproduct material as may be produced by the Duke Training and Technology Center.
- C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:
- (1) Maximum Power Level

The licensee is authorized to operate the facility at a reactor core full steady state power level of 3,469 megawatts thermal (100%).
 - (2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 267, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.
 - (3) Updated Final Safety Analysis Report

The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on December 16, 2002, describes certain future activities to be completed before the period of extended operation. Duke shall complete these activities no later than March 3, 2023, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

The Updated Final Safety Analysis Report supplement as revised on December 16, 2002, described above, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following issuance of this renewed operating license. Until that update is complete, Duke may make changes to the programs described in such supplement without prior Commission approval, provided that Duke evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59, and otherwise complies with the requirements in that section.

4.0 DESIGN FEATURES

4.1 Site Location

The McGuire Nuclear Station site is located at latitude 35 degrees, 25 minutes, 59 seconds north and longitude 80 degrees, 56 minutes, 55 seconds west. The Universal Transverse Mercator Grid Coordinates are E 504, 669, 256, and N 3, 920, 870, 471. The site is in northwestern Mecklenburg County, North Carolina, 17 miles north-northwest of Charlotte, North Carolina.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of either Zircalloy, ZIRLO[®], or Optimized ZIRLO[™] clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO₂) as fuel material. Limited substitutions of ZIRLO[®], Optimized ZIRLO[™], zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Rod Assemblies

The reactor core shall contain 53 control rod assemblies. The control material shall be silver indium cadmium (Unit 1) silver indium cadmium and boron carbide (Unit 2) as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

- 4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:
- a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.00 weight percent;
 - b. $k_{\text{eff}} < 1.0$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR;
 - c. $k_{\text{eff}} \leq 0.95$ if fully flooded with water borated to 800 ppm, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR;

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

14. DPC-NE-2009-P-A, "Westinghouse Fuel Transition Report," (DPC Proprietary).
15. WCAP-12945-P-A, Volume 1 and Volumes 2-5, " Code Qualification Document for Best-Estimate Loss of Coolant Analysis," (W Proprietary).
16. DPC-NE-1005P-A, "Duke Power Nuclear Design Methodology Using CASMO-4/SIMULATE-3 MOX," (DPC Proprietary).
17. DPC-NE-1007-PA, "Conditional Exemption of the EOC MTC Measurement Methodology" (Duke and Westinghouse Proprietary).
18. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995. (Westinghouse Proprietary).
19. WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," July 2006. (Westinghouse Proprietary).

The COLR will contain the complete identification for each of the Technical Specifications referenced topical reports used to prepare the COLR (i.e., report number, title, revision number, report date or NRC SER date, and any supplements).

- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.
- d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.6 Ventilation Systems Heater Failure Report

When a report is required by LCOs 3.6.10, "Annulus Ventilation System (AVS)," or LCO 3.7.9, "Control Room Area Ventilation System (CRAVS)," a report shall be submitted within the following 30 days. The report shall outline the reason for the inoperability and the planned actions to return the systems to OPERABLE status.

5.6.7 PAM Report

When a report is required by LCO 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status..

(continued)



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

DUKE ENERGY CAROLINAS, LLC

NORTH CAROLINA ELECTRIC MEMBERSHIP CORPORATION

DOCKET NO. 50-413

CATAWBA NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 284
Renewed License No. NPF-35

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to the Catawba Nuclear Station, Unit 1 (the facility) Renewed Facility Operating License No. NPF-35 filed by the Duke Energy Carolinas, LLC, acting for itself, and North Carolina Electric Membership Corporation (licensees), August 20, 2015, 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.

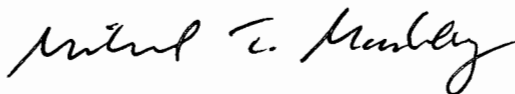
2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-35 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 284, which are attached hereto, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC, 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 120 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-35
and the Technical Specifications

Date of Issuance: June 21, 2016



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

DUKE ENERGY CAROLINAS, LLC

NORTH CAROLINA MUNICIPAL POWER AGENCY NO. 1

PIEDMONT MUNICIPAL POWER AGENCY

DOCKET NO. 50-414

CATAWBA NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 280
Renewed License No. NPF-52

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to the Catawba Nuclear Station, Unit 2 (the facility) Renewed Facility Operating License No. NPF-52 filed by the Duke Energy Carolinas, LLC, acting for itself, North Carolina Municipal Power Agency No. 1 and Piedmont Municipal Power Agency (licensees), dated August 20, 2015, 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.

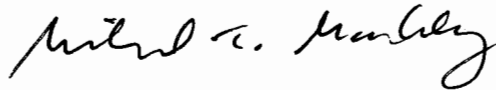
2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-52 is hereby amended to read as follows:

- (2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 280, which are attached hereto, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC, 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 120 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-52
and the Technical Specifications

Date of Issuance: June 21, 2016

ATTACHMENT TO
LICENSE AMENDMENT NO. 284
RENEWED FACILITY OPERATING LICENSE NO. NPF-35
AND LICENSE AMENDMENT NO. 280
RENEWED FACILITY OPERATING LICENSE NO. NPF-52
DOCKET NOS. 50-413 AND 50-414

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

License pages
NPF-35: 4
NPF-52: 4

TS pages
4.0-1
5.6-4

Insert

License Pages
NPF-35: 4
NPF-52: 4

TS pages
4.0-1
5.6-4

(2) TECHNICAL SPECIFICATIONS

The Technical Specifications contained in Appendix A, as revised through Amendment No. 284 which are attached hereto, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC shall operate the facility in accordance with the Technical Specifications.

(3) Updated Final Safety Analysis Report

The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on December 16, 2002, describes certain future activities to be completed before the period of extended operation. Duke shall complete these activities no later than December 6, 2024, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

The Updated Final Safety Analysis Report supplement as revised on December 16, 2002, described above, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following issuance of this renewed operating license. Until that update is complete, Duke may make changes to the programs described in such supplement without prior Commission approval, provided that Duke evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

(4) Antitrust Conditions

Duke Energy Carolinas, LLC shall comply with the antitrust conditions delineated in Appendix C to this renewed operating license.

(5) Fire Protection Program (Section 9.5.1, SER, SSER #2, SSER #3, SSER #4, SSER #5)*

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program as described in the Updated Final Safety Analysis Report, as amended, for the facility and as approved in the SER through Supplement 5, subject to the following provisions:

The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

*The parenthetical notation following the title of this renewed operating license condition denotes the section of the Safety Evaluation Report and/or its supplement wherein this renewed license condition is discussed.

(2) TECHNICAL SPECIFICATIONS

The Technical Specifications contained in Appendix A, as revised through Amendment No. 280, which are attached hereto, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC shall operate the facility in accordance with the Technical Specifications.

(3) Updated Final Safety Analysis Report

The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on December 16, 2002, describes certain future activities to be completed before the period of extended operation. Duke shall complete these activities no later than December 6, 2024, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

The Updated Final Safety Analysis Report supplement as revised on December 16, 2002, described above, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following issuance of this renewed operating license. Until that update is complete, Duke may make changes to the programs described in such supplement without prior Commission approval, provided that Duke evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section

(4) Antitrust Conditions

Duke Energy Carolinas, LLC shall comply with the antitrust conditions delineated in Appendix C to this renewed operating license.

(5) Fire Protection Program (Section 9.5.1, SER, SSER #2, SSER #3, SSER #4, SSER #5)*

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program as described in the Updated Final Safety Analysis Report, as amended, for the facility and as approved in the SER through Supplement 5, subject to the following provisions:

The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

*The parenthetical notation following the title of this renewed operating license condition denotes the section of the Safety Evaluation Report and/or its supplement wherein this renewed license condition is discussed.

4.0 DESIGN FEATURES

4.1 Site Location

Catawba Nuclear Station is located in the north central portion of South Carolina approximately six miles north of Rock Hill and adjacent to Lake Wylie. The station center is located at latitude 35 degrees, 3 minutes, 5 seconds north and longitude 81 degrees, 4 minutes, 10 seconds west. The corresponding Universal Transverse Mercator Coordinates are E 493, 660 and N 3, 878, 558, zone 17.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of either Zircalloy, ZIRLO[®], or Optimized ZIRLO[™] clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO₂) as fuel material.* Limited substitutions of ZIRLO[®], Optimized ZIRLO[™], zirconium alloy, or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

* A maximum of four lead assemblies containing mixed oxide fuel and M5[™] cladding may be inserted into the Unit 1 or Unit 2 reactor core.

4.2.2 Control Rod Assemblies

The reactor core shall contain 53 control rod assemblies. The control material shall be silver indium cadmium and boron carbide as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

12. DPC-NE-2008-P-A, "Fuel Mechanical Reload Analysis Methodology Using TACO3" (DPC Proprietary).
13. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code" (W Proprietary).
14. DPC-NE-2009-P-A, "Westinghouse Fuel Transition Report" (DPC Proprietary).
15. WCAP-12945-P-A, Volume 1 and Volumes 2-5, "Code Qualification Document for Best-Estimate Loss of Coolant Analysis" (W Proprietary).
16. DPC-NE-1005P-A, "Duke Power Nuclear Design Methodology Using CASMO-4/SIMULATE-3 MOX," (DPC Proprietary).
17. BAW-10231P-A, "COPERNIC Fuel Rod Design Computer Code," (Framatome ANP Proprietary).
18. DPC-NE-1007-PA, "Conditional Exemption of the EOC MTC Measurement Methodology" (Duke and Westinghouse Proprietary).
19. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995 (Westinghouse Proprietary).
20. WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," July 2006 (Westinghouse Proprietary).

The COLR will contain the complete identification for each of the Technical Specifications referenced topical reports used to prepare the COLR (i.e., report number, title, revision number, report date or NRC SER date, and any supplements).

- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.
- d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

(continued)



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 288 TO RENEWED FACILITY OPERATING LICENSE NPF-9

AMENDMENT NO. 267 TO RENEWED FACILITY OPERATING LICENSE NPF-17

AMENDMENT NO. 284 TO RENEWED FACILITY OPERATING LICENSE NPF-35

AMENDMENT NO. 280 TO RENEWED FACILITY OPERATING LICENSE NPF-52

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated August 20, 2015 (Reference 1), Duke Energy Carolinas, LLC (Duke Energy or the licensee) requested changes to the Technical Specifications (TSs) for Catawba Nuclear Station (CNS), Units 1 and 2, and McGuire Nuclear Station (MNS), Units 1 and 2. The proposed changes would revise TS 4.2.1, "Fuel Assemblies," and TS 5.6.5.b, "Core Operating Limits Report (COLR)," to allow the use of Optimized ZIRLO™ fuel cladding material in both CNS and MNS, Units 1 and 2.

The proposed changes would revise TS 4.2.1 to allow the use of Optimized ZIRLO™ fuel rod cladding at both CNS and MNS, Units 1 and 2. The proposed changes would also revise TS 5.6.5 to add WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report" (Reference 2), and Addendum 1-A to Topical Reports WCAP-12610-P-A and CENPD-404-P-A, entitled, "Optimized ZIRLO™" (Reference 3), to the list of documents previously reviewed and approved by the U.S. Nuclear Regulatory Commission (NRC or the Commission).

These amendments are also supported by an exemption from certain requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models," for both CNS and MNS.

2.0 REGULATORY EVALUATION

Section 50.36 of 10 CFR requires that TSs be included by applicants for a license authorizing operation of a production or utilization facility. Section 50.36(c) of 10 CFR 50.36 requires that TS include (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 proposed change to TS 4.2.1 would revise the design features for fuel assemblies listed within the reactor core TSs and the proposed change to TS 5.6.5 would revise administrative controls TSs.

Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (NUREG-0800) (SRP), Section 4.2, "Fuel System Design," provides regulatory guidance for the review of fuel rod cladding materials and fuel system. In addition, the SRP provides guidance for compliance with the applicable General Design Criteria (GDCs) in 10 CFR Part 50, Appendix A. According to SRP Section 4.2, the fuel system safety review provides assurance that:

- The fuel system is not damaged as a result of normal operation and anticipated operational occurrences,
- Fuel system damage is never so severe as to prevent control rod insertion when it is required,
- The number of fuel rod failures is not underestimated for postulated accidents, and
- Coolability is always maintained.

Appendix A to 10 CFR Part 50 provides GDC that must be considered when developing the principal design criteria for a water-cooled nuclear power plant. Section 3.1 of the MNS and CNS updated final safety analysis reports (UFSARs) discuss conformance with the GDC. The proposed amendment was evaluated against the following GDCs, as incorporated into the MNS and CNS licensing basis through their respective UFSARs.

GDC 10, "Reactor design" – The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

GDC 27, "Combined reactivity control system capability" – The reactivity control systems shall be designed to have a combined capability, in conjunction with poison addition by the emergency core cooling system, of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained.

3.0 TECHNICAL EVALUATION

3.1 Proposed Change to TS 4.2.1 and TS 5.6.5

3.1.1 Introduction

The CNS and MNS units' reactor cores are made up of 193 fuel assemblies with 53 control rod assemblies. Each fuel assembly is a 17 x 17 square lattice fuel rod array containing 264 fuel rods, 24 guide thimbles, and one instrument tube. Each fuel assembly is a canless type with the basic assembly consisting of the Rod Cluster Control (RCC) guide thimbles fastened to grids and top and bottom nozzles. The fuel rods are made up of slightly enriched uranium dioxide pellets, which are clad in a tube made from zircaloy or ZIRLO[®]. Zircaloy-4 is an alloy of zircaloy used in power reactors.

The proposed change to TS 4.2.1 will add "Optimized ZIRLO[™]" to the list of cladding materials listed in the sentence describing the fuel rods. The NRC staff has approved Optimized ZIRLO[™] fuel cladding based upon (1) similarities with standard ZIRLO[®], (2) demonstrated material performance, and (3) a commitment to provide irradiated data and validate fuel performance models ahead of burnups achieved in batch applications.

3.1.2 Limitations and Conditions in Addendum 1-A of WCAP-12610

The NRC staff's safety evaluation (SE) for the topical report (Reference 3) contains ten conditions and limitations. The staff indicated in the SE that licensees referencing Addendum 1-A of WCAP-12610-P-A and CENPD 404-P-A to implement Optimized ZIRLO[™] must ensure compliance with the ten conditions and limitations. The licensee provided documentation of its compliance with these ten conditions and limitations and, by including reference to the topical report in the TSs, will continue to ensure compliance for future reloads. Each condition and limitation is restated below, along with the NRC's staff evaluation of Duke Energy's response.

3.1.2.1 Condition and Limitation 1 – Need for Exemption

Condition and Limitation 1 states that until rulemaking to 10 CFR Part 50 addressing Optimized ZIRLO[™] has been completed, implementation of Optimized ZIRLO[™] fuel clad requires an exemption from 10 CFR 50.46 and 10 CFR Part 50 Appendix K. Duke Energy submitted an exemption request for both CNS and MNS concurrent with this amendment request. On August 20, 2015, the licensee submitted an exemption to 10 CFR 50.46 and Appendix K to 10 CFR Part 50. Therefore, the NRC staff concludes that this condition and limitation has been satisfied.

3.1.2.2 Condition and Limitation 2 – Burnup Limit

Condition and Limitation 2 states that the fuel rod burnup limit for this approval must remain at currently established limits 62 Gigawatt-Days per Metric Ton Uranium (GWd/MTU) for Westinghouse Electric Company LLC (Westinghouse) fuel designs and 60 GWd/MTU for Combustion Engineering (CE) fuel designs. CNS and MNS use a Westinghouse fuel design and Duke Energy has stated that CNS and MNS will continue to use a 62 GWd/MTU rod

burnup. The addition of Addendum 1-A of WCAP-12610-P-A and CENPD 404-P-A to TS 5.6.5.b for both CNS and MNS will require both CNS and MNS to maintain a maximum rod burnup of 62 GWd/MTU. Therefore, the NRC staff concludes that this condition and limitation has been satisfied.

3.1.2.3 Condition and Limitation 3 – Corrosion Limit

Condition and Limitation 3 states that the maximum fuel rod waterside corrosion, as predicted by the best-estimate model, will satisfy proprietary limits in the topical report and proprietary version of the SE of hydrides for all locations of the fuel rod. Duke Energy confirmed that the methodologies used for normal reload process will ensure that the maximum fuel rod waterside corrosion limit will be verified to be less than the specified proprietary limits for all fuel rod locations as a normal part of the reload design process. Therefore, the NRC staff has concluded that this condition and limitation has been satisfied.

3.1.2.4 Condition and Limitation 4 – Conditions on Approved Methodologies

Condition and Limitation 4 states that all the conditions listed in previous NRC SE approvals for methodologies used for standard ZIRLO[®] and Zircaloy-4 fuel analysis will continue to be met, except that the use of Optimized ZIRLO[™] cladding, in addition to standard ZIRLO[®], and Zircaloy-4 cladding is now approved. Duke Energy confirmed that future analysis using Optimized ZIRLO[™], as required by the reload methodologies listed in TS 5.6.5.b, will continue to meet all conditions contained within the approved methods. Therefore, the NRC staff has concluded that this condition and limitation has been satisfied.

3.1.2.5 Condition and Limitation 5 – Application Domain

Condition and Limitation 5 states that all methodologies will be used only within the range for which ZIRLO[®] and Optimized ZIRLO[™] data were acceptable and for which the verifications discussed in Addendum 1 and responses to requests for additional information (RAIs) for Addendum 1 were performed. Duke Energy confirmed that the application of Optimized ZIRLO[™] will be consistent with the approach accepted in WCAP-12610-P-A and CENPD-404-P-A Addendum 1-A, and that confirmation of these conditions is part of the normal reload design process required by the methodologies in TS 5.6.5.b. Therefore, the NRC staff has concluded that this condition and limitation has been satisfied.

3.1.2.6 Condition and Limitation 6 – Lead Test Assembly (LTA) Data

Condition and Limitation 6 states that the licensee is required to ensure that Westinghouse has fulfilled the following commitment: Westinghouse shall provide the NRC staff with a letter(s) containing the following information:

- a. Optimized ZIRLO[™] LTA data from the Byron Station (Byron), Calvert Cliffs Nuclear Power Plant (Calvert Cliffs), CNS, and Millstone Power Station (Millstone).
 - i. Visual
 - ii. Oxidation of fuel rods
 - iii. Profilometry
 - iv. Fuel rod length

v. Fuel assembly length

- b. Using the standard and Optimized ZIRLO™ database, including the most recent LTA data, confirm applicability with currently approved fuel performance models (e.g., measured versus predicted).

Confirmation of the approved models' applicability up through the projected end of cycle burnup for the Optimized ZIRLO™ fuel rods must be completed prior to its initial batch loading and prior to the startup of subsequent cycles. For example, prior to the first batch application of Optimized ZIRLO™, sufficient LTA data may only be available to confirm the models' applicability up through 45 GWd/MTU. In this example, the licensee would need to confirm the models up through the end of the initial cycle. Subsequently, the licensee would need to confirm the models, based upon the latest LTA data, prior to reinserting the Optimized ZIRLO™ fuel rods in future cycles. Based upon the LTA schedule, it is expected that this issue may only be applicable to the first few batch implementations since sufficient LTA data, up through the burnup limit, should be available within a few years.

Westinghouse submitted numerous documents to the NRC to supply the requested information in various stages:

- LTR-NRC-07-1 (Reference 9) – This submittal includes information from the complete Byron LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-07-58 (Reference 10) – This submittal includes information from the complete Byron LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-07-58, Rev. 1. (Reference 11) – This submittal includes information from the complete Byron LTA (three cycles). It also includes updated information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (two cycles), and Millstone LTA (one cycle).
- LTR-NRC-08-60 (Reference 12) – This submittal includes information from the complete Byron LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (two cycles), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-10-53 (Reference 13) – This submittal includes information from the complete Byron LTA (three cycles), CNS LTA (three cycles), and Millstone LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (three cycles).
- LTR-NRC-13-6 (Reference 14) – This submittal includes information from the complete Byron LTA (three cycles), CNS LTA (three cycles), Millstone LTA (three cycles), and Calvert Cliffs LTA (three cycles).
- LTR-NRC-15-7 (Reference 15) – This submittal includes the Vogtle growth and creep data summary reports and provides the responses to RAIs received in response to letter

LTR-NRC-13-6 (Reference 14), which was issued to fulfill Conditions 6 and 7 of WCAP-12610- P-A and CENPD-404-P-A Addendum 1-A (Reference 3).

The LTA measurements submitted showed the corrosion rate of the stress-relief annealed (SRA) Optimized ZIRLO™ and partially-re-crystallized annealed (PRXA) Optimized ZIRLO™ to be significantly lower than that of the standard ZIRLO®. Similarly, the measured SRA/PRXA Optimized ZIRLO™ fuel rod growth is also within the predictive capability of the standard ZIRLO® fuel rod growth model, as the measured values are well within the scatter band of the standard ZIRLO® fuel rod growth database. Based on the measurements and evaluations of LTA data, the NRC staff finds that the licensee has demonstrated acceptable in-reactor performance, the fuel rod and assembly design calculations remain valid, and the Optimized ZIRLO™ fuel will operate within design criteria.

By submitting this information, the models' applicability has been confirmed for burnups up to 62 GWd/MTU for Westinghouse fuels. None of the visual inspections showed anomalies. The oxidation measurements demonstrated that the oxide thickness of Optimized ZIRLO™ was bounded by that of ZIRLO®. The profilometry data demonstrated that the growth of Optimized ZIRLO™ was bounded by that of ZIRLO® and was appropriately bounded by performance and design (PAD). The measurements of axial growth demonstrated that the Optimized ZIRLO™ assemblies were within the upper and lower growth bounds. Based on this information, the NRC staff concludes that this condition and limitation is satisfied.

3.1.2.7 Condition and Limitation 7 – Cycle Data

Condition and Limitation 7 states that the licensee is required to ensure that Westinghouse has fulfilled the following commitment: Westinghouse shall provide the NRC staff with a letter containing the following information:

- a. Vogtle Electric Generating Plant (Vogtle) growth and creep data summary reports.
- b. Using the standard ZIRLO® and Optimized ZIRLO™ database, including the most recent Vogtle data, confirm applicability with currently approved fuel performance models (e.g., level of conservatism in W rod pressure analysis, measured versus predicted, predicted minus measured versus tensile and compressive stress).

Confirmation of the approved models' applicability up through the projected end of cycle burnup for the Optimized ZIRLO™ fuel rods must be completed prior to its initial batch loading and prior to the startup of subsequent cycles. For example, prior to the first batch application of Optimized ZIRLO™, sufficient LTA data may only be available to confirm the models' applicability up through 45 GWd/MTU. In this example, the licensee would need to confirm the models up through the end of the initial cycle. Subsequently, the licensee would need to confirm the models, based upon the latest LTA data, prior to reinserting the Optimized ZIRLO™ fuel rods in future cycles. Based upon the LTA schedule, it is expected that this issue may only be applicable to the first few batch implementations, since sufficient LTA data, up through the burnup limit, should be available within a few years.

Westinghouse submitted numerous documents to the NRC to supply the requested information in various stages:

- LTR-NRC-07-1 (Reference 9) – This submittal includes information from the complete Byron LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (one cycle), and Millstone LTA (one cycle).
- LTR-NRC-07-58 (Reference 10) – This submittal includes information from the complete Byron LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-07-58, Rev. 1 (Reference 11) – This submittal includes information from the complete Byron LTA (three cycles). It also includes updated information from the ongoing Calvert Cliffs LTA (one cycle), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-08-60 (Reference 12) – This submittal includes information from the complete Byron LTA (3 cycles). It also includes information from the ongoing Calvert Cliffs LTA (two cycles), CNS LTA (two cycles), and Millstone LTA (two cycles).
- LTR-NRC-10-53 (Reference 13) - This submittal includes information from the complete Byron LTA (three cycles), CNS LTA (three cycles), and Millstone LTA (three cycles). It also includes information from the ongoing Calvert Cliffs LTA (three cycles).
- LTR-NRC-13-6 (Reference 14) – This submittal includes information from the complete Byron LTA (three cycles), CNS LTA (three cycles), Millstone LTA (three cycles), and Calvert Cliffs LTA (three cycles).
- LTR-NRC-15-7 (Reference 15) – This submittal includes the Vogtle growth and creep data summary reports provides the responses to RAIs received in response to letter LTR-NRC-13-6 (Reference 14), which was issued to fulfill Conditions 6 and 7 of WCAP-12610- P-A and CENPD-404-P-A Addendum 1-A (Reference 3).

One of the main objectives of the ongoing Westinghouse creep program is to demonstrate Optimized ZIRLO™ creep is the same as standard ZIRLO®, and that the creep in tension is similar to creep in compression. Westinghouse concludes (Reference 14) that the PAD 4.0 creep model does not extrapolate well to the low temperatures at which the Vogtle capsule operates. However, the PAD 4.0 model provides acceptable results in the high temperature region that are typically limiting for fuel performance analyses. Section 3.3 of Reference 14 summarizes creep/growth results based on currently available data for (1) the irradiation growth and creep of standard ZIRLO® and PRXA Optimized ZIRLO™, and (2) the irradiation creep of standard ZIRLO® under tensile and compressive deviatoric (differential) hoop stresses. The irradiation creep was measured using samples filled with helium gas. The internal gas pressure was either below or above system pressure so that the samples were in either compressive or tensile hoop stress, respectively.

Figures 14-17 of Reference 14 (as amended by Attachment 2 of Reference 15) presents the diameter irradiation creep data for standard ZIRLO®, PRXA Optimized ZIRLO™ and SRA Optimized ZIRLO™ under compressive stress. In response to an NRC staff request (RAI #3a of

Reference 15), Westinghouse provided similar irradiation creep data under tensile stress. The measured data show that the diameter irradiation creep of PRXA Optimized ZIRLO™ cladding and SRA ZIRLO™ cladding are similar under both compression and tension stresses.

Figures 18, 19, 20, and 21 of Reference 14 (as amended by Attachment 2 of Reference 15) present an evaluation of the irradiation creep data for standard ZIRLO® for tensile and compressive deviatoric hoop stresses. In response to an NRC staff request (RAI #4 of Reference 15), Westinghouse provided similar irradiation creep data for PRXA Optimized ZIRLO™. All of these figures show that the data are consistent between stress levels, the strain behavior is linear as a function of the deviatoric (differential) hoop stress, and the regression fits to the data approximately exhibit zero strain when the deviatoric hoop stress is zero, demonstrating that compressive and tensile creep are equivalent.

Section 4.0 of Reference 14 describes the analytical evaluations relating the measured Vogtle and other ZIRLO® creep and growth profilometry data to the Westinghouse licensed fuel performance models (PAD 4.0 and FATES3B) to assess the ability of the existing creep models to predict the data. In response to NRC staff concerns regarding the comparison of data trends based on deviatoric stress and model predictions based on total hoop stress (RAI #5 of Reference 15), Westinghouse stated that limitations with the existing creep model would be addressed in PAD 5 (currently under review). In RAI #7 of Reference 15, Westinghouse states that while the existing creep models may under-predict the data under low temperature conditions, these same models provide acceptable results in the high temperature regions, which are typically limiting for fuel performance analyses. Based on this information, the NRC staff concludes that this condition and limitation is satisfied.

3.1.2.8 Condition and Limitation 8 – Yield Strength

Condition and Limitation 8 states that the licensee shall account for the relative differences in unirradiated strength (yield strength and ultimate tensile strength) between Optimized ZIRLO™ and standard ZIRLO® in cladding and structural analyses, until irradiated data for Optimized ZIRLO™ have been collected and provided to the NRC staff.

- a. For the Westinghouse fuel design analyses:
 - i. The measured, unirradiated Optimized ZIRLO™ strengths shall be used for beginning of life (BOL) analyses.
 - ii. Between BOL up to a radiation fluence of 3.0×10^{21} n/cm² (E>1 MeV), pseudo-irradiated Optimized ZIRLO™ strength set equal to linear interpolation between the following two strength level points: at zero fluence, strength of Optimized ZIRLO™ equal to measured strength of Optimized ZIRLO™ and at a fluence of 3.0×10^{21} n/cm² (E>1 MeV), irradiated strength of standard ZIRLO® at the fluence of 3.0×10^{21} n/cm² (E>1 MeV) minus 3 kilopounds per square inch (ksi).
 - iii. During subsequent irradiation from 3.0×10^{21} n/cm² up to 12×10^{21} n/cm², the differences in strength (the difference at a fluence of 3×10^{21} n/cm² due to tin content) shall be decreased linearly such that the pseudoirradiated

Optimized ZIRLO™ strengths will saturate at the same properties as standard ZIRLO® at 12×10^{21} n/cm².

- b. For the CE fuel design analyses, the measured, unirradiated Optimized ZIRLO™ strengths shall be used for all fluence levels (consistent with previously approved methods).

Duke Energy stated that future analysis of Optimized ZIRLO™ will use the yield strength and ultimate tensile strength as modified per Conditions 8.a.i, 8.a.ii, and 8.a.iii, until such time as the irradiated data for Optimized ZIRLO™ cladding strengths have been collected and accepted by the NRC and that this is confirmed as part of the normal reload design process as required by the methodologies listed in TS 5.6.5.b. Therefore, the NRC staff concludes that this condition and limitation is satisfied.

CNS and MNS use a Westinghouse fuel design and, therefore, Condition and Limitation 8.b does not apply.

3.1.2.9 Condition and Limitation 9 – LOCBART or STRIKIN-II Early Peak Cladding Temperature (PCT)

Condition and Limitation 9 states that as discussed in response to RAI #21 (Reference 3), for plants introducing Optimized ZIRLO™ that are licensed with LOCBART or STRIKIN-II and have a limiting PCT that occurs during blowdown or early reflood, the limiting LOCBART or STRIKIN-II calculation will be rerun using the specified Optimized ZIRLO™ material properties. Although not a condition of approval, the NRC staff strongly recommends that, for future evaluations, Westinghouse update all computer models with Optimized ZIRLO™ specific material properties. CNS and MNS are not licensed with LOCBART or STRIKIN-II. Therefore, the NRC staff concludes that this condition and limitation does not apply.

3.1.2.10 Condition and Limitation 10 – Locked Rotor PCT

Condition and Limitation 10 states that due to the absence of high temperature oxidation data for Optimized ZIRLO™, the Westinghouse coolability limit on PCT during the locked rotor event shall be maintained within the proprietary limits included in the topical report and proprietary version of the SE.

Duke Energy does not use a PCT limit for the locked rotor event, but instead uses a core cooling capability analyses, which determines to what extent fuel cladding integrity is comprised by calculating the number of fuel rods that exceed the 95/95 departure from nucleate boiling ratio limit. Therefore, the NRC staff concludes that this condition and limitation does not apply.

3.1.3 Thermal-Hydraulic Design, Transients, and Accidents Methodology

Duke Energy stated that it will transition to Optimized ZIRLO™ using the same thermal-hydraulic analysis and transients and accident (non-loss-of-coolant accident (LOCA)) analyses described in WCAP-9272-P-A (Reference 20), which is currently approved for use at CNS and MNS, as listed TS 5.6.5, "Core Operating Limits Report." The current methods remain valid for Optimized ZIRLO™ transition cores, as described in WCAP-12610-P-A. This process

is valid for all resident fuel designs licensed for CNS and MNS, and the transition has no impact on both non-LOCA and LOCA analyses methodologies at CNS and MNS. Therefore, the NRC staff concludes that this is acceptable.

3.1.4 Technical Conclusion

Based upon the NRC staff's prior approval of Optimized ZIRLO™, the licensee's compliance with the SE conditions and limitations through inclusion of the topical reports into the TSs, and the licensees use of NRC-approved methodologies in TS 5.6.5.b for thermal-hydraulic transients and accidents analyses to ensure that the operating limits will be appropriate, the NRC staff finds the proposed changes to TS 4.2.1 and TS 5.6.5 to allow the use of Optimized ZIRLO™ acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the North Carolina and South Carolina State officials were notified of the proposed issuance of the amendments. The State officials 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 80 FR 73236. 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.

7.0 REFERENCES

1. Duke Energy, R. T. Repko letter to U.S. NRC, "License Amendment Request and 10 CFR 50.12 Exemption Request for the Use of Optimized ZIRLO™ Fuel Rod Cladding," RA-15-0020, August 20, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15295A016).

2. Westinghouse, "VANTAGE+ Fuel Assembly Reference Core Report," WCAP-12610-P-A, April 1995 (ADAMS Accession No. ML090720988 (non-public) (proprietary)).
3. Westinghouse, "Optimized ZIRLO™," WCAP-12610-P-A and CENPD-404-P-A Addendum I-A, July 2006 (ADAMS Accession No. ML062080576 (non-public) (proprietary)).
4. U.S. NRC, B. K. Singal letter to E. D. Halpin, STP Nuclear Operating Company, "South Texas Project, Units 1 and 2 – Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ as Fuel Rod Cladding Material (TAC Nos. ME5365 and ME5366)," October 28, 2011 (ADAMS Accession No. ML112420611).
5. U.S. NRC, P. S. Tam letter to L. J. Webber, Indiana Michigan Power Company, "Donald C. Cook Nuclear Plant, Unit 2, Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ Clad Fuel Rods (TAC No. ME7722)," August 23, 2012 (ADAMS Accession No. ML12142A287).
6. U.S. NRC, A. L. Klett letter to M. Nazar, NextEra Energy, "Turkey Point Nuclear Generating Unit Nos. 3 and 4 - Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ Clad Fuel Rods (TAC Nos. MF1453 and MF1454)," February 20, 2014 (ADAMS Accession No. ML13329A348).
7. U.S. NRC, T. A. Beltz letter to E. McCartney, NextEra Energy Point Beach, LLC, "Point Beach Nuclear Plant, Units 1 and 2 – Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ Clad Fuel Rods (TAC Nos. MF1945 and MF1946)," May 9, 2014 (ADAMS Accession No. ML14058B059).
8. U.S. NRC, J. G. Lamb letter to K. Walsh, NextEra Energy Seabrook, LLC, "Seabrook Station, Unit 1, Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ Clad Fuel Rods (TAC No. MF2411)," March 5, 2015 (ADAMS Accession No. ML13213A074).
9. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™,'" LTR-NRC-07-1, January 4, 2007 (ADAMS Accession No. ML070100385 (submittal letter), ADAMS Accession No. ML070100388 (non-proprietary attachment), and ADAMS Accession No. ML070100389 (non-public) (proprietary attachment)).
10. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™,'" LTR-NRC-07-58, November 6, 2007 (ADAMS Accession No. ML073130556) (submittal letter) (ADAMS Accession No. ML073130560 (non-proprietary attachment)) (ADAMS Accession No. ML073130562 (non-public) (proprietary attachment)).

11. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™'," LTR-NRC-07-58, Rev. 1, February 5, 2008 (ADAMS Accession No. ML080390451 (submittal letter) (ADAMS Accession No. ML080390452) (non-proprietary attachment)) (ADAMS Accession No. ML080390453 (non-public) (proprietary attachment)).
12. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™'," LTR-NRC-08-60, December 30, 2008 (ADAMS Accession No. ML090080380) (submittal letter) (ADAMS Accession No. ML090080381 (non-proprietary attachment)) (ADAMS Accession No. ML090080382 (non-public) (proprietary attachment)).
13. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™'," LTR-NRC-10-43, July 26, 2010 (ADAMS Accession No. ML102140213) (submittal letter) (ADAMS Accession No. ML102140214) (non-proprietary attachment)) (ADAMS Accession No. ML102140215 (non-public) (proprietary attachment)).
14. Westinghouse, J. A. Gresham letter to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™'," LTR-NRC-13-6, February 25, 2013 (ADAMS Accession No. ML13070A188) (submittal letter) (ADAMS Accession No. ML13070A189 (non-proprietary attachment)) (ADAMS Accession No. ML13070A190 (proprietary attachment)).
15. Westinghouse, letter from J. A. Gresham to U.S. NRC, "Submittal of Responses to Draft RAIs and Revisions to Select Figures in LTR-NRC-13-6 to Fulfill Conditions 6 and 7 of the Safety Evaluation for WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A," LTR-NRC-15-7, February 9, 2015 (ADAMS Accession No. ML15051A427) (submittal letter) (ADAMS Accession No. ML15051A428 (non-proprietary attachment 1)) (ADAMS Accession No. ML15051A429 (non-proprietary attachment 2)) (ADAMS Accession No. ML15051A430 (proprietary attachment 1)) (ADAMS Accession No. ML15051A431 (proprietary attachment 2)).
16. Westinghouse, letter from J. A. Gresham to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1 -A, 'Optimized ZIRLO™'," LTR-NRC-07-1, January 4, 2007 (ADAMS Accession No. ML070100389, proprietary (non-public)).
17. Westinghouse, letter from J. A. Gresham to U.S. NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum I-A, 'Optimized ZIRLO™'," LTR-NRC-07-58, November 6, 2007 (ADAMS Accession No. ML073130562, proprietary (non-public)).
18. Westinghouse, letter from J. A. Gresham to U.S. NRC (Document Control Desk), "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum I-A, 'Optimized ZIRLO™'," LTR-NRC-07-58, Rev. 1, February 5, 2008 (ADAMS Accession No. ML080390452).

19. Westinghouse, letter from J. A. Gresham to U.S. NRC, "SER Compliance of WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™'," LTR-NRC-08-60, December 30, 2008 (ADAMS Accession No. ML090080380).
20. WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," Westinghouse Nuclear Energy Systems, March 1978.

Principal Contributor: Joshua Kaizer

Date: June 21, 2016

J. Eltnisky

- 2 -

If you have any questions, please contact me at 301-415-1119 or Ed.Miller@nrc.gov.

Sincerely,

/RA/ M. Orenak for

G. Edward Miller, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370, 50-413,
and 50-414

Enclosures:

1. Amendment No. 288 to NPF-9
2. Amendment No. 267 to NPF-17
3. Amendment No. 284 to NPF-35
4. Amendment No. 280 to NPF-52
5. Safety Evaluation

cc w/enclosures: Distribution via Listserv

DISTRIBUTION:

PUBLIC

LPL2-1 R/F

RidsACRS_MailCTR Resource

RidsNrrDssStsb Resource

RidsNrrDorIDpr Resource

RidsNrrDorLpl2-1 Resource

RidsNrrPMMcGuire Resource

RidsNrrPMCatawba Resource

RecordsAmend

RidsNrrLALRonewicz Resource

RidsRgn2MailCenter Resource

RidsNrrDssSnpb Resource

ADAMS Accession No.: ML16105A326 *by memo

OFFICE	NRR/DORL/LPL2-1/PM	NRR/DORL/LPL2-1/LA	DSS/SNPB/BC*	DSS/STSB/BC
NAME	EMiller (MOrenak for)	LRonewicz	JDean	AKlein
DATE	06/02/16	04/18/16	04/05/16	06/13/16
OFFICE	OGC - NLO	NRR/DORL/LPL2-1/BC	NRR/DORL/LPL2-1/PM	
NAME	MYoung	MMarkley	EMiller (MOrenak for)	
DATE	05/31/16	06/16/16	06/21/16	

OFFICIAL RECORD COPY