UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

February 25, 2023

The Honorable Christopher T. Hanson
Chair
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE SUBSEQUENT LICENSE RENEWAL APPLICATION REVIEW OF OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

Dear Chair Hanson:

During the 702nd meeting of the Advisory Committee on Reactor Safeguards (ACRS), February 1-3, 2023, we completed our review of the subsequent license renewal (SLR) application for the Oconee Nuclear Station (Oconee), Units 1, 2, and 3, and the associated safety evaluation report prepared by staff. Our review considered actions by Duke Energy Carolinas, LLC (Duke), to extend the license of each unit by 20 years beyond the currently approved 60 years of licensed operation.

During this review, we had the benefit of discussions with representatives of the Nuclear Regulatory Commission (NRC) staff and Duke. We also had the benefit of the referenced documents. This report fulfills the requirement of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.25 that the ACRS review and report on all license renewal applications.

CONCLUSION AND RECOMMENDATION

1. The established programs and the commitments made by Duke to manage age-related degradation provide confidence that Oconee can be operated in accordance with its current licensing basis for the subsequent period of extended operation (SPEO) without undue risk to the health and safety of the public.

2. The application for the subsequent license renewal of the operating licenses for Oconee should be approved.

BACKGROUND

The Oconee Nuclear Station, which includes three units, is located in Seneca, SC. Each unit consists of a pressurized water reactor with licensed output of 2,568 megawatts thermal (MWt). The NRC issued the initial operating licenses on February 6, 1973, for Unit 1, October 6, 1973, for Unit 2, and July 19, 1974, for Unit 3. The NRC issued the first 20 year renewed operating licenses on May 23, 2000.

In this application, Duke requests renewal of the operating licenses for an additional 20 years beyond the expiration of their current renewed licenses. The licenses would be extended to February 6, 2053, for Unit 1, October 6, 2053, for Unit 2, and July 19, 2054, for Unit 3.

DISCUSSION

The staff reviewed Duke's application for SLR in accordance with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) and the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) guidance documents. Conformance with this guidance provides the bases for a conclusion that an applicant for a license renewal of 20 additional years beyond its current approved license for 60 years will assure adequate protection of the public throughout the SPEO.

Significant generic issues challenging the industry for plant operation beyond 60 years include: reactor pressure vessel embrittlement; irradiation-assisted stress corrosion cracking of reactor internals; concrete structures and containment degradation; and electrical cable environmental qualification, condition monitoring, and assessment. Each of these items has been addressed by Duke and evaluated by staff through the review process. We concur with the staff's safety evaluation regarding these issues.

Duke applied lessons learned from previous SLR applications in preparation of the Oconee SLR application. Duke assembled a multidisciplined team of employees who have been engaged in executing the current Oconee license renewal program and are knowledgeable in SLR requirements and application development. This team was augmented with key vendor support experienced in SLR requirements and evaluation methodologies specific to the Oconee application. Duke also worked with the industry during the development of the GALL-SLR report. Lastly, Duke participated in peer reviews of other SLR applications and conducted a peer review of the Oconee SLR application. The Oconee SLR application was additionally informed by initial Oconee license renewal aging management program effectiveness reviews performed using elements of Nuclear Energy Institute (NEI) 14-12, "Aging Management Program Effectiveness."

Duke has been making improvements in the Oconee facility based on equipment performance monitoring. Significant primary system modifications for each unit included replacement of the reactor vessel heads and once-through steam generators. Additionally, a digital upgrade of the engineered safeguards and reactor protection systems for each unit was completed. Important secondary system modifications for each unit were also implemented, including replacement of high-pressure feedwater heaters, and low-pressure turbine rotors. Electrical modifications included replacement and upgrade of main step-up transformers and replacement of the stator and rotor poles on the Keowee Emergency alternating-current (AC) power electrical generators. Auxiliary system modifications for each unit included: replacement of low-pressure service water inlet/outlet piping to the reactor coolant pumps with stainless steel piping; and upgrades to plant electrical power and service water systems. Structural modifications included: installation of tornado missile protection on the borated water storage tank and replacement of the turbine building roof. These improvements extend the life of existing structures, systems, and components, provide additional operational margin, and demonstrate a commitment by Duke to maintain the Oconee units in good material condition in support of safe operation.

Duke will implement 48 Aging Management Programs (AMPs) for SLR, comprised of 34 existing programs and 14 new programs. Of the new programs, 11 are consistent with the GALL-SLR report and three are consistent with exceptions. Of the 34 existing programs, six are consistent with the GALL-SLR report, 27 are consistent with enhancements and/or allowed exceptions, and one is plant specific. The staff found the programs with enhancements and exceptions to be acceptable.

Duke has demonstrated the effectiveness of their programs to maintain material condition, sustain system and equipment performance, and identify and implement improvements to ensure facility safety and reliability. Commitments within the SLR application and in Duke responses to the staff audits and inspections provide confidence that these programs will be implemented effectively throughout the SPEO. The detailed elements of the GALL-AMPs and related commitments are documented in the proposed Updated Final Safety Analysis Report supplement and will be managed through Duke's commitment tracking program.

In the safety evaluation report, staff documented their review of the SLR application, additional information submitted by Duke, and information obtained through staff audits, related inspections, and responses to requests for additional information. The staff conducted a regulatory audit on the technical details of the SLR application from July 26, 2021, through October 8, 2021. This thorough investigation evaluated the completeness of the identified structures, systems, and components within the scope of the Oconee SLR program, the suitability and adequacy of the aging management review, and the acceptability of the plant-specific time-limited aging analyses. The staff audit report confirms the Oconee AMPs are comprehensive.

Four license renewal inspections for the initial period of extended operation were conducted at Oconee between 2011 and 2014. These inspections verified the current license renewal requirements are being implemented appropriately. The staff also examined Reactor Oversight Process baseline inspections for issues related to AMP implementation. The corresponding inspection and audit reports were thorough with no AMP findings identified.

Based on the audits, inspections, and the staff reviews, the staff concluded that Duke would continue to adequately manage the effects of aging. It is reasonable to conclude that safety functions will be maintained consistent with the Oconee licensing basis for the SPEO, as required by 10 CFR 54.21(a)(3). The staff's extensive and detailed review of the SLR application, documented in the safety evaluation report, identified no open or confirmatory items.

An area we explored was the unique arrangement of emergency AC power for Oconee being provided by the Keowee Hydro Station (Keowee). The Federal Energy Regulatory Commission (FERC) provides regulatory oversight of Keowee, while the NRC provides oversight of operations interfacing with Oconee. AMPs on the equipment supporting Oconee meet the guidance provided in the GALL-SLR. Therefore, there is no conflict of regulatory oversight between NRC and FERC. Although not an SLR issue for Oconee, there appears to be opportunity to enhance the formal coordination between FERC and NRC oversight processes.

We conclude that the application for the Oconee subsequent license renewal meets the requirements described in 10 CFR 54.29(a)(1) and (a)(2).

SUMMARY

The established programs and the commitments made by Duke to manage age-related degradation provide confidence that Oconee can be operated in accordance with its current licensing basis for the SPEO without undue risk to the health and safety of the public. The application for the SLR of the operating licenses for Oconee should be approved.

Member Sunseri did not deliberate in portions of the review related to metal and environmental fatigue or irradiation embrittlement of the reactor pressure vessel.

We are not requesting a formal response from the staff to this letter report.

Sincerely,

Signed by Rempe, Joy on 02/25/23

Joy L. Rempe
Chairman

REFERENCES

1. Duke Energy Carolinas, LLC, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station (ONS), Units 1, 2, and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, DPR-55, Application for Subsequent Renewed Operating Licenses," June 7, 2021 (ADAMS Accession No. ML21158A194).

2. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Subsequent License Renewal of Oconee Nuclear Station, Units 1, 2, and 3," December 2022 (ML22349A145).

3. U.S. Nuclear Regulatory Commission, "Oconee Nuclear Station, Units 1, 2, and 3 – Aging Management Audit Plan Regarding the Subsequent License Renewal Application Review (EPID NO. L-2021-SLR-000)," July 23, 2021 (ML21196A076).

4. U.S. Nuclear Regulatory Commission, "Oconee Nuclear Station, Units 1, 2, and 3 – Report for the Aging Management Audit Regarding the Subsequent License Renewal Application Review (EPID No. L-2021-SLR-0000)," February 14, 2022 (ML22045A053).

5. U.S. Nuclear Regulatory Commission, "Oconee Nuclear Station Unit 1 NRC Post Approval Site Inspection for License Renewal Inspection Report 05000269/2011013," May 5, 2011 (ML111250604).

6. U.S. Nuclear Regulatory Commission, "Oconee Nuclear Station Unit 1 - NRC Post-Approval Site Inspection for License Renewal, Inspection Report 05000269/2012010," November 29, 2012 (ML12335A243).

7. U.S. Nuclear Regulatory Commission, "Oconee Nuclear Plant - NRC Post Approval Site Inspection for License Renewal, Inspection Report 05000269/2012008, 05000270/2012008, 05000287/2012008," October 2, 2012 (ML12277A420).

8. U.S. Nuclear Regulatory Commission, “Oconee Nuclear Station Unit 3 – U.S. Nuclear Regulatory Commission Post-Approval Site Inspection for License Renewal Inspection Report 05000287/2014009,” June 2, 2014 (ML14153A244).

9. U.S. Nuclear Regulatory Commission, “Oconee Nuclear Station – Integrated Inspection Report 05000269/2022002, 05000270/2022002 and 05000287/2022002,” Post-Approval Site Inspection for License Renewal - Phase 4,” July 29, 2022 (ML22209A250).

10. U.S. Nuclear Regulatory Commission, NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” July 2017 (ML17188A158).

11. U.S. Nuclear Regulatory Commission, NUREG-1801, Revision 2, “Generic Aging Lessons Learned (GALL) Report,” December 2010 (ML103490041).

12. U.S. Nuclear Regulatory Commission, NUREG-2191, Volume 1, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” July 2017 (ML17187A031).

13. U.S. Nuclear Regulatory Commission, NUREG-2191, Volume 2, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” July 2017 (ML17187A204).

14. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.188, Revision 1, “Standard Format and Content for Application to Renew Nuclear Power Plant Operating Licenses,” September 2005 (ML051920430).

15. U.S. Nuclear Regulatory Commission, NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” July 2017 (ML17188A158).

16. U.S. Nuclear Regulatory Commission, NUREG-2221, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” December 2017 (ML17362A126).

17. U.S. Nuclear Regulatory Commission, NUREG-2222, “Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” December 2017 (ML17362A143).

18. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” May 1988 (ML003740284).

19. Nuclear Energy Institute, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal (NEI 17-01),” March 2017 (ML17339A599).

20. Nuclear Energy Institute, “NEI 14-12, Revision 0, Aging Management Program Effectiveness,” December 2014 (ML5090A665).

February 25, 2023

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE SUBSEQUENT LICENSE RENEWAL APPLICATION REVIEW OF OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

Accession No: ML23046A172 **Publicly Available (Y/N):** Y **Sensitive (Y/N):** N
If Sensitive, which category?
Viewing Rights: ☒ NRC Users or ☐ ACRS only or ☐ See restricted distribution

OFFICE	ACRS*	SUNSI Review*	ACRS*	ACRS*	ACRS*
NAME	KHoward	KHoward	LBurkhart	SMoore	JRempe
DATE	02/15/2023	02/15/2023	02/15/2023	02/23/2023	02/25/2023

OFFICIAL RECORD COPY