[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket Nos.: 50-269, 50-270, and 50-287; NRC-2012-0088]

Duke Energy Carolinas, LLC.,

Oconee Nuclear Station, Units 1, 2, and 3

Exemption

1.0 BACKGROUND

Duke Energy Carolinas, LLC (the licensee) is the holder of Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55, which authorize operation of the Oconee Nuclear Station, Units 1, 2 and 3 (ONS, Units 1, 2, and 3). The licenses provide, among other things, that the facilities are subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of three pressurized water reactors located in Oconee County in South Carolina.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix G, "Fracture Toughness Requirements," requires that fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary of light water nuclear power reactors provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests, to which the pressure boundary may be subjected over its service lifetime; and 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," provides fracture toughness requirements for protection against pressurized thermal shock (PTS) events.

By letter dated August 3, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11223A010), the licensee requested exemptions from

certain requirements of 10 CFR 50.61 and 10 CFR Part 50, Appendix G. The exemptions would allow use of alternate initial RT_{NDT} (reference nil ductility temperature), as described in the NRC-approved topical reports (TRs), BAW-2308, "Initial RT_{NDT} of Linde 80 Weld Materials," Revisions 1-A and 2-A, for determining the adjusted RT_{NDT} of Linde 80 weld materials present in the beltline region of the ONS, Units 1, 2, and 3 reactor vessels (RVs).

The licensee requested an exemption from Appendix G to 10 CFR Part 50 to replace the required use of the existing Charpy V-notch (C_v) and drop weight-based methodology and allow the use of an alternate methodology to incorporate the use of fracture toughness test data for evaluating the integrity of the ONS, Units 1, 2, and 3 reactor vessel (RV) beltline welds based on the use of the 1997 and 2002 editions of American Society for Testing and Materials (ASTM) Standard Test Method E 1921, "Standard Test Method for Determination of Reference Temperature T_0 , for Ferritic Steels in the Transition Range," and American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), Code Case N-629, "Use of Fracture Toughness Test Data to Establish Reference Temperature for Pressure Retaining Materials of Section III, Division 1, Class 1." The exemption is required since Appendix G to 10 CFR Part 50, through reference to Appendix G to Section XI of the ASME Code pursuant to 10 CFR 50.55a, requires the use of a methodology based on C_v and drop weight data.

The licensee also requested an exemption from 10 CFR 50.61(a)(5) to use an alternate methodology to allow the use of fracture toughness test data for evaluating the integrity of the ONS, Units 1, 2, and 3 for RV beltline welds based on the use of the 1997 and 2002, editions of ASTM E 1921, and ASME Code Case N-629. The exemption is required since the methodology for evaluating RV material fracture toughness in 10 CFR 50.61 requires the use of the C_v and drop weight data for establishing the PTS reference temperature (RT_{PTS}).

3.0 DISCUSSION

Pursuant to 10 CFR 50.12(a), the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, are consistent with the common defense and security; and (2) when special circumstances are present. These circumstances include the special circumstances that allow the licensee an exemption from the use of the C_v and drop weight-based methodology required by 10 CFR Part 50, Appendix G and 10 CFR 50.61. This exemption only modifies the methodology to be used by the licensee for demonstrating compliance with the requirements of 10 CFR Part 50, Appendix G and 10 CFR 50.61, and does not exempt the licensee from meeting any other requirement of 10 CFR Part 50, Appendix G and 10 CFR 50.61.

Authorized by Law

These exemptions would allow the licensee to use an alternate methodology to make use of fracture toughness test data for evaluating the integrity of the ONS, Units 1, 2, and 3 RV beltline welds, and would not result in changes to operation of the plant. Section 50.60(b) of 10 CFR Part 50 allows the use of alternatives to the described requirements in 10 CFR Part 50, Appendix G, or portions thereof, when an exemption is granted by the Commission under 10 CFR 50.12. In addition, 10 CFR 50.60(b) of 10 CFR Part 50 permits different NRC approved methods for use in determining the initial material properties. As stated above, 10 CFR 50.12(a) allows the NRC to grant exemptions from the requirements of 10 CFR Part 50, Appendix G and 10 CFR 50.61. The NRC staff has determined that granting of the licensee's proposed exemptions will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemptions are authorized by law.

No Undue Risk to Public Health and Safety

The underlying purpose of Appendix G to 10 CFR Part 50 is to set forth fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary of light water nuclear power reactors to provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests, to which the pressure boundary may be subjected over its service lifetime. The methodology underlying the requirements of Appendix G to 10 CFR Part 50 is based on the use of C_v and drop weight data. The licensee proposes to replace the use of the existing C_v and drop weight-based methodology by a fracture toughness-based methodology to demonstrate compliance with Appendix G to 10 CFR Part 50. The NRC staff has concluded that the exemptions are justified based on the licensee utilizing the fracture toughness methodology specified in BAW-2308, Revisions 1-A[1] and 2-A, which include the conditions and limitations delineated in the NRC staff's safety evaluations (SEs), dated August 4, 2005 (ADAMS Accession No. ML052070408), and March 24, 2008 (ADAMS Accession No. ML080770349). The use of the methodology specified in the NRC staff's SEs will ensure that pressure-temperature limits developed for the ONS, Units 1, 2, and 3 RVs will continue to be based on an adequately conservative estimate of RV material properties and ensure that the pressure-retaining components of the reactor coolant pressure boundary retain adequate margins of safety during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests. This exemption only modifies the methodology to be used by the licensee for demonstrating compliance with the requirements of Appendix G to 10 CFR Part 50, and does not exempt the licensee from meeting any other requirement of Appendix G to 10 CFR Part 50.

1 Note, a revision number including a "-A" denotes an NRC-staff approved version of the TR which includes the NRC staff's final safety evaluation.

The underlying purpose of 10 CFR 50.61 is to establish requirements for evaluating the fracture toughness of RV materials to ensure that a licensee's RV will be protected from failure during a PTS event. The licensee seeks an exemption from 10 CFR 50.61 to use a methodology for the determination of adjusted/indexing reference temperatures. The licensee proposes to use ASME Code Case N-629 and the methodology outlined in its submittal, which are based on the use of fracture toughness data, as an alternative to the C_v and drop weight-based methodology required by 10 CFR 50.61 for establishing the initial, unirradiated properties when calculating RT_{PTS} values. The NRC staff has concluded that the exemption is justified based on the licensee utilizing the methodology specified in TRs BAW-2308, Revisions 1-A and 2-A. These TRs established an alternative method for determining initial (unirradiated) material reference temperatures for RV welds manufactured using Linde 80 weld flux (i.e., "Linde 80 welds") and established weld wire heat-specific and Linde 80 weld generic values of this reference temperature. These weld wire heat-specific and Linde 80 weld generic values may be used in lieu of the RT_{NDT} determined as specified by paragraph NB-2331 of Section III of the ASME Code. Regulations associated with the determination of RV material properties involving protection of the RV from brittle failure or ductile rupture includes Appendix G to 10 CFR Part 50 and 10 CFR 50.61, the PTS rule. These regulations require that the initial (unirradiated) material reference temperature, RT_{NDT}, be determined in accordance with the provisions of the ASME Code, and provide the process for determination of RT_{PTS}, the reference temperature RT_{NDT}, evaluated for the end of license fluence.

In TR BAW-2308, Revision 1, the Babcock and Wilcox Owners Group (B&WOG) proposed to perform fracture toughness testing based on the application of the Master Curve evaluation procedure, which permits data obtained from sample sets tested at different temperatures to be combined, as the basis for redefining the initial (unirradiated) material

properties of Linde 80 welds. NRC staff evaluated this methodology for determining Linde 80 weld initial (unirradiated) material properties and uncertainty in those properties, as well as the overall method for combining unirradiated material property measurements based on T_o values (i.e., IRT_{To}), with property shifts from models in Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," which are based on C_v testing and a defined margin term to account for uncertainties in the NRC staff SE. Table 3 in the NRC staff's August 4, 2005 SE of BAW-2308, Revision 1, contains the NRC staff-accepted IRT_{TO} and initial margin (denoted as σ_i) for specific Linde 80 weld wire heat numbers. In accordance with the conditions and limitations outlined in the NRC staff's August 4, 2005 SE of TR BAW-2308, Revision 1, for utilizing the values in Table 3: the licensee's proposed methodology has (1) utilized the appropriate NRC staff-accepted IRT_{To} and σ_i values for Linde 80 weld wire heat numbers; (2) applied chemistry factors greater than 167°F (the weld wire heat-specific chemical composition, via the methodology of RG 1.99, Revision 2, indicated that higher chemistry factors are applicable); (3) applied a value of 28°F for σ_Δ in the margin term; and (4) submitted values for ΔRT_{NDT} and the margin term for each Linde 80 weld in the RV through the end of the current operating license. Additionally, the NRC's SE for TR BAW-2308, Revision 2 concludes that the revised IRT_{T0} and σ_i values for Linde 80 weld materials are acceptable for referencing in plant-specific licensing applications as delineated in TR BAW-2308, Revision 2 and to the extent specified under Section 4.0, Limitations and Conditions, of the SE, which states: "Future plant-specific applications for RPVs [reactor pressure vessels] containing weld heat 72105, and weld heat 299L44, of Linde 80 welds must use the revised IRT_{To} and σ_i, values in TR BAW-2308, Revision 2." The NRC staff notes that heat 299L44 is used in one ONS 1 RV beltline weld and one ONS 2 RV beltline weld and heat. The NRC staff also notes heat 72105 is used in an ONS 3 beltline weld. The NRC staff verified that the revised IRT_{T0} and σ_i values from TR BAW-2308,

Revision 2 were used for these three welds. The licensee also used the revised IRT_{To} and σ_i, values in TR BAW-2308, Revision 2 for the other weld heats. Although the revised IRT_{To} values for the weld heats other than 72105 and 299L44 are lower than the values given in the NRC staff's SE of BAW-2308, Revision 1, these values are acceptable because the NRC staff determined in its SE for BAW-2308, Revision 2, that the modified methodology used to calculate these values is acceptable, and more accurate than the methodology used to generate the values given in the NRC staff's SE of BAW-2308, Revision 1. Therefore, all conditions and limitations outlined in the NRC staff SEs for TRs BAW-2308, Revisions 1 and 2, have been met for ONS, Units 1, 2, and 3.

The use of the methodology in TRs BAW-2308, Revisions 1-A and 2-A, will ensure the PTS evaluation developed for the ONS, Units 1, 2, and 3 RVs will continue to be based on an adequately conservative estimate of RV material properties, and ensure the RV will be protected from failure during a PTS event. Also, when additional fracture toughness data relevant to the evaluation of the ONS, Units 1, 2, and 3 RV welds is acquired as part of the surveillance program, these data must be incorporated into the evaluation of the ONS, Units 1, 2, and 3 RV fracture toughness requirements.

Based on the above, no new accident precursors are created by allowing an exemption to use an alternate methodology to comply with the requirements of 10 CFR 50.61 in determining adjusted/indexing reference temperatures, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety. On February 3, 2010, a new rule, 10 CFR 50.61a, "Alternate Fracture Toughness Requirements for Protection Against [PTS] Events," became effective. The NRC staff reviewed this new rule against the licensee's exemption request and determined that there is no effect on the

exemption request. The new rule does not modify the requirements from which the licensee has sought an exemption, and the alternative provided by the new rule does not address the scope of issues associated with both 10 CFR 50.61 and 10 CFR Part 50, Appendix G that the requested exemption does.

Consistent with Common Defense and Security

The proposed exemption would allow the licensee to use an alternate methodology to allow the use of fracture toughness test data for evaluating the integrity of the ONS, Units 1, 2, and 3 RV beltline welds. This change has no relation to security issues. Therefore, the common defense and security is not impacted by these exemptions.

Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR Part 50, Appendix G and 10 CFR 50.61 is to protect the integrity of the reactor coolant pressure boundary by ensuring that each reactor vessel material has adequate fracture toughness. Therefore, since the underlying purpose of 10 CFR Part 50, Appendix G and 10 CFR 50.61 is achieved by an alternative methodology for evaluating RV material fracture toughness, the special circumstances required by 10 CFR 50(a)(2)(ii) for the granting of an exemption from portions of the requirements of 10 CFR Part 50, Appendix G and 10 CFR 50.61 exist.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Duke Energy Carolinas, LLC an exemption

from certain requirements of Appendix G to 10 CFR Part 50 and 10 CFR 50.61, to allow an alternative methodology to incorporate the use of fracture toughness test data for evaluating the integrity of the ONS, Units 1, 2, and 3 reactor vessel (RV) beltline welds that is based on using fracture toughness test data to determine initial, unirradiated properties.

Pursuant to 10 CFR 51.32, “Finding of no significant impact,” the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment 77 FR 21594.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 25th day of April 2012.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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