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NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

1.0 INTRODUCTION

The Technical Specifications (TS) for the Shearon Harris Nuclear Power Plant state that the inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel (B&PV) Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in the 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the Shearon Harris Nuclear Power Plant second 10-year ISI interval, is the 1989 edition.

By letters dated January 27, 1998, and August 24, 1998, the licensee submitted requests for relief and proposed alternatives to the Code requirements for Shearon Harris Nuclear Power Plant.

2.0 EVALUATION

The staff, with technical assistance from its contractor, the Idaho National Engineering and Environmental Laboratory (INEEL), has evaluated the information provided by the licensee in support of its second 10-year ISI interval program plan requests for relief for the Shearon Harris

Enclosure

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Nuclear Power Plant. Based on the results of the review, the staff adopts the contractor's conclusions and recommendations presented in the Technical Letter Report (TLR) attached.

Request for Relief RR-2R1-010: This request for relief involves the use of Code Case N-533, "Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections," Section XI, Division 1 as an alternative to the ASME Code Section XI requirement under Paragraph IWA-5242(a).

Section IWA-5242(a), "Insulated Components," requires removal of all insulation from pressure retaining bolted connections in systems borated for the purpose of controlling reactivity when performing VT-2 visual examinations during system pressure tests. In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposes to use Code Case N-533, "Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections," Section XI, Division 1. To satisfy Code Case N-533, the licensee must ensure that (a) performance of the Code-required system pressure test and VT-2 visual examination is completed without removing the insulation; and (b) insulation shall be removed each refueling outage from the Class 1 bolted connection and VT-2 examined, while the connection is not pressurized. If there is leakage at the connection or evidence of leakage at the connection by noting the presence of boric acid crystals or other residues, the connection shall be evaluated in accordance with IWA-5250.

The proposed use of Code Case N-533 provides a reasonable approach for ensuring the leak-tight integrity of insulated bolted connections in Class 1 systems borated for the purpose of controlling reactivity. Any significant leakage will be detected by a system leakage test with insulation in place, and by removing insulation the licensee will be able to detect minor leakage by noting the presence of boric acid crystals or other residues. This approach meets the intent of IWA-5242(a) and provides a reasonable assurance that structural integrity of bolted connections in borated systems will be maintained. Invoking Code Case N-533 during the conduct of the Code-required system pressure test mitigates the safety hazard due to elevated temperatures and excess radiation exposure to plant personnel encountered under adherence to IWA-5242(a). In addition, the VT-2 examination during the system pressure test conducted in accordance with the Code requirements provides sufficient time for observable evidence of leakage through the insulation. Therefore, the requirements of IWA-5242(a) create an undue burden on the licensee without a compensating increase in the quality and safety.

The staff has completed its review of the information provided by the licensee and concludes that for request for relief RR-2R1-010, imposing the Code requirements on the licensee would result in a burden without a compensating increase in quality and safety. In addition, the licensee's proposed alternative to incorporate the use of Code Case N-533 provides reasonable assurance of operational readiness. Therefore, the licensee's proposed alternative in request for relief RR-2R1-010 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii). The use of Code Case N-533 is authorized for insulated bolted connections in Class 1 systems borated for controlling reactivity for the second 10-year interval at the Shearon Harris Nuclear Power Plant or until the Code case is approved for general use by reference in Regulatory Guide 1.147. After that time, the licensee may continue to use the Code case with the limitations, if any, listed in Regulatory Guide 1.147.



Request for Relief RR-2RG-009: This Request for Relief involves the use of a detailed engineering evaluation as an alternative to the ASME Code Section XI, Paragraph IWA-5250(a)(2), "Corrective Measures for Bolted Connections, for Class 1, 2, and 3 Pressure Retaining Bolted Connections."

In accordance with the ASME Code, 1989 Edition, Section XI, Paragraph IWA-5250(a)(2) requires bolting to be removed if leakage occurs at the connection, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee has proposed an alternative to the requirements of IWA-5250(a)(2), to remove at least one bolt from a leaky bolted connection. The bolt will receive a VT-1 examination and be evaluated for corrosion in accordance with IWA-3100(a) and dispositioned in accordance with IWB-3140. In accordance with ASME Code, Section XI, IWA-5250(a)(2), if leakage occurs at a bolted connection, the bolting must be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100. However, IWA-3100 does not provide acceptance standards for VT-3 visual examination. As a result, the licensee proposed to evaluate the bolting to determine its susceptibility to corrosion. The proposed evaluation is similar to Code Case N-566, in that as a minimum, fastener materials, the corrosive nature of the process fluid, the leakage location and history, components in the vicinity of leakage that may be degraded, and visual evidence of corrosion at the assembled connection will be examined.

Based on the items presented in the proposed alternative, the staff finds that the evaluation proposed by the licensee provides an acceptable level of quality commensurate to the Code requirements. In addition, if initial evaluation indicates the necessity for detailed analysis, the bolt closest to the source of leakage will be removed, VT-1 visually examined, and evaluated in accordance with IWA-3100(a). The VT-1 examination criteria is more stringent than the corrosion evaluation described in IWA-5250(a)(2). Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the licensee's alternative for the second interval for Class 1, 2, and 3 pressure-retaining bolted connections at the Shearon Harris Nuclear Power Plant.

3.0 CONCLUSION

For Request for Relief 2R1-010, the staff concluded that the licensee's proposed alternative provides reasonable assurance of operational readiness and continued structural integrity for insulated pressure-retaining bolted connections in borated systems. Moreover, the staff concluded that imposing the Code requirements on the licensee results in a burden without a compensating increase in quality and safety. Therefore, the licensee's proposed alternative is authorized, for Class 1 Insulated Pressure-Retaining Bolted Connections, for the second interval, pursuant to 10 CFR 50.55a(a)(3)(ii). The use of Code Case N-533 is authorized for the second interval, or until it is published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code case, the licensee is to follow all provisions in Code Case N-533 with limitations issued in Regulatory Guide 1.147, if any.

For Request for Relief 2RG-009, the staff concluded that the licensee's proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) the licensee's proposed alternative is authorized for Class 1, 2, and 3 pressure-retaining bolted connections.

Principal Contributor: G. Hatchett

Date: November 4, 1998

TECHNICAL LETTER REPORT
ON THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION
PROGRAM PLAN
EXPEDITED REQUESTS FOR RELIEF 2R1-010 AND 2RG-009
FOR
CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NUMBER: 50-400

1. **INTRODUCTION**

By letter dated January 27, 1998, the licensee, Carolina Power & Light Company, submitted its second 10-year inservice inspection (ISI) program for Shearon Harris Nuclear Power Plant. By letter dated April 7, 1998, the licensee requested that the review of several requests for relief, including 2R1-010, be expedited for implementation in an upcoming outage. By letter dated August 24, 1998, the licensee responded to a NRC request for additional information. In this submittal the licensee withdrew multiple requests for relief and submitted new Request for Relief 2RG-009. The Idaho National Engineering and Environmental Laboratory (INEEL) staff has evaluated the information provided by the licensee in support of expedited Requests for Relief 2R1-010, and 2RG-009 in the following section.

2. **EVALUATION**

The information provided by Carolina Power & Light Company in support of the requests for relief from Code requirements has been evaluated and the bases for disposition are documented below. The Code of record for the Shearon Harris Nuclear Power Plant, Second 10-year ISI interval, which began February 2, 1998, is the 1989 Edition of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

ATTACHMENT

A. Request for Relief 2R1-010, Paragraph IWA-5242(a), Use of Code Case N-533, Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections, Section XI, Division 1

Code Requirement: IWA-5242(a) requires that insulation shall be removed from pressure-retaining bolted connections for VT-2 visual examination in systems borated for the purpose of controlling reactivity.

Licensee's Proposed Alternative: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed to use Code Case N-533, *Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections, Section XI, Division 1*. The licensee stated:

"Code Case N-533 is to be applied as alternative rules for the pressure testing and visual VT-2 examination of Class 1 pressure-retaining bolted connections."

Licensee's Basis for Proposed Alternative (as stated):

"Pursuant to 10 CFR 50.55a(a)(3)(ii), relief is requested on the basis that compliance with the original examination requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

"Code Case N-533 has already been approved by the Section XI Code Committee, thus providing an alternative to the examination of insulated Class 1 pressure-retaining bolted connections. The concern that led to the Section XI requirement for removal of insulation on bolted connections, while performing pressure testing and VT-2 examinations, is that a borated-water leak from a bolted connection could cause corrosion of the bolting materials. The weakening of the bolting could be hidden by the insulation if it were not removed. Thus, the structural integrity of a safety-related system could be compromised by a small leak that could be unnoticed if the insulation remains in place during the pressure testing and VT-2 examination. The removal and reinstallation of insulation is often a critical path activity which directly affects the duration of refueling outages and therefore places a hardship on the financial viability of the plant.

"Code Case N-533 addresses the structural integrity concerns while allowing the tests to be performed in a manner that reduces the critical path impact of the testing. Code Case N-533 essentially divides the pressure testing and the VT-2 examination into two activities that need not be performed at the same time. This division allows the work to be spread out during an outage, therefore reducing the impact on the outage duration. In the code Case, the Code Committee has stated that the following requirements must be met:

- (a) A system pressure test and VT-2 visual examination shall be performed each refueling outage without removal of insulation.
- (b) Each refueling outage the insulation shall be removed from the bolted connections, and a VT-2 visual examination shall be performed. The connection is not required to be pressurized. Any evidence of leakage shall be evaluated in accordance with IWA-5250."

Justification

"The proposed alternative provides an acceptable level of quality and safety since the insulated Class 1 bolted connections still receive pressure testing and visual VT-2 examinations each refueling outage. There are no changes being made to the areas that are inspected nor to visual VT-2 personnel qualifications. Neither are there any changes to acceptance criteria.

Evaluation: The Code requires the removal of all insulation from pressure-retaining bolted connections in systems bordinated for the purpose of controlling reactivity when performing VT-2 visual examinations during system pressure tests. As an alternative, the licensee has proposed to use Code Case N-533 which includes performance of:

- (a) A system pressure test and VT-2 visual examination at operating pressure.
- (b) A direct visual examination with the insulation removed from the bolted connections.

The INEEL staff interprets the Code Case to allow the VT-2 visual examination to be performed at the end of each refueling outage during ascension to power. It is also interpreted to allow the separate direct visual examination with the insulation removed from the bolted connections to be performed during each refueling outage.

The use of Code Case N-533 provides a two-phased approach for ensuring the leak-tight integrity of Class 1 systems bordinated for the purpose of controlling reactivity; 1) any significant leakage will be detected during the Code required system pressure test with the insulation in place, and 2) by removing the insulation from the bolted connection for direct visual examination during each subsequent refueling outage, the licensee will be able to detect minor leakage that may have

occurred by noting the presence of boric acid crystals or residue. This approach provides reasonable assurance of continued structural integrity for bolted connections in borated systems. Requiring the licensee to remove insulation during the Code-required system pressure test would create a safety hazard due to the elevated temperatures, and would also result in excess radiation exposure to plant personnel. In addition, the VT-2 examination during the system pressure test conducted in accordance with the Code requirements provides sufficient time for observable evidence of leakage through the insulation. Therefore, a strict adherence to the requirements of IWA-5242(a) would create an undue burden on the licensee without a compensating increase in the quality and safety.

Based on the evaluation above, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). The use of Code Case N-533 should be authorized for the second 10-year interval at Harris Nuclear Power Plant or until the Code Case is approved for general use by reference in Regulatory Guide 1.147. After that time, the licensee may continue to use the Code Case with the limitations, if any, listed in Regulatory Guide 1.147.

B. Request for Relief 2RG-009, IWA-5250(a)(2), Corrective Measures for Bolted Connections

Code Requirement: In the 1989 Edition of Section XI, IWA-5250(a)(2) requires that if leakage occurs at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

Licensee's Proposed Alternative: Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee has proposed an alternative to the requirements of IWA-5250(a)(2), i.e. to perform an evaluation of the bolted connections in lieu of removing the bolting. The licensee stated:

"The source of leakage at bolted connections detected by VT-2 examination during system pressure tests shall be located and evaluated for corrective measures. This evaluation will consider the following variables at a minimum:

- "1. Location of leakage,
- "2. History of leakage,
- "3. Fastener materials,
- "4. Evidence of corrosion, with the connection assembled,
- "5. Corrosiveness of the process fluid, and
- "6. Other components in the vicinity that may be degraded due to the leakage.

"When the evaluation of the above variables is concluded and the evaluation determines that the leaking condition has not degraded the fasteners, then no further action is necessary. However, reasonable attempts to stop the leakage shall be taken.

"If the evaluation of the variables above indicates the need for further evaluation, or no evaluation is performed, then a bolt closest to the source of leakage shall be removed. The bolt will receive a VT-1 examination and be evaluated for corrosion in accordance with IWA-3100(a) and dispositioned in accordance with IWB-3140. When the removed bolting shows evidence of rejectable degradation, all remaining bolts shall be removed and receive a VT-1 examination and evaluation in accordance with IWB-3140. If the leakage is identified when the bolted connection is in service, and the information in the evaluation is supportive, the removal of the bolt for VT-1 examination may be deferred to the next refueling outage."

Licensee's Basis for Proposed Alternative (as stated):

"Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested on the basis that the proposed alternatives discussed in this request for relief would provide an acceptable level of quality and safety. In addition, there are several problems associated with the current requirements of IWA-5250(a)(2). These problems are summarized below.

- "1. IWA-3100 does not provide an acceptance standard for VT-3 bolt inspection.
- "2. The requirement calls for bolt removal without regard to the size of the leakage.
- "3. The requirement increases the radiological dose to workers for leaks that are often not a challenge to operational or structural limits.
- "4. In some cases, bolts cannot be removed without damaging the bolts. In some cases, bolts cannot be removed due to the component configuration.
- "5. It is not a requirement of the Code that the Owner must stop the leakage, and inspection of the bolting is not necessarily going to stop the leak.
- "6. Removing one bolt at a time, if allowed by system conditions, may actually increase the leakage.
- "7. In many cases, implementation of the requirement would cause the plant an unnecessary transient or delay startup.

Justification

"The ASME Code Committee has approved Code Case N-566, which allows evaluation of leakage at bolted connections. This relief request is more prescriptive and conservative than Code Case N-566. The proposed joint evaluation must

consider specific factors which, if indicative of degradation, must be dispositioned in accordance with IWB-3140 of Section XI. This engineering evaluation is more comprehensive than the simple bolt inspection currently required by IWA-5250. The proposed alternative also addresses many of the implementation and radiological hardships associated with IWA-5250(a)(2) and yet maintains the conclusion of the ASME Code Committee by assuring that a proper evaluation of the connection and/or the bolting is performed.

"The proposed alternative requirements will ensure an acceptable level of quality and safety by ensuring that structural integrity is maintained, while reducing the operational, maintenance, and radiological hardships of the current Code requirement."

Evaluation: In accordance with IWA-5250(a)(2), if leakage occurs at a bolted connection, the bolting must be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100. In lieu of this requirement, the licensee has proposed to evaluate the bolting to determine its susceptibility to corrosion. The proposed evaluation will consider, as a minimum, fastener materials, the corrosive nature of the process fluid, the leakage location and history, components in the vicinity of leakage that may be degraded, and visual evidence of corrosion at the assembled connection.

Based on the items included in the evaluation process, the INEEL staff believes that the evaluation proposed by the licensee presents a sound engineering approach. In addition, if the initial evaluation indicates the need for a more detailed analysis, the licensee has committed to removing the bolt closest to the source of leakage, performing a VT-1 visually examination, and evaluating the bolt in accordance with IWA-3100(a). The VT-1 examination criteria is more stringent than a simple corrosion evaluation described in IWA-5250. For these reasons, reasonable assurance of the operational readiness of the bolted connection will be provided. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that the licensee's proposed alternative be authorized for the second interval at the Shearon Harris Nuclear Power Plant.

3. CONCLUSION

The INEEL staff has reviewed the licensee's submittal and concludes that for Request for Relief 2RG-009, the licensee's proposed alternative will provide an acceptable level of quality and safety. Therefore, it is recommended that this proposed alternative be authorized for the second interval pursuant to 10 CFR 50.55a(a)(3)(i).

For Request for Relief 2R1-010, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). The use of Code Case N-533 should be authorized for the second interval, or until it is published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee is to follow all provisions in Code Case N-533 with limitations issued in Regulatory Guide 1.147, if any.