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SCAROLA,J. Carolina Power & Light Co.
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SUBJECT: Requests relief from 1989 Edition of ASME Code Section XI,IW A-4120 requirements for repair of control rod drive mechanism housing seal weld.Supporting calculation,encl.

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NOTES:Application for permit renewal filed. 05000400

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SERIAL: HNP-98-161
10 CFR 50.55a

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
INSERVICE INSPECTION PROGRAM RELIEF REQUEST NO. 2R1-012
ALTERNATIVE TO ASME CODE SECTION XI, IWA-4000 REQUIREMENTS

Dear Sir or Madam:

In accordance with 10 CFR 50.55a(a)(3)(ii), Carolina Power & Light Company (CP&L) requests relief from the 1989 Edition of the American Society of Mechanical Engineers (ASME) Code Section XI, IWA-4120 requirements for repair of a Control Rod Drive Mechanism (CRDM) housing seal weld. Specifically, NRC approval of an alternative to the surface (liquid penetrant) examination requirement for a repair of a leaking CRDM housing lower canopy seal weld is requested.

Section XI of the Code requires that repairs be performed in accordance with the Owner's original Construction Code of the component or system, or later editions and addenda of the Construction Code. The Harris Nuclear Plant's (HNP) CRDM housing canopy seal welds were designed and fabricated in accordance with the 1974 Edition including Winter 1976 Addenda of Section III of the ASME Code (Construction Code). Both this edition and the 1989 edition of Section III (NB-5271, Welds of Specially Designed Seals) require a surface examination for CRDM housing seal welds. A repair of a CRDM housing lower canopy seal weld will be performed in accordance with the 1989 Edition of ASME Section III.

As part of the HNP Refueling Outage 8 (RFO 8) activities, during CRDM area inspection for boric acid leakage, indication of boric acid was found under the insulation around the top of the reactor vessel head. The boric acid was determined to be coming from the CRDM housing lower canopy seal weld. The CRDM housing canopy seal weld requires repair prior to the reactor vessel head being placed back on the HNP reactor vessel as part of the activities to complete RFO 8. A weld buildup will be used to repair the weld. Even though the canopy seal does not provide structural strength for the joint, the weld buildup over the canopy seal is considered a repair under the rules of ASME Code Section XI, IWA-4000, because the welding is performed on pressure retaining components. In addition, in order to facilitate the weld buildup repair, a portion of the associated Reactor Vessel Level Instrument System (RVLIS) piping requires removal and subsequent replacement. This RVLIS work is considered a replacement activity under the rules

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of ASME Code Section XI. The RVLIS line is 1-inch diameter, Class 2 ASME piping. As such, this replacement activity is exempt from the ASME Section XI requirements.

An alternative to the liquid penetrant examination is proposed in the Enclosed Relief Request Number 2R1-012. Performing the required liquid penetrant examination on the CRDM housing canopy seal weld would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. It is requested that the NRC review this relief request by November 6, 1998 to avoid delay of plant restart from RFO 8.

Please refer any question regarding this submittal to Mr. J. H. Eads at (919) 362-2646.

Sincerely,

J. Scarola

AEC

Enclosure

c: Mr. J. B. Brady (NRC Senior Resident Inspector, HNP)
Mr. L. A. Reyes (NRC Regional Administrator, Region II)
Mr. S. C. Flanders (NRR Project Manager, HNP)

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
INSERVICE INSPECTION PROGRAM RELIEF REQUEST NO. 2R1-012
ALTERNATIVE TO ASME CODE SECTION XI, IWA-4000 REQUIREMENTS

SYSTEM/COMPONENT(S) FOR WHICH RELIEF IS REQUESTED:

Control Rod Drive Mechanism (CRDM) housing canopy seal weld.

CODE REQUIREMENT(S):

The 1989 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, IWA-4120(a) requires that repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system, or later editions and addenda of the Construction Code. Harris Nuclear Plant's (HNP) CRDM housing canopy seal welds were designed and fabricated in accordance with the 1974 Edition including Winter 1976 Addenda of Section III of the ASME Code (Construction Code). Both this edition and the 1989 edition of Section III (NB-5271, Welds of Specially Designed Seals) require a surface examination for CRDM housing seal welds.

CODE REQUIREMENT FROM WHICH RELIEF IS REQUESTED:

A weld buildup will be used to repair a CRDM housing lower canopy seal weld. Relief is requested from performing the surface examination of the weld buildup area. An alternative examination is proposed.

BASIS FOR RELIEF:

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. Access to the canopy seal being repaired does not provide adequate clearance to gain complete access to the inner rod travel housing to perform the liquid penetrant examination of the weld repair. Additionally, the canopy seal being repaired is located in a high radiation area.

A liquid penetrant examination would provide a more stringent verification of the final weld surface condition and, therefore, would afford an added measure of the quality and safety of the completed weld buildup. However, the liquid penetrant examination does not provide a substantial increase in quality and safety above what is provided by the measures (controlled process, observation of the weld process using 8x camera, final 8x visual inspection, and system leakage test) that will be taken in lieu of the liquid penetrant examination. These measures are described below.

ALTERNATE EXAMINATION(S):

While the liquid penetrant examination specified by the Construction Code and HNP's Design Specification would provide indication of surface cracks, the processes used to perform the weld buildup and the visual examination of the weld provides the best measure of the lower canopy seal weld buildup acceptability due to the limited accessibility and high radiation fields. The surface to be repaired will be examined with an 8x camera during weld surface preparation. The weld buildup will be deposited using a fully automatic Gas Tungsten Arc Welding process. All welding parameters will be controlled within the qualified range from a remote panel. The weld puddle/deposit will be observed via a 8x camera during every phase of the welding. A final visual examination of the weld surface will be completed using the same 8x camera. In addition, the post outage system leakage test of the reactor coolant system will include a VT-2 inspection of the lower canopy seal weld area for leakage. In summary HNP proposes the following alternative:

1. Use of a controlled automatic welding process.
2. Observation of the weld puddle/deposit via a 8x camera during the welding process.
3. A final visual examination of the weld surface using the same 8x camera.
4. Performance of a VT-2 inspection of the canopy seal weld area for leakage during the post outage system leakage test.
5. Authorized Nuclear Inservice Inspector approval of alternative testing and NIS-2 acceptance.

JUSTIFICATION FOR REQUESTING RELIEF:

Performing the required liquid penetrant examination of the canopy seal weld buildup would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Access to the canopy seal being repaired is difficult due to the limited clearance between the adjacent control rod drive housings. The separation between the outer rod travel housing is approximately 8 inches. This is not adequate clearance to gain complete access to the inner rod travel housing to perform the liquid penetrant examination of the weld repair. Additionally, the canopy seal being repaired is located in a high radiation area, with radiation fields of approximately 500 - 800 mrem/hr (1 - 1 ½ rem/hr on contact). Final weld surface preparation (grinding), the liquid penetrant examination and the subsequent cleanup would be difficult and time consuming due to the limited access, and personnel performing these operations would incur substantial radiation exposure.

The repair options were evaluated and it was determined that the most appropriate repair was the use of a weld buildup rather than removing the defect and performing a weld repair. A limited liquid penetrant inspection of the leakage area was conducted, after boron removal, to determine the extent of the defect. The coverage of this inspection was limited to the leakage area only. Two rounded indications, 1/16 - inch in diameter, were identified on the top toe of the canopy seal weld, separated by 1 inch. A faint linear indication was seen that appeared to connect the two rounded indications. The inspection showed no evidence of an axial (longitudinally oriented) flaw. Weld buildup is an acceptable repair technique because the canopy seal weld does not

provide the structural strength or the pressure boundary for the joint. A fracture mechanics analysis was performed to justify not removing the existing defect.

An analysis was performed by Structural Integrity Associates to demonstrate that a through-wall flaw could be detected by visual examination which has a flaw size which is sufficiently smaller than the critical flaw size, thus assuring sufficient safety margins. The analysis demonstrated that, under a variety of conservative assumptions, the critical flaw size predicted for the repair geometry is in all cases of significant length. It is likely that a much smaller flaw could be credibly detected by visual examination under 8x magnification. The analysis results are summarized in Attachment 1. Also included in Attachment 1 are the results of the fracture mechanics analysis performed to justify not removing the existing defect.

In order to confirm the detectable flaw size, tests were performed by Welding Services Incorporated to evaluate the capabilities of the camera system used in the performance of the weld repair. This testing confirmed that the critical flaw sizes resulting from the Structural Integrity analysis are detectable with margin by the visual inspection technique. A summary of the tests performed and the test results are provided as Attachment 2.

In summary, performing the Code required liquid penetrant examination of the CRDM housing lower canopy seal weld repair would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety over that provided by the proposed alternative.

IMPLEMENTATION SCHEDULE:

This Relief Request is applicable to the HNP Second 10-year Inservice Inspection Interval.

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
EVALUATION OF LIMITING FLAWS FOR STRUCTURAL INTEGRITY IN CANOPY SEAL REPAIRS AT HARRIS NUCLEAR PLANT

STRUCTURAL INTEGRITY ASSOCIATES, INC.