

July 30, 2001

Mr. J. W. Moyer, Vice President  
Carolina Power & Light Company  
H. B. Robinson Steam Electric Plant,  
Unit No. 2  
3581 West Entrance Road  
Hartsville, South Carolina 29550

SUBJECT: H. B. ROBINSON ELECTRIC PLANT, UNIT 2: REQUEST FOR RELIEF  
(RELIEF REQUEST NO. 33) REGARDING EXAMINATION OF CONTROL ROD  
DRIVE MECHANISM HOUSING SEAL WELD (TAC NO. MB1753)

Dear Mr. Moyer:

By letter dated April 20, 2001, as supplemented by letters dated April 20 and April 23, 2001, Carolina Power & Light Company, the licensee for H. B. Robinson Steam Electric Plant, Unit 2 (HBRSEP2), pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(ii), requested relief from the surface examination requirements of the 1986 Edition with no addenda of the ASME Code, Section III, Paragraph NB-5271, "Welds of Specially Designed Seals," which states that welds shall be examined by either the magnetic particle or liquid penetrant method. Specifically, the licensee requested relief from surface examination requirements for a control rod drive mechanism (CRDM) housing-to-canopy seal weld.

During an April 20, 2001, telephone call, the licensee requested verbal approval of the subject relief request. The licensee explained that unanticipated circumstances associated with the pending refueling outage impacted their ability to submit the request in a timely manner. The subject relief was verbally granted by the staff during the April 20, 2001, telephone call.

The Nuclear Regulatory Commission has reviewed and evaluated the subsequent information provided by the licensee. Based on this information, and pursuant to 10 CFR 50.55a(a)(3)(ii), the staff has determined that the proposed alternative for HBRSEP2 was acceptable and that the Code-required surface examination of the No. 68 CRDM housing-to-canopy seal weld would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. The staff concluded that with the use of the remote enhanced visual examination of the multiple layers of weld material over the existing seal weld, and together with the system leakage test, the licensee's proposed alternative would provide adequate assurance of structural integrity of the subject welds, as required by the Code.

J. W. Moyer

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This relief is authorized for the third 10-year inservice inspection interval for HBRSEP2, which began on February 19, 1992. The enclosed Safety Evaluation documents our review.

If you have any questions, please contact R. Subbaratnam at 301-415-1478.

Sincerely,

***/RA by K. Jabbour for P. Madden/***

Patrick M. Madden, Acting Chief, Section 2  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosure: Safety Evaluation

cc w/encl: See next page

J. W. Moyer

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM  
RELIEF REQUEST NO. 33 FROM THE ASME CODE, SECTION XI REQUIREMENTS  
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NUMBER 50-261

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code (Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 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 in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (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 (ISI) 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 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The Code of record for the third 10-year ISI interval at H. B. Robinson Steam Electric Plant, Unit 2 (HBRSEP2) is the 1986 Edition of Section XI of the ASME B&PV Code. The third 10-year ISI began on February 19, 1992.

The staff has reviewed the information submitted by Carolina Power & Light Company, the licensee, in a letter dated April 20, 2001, as supplemented April 20 and April 23, 2001, requesting relief from certain Code-required inspection criteria. Specifically, the licensee is requesting relief from surface examination requirements for a control rod drive mechanism (CRDM) housing-to-canopy seal weld. The licensee determined that surface examination of the subject weld created a hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee proposed performing multiple seal weld passes, visually monitoring the welding, and visually examining the finished weld.

Enclosure

## 2.0 WELD SURFACE EXAMINATION

The component affected by the request for relief is the No. 68 CRDM housing-to-canopy seal weld.

## 3.0 CODE REQUIREMENTS FOR WHICH RELIEF IS REQUESTED

The licensee is using the Section XI of the 1986 Edition of the Code for preservice and ISI examinations. Paragraph IWA-4120(a) requires that repairs to pressure-retaining components and their supports, including appurtenances and subassemblies or parts of a component 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. Pursuant to 10 CFR50.55a(a)(3)(ii), the licensee is requesting relief from the surface examination requirements of the 1986 Edition with no addenda of the ASME Code, Section III, Paragraph NB-5271, "Welds of Specially Designed Seals," which states that welds shall be examined by either the magnetic particle or liquid penetrant method. The relief is for the third 10-year ISI interval which began February 19, 1992.

## 4.0 LICENSEE'S PROPOSED ALTERNATIVE TO CODE

In lieu of performing a surface examination of the seal weld, HBRSEP will use a multiple pass weld build-up over the current seal and will monitor the welding process using an 8X magnification, remotely operated, video camera. The finished weld surface will also be examined with the 8X magnification, remotely operated, video camera. The resolution of the video camera is capable of resolving a 0.001-inch diameter wire.

## 5.0 LICENSEE'S BASES FOR ALTERNATIVE

The licensee discovered two through-wall leaks at the seal weld connecting the canopy-to-CRDM Housing Number 68. The leaks were identified from stains on the CRDM; however, the actual flaws were not visually discernable. The licensee stated:

Industry experience of failure analyses performed on leaking canopy seal welds removed from service at other plants have attributed the majority of cases to transgranular stress corrosion cracking. The size of the opening where leakage occurs has been extremely small, normally only a few thousandths of an inch in size. The crack orientations vary, but often radiate outward such that a pinhole appears on the surface, as opposed to a long crack. The stress corrosion cracking results from exposure of a susceptible material (i.e., Type 308 stainless steel) to residual stress, which is often concentrated by weld discontinuities, and to a corrosive environment, such as water trapped in the cavity behind the seal weld which was mixed with the air initially in the cavity, resulting in a higher oxygen content than is in the bulk primary coolant.

The licensee states that a Code-required liquid penetrant testing (PT) examination can be performed, but it would expose personnel to high occupational radiation doses. The general dose rate averages approximately 700 mRem/hr at the CRDMs. Based upon an estimated total time of 2 hours to perform the liquid penetrant examinations, the radiation exposure from the Code-required examinations will add approximately 1.4 person-Rem to the total repair dose. The licensee stated:

The seal welds are required to be repaired prior to completion of RO [Refueling Outage]-20 .... the flaws will not be removed, but an analysis of the repaired weldment has been performed ... to assure the remaining flaw will not propagate unacceptably. The analysis shows that the visual method is capable of detecting flaws sufficiently below the critical flaw size to assure a sufficient safety margin of 3.0. The canopy seal weld is not a structural weld, nor a pressure retaining weld, but provides a seal to prevent reactor coolant leakage. The weld buildup is considered a repair in accordance with ASME B&PV Code, Section XI, Paragraph IWA-4000, because the weld is performed on an appurtenance to a pressure retaining component.

... the ASME B&PV Code, 1986 Edition, No addenda, Section III design requirements for canopy seal welds will be applied to the repair. The threaded connection between the CRDM latch housing and the adapter will resist bending moments or secondary stresses applied to the connection, and the canopy seal weld will not be required to resist such loadings. The canopy seal weld design requirements specified in Paragraph NB-3227.7 of Section III, "Requirements for Specially Designed Welded Seals" are used to determine if the overlay design [multiple pass seal weld design] will withstand the operating pressure applied at operating temperatures.

The GTAW [gas tungsten arc weld] overlay weld repair method results in lower radiation exposure because the equipment is remotely operated after setup. The visual examination system eliminates the need for an inspector to place himself within 2 feet of the CRDM for a cumulative period of approximately 2 hours during the three phases of required surface examinations.

The 8X visual examination method permits separate examinations to be performed on the weld passes, consisting of an examination of the surface before and after welding, and an examination while the weld deposit is being applied. Potential flaws resulting from contamination of the weld deposit, burn-through, or blow back can be seen as soon as they occur, and welding can be stopped to permit correction of the problems immediately. After each bead is applied in one direction, the machine is rotated back in the other direction permitting visual examination of the entire bead, including overlaps. No additional radiation exposure other than that required to set up the welding equipment is required.

## 6.0 EVALUATION

The licensee has proposed to perform a remote visual (VT-1) examination with an 8X magnification video camera during welding and on the finished weld. The effectiveness of the seal is verified with a system pressure test. The proposed alternative is in lieu of the Code-required PT for the multiple pass weld repair on the No. 68 CRDM housing-to-canopy seal weld. The repair was performed in accordance with the 1986 Edition of Section XI of the Code. Paragraph IWA-4120(a) requires that repairs to pressure-retaining components and their supports, including appurtenances and subassemblies or parts of a component, 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. The licensee chose to use the 1986 Edition of Section III of the ASME Code to examine the weld. Paragraph NB-5271, "Welds of Specially Designed Seals" specifies that welds be examined by either the magnetic particle testing or the PT method. The licensee is proposing

to use an 8X magnification, remotely operated, video camera to view the welding puddle. The examinations will be performed several inches from the weld surface and will enable the welding operator to take corrective actions during the course of welding, if needed. The visual resolution of the camera system was demonstrated as being capable of resolving a 0.001-inch diameter wire segment. The proposed enhanced VT-1 is more restrictive than the 0.03125-inch resolution Code-requirement for visual examinations, and is in the range that can be detected using a PT examination. The welding process consists of multiple layers of weld metal welded over the existing seal weld. The multiple layers of weld metal provide a redundant CRDM housing-to-canopy seal. Each layer is a seal by itself. The adequacy of the seal is verified with a routine system leakage test that is performed prior to returning the system to service. These measures provide adequate assurance that weld integrity is maintained.

The licensee's basis for performing the remote 8X enhanced visual examination (with a resolution of at least 0.001 inches) in lieu of a PT is the dose savings that are anticipated to be achieved through the use of the remote visual examination method when compared to a manual PT examination method. The licensee estimated a total dose resulting from the performance of a PT examination on the subject weld repair to be in the range of 1.4 person-Rem. This dose represents the total amount that could be averted for the examination since the dose associated with setting up the remote visual examination system is included in the dose associated with installing and removing the welding equipment. Based on the determination above that adequate assurance of weld integrity is provided by the use of the remote enhanced visual examination, the multiple layers of weld material over the existing seal weld, and the system leakage test, the licensee's proposed alternative assures weld integrity. Although the dose associated with the performance of the Code-required PT is small, it represents a dose that, if incurred, would not result in a compensating increase in the level of quality and safety.

## 7.0 CONCLUSION

Based on the discussion above, the staff concludes that the Code-required surface examination of the No. 68 CRDM-to-canopy seal weld would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the staff authorizes the proposed alternative for the H.B. Robinson, Unit 2, for the third 10-year ISI interval, which began on February 19, 1992.

Principal Contributor: Donald G. Naujock, NRR

Date: July 30, 2001

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Plant, Unit No. 2

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