March 28, 2006

Mr. David A. Christian
Senior Vice President
and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: SURRY POWER STATION, UNIT NO. 1 (SURRY 1) - THIRD 10-YEAR INSERVICE INSPECTION INTERVAL RELIEF REQUEST PRT-07 (TAC NO. MC6690)

Dear Mr. Christian:

By letter dated April 11, 2005, Virginia Electric and Power Company (VEPCO) submitted Relief Request PRT-07 for the third 10-year inservice inspection (ISI) interval at Surry 1. In Relief request PRT-07, the licensee requested approval for the reduced examination coverage of the specified reactor vessel shell-to-flange weld at Surry 1. The Nuclear Regulatory Commission (NRC) staff has completed its review of this relief request, and the NRC staff's evaluation and conclusion are contained in the enclosed Safety Evaluation.

The NRC staff has determined that imposing certain American Society of Mechanical Engineers Code requirements is impractical. Furthermore, the NRC staff concludes that VEPCO's proposed alternative provides reasonable assurance of structural integrity of the subject component. Therefore, VEPCO's request for relief is granted pursuant to Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55a(g)(6)(i) for the third 10-year ISI at Surry 1. The granting of relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The NRC staff will provide its evaluation of Relief Request PRT-08 under separate correspondence.

Sincerely,

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-280

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST PRT-07

SURRY POWER STATION, UNIT NO. 1

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-280

1.0 INTRODUCTION

By letter dated April 11, 2005, Virginia Electric and Power Company (the licensee) submitted Relief Request PRT-07 for the third 10-year inservice inspection (ISI) interval at Surry Power Station, Unit No.1 (Surry 1). Relief Request PRT-07 pertains to a reduced examination coverage of the reactor vessel (RV) shell-to-flange weld at Surry 1. The Nuclear Regulatory Commission (NRC) staff has found that the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, Article IWB-2500, requirement for essentially 100-percent volumetric examination coverage of the RV shell-to-flange weld joint, as specified, is impractical for Surry 1 and that the licensee's alternative examination of the subject component provides reasonable assurance of structural integrity.

2.0 REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a, paragraph (g), requires that the ISI of ASME Code Class 1, 2, and 3 components be performed in accordance with the applicable edition of Section XI of the ASME Code and applicable addenda, except where specific relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the Director of the Office of Nuclear Reactor Regulation, if the applicant 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 preservice 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 examinations 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 ASME Code, Section XI incorporated by reference in 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 ASME Code of record for the Surry 1 ISI program is the 1989 edition of ASME Code, Section XI. The licensee requested relief for the third 10-year ISI interval at Surry 1, which began on May 10, 1994, and ended on May 9, 2005.

3.0 TECHNICAL EVALUATION

3.1 ASME Code, Section XI Requirement

The 1989 edition of ASME Code, Section XI, Article IWB-2500, requires that components be examined and tested as specified in Table IWB-2500-1. Table IWB-2500-1, examination category B-A, Item Number B1.30, requires a volumetric examination of the RV shell-to-flange weld once each 10-year ISI interval, with essentially 100-percent volumetric coverage of the examination volume specified in Figure IWB-2500-4 of ASME Code, Section XI.

3.2 Component for Which Relief is Requested

Category	Item	Description
B-A	B1.30	RV Shell-to-Flange Weld

3.3 Licensee's Basis for Relief Request

> The ultrasonic examination of the reactor vessel shell-to-flange weld was performed using a combination of manual and remote automated ultrasonic examination techniques. The manual examination was applied from the flange surface with techniques in accordance with the requirements of ASME Section V, Article 4. The remote automated ultrasonic examinations were performed from the vessel shell inside surface using techniques qualified by demonstration for Appendix VIII, Supplements 4 and 6 of the 1995-1996 Addenda of ASME Section XI as allowed by approved relief request SR-030 (NRC letter dated October 16, 2004). These automated techniques are noted to produce more accurate, reliable and repeatable procedures of examinations than the standard [ASME Code] Section V techniques previously used.
>
> Figure 1 [of the licensee's submittal] shows the reactor vessel and associated welds. Figures 2 and 3 [of the licensee's submittal] illustrate the weld profile and show scan orientation and directions. Coverage of the examination volume is obtained by combining the manual examination performed from the flange surface with the automated coverage obtained from the vessel shell surface. The examination performed from the flange surface provides examination coverage with the ultrasonic sound beam directed essentially normal to the weld axis. Coverage from the flange provides coverage of the examination volume in one beam direction, perpendicular to the weld axis. The ASME Section XI, Appendix VIII, Supplements 4 and 6 techniques are applied from the vessel inside surface, scanning in four directions to the extent possible. Due to the surface geometry of the flange, the ability to scan the necessary areas to provide complete coverage of the examination volume in four directions is limited. The examination tool end effector, which holds the ultrasonic transducers, is not able to maintain the necessary surface contact on the non-parallel surface of the

flange taper located just above the weld. The area most affected by this surface geometry limitation is the 1/2t base metal volume above the weld. The total examination coverage obtained for the weld volume was 97.6% [percent]. Table 1 [of the licensee's submittal] provides the breakdown of coverage of the required examination volume. The overall coverage of the entire examination volume using the combined techniques is 85.17% [percent].

3,4 Licensee's Alternative Examination

As part of the requirement of Table IWB-2500-1, Category B-P, Item B15.10, a visual VT-2 inspection is conducted on the reactor vessel every refueling outage to detect evidence of through wall leakage on the vessel. This examination has been performed in conjunction with approved Relief Request RR-014, which addresses visual inspection of the bottom of the reactor vessel. The reactor vessel was visually inspected for the Third Inspection Interval and will continue to receive similar inspection in the Fourth Inspection Interval by approved Relief Request SPT-004, Revision 1. Furthermore, Technical Specifications have surveillance requirements that monitor leakage and radiation levels of the reactor coolant system.

The station leakage monitoring methods, the VT-2 visual examination of the bottom of the reactor vessel performed every refueling outage and the limited coverage volumetric examination revealing no indications provide an acceptable level of quality and safety. The weld in question has been examined to the greatest extent achievable with greater reliability and accuracy than in previous intervals. Dominion [Virginia Electric and Power Company] proposes that the examination already performed at the reduced coverage be considered as meeting the [ASME] Code, [Section XI] requirements.

3.5 NRC Staff's Evaluation

The 1989 edition of ASME Code, Section XI, Article IWB-2500, requires that components be examined and tested as specified in Table IWB-2500-1. Table IWB-2500-1 requires a volumetric examination of the RV shell-to-flange weld at Surry 1, with essentially 100-percent volumetric coverage of the examination volume specified in Figure IWB-2500-4 of ASME Code, Section XI. Figure IWB-2500-4 of ASME Code, Section XI, specifies that the total examination volume include the weld and the adjacent RV base metal material extending to a distance of one-half the thickness of the RV wall from the extremities of the weld crown at the outside surface of the RV. The volumetric examination is required to be performed using ultrasonic sound beams directed both perpendicular and parallel to the weld axis and in opposing directions. This translates into four orthogonal sound beam directions relative to the weld axis: up (perpendicular to the weld axis), down (perpendicular to the weld axis), clock-wise (parallel to the weld axis), and counter-clock-wise (parallel to the weld axis). The intent of these requirements is to increase the likelihood of flaw detection by interrogating the component with multiple sound fields in order to find potential service-induced degradation.

The licensee was able to obtain partial coverage of the ASME Code, Section XI, required-examination volume by conducting a manual ultrasonic examination from the flange surface using techniques that met the requirements of ASME Code, Section V, Article 4, and a remote

automated ultrasonic examination from the vessel's inside surface using techniques that were qualified in accordance with the performance demonstration requirements of the 1995-1996 addenda of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6. The licensee conducted these examinations using three qualified ultrasonic transducers. Using this combination of examination techniques and transducers, the licensee obtained an overall examination volume coverage of 85.17 percent of the ASME Code, Section XI, required-examination volume. Furthermore, the limitation in volumetric coverage primarily affected the examination of the base metal material extending to a distance of one-half the thickness of the RV wall from the extremities of the weld crown. The examination coverage that was achieved for the actual weld was 97.6 percent of the weld volume. The licensee indicated that the overall examination volume coverage percentage was calculated by averaging the combined volumetric coverage of the weld and the base metal over each of the required ultrasonic sound beam directions and each of the qualified ultrasonic transducers.

The licensee provided drawings which depict the RV shell-to-flange weld and the associated ASME Code, Section XI, required-examination volume along with the orientation of the ultrasonic sound beams for both the manual ultrasonic examination and the remote automated ultrasonic examination. In addition to the drawings, the licensee provided a table depicting the RV shell-to-flange weld volumetric coverage percentages for each of the four ultrasonic sound beam directions using each of the three qualified ultrasonic transducers. The manual ultrasonic examination from the flange surface provided volumetric coverage in one of the four required directions, with the sound beam directed down through the examination volume and essentially normal to the weld axis. The remote automated ultrasonic examination from the vessel inside surface provided limited volumetric coverage in all four directions, both normal and parallel to the weld axis. By combining the manual ultrasonic examination from the flange surface with the remote automated ultrasonic examination from the vessel inside surface, the licensee was able to obtain essentially 100-percent volumetric coverage of the entire ASME Code, Section XI, required-examination volume with the sound beam directed down through the flange and normal to the weld axis using all three qualified ultrasonic transducers.

The limitations on coverage in the other three beam directions were caused by the interior surface geometry of the flange for the remote automated ultrasonic examinations. The curvature of the flange taper, located just above the weld, prevented the examination tool end effector, which held the ultrasonic transducers, from maintaining full contact with the inside surface of the flange. As discussed previously, this limitation primarily impacted the volumetric coverage of the base metal material extending to a distance of one-half the thickness of the RV wall from the extremities of the weld crown. However, the reduction in the examination volume of the actual weld as a result of the limitation was not significant. Furthermore, the licensee would have to implement significant modifications to the design of the flange in order to be able to obtain complete volumetric coverage of the entire ASME Code, Section XI, required-examination volume for the RV shell-to-flange weld; such modifications would constitute a significant burden on the licensee. The licensee has clearly demonstrated that it has maximized the examination coverage to the fullest extent practical for this weld.

In addition to the reduced examination volume coverage of the RV shell-to-flange weld, a visual VT-2 examination of the RV is conducted every refueling outage to detect evidence of reactor coolant boundary leakage. Furthermore, the Surry 1 Technical Specifications (TS) have surveillance requirements for monitoring leakage from the reactor coolant system.

Based on the above considerations, the NRC staff concludes that the ASME Code, Section XI, requirement to perform the volumetric examination of the RV shell-to-flange weld, with essentially 100-percent volumetric coverage of the examination volume specified in Figure IWB-2500-4, is impractical for Surry 1. Furthermore, because the licensee has obtained an overall examination volume of 85.17 percent of the ASME Code-required volume, because the licensee will also be conducting a VT-2 visual examination of the RV every refueling outage, and because the TS have surveillance requirements for the monitoring of reactor coolant system leakage, the NRC staff has determined that the licensee's alternative examination provides reasonable assurance of structural integrity for the RV shell-to-flange weld.

4.0 CONCLUSION

The NRC staff concludes that the ASME Code, Section XI, Figure IWB-2500-4, requirement to perform the volumetric examination of the RV shell-to-flange weld, with essentially 100-percent volumetric coverage of the examination volume, is impractical for Surry 1. Furthermore, the NRC staff concludes that the licensee's alternative examination provides reasonable assurance of structural integrity of the subject component. Therefore, the licensee's request for relief is authorized pursuant to 10 CFR 50.55a(g)(6)(i) for the third 10-year ISI interval. The granting of relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other requirements of ASME Code, Section XI, for which relief has not been specifically requested and approved, remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

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Date: March 28, 2006

Surry Power Station, Units 1 & 2

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