April 14, 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. 2 (SURRY 2) - THIRD 10-YEAR INSERVICE INSPECTION INTERVAL RELIEF REQUESTS PRT-01 and PRT-02 (TAC NOS. MC9223 AND MC9224)

Dear Mr. Christian:

By letter dated December 12, 2005, Virginia Electric and Power Company (VEPCO) submitted Relief Requests PRT-01 and PRT-02 for the third 10-year inservice inspection (ISI) interval at Surry 2. In Relief Requests PRT-01 and PRT-02, the licensee requested approval for the reduced examination coverage of the reactor vessel shell-to-flange weld and circumferential shell weld at Surry 2. 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, *Boiler and Pressure Vessel Code* requirements is impractical at Surry 2. 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 2. 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.

Sincerely,

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

Docket No. 50-281

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS PRT-01 AND PRT-02

SURRY POWER STATION, UNIT 2

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-281

1.0 INTRODUCTION

By letter dated December 12, 2005 (Agencywide Documents Access and Management System Accession No. ML053470475), the Virginia Electric and Power Company (the licensee) submitted two relief requests (Relief Requests PRT-01 and PRT-02) associated with the reactor vessel inservice inspection (ISI) of the welds for the third 10-year ISI interval at Surry Power Station, Unit 2 (Surry 2). Relief Request PRT-01 pertains to a reduced examination of the reactor vessel shell-to-flange weld and Relief Request PRT-02 pertains to a reduced examination of the reactor vessel circumferential weld

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 American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code) Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific relief has been granted by the Nuclear Regulatory Commission (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 pre-service examination requirements, set forth in 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 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 2 third 10-year ISI program, which began on May 10, 1994, and ended on May 9, 2005, is the 1989 edition of

Section XI of the ASME Code, with no addenda. The licensee extended the third 10-year ISI program interval by 1 year as permitted by the ASME Code, Section XI, IWA-2430(b).

3.0 TECHNICAL EVALUATION

3.1 Relief Request PRT-01

3.1.1 Component Identification

Weld No.: 1-01
Drawing: 11548-WMKS-RC-R-1.1 1
ASME Class: 1
Description: Reactor Vessel Shell-to-Flange Weld

3.1.2 ASME Code Requirements

The 1989 edition of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, item number B1.30, requires volumetric examination of the reactor vessel shell-to-flange weld. The volume to be examined includes the weld plus 1/2t (t = thickness) of base material on each side of the weld for essentially 100 percent of the weld length. The subject examination volume is required to be examined in four directions; two opposing perpendicular and two opposing parallel beam directions in relationship to the weld axis.

3.1.3 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 Edition, 1996] Addenda of ASME Section XI, as allowed by NRC approved relief request SR-035 (Reference NRC letter to Virginia Electric and Power Company dated December 8, 2004). These automated techniques are noted to produce more accurate, reliable and repeatable procedures of examinations than the standard Section V techniques previously used.

Figure 1[1] shows the reactor vessel and associated welds. Figures 2[1] and 3[1] 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 (Figure 2) with the automated coverage obtained from the vessel shell surface (Figure 3). 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

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1. Figures 1, 2, and 3 are not included in this Safety Evaluation and are found in the licensee's letter dated December 12, 2005 (ML053470475).

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. Specifically, the examination tool end effector[2], which holds the ultrasonic transducers, is not able to maintain the necessary surface contact on the nonparallel surface of the flange taper located just above the weld. The area most affected by this surface geometry limitation is the 1/2t base material volume above the weld. The total examination coverage obtained for the weld volume was 97.6 [percent]. Table 1[3] provides the breakdown of coverage of the required examination volume. The overall coverage of the entire required examination volume using the combined techniques is 85.1 [percent].

3.1.4 Licensee's Proposed 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-008, which addresses visual inspection of the bottom of the reactor vessel for the Third Inspection Interval. Similar inspection will continue in the Fourth Inspection Interval by approved Relief Request SPT-003, Revision 1. The weld in question has been examined to the greatest extent achievable with greater reliability and accuracy than in previous intervals. Furthermore, Surry's Technical Specifications [TSs] include surveillance requirements that monitor for reactor coolant system leakage and radiation levels in containment. Consequently, based on: 1) VT-2 visual examination of the bottom of the reactor vessel performed every refueling outage, 2) limited volumetric examination coverage revealing no indications, and 3) TS required RCS [reactor coolant system] leakage and containment radiation monitoring, appropriate actions have been taken and adequate monitoring is in place for detecting through-wall leakage.

Therefore, [the licensee] requests relief from performing the [ASME] code required volumetric examination on the inaccessible portion of the Surry Unit 2 reactor vessel shell-to-flange weld in accordance with 10 CFR 50.55a(g)(6)(i) since examination in this area is impractical.

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2. An end effector is the term used for a robotic apparatus that fits on an arm or other device. The end effector in this case is an ultrasonic transducer sled package.

3. Table 1 is not included in this Safety Evaluation and can be found in the licensee's letter dated December 12, 2005 (ML053470475).

3.1.5 NRC Staff's Evaluation of PRT-01

The ASME Code, Section XI, requires volumetric examination of essentially 100 percent of the weld length of the reactor vessel shell-to-flange weld. The NRC staff has determined, based on the drawings and descriptions provided by the licensee of the reactor vessel shell-to-flange weld, that complete ASME Code examinations are not possible due to a flange taper located just above the weld. The surface geometry of the flange limits the ability to scan the necessary areas to perform the ASME Code-required examinations. The licensee-obtained overall coverage of the entire required-examination volume using the combined techniques is 85.1 percent. Specifically, the licensee noted that the examination tool end effector was not able to maintain the necessary surface contact on the nonparallel surface of the flange taper located just above the weld. The area most affected by this surface geometry limitation was the 1/2t base material volume above the weld. To perform the required ASME Code examination, the RPV and associated components would require significant design modifications. Therefore, the NRC staff determined that the ASME Code-required examinations are impractical and imposition of this requirement would cause a significant burden on the licensee. The licensee has demonstrated that it has maximized the examination coverage to the fullest extent practical for this weld.

The licensee performed the ultrasonic examination of the reactor vessel shell-to-flange weld 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 Code, 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 edition/1996 addenda of ASME Code, Section XI, as allowed by NRC staff approved Relief Request SR-035, dated December 8, 2004 (Agencywide Documents Access and Management System Accession No. ML043510436). The licensee-obtained overall coverage of the entire required-examination volume using the combined techniques is 85.1 percent. The volumetric coverage obtained for the reactor vessel shell-to-flange weld by the licensee represents a significant portion of the ASME Code-required volume. The licensee did not find any indications during its examinations. The NRC staff has determined that these examinations would have detected any significant patterns of degradation, if any had occurred.

Based on the above considerations, the NRC staff concludes that the ASME Code, Section XI requirement to perform the volumetric examination of the reactor vessel shell-to-flange weld, with essentially 100-percent volumetric coverage as specified in Table IWB-2500-1, is impractical. Furthermore, because the licensee has obtained 85.1 percent volumetric coverage of the reactor vessel shell-to-flange weld, because the licensee will be conducting a VT-2 visual examination of the bottom of the reactor vessel every refueling outage, and because the TSs have surveillance requirements for the monitoring of reactor coolant system leakage and containment radiation, the NRC staff has determined that the licensee's alternative examination provides reasonable assurance of structural integrity of the reactor vessel shell-to-flange weld.

3.2 Relief Request PRT-02

3.2.1 Component Identification

Weld No.:	1-04
Drawing:	11548-WMKS-RC-R-1.1
ASME Class:	1
Description:	Reactor Vessel Circumferential Shell Weld

3.2.2 ASME Code Requirements

The 1989 edition of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, item number B1.11, requires volumetric examination of the reactor vessel circumferential shell weld. The volume to be examined includes the weld plus 1/2t (t = thickness) of base material on each side of the weld for essentially 100 percent of the weld length. The examination volume is addressed in two regions to provide the necessary coverage with qualified examination techniques: one region is the clad-to-base metal interface, including 15-percent thickness of the vessel wall (measured from the clad-to-base metal interface), and the other region is the remaining 85 percent of the vessel thickness. The clad-to-base metal interface region shall be examined from four orthogonal directions, using procedures and personnel qualified in accordance with Supplement 4 of Appendix VIII to ASME Code, Section XI. The remaining 85 percent of the vessel thickness shall be examined from four orthogonal directions, using procedures and personnel qualified in accordance with Supplement 6 to Appendix VIII. When access restricts coverage in four directions, coverage of the remaining 85 percent of the examination volume is considered fully examined if coverage is obtained in one parallel and one perpendicular direction using a procedure and personnel qualified for single-side examination in accordance with Supplement 6.

3.2.3 Licensee's Basis for Relief Request

> The ultrasonic examination of the reactor pressure vessel circumferential shell weld is conducted in accordance with techniques qualified by demonstration for Appendix VIII Supplements 4 and 6 of the 1995 [edition], 1996 addenda of ASME Section XI.
>
> There are four core support lugs located at the 0-degree, 90-degree, 180-degree, and 270-degree positions of the vessel inside surface just above the weld, which restrict complete coverage of the required examination volume. The ultrasonic examination of this weld was performed by scanning the accessible scan surfaces between the support lugs and below the support lugs. Figure 1[4] shows the general configuration of the reactor vessel and location of weld 1-04. Figures 2[4] and 3[4] show the ultrasonic scanning boundaries for this weld with the restrictions due to the core support lugs. The size of the ultrasonic

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4. Figures 1, 2, and 3 are not included in this Safety Evaluation and are found in the licensee's letter dated December 12, 2005 (ML053470475).

manipulator end effector[5] limits how close the individual transducers can be positioned to the support lugs while scanning. The proximity of the end effector to the support lugs limits the amount of coverage obtained with each of the qualified transducers. Table 1[6] provides the breakdown of percent coverage of the required examination volume by scan direction and transducer. The achieved coverage of the required examination volume applying the qualified techniques is 76.3 [percent].

3.2.4 Licensee's Proposed 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-008, which addresses visual inspection of the bottom of the reactor vessel for the Third Inspection Interval. Similar inspection[s] will continue in the Fourth Inspection Interval by approved Relief Request SPT-003, Revision 1. The weld in question has been examined to the greatest extent achievable with greater reliability and accuracy than in previous intervals. Furthermore, Surry's Technical Specifications [TSs] include surveillance requirements that monitor for reactor coolant system (RCS) leakage and radiation levels in containment. Consequently, based on: 1) VT-2 visual examination of the bottom of the reactor vessel performed every refueling outage, 2) limited volumetric examination coverage revealing no indications, and 3) TS required RCS leakage and containment radiation monitoring, appropriate actions have been taken and adequate monitoring is in place for detecting through-wall leakage.

Therefore, [the licensee] requests relief from performing the [ASME] Code required volumetric examination on the inaccessible portion of the Surry Unit 2 reactor vessel circumferential shell weld in accordance with 10 CFR 50.55a(g)(6)(i) since examination in this area is impractical.

3.2.5 NRC Staff's Evaluation of PRT-02

The ASME Code requires essentially 100-percent volumetric examination of the reactor vessel circumferential shell weld. The licensee requested relief from the ASME Code requirements as it was not possible to obtain the ASME Code-required examination coverage of essentially 100-percent. As shown in the drawings provided by the licensee, there are four core support lugs located at the 0-degree, 90-degree, 180-degree, and 270-degree positions on the vessel inside surface just above the weld; these support lugs restrict complete coverage on the required examination volume. The licensee noted that the size of the ultrasonic manipulator end effector limits how close the individual transducers can be positioned to the support lugs

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5. An end effector is the term used for a robotic apparatus that fits on an arm or other device. The end effector in this case is an ultrasonic transducer sled package.

6. Table 1 is not included in this Safety Evaluation and can be found in the licensee's letter dated December 12, 2005 (ML053470475).

while scanning. The proximity of the end effector to the support lugs limits the amount of coverage obtained with each of the qualified transducers. The NRC staff has determined that to perform the required ASME Code examination, the RPV and associated components would require significant design modifications. Therefore, the NRC staff has determined that the ASME Code-required examinations are impractical and imposition of this requirement would cause a significant burden on the licensee.

For the reactor vessel circumferential shell weld, the licensee obtained 76.3 percent volumetric coverage applying the qualified techniques. The volumetric coverage obtained for the reactor vessel circumferential shell weld represents a significant portion of the ASME Code-required volume. The NRC staff has determined that the examinations would have detected any significant patterns of degradation, if any had occurred. As such, the licensee has demonstrated that it has maximized the examination coverage to the fullest extent practical for this weld.

Based on the above considerations, the NRC staff concludes that the ASME Code, Section XI, requirement to perform the volumetric examination of the reactor vessel circumferential weld, with essentially 100-percent volumetric coverage as specified in Table IWB-2500-1, is impractical. Furthermore, because the licensee has obtained 76.3 percent volumetric coverage of the reactor vessel circumferential weld, because the licensee will be conducting a VT-2 visual examination of the bottom of the reactor vessel every refueling outage, and because the TSs have surveillance requirements for the monitoring of reactor coolant system leakage and containment radiation, the NRC staff has determined that the licensee's alternative examination provides reasonable assurance of structural integrity of the reactor vessel shell-to-flange weld.

4.0 Conclusion

For Relief Requests PRT-01 and PRT-02, the NRC staff has concluded that the ASME Code-required examinations are impractical to perform at Surry 2 due to physical obstructions and that imposition of these requirements would cause a significant burden on the licensee. The combination of the licensee's volumetric examinations that were conducted to the extent practical, the VT-2 visual examination of the reactor vessel that are performed every refueling outage, and the TS-requirements for the licensee to monitor reactor coolant system leakage and containment radiation serves to provide reasonable assurance of structural integrity for the subject RPV welds. Therefore, for the reactor vessel shell-to-flange weld (PRT-01) and for the reactor vessel circumferential shell weld (PRT-02), relief is granted pursuant to 10 CFR 50.55a(g)(6)(i) for the third 10-year ISI program at Surry 2.

The NRC staff has determined that granting 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 the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: T. McLellan

Date:

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cc:

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