

May 28, 2004

Mr. David A. Christian  
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SUBJECT: SURRY POWER STATION, UNIT 1 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE, SECTION XI, RELIEF REQUEST PRT-01 (TAC NO. MC1830)

Dear Mr. Christian:

During the spring 2003 refueling outage, Virginia Electric and Power Company (the licensee), replaced the reactor pressure vessel (RPV) head at Surry Power Station, Unit 1 (SPS-1). While conducting a preservice examination of the replacement head, the licensee encountered interferences, from the three lifting lugs and the RPV head-to-flange weld configuration, that prevented a complete examination of this weld. Subsequently, by letter dated January 22, 2004, the licensee requested relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, for the third 10-year inservice inspection (ISI) interval at SPS-1. This relief has been identified as PRT-01.

The Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the information provided by the licensee. The NRC staff's evaluation of Relief Request (RR) PRT-01 is enclosed.

The NRC staff concludes that the ASME Code-required examination is impractical to perform for the subject RPV head-to-flange weld. Additionally, the NRC staff concludes that the coverage obtained from ultrasonic and surface examinations provides reasonable assurance of structural integrity of the subject component. Therefore, RR PRT-01 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 interval at SPS-1. 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. The NRC staff notes that this approval is only applicable to the preservice examination requirements.

D. Christian

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This completes the NRC staff's activities associated with TAC No. MC1830.

Sincerely,

*/RA/*

Stephanie Coffin, Chief, Section 1  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-280

Enclosure: As stated

cc w/encl: See next page

D. Christian

-2-

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cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

RELIEF REQUEST PRT-01

SURRY POWER STATION, UNIT 1

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-280

1.0 INTRODUCTION

During the spring 2003 refueling outage, Virginia Electric and Power Company (the licensee) replaced the reactor pressure vessel (RPV) head at Surry Power Station, Unit 1 (SPS-1). While conducting a preservice examination of the replacement head, the licensee encountered interferences, from the three lifting lugs and the RPV head-to-flange weld configuration, that prevented a complete examination of this weld. Subsequently, by letter dated January 22, 2004 (Reference 1), the licensee requested relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, for the third 10-year inservice inspection (ISI) interval at SPS-1. This relief has been identified as PRT-01.

The Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the information provided by the licensee.

2.0 REGULATORY REQUIREMENTS

ISI of the ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable 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 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 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 examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the

Enclosure

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. At the time of the preservice examination, SPS-1 was in the third 10-year ISI interval and the applicable Code of record was the 1989 Edition of the ASME Code, Section XI.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Identification of Component for Which Relief is Requested:

RPV head-to-flange weld (Weld 1-01, drawing 11448-WMKS-RC-R-1.2) for the replacement reactor vessel head.

#### 3.2 Code Requirements for which Relief is Requested:

ASME Code, Section XI, Paragraph IWB-2200(c), requires preservice examinations to be performed on all Class 1 components that are replaced, added, or altered during the service lifetime of a plant. These preservice examinations are performed to establish a baseline for comparison with future inservice examinations of these components. As such, preservice examinations must be conducted in accordance with the requirements of Table IWB-2500-1, which lists inservice examination requirements for all Class 1 components. The 1989 Edition of the ASME Code, Section XI, Examination Category B-A, Item B1.40 of Table IWB-2500-1, requires volumetric and surface examination, as defined by Figure IWB-2500-5, of essentially 100 percent of the weld length of the RPV closure head-to-flange weld. ASME Code Case N-460, "Alternative Examination Coverages for Class 1 and Class 2 Welds, Section XI, Division 1," defines the term "Essentially 100 percent," as meaning greater than 90-percent coverage of the examination volume, or surface area, as applicable.

#### 3.3 Licensee's Alternate Provisions:

One third of the reactor pressure vessel head-to-flange weld will be examined each period to the extent permitted by the configuration of the reactor pressure vessel closure head.

In addition, it is proposed that the preservice examinations already completed at the reduced coverage be counted as meeting the Code requirements.

#### 3.4 Licensee's Basis for Relief:

The ultrasonic examination of the reactor pressure vessel head-to-flange weld is conducted in accordance with Section XI, Appendix I of the ASME Code, 1989 Edition. Section XI, Appendix I states that the ultrasonic examination shall be conducted in accordance with Article 4 of Section V as supplemented by Table I-2000-1 in the Appendix. Article 4, Section V requires the weld and the adjacent base metal be examined using nominal angles of 45 and 60 degrees (deviation is permitted if geometry limits the coverage, however, separation of angles must be 10 degrees) and a straight beam. Four basic scan directions are required for the angle beams; two perpendicular to the weld axis (axial scan) from opposite directions and two parallel to the weld axis (circumferential scan) from opposite directions. These requirements apply for each of

the 45 and 60 degree angle beams used. Each of the 45 and 60 degree angle beams is required to pass through all of the weld volume in the four basic scan directions.

The cross-sectional geometry of the component at the reactor pressure vessel head-to-flange weld produces a high transitional angle between the flange and the domed head. Scanning from the flange side may not provide the necessary angular orientation to provide full examination coverage. Examination is limited to 0.5 inches from the weld toe due to the flange configuration. The reactor vessel closure head is a carbon steel vessel with stainless steel cladding on the inside surface. Due to this cladding, the ultrasonic beam cannot be "bounced" from the inside clad surface to increase the examination coverage. Therefore, a full-V examination from the flange side is not possible. Following operational service, radiographic examination of this weld will not be practical due to the projected high radiation levels at the inside surface of the head.

The reduction in preservice volumetric coverage is detailed in Table PRT-01-1<sup>1</sup>. Sketches PRT-01-1 through PRT-01-5<sup>2</sup> are provided detailing the configuration limitations experienced. The preservice examination on the component listed above was completed to the extent practical as required by the Code.

Furthermore, three lifting lugs are located 120° apart. Each lug obstructs the volumetric examination for approximately 8 inches, resulting in obstruction of 2 of the 45 feet of total weld length. This limits access to approximately 4 percent of the weld length. However, these lifting lugs result in only a 0.8 percent obstruction during the magnetic particle examination resulting in a 99.2 percent surface examination.

The limited volumetric examination and the surface examination should detect any general patterns of degradation that may occur in the areas covered, therefore providing reasonable assurance of the continued structural integrity of the subject weld.

### 3.5 Staff Evaluation:

ASME Code, Section XI, requires that a preservice examination on components that are replaced, added, or altered during the service lifetime of a plant be performed prior to placing the component in operation. As such, the licensee replaced the RPV head for SPS-1. One of the objectives of the preservice examination is to establish a baseline for comparison with future examinations, thus the preservice examination must conform to the same requirements as are listed in the ASME Code for inservice examinations. The ASME Code requires essentially 100-percent volumetric coverage of RPV closure head-to-flange weld at SPS-1. The volumetric examinations are required to be performed by using several ultrasonic sound beams (at the proper angles within the material) that are directed both perpendicular and parallel to the

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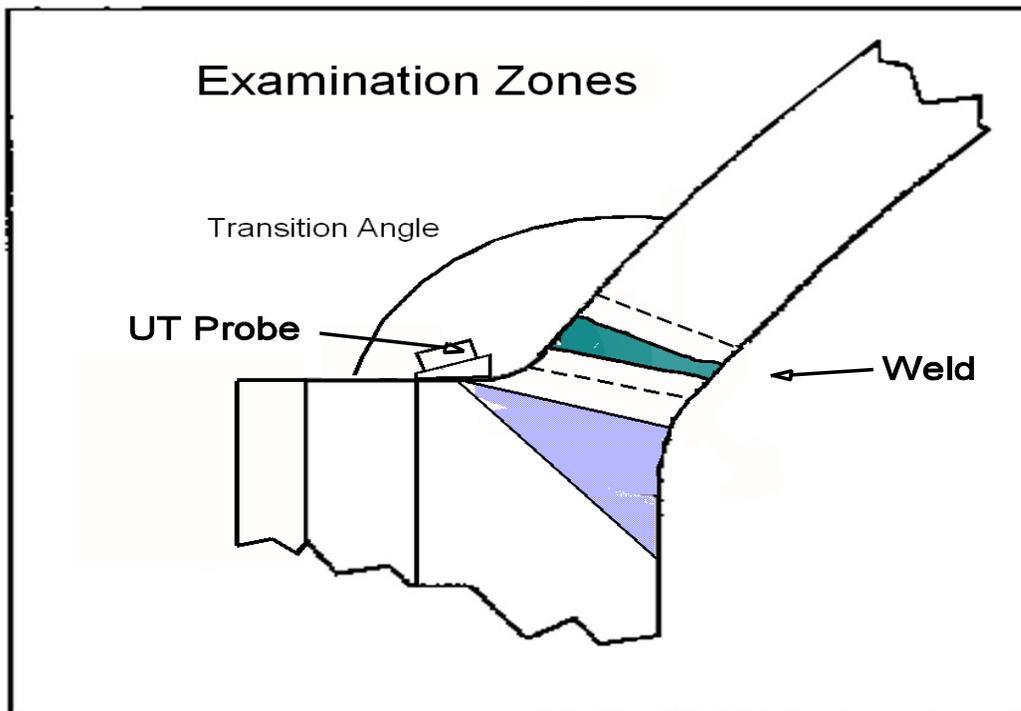
<sup>1</sup> Table PRT-01-1 is included in the licensee's January 22, 2004, submittal (Reference 1) and is not included in this Safety Evaluation.

<sup>2</sup> Sketches PRT-01-1 through PRT-01-5 are included in the licensee's January 22, 2004, submittal (Reference 1) and are not included in this Safety Evaluation.

weld. The ultrasonic scans are performed from the outside surface of the component, and these scans should be conducted from each side of the weld and across the surface (crown) of the weld. 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 cross-sectional geometry of the RPV head-to-flange weld produces a high transition angle between the flange and the domed head. As illustrated in Figure 1, scanning from the flange side of the weld is severely limited due to location of the weld and the transition angle. In addition, the location of three closure head lifting lugs further restricts access for performing ultrasonic examination of this weld. For these reasons, the component configuration does not allow the licensee to obtain the full ASME Code-required volumetric coverage from both sides of the weld. For the licensee to achieve 100-percent volumetric coverage, the RPV closure head would have to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100-percent volumetric examination is impractical for the head-to-flange weld.

By letter dated January 22, 2004, the licensee provided information showing that a substantial amount (approximately 66 percent) of the ASME Code-required examination volume can be



**Figure 1** Cross-sectional view of head-to-flange weld showing the required inspection volume (within dashed lines) and UT beam. The figure illustrates that inspection from the flange side is severely limited due to transition angle and location of weld.

obtained with the perpendicular, parallel and 0-degree angle ultrasonic scans that were performed from the head side of the weld. For both the 45- and 60-degree angle scans, the licensee was able to achieve the ASME Code-required coverage from a single side. In addition to the volumetric examinations of this weld, the licensee was able to obtain essentially 100 percent of the ASME Code-required surface examinations performed on the outside of the component. The examinations completed by the licensee establish a reasonable basis for comparison with future inservice examinations and should have detected any significant conditions that might challenge the structural integrity of the subject welds. Therefore, the licensee's proposed alternative provides reasonable assurance of structural integrity of the subject component.

#### 4.0 CONCLUSION

The NRC staff concludes that for RR PRT-01, the required Code examination coverage is impractical to perform on the subject RPV head-to-flange weld. Furthermore, the NRC staff concludes that the coverage obtained from ultrasonic and surface examinations provides reasonable assurance of structural integrity of the subject component. Therefore, RR PRT-01 is granted pursuant to 10 CFR 50.55a(g)(6)(i) for the third 10-year ISI interval for SPS-1. The NRC staff notes that this approval is only applicable to the preservice examination requirements.

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, Sections III and XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

#### 5.0 REFERENCE

1. Letter from L. Hartz (Dominion) to the NRC, "Virginia Electric and Power Company (Dominion), North Anna Power Station Units 1, Surry Power Station Unit 1, ASME Section XI Inservice Inspection Program Relief Requests, Partial Examination of Reactor Pressure Vessel Head-To-Flange Welds," dated January 22, 2004. Adams Accession Number ML040290659

Principal Contributor: J. Arroyo

Date: May 28, 2004