June 5, 2007

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 NOS. 1 AND 2 - FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL RELIEF REQUEST CMP-001, REVISION 1 (TAC NOS. MD3673 AND MD3674)

Dear Mr. Christian:

By letter dated November 17, 2006, Virginia Electric and Power Company submitted Relief Request CMP-001, Revision 1 for the fourth 10-year inservice inspection (ISI) interval at Surry Power Station, Unit Nos. 1 and 2 (Surry 1 and 2). In Relief Request CMP-001, Revision 1, the licensee requested relief from the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code) examination requirements for the inner radius section of the integrally cast pressurizer surge nozzle due to excessive personnel radiation exposure and geometric examination difficulties at Surry 1 and 2. The Nuclear Regulatory Commission (NRC) staff has completed its review of this relief request, and the NRC staff's evaluation and conclusions are contained in the enclosed Safety Evaluation.

The NRC staff has determined that imposing certain ASME Code requirements are a hardship without a compensating increase in quality and safety and that to impose the ASME Code requirements would be a hardship on the licensee. The NRC staff also concludes that the licensee's proposed alternative to use VT-2 examination in lieu of volumetric examination provides reasonable assurance of structural integrity of the pressurizer surge nozzle. Therefore, the licensee's proposed alternative is authorized pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.55a(a)(3)(ii) for the Surry 1 and 2 fourth 10-year ISI interval. 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.

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 CMP-001, REVISION 1

SURRY POWER STATION, UNIT NOS. 1 AND 2

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NOS. 50-280 AND 50-281

1.0 INTRODUCTION

By letter dated November 17, 2006 (Agencywide Documents Access and Management System Accession No. ML063310055), the Virginia Electric and Power Company (the licensee) submitted a relief request (Relief Request CMP-001, Revision 1) associated with the examination of the pressurizer surge nozzle for the fourth 10-year inservice inspection (ISI) interval at Surry Power Station, Unit Nos. 1 and 2 (Surry 1 and 2). Relief Request CMP-001, Revision 1 pertains to a relief from the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code) examination requirements for the inner radius section of the integrally cast pressurizer surge nozzle due to excessive personnel radiation exposure and geometric examination difficulties at Surry 1 and 2.

2.0 REGULATORY REQUIREMENTS

Inservice inspection 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), Part 50, Section 50.55a(g), 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 NRC, if: (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 1 and 2 Fourth 10-year ISI Program is the 1998 edition of Section XI of the ASME Code, through the 2000 addenda.

3.0 TECHNICAL EVALUATION

Request for Relief No. CMP-001, Revision 1 Component Identification:

Weld Nos.:	23NIR (Unit 1) 15NIR (Unit 2)
Components:	1-RC-E-2 (Unit 1) 2-RC-E-2 (Unit 2)
ASME Class:	1
Description:	Nozzle Inner Radius Section (Pressurizer Surge Nozzle)

ASME Code Requirements

Section 50.55a(b)(2)(xxi)(A) requires that the inspection requirements in the 1998 edition of the ASME Code, Section XI be applied for Category B-D, Item B3.120 welds.
Section 50.55a(b)(2)(xxi)(A) also permits the use of enhanced VT-1 visual examination of the interior surface of the nozzle radius in lieu of the required volumetric examination.

Licensee's Basis for Relief Request (As Stated)

> The Surry Unit 1 [Surry 1 and 2] pressurizer surge line nozzle[s] is [are] integrally cast into the bottom head of the pressurizer. The nozzle is located under the pressurizer skirt and is surrounded by the 78 heater penetrations (Figure 1[1]). Multi-layered, stainless steel mirror insulation and cables for the pressurizer heaters (Figure 2[1]) obstruct access to the nozzle.
>
> Removal of the insulation and cables would be difficult as well as labor and time intensive. The radiation exposure to the personnel involved in performing the associated work is a real and relevant concern. It is almost certain that some, and possibly all, heater cables would have to be disconnected so that the cables can be pulled back to allow access for removing insulation and performing the exam. It is also likely that some cable or heater damage would occur during this removal, if it is assumed that all seventy-eight (78) heater cables have to be disconnected and pulled back, the dose estimate for this work is 56 man-rem.
>
> Other personnel safety concerns potentially involved with this examination include the increased risk for an unplanned exposure event and prevention of contamination with personnel working in tight spaces between the surge line and the exposed portion of the pressurizer heaters. While actions would be taken to prevent any such events, the large dose rate gradients in the under-pressurizer area would challenge even the protection afforded by the best available technology. Temporary shielding is considered impractical in this regard because placement of the shielding material would obstruct and potentially preclude accessibility to the examination surface. Other issues include actual accessibility after removal of the various forms of interference and the likelihood

1. Figures 1 and 2 are not included in this safety evaluation (SE) and are proprietary information.

of difficulties in replacing the insulation to its original configuration. Furthermore, the amount of examination coverage would be dependent on the overall accessibility obtained.

In conjunction with license renewal, Westinghouse [Westinghouse Owners Group (WOG) report WCAP-14575-A[2]] performed an evaluation to address the impact of operational transients for SPS 1 to account for insurge/outsurge transients in addition to design transients in the pressurizer lower head. The results of the evaluation show that the Cumulative Usage Factor (CUF) for the nozzle inner radius is 0.29 (inside surface) and 0.11 (outside surface). Fatigue is one of the prominent degradation mechanisms and the CUF is an indicator of fatigue for which the ASME [Code] design limit is 1.0. The ASME [Code] limit of 1.0 on the usage factor is a design threshold and is not intended to be a limit on serviceability. The calculation of CUF is performed using the worst combinations of design transients, which are much more severe than actual operational transients. This introduces additional conservatism to the analysis. Thus, it can be said that the calculated CUF of 0.29 for all loading conditions including insurge/outsurge transients indicates that degradation due to fatigue is very small in the operating conditions. The environmental effects on fatigue were evaluated for the pressurizer surge line and the surge nozzle during [the] license renewal application. It was determined that the surge line weld at the hot leg pipe connection will be inspected and used as the leading indicator for Environmentally Assisted Fatigue (EAF) concerns. The surge line weld at the hot leg pipe connection is included in augmented inspections as a part of our [Dominion's] commitment for Aging Management. The results of these inspections and the results of planned research by the EPRI [Electric Power Research Institute]-sponsored Materials Reliability Program will be used to address and assess EAF for the surge nozzle. Dominion is unaware of any industry failure involving the inside radius section of the surge line nozzle in a Westinghouse designed pressurizer.

There are several uncertainties regarding an alternative examination of the inside surface of the pressurizer surge line area by use of a remote visual tool. Such an examination requires that a boroscope be fed through the manway and down through openings in the heater support baffles. Adding to the difficulty in performing such an exam, there is a perforated basket diffuser covering the surge nozzle opening on the inside of the pressurizer (Figure 3[3]). The boroscope would need to be positioned through the support plates, and then threaded through a perforation in the basket diffuser, if possible, to the pressurizer surge line area. This examination will be partially obscured by the thermal sleeve, which extends beyond the inside radius area into the volume of the pressurizer. These obstructions would need to be overcome several times in order to achieve the required examination coverage. Furthermore, the resulting examination would be of the cladding that covers the inside radius of the nozzle, which is considered to be only marginally beneficial in determining the structural integrity of the nozzle. Additionally, performing the visual inspection requires opening the RCS and establishing access and foreign material exclusion controls. The boroscope itself has

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2. The WOG report is not included in this SE and is proprietary information.

3. Figure 3 is not included in this SE and is proprietary information.

the potential to become lodged inside the perforated basket diffuser or behind a pressurizer heater support plate.

Any ultrasonic examination on this nozzle could only be described as "best effort." The limited benefit gained would not be commensurate with the difficulty and anticipated exposure estimate of 56 man-rem to perform this examination. An alternative examination employing a remote visual technology also has limited benefit as well as a limited probability of success. Therefore, Dominion concludes that this inspection effort and the associated significant potential risk are not commensurate with the limited benefit that may be obtained from the inspection. As such, we are applying for relief per 10 CFR 50.55a(a)(3)(ii) since compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Licensee's Proposed Alternative Examination (As Stated)

The pressurizer surge line nozzle-to-vessel inner radius section will be VT-2 examined as part of the normally scheduled Class 1 system leakage test each refueling. In addition, the surveillance requirements of Technical Specifications [TSs] that determine the reactor coolant system leak rate and the containment atmosphere radioactivity will be satisfied. The pressurizer surge line weld to the reactor coolant hot leg will be examined as part of augmented inspections to detect [EAF] and will be used as the leading indicator of EAF. Furthermore, Dominion has an active Boric Acid Corrosion Control Program that identifies and monitors borated water leakage to prevent boric acid-related degradation of the Reactor Coolant System [RCS]. These programs ensure that the overall level of plant quality and safety will not be compromised.

NRC Staff's Evaluation

Section 50.55a(b)(2)(xxi)(A) requires that the inspection requirements in the 1998 edition of the ASME Code, Section XI be applied for Category B-D, Item B3.120 welds.
Section 50.55a(b)(2)(xxi)(A) also permits the use of enhanced VT-1 visual examination of the interior surface of the nozzle radius in lieu of the required volumetric examination.

In lieu of the ASME Code requirements, the licensee proposed to perform VT-2 visual examinations of the pressurizer surge line nozzle-to-vessel inner radius section as part of the normally scheduled Class 1 system leakage test each refueling outage. In addition, the licensee will examine the pressurizer surge line weld to the reactor coolant hot leg as part of augmented inspections to detect EAF and will be used as the leading indicator of EAF.
The pressurizer surge line nozzle is integrally cast into the bottom head of the pressurizer; is located under the pressurizer skirt; and is surrounded by 78 heater penetrations. In addition, multi-layered, stainless steel mirror insulation and cables for the pressurizer heaters obstruct access to the subject nozzle. In order for the licensee to examine the nozzle inter radius, it would have to remove the insulation and heater cables exposing the licensee's personnel to an estimated dose of 56 man-rem. The licensee considered temporary shielding; however, it was considered impractical because the shielding material would obstruct and prevent accessibility

of the examination surface. In addition disconnecting the heater cables could also cause damage to both the cables and heaters.

The licensee noted that an alternative examination employing a remote visual technology had a limited benefit as well as a limited probability of success. The subject nozzle has a perforated basket diffuser covering the nozzle opening on the inside of the pressurizer. It would be very difficult for the licensee to feed a boroscope through the pressurizer access manway, down through openings in the heater support baffles and perforated basket diffuser covering the surge nozzle opening. Therefore, the NRC staff determined that the ASME Code-required examination and/or the optional visual examination discussed in 10 CFR 50.55a(b)(2)(xxi)(A) would impose a hardship on the licensee without a compensating increase in quality and safety.

For the Surry 1 and 2 license renewal[4], WOG performed an evaluation to address the impact of operational transients to account for insurge/outsurge transients in addition to design transients in the pressurizer lower head in its report WCAP-14575-A. The results showed that the CUF for the nozzle inner radius is 0.29 (inside surface) and 0.11 (outside surface). It was noted by the licensee that fatigue is one of the prominent degradation mechanisms and the CUF is an indicator of fatigue for which the ASME Code, Section III design limit is 1.0. In the WOG report, the calculation of CUF was performed using the worst combinations of design transients, which are much more severe than actual operational transients. Therefore, the calculated CUF of 0.29 for all loading conditions including insurge/outsurge transients indicates that degradation due to fatigue is low in the operating conditions.

In addition, the WOG report also considered the environmental effects on fatigue. It was also determined that the surge line weld at the hot leg pipe connection should be inspected and used as the leading indicator for EAF concerns. As a result of the report, the surge line weld at the hot leg pipe connection was to be included in augmented inspections based on a licensee commitment associated with the licensee renewal application Surry, Unit 1. The augmented inspection results and the results of planned research by the EPRI-sponsored Materials Reliability Program will be used to address and assess EAF for the surge nozzle.

The Surry 1 and 2 TS surveillance requirements regarding reactor coolant system leak rate and the containment atmosphere radioactivity will further ensure the integrity of leak tightness of the pressurizer surge line nozzle. Furthermore, the licensee has an active Boric Acid Corrosion Control Program that identifies and monitors borated water leakage to prevent boric-acid-related degradation of the RCS. The NRC staff has determined that the licensee's proposed alternative to perform a VT-2 visual examination on the outside of the pressurizer surge line nozzle, the augmented inspections of other welds, and Boric Acid Corrosion Control Program, provide reasonable assurance of the structural integrity of the subject components.

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4. The license's application for the Surry, Unit 1 license renewal was approved in NRC SE dated November 2002 (ML02030905520).

4.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittial and based on the information provided, concludes that it has been shown that compliance with the ASME Code requirements would result in a hardship or unusual difficulty without a compensating increase in quality or safety. Furthermore, the NRC staff concludes that the licensee's proposed alternative to perform a VT-2 visual examination on the pressurizer surge line nozzle-to-vessel weld, proposed augmented inspections of other welds, and the Boric Acid Corrosion Control Program of the subject component provide reasonable assurance of the structural integrity of the subject pressurizer system components. Therefore, the licensee's proposed alternative to perform VT-2 visual examinations on the pressurizer surge line nozzle-to-vessel inner radius in lieu of the ASME Code-required volumetric examination is authorized for the fourth 10-year ISI interval, pursuant to 10 CFR 50.55a(a)(3)(ii).

All other requirements of the ASME Code, Section XI for which relief has not been specifically requested remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: T. McLellan

Date: June 5, 2007

Surry Power Station, Units 1 & 2

cc:

Ms. Lillian M. Cuoco, Esq.
Senior Counsel
Dominion Resources Services, Inc.
Building 475, 5th Floor
Rope Ferry Road
Waterford, Connecticut 06385

Mr. Donald E. Jernigan
Site Vice President
Surry Power Station
Virginia Electric and Power Company
5570 Hog Island Road
Surry, Virginia 23883-0315

Senior Resident Inspector
Surry Power Station
U. S. Nuclear Regulatory Commission
5850 Hog Island Road
Surry, Virginia 23883

Chairman
Board of Supervisors of Surry County
Surry County Courthouse
Surry, Virginia 23683

Dr. W. T. Lough
Virginia State Corporation Commission
Division of Energy Regulation
Post Office Box 1197
Richmond, Virginia 23218

Dr. Robert B. Stroube, MD, MPH
State Health Commissioner
Office of the Commissioner
Virginia Department of Health
Post Office Box 2448
Richmond, Virginia 23218

Office of the Attorney General
Commonwealth of Virginia
900 East Main Street
Richmond, Virginia 23219

Mr. Chris L. Funderburk, Director
Nuclear Licensing & Operations Support
Dominion Resources Services, Inc.
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, Virginia 23060-6711