UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 17, 2014

Mr. David A. Heacock
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, FIFTH INTERVAL INSERVICE INSPECTION (ISI) PROGRAM, SYSTEM PRESSURE TESTING (SPT), S1-I5-SPT-01 (TAC NO. MF3200)

Dear Mr. Heacock:

By letter dated November 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13336A142), as supplemented by letter dated March 7, 2014 (ADAMS Accession No. ML14072A010), Virginia Electric and Power Company – Dominion (the licensee) submitted for the U.S. Nuclear Regulatory Commission (NRC) approval request for alternative (RFA) S1-I5-SPT-01. The licensee proposed an alternative to a certain requirement of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI. The request relates to the inservice inspection (ISI) requirement of IWB-5221 when the licensee conducts system leakage testing of the bottom of the reactor pressure vessel (RPV). The licensee submitted the request for the Surry Power Station (Surry), Unit 1.

The NRC staff has concluded based on the information provided by the licensee, that pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the Relief Request an alternative system leakage test of the bottom of the RPV is authorized on the basis that complying with the specified requirement would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

If you have any questions concerning this matter, please contact Dr. Sreenivas, at (301) 415-2597.

Sincerely,

Robert J. Pascarelli, Branch Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-280

Enclosure:
Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE S1-I5-SPT-01

REGARDING SYSTEM PRESSURE TEST OF BOTTOM OF REACTOR VESSEL VIRGINIA

ELECTRIC AND POWER COMPANY

SURRY POWER STATION, UNIT 1

DOCKET NUMBER 50-280

1.0 INTRODUCTION

By letter dated November 26, 2013 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML13336A142), as supplemented by letter dated March 7, 2014 (ADAMS Accession No. ML14072A010), Virginia Electric and Power Company - Dominion (the licensee) submitted for the U.S. Nuclear Regulatory Commission (NRC) approval request for alternative (RFA) S1-I5-SPT-01. The licensee proposed an alternative to a certain requirement of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI. The request relates to the inservice inspection (ISI) requirement of IWB-5221 when the licensee conducts system leakage testing of the bottom of the reactor pressure vessel (RPV). The licensee submitted the request for the Surry Power Station (Surry), Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the licensee proposed an alternative system leakage testing of the bottom of the RPV on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), the ASME Code Class 1, 2, and 3 components (including supports) must 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 inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals must 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 conditions listed therein.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates (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.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Request for Alternative

The component affected is ASME Code Class 1 pressure retaining boundary and Examination Category B-P, Item Number B15.10, in accordance with IWB-2500, Table IWB-2500-1. The component is the bottom area of the RPV.

The code of record for the fifth 10-year ISI interval at Surry, Unit 1, is the 2004 Edition and no Addenda of the ASME Code.

The ASME Code, Section XI, IWB-2500, Table IWB-2500-1, Examination Category B-P, requires the system leakage test be conducted according to IWB-5220 and the associated VT-2 visual examination according to IWA-5240, prior to plant startup following each refueling outage. As required by IWB-5221(a), the system leakage test shall be conducted at a pressure not less than the pressure corresponding to the 100 percent rated reactor power. In accordance with IWB-5221(b), the system test pressure and temperature shall be attained at a rate in accordance with the heat-up limitations specified for the system.

The licensee proposed an alternative to IWB-5221(a) and IWB-5221(b). In lieu of performing system leakage test of the bottom the RPV at normal reactor operating pressure and temperature, the licensee proposed to conduct the system leakage test during the refueling outage when the reactor containment is at atmospheric conditions (i.e., atmospheric pressure and ambient air temperature). Accompanied with the proposed system leakage testing, the licensee will perform the required VT-2 visual examination of the bottom of the RPV for evidence of leak and boric acid corrosion.

The licensee stated that station administrative procedures require a self-contained breathing apparatus be worn for containment entries under sub-atmospheric conditions. This administrative requirement significantly complicates the required VT-2 visual examination of the bottom of the reactor vessel during the ASME Code required system leakage testing. Access to the bottom of the reactor vessel requires the examiner descend several levels by ladder and navigate a small entrance leading to the reactor vessel. In addition to these physical constraints, the examiner must contend with extreme environmental conditions. The extreme environmental conditions include the high air temperatures due to the reactor coolant temperature at greater than 500 degrees Fahrenheit and limited air circulation in the vessel cubicle area. The licensee stated that the hardship arises less from the time constraint created by the use of bottled air or the

involved radiation levels, but rather more from the extreme temperature due to the reactor normal operating temperature conditions that exist during the Code required system leakage testing. These factors increase the safety hazard associated with the required VT-2 visual examination of the bottom of the reactor vessel.

The licensee stated that the combination of adverse conditions from the reactor normal operation will not exist if the system leakage test takes place at the ambient temperature and pressure during refueling outage. The involved personnel will perform the alternative system leakage test under conditions that is safer. In addition, the proposed test allows for a more thorough VT-2 visual examination of the bottom area of the reactor.

In letter dated March 7, 2014, the licensee stated that it will perform the required VT-2 visual examination with the insulation in place for the bottom of the reactor vessel in accordance with IWA-5242. The licensee will conduct the VT-2 visual examination as soon as conditions allow entry into the in-core area during reactor shutdown. The licensee stated that adherence to the VT-2 visual examination requirements would identify leakage from the bottom of the reactor vessel. The licensee stated that if it detects any leakage, it will take the appropriate actions in accordance with IWA-5250.

In letter dated March 7, 2014, the licensee stated that there are bottom mounted instrumentation penetrations that are also subject to the VT-2 visual examination during the system leakage test of the bottom of the reactor vessel.

The licensee stated that it will continue to monitor the bottom of the reactor vessel with surveillance requirements and alarms for leakage, if it were to occur. The licensee stated that the in-core sump room collects any leakage that originates from the bottom of the reactor vessel, and the in-core sump room sump pump discharges to the containment sump. Both the in-core sump room sump and the containment sump level switches provide alarm indication and pump control signals. The high level alarm from the in-core sump and containment sump would alert control room operators of a high level condition. In addition, the daily leak rate calculations would identify an increase in unidentified leakage. Leakage exceeding action levels prompts entry into procedure(s) for identifying the source(s) of the increased leakage. The licensee stated that it also monitors the containment atmosphere for radioactive gases and particulates. Therefore, in the event of a leak in the bottom of the RPV, these actions would identify any integrity concerns associated with the area.

The licensee stated that there has not been any plant-specific and fleet operating experience regarding potential degradation of the bottom of the reactor vessel due to known degradation mechanisms that would lead to leakage. Further, the licensee provided a list of industry operating experience of primary water stress corrosion cracking in the bottom mounted instrumentation penetration nozzles.

The licensee stated that it conducted voluntary volumetric examinations of the bottom mounted nozzles of Surry, Unit 1, in November 2004 and Surry, Unit 2, in May 2005. The licensee identified no issues and no rejectable indications during performance of the volumetric examinations. In addition, the licensee has conducted the bare metal visual examination of the bottom mounted instrumentation penetrations in accordance with ASME Code Case N-722-1 "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials, Section XI, Division1" every other refueling outage, as required

by 10 CFR 50.55a(g)(6)(ii)(E) "Reactor coolant pressure boundary visual inspections" with conditions. ASME Code Case N-722-1 provides description for the visual examination and procedure for its performance. The licensee has not identified any issues and evidence of leakage during performance of the visual examinations.

The licensee submitted this request for the fifth 10-year ISI interval, which commenced on December 14, 2013, and will end on October 13, 2023.

3.2 NRC Staff Evaluation

The NRC staff has evaluated RFA S1-I5-SPT-01 pursuant to 10 CFR 50.55a(a)(3)(ii). The NRC staff focuses on whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

The NRC staff determined that compliance with the ASME Code, Section XI, IWB-5221(a) and IWB-5221(b), during system leakage test of the bottom of the RPV would result in hardship. The basis for the hardship is as follows. To comply with the system leakage testing requirements, the licensee's personnel has to enter a confined area under the reactor vessel when the reactor coolant system is at normal operating pressure and temperature and the reactor containment is at a sub-atmospheric pressure. The high air temperature in the reactor containment would create safety hazards to personnel conducting the required VT-2 visual examination of the bottom of the RPV. To conduct the required VT-2 visual examination, the licensee's personnel would have to wear protective gears for safety from high air temperature and sub-atmospheric pressure of the reactor containment, and descend and navigate through a small entrance into the cubical area beneath vessel. Conducting the required VT-2 visual examination by the licensee's personnel under such physical constraints and adverse environment would significantly affect the quality of the examination. Therefore, the NRC staff determines that the above conditions constitute a hardship.

The NRC staff finds that, in lieu of the required pressure and temperature specified in IWB-5221(a) and IWB-5221(b), the licensee will conduct the system leakage test of the bottom of the RPV including the bottom mounted instrumentation penetration nozzles at the ambient pressure and temperature during the refueling outage. This allows the licensee to perform the required VT-2 visual examination in a tolerable and a safe condition. The licensee will perform the VT-2 visual examination of both the insulated and non-insulated area of the bottom of the RPV including the bottom mounted instrumentation penetration nozzles in accordance with IWA-5240. Therefore, the NRC staff determined that by performing the required VT-2 visual examination of the bottom of the RPV including the bottom mounted instrumentation penetrations, the licensee will be able to identify any pressure retaining boundary leakage (or evidence of any leakage such as boric acid corrosion, boron residue, and staining) that would originate from a flaw.

The licensee stated that its review of plant-specific and fleet operating experience did not identify any documented degradation of the bottom of the reactor vessel due to known degradation mechanisms that would lead to leakage. The NRC staff review of operating experience, including Surry, has not identified any documented degradation of the bottom of the reactor vessel. In addition, the NRC staff notes that the industry experience of known degradation in the bottom mounted instrumentation penetration nozzles has resulted in regulatory requirement of 10 CFR 50.55a(g)(6)(ii)(E). Pursuant to 10 CFR 50.55a(g)(6)(ii)(E), all licensees shall examine the

bottom mounted instrumentation penetration nozzles in accordance with ASME Code Case N-722-1, with conditions.

In addition, the NRC staff recognizes that, (a) the licensee voluntary performed the volumetric examination of the bottom mounted instrumentation penetration nozzles of Surry, Units 1 and 2, during the fourth 10-year ISI interval and did not identify any unacceptable indications; and (b) pursuant to 10 CFR 50.55a(g)(6)(ii)(E), the licensee has performed the bare metal visual examination of the bottom mounted instrumentation penetrations in accordance with ASME Code Case N-722-1, every other refueling outage. The licensee did not identify any evidence of pressure retaining boundary leakage. The above examinations will provide additional assurance of the structural integrity of the bottom mounted instrumentation penetrations.

Furthermore, the NRC staff finds that the existing reactor coolant leakage detection systems are sufficient to provide warning to the control room operator in an unlikely event of a through wall leak in the bottom of the RPV. The NRC staff finds that if the subject components developed a through wall flaw, the reactor coolant leakage detection systems will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in accordance with the plant technical specifications.

In summary, the NRC staff finds that the proposed system leakage testing is adequate to provide a reasonable assurance of structural integrity and leak tightness of the subject components.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative system leakage testing provides reasonable assurance of structural integrity and leak tightness of the bottom of the reactor vessel. The NRC staff determined that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes the use of RFA S1-I5-SPT-01 at Surry, Unit 1, for the fifth 10-year ISI interval which commenced on December 14, 2013, and will end on October 13, 2023.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the staff remain applicable, including the third party review by the Authorized Nuclear In-service Inspector.

If you have any questions concerning this matter, please contact Dr. Sreenivas, at (301) 415-2597.

Sincerely,

/RA/

Robert J. Pascarelli, Branch Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-280

Enclosure:
Safety Evaluation

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