

September 23, 2003

Mr. David A. Christian
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Virginia Electric and Power Company
Innsbrook Technical Center
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SUBJECT: SURRY POWER STATION, UNITS 1 AND 2, AND NORTH ANNA POWER STATION, UNITS 1 AND 2 - RISK-INFORMED INSERVICE INSPECTION RELIEF REQUEST R-1 (TAC NOS. MB5437, MB5438, MB5439, AND MB5440)

Dear Mr. Christian:

By letter dated June 13, 2002, Virginia Electric and Power Company (VEPCO) requested approval for risk-informed relief request R-1 for Surry Power Station, Unit 1 (SPS 1), and approval for a revision to the previously approved risk-informed relief request R-1 for Surry Power Station, Unit 2 (SPS 2) and North Anna Power Station, Units 1 and 2 (NAPS). VEPCO provided supplemental information in letters dated April 2 and June 5, 2003. Relief request R-1 addresses the inherent difficulties of performing volumetric examinations of socket welded connections. For NAPS and SPS 2, VEPCO proposed to revise the scope of the previously approved relief request R-1 to include branch connection welds. VEPCO's request to approve R-1 for SPS 1 also includes branch connection welds.

The RI-ISI program for SPS 1 was approved by the NRC staff on December 16, 1998. At that time, VEPCO did not request approval of relief request R-1 as part of its RI-ISI program approval process for SPS 1. Relief request R-1 was initially approved by the U.S. Nuclear Regulatory Commission (NRC) staff for NAPS and SPS 2 as part of the risk-informed inservice inspection (RI-ISI) program review in letters dated September 18, 2001, and January 26, 2001, respectively.

Our evaluations and conclusions are contained in the enclosed Safety Evaluation. The NRC staff finds that during the evaluation of the NAPS and SPS 2 RI-ISI programs, the NRC staff had already considered the subject branch connections in its evaluations. As a result, the requested relief is merely a clarification of the relief that was already granted for NAPS in our letter dated September 18, 2001, and for SPS 2, in our letter dated January 26, 2001. The NRC staff concludes that no additional relief is necessary at NAPS and SPS 2 to perform VT-2 examinations on high safety-significant branch connections.

For SPS 1, the NRC staff concludes that the proposed alternative, as described in your request for relief, provides reasonable assurance of structural integrity. The NRC staff finds that complying with certain requirements of the RI-ISI program and Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(ii), your proposed alternative is authorized for the remainder of the third 10-year ISI interval for SPS 1.

Mr. David A. Christian

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The NRC staff has completed its evaluation of this request; therefore, we are closing TAC Nos. MB5437, MB5438, MB5439, and MB5440.

Sincerely,

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-280, 50-281,
50-338, and 50-339

Enclosure: As stated

cc w/encl: See next page

Mr. David A. Christian

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST R-1

SURRY POWER STATION, UNITS 1 AND 2 (SPS)

NORTH ANNA POWER STATION, UNITS 1 AND 2 (NAPS)

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NOS. 50-280, 50-281, 50-338 AND 50-338

1.0 INTRODUCTION

By letter dated June 13, 2002, as supplemented by letters dated April 2, and June 5, 2003, Virginia Electric and Power Company (the licensee) submitted relief request R-1 for North Anna Power Station, Units 1 and 2 (NAPS), and Surry Power Station, Units 1 and 2 (SPS). In this relief, the licensee proposed to perform a VT-2 examination on high safety-significant (HSS) socket welds and their associated branch connections that have a nominal pipe size (NPS) of 2 inches or smaller during each refueling outage in lieu of performing either the surface examination required by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) or the volumetric examination required by the WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods of Piping Inservice Inspection Topical Report," (WCAP-14572) methodology. Since NAPS and Surry Power Station, Unit 2 (SPS 2), have approved risk-informed inservice inspection (RI-ISI) programs that include relief R-1, this proposed relief request merely expands the scope of R-1 to include welds associated with branch connections. VEPCO did not request approval of R-1 for Surry Power Station, Unit 1 (SPS 1) as part of its original RI-ISI program; however, it is now requesting approval of R-1 for SPS 1, including the expanded scope associated with branch connection welds.

The proposed relief requests are for the remainder of the third 10-year ISI interval at NAPS and SPS.

2.0 REGULATORY EVALUATION

The ISI of 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 U.S. Nuclear Regulatory Commission (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 pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) 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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. In accordance with 10 CFR 50.55a(b), the applicable version of the Code is the 1989 Edition for the third 10-year ISI interval at NAPS 1 and SPS. The applicable version of the Code is the 1995 through the 1996 Addenda for the third 10-year ISI interval at NAPS 2.

3.0 TECHNICAL EVALUATION

3.1 The Components for Which Relief is Requested

For NAPS and SPS 2:

ASME Code Class 1 socket weld connections and their branch connections, NPS 2 and smaller, that are identified as being HSS.

For SPS 1:

ASME Code Class 1, 2, and 3, and non-class socket weld connections and their branch connections, NPS 2 and smaller, that are identified as being HSS.

3.2 Code Requirements

NAPS and SPS implemented RI-ISI programs during each unit's third 10-year inspection interval. The RI-ISI programs were developed using the methodology in WCAP-14572, Rev. 1-NP-A. The methodology in the NRC staff approved WCAP-14572, Rev. 1-NP-A, requires examination of HSS components based upon the postulated failure mechanism for the element of piping being examined. The methodology does not account for the geometric limitations imposed by socket welds and their branch connections, NPS 2 and smaller, when volumetric examinations are specified.

3.3 Licensee's Proposed Alternative (as stated)

For NAPS:

A VT-2 examination will be performed on the subject socket weld connections and their branch connections, NPS 2 and smaller, on a refueling outage frequency in conjunction with the system pressure test. These examinations will be tracked and reported by pressure test zone associated with the system pressure test program required by ASME Section XI.

For SPS:

A VT-2 exam will be performed on the subject socket weld connections and their branch connections, NPS 2 and smaller, on a refueling outage frequency while the component is pressurized.

For both NAPS and SPS, the licensee stated that the pressure test will be performed in accordance with ASME Section XI IWA-2000 and 5000, or Code Case N-498-1 (or later NRC approved revision), except for test frequencies, which will be performed on a refueling outage basis, and the pressure tests, which will be performed at nominal operating pressure.

3.4 Licensee's Basis for Requesting Relief

The licensee described the basis for the R-1 relief request at NAPS and SPS in its letter dated June 13, 2002. The licensee's basis is summarized in the following paragraphs:

Certain socket weld connections and their branch connections, NPS 2 and smaller, for NAPS and SPS, have been identified as HSS and require volumetric examination for their postulated failure mechanism by WCAP-14572, Rev. 1-NP-A. The HSS socket weld connections and their branch connections are associated with a potential thermal fatigue damage mechanism either caused by a snubber malfunction or as a default mechanism for segments selected for their consequence of failure with no assumed active mechanism occurring. Performing a volumetric examination on a socket weld connection or the branch connection, NPS 2 and smaller, provides little or no benefit due to limitations imposed by the joint configuration and the smaller pipe size.

The ASME Code Committee recognized this problem and revised Code Case N-577 to allow substitution of the VT-2 examination method for all damage mechanisms on socket weld connections selected as HSS. The revised version is identified as Code Case N-577-1 and provides for the substitution in Note 12 of Table 1 in the revised Code case. Incorporation of the branch connection, NPS 2 and smaller, into the Code cases is now under consideration by the committee for similar size and joint configuration limitation reasons.

The licensee concluded that performing a volumetric examination on socket weld connections or their branch connections that are NPS 2 and smaller would be unusually difficult and would not provide any meaningful results or a compensating increase in the level of quality and safety. As such, the licensee requested relief under 10 CFR 50.55a(a)(3)(ii). The licensee also concluded that substituting a VT-2 examination as the proposed alternative to performing the required volumetric examination each refueling outage for the subject HSS locations provides reasonable assurance of component integrity.

3.5 NRC Staff Evaluation

The licensee requested to perform a VT-2 examination each refueling outage in accordance with the requirements of ASME Section XI, IWA-2000 and 5000, or Code Case N-498-1 on HSS socket welds and their associated branch connections, NPS 2 and smaller, in lieu of the Code-required surface examination or the volumetric examination directed by the Westinghouse Owners Group methodology in WCAP-14572, Revision 1-NP-A. The licensee indicated that Code Case N-577 has been revised to allow the substitution of the VT-2

examination method for all damage mechanisms on socket welds identified as HSS. While revised Code Case N-577 has not been reviewed and approved by the NRC, NRC staff acknowledges that the volumetric examination of socket welds and branch connections can produce ineffective results due to the geometric limitations imposed by the socket welds and branch connections. Therefore, the NRC staff finds the proposed alternative using VT-2 examinations reasonable.

However, the NRC staff also notes that Table IWB-2500-1 of the ASME Code requires surface examination, not volumetric examination, for socket welds. Surface examinations (e.g., liquid penetration examination) are an effective method for the identification of outside surface initiated flaws - of specific concern, flaws induced by low-cycle fatigue or by external chloride stress corrosion cracking (ECSCC). The licensee indicated in a letter dated April 2, 2003, that most of the subject piping (i.e., Class 1 and 2) is not located in areas that are subject to ECSCC. In areas that are subject to ECSCC and contain Class 3 piping, the piping material used in these applications is not considered susceptible to ECSCC. The licensee also stated that low-cycle fatigue was considered in the piping design, making the occurrence of an outside surface-initiated flaw due to this mechanism a very low probability event. As for a potential outside surface flaw caused by vibration-induced fatigue, such a flaw is likely to take a long period for initiation. After the initiation phase, the flaw will likely propagate rapidly and cause the pipe to leak. The NRC staff finds the proposed alternative of performing a VT-2 each refueling outage to be sufficiently effective and acceptable to detect such leakage. Thus, approval of this request is based on the technical soundness of applying visual VT-2 examination at the subject facilities for HSS socket and branch connections NPS 2 and smaller, and should not be considered as an endorsement of revised Code Case N-577.

By letter dated April 2, 2003, the licensee clarified the differences between relief request R-1 for SPS 1, SPS 2, and NAPS. The NRC staff previously approved the relief requests associated with the licensee's SPS 1 RI-ISI program on December 16, 1998. The SPS 1 RI-ISI program provides for volumetric examinations of socket welds (and their branch connection) on piping sections greater than NPS 1. In its letter dated June 16, 2002, for relief request R-1 at SPS 1, the licensee proposed to perform a VT-2 examination in lieu of a volumetric examination for socket welds and their associated branch connections on piping connections NPS 2 and smaller. In its letter dated April 2, 2003, the licensee discussed the impact of the proposed change in examination method on the RI-ISI program development. The NRC staff finds that the proposed change has no impact on the safety significance classification of the segments because the classification is independent of the examination technique. However, the NRC staff notes that the proposed change in examination techniques could have an impact on the change in risk evaluations.

By letter dated April 2, 2003, the licensee provided a table indicating that where butt welds were mixed with socket welds in a single HSS segment at least one and sometimes two butt welds have been selected for inspection and will continue to be volumetrically inspected. The number of butt weld examination locations was derived based on the application of the Perdue methodology to the population of butt welds in the segment. This process comports with the approved WCAP methodology and is acceptable. In this WCAP methodology, a segment that has at least one location inspected has the same probability of failure regardless of the number of inspection locations. Consequently, replacing volumetric inspections with VT-2 inspections of socket welds and their associated branch connections in segments that have, and will

continue to have, one or more butt welds inspected will not impact the change in risk. The change in failure frequency that could be expected by replacing volumetric examinations with VT-2 examinations in the remaining segments was evaluated by the licensee. The licensee stated that crediting only a visual examination instead of a volumetric examination for the segments that had no butt welds yielded a change in risk results that continue to meet the WCAP change in risk guidelines. Therefore, the NRC staff finds this acceptable.

The relief requests for SPS 2 and NAPS RI-ISI programs were approved on January 26, 2001, and September 18, 2001, respectively. In the applications, the licensee requested relief from the WCAP-14572 requirement to perform volumetric examinations of HSS ASME Class 1 socket connections. The change in risk estimates for SPS 2 and NAPS incorporate VT-2 examinations for socket welds instead of volumetric examinations in the RI-ISI program, as noted in licensee letters dated April 27, 2000, and April 26, 2001, respectively. The licensee's June 13, 2002, letter clarified that during the SPS 2 and NAPS RI-ISI program development, VT-2 inspections were also credited on the socket welds' branch connections because the branch connection was considered part of the socket weld, and this was not explicitly mentioned in WCAP-14572 and the letter containing the SPS 1 RI-ISI program dated October 31, 1997. The licensee's April 2, 2003, letter states, and the NRC staff concurs, that the June 13, 2002, relief request for SPS 2 and NAPS is a clarification that has no impact on the RI-ISI program development and requires no further analysis.

Based on the preceding evaluation, the NRC staff finds that the relief requests for SPS 2 and NAPS represent only a clarification of reliefs previously approved by the NRC staff. No additional relief is necessary for the SPS 2 and NAPS RI-ISI programs. Specifically, performing a VT-2 inspection in lieu of a volumetric examination of the subject socket weld branch connections together with the population of socket welds, NPS 2 and smaller, each refueling outage is acceptable. For SPS 1, the relief request will change the RI-ISI program, and the licensee re-evaluated the RI-ISI program incorporating the change in the program. The licensee determined that the modified program continues to comport with the WCAP methodology and criteria. Based on its review, the NRC staff has determined that the modified RI-ISI program is consistent with the WCAP methodology and, therefore, the NRC staff finds the modified program acceptable.

4.0 CONCLUSION

Based on the above, the NRC staff finds that for the NAPS and SPS 2 RI-ISI programs, the NRC staff had already considered the subject branch connections in our evaluation of the previously approved R-1 relief requests. As a result, this request for relief merely clarifies the scope of the R-1 relief that has already been granted for NAPS and SPS 2 in the NRC staff's letters dated September 18, 2001, and January 26, 2001, respectively. These reliefs are currently in effect for the remainder of the third 10-year ISI interval. The NRC staff concludes that no additional relief is required at NAPS and SPS 2 to perform VT-2 examinations on the subject branch connections.

The licensee also requested that the NRC staff approve the R-1 relief request for SPS 1, including the revised scope that includes branch connection welds. The NRC staff acknowledges that volumetric examination of socket welds and branch connections NPS 2 and

smaller can produce inconclusive results due to the geometric limitations imposed by the socket welds and the small connection size. The NRC staff also acknowledges that the ASME Code-required surface examination for the subject welds is not useful due to the absence of outside-initiated flaws.

Based on the above evaluation, the NRC staff concludes that the proposed alternative of performing a VT-2 examination each refueling outage for the subject HSS socket welds and branch connections that are NPS 2 and smaller provides reasonable assurance of structural integrity. Complying with the specified requirements would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative pursuant to 10 CFR 50.55a(a)(3)(ii) for the remainder of the third 10-year ISI interval at SPS 1.

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Date: September 23, 2003

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