

September 13, 2004

Mr. David A. Christian
Sr. Vice President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, Virginia 23060-6711

SUBJECT: SURRY POWER STATION, UNIT 1 - RISK-INFORMED INSERVICE
INSPECTION RELIEF REQUEST R-1 (TAC NO. MB7770)

Dear Mr. Christian:

By letter dated December 12, 2002, as supplemented by letters dated December 5, 2003, and April 20, 2004, Virginia Electric and Power Company (VEPCO) requested approval for risk-informed Relief Request R-1 for Surry Power Station, Unit 1. Relief Request R-1 addresses the inherent difficulties of performing volumetric examinations of socket weld connections.

Our evaluation and conclusion are contained in the enclosed Safety Evaluation. The NRC staff concludes that the proposed alternative, as described in your request for relief, provides reasonable assurance of structural integrity. In addition, the NRC staff finds that complying with the requirements of Section XI of the American Society of Mechanical Engineers Code would result in 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 fourth 10-year inservice inspection interval at Surry, Unit 1.

This completes the NRC staff's activities associated with TAC No. MB7770.

Sincerely,

/RA/

Mary Jane Ross-Lee, Acting 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

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

SURRY POWER STATION, UNIT 1

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-280

1.0 INTRODUCTION

By letter dated December 12, 2002, as supplemented by letters dated December 5, 2003, and April 20, 2004, Virginia Electric and Power Company (the licensee) submitted Relief Request R-1 in order to perform a VT-2 exam 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 exam required by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) or the volumetric exam directed by the Westinghouse Owners Group methodology in WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods of Piping Inservice Inspection Topical Report," (WCAP-14572). This proposed relief request is for the fourth 10-Year inservice inspection (ISI) interval at Surry Power Station, Unit 1 (SPS 1).

By letter dated June 13, 2002, as supplemented by letters dated April 2 and June 5, 2003, the licensee had submitted Relief Request R-1 for the third 10-Year ISI interval at SPS 1. This relief was approved by the NRC staff on September 23, 2003. In support of Relief Request R-1 for the fourth 10-Year ISI interval, in its submittal dated April 20, 2004, the licensee stated that all information provided in support of Relief Request R-1 for the third 10-Year ISI interval is also valid for its current relief request.

2.0 REGULATORY EVALUATION

The ISI of the ASME Code Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and 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). As stated in 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the 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.

ENCLOSURE

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.

The ISI Code of record for the fourth 10-year interval at SPS 1 is the 1995 Edition through the 1996 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval. As such, by letter dated August 11, 2004, the NRC staff approved of the licensee's request to use the 1998 Edition through the 2000 Addenda of the ASME Code, with certain limitations, for the fourth 10-year interval at SPS 1. The fourth 10-year ISI interval at SPS 1 began on October 14, 2003, and ends on December 13, 2013.

3.0 TECHNICAL EVALUATION

3.1 The Components for Which Relief is Requested:

ASME Class 1, 2, 3, and nonclass socket weld connections and their branch connections, nominal pipe size 2 inches (NPS 2) and smaller, which are identified as being HSS.

3.2 Code Requirement:

SPS 1 has been approved to use a Risk-Informed Inservice Inspection (RI-ISI) program. The RI-ISI program at SPS 1 was 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 that have an NPS 2 and smaller when volumetric examinations are specified.

3.3 Licensee's Proposed Alternative:

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.

In addition, by letter dated June 5, 2003, the licensee stated that the 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. The tests will be performed at nominal operating pressure.

3.4 Licensee's Basis for Requesting Relief:

Certain socket weld connections and their branch connections, NPS 2 and smaller, for Surry Unit 1 have been identified as HSS and require volumetric examination for their postulated failure mechanism by WCAP-14572, Rev. 1-NP-A. These instances are associated with a potential thermal fatigue damage mechanism either caused by a postulated temperature stratification 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 has recognized this problem and has 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, N-577-1, has been issued and provides the substitution in note 12 of Table 1 of the Code Case. Incorporation of the branch connection, NPS 2 and smaller, into the Code Case is now under consideration by the committee for similar size and joint configuration limitation reasons.

Performing a volumetric examination on socket weld connections or their branch connections, NPS 2 and smaller, would result in unusual difficulty without providing any meaningful results, and thus no compensating increase in the level of quality and safety. As such, relief is requested per 10 CFR 50.55a(a)(3)(ii). Substituting a VT-2 examination as an alternative on a refueling outage frequency for these locations ensures reasonable assurance of component integrity.

4.0 STAFF EVALUATION

The licensee requested to perform a VT-2 exam during 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 surface exam required by the ASME Code or the volumetric exam 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 Code Case N-577 has not been reviewed and approved by the NRC, the 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 notes that Table IWB-2500-1 of the ASME Code requires surface examination, not volumetric examination, at the socket welds. Surface examinations (e.g., liquid penetration examination) is an effective method for the identification of outside surface-initiated flaws; of specific concern are flaws induced by low-cycle fatigue or by external chloride stress corrosion cracking (ECSCC). By letter dated April 2, 2003, the licensee indicated that the subject Class 1 and 2 piping is not located in areas that are subject to an

environment promoting 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 SPS 1 for the HSS socket and branch connections NPS 2 and smaller, and should not be considered as an endorsement of revised Code Case N-577.

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 examination technique. However, the NRC staff notes that the proposed change in examination techniques could have an impact on the change in risk evaluations.

In its April 2, 2003 letter, 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 a visual examination instead of volumetric examination for the segments that had no butt welds yielded a change in risk results that continues to meet the WCAP change in risk guidelines. The NRC staff finds the licensee's request to be acceptable because its assessment will continue to meet the NRC staff-approved WCAP change in risk guidelines.

5.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the proposed visual VT-2 examinations during each refueling outage for the subject HSS socket welds and their associated branch connections that are NPS 2 and smaller provides reasonable assurance of structural integrity of the subject piping welds. Complying with the specified requirement 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 fourth 10-year ISI interval at SPS 1.

6.0 REFERENCES

1. Letter dated December 12, 2002, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company, Surry Power Station Unit 1, Fourth Interval Inservice Inspection Program.*
2. Letter dated April 20, 2004, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company, Surry Power Station Unit 1, Fourth Interval Inservice Inspection Program, Request for Additional Information.*
3. WCAP-14572, Revision 1-NP-A, *Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report*, February 1999.
4. Letter dated June 13, 2002, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, Surry Power Station Units 1 and 2, Risk-Informed ISI Relief Requests R-1.*
5. Letter dated April 2, 2003, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, Surry Power Station Units 1 and 2, Risk-Informed ISI Relief Requests R-1, Response to Request for Additional Information.*
6. Letter dated June 5, 2003, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company, North Anna Power Stations Units 1 and 2, Surry Power Station Units 1 and 2, Risk-Informed ISI Relief Request R-1, Response to Request for Additional Information.*
7. Letter dated December 5, 2003, L.N. Hartz (Virginia Electric and Power Company, Vice President, Nuclear Engineering and Services) to U.S. Nuclear Regulatory Commission, *Virginia Electric and Power Company Surry Power Station Unit 1 Fourth Interval Inservice Inspection Program Request for Additional Information.*

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Date: September 13, 2004

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