February 9, 2006

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: NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2 (NORTH ANNA 1 AND 2) - ASME CODE THIRD 10-YEAR ISI PROGRAM (TAC NOS. MC5588, MC5589, MC5590, MC5591, MC5592, MC5593, MC5594, MC5595, MC5599 AND MC5600)

Dear Mr. Christian:

By letter dated January 10, 2005, as supplemented by letter dated August 2, 2005, Virginia Electric and Power Company (VEPCO) requested relief from the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI, requirements for the third 10-year Inservice Inspection (ISI) program interval at North Anna 1 and 2. In its submittal, VEPCO requested Nuclear Regulatory Commission (NRC) staff approval of Relief Requests SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 1 and SPT-009, SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 2.

Our evaluations of Relief Requests SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 1 and SPT-009, SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 2 are enclosed. In its letter dated August 2, 2005, VEPCO withdrew Relief Request SPT-011 for North Anna 2.

For Relief Requests SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 1 and SPT-009, SPT-010, SPT-012, and SPT-013 for North Anna 2, the NRC staff has determined that the ASME Code-required examinations would cause significant hardship without a compensating increase in the level of quality and safety. VEPCO's proposed alternative provides reasonable assurance of leak tightness and structural integrity of the subject components. Therefore, VEPCO's Relief Requests SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna 1 and SPT-009, SPT-010, SPT-012, and SPT-013 for North Anna 2 are granted pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(ii), for the third 10-year ISI interval. Relief Request SPT-011 for North Anna 2 was withdrawn by letter dated August 2, 2005.

The NRC staff is closing out TAC Nos. MC5588, MC5589, MC5590, MC5591, MC5592, MC5593, MC5594, MC5595, MC5599, and MC5600 with this letter.

Sincerely,

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Safety Evaluation

cc w/encl: See next page

The NRC staff is closing out TAC Nos. MC5588, MC5589, MC5590, MC5591, MC5592, MC5593, MC5594, MC5595, MC5599, and MC5600 with this letter.

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Evangelos C. Marinos, Chief
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS SPT-009 THROUGH SPT-013

NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated January 10, 2005, as supplemented by letter dated August 2, 2005, Virginia Electric and Power Company (VEPCO, the licensee) submitted Relief Requests SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna Power Station, Unit No. 1 (North Anna 1) and SPT-009, SPT-010, SPT-011, SPT-012, and SPT-013 for North Anna Power Station, Unit No. 2 (North Anna 2), for the third 10-year inservice inspection (ISI) program interval. In its letter dated August 2, 2005, the licensee withdrew Relief Request SPT-011 for North Anna 2. The Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has evaluated the information provided by the licensee. As a result, the NRC staff adopts the evaluations and recommendations for granting or authorizing relief contained in PNNL's Technical Letter Report (TLR), included as Attachment 2 of this safety evaluation (SE). Attachment 1 of this SE lists each relief request and the status of approval.

2.0 REGULATORY REQUIREMENTS

The ISI of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (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 Commission 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 Director of the Office of Nuclear Reactor Regulation, 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 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

Enclosure

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 North Anna 1 third 10-year ISI interval, which began on May 1, 1999, is the 1989 edition of the ASME Code, Section XI, with no addenda. The ASME Code of record for the North Anna 2 third 10-year ISI interval, which began on December 14, 2001, is the 1995 edition of ASME Code, Section XI, including the 1996 addenda.

3.0 TECHNICAL EVALUATION

In its application for the third 10-year ISI Program Plan, the licensee proposed Requests for Relief SPT-010, SPT-11, SPT-012, and SPT-013 for North Anna 1 and Requests for Relief SPT-009, SPT-010, SPT-011, SPT-12, and SPT-013 for North Anna 2. In response to an NRC request for additional information, the licensee withdrew SPT-011 for North Anna 2 in its letter dated August 2, 2005. The NRC staff adopts the evaluations and recommendations for authorizing relief contained in PNNL's TLR included as Attachment 2 of this SE. Attachment 1 of this SE lists each relief request and the status of approval.

In its submittal, the licensee requested relief on the various components and piping that are part of the extended Class 1 boundary and are required to be pressurized at or near the end of the ISI interval. For instance, SPT-010 for North Anna 1 and SPT-009 for North Anna 2 addressed the residual heat removal (RHR) and safety injection (SI) piping shown on Attachment 2, Tables 3.1 and 3.3, respectively. SPT-011 for North Anna 1 addressed Class 1 components and piping on the RHR suction line between 1-RH-MOV-1700 and 1-RH-MOV-1701. Similarly, SPT-010 for North Anna 2 addressed Class 1 components and piping on the RHR suction line between 2-RH-MOV-2700 and 2-RH-MOV-2701. SPT-012 for North Anna 1 and SPT-012 for North Anna 2 addressed the SI piping shown on Attachment 2, Tables 3.2 and 3.4, respectively. SPT-013 for North Anna 1 addressed the components and piping between 1-RC-R-1 (inner O-ring), 1-RC-32 and valve 1-RC-HCV-1544 in the reactor pressure vessel (RPV) flange leakage detection system. SPT-013 for North Anna 2 addressed components and piping between 2-RC-R-1 (inner O-ring), 2-RC-32 and valve 2-RC-HCV-1544 in the RPV flange leakage detection system.

The ASME Code, Section XI, Examination Category B-P, Item B15.50, requires that a system leakage test, as defined in Paragraph IWB-5220, be performed on Class 1 piping systems at or near the end of each ISI interval, following each reactor refueling outage prior to plant startup. Paragraph IWB-5220 requires the system leakage test to be conducted between 102 percent and 110 percent of the nominal operating pressure associated with 100-percent rated reactor power. The pressure retaining boundary, during Class 1 system leakage tests, shall correspond to the reactor coolant boundary, with all valves in the position required for normal reactor operation startup. Additionally, when the system leakage test is conducted at or near the end of each ISI interval, the pressure retaining boundary shall extend to all Class 1 components within each system boundary.

The licensee requested relief from performing the ASME Code-required system leakage tests at normal reactor coolant system (RCS) pressure of approximately 2,235 pounds-per-square-inch gauge on the RHR, SI, and RCS piping segments, described above. As an alternative, the licensee proposed to perform the system leakage tests at system pressures less than those specified by the ASME Code. To perform the ASME Code-required system leakage test at the pressure specified by the ASME Code, the licensee would either have to make plant design modifications to enable the use of high-pressure hoses as temporary jumpers around valves, or employ hydrostatic pumps connected directly to the piping segments. Either of these options would conflict with the operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. Furthermore, as described in Attachment 2, to require the licensee to make plant modifications in order to pressurize the subject piping segments to normal RCS pressure, would result in a considerable hardship.

Therefore, the NRC staff has determined that having the licensee perform the ASME Code-required system leakage tests at normal RCS pressure would be a significant hardship without a compensating increase in quality and safety. Furthermore, the NRC staff has determined that the licensee's proposed alternative to perform the system leakage tests at pressures less than those specified by ASME Code provides reasonable assurance of leak tightness and structural integrity of the piping segments.

4.0 CONCLUSION

The North Anna 1 Requests for Relief SPT-010, SPT-011, SPT-012, and SPT-013 and North Anna 2 Requests for Relief SPT-009, SPT-010, SPT-012, and SPT-013 have been reviewed by the NRC staff with the assistance of its contractor, PNNL. The TLR provides PNNL's evaluation of these requests for relief in Attachment 2 of this SE. The NRC staff has reviewed the contractor's TLR and adopts the evaluations and recommendations for authorizing the North Anna 1 Requests for Relief SPT-010, SPT-011, SPT-012, and SPT-013 and North Anna 2 Requests for Relief SPT-009, SPT-010, SPT-012, and SPT-013 for the third 10-year ISI interval.

For the North Anna 1 Requests for Relief SPT-010, SPT-011, SPT-012, and SPT-013 and North Anna 2 Requests for Relief SPT-009, SPT-010, SPT-012, and SPT-013, the NRC staff concludes that the ASME Code-required examinations would cause significant hardship without a compensating increase in the level of quality and safety and the licensee's proposed alternative provides reasonable assurance of leak tightness and structural integrity of the piping segments. Therefore, the licensee's proposed alternatives are authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the third 10-year ISI program interval.

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.

Attachments: 1. Summary of Relief Requests
2. TLR, Pacific Northwest National Laboratory

Principal Contributor: T. McLellan

Date: February 9, 2006

North Anna Power Station, Units 1 and 2
Third 10-Year ISI Interval

TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	PNNL TLR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
SPT-010 (North Anna 1)	3.1	Residual Heat Removal & Safety Injection Piping	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure for 100% rated reactor power	Visual VT-2	Perform leakage tests in specific piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-011 (North Anna 1)	3.2	Residual Heat Removal Piping	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure for 100% rated reactor power	Visual VT-2	Perform leakage tests between valves 1-RH-MOV-1700 and -1701 along with other Class 2 portions of this piping at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-012 (North Anna 1)	3.3	Safety Injection Piping	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure for 100% rated reactor power	Visual VT-2	Perform leakage tests in specific piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-013 (North Anna 1)	3.4	Reactor Pressure Vessel Flange Seal	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure for 100% rated reactor power	Visual VT-2	Perform leakage tests in specific flange areas and piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-009 (North Anna 2)	3.5	Residual Heat Removal & Safety Injection Piping	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure during normal operation	Visual VT-2	Perform leakage tests in specific piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-010 (North Anna 2)	3.6	Residual Heat Removal Piping	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure during normal operation	Visual VT-2	Perform leakage tests between valves 2-RH-MOV-2700 and -2701 along with other Class 2 portions of this piping at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-011 (North Anna 2)	3.7	All Pressure Retaining Components	B-P	B15.50 B15.70	100% of pressure-retaining boundary is required to be tested following each refueling outage	Visual VT-2	Conduct pressure testing and VT-2 examinations at beginning of refueling outages	Withdrawn by licensee in letter dated August 2, 2005
SPT-012 (North Anna 2)	3.8	Safety Injection	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure during normal operation	Visual VT-2	Perform leakage tests in specific piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)
SPT-013 (North Anna 2)	3.9	Reactor Pressure Vessel Flange Seal	B-P	B15.50	100% of Class 1 pressure-retaining boundary is required to be pressure tested at nominal RCS pressure during normal operation	Visual VT-2	Perform leakage tests in specific piping segments at lower than RCS pressure	Authorized 10 CFR 50.55a(a)(3)(ii)

ATTACHMENT 1

TECHNICAL LETTER REPORT

ON THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

REQUESTS FOR RELIEF

VIRGINIA POWER AND ELECTRIC COMPANY (DOMINION)

NORTH ANNA POWER STATION, UNITS 1 AND 2

DOCKET NUMBERS 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated January 10, 2005, the licensee, Virginia Power and Electric Company (Dominion), submitted several requests for relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*. The requests are for the third 10-year inservice inspection (ISI) interval at North Anna Power Station, Units 1 and 2 (North Anna 1-2). In response to a U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI), the licensee submitted further information by letter dated August 2, 2005. Pacific Northwest National Laboratory (PNNL) has evaluated the requests for relief and supporting information submitted by the licensee in Section 3.0 below.

2.0 REGULATORY REQUIREMENTS

Inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (B&PV Code), and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 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 (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, which was 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 ASME Code of record for the North Anna Power Station, Unit 1 third 10-year interval ISI, which began on May 1, 1999, is the 1989 Edition of Section XI, with no addenda. The ASME Code of record for the North Anna, Unit 2 third 10-year inspection interval which began on December 14, 2001, is the 1995 Edition of Section XI including the 1996 Addenda.

3.0 TECHNICAL EVALUATION

The information provided by Dominion in support of the requests for relief from ASME Code requirements has been evaluated and the bases for disposition are documented below.

3.1 Request for Relief SPT-010, North Anna Unit 1 (TAC MC5589), Examination Category B-P, Pressure Retaining Components in the Residual Heat Removal (RHR) and Safety Injection (SI) Systems

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system hydrostatic test be performed on Class 1 components at or near the end of each inservice inspection interval. The pressure retaining boundary during the test shall include all Class 1 components within the system boundary. The test pressure, as required by Paragraph IWB-5222(a), is required to be between 102% and 110% of the nominal operating pressure associated with 100% rated reactor power and corresponding to the system temperature during the test, as specified in Table IWB-5222-1.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for portions of piping in the safety injection (SI) and residual heat removal (RHR) systems that connect to the reactor coolant system (see Table 3.1 below for descriptions of the piping segments included in this alternative). The licensee's alternative is to perform the hydrostatic tests at pressures less than those specified by ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Table 3.1 - Piping Segments in Request for Relief SPT-10, North Anna 1

Segment Description	NPS Diameter (inches)	Segment Length (feet)
1-SI-125, 1-SI-127 and 1-SI-126	From 1-SI-125 to 1-SI-127 is 12 inch From 1-SI-126 to 1-SI-HCV-1850B is 3/4 inch	84 1
1-SI-142, 1-SI-144, 1-SI-143 and 1-RH-MOV-1720A	From 1-SI-142 to 1-SI-144 is 12 inch Connection to 1-RH-MOV-1720A is 10 inch 1-SI-143 is 3/4 inch	84 8 1
1-SI-161, 1-SI-159, 1-SI-160 and 1-RH-MOV-1720B	From 1-SI-161 to 1-SI-159 is 12 inch Connection to 1-RH-MOV-1720B is 10 inch 1-SI-160 is 3/4 inch	83 24 1

Licensee Basis for Alternative (as stated):

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by a single check valve, and as such does not normally see this pressure. The area in question is pressurized during normal operation to approximately 660 psig from the passive safety injection accumulators. The accumulator pressure is monitored from the control room throughout the operating cycle. An external pressurization source would be necessary to meet either the ASME Code hydrostatic test requirement or the alternative code case requirement of normal reactor coolant pressure. Since the check valve would be part of the test boundary, a pressure differential would be required between the reactor coolant system and the area in question to maintain check valve closure. Maintaining the differential pressure and ensuring no test fluid intrusion into the reactor coolant system (reactivity control issue) is considered unusually difficult to meet with no compensating increase in quality or level of safety when considering the alternative below.

Licensee's Proposed Alternative Examination (as stated):

The areas in question are examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. These areas will be examined at that time at the safety injection accumulator nominal operating pressure. Additionally, the area in question is subject to safety injection accumulator pressure during normal operation. Through-wall leakage for the area in question would be identified by the control room through their monitoring of the pressure on the safety injection accumulators.

Evaluation: The ASME Code requires that a system hydrostatic test be performed once each interval to include all Class 1 components within the reactor coolant system (RCS) boundary. The hydrostatic test must be performed at or near the end of the inservice inspection interval, and the test pressure is required to be at the nominal operating RCS system pressure associated with 100% rated reactor power, depending on the system temperature during the test. However, several piping line segments are connected to the RCS through self-actuating check valves, or inter-locked motor controlled valves, which does not allow normal RCS pressure to be used to pressurize these segments.
In order to test the subject piping segments to normal operating RCS pressure (approximately 2235 psig), the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around valves or employ hydrostatic pumps connected directly to the piping segments. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, pressurizing these segments to normal RCS pressures may result in test fluid intrusion into the RCS system boundary, which could become a reactivity control issue. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure, would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the "return to power" sequence at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject safety injection system and residual heat removal piping segments are isolated from the RCS. These segments are described in

Table 3.1, and primarily consist of limited runs of piping between the first and second isolation valves in the SI connections on each of the four primary coolant loops. In addition, a section of RHR piping between the first and second isolation valves is also included. The piping segments are fabricated of austenitic stainless steel and range in diameter from 3/4 inch to 12 inch NPS. These segments, including the first and second isolation valves, are considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

For SI piping segments connecting to the RCS, the self-actuating isolation check valves are designed to prevent back-flow of primary coolant into the respective high and low pressure SIS piping, while providing a passive flow-path for injecting coolant during normal start-ups and shutdowns, as well as during postulated emergency events. Therefore, the design and function of these valves do not allow piping upstream of the first isolation check valve in each line segment to experience normal RCS pressures. North Anna Unit 1 does not have a flow path from the high pressure safety injection pumps through the safety accumulators. In order to subject the identified piping segments to RCS pressure, the first isolation valve would have to be by-passed. This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Another option would be for the licensee to use a stand-alone hydrostatic pump connected to the subject piping between the first and second isolation valves to obtain a pressure equivalent to that during normal RCS operation. Again, this may require modifications to the piping pressure boundary, and could potentially inject water into the primary system if pump pressure slightly exceeds normal RCS pressure. Either of these methods would result in a significant hardship for the licensee. The controls necessary to complete the test safely would be very difficult to maintain, and at test pressures that approach that of the RCS at nominal operating pressure, such a test setup could potentially defeat the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, test personnel would be required to wear self-contained breathing apparatus (SCBA), since the containment would be sub-atmospheric adding to the difficulty to perform the required inspection.

Similar problems exist for the RHR piping segments connected to the RCS upstream of the first SI check valve. The RHR system has a maximum design pressure of approximately 600 psig, therefore, it is only operated during normal shutdown and start-up sequences, and is not designed to experience normal RCS operating pressure. The first motor operated valve is closed and locked prior to the RCS pressure exceeding 415 psig, thus the RHR piping segments between the first SI check valve and the locked RHR motor operated valve cannot be pressurized during a normal RCS pressure test sequence.

As an alternative to pressurizing the subject line segments in accordance with the ASME Code requirements noted above, the licensee has proposed that the SI piping segments subject to this relief request be pressurized to approximately 640 psig (normal accumulator operating pressure).

The licensee's proposal represents the highest test pressures that can be obtained without significant plant modifications and are intended to test the subject piping segments to conditions similar to those that may be experienced during postulated design basis events.

It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist, as well as verify that connections in these piping segments that may have been opened during the outage have been properly secured. The licensee has also committed to meeting the hold times for insulated (4 hours) and non-insulated (10 minutes) components, as shown in paragraph IWA-5213, prior to performing the required VT-2 visual examinations.

It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

3.2 Request for Relief SPT-011, North Anna Unit 1 (TAC MC5591), Examination Category B-P, Pressure Retaining Components in the Residual Heat Removal (RHR) System

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system hydrostatic test be performed on Class 1 components at or near the end of each inservice inspection interval. The pressure retaining boundary during the test shall include all Class 1 components within the system boundary. The test pressure, as required by Paragraph IWB-5222(a), is required to be between 102% and 110% of the nominal operating pressure associated with 100% rated reactor power and corresponding to the system temperature during the test, as specified in Table IWB-5222-1.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for the Class 1 components and piping between valves 1-RH-MOV-1700 and 1-RH-MOV-1701 on the residual heat removal (RHR) system suction line. The licensee's alternative is to perform the hydrostatic tests at pressures less than those specified by ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Licensee Basis for Alternative (as stated):

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by a single closed valve, and as such does not normally see this pressure. Opening valve 1-RH-MOV-1700 is prevented by a pressure interlock, which prevents opening, when pressure in the reactor coolant system is above 418 psig. The interlock protects the low pressure RHR system from being over-pressurized by the higher pressure reactor coolant system. There is no other valve that would allow pressurization of the area from an external source. The system design prevents Code compliance (Code or Code Case) in this area and it is, therefore, considered a hardship, since a plant modification would be needed, to meet code requirements.

Licensee's Proposed Alternative Examination (as stated):

The area in question is examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. Additionally, it is proposed that the area be examined as part of the Class 2 system inservice test pressure boundary using the Class 2 test requirements associated with the adjoining Class 2 piping. This would result in an additional pressure test each period at the Class 2 RHR system nominal operating pressure with the associated visual VT-2 examination.

Evaluation: The ASME Code requires that a system leakage test be performed at the end of each refueling outage, and when performed at or near the end of the interval, the test must include all Class 1 components within the RCS boundary. The system leakage test must be performed at a test pressure not less than the nominal operating RCS pressure corresponding with 100% rated reactor power. However, an RHR suction piping segment located between two inter-locked motor controlled valves does not allow normal RCS pressure to be used to pressurize this segment. In order to test the subject piping segment to normal operating RCS pressure (approximately 2235 psig), the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around these valves or employ hydrostatic pumps connected directly to the piping segment. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the “return to sequence” at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject RHR piping segment is isolated from the RCS by two, inter-locked motor operated control valves. The subject components are fabricated of austenitic stainless steel and consist of a thirty foot long segment of 14-inch NPS diameter piping, and motor operated valves 1-RH-MOV-1700 and 1-RH-MOV-1701. This segment, including the motor operated control valves, is considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

The RHR system has a maximum design pressure of 600 psig, and is normally only operated during shutdown and start-up sequences. The motor operated valves are required by technical specifications to be closed and locked prior to the RCS pressure exceeding 415 psig, therefore, the RHR piping segment cannot be pressurized during a normal RCS pressure test sequence. In order to subject the identified piping segment to RCS pressure, the first motor operated valve would have to be by-passed. This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Another option would be for the licensee to use a stand-alone hydrostatic pump connected to the subject piping between the first and second isolation valves to obtain a pressure equivalent to that during normal RCS operation. Again, this would require modifications to the existing pressure boundary. Either of these methods would result in a significant hardship for the licensee.

The licensee has proposed to perform the pressure tests and accompanying visual VT-2 examinations of the subject piping segment, along with the remaining Class 2 (downstream of valve 1-RH-MOV-1701) portions of the system, during the RHR system walk-downs at the beginning of each refueling outage. The test pressure will be approximately 300-350 psig, which is the maximum normal operating pressure of the RHR system. In addition, this piping segment will continue to receive a visual VT-2 examination in conjunction with the Class 1 portions of the RCS, although not at RCS pressure.

The licensee's proposal represents the highest test pressure that can be obtained without significant plant modifications and is intended to test the subject piping segment to conditions similar to those that may be experienced during postulated design basis events. It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist. It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements, would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

3.3 Request for Relief SPT-012, North Anna Unit 1 (TAC MC5593), Examination Category B-P, Pressure Retaining Components in the Safety Injection System

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system hydrostatic test be performed on Class 1 components at or near the end of each inservice inspection interval. The pressure retaining boundary during the test shall include all Class 1 components within the system boundary. The test pressure, as required by Paragraph IWB-5222(a), is required to be between 102% and 110% of the nominal operating pressure associated with 100% rated reactor power and corresponding to the system temperature during the test, as specified in Table IWB-5222-1.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for components and piping in the following pipe segments. The licensee's alternative is to perform the hydrostatic tests at pressures less than those specified by the ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Table 3.2 - Piping Segments in Request for Relief SPT-012, North Anna Unit 1

Segment Description	NPS Diameter (inches)	Segment Length (feet)
1-SI-195, 1-SI-197, 1-SI-199, 1-SI-MOV-1890C and 1-SI-MOV-1890D	From 1-SI-195 to 1-SI-197 to 1-SI-199 is 6 inch; from reducer to RCS is 6 inch	16
	Each segment includes ½ and 3/4 inch test/drain lines	1 ea
	Between 1-SI-MOV-1890C and 1-SI-MOV-1890D to reducer is 10 inch	15

Table 3.2 - Piping Segments in Request for Relief SPT-012, North Anna Unit 1		
Segment Description	**NPS Diameter (inches)**	**Segment Length (feet)**
1-SI-211, 1-SI-209, 1-SI- 213, 1-SI-MOV-1890A and 1-SI-MOV-1890B	From 1-SI-211 to 1-SI-209 to 1-SI- 213 is 6 inch; from reducer to RCS is 6 inch	494
	Each segment includes a 3/4 inch test/drain line	2
	Between 1-SI-MOV-1890A and 1-SI-MOV-1890B to reducer is 10 inch	35

Licensee Basis for Alternative (as stated):

North Anna Unit 1 is in the third ISI interval utilizing the requirements of ASME Section XI, 1989 Edition. Additionally, the unit makes use of Code Case –498-1, "Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems." The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by check valves, and as such does not normally see this pressure. The Class 1 boundary for Section XI matches the construction code (B31.7 1969 with the 1970 Addenda) Class 1 (Q1) classification. This earlier classification followed closely the definition of reactor coolant system pressure boundary for the Class 1 boundary. This meant for systems connected to the reactor coolant system, the boundary extended to the outermost containment isolation valve in system piping which penetrates primary reactor containment. As such, more than two valves separate the reactor coolant system from certain parts of the extended Class 1 boundary. External pressurization would be necessary to meet either the ASME Code hydrostatic test requirement or the alternative code case requirement of normal reactor coolant pressure. Since check valves would be part of the test boundary, a pressure differential would be required between the reactor coolant system and the area in question to maintain check valve closure. Maintaining the differential pressure and ensuring no test fluid intrusion into the reactor coolant system (reactivity control issue) is considered unusually difficult to meet with no compensating increase in quality or level of safety when considering the alternative below.

Licensee's Proposed Alternative Examination (as stated):

The areas in question are examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. Additionally, it is proposed that the areas identified above be examined (VT-2) based upon a Class 2 system functional test at or near the end of the interval. The test would be performed at reduced pressure based upon low head safety injection pump pressure and flow to an non-pressurized reactor coolant system. The pressure, although reduced, would simulate actual system pressure in an accident situation. Additionally, it only involves Class 1 piping beyond the second isolation valve from the reactor coolant system to the first isolation valve outside containment. This piping based upon 10 CFR 50.55a(c)(2)(ii) would now allow a Class 2 classification, if constructed today.

Evaluation: The ASME Code requires that a system hydrostatic test be performed once each interval to include all Class 1 components within the RCS boundary. The hydrostatic test must be performed at or near the end of the ISI interval, and the test pressure is required to be at the nominal operating RCS system pressure associated with 100% rated reactor power, depending on the system temperature during the test. However, several SI system piping segments are connected to the RCS through self-actuating check valves, which do not allow normal RCS pressure to be used to pressurize these segments. In order to test the subject piping segments to normal operating RCS pressure (approximately 2235 psig), the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around valves or employ hydrostatic pumps connected directly to the piping segments as explained below. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, pressurizing these segments to normal RCS pressures may result in test fluid intrusion into the RCS system boundary, which could become a reactivity control issue. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the “return to power” sequence at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject SI piping segments are isolated from the RCS by self-actuating check valves. The piping segments referenced in this relief request consist of limited runs of piping between the first and second isolation valves in the SI connections on the primary coolant loops. The piping segments are fabricated of austenitic stainless steel and range in diameter from ½ inch to 10 inch NPS. These segments, including the first and second isolation valves, are considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

For SI piping segments connected to RCS, the self-actuating isolation check valves are designed to prevent back-flow of primary coolant into the respective high and low pressure SI piping, while providing a passive flow-path for injecting coolant during normal start-ups and shutdowns, as well as during postulated emergency events. Therefore, the design and function of these valves do not allow piping upstream of the first isolation check valve in each line segment to experience normal RCS pressures.

North Anna has separate high pressure and low pressure SI pumps. The piping segments identified in the relief are connected to the low pressure safety injection pumps discharge flow path. The normal operating pressure for these pumps is approximately 120 psig with temperature corresponding initially in accident conditions to the refueling water storage tank (RWST) temperature of approximately 40° F. The temperature would rise after the pumps are switched to take suction from the containment sump during the accident. The high pressure safety injection pumps do not flow through the piping segments and cannot pressurize these segments due to check valve placement. In order to subject the identified piping segments to RCS pressure, the first isolation valve would have to be by-passed and an external pressure source used to pressurize the piping segments. This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Requiring the licensee to comply with ASME Code testing requirements, would result in a significant hardship for the licensee and would require the use of temporary check valves as boundary valves. The controls necessary to complete the test safely would be very difficult to maintain, and at test pressures that approach that of the RCS pressure at nominal operating pressure, such a test setup could potentially defeat the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, test personnel would be required to wear SCBA, since the containment would be sub-atmospheric, adding to the difficulty to perform the required inspection.

The licensee's alternative is to conduct a system functional pressure test of the subject piping segments at approximately 120 psig and nominal operating temperature (refueling water storage tank temperature). These test conditions represent the actual accident pressure and temperature for the subject piping segments. The test pressure corresponds to the adjacent Class 2 SI piping pressure test requirements and would identify through-wall leakage. Additionally, the piping would be visually examined (VT-2) each refueling outage as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage.

The licensee's proposal represents the highest test pressures that can be obtained without significant plant modifications and are intended to test the subject piping segments to conditions similar to those that may be experienced during postulated design basis events. It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist, as well as verify that connections in these piping segments that may have been opened during the outage have been properly secured. The licensee has also committed to meeting the hold times for insulated (4 hours) and non-insulated (10 minutes) components, as shown in paragraph IWA-5213, prior to performing the required VT-2 visual examinations.

It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

3.4 Request for Relief SPT-013, North Anna Unit 1 (TAC MC5595), Examination Category B-P, Pressure Retaining Components in the Reactor Coolant System

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system hydrostatic test be performed on Class 1 components at or near the end of each ISI interval. The pressure retaining boundary during the test shall include all Class 1 components within the system boundary. The test pressure, as required by Paragraph IWB-5222(a), is required to be between 102% and 110% of the nominal operating pressure associated with 100% rated reactor power and corresponding to the system temperature during the test, as specified in Table IWB-5222-1.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for components and piping between 1-RC-R-1 (inner O-ring), 1-RC-32 and valve 1-RC-HCV-1544 in the reactor pressure vessel (RPV) flange leakage detection system.

Licensee Basis for Alternative (as stated):

North Anna Unit 1 is in the third ISI interval utilizing the requirements of ASME Section XI, 1989 Edition. Additionally, the unit makes use of Code Case –498-1, "Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems." The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The components and piping being addressed are associated with the reactor head and flange leakage detection system. They are used to support identification of inner O-ring leakage. An increase in temperature above ambient is an indication of inner O-ring seal leakage. High temperature actuates an alarm. On indication of inner O-ring leakage the isolation valve in the leak-off line can be closed to put the outer O-ring into the pressure retention mode, and the inner O-ring leak detection system would be pressurized to reactor coolant pressure up to the closed isolation valve.

These lines can only be tested externally, since during normal operation they are separated from RCS pressure by the inner O-ring. Pressurizing the lines externally would put pressure on the inner O-ring in a direction opposite that it was designed for. This could move the inner O-ring from its normal position against the outer channel wall of the reactor vessel flange potentially affecting the O-ring leak tightness and requiring that maintenance be performed. This is considered an unnecessary hardship without a compensating increase in quality or safety when considering the system design and the monitoring capability of the system.

Licensee's Proposed Alternative Examination (as stated):

The area in question is examined (VT-2) each refueling as part of the normal Class 1 system leakage test for evidence of leakage. Additionally, leakage past the inner O-ring must occur to potentially pressurize the components and piping being addressed. This leakage would be identified by an alarm or by RCS inventory balance calculations and addressed by procedures. The leakage would also be limited by the passive inner O-ring. Any leakage is normally directed to the primary drain transfer tank unless the system is isolated by operator action. These activities would be closely monitored by the procedurally controlled operator actions allowing identification of any further compensatory actions required.

Evaluation: The ASME Code requires that a system hydrostatic test be performed once each interval to include all Class 1 components within the RCS boundary. The hydrostatic test must be performed at or near the end of the inservice inspection interval, and the test pressure is required to be at the nominal operating RCS system pressure associated with 100% rated reactor power, depending on the system temperature during the test. However, subjecting certain components in the RPV closure head flange seal system to the pressure required by ASME Code could potentially compromise the structural integrity of these components, and present a significant hardship for the licensee.
Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The components and piping being addressed are associated with the RPV closure head flange leakage detection system. The RPV closure head flange is designed with two concentric

O-rings that act as flange seals to enable the vessel to be pressurized during normal operation. The inner O-ring acts as the primary pressure seal for the RPV. The area between the O-rings, the secondary outer O-ring, and subject piping segments downstream are designed to support identification of leakage should the primary inner O-ring seal leak. These components/areas are empty of primary system water during normal reactor operation, not intended to experience full RCS pressure, and could only be tested using an external pressure source. Pressurizing the lines externally would put pressure on the inner O-ring in a direction that is opposite its design and could potentially cause damage to the primary O-ring, which might compromise the RCS pressure boundary. In addition, test personnel would have to wear SCBA, since the containment would be sub-atmospheric adding to the difficulty to perform the required inspection.

The subject areas/components are visually (VT-2) examined for evidence of leakage during each refueling outage as part of the normal Class 1 system leakage test. The visual examinations performed should detect any evidence of significant leakage, should it exist. Additionally, during normal operation any leakage past the inner O-ring would be identified by an alarm in the RCS monitoring system and by inventory balance calculations. Considering the system design and monitoring function, requiring the licensee to meet ASME Code pressure requirements would result in unnecessary hardship with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee’s proposed alternative be authorized.

3.5 <u>Request for Relief SPT-009, North Anna Unit 2 (TAC MC5599), Examination Category B-P, Pressure Retaining Components in the Residual Heat Removal (RHR) and Safety Injection (SI) Systems</u>

<u>ASME Code Requirement:</u> Examination Category B-P, Item B15.50, requires that a system leakage test be performed on Class 1 components in accordance with the requirements of paragraph IWB-5220. IWB-5221(a) states that the system leakage test shall be conducted at a pressure not less than nominal operating pressure associated with normal system operation. IWB-5221(b) states that the pressure retaining boundary during the system leakage test conducted at or near the end of the inspection interval shall extend to all Class 1 pressure retaining components within the system boundary.

<u>Licensee’s Alternative to ASME Code:</u> In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for portions of piping in the SI and residual heat removal systems that connect to the RCS (see Table 3.2 below for descriptions of the piping segments included in this alternative). The licensee’s alternative is to perform the leakage tests at pressures less than those specified by ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Table 3.3 - Piping Segments in Request for Relief SPT-009		
Segment Description	**NPS Diameter (inches)**	**Segment Length (feet)**
2-SI-153, 2-SI-151 and 2-SI-152	From 2-SI-153 to 2-SI-15-1 is 12 inch 2-SI-152 is 3/4 inch	84 feet 1 foot
2-SI-170, 2-SI-168 and 2-SI-169 and 2-RH-MOV-2720A	From 2-SI-170 to 2-SI-168 - 12 inch 2-SI-169 is 3/4 inch From RCS Loop to 2-HR-MOV-2720A is 10 inch	84 feet 1 foot 12 feet
2-SI-187, 2-SI-185 and 2-SI-186 and 2-RH-MOV-2720B	From 2-SI-187 to 2-SI-185 is 12 inch 2-SI-186 is 3/4 inch From RCS Loop to 2-HR-MOV-2720B is 10 inch	84 feet 1 foot 22 feet

<u>Licensee Basis for Alternative (as stated):</u>

North Anna Unit 2 is in the third ISI interval utilizing the requirements of ASME Section XI, 1995 Edition with the 1996 Addenda. The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by a single check valve, and as such does not normally see this pressure. The area in question is pressurized during normal operation to approximately 660 psig from the passive safety injection accumulators. The accumulator pressure is monitored from the control room throughout the operating cycle. An external pressurization source would be necessary to meet the test requirement of normal reactor coolant pressure. Since the check valve would be part of the test boundary, a pressure differential would be required between the reactor coolant system and the area in question to maintain check valve closure. Maintaining the differential pressure and ensuring no test fluid intrusion into the reactor coolant system (reactivity control issue) is considered unusually difficult to meet with no compensating increase in quality or level of safety when considering the alternative below.

<u>Licensee's Proposed Alternative Examination (as stated):</u>

The areas in question are examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. These areas will be examined at that time at the safety injection accumulator nominal operating pressure. Additionally, the area in question is subject to safety injection accumulator pressure during normal operation. Through-wall leakage for the area in question would be identified by the control room through their monitoring of the pressure on the safety injection accumulators.

Evaluation: The ASME Code requires that a system leakage test be performed each refueling outage to include all Class 1 components within the RCS boundary. If performed at or near the end of the interval, the test shall extend to all components within the Class 1 pressure boundary. The leakage test must be performed at a test pressure not less than nominal operating pressure during normal system operation. Normal operating pressure for the RCS at North Anna, Unit 2, is approximately 2235 psig. However, several piping line segments are connected to the RCS through self-actuating check valves, or inter-locked motor controlled valves, which does not allow normal RCS pressure to be used to pressurize these segments. In order to test the subject piping segments to normal operating RCS pressure, the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around valves or employ hydrostatic pumps connected directly to the piping segments. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, pressurizing these segments to normal RCS pressures may result in test fluid intrusion into the RCS system boundary, which could become a reactivity control issue. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the “return to power” sequence at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject SI system and residual heat removal piping segments are isolated from the RCS. These segments are described in Table 3.1, and primarily consist of limited runs of piping between the first and second isolation valves in the SI connections on each of the four primary coolant loops. In addition, a section of RHR piping between the first and second isolation valves is also included. The piping segments are fabricated of austenitic stainless steel and range in diameter from 3/4 inch to 12 inch NPS. These segments, including the first and second isolation valves, are considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

For SI piping segments connecting to the RCS, the self-actuating isolation check valves are designed to prevent back-flow of primary coolant into the respective high and low pressure SI piping, while providing a passive flow-path for injecting coolant during normal start-ups and shutdowns, as well as during postulated emergency events. Therefore, the design and function of these valves do not allow piping upstream of the first isolation check valve in each line segment to experience normal RCS pressures. North Anna Unit 1 does not have a flow path from the high pressure safety injection pumps through the safety accumulators. In order to subject the identified piping segments to RCS pressure, the first isolation valve would have to be by-passed.

This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Another option would be for the licensee to use a stand-alone hydrostatic pump connected to the subject piping between the first and second isolation valves to obtain a pressure equivalent to that during normal RCS operation. Again, this may require modifications to the piping pressure boundary, and could potentially inject water into the primary system if pump pressure slightly exceeds normal RCS pressure. Either of these methods would result in a significant hardship for the licensee. The controls necessary to complete the test safely would be very difficult to maintain, and at test pressures that approach that of the RCS at nominal operating pressure, such a test setup could potentially defeat the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, test personnel would be required to wear SCBA, since the containment would be sub-atmospheric adding to the difficulty to perform the required inspection.

Similar problems exist for the RHR piping segments connected to the RCS upstream of the first SI check valve. The RHR system has a maximum design pressure of approximately 600 psig, therefore, it is only operated during normal shutdown and start-up sequences, and is not designed to experience normal RCS operating pressure. The first motor operated valve is closed and locked prior to the RCS pressure exceeding 415 psig, thus the RHR piping segments between the first SI check valve and the locked RHR motor operated valve cannot be pressurized during a normal RCS pressure test sequence.

As an alternative to pressurizing the subject line segments in accordance with ASME Code requirements, the licensee has proposed that the SI piping segments subject to this relief request be pressurized to approximately 640 psig (normal accumulator operating pressure).

The licensee's proposal represents the highest test pressures that can be obtained without significant plant modifications and are intended to test the subject piping segments to conditions similar to those that may be experienced during postulated design basis events. It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist, as well as verify that connections in these piping segments that may have been opened during the outage have been properly secured. The licensee has also committed to meeting the hold times for insulated (4 hours) and non-insulated (10 minutes) components, as shown in paragraph IWA-5213, prior to performing the required VT-2 visual examinations.

It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

3.6 <u>Request for Relief SPT-010, North Anna Unit 2 (TAC MC5588), Examination Category B-P, Pressure Retaining Components in the Residual Heat Removal (RHR) System</u>

<u>ASME Code Requirement:</u> Examination Category B-P, Item B15.50, requires that a system leakage test be performed on Class 1 components in accordance with the requirements of paragraph IWB-5220. IWB-5221(a) states that the system leakage test shall be conducted at a pressure not less than nominal operating pressure associated with normal system operation. IWB-5221(b) states that the pressure retaining boundary during the system leakage test conducted at or near the end of the inspection interval shall extend to all Class 1 pressure retaining components within the system boundary.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for the Class 1 components and piping between valves 2-RH-MOV-2700 and 2-RH-MOV-2701 on the residual heat removal (RHR) suction line. The licensee's alternative is to perform the hydrostatic tests at pressures less than those specified by ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Licensee Basis for Alternative (as stated):

North Anna Unit 2 is in the third ISI interval utilizing the requirements of ASME Section XI, 1995 Edition with the 1996 Addenda. The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by a single closed valve, and as such does not normally see this pressure. Opening valve 2-RH-MOV-2700 is prevented by a pressure interlock, which prevents opening, when pressure in the reactor coolant system is above 418 psig. The interlock protects the low pressure RHR system from being over-pressurized by the higher pressure reactor coolant system. There is no other valve that would allow pressurization of the area from an external source. The system design prevents Code compliance in this area and it is therefore considered a hardship, since a plant modification would be needed, to meet code requirements.

Licensee's Proposed Alternative Examination (as stated):

The area in question is examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. Additionally, it is proposed that the area be examined as part of the Class 2 system leakage test pressure boundary using the Class 2 test requirements associated with the adjoining Class 2 piping. This would result in an additional pressure test each period at the Class 2 RHR system nominal operating pressure with the associated visual VT-2 examination.

Evaluation: The ASME Code requires that a system leakage test be performed at the end of each refueling outage, and when performed at or near the end of the interval, the test must include all Class 1 components within the RCS boundary. The system leakage test must be performed at a test pressure not less than nominal RCS pressure during normal operation (approximately 2235 psig). However, an RHR suction piping segment located between two inter-locked motor controlled valves does not allow normal RCS pressure to be used to pressurize this segment. In order to test the subject piping segment to normal operating RCS pressure, the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around these valves or employ hydrostatic pumps connected directly to the piping segment. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the “return to power” sequence at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject RHR piping segment is isolated from the RCS by two, inter-locked motor operated control valves. The subject components are fabricated of austenitic stainless steel and consist of a thirty-one foot long segment of 14-inch NPS diameter piping and motor operated valves 1-RH-MOV-2700 and 1-RH-MOV-2701. This segment, including the motor operated control valves, is considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

The RHR system has a maximum design pressure of 600 psig, and is normally only operated during shutdown and start-up sequences. The motor operated valves are required by technical specifications to be closed and locked prior to the RCS pressure exceeding 415 psig, therefore, the RHR piping segment cannot be pressurized during a normal RCS pressure test sequence. In order to subject the identified piping segment to RCS pressure, the first motor operated valve would have to be by-passed. This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Another option would be for the licensee to use a stand-alone hydrostatic pump connected to the subject piping between the first and second isolation valves to obtain a pressure equivalent to that during normal RCS operation. Again, this would require modifications to the existing pressure boundary. Either of these methods would result in a significant hardship for the licensee.

The licensee has proposed to perform the pressure tests and accompanying visual VT-2 examinations of the subject piping segment along with the remaining Class 2 (downstream of valve 1-RH-MOV-2701) portions of the system during the RHR system walk-downs at the beginning of each refueling outage. The test pressure will be approximately 300-350 psig, which is the maximum normal operating pressure of the RHR system. In addition, this piping segment will continue to receive a visual VT-2 examination in conjunction with the Class 1 portions of the RCS, although not at RCS pressure.

The licensee’s proposal represents the highest test pressure that can be obtained without significant plant modifications and is intended to test the subject piping segment to conditions similar to those that may be experienced during postulated design basis events. It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist. It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements, would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee’s proposed alternative be authorized.

3.7 Request for Relief SPT-011, North Anna Unit 2 (MC5590), All Class 1 Systems in Category B-P, Pressure Retaining Components

Note: As a result of an NRC RAI, the licensee elected to withdraw this request for relief in a letter dated August 2, 2005.

3.8 Request for Relief SPT-012, North Anna Unit 2 (MC5592), Category B-P, Pressure Retaining Components in the Safety Injection System

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system leakage test be performed on Class 1 components in accordance with the requirements of paragraph IWB-5220. IWB-5221(a) states that the system leakage test shall be conducted at a pressure not less than nominal operating pressure associated with normal system operation. IWB-5221(b) states that the pressure retaining boundary during the system leakage test conducted at or near the end of the inspection interval shall extend to all Class 1 pressure retaining components within the system boundary.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for components and piping in the piping segments shown in Table 3.4. The licensee's alternative is to perform the leakage tests at pressures less than those specified by ASME Code, based on the hardship that would be incurred if the ASME Code-required pressures are imposed.

Table 3.4 - Piping Segments in Request for Relief SPT-012, North Anna Unit 2

Segment Description	NPS Diameter (inches)	Segment Length (feet)
2-SI-91, 2-SI-99, 2-SI-105 2-SI-MOV-2890C and 2-SI-MOV-2890D	From 2-SI-91 to 2-SI-99 to 2-SI-105 is 6 inch; from Reducer to RCS is 6 inch	52
	Each piping segment has 3/4 inch and ½ inch test/drain lines	1 ea
	From 2-SI-MOV-2890C and 2-SI-MOV-2890D to reducer is 10 inch	18
2-SI-112, 2-SI-117, 2-SI-124 2-SI-MOV-2890A and 1-SI-MOV-2890B	From 2-SI-112 to 2-SI-117 to 2-SI- 124 is 6; from Reducer to RCS is 6 inch	614
	Each piping segments has 3/4 inch test/drain lines	2
	From 2-SI-MOV-2890A and 1-SI-MOV-2890B to reducer is 10 inch	14

Licensee Basis for Alternative (as stated):

North Anna Unit 2 is in the third ISI interval utilizing the requirements of ASME Section XI, 1995 Edition with the 1996 Addenda. The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The piping in question is separated from this reactor coolant pressure by check valves, and as such does not normally see this pressure. The Class 1 boundary for Section XI matches the construction code (B31.7 1969 with the 1970 Addenda) Class 1 (Q1) classification. This earlier classification followed closely the definition of reactor coolant system pressure boundary for the Class 1 boundary. This meant for systems connected to the reactor coolant system, the boundary extended to the outermost containment isolation valve in system piping which penetrates primary reactor containment. As such, more than two valves separate the reactor coolant system from certain parts of the extended Class 1 boundary. External pressurization would be necessary to meet the ASME Code test requirement of normal reactor coolant pressure. Since check valves would be part of the test boundary, a pressure differential would be required between the reactor coolant system and the area in question to maintain check valve closure. Maintaining the differential pressure and ensuring no test fluid intrusion into the reactor coolant system (reactivity control issue) is considered unusually difficult to meet with no compensating increase in quality or level of safety when considering the alternative below.

Licensee's Proposed Alternative Examination (as stated):

The areas in question are examined (VT-2) each refueling as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage. Additionally, it is proposed that the areas identified above be examined (VT-2) based upon a Class 2 system functional test at or near the end of the interval. The test would be performed at reduced pressure based upon low head safety injection pump pressure and flow to an non-pressurized reactor coolant system. The pressure, although reduced, would simulate actual system pressure in an accident situation. Additionally, it only involves Class 1 piping beyond the second isolation valve from the reactor coolant system to the first isolation valve outside containment. This piping based upon 10 CFR 50.55a(c)(2)(ii) would now allow a Class 2 classification, if constructed today.

Evaluation: The ASME Code requires that a system leakage test be performed at the end of each refueling outage, and when performed at or near the end of the interval, the test must include all Class 1 components within the RCS boundary. The system leakage test must be performed at a test pressure not less than nominal RCS pressure during normal operation (approximately 2235 psig). However, several SI system piping segments are connected to the RCS through self-actuating check valves, which do not allow normal RCS pressure to be used to pressurize these segments. In order to test the subject piping segments to normal operating RCS pressure (approximately 2235 psig), the licensee would have to make plant design modifications to enable the use of high pressure hoses as temporary jumpers around valves or employ hydrostatic pumps connected directly to the piping segments as explained below. Either of these options would conflict with operational design requirements by potentially defeating the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, pressurizing these segments to normal RCS pressures may result in test fluid intrusion into the RCS system boundary, which could become a reactivity control issue. To require the licensee to make plant modifications in order to pressurize the subject line segments to normal RCS pressure, would result in a considerable hardship.

Pressure testing of the RCS is typically performed during the "return to power" sequence at the end of a refueling outage using reactor coolant pumps and pressurizer heaters to bring the RCS to normal operating temperature and pressure, prior to initiating core criticality. At that time, the subject SI piping segments are isolated from the RCS by self-actuating check valves. The piping segments referenced in this relief request consist of limited runs of piping between the first and second isolation valves in the SI connections on the primary coolant loops. The piping segments are fabricated of austenitic stainless steel and range in diameter from ½ inch to 10 inch NPS. These segments, including the first and second isolation valves, are considered part of the reactor coolant pressure boundary, as defined in 10 CFR 50.2.

For SI piping segments connected to RCS, the self-actuating isolation check valves are designed to prevent back-flow of primary coolant into the respective high and low pressure SI piping, while providing a passive flow-path for injecting coolant during normal start-ups and shutdowns, as well as during postulated emergency events. Therefore, the design and function of these valves do not allow piping upstream of the first isolation check valve in each line segment to experience normal RCS pressures.

North Anna has separate high pressure and low pressure SI pumps. The piping segments identified in the relief are connected to the low pressure safety injection pumps discharge flow path. The normal operating pressure for these pumps is approximately 120 psig with temperature corresponding initially in accident conditions to the RWST temperature of approximately 40° F. The temperature would rise after the pumps are switched to take suction from the containment sump during an accident. The high pressure SI pumps do not flow through the piping segments and cannot pressurize these segments due to check valve placement. In order to subject the identified piping segments to RCS pressure, the first isolation valve would have to be by-passed and an external pressure source used to pressurize the piping segments. This would require the licensee to make pressure boundary modifications to the existing piping to accommodate fittings, valves, or other appurtenances needed to support this activity. Requiring the licensee to comply with ASME Code testing requirements, would result in a significant hardship for the licensee and would require the use of temporary check valves as boundary valves. The controls necessary to complete the test safely would be very difficult to maintain, and at test pressures that approach that of the RCS pressure at nominal operating pressure, such a test setup could potentially defeat the RCS boundary double isolation, which is mandated when fuel is present in the reactor vessel. In addition, test personnel would be required to wear SCBA, since the containment would be sub-atmospheric, adding to the difficulty to perform the required inspection.

The licensee's alternative is to conduct a system functional pressure test of the subject piping segments at approximately 120 psig and nominal operating temperature (refueling water storage tank temperature). These test conditions represent the actual accident pressure and temperature for the subject piping segments. The test pressure corresponds to the adjacent Class 2 safety injection piping pressure test requirements and would identify through-wall leakage. Additionally, the piping would be visually examined (VT-2) each refueling outage as part of the normal Class 1 system leakage test (normal valve line-up) for evidence of leakage.

The licensee's proposal represents the highest test pressures that can be obtained without significant plant modifications and are intended to test the subject piping segments to conditions similar to those that may be experienced during postulated design basis events. It is expected that the proposed test pressures will be sufficient to produce detectable leakage from significant service-induced degradation sources, should these exist, as well as verify that connections in these piping segments that may have been opened during the outage have been properly secured. The licensee has also committed to meeting the hold times for insulated (4 hours) and non-insulated (10 minutes) components, as shown in paragraph IWA-5213, prior to performing the required VT-2 visual examinations.

It is concluded that, for the licensee to pressurize the subject piping segments in accordance with ASME Code requirements would require significant plant modifications and would subject the licensee to an undue burden with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

3.9 Request for Relief SPT-013, North Anna Unit 2 (MC5594), Examination Category B-P, Pressure Retaining Components in the Reactor Coolant System

ASME Code Requirement: Examination Category B-P, Item B15.50, requires that a system leakage test be performed on Class 1 components in accordance with the requirements of paragraph IWB-5220. IWB-5221(a) states that the system leakage test shall be conducted at a pressure not less than nominal operating pressure associated with normal operating pressure. IWB-5221(b) states that the pressure retaining boundary during the system leakage test conducted at or near the end of the inspection interval shall extend to all Class 1 pressure retaining components within the system boundary.

Licensee's Alternative to ASME Code: In accordance with 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the pressure test requirements for components and piping between 2-RC-R-1 (inner O-ring), 2-RC-32 and valve 2-RC-HCV-1544 in the RPV flange leakage detection system.

Licensee Basis for Alternative (as stated):

North Anna Unit 2 is in the third ISI interval utilizing the requirements of ASME Section XI, 1995 Edition with the 1996 Addenda. The unit is currently in the second ISI period.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The components and piping being addressed are associated with the reactor head and flange leakage detection system. They are used to support identification of inner O-ring leakage. An increase in temperature above ambient is an indication of inner O-ring seal leakage. High temperature actuates an alarm. On indication of inner O-ring leakage the isolation valve in the leak-off line can be closed to put the outer O-ring into the pressure retention mode, and the inner O-ring leak detection system would be pressurized to reactor coolant pressure up to the closed isolation valve.

These lines can only be tested externally, since during normal operation they are separated from RCS pressure by the inner O-ring. Pressurizing the lines externally would put pressure on the inner O-ring in a direction opposite that it was designed for. This could move the inner O-ring from its normal position against the outer channel wall of the reactor vessel flange potentially affecting the O-ring leak tightness and requiring that maintenance be performed. This is considered an unnecessary hardship without compensating increase in quality or safety when considering the system design and the monitoring capability of the system.

Licensee's Proposed Alternative Examination (as stated):

The area in question is examined (VT-2) each refueling as part of the normal Class 1 system leakage test for evidence of leakage. Additionally, leakage past the inner O-ring must occur to potentially pressurize the components and piping being addressed. This leakage would be identified by an alarm or by RCS inventory balance calculations and addressed by procedures. The leakage would also be limited by the passive inner O-ring. Any leakage is normally directed to the primary drain transfer tank unless the system is isolated by operator action. These activities would be closely monitored by the procedurally controlled operator actions allowing identification of any further compensatory actions required.

Evaluation: The ASME Code requires that a system leakage test be performed during each refueling outage, and if performed at or near the end of the interval, the test must be extended to include all Class 1 components within the RCS boundary. The system leakage test must be performed at a test pressure not less than nominal RCS pressure during normal operation (approximately 2235 psig). However, subjecting certain components in the RPV closure head flange seal system to the pressure required by ASME Code could potentially compromise the structural integrity of these components, and present a significant hardship for the licensee.

Normal reactor coolant pressure at 100% rated power is approximately 2235 psig. The components and piping being addressed are associated with the RPV closure head flange leakage detection system. The RPV closure head flange is designed with two concentric O-rings that act as flange seals to enable the vessel to be pressurized during normal operation. The inner O-ring acts as the primary pressure seal for the RPV. The area between the O-rings, the secondary outer O-ring, and subject piping segments downstream are designed to support identification of leakage should the primary inner O-ring seal leak. These components/areas are empty of primary system water during normal reactor operation, not intended to experience full RCS pressure, and could only be tested using an external pressure source. Pressurizing the lines externally would put pressure on the inner O-ring in a direction that is opposite its design and could potentially cause damage to the primary O-ring, which might compromise the RCS pressure boundary. In addition, test personnel would have to wear SCBA, since the containment would be sub-atmospheric adding to the difficulty to perform the required inspection.

The subject areas/components are visually (VT-2) examined for evidence of leakage during each refueling outage as part of the normal Class 1 system leakage test. The visual examinations performed should detect any evidence of significant leakage, should it exist. Additionally, during normal operation any leakage past the inner O-ring would be identified by an alarm in the RCS monitoring system and by inventory balance calculations. Considering the system design and monitoring function, requiring the licensee to meet ASME Code pressure requirements, would result in unnecessary hardship with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's proposed alternative be authorized.

4.0 CONCLUSIONS

Pacific Northwest National Laboratory has reviewed the licensee's submittal and has determined that compliance with the ASME Code requirements would result in a hardship or unusual difficulty with no compensating increase in quality or safety. Further, it is reasonable to conclude the alternative pressure tests proposed by the licensee should be sufficient to produce detectable leakage from significant service-induced sources, should these exist. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that Requests for Relief SPT-010, -011, -012 and -013 be authorized for the third 10-year interval at North Anna Power Station, Unit 1.

Similarly, for North Anna, Unit 2, it has been shown that compliance with the ASME Code requirements would result in a hardship or unusual difficulty with no compensating increase in quality or safety. Further, it is reasonable to conclude the alternative pressure tests proposed by the licensee should be sufficient to produce detectable leakage from significant service-induced sources, should these exist. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that Requests for Relief SPT-009, -010,-012 and -013 be authorized for the third 10-year interval at North Anna Power Station, Unit 2.

As a result of an NRC RAI, the licensee elected to withdraw Request for Relief SPT-011 for North Anna, Unit 2.

North Anna Power Station, Units 1 & 2

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