VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

October 27, 2016

10 CFR 50.55a

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No.	16-146A
NLOS/GDM	R3
Docket No.	50-281
License No.	DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT 2
ASME SECTION XI INSERVICE INSPECTION PROGRAM
RELIEF REQUESTS FOR LIMITED COVERAGE EXAMINATIONS
PERFORMED IN THE FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

By letter dated May 5, 2016 (Serial No. 16-146), Virginia Electric and Power Company (Dominion) submitted eight relief requests for Surry Power Station Unit 2 for limited coverage component examinations for the fourth 10-year inservice inspection interval that began on May 10, 2004 and ended on May 9, 2015. The relief requests were based on the impracticality of performing the required examination coverages due to physical obstructions and limitations imposed by design, geometry, and/or materials of construction of the subject components. On September 1, 2016, the NRC Project Manager for Surry sent Dominion requests for additional information (RAIs) associated with the submitted relief requests. Dominion's response to the RAIs associated with Relief Requests LMT-C01, LMT-C02, LMT-C03, and LMT-C04 is provided in Attachment 1, and Dominion's responses to the RAIs associated with Relief Requests LMT-R01, LMT-SS01, LMT-CS01, and LMT-P01 are provided in Attachments 2 through 5, respectively.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Sincerely,

Mark D. Sartain
Vice President – Nuclear Engineering

Commitments made in this letter: None

A047
NRR

Attachments:

1. Response to Request for Additional Information, Relief Requests LMT-C01, LMT-C02, LMT-C03 And LMT-C04
2. Response to Request for Additional Information, Relief Request LMT-R01
3. Response to Request for Additional Information, Relief Request LMT-SS01
4. Response to Request for Additional Information, Relief Request LMT-CS01
5. Response to Request for Additional Information, Relief Request LMT-P01

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NRC Senior Resident Inspector
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Attachment 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUESTS LMT-C01, LMT-C02, LMT-C03 AND LMT-C04

Virginia Electric and Power Company
(Dominion)
Surry Power Station Unit 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION, RELIEF REQUESTS LMT-C01, LMT-C02, LMT-C03 AND LMT-C04

SURRY POWER STATION UNIT 2

NRC Comment

By letter dated May 5, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML16131A635), Virginia Electric and Power Company (Dominion, the licensee) submitted relief requests LMT-C01, LMT-C02, LMT-C03, and LMT-C04 to the U.S. Nuclear Regulatory Commission (NRC) for the fourth ten-year inservice inspection interval of the Surry Power Station, Unit 2.

In relief requests LMT-C01 and LMT-C02, the licensee requested relief from the examination requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) applicable to ASME Code Class 1 pressurizer vessel welds (ASME Code, Section XI, Examination Category B-B) and pressurizer nozzle inside radii (ASME Code, Section XI, Examination Category B-D). In relief requests LMT-C03 and LMT-C04, the licensee requested relief from the examination requirements of Section XI of the ASME Code applicable to ASME Code Class 2 integral welded attachments for piping (ASME Code, Section XI, Examination Category C-C).

The licensee determined that conformance with the examination requirements of Section XI of the ASME Code is impractical. Title 10 of the Code of Federal Regulations, Part 50, Paragraph 50.55a(g)(5)(iii) requires the licensee to submit information to the NRC to support the determination of impracticality. The staff requires responses to the following requests for additional information (RAI) to complete the review of relief requests LMT-C01, LMT-C02, LMT-C03, and LMT-C04.

NRC RAI Question No. 1

a) *With respect to relief requests LMT-C01 and LMT-C02, please discuss the ASME Code Section XI, Appendix I "Ultrasonic Examinations" requirements on which the volumetric examination methods are based. If supplements apply, please discuss which supplements were used.*

Dominion Response

For Relief Requests LMT-C01 and LMT-C02, the ASME Section XI, Appendix I, requirements on which the volumetric examinations were based are provided in paragraph I-2120 of Appendix I, which is applicable to "Other Vessels". The Surry Unit 2 pressurizer is a vessel greater than two inches in thickness. Therefore, the volumetric examinations shall be conducted in accordance with Article 4 of Section V

as supplemented by Table I-2000-1. Of the twelve supplements specified in Table I-2000-1 that potentially apply to other vessels greater than two inches in thickness, all of the supplements were used except for:

1. Supplement 4: Alternative Calibration Block Design, and
2. Supplement 5: Electronic Simulators

These two supplements were not applicable to the examination procedure.

b) *With respect to relief requests LMT-C03 and LMT-C04, please discuss the ASME Code Section XI, IWA-2220 "Surface Examination" requirements (and supplements, if any) on which the surface examination methods are based.*

Dominion Response

For Relief Requests LMT-C03 and LMT-C04, the ASME Code Section XI, IWA-2220 "Surface Examination," requirements on which the surface examination methods were based are provided in Code paragraph IWA-2221, "Magnetic Particle Examination." For both relief requests, the applicable NDE method is magnetic particle (MT) examination. As required by IWA-2221(a), the magnetic particle examinations were conducted in accordance with ASME Section V, Article 7. Paragraph IWA-2221(b) did not apply as the examination area was entirely free of any coatings.

NRC RAI Question No. 2

With respect to relief requests LMT-C01, LMT-C02, LMT-C03, and LMT-C04, please discuss any plant-specific operating experience regarding potential degradation (such as fatigue cracking) in the subject pressurizer welds, pressurizer nozzle inner radius, and integral welded attachments.

Dominion Response

The results of the pressurizer weld inspections were reviewed from the second and third intervals. There has been no history of service induced degradation on the pressurizer head to shell longitudinal welds or nozzle inner radius sections over the previous two (i.e., the second and third) inspection intervals. These weld examinations were limited by the support ring structure; however no indications were noted on the areas that were examined. The six nozzle inner radius (NIRs) sections for each unit were examined during the second and third intervals either ultrasonically or visually. The only indications noted were attributable to the rough surface of one Unit 2 NIR section and were detected while scanning for ultrasonic examinations. These indications were dispositioned and did not indicate any type of degradation.

Three Main Steam integral attachments were examined on Surry Unit 1 during the fourth interval with no limitations noted and no indications identified. Five integral attachments in addition to those discussed in this relief request were examined on Surry Unit 2 during the fourth inspection interval with no limitations noted and no indications identified.

In the previous intervals, i.e., the second and third intervals, a total of forty integral attachments were examined on the Main Steam system on Unit 1, and a total of eighteen were examined on Unit 2. Three of these examinations were shown as limited in the historical inservice inspection databases, and only one required repair in 1988 due to a linear indication.

NRC RAI Question No. 3

With respect to relief request LMT-C01, please provide coverage calculations and scan diagrams, similar to those submitted to the NRC by letter dated October 9, 2015 (ADAMS Accession Number ML15293A124) for the Surry, Unit 1 relief request LMT-C01 (see pages 6 to 7 and 10 to 11 of Attachment 5 of the October 9, 2015 letter), and make clear in the diagrams that both scan directions, parallel and perpendicular to the subject welds, were performed.

Dominion Response

As stated in Dominion's May 5, 2016 letter (Serial No. 16-146), the examinations of the Surry Unit 2 pressurizer shell welds 1-07 and 1-02 were performed during the third inservice inspection interval, as documented in Dominion letter dated March 18, 1994 (Serial No. 94-006) and approved by NRC letter dated August 30, 1995. Documentation of the fourth interval examinations was provided in Figures 2 and 3 for Welds 1-02 and 1-07, respectively, in Attachment 5 of the May 5, 2016 letter. The previous obstructions from the third interval inspection (shown in Figure 4 in Attachment 5 of the May 5, 2016 letter) were verified during performance of the fourth interval examinations for Welds 1-07 and 1-02.

With respect to relief request LMT-C01, the following documents are provided in the enclosure to this attachment:

- Tabulation of percent volume by scan direction (coverage calculations) for Weld 1-02*
- Tabulation of percent volume by scan direction (coverage calculations) for Weld 1-07*
- Scan diagram for Weld 1-07*

(* The attached information is from the third interval examination. As stated in the May 5, 2016 letter and as noted above, examination of welds 1-07 and 1-02 was performed during the third inspection interval, and the previous obstructions from the third interval were verified during the fourth interval examinations.)

Weld 1-02 does not have an associated scan diagram. The limitation encountered during the ultrasonic testing (UT) examination of weld 1-02 is the support ring for the pressurizer insulation, which is attached to a component structural support for one of the power-operated relief valves (PORVs). The insulation support ring is 6 inches wide and covers approximately 4 inches (~1/3) of the 12 inches of longitudinal weld length. Although approximately 2/3 (~66%) of the weld was accessible, the coverage was conservatively calculated at 50% due to the interference of the support ring with the required scan areas. To be fully accessible, the required scan areas for the ultrasonic transducers must be available, and these dimensions are a function of the examination angle. The accessible portions of weld 1-02 were scanned in all possible directions (perpendicular and parallel to the weld) with the required examination angles (0°, 45° and 60°).

Regarding the scan directions for the subject welds, scans in both the parallel and perpendicular directions were performed during the fourth interval examinations. Documentation of the scans is provided in Figures 2 and 3 in Attachment 5 of the May 5, 2016 letter. Scan coverage is checked for upstream [perpendicular], downstream [perpendicular], CW (clockwise) [parallel], and CCW (counter-clockwise) [parallel].

NRC RAI Question No. 4

With respect to relief request LMT-C02, please clarify that the obstructions are the two beams of the insulation support frame as depicted in pages 4 and 5 of Attachment 6 "Relief Request LMT-C02, Examination Category B-D, Pressurizer Inner Radius Section" of the licensee's submittal. In addition, please state whether recordable indications were detected in the 80% volumetric coverage of 14NIR that was achieved.

Dominion Response

The obstructions are the two beams of the insulation support frame as depicted in pages 4 and 5 of Attachment 6, "Relief Request LMT-C02, Examination Category B-D, Pressurizer Inner Radius Section," included in our May 5, 2016 letter. There were no recordable indications detected in the 80% volumetric coverage of 14NIR that was achieved.

ENCLOSURE

- **TABULATION OF PERCENT VOLUME BY SCAN DIRECTION (COVERAGE CALCULATIONS) FOR WELD 1-02**
- **TABULATION OF PERCENT VOLUME BY SCAN DIRECTION (COVERAGE CALCULATIONS) FOR WELD 1-07**
- **SCAN DIAGRAM FOR WELD 1-07**

Dominion

PERCENT VOLUME BY SCAN DIRECTION

Drawing Number: 11548-WMKS-RC-E-2 Mark Number: 1-02

SCAN ANGLE	SCAN DIRECTION	SCAN AREA	PERCENT EXAMINED
0°	0	Weld & Base Metal	50%
45°	2	Weld & Base Metal	50%
60°	2	Weld & Base Metal	50%
45°	5	Weld & Base Metal	50%
60	5	Weld & Base Metal	50%
45°	7	Weld & Base Metal	50%
60°	7	Weld & Base Metal	50%
45°	8	Weld & Base Metal	50%
60°	8	Weld & Base Metal	50%
			Total 50%

Comments: All areas were scanned with the maximum extent possible from both sides of the weld with the 0°, 45° and 60° transducers.

AVERAGE PERCENT EXAMINED 50 %

[signature]
DOMINION, VIRGINIA POWER, LEVEL III

October 11, 2003
DATE

VIRGINIA POWER
[initials]
10/13/03
Level III
NDE Review

HSB-CT ANI/ANII REVIEWS
INITIAL___ FINAL ✓
[initials] 10/13/03

Tabulation of Percent Volume by Scan Direction (Coverage Calculations) for Weld 1-02

Dominion

PERCENT VOLUME BY SCAN DIRECTION

Drawing Number: 11548-WMKS-RC-E-2 Mark Number: 1-07

SCAN ANGLE	SCAN DIRECTION	SCAN AREA	PERCENT EXAMINED
0°	0	Weld & Base Metal	86%
45°	2	Weld & Base Metal	98.4%
60°	2	Weld & Base Metal	98.8%
45°	5	Weld & Base Metal	32.3%
60	5	Weld & Base Metal	22%
45°	7	Weld & Base Metal	100%
60°	7	Weld & Base Metal	100%
45°	8	Weld & Base Metal	100%
60°	8	Weld & Base Metal	100%
			Total 82%

Comments: All areas were scanned with the maximum extent possible from both sides of the weld with the 0°, 45° and 60° transducers.

AVERAGE PERCENT EXAMINED 82 %

DOMINION, VIRGINIA POWER, LEVEL III

October 11, 2003
DATE

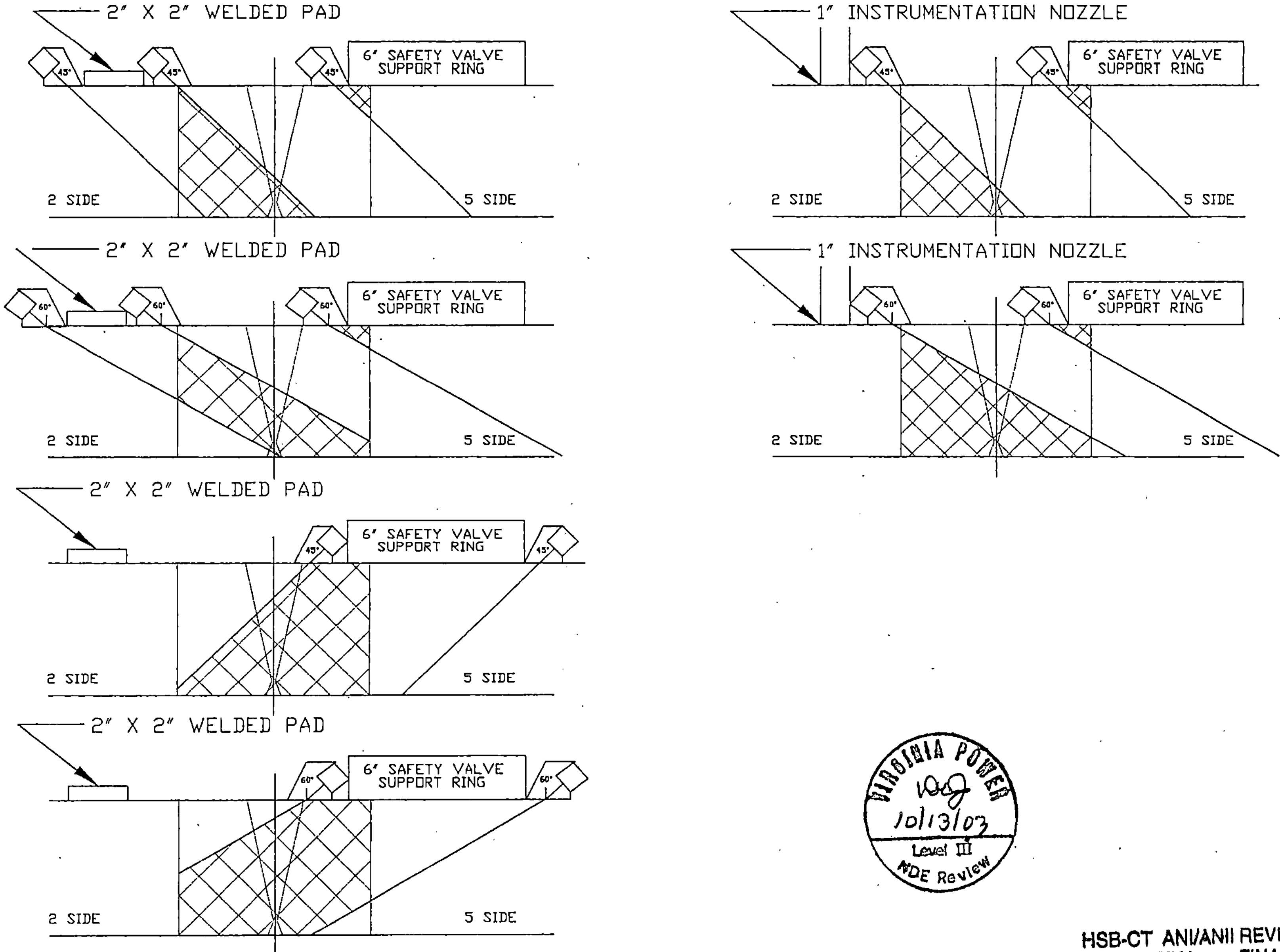
VIRGINIA POWER
10/13/03
Level III
NDE Review

HSB-CT ANI/ANII REVIEWS
INITIAL ___ FINAL ✓
10/13/03

Tabulation of Percent Volume by Scan Direction (Coverage Calculations) for Weld 1-07

11548-WMKS-RC-E-2 1-07

(Hatched areas represent no examination coverage)



Scan Diagram for Weld 1-07

VIRGINIA POWER
10/13/03
Level III
NDE Review

Serial No. 16-146A
Docket No. 50-281
RAI Response - Relief Request LMT-CO1/2/3/4
Attachment 1; Enclosure

HSB-CT ANI/ANII REVIEWS
INITIAL ___ FINAL ✓
10/13/03

RT3397B

Attachment 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUEST LMT-R01

Virginia Electric and Power Company
(Dominion)
Surry Power Station Unit 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUEST LMT-R01

SURRY POWER STATION UNIT 2

NRC Comment

By letter dated March 5, 2016 (Accession Number ML16131A635), Virginia Electric and Power Company - Dominion (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code) specifically related to ASME Code Case N-460 "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." Relief request LMT-R01 pertains to the examination coverage of the Class 1 welds at the Surry Power Station (Surry), Unit 2.

To complete its review, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information.

NRC RAI Question No. 1

Tables 4a, 4b, and 4c of the relief request contain materials of construction for the pipe only (austenitic stainless steel pipe).

a. *Provide materials of construction for each weld and its associated components (e.g., valve, reducer, nozzle, elbow, and weldolet).*

Dominion Response

The materials of construction for each weld and associated component were researched through specific work orders, design specifications and original construction specifications and verified to be constructed of austenitic stainless steel.

Furthermore, the licensee stated in Section 6 of the relief request that,

"None of the pipe or weld material is constructed with Alloy 600/82/182 materials, therefore, there are no primary water stress corrosion cracking (PWSCC) concerns."

The NRC staff notes that Weld No. 2-35 is a pipe to nozzle weld (as described in Table 4b). Generally, a nozzle is made of low alloy steel (LAS). Welding of a LAS nozzle to an austenitic stainless steel pipe is typically done by buttering the LAS with nickel based alloy (e.g., Alloy 182 or Alloy 152), and then welding by either nickel based alloy or stainless steel material.

b. *Is the weld metal used nickel based alloy? If yes, describe.*

Dominion Response

The weld metal used was not a nickel based alloy. Weld 2-35 is the pipe to nozzle safe-end weld. The safe-end, weld filler metal and pipe are austenitic stainless steel, which is not susceptible to Primary Water Stress Corrosion Cracking (PWSCC).

c. *Is Weld No. 2-35 part of an augmented program for managing PWSCC susceptibility? Describe.*

Dominion Response

Weld 2-35 is not part of an augmented program for managing PWSCC susceptibility. However, this weld is included in the Surry sensitized stainless steel augmented inspection scope (which is required by Technical Requirements Manual Table 6.1-1, Item 2.1.1). The Surry Augmented Inspection Program was developed and committed to during the original licensing of Surry Power Station and provides additional inspections beyond the requirements of ASME Section XI.

NRC RAI Question No. 2

Provide operating temperature and pressure for each weld listed in Tables 4a, 4b, and 4c.

Dominion Response

Weld ID	Operating Temperature (Estimated)	Operating Pressure (Estimated)
Table 4a		
11548-WMKS-RC-10-1 27.5"-RC-309-2501R / 1-13	606 °F	2235 psig
11548-WMKS-RC-11-1 27.5"-RC-306-2501R / 1-13	606 °F	2235 psig
11548-WMKS-RC-12-1 27.5"-RC-303-2501R / 1-13	606 °F	2235 psig

Weld ID	Operating Temperature (Estimated)	Operating Pressure (Estimated)
Table 4b		
11548-WMKS-0127J1 / 2-SI-274 / 1-12BW	280 °F	2520 psig
11548-WMKS-0125A1 / 4-RC-315 / 2-35	543 °F	2235 psig
Table 4c		
11548-WMKS-0122H1 / 6-RC-316 / 1-09	606 °F	2235 psig
11548-WMKS-0127J2 / 6-RC-319 / 1-02	606 °F	2235 psig
11548-WMKS-0127J2 / 6-RC-319 / 1-03A	606 °F	2235 psig
11548-WMKS-0127J1 / 6-RC-317 / 1-03	606 °F	2235 psig
11548-WMKS-0127J3 / 6-RC-320 / 1-02	310 °F	150 psig
11548-WMKS-0127J3 / 6-RC-320 / 1-03B	310 °F	150 psig
11548-WMKS-0122J1 / 6-RC-321 / 1-08	606 °F	2235 psig
11548-WMKS-0122J1 / 6-RC-321 / 1-09	606 °F	2235 psig
11548-WMKS-0122J1 / 6-RC-321 / 1-11	606 °F	2235 psig
11548-WMKS-0122K1-1 / 6-RC-318 / 1-01BC	606 °F	2235 psig

NRC RAI Question No. 3

The licensee stated that Weld No. 1-03A was replaced in 2006. Was this weld replaced due to presence of unacceptable indications? If yes, discuss.

Dominion Response

Weld No. 1-03A was not replaced due to unacceptable conditions in the weld. The adjacent valve was cut out and replaced, which created the need to rework this weld.

NRC RAI Question No. 4

As part of an augmented inspection program for managing thermal fatigue, industry has issued MRP-146, "Management of Thermal Fatigue in Normally Stagnant Non-Isolable

Reactor Coolant System Branch Lines Supplemental Guidance," and the EPRI-MRP Interim Guidance for Management of Thermal Fatigue MRP 2015-025 (Accession Number ML15189A100).

Section 2.4.3 "Needed Requirement" of Attachment 1 "NEI 03-08 Needed and Good Practice Interim Guidance for Management of Thermal Fatigue" to MRP 2015-025 states that,

"Examination Volume Coverage

Essentially 100% of the examination volumes specified in MRP-146 and this Interim Guidance, shall be inspected. If the achieved examination coverage of the required base metal volume was not greater than 90%, or if the achieved examination coverage of the required weld volume was not greater than 90%, then the Responsible Engineer shall be informed and a Corrective Action Program (CAP) item shall be generated to document the coverage limitation and assess the actual coverage obtained. The Responsible Engineer shall assess the potential risk from cracking in the unexamined volumes and determine if compensatory measures such as alternate examination techniques or weld crown removal are warranted."

In Section 4c of Attachment 1 to the relief request, the licensee stated that mode of degradation for the welds listed in Table 4c is thermal fatigue, and they are analyzed and inspected under guidelines of MRP-146 for management of thermal fatigue.

Given that only 50 percent coverage was achieved for the welds listed in Table 4c, has the licensee assessed the potential risk from cracking in the unexamined volumes and determined if compensatory measures such as alternate examination techniques are warranted? If not, explain.

Dominion Response

The pipe lines listed in Table 4C in our May 5, 2016 letter were analyzed under the Surry Augmented Inspection Program for MRP 146 Thermal Stratification Inspections within the time of the Surry Unit 2 fourth inservice inspection interval. The areas determined most susceptible to thermal stratification were examined in November 2009 before the end of the fourth interval. The examinations resulted in no recordable indications (NRI). Evaluation of the unexamined volumes, due to physical limitations, was not required as part of the MRP Guidance in 2009. Therefore, an analysis of the unexamined area with regard to the potential risk of cracking was not required and was not performed.

Attachment 1, "NEI 03-08 - Needed and Good Practice Interim Guidance for Management of Thermal Fatigue," to MRP 2015-025 was issued during the Surry Unit 2

fifth interval. Surry incorporated the guidance of this document into the MRP 146 Augmented Inspection Program and performed an evaluation of limited coverage obtained when performing ultrasonic examinations in 2015 on Reactor Coolant System small bore piping where a thermal stratification concern was determined to exist.

This evaluation on the small bore piping was completed on November 13, 2015. The assessment determined that compensatory measures, such as scope expansion, alternate examination techniques, or weld crown removal, were not warranted due to achieving less than 90% coverage. The Responsible Engineer determined that the risk of thermal fatigue in the regions with less than 90% coverage was low and acceptable.

It should be noted that this evaluation was neither an ASME Section XI requirement nor a requirement of the applicable Risk Informed Program during the Surry Unit 2 fourth interval. In most pipe to valve configurations, 50% is the maximum coverage obtainable by ultrasonic scanning since the scan can only be achieved from one side of the weld.

NRC RAI Question No. 5

The mode of degradation for the welds in Table 4a and Weld No. 1-12BW in Table 4b is thermal fatigue. Are these welds part of an augmented program such as MRP-146, and/or the Electric Power Research Institute interim guidance MRP 2015-025 "EPRIMRP Interim Guidance for Management of Thermal Fatigue" (Accession Number ML15189A100)? If not, explain.

Dominion Response

These welds are not part of the MRP-146 Augmented Program. These welds are High Safety Significant in the Risk Informed Program, are assigned a degradation mechanism of thermal fatigue, and were inspected as such. The Risk Informed Program designates welds as either High Safety Significant or Low Safety Significant. The most likely cause of degradation is assigned to the High Safety Significant components. Thermal fatigue can occur in the form of thermal stratification and/or thermal transient (shock) in the Risk Informed Program. Thermal fatigue is analyzed for each High Safety Significant line, not just normally stagnant, non-isolable Reactor Coolant System branch lines on which the MRP-146 Augmented Program is based.

The Risk Informed Program used during the fourth inservice inspection interval designated a larger population of welds as subject to thermal fatigue than the MRP-146 population which addresses thermal stratification only on normally stagnant, non-isolable, reactor coolant lines.

NRC RAI Question No. 6

The mode of degradation for the last three welds (i.e., Weld Nos. 1-09, 1-11, and 1-01BC) in Table 4c is intergranular stress corrosion cracking. Are these welds part of the sensitized stainless steel augmented program? If not, explain.

Dominion Response

Item #R1.20 shown on these three welds is an updated item number for the current ASME Code Case N-716-1, Risk Informed Program that is being used for Surry's fifth inservice inspection interval; Item #R1.20 indicates High Safety Significant, subject to selection for inspection with no specific degradation mechanism assigned. During the fourth inspection interval, the assigned degradation mechanism was thermal fatigue, item #R1.11; a corrected excerpt from Table 4c from the May 5, 2016 letter is provided below. The line numbers [6"-RC-318 and 6"-RC-321] were analyzed as subject to thermal fatigue by the MRP-146 Augmented Program, and the areas most susceptible to this degradation mechanism were ultrasonically examined during the fourth interval.

11548-WMKS-0122J1 / 6-RC-321 / 1-09 / **R1.11** ~~**R1.20**~~ / Reactor Coolant Segment ECC-007	ASME Spec SA 376 TP 316	6"	0.562"	50% (UT) 6% (UT Best Effort)	UT- single sided, valve to elbow / NRI / Analyzed as part of Augmented Program MRP-146	4c8
11548-WMKS-0122J1 / 6-RC-321 / 1-11 / **R1.11** ~~**R1.20**~~ / Reactor Coolant Segment ECC-007	ASME Spec SA 376 TP 316	6"	0.562"	50% (UT) 11% (UT Best Effort)	UT- single sided, valve to pipe / NRI / Analyzed as part of Augmented Program MRP-146	4c9
11548-WMKS-0122K1-1 / 6-RC-318 / 1-01BC / **R1.11** ~~**R1.20**~~ / Reactor Coolant Segment RC-017	ASME Spec SA 376 TP 316	6"	0.562"	50% (UT) 23.7% (UT Best Effort)	UT- single sided, weldolet to pipe / NRI / Analyzed as part of Augmented Program MRP-146	4c10

Intergranular stress corrosion cracking has never been an assigned degradation mechanism. These welds are not part of the Surry Augmented Inspection Program for sensitized stainless steel.

Attachment 3

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUEST LMT-SS01**

**Virginia Electric and Power Company
(Dominion)
Surry Power Station Unit 2**

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION RELIEF REQUEST LMT-SS01

SURRY POWER STATION UNIT 2

NRC Comment

By letter dated May 5, 2016 (Accession Number ML16131A635), Virginia Electric and Power Company - Dominion (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code) specifically related to ASME Code Case N-460 "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." Relief request LMT-SS01 pertains to the examination coverage of the Class 2 welds at the Surry Power Station (Surry), Unit 2.

To complete its review, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information.

NRC RAI Question No.1

Table 4a of Attachment 2 to the relief request contains materials of construction for the pipe only. Provide materials of construction for each weld and its associated components (e.g., elbow, valve, tee, reducer, and flange).

Dominion Response

The materials of construction for each weld and associated component were researched through specific work orders, design specifications and original construction specifications and verified to be constructed of austenitic stainless steel.

NRC RAI Question No.2

Provide operating temperature and pressure for each weld listed in Table 4a.

Dominion Response

Weld ID/ Table 4a	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-SI-1 / 12-SI-201 / 0-03	Ambient	Slight vacuum*

Weld ID/ Table 4a	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-SI-1 / 12-SI-201 / 0-05 (LHSI Pump Suction)	Ambient	35 psig
11548-WMKS-SI-1 / 12-SI-202 / 0-13	Ambient	Slight vacuum*
11548-WMKS-SI-1 / 12-SI-202 / 0-16 (LHSI Pump Suction)	Ambient	35 psig
11548-WMKS-SI-10 / 3-SI-270 / 0-08 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-SI-12A / 3-SI-272 / 2-08B (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-SI-12A / 3-SI-272 / 2-09A (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-SI-15 / 3-SI-346 / 0-02 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-SI-15 / 3-SI-346 / 0-03 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-SI-16 / 3-SI-347 / 2-01 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-SI-18 / 3-SI-347 / 0-19 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-SI-2 / 3-SI-270 / 1-12 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-SI-37 / 16-SI-205 / 0-02	Ambient	35 psig
11548-WMKS-SI-4 / 12-SI-205 / 0-15	Ambient	35 psig

Weld ID/ Table 4a	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-0117A1-1 / 14-RH-102 / 2-15	350 °F	350 psig
11548-WMKS-0117A1-1 / 14-RH-118 / 2-25	350 °F	350 psig
11548-WMKS-0117B1 / 12-RH-112 / 2-06A	350 °F	450 psig
11548-WMKS-0122H1 / 6-SI-249 / 2-01 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-0122J1 / 6-SI-250 / 2-01 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-0122K1-2 / 6-SI-249 / 3-13 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-0122K1-2 / 6-SI-249 / 5-35 (To Hot Leg RCS)	606 °F***	2235 psig***
11548-WMKS-0123L1 / 12-CS-102 / 0-09	Ambient	100 psig
11548-WMKS-0123M1 / 12-CS-101 / 0-06	Ambient	100 psig
11548-WMKS-0123N1Z / 12-RS-107 / 0-01	Ambient	Slight vacuum*
11548-WMKS-0123N1Z / 12-RS-107 / 0-02	Ambient	Slight vacuum*
11548-WMKS-0123N1Z / 12-RS-108 / 0-04	Ambient	Slight vacuum*
11548-WMKS-0123N1Z / 12-RS-108 / 0-05	Ambient	Slight vacuum*
11548-WMKS-0127C2 / 10-SI-352 / 1-08	606 °F***	2235 psig***
11548-WMKS-0127C2 / 10-SI-348 / 2-12	606 °F***	2235 psig***

Weld ID/ Table 4a	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-0127J1 / 6-SI-345 / 2-01 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-0127J2 / 6-SI-344 / 3-01 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-0127J5 / 6-SI-345 / 1-05 (To Cold Leg RCS)	540 °F**	2235 psig**
11548-WMKS-CH-11 / 3-CH-303 / 1-03	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-303 / 1-10	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-303 / 1-12	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-302 / 2-03	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-302 / 2-05A	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-381 / 3-03	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-381 / 3-04A	170 °F	2500 psig
11548-WMKS-CH-11 / 3-CH-381 / 3-05A	170 °F	2500 psig
11548-WMKS-CH-18 / 3-CH-371 / 0-08	170 °F	2500 psig
11548-WMKS-CH-24 / 3-CH-413 / 0-16	130 °F	60 psig

* This is an emergency system that is not normally in operation. This piping is maintained water filled and at a slight vacuum. It is pump suction piping from a sub-atmospheric containment sump.

** This is an emergency system that is not normally in operation. During unit operation, this piping has typically equalized to the reactor coolant nominal operating pressure and temperature for the Cold Leg. These are maximum pressure and temperature values.

*** This is an emergency system that is not normally in operation. During unit operation, this piping has typically equalized to the reactor coolant nominal operating pressure and temperature for the Hot Leg. These are maximum pressure and temperature values.

NRC RAI Question No.3

The NRC staff notes that the regulations require essentially 100 percent coverage for each weld. The NRC staff also notes that for some welds, the coverage achieved is as low as 19 percent.

a. *Based on the difference in required versus achieved coverage, please describe why the coverage achieved is adequate to provide a reasonable assurance of structural integrity and leak tightness of the weld. Issues which can be addressed in your response include but are not limited to: known degradation mechanisms, the number and extent of similar welds (materials and environmental conditions) which have been examined (both full coverage and limited coverage), the existence and applicability of any guidance concerning the probable location of flaws in welds of this type relative to the inspection coverage actually achieved.*

Dominion Response

The table below shows the welds with limited coverage less than 50 percent. In most pipe-to-component configurations, 50% is the maximum coverage obtainable by ultrasonic scanning since the scan can only be achieved from one side of the weld. Ultrasonic coverage is further restricted when the weld joins a component, such as a valve, flange, pump, etc., to a pipe configuration other than a straight run, such as an elbow, reducer or pipe tee.

There are no known degradation mechanisms (DM) assigned to these welds.

129 category C-F-1 welds were examined in the 4th Interval for Unit 2. Only one of the 129 examinations had recordable surface indications. These indications were discovered in the base metal not the weld. The indications were evaluated and determined to be within the acceptance standards of ASME Section XI, IWC-3514.

The welds in the table below have been evaluated for inspection requirements under the fifth inspection interval Risk Informed Program based on Code Case N-716-1. The welds shown in the table below were ranked as Low Safety Significant and therefore no longer require ultrasonic inspection. They continue to receive periodic visual VT-2 examinations for through-wall leakage under ASME Section XI, IWC-5000, "System Pressure Tests."

As a result of the above considerations and as stated in our May 5, 2016 letter, based on the obtained volumetric coverage with acceptable results, the routinely performed visual (VT-2) examinations, and the fact that Best Effort Coverage and/or surface examinations were also performed, it is reasonable to conclude that service induced degradation would be detected. The proposed alternatives and the

achieved coverage provide an acceptable level of quality and safety by providing reasonable assurance of structural integrity of the subject welds.

b. *Discuss whether the welds with limited coverage of less than 50 percent are susceptible to degradation due to fatigue (for example: thermal fatigue); and for assurance of structural integrity of unexamined volume of the weld, provide cumulative fatigue usage factor for those welds with limited coverage of less than 50 percent.*

Dominion Response

These welds were examined under the selection guidance of the traditional ASME Section XI Program. There are no degradation mechanisms assigned to the welds, nor any associated augmented inspection based on degradation concerns.

Surry Power Station Unit 2 piping systems were built to ASA B31.1-1955 with Code Cases N1 through N13 and USAS B31.1 – 1967 construction codes. These earlier construction codes did not require calculated cumulative fatigue usage factors for welds.

Welds with < 50% Coverage

Weld Identification Drawing / Line# / ID Item System	Coverage Obtained	Degradation Mechanism (DM) Associated with Weld
11548-WMKS-SI-1 / 12-SI-201 / 0-03 C5.11 Safety Injection	19% (UT) 80% (PT) [Elbow to Valve]	No associated DM
11548-WMKS-SI-1 / 12-SI-201 / 0-05 C5.11 Safety Injection	38% (UT) 3.5% (UT Best Effort) 77.5% (PT) [Valve to Tee]	No associated DM
11548-WMKS-SI-1 / 12-SI-202 / 0-13 C5.11 Safety Injection	46% (UT) 4.33% (UT Best Effort) 100% (PT) [Elbow to Valve]	No associated DM
11548-WMKS-SI-1 / 12-SI-202 / 0-16 C5.11 Safety Injection	39.5% (UT) 0% (UT Best Effort) 100% (PT) [Tee to Valve]	No associated DM

Weld Identification Drawing / Line# / ID Item System	Coverage Obtained	Degradation Mechanism (DM) Associated with Weld
11548-WMKS-SI-2 / 3-SI-270 / 1-12 C5.21 Safety Injection	43% (UT) 10.6% (UT Best Effort) [Pipe to Valve]	No associated DM
11548-WMKS-SI-4 / 12-SI-205 / 0-15 C5.11 Safety Injection	43% (UT) 4.66% (UT Best Effort) [Valve to Reducer]	No associated DM
11548-WMKS-0123N1Z / 12-RS-107 / 0-01 Recirculation Spray	26% (UT) 0% (UT Best Effort) [Pipe to Valve]	No associated DM
11548-WMKS-0123N1Z / 12-RS-108 / 0-04 C5.11 Recirculation Spray	45% (UT) 3% (UT Best Effort) [Pipe to Flange]	No associated DM
11548-WMKS-CH-11 / 3-CH-302 / 2-03 C5.21 Charging	40% (UT) 14.3% (UT Best Effort) [Flange to Pipe]	No associated DM
11548-WMKS-CH-11 / 3-CH-302 / 2-05A C5.21 Charging	40% (UT) 15.5% (UT Best Effort) [Valve to Pipe]	No associated DM
11548-WMKS-CH-11 / 3-CH-381 / 3-04A C5.21 Charging	43.3% (UT) 10% (UT Best Effort) [Valve to Pipe]	No associated DM
11548-WMKS-CH-11 / 3-CH-381 / 3-05A C5.21 Charging	43.3% (UT) 15.6% (UT Best Effort) [Valve to Pipe]	No associated DM

Attachment 4

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUEST LMT-CS01

Virginia Electric and Power Company
(Dominion)
Surry Power Station Unit 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION RELIEF REQUEST LMT-CS01

SURRY POWER STATION UNIT 2

NRC Comment

By letter dated May 5, 2016 (Accession Number ML16131A635), Virginia Electric and Power Company - Dominion (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code) specifically related to ASME Code Case N-460 "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." Relief request LMT-CS01 pertains to the examination coverage of the Class 2 welds at the Surry Power Station (Surry), Unit 2.

To complete its review, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information.

NRC RAI Question No. 1

Table LMT-CS01 of Attachment 3 to the relief request provides materials of construction for the pipe only. Provide materials of construction for the weld and the associated components (branch connections, valve, elbow, flange, and tee).

Dominion Response

The materials of construction for each weld and associated component were researched through specific work orders, design specifications and original construction specifications and verified to be constructed of carbon steel.

NRC RAI Question No. 2

Provide operating temperature and pressure for each weld listed in Table LMT-CS01.

Dominion Response

Drawing / Line# / ID Item System	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-0103A2-4 / 30-SHP-122 / 1-22BC C5.81 Main Steam	505 °F	700 psig

11548-WMKS-0118A1 / 3-WAPD-110 / 0-17 C5.61 Auxiliary Feedwater	435 °F*	900 psig*
11548-WMKS-0118A1 / 6-WAPD-101 / 0-02A C5.51 Auxiliary Feedwater	435 °F*	900 psig*
11548-WMKS-0118A2 / 3-WAPD-109 / 0-108 C5.61 Auxiliary Feedwater	435 °F*	900 psig*
11548-WMKS-0118A2 / 3-WAPD-110 / 0-109 C5.61 Auxiliary Feedwater	435 °F*	900 psig*

*Maximum values considering leakby across check valves from Main Feedwater.

NRC RAI Question No. 3

The NRC staff notes that the regulations require essentially 100 percent coverage for each weld. The NRC staff also notes that for some welds, the coverage achieved is as low as 40 percent.

a. *Based on the difference in required versus achieved coverage, please describe why the coverage achieved is adequate to provide a reasonable assurance of structural integrity and leak tightness of the weld. Issues which can be addressed in your response include but are not limited to: known degradation mechanisms such as flow accelerated corrosion and fatigue, the number and extent of similar welds (materials and environmental conditions) which have been examined (both full coverage and limited coverage), the existence and applicability of any guidance concerning the probable location of flaws in welds of this type relative to the inspection coverage actually achieved.*

Dominion Response

The pipe lines listed in the table above are included in the Flow-Accelerated Corrosion (FAC) Program and evaluated for need of inspection. The Auxiliary Feedwater lines are stagnant (non-flowing) piping during normal operation; consequently, they do not typically exhibit flow-accelerated corrosion. Main Steam line 30"-SHP-122 is the header for the Main Steam safety valves and normally does not experience flow; therefore, this line also screened out for FAC concerns. There are no other proposed degradation mechanisms assigned to the lines in the table above.

As stated in our May 5, 2016 letter, based on the volumetric and area coverage that was obtained with acceptable results and the visual examinations routinely performed to detect through-wall leakage, it is reasonable to conclude that service induced degradation would be detected. Therefore, the proposed alternatives and the coverage achieved provide an acceptable level of quality and safety by providing reasonable assurance of structural integrity of the subject welds.

b. *Discuss whether the welds with limited coverage of less than 50 percent are susceptible to degradation due to fatigue; and for assurance of structural integrity of unexamined volume of the weld, provide cumulative fatigue usage factor for those welds with limited coverage of less than 50 percent.*

<u>Dominion Response</u>

Only one weld out of this group received less than 50 percent coverage:

11548-WMKS-0118A1 / 3-WAPD-110 / 0-17	40.17% UT coverage obtained

As stated in the response to Question 3.a above, this Auxiliary Feedwater pipe is normally at stagnant conditions during routine plant operation. This is not the Main Feedwater flow path. During normal plant operations, no change in temperature exists in this area which would create a thermal fatigue concern.

Surry Power Station Unit 2 piping systems were built to ASA B31.1-1955 with Code Cases N1 through N13 and USAS B31.1 – 1967 construction codes. The earlier construction codes did not require calculated cumulative fatigue usage factors (CUF) for welds. Therefore, a CUF does not exist for this weld.

Attachment 5

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
RELIEF REQUEST LMT-P01**

**Virginia Electric and Power Company
(Dominion)
Surry Power Station Unit 2**

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION RELIEF REQUEST LMT-P01

SURRY POWER STATION UNIT 2

NRC Comment

By letter dated May 5, 2016 (Accession Number ML16131A635), Virginia Electric and Power Company - Dominion (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code) specifically related to ASME Code Case N-460 "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." Relief Request LMT-P01 pertains to examination coverage of the Class 1 and 2 welds at the Surry Power Station (Surry), Unit 2, during preservice inspection (PSI) before returning to service after repair/replacement.

To complete its review, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information.

NRC RAI Question No. 1

Table LMT-P01 of Attachment 4 to this relief request contains materials of construction for the pipe only. Provide materials of construction for each weld and its associated components (e.g., elbow, valve, tee, reducer, and flange).

Dominion Response

The materials of construction for each weld and associated component was researched through specific work orders, design specifications and original construction specifications and verified to be constructed of austenitic stainless steel.

NRC RAI Question No. 2

Provide operating temperature and pressure for each weld listed in Table LMT-P01.

Dominion Response

Drawing / Line# / ID System / Class Category / Item	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-SI-12A / 3-SI-272 / 2-08C Safety Injection / 2 C-F-1 / C5.21	280 °F	2520 psig

Drawing / Line# / ID System / Class Category / Item	Operating Temperature (Estimated)	Operating Pressure (Estimated)
11548-WMKS-SI-12A / 3-SI-272 / 2-09B Safety Injection / 2 C-F-1 / C5.21	280 °F	2520 psig
11548-WMKS-0127J2 / 6-SI-319 / 1-03A Safety Injection / 1 R-A / R1.11	540 °F	2235 psig

NRC RAI Question No. 3

The licensee stated that the mode of degradation for Weld No. 1-03A is thermal fatigue.

a. *Is this weld part of an augmented program such as Materials Reliability Program (MRP)-146, and/or the Electric Power Research Institute (EPRI) interim guidance MRP 2015-025 "EPRI-MRP Interim Guidance for Management of Thermal Fatigue" (Accession Number ML15189A100)? Explain why it is or is not.*

Dominion Response

Weld 1-03A on line 6"-SI-319-1502 screened in for thermal stratification as a result of the MRP-146 Revision 1 analysis. This weld is part of the Surry Augmented Inspection Program for "MRP-146 Thermal Stratification Inspections".

b. *Based on the difference in required versus achieved coverage, explain why the coverage achieved is adequate to provide a reasonable assurance of structural integrity and leak tightness of the weld. Issues which can be addressed in your response may include but are not limited to: known degradation mechanisms, the number and extent of similar welds (materials and environmental conditions) which have been examined (both full coverage and limited coverage), the existence and applicability of any guidance concerning the probable location of flaws in welds of this type relative to the inspection coverage actually achieved.*

Dominion Response

Weld 1-03A and the similar welds on the two additional cold leg loops received an initial ultrasonic examination during the fall 2015 refueling outage to meet the MRP-146 requirements due to concern of thermal stratification. No indications were identified. No leakage has been discovered to date in the weld population monitored by MRP-146 at Surry Power Station. As discussed in the response to Question 3.a

above, Weld 1-03A will continue to be monitored by the MRP-146 Thermal Stratification Augmented Inspection Program.

In addition, Class 2 welds on the Safety Injection system were inspected in accordance with the selection rules of ASME Section XI. For the thirty-two small bore welds selected for inspection on the Safety Injection line during the fourth interval, all examination results were within acceptable standards. (One inspected weld revealed indications that, upon further evaluation, were determined to be within the acceptance standards of ASME Section XI, IWC-3514.) These welds are categorized as Low Safety Significant in the fifth inspection interval, full scope Risk Informed Inspection Program. The only inspection required to meet ASME Section XI requirements is the period system pressure test under Category C-H for the fifth interval.

As a result of these considerations and as stated in our May 5, 2016 letter, based on the volumetric coverage that was obtained with acceptable results, the visual (VT-2) examinations that are routinely performed, and the additional surface (liquid penetrant) and volumetric (radiography) examinations, it is reasonable to conclude that no flaws exist in Weld 1-03A. The proposed alternative and the achieved coverage provide an acceptable level of quality and safety by providing reasonable assurance of structural integrity of the subject weld.

NRC RAI Question No. 4

The NRC staff notes that relief is requested from the PSI. Was the repair/replacement due to degradation of the welds? Explain the reasons for repair/replacements activities associated with these welds.

Dominion Response

The welds were reworked to replace the adjacent valve. There were no failures associated with the original welds.