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

May 10, 2016

Mr. Jon A. Franke
Site Vice President
Susquehanna Nuclear, LLC
769 Salem Boulevard
NUCSB3
Berwick, PA 18603-0467

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 - RELIEF REQUESTS FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (CAC NOS. MF6302, MF6303, MF6304, MF6305, MF6306, AND MF6307)

Dear Mr. Franke:

By letter dated May 28, 2015, as superseded by letter dated August 6, 2015, and supplemented by letter dated December 10, 2015 (Agencywide Documents Access and Management System Accession Nos. ML15148A774, ML15233A089, and ML15345A005, respectively), Susquehanna Nuclear, LLC (the licensee) submitted Relief Request Numbers 3RR-19, 3RR-20, and 3RR-21 to the U.S. Nuclear Regulatory Commission (NRC) for the third 10-year inservice inspection (ISI) interval of Susquehanna Steam Electric Station, Units 1 and 2 (SSES).

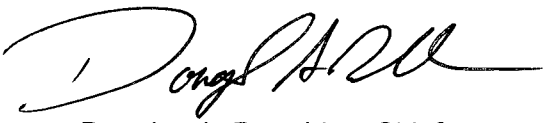
Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from certain reactor pressure vessel (RPV) and piping examination requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." The licensee requested relief from the requirements for ISI of specific RPV and piping welds on the basis that the ASME Code requirements are impractical.

The NRC staff has reviewed the subject requests and concludes, as set forth in the enclosed safety evaluation, that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the NRC staff grants Relief Request Number 3RR-19, Revision 1, for the SSES, third 10-year ISI interval. The NRC staff grants Relief Request Number 3RR-20, Revision 1, for the SSES, third 10-year ISI interval, and imposes the requirement that the licensee inspects weld DG-DH of SSES, Unit 1, during the SSES, Unit 1, Spring 2016 refueling outage. Additionally, the NRC staff grants Relief Request Number 3RR 21, Revision 1, for the SSES, third 10 year ISI interval. The NRC staff grants this relief for the duration of the third 10-year ISI interval at SSES which began on June 1, 2004, and ended on May 31, 2014.

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

If you have any questions, please contact the project manager, Ms. Tanya E. Hood, at Tanya.Hood@nrc.gov or 301-415-1387.

Sincerely,



Douglas A. Broaddus, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures:
Safety Evaluation

cc w/enclosures: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NUMBERS 3RR-19, 3RR-20, AND 3RR-21, REVISION 1

REGARDING WELD EXAMINATION COVERAGE

SUSQUEHANNA NUCLEAR, LLC

ALLEGHENY ELECTRIC COOPERATIVE, INC.

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-387 AND 50-388

1.0 INTRODUCTION

By letter dated May 28, 2015, as superseded by letter dated August 6, 2015, and supplemented by letter dated December 10, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML15148A774, ML15233A089, and ML15345A005, respectively), Susquehanna Nuclear, LLC (the licensee) submitted Relief Requests Numbers 3RR-19, 3RR-20, and 3RR-21 to the U.S. Nuclear Regulatory Commission (NRC) for the third 10-year inservice inspection (ISI) interval of the Susquehanna Steam Electric Station, Units 1 and 2 (SSES).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from certain reactor pressure vessel (RPV) and piping examination requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." The licensee requested relief from the requirements for ISI of specific RPV and piping welds on the basis that the ASME Code requirements are impractical.

2.0 REGULATORY EVALUATION

In its submissions, the licensee requests relief from various inservice inspection requirements contained in Section XI of the ASME Code.

- 10 CFR 50.55a(g)(4)(ii), which states, in part, inservice examination of components during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in paragraph (a) of Section 50.55a 12 months before the start of the 120-month inspection interval (or the optional ASME Code Cases listed in RG 1.147, Revision 17, when using Section XI, that are incorporated by reference in paragraphs (a)(3)(ii) and (iii) of 50.55a), subject to the

conditions listed in paragraph (b) of 50.55a. The code of record for SSES, for the third 10-year ISI interval, is the 2000 Addenda to the 1998 Edition of the ASME Code, Section XI.

- 10 CFR 50.55a(g)(5)(iii), which states:

> If the licensee has determined that conformance with a Code requirement is impractical for its facility the licensee must notify the NRC and submit, as specified in § 50.4, information to support the determinations. Determinations of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the Code requirements during the inservice inspection interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought.

- 10 CFR 50.55a(g)(6)(i), which states, in part, the Commission will evaluate determinations under paragraph (g)(5) of 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Based on the above, and subject to the technical evaluation in Section 3 below, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to grant the relief requested by the licensee and impose alternative requirements.

3.0 TECHNICAL EVALUATION

3.1 Relief Request Number 3RR-19, Revision 1, ASME Code, Section XI, Examination Category B-D, Item No. B3.90, Full Penetration Nozzles-to-Vessel Welds ASME Component Affected

ASME Code Component Identification

ASME Code Class:	1
Reference:	Table IWB-2500-1
Examination Category:	B-D
Item Number:	B3.90
Description:	Alternative Requirements to the Examination of Full Penetration Welds of Nozzles in Vessels
Component Number:	Ref. Tables 3RR-19.1 and 3RR-19.2 [of the August 6, 2015, submittal]

ASME Component Affected

Table 1: 3RR-19 Nozzle-to-Vessel Weld Components and Examination Coverage Achieved

ASME Code Examination Category, Item No.	Unit	Nozzle Identification	Component Description	Percent Examination Coverage Achieved
B-D, B3.90	1	N1A, B	Recirculation Suction Nozzle-to-Vessel Weld	84.5
B-D, B3.90	1	N2A, F	Recirculation Discharge Nozzle-to-Vessel Weld	86.3
B-D, B3.90	1	N3A through D	Main Steam Nozzle-to-Vessel Weld	74.1
B-D, B3.90	1	N4B, C, E, F	Feedwater Nozzle-to-Vessel Weld	80.5
B-D, B3.90	1	N4A	Feedwater Nozzle-to-Vessel Weld	79.3
B-D, B3.90	1	N4D	Feedwater Nozzle-to-Vessel Weld	75
B-D, B3.90	1	N6A, B	Head Spray and Spare Nozzle-to-Vessel Weld	77.1
B-D, B3.90	1	N7	Vent Nozzle-to-Vessel Weld	81.8
B-D, B3.90	1	N8A, B	Jet Pump Instrumentation Nozzle-to-Vessel Weld	78.8
B-D, B3.90	1	N9	Control Rod Drive (CRD) Hydraulic System Return	79.2
B-D, B3.90	2	N1A	Recirculation Suction Nozzle-to-Vessel Weld	80.2
B-D, B3.90	2	N1B	Recirculation Suction Nozzle-to-Vessel Weld	87.1
B-D, B3.90	2	N2A, F, K	Recirculation Discharge Nozzle-to-Vessel Weld	76.6
B-D, B3.90	2	N2J	Recirculation Discharge Nozzle-to-Vessel Weld	76.4
B-D, B3.90	2	N4A, D	Feedwater Nozzle-to-Vessel Weld	76.3
B-D, B3.90	2	N4B, C, E, F	Feedwater Nozzle-to-Vessel Weld	86.6
B-D, B3.90	2	N7	Vent Nozzle-to-Vessel Weld	82.1
B-D, B3.90	2	N8A, B	Jet Pump Instrumentation Nozzle-to-Vessel Weld	84.6
B-D, B3.90	2	N9	CRD Hydraulic System Return Nozzle-to-Vessel	84.6

ASME Code Requirements

The examination requirements of ASME Code, Section XI, Examination Category B-D, Item No. B3.90, are applicable for Relief Request Number 3RR-19. The applicable requirements are volumetric examinations of all RPV nozzle-to-vessel welds as defined by Figures IWB-2500-7(a) through IWB-2500-7(d) of the ASME Code, Section XI. When 100% of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," allows reduction of the examination volume to 90% of the required volume. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, Revision 17.

Impracticality of Compliance

The licensee stated that complete examination of the SSES Examination Category B-D nozzle-to-vessel welds is not practical due to the nozzle forging configuration. The licensee indicated that the radius of curvature of the nozzle forging (the nozzle side of the weld) causes the ultrasonic search unit to lift and lose contact, thereby limiting complete volumetric examination required by ASME Code, Section XI. The licensee stated that examination limitation affects both the transverse and parallel scans of those components listed in Table 3RR-19.1 and Table 3RR-19.2 of Attachment 2 of the licensee's August 6, 2015, submittal.

The licensee stated that the burden caused by compliance includes major modification of plant components to remove obstructions, redesigning of plant systems, and/or replacement of components where geometry is inherent to component design. Obstruction or interference removal as well as plant modification requires significant work that increases radiological dose received by personnel involved.

Licensee's Basis for Relief Request (as stated)

> Due to the limitations created by the configuration of the vessel nozzles, there are no means of [ASME Code] Appendix VIII qualified demonstrated ultrasonic inspection that may result in additional coverage.
>
> Examinations of two Feedwater nozzle-to-vessel welds - N4A and N4D - are further limited due to plant design obstructions. A spacing of approximately 4.5 inches between the N4 and the N11 nozzles restricts examination of an arc of approximately 45 degrees (12.5%) of the affected nozzle-to-vessel welds.
>
> Automatic examination of the Reactor Recirculation discharge nozzle-to-vessel weld N2J is limited due to plant design obstructions on Unit 2. The proximity of the N2J and N8D nozzles restricts examination of an arc of approximately 45 degrees (12.5%) of the affected nozzle-to-vessel welds.

Licensee's Requested Relief

The licensee stated that the examinations were performed to the maximum extent practicable in accordance with Appendix VIII of the ASME Code, Section XI. The proposed relief requested is

the maximum coverage achievable shown in Tables 3RR-19.1 and 3RR-19.2 of the licensee's August 6, 2015, submittal.

The licensee stated that the RPV pressure retaining welds are subject to VT-2 visual examination during system pressure testing in accordance with the requirements of Examination Category B-P. Online leakage monitoring for the subject welds is provided by the drywell floor drain sump monitoring system. The licensee stated that this system has technical specification (TS)-required monitoring (TS 3.4.4.1) every 12 hours. If leakage were to be detected beyond the limits identified in TS 3.4.4, the unit would be shut down, and any leakage would be identified and repaired.

NRC Staff Evaluation

The NRC staff has evaluated Relief Request Number 3RR-19 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff focused on whether a technical justification exists to support the determination that the ASME Code requirement is impractical, imposing the requirements could result a burden upon the facility, and the structural integrity or leak tightness of component is reasonably assured.

Impracticality of Compliance

As described and demonstrated in the licensee's August 6, 2015, submittal, Tables 3RR-19.1 and 3RR-19.2, and the sketches in Attachment 2 to Relief Request Number 3RR-19, the examination coverage of the ASME Code, Section XI, Category Examination Category B-D, Item No. B3.90, welds identified in Table 1 of this safety evaluation was limited due to scanning limitations caused by the radius of curvature of the nozzle forging. In each case, the radius of curvature of the nozzle forging (the nozzle side of the weld) causes the ultrasonic examination search unit to lift and lose contact, thereby limiting complete volumetric examination of the ASME Code-required volume. The nozzle-to-vessel welds of feedwater nozzles N4A and N4D are further limited by interferences with the N11 nozzles. The nozzle-to-vessel weld of reactor recirculation discharge nozzle N2J of SSES, Unit 2, is further limited due to interference with the N8B nozzle. The NRC staff confirms that the design configurations of these welds would limit the coverage of the examination volume. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100% coverage is impractical.

Burden of Compliance

Otaining the ASME Code-required examination volumes would require significant modification of the RPVs, which imposes a burden.

Examination Coverage Achieved

The licensee presented the achieved examination volumes, per NRC staff request, as shown in Table 1 for the subject welds. The examinations were performed with ultrasonic examination techniques that have been qualified in accordance with Supplements 4 and 6 of the ASME Code, Section XI, Appendix VIII, as implemented by the industry's Performance Demonstration

Initiative (PDI) program. The welds were examined to the maximum extent practical, primarily from the vessel side of the welds, scanning both parallel and perpendicular to the welds. The NRC staff confirmed the percentage coverages achieved and verified the scanning limitations by inspecting the diagrams provided by the licensee. The examination volumes included the weld and base materials near the inside surface of the weld joint, which are regions of high stress and where one would expect degradation to be manifested should it occur. The licensee stated that other means to achieve examination coverage of the ASME Code-required volume, such as smaller search units and full-vee path examinations, were considered but determined to be ineffective in improving the coverage.

In evaluating the licensee's request for relief, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. Ultrasonic scans were primarily limited to the vessel side. Inspections conducted through carbon steel are equally effective, whether the ultrasonic waves have only to propagate through the base metal or have to also propagate through the carbon steel weldment[1]. Therefore, it is expected that the ultrasonic examination techniques employed by the licensee on the RPV nozzle-to-vessel welds would detect structurally significant flaws that might occur on either side of the subject welds due to the fine-grained carbon steel microstructures present in these materials.

For the welds identified in Table 1, the licensee provided a schematic diagram depicting the isonification angles, ultrasonic weld modes, and volumetric coverage. These datasheets identify details of the ultrasonic testing (UT) scanning apparatus including transducer size, frequency, wave modality, and isonification angles. The licensee indicated that there is no other relevant internal or external operating experience regarding potential degradation mechanisms applicable to the subject welds. Based on the examination coverage achieved for the subject welds and NRC staff knowledge of RPV welds similar to the subject welds, if significant service-induced degradation were occurring, the staff concluded that there is reasonable assurance that evidence of degradation would be detected by the examinations.

Inspections

The NRC staff also found that in addition to the required volumetric examination, visual examination during system pressure testing in accordance with Examination Category B-P of Table IWB-2500-1, "Examination Categories," of Section XI of the ASME Code, are required to be performed. Despite reduced coverage of the required examination volume, the NRC staff finds that the licensee's supplemental and other inspections will provide additional assurance that any pattern of degradation, if it were to occur, would be detected.

The NRC staff also notes that if in an unlikely event these welds that are all located inside the primary containment developed a through wall flaw and a leak, the existing plant leakage monitoring system (e.g., drywell floor drain sump) will be able to identify the leakage during normal operation, and the licensee will be required to take appropriate corrective actions in

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[1] P.G. Heasler, and S. R. Doctor, 1996. *Piping Inspection Round Robin*, NUREG/CR-5068, PNNL-10475, U.S. Nuclear Regulatory Commission, Washington, DC.

accordance with the plant TSs.

Therefore, the NRC staff determined that obtaining the ASME Code-required examination volume is impractical because it would impose a burden upon the licensee. The staff also determined that the volumetric examinations performed to the maximum extent possible and VT-2 visual examination provide reasonable assurance of the structural integrity and leak tightness of the subject welds identified in Relief Request Number 3RR-19, Revision 1. In addition, the online leakage monitoring by the drywell floor drain sump monitoring system provide reasonable assurance of detection should a leak occur in the subject system.

3.2 Relief Request Number 3RR-20, Revision 1, ASME Code, Section XI, Examination Category B-A, Item Nos. B1.12 and B1.22, RPV Shell and Head Welds

ASME Code Component Identification

ASME Code Class: 1
Reference: Table IWB-2500-1
Examination Category: B-A
Item Numbers: B1.12, B1.22
Description: Alternative Requirements to the Examination of Pressure Retaining Welds in the Reactor Pressure Vessel
Component Number: Ref. Tables 3RR-20.1 and 3RR-20.2 [of the August 6, 2015, submittal]

ASME Code Components Affected

Table 2: 3RR-20 RPV Shell and Head Welds and Examination Coverage Achieved

ASME Code Examination Category, Item No.	Unit	Component Identification	Component Description	Percent Examination Coverage Achieved
B-A, B1.12	1	BK	Vessel Longitudinal Weld	76.7
B-A, B1.12	1	BM	Vessel Longitudinal Weld	76.3
B-A, B1.22	1	DA-DF	Bottom Head Meridional Weld	85.3
B-A, B1.22	1	DG-DH	Bottom Head Meridional Weld	7.7
B-A, B1.12	2	BK	Vessel Longitudinal Weld	72.1
B-A, B1.12	2	BM	Vessel Longitudinal Weld	70.6
B-A, B1.22	2	DA-DF	Bottom Head Meridional Weld	85.2
B-A, B1.22	2	DG-DH	Bottom Head Meridional Weld	23.7

ASME Code Requirements

The examination requirements of ASME Code, Section XI, Examination Category B-A, Item Nos. B1.12 and B1.22, are applicable for Relief Request Number 3RR-20. The requirements are volumetric examinations of the weld length for Item B1.12 and of the accessible weld length for item B1.22. When 100% of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460 allows reduction of the examination volume to 90% of the required volume. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, Revision 17.

Impracticality of Compliance

The licensee stated that the burden caused by compliance includes major modification of plant components to remove obstructions, redesign plant systems, and/or replace components where geometry is inherent to component design. Obstruction or interference removal as well as plant modification requires significant work that increases radiological dose received by personnel involved.

Licensee's Basis for Relief Request (as stated)

> Examinations of the affected welds were performed to the maximum extent practical.
>
> For item Number B1.12, longitudinal welds, the total examination coverage obtained is the maximum practical due to interference with permanent RPV mirror insulation support steel.
>
> For Item Number B1.22, meridional welds, the total examination coverage obtained is the maximum practical due to interference with the vessel support skirt and Control Rod Drive (CRD) obstructions.
>
> Modification or temporary removal of the RPV mirror insulation support steel, vessel support skirt, and CRD obstructions is a significant burden to achieve any additional examination coverage.

Licensee's Requested Relief

The licensee stated that the examinations were performed to the maximum extent practicable in accordance with Appendix VIII of the ASME Code, Section XI. The proposed relief requested is the maximum coverage achievable shown in Tables 3RR-20.1 and 3RR-20.2 of the licensee's August 6, 2015, submittal.

The licensee stated that the RPV pressure retaining welds are subject to VT-2 visual examination during system pressure testing in accordance with the requirements of Examination Category B-P. Online leakage monitoring for the subject welds is provided by the drywell floor drain sump monitoring system. The licensee stated that this system has TS-required monitoring

(TS 3.4.4.1) every 12 hours. If leakage were to be detected beyond the limits identified in TS 3.4.4, the unit would be shut down, and any leakage would be identified and repaired.

NRC Staff Evaluation

The NRC staff has evaluated Relief Request Number 3RR-20 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff focuses on whether a technical justification exists to support the determination that the ASME Code requirement is impractical, imposing the requirements could result a burden upon the facility, and the structural integrity or leak tightness of component is reasonably assured.

Impracticality of Compliance

As described and demonstrated in the licensee's August 6, 2015, submittal, Tables 3RR-20.1 and 3RR-20.2, and the sketches in Attachment 3 to Relief Request Number 3RR-20, the examination coverage of the ASME Code, Section XI, Category Examination Category B-A, Item Nos. B1.12 and B1.122, welds identified in Table 2 of this safety evaluation was limited due to scanning limitations caused by interference with permanent RPV mirror insulation support steel for Item No. B1.12 welds and interference with the vessel support skirt and control rod drive obstructions for Item No. B1.22 welds. The NRC staff confirms that the design configurations of these components would limit the coverage of the examination volume. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100% coverage is impractical.

Burden of Compliance

Obtaining the ASME Code-required examination volumes would require significant modification of the RPVs, which imposes a burden on the licensee.

Examination Coverage Achieved

The licensee presented the achieved examination volumes, per NRC staff request, as shown in Table 2 for the subject welds. The examinations were performed with ultrasonic examination techniques that have been qualified in accordance with Supplements 4 and 6 of the ASME Code, Section XI, Appendix VIII, as implemented by the industry's PDI program. The welds were examined to the maximum extent practical, from both sides of the welds, scanning both parallel and perpendicular to the welds. The NRC staff confirmed the percentage coverages achieved and verified the scanning limitations by inspecting the diagrams provided by the licensee. The examination volumes included the weld and base materials near the inside surface of the weld joint, which are regions of high stress, and where one would expect degradation to be manifested should it occur.

By letter dated November 13, 2015 (ADAMS Accession No. ML15316A563), the NRC staff issued a request for additional information, requesting the licensee to explain why the achieved examination coverage decreased from 23.7% to 7.7% for weld DG-DH of SSES, Unit 1, during the third 10-year ISI interval. By letter dated December 10, 2015 (ADAMS Accession No. ML15345A005), the licensee responded that it has not determined the cause of the discrepancy of achieved coverage of weld DG-DH between SSES, Unit 1 and Unit 2 (i.e., the drop in

Unit 1, during the third 10-year ISI interval. By letter dated December 10, 2015 (ADAMS Accession No. ML15345A005), the licensee responded that it has not determined the cause of the discrepancy of achieved coverage of weld DG-DH between SSES, Unit 1 and Unit 2 (i.e., the drop in achieved examination coverage of 23.7 percent to 7.7 percent), and that the discrepancy is entered into the licensee's corrective action program, which will provide the licensee an opportunity to perform an additional examination during the refueling outage in spring 2016. The staff finds this response acceptable and imposes, as a condition of approval of Relief Request Number 3RR-20, Revision 1, that the licensee perform the additional examination of weld DG-DH of SSES, Unit 1, during the refueling outage in spring 2016, as described in the response to the staff's request for additional information. The staff determined that the drop in 23.7 percent and 7.7 percent achieved examination coverage does not pose a degradation concern because any degradation in the additional unexamined region would be manifested in the examined regions of other welds in the RPV bottom head of SSES, Unit 1.

For the welds identified in Table 2, the licensee provided a schematic diagram depicting the isonification angles, ultrasonic weld modes, and volumetric coverage. These datasheets identify details of the UT scanning apparatus, including transducer size, frequency, wave modality, and isonification angles. The licensee indicated that there is no other relevant internal or external operating experience regarding potential degradation mechanisms applicable to the subject welds. Based on the examination coverage achieved for the subject welds and NRC staff knowledge of RPV welds similar to the subject welds, if significant service-induced degradation were occurring, the staff concluded that there is reasonable assurance that evidence of degradation would be detected by the examinations.

Inspections

The NRC staff also found that, in addition to the required volumetric examination, VT-2 visual examination during system pressure testing in accordance with Examination Category B-P of Table IWB-2500-1 of Section XI of the ASME Code is required to be performed. Despite reduced coverage of the required examination volume, the NRC staff finds that the licensee's supplemental and other inspections will provide additional assurance that any pattern of degradation, if it were to occur, would be detected.

The NRC staff also notes that if in an unlikely event the existing plant leakage monitoring system (e.g., drywell floor drain sump) will be able to identify the leakage during normal operation, the licensee will be required to take appropriate corrective actions in accordance with the plant TSs.

Therefore, the staff determined that obtaining the ASME Code-required examination volume is impractical because it would impose a burden upon the licensee. The staff also determined that the volumetric examinations performed to the maximum extent possible, and VT-2 visual examination, provide reasonable assurance of the structural integrity and leak tightness of the subject welds identified in Relief Request Number 3RR-20, Revision 1. In addition, the online leakage monitoring by the drywell floor drain sump monitoring system provides reasonable assurance of detection, should a leak occur in the subject system.

Background

By letter dated July 28, 2005 (ADAMS Accession No. ML051990330), the NRC-approved implementation of the risk-informed inservice inspection (RI-ISI) program for the Class 1 piping welds (Examination Categories B-F and B-J) and the Class 2 piping welds (Examination Categories C-F-I and C-F-2) in the third 10-year ISI interval of SSES. The licensee developed the RI-ISI program in accordance with the NRC-approved methodology of the Electric Power Research Institute (EPRI) Topical Report (TR)-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure" (ADAMS Accession No. ML013470102).

ASME Code Component Identification

ASME Code Class: 1
Reference: 3RR-01
Examination Category: N/A
Item Number: RI.11, RI.20
Description: Alternative Requirements to the Examination of
Component Number: Ref. Tables 3RR-21.I and 3RR-21.2 [of the August 6, 2015, submittal]

ASME Component Affected

Table 3: 3RR-21 Components Subject to the Risk-Informed Inspection Program and Various Augmented Inspection Programs and Examination Coverage Achieved

Component Identification, Item No.	Unit	Exam Requirement	Configuration/ System	Percent Examination Coverage Achieved
DCA1081-I-A, R1.11	1	Risk Informed ISI/IGSCC Category B	Pipe to Elbow/Residual Heat Removal	75
DCA1081-FW-3, R1.11	1	Risk Informed ISI/IGSCC Category B	Elbow to Valve/Residual Heat Removal	75
DCA1101-FW-8, R1.11	1	Risk Informed ISI/IGSCC Category B	Elbow to Valve/Residual Heat Removal	75
DCA1101-FW-9, R1.11	1	Risk Informed ISI/IGSCC Category B	Pipe to Valve/Residual Heat Removal	56.8
DCA1101-FW-10, R1.11	1	Risk Informed ISI/IGSCC Category B	Pipe to Valve/Residual Heat Removal	75

Component Identification, Item No.	Unit	Exam Requirement	Configuration/ System	Percent Examination Coverage Achieved
DCA1102-FW-8, R1.11	1	Risk Informed ISI/IGSCC Category B	Elbow to Valve/Residual Heat Removal	75
DCA1102-FW-9, R1.11	1	Risk Informed ISI/IGSCC Category B	Valve to Pipe/Residual Heat Removal	60.7
DCA1102-FW-10, R1.11	1	Risk Informed ISI/IGSCC Category B	Pipe to Valve/Residual Heat Removal	59.7
VRRB311-FW-A14M, R1.20	1	Risk Informed ISI	Pipe to Pipe/Reactor Recirculation	75
DCA2071-FW-4, R1.11	2	Risk Informed ISI	Valve to Elbow/Core Spray	75
DCA2071-FW-5, R1.11	2	Risk Informed ISI	Reducer to Safe End/Core Spray	100
DCA2081-1-A, R1.11	2	Risk Informed ISI/IGSCC Category B	Elbow to Pipe/Residual Heat Removal	100
DCA2101-FW-8, R1.11	2	Risk Informed ISI/IGSCC Category B	Elbow to Valve/Residual Heat Removal	72.5
DCA2101-FW-10, R1.11	2	Risk Informed ISI/IGSCC Category B	Pipe to Valve/Residual Heat Removal	75
DCA2102-FW-7, R1.11	2	Risk Informed ISI/IGSCC Category B	Elbow to Valve/Residual Heat Removal	73.9
DCA2102-FW-8, R1.11	2	Risk Informed ISI/IGSCC Category B	Valve to Pipe/Residual Heat Removal	70.8
DCA2102-FW-9, R1.20	2	Risk Informed ISI/IGSCC Category B	Pipe to Valve/Residual Heat Removal	75

ASME Code Requirement

The ASME Code requirements appliecable to this request originate in ASME Code, Section XI, Table IWA 2500-1. These requirements were modified in accordance with EPRI TR-112657, Revision B-A, Table 1. In accordance with ASME Code Case N-578-1, which implements the EPRI methodogy, the subject welds are classified as Item Nos. R1.11 and R1.20. The use, and results, of applying this methodology were authorized by the NRC staff in a safety evaluation dated July 28, 2005 (ADAMS Accession No. ML051990330). In both the original ASME Code

requirement and as authorized by the NRC safety evaluation, the subject welds must be volumetrically examined once every 10 year ISI interval and the volumetric examination must achieve essentially 100% coverage. When 100% of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME code case N-460 establishes that the term "essentially 100% coverage" is satisfied by coverage of not less than 90%. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, Revision 17.

Impracticality of Compliance

The licensee stated that it was not possible to obtain greater than 90% of the ASME Code-required examination volume due to limitations such as the weld or component configuration and geometry, interference by other component, and metallurgical constraints. In Tables 3RR-21.1 and 3RR-21.2 of Attachment 4 of the licensee's August 6, 2015, submittal, the licensee identified and described these limitations for each weld (i.e., single-sided access to the weld due to the valve or sweep-o-let configuration or interference from hanger, and limited double-sided access to the weld due to interference from a support collar or an eccentric reducer). The coverage credited is limited up to the weld centerline when access can only be available from one side of the weld.

The licensee stated that the burden caused by compliance includes major modification of plant components to remove obstructions, redesign plant systems, and/or replace components where geometry is inherent to component design. Obstruction or interference removal, as well as plant modification, requires significant work that increases radiological dose received by personnel involved.

Licensee's Bases for Relief Request

The licensee stated that it performed the UT to the maximum extent possible utilizing personnel qualified and procedures demonstrated in accordance with Supplement 2, "Qualification Requirements for Wrought Austenitic Piping Welds," of Appendix VIII to the 1998 Edition through 2000 Addenda of the ASME Code, Section XI. In Tables 3RR-21.1 and 3RR-21.2 of Attachment 4 of the licensee's August 6, 2015, submittal, the licensee provided for each weld the percentage of coverage obtained by the UT. For the welds with single-sided access, the licensee extended the beam path (60 degree refracted longitudinal (L)-waves) into the far side of the weld centerline to examine, to the extent practical, the other side of the weld as a "Best Effort" examination. The licensee also provided the percentage of coverage for the "Best Effort" examinations. However, the licensee did not claim credit for any coverage obtained past the weld centerline ("Best Effort" examination) in a single-sided examination since access for scanning was not available from the other side of the weld. The licensee did not find any unacceptable indications in the subject welds in the examination volumes covered by the UT during the third 10-year ISI intervals.

The licensee determined that use of the radiographic testing (RT) was impractical due to impact of increased radiation dose from RT on personnel working in the surrounding work area. Draining of affected piping for preparation for radiography results in an additional dose rate in the surrounding areas.

The licensee stated that there is no applicable plant-specific operating experience regarding service-induced degradation of the subject welds and associated components because evidence of such degradation would have been detected by the examinations that were performed. There has been no operating experience regarding potential severe loading for the subject welds.

The licensee stated that no relevant indications were identified during both preservice inspection (PSI) and previous 10-year ISI intervals. In Tables 3RR-21.1 and 3RR-21.2 of Attachment 4 of the licensee's August 6, 2015, submittal, the licensee provided a summary of the PSI and previous ISI results.

The licensee stated that it has performed the VT-2 visual examinations during the required system leakage testing in accordance with the requirements of Examination Category B-P in Table IWB-2500-1. Routine walked-downs have also been performed by operators and system engineers for the piping that is external to primary containment to identify any system anomalies that could affect plant performance. The VT-2 visual examinations, online leakage monitoring systems (e.g., drywell floor drain sump) in the plant, and routine walked-downs provide additional assurance that evidence of a through wall flaw would be detected.

Licensee's Requested Relief

The licensee reported for each weld percentage of the examination coverage achieved by the UT in the examination performed. The licensee proposed to use this alternative coverage to satisfy the ASME Code requirement (essentially 100% coverage of the required examination volume).

3.4 NRC Staff Evaluation

The NRC staff has evaluated Relief Request Number 3RR-21 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff focuses on whether a technical justification exists to support the determination that the ASME Code requirement is impractical, imposing the requirements could result a burden upon the facility, and the structural integrity or leak tightness of component is reasonably assured.

Impracticality of Compliance

As described and demonstrated in the licensee's August 6, 2015, submittal, Tables 3RR-21.1 and 3RR-21.2, and the sketches in Attachment 4 to 3RR-21, the predominant limitations that prevented the licensee's UT to achieve essentially 100% coverage of the ASME Code-required volume were the valve or sweep-o-let configuration or a hanger interference that restricted access to only one side of the welds (single-sided access only), and interference from a support collar or an eccentric reducer configuration that created some limitations to fully access both sides of the welds. The licensee performed the UT from both sides if the weld was accessible for scanning from both sides. For the weld with single-sided access only, the licensee performed the UT from one side of the weld. The NRC staff confirms that the design configurations of these welds would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff

finds that a technical justification exists to support the determination that achieving essentially 100% coverage is impractical.

Burden of Compliance

The licensee proposed that making the welds accessible for inspection from both sides would require replacement or significant design modification to the pipe and associated components. The NRC staff finds that replacing or reconfiguring the components of these welds is the only reasonable means to achieve dual-sided coverage of these welds and that replacement or reconfiguration of the pipe and associated components constitutes a burden on the licensee.

Examination Coverage Achieved

In evaluating the licensee's request for relief, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From review of Tables 3RR-21.1 and 3RR-21.2 and the sketches in Attachment 4 of the licensee's August 6, 2015, submittal, the NRC staff confirms the maximum examination coverage achieved for each weld (i.e., percentage of the required examination volume covered by the UT using applicable ultrasonic modes of propagation and probe angles). The coverage obtained for each weld represents the aggregate coverage of the required UT performed (axial and circumferential directions combined). The licensee performed the UT with the personnel qualified and the procedures developed and demonstrated in accordance with Supplement 2 of Appendix VIII to the ASME Code, Section XI, under the PDI program. In the volume examined by the ASME Code-required UT, the licensee did not identify any unacceptable indications in any of the welds. The NRC staff confirms that the physical access, the design configuration, or the material type would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff found that the licensee made every effort to obtain as much coverage as reasonably possible with the ASME Code-required UT.

Safety Significance of Unexamined Volumes - Unachievable Coverage

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of welds - unachievable coverage. From review of Tables 3RR-21.1 and 3RR-21.2 and the sketches in Attachment 4 of the licensee's August 6, 2015, submittal, the NRC staff verified that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and the heat affected zone (HAZ) of the base material near the identified surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. The NRC staff notes that the coverage obtained for axial scans was limited to the volume up to the weld centerline (near-side), because claiming coverage for the volume on the opposite side of the weld centerline (far-side) requires meeting the 10 CFR 50.55a(b)(2)(xv)(A)(2) far-side UT qualifications, which has not been demonstrated in any qualification attempts to date. As an extra effort to interrogate the examination volume on the far-side in a single-sided examination, the licensee conducted a supplemental UT using the refracted longitudinal (L)-waves as a "Best Effort" examination, which is not included in the aggregate coverage. The L-waves have shown to have better penetration capability in the cast and austenitic stainless steel materials. In the volume examined by the supplemental UT, the

licensee did not identify any unacceptable indications in any of the welds. Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT, the supplemental "Best Effort" examinations, and the examination of the weld root and its HAZ to the extent possible, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

In performing this analysis, the NRC staff noted that the piping and welds under consideration are made of stainless steel, their inspections are governed by the SSES RI-ISI program, and they could be subject to degradation by thermal fatigue and intergranular stress-corrosion cracking (IGSCC). However, thermal fatigue cracking is known to be initiated as many small cracks; therefore, the proposed coverage is adequate to detect the presence of cracks. For managing IGSCC, the licensee has continued implementing the augmented program in accordance with Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," and NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping" (as stated in the relief request dated September 16, 2003 (ADAMS Accession No. ML032670839)). Therefore, the NRC staff finds that significant service-induced degradation would likely be detected by the volume covered.

Inspections

The NRC staff also found that in addition to the required volumetric examinations, these welds have received the required system leakage test in accordance with Examination Category B-P of Table IWB-2500-1, "Examination Categories," of Section XI of the ASME Code that are required to be performed. Despite reduced coverage of the required examination volume, the NRC staff finds that the licensee's supplemental and other inspections will provide additional assurance that any pattern of degradation, if it were to occur, would be detected, and the licensee will be required to take appropriate corrective actions.

The NRC staff also notes that if in an unlikely event these welds, that are all located inside the primary containment, developed a through wall flaw and a leak, the existing plant leakage monitoring system (e.g., drywell floor drain sump) will be able to identify the leakage during normal operation, and the licensee will be required to take appropriate corrective actions in accordance with the plant TSs.

Therefore, the NRC staff finds that the volumetric examinations performed to the extent possible and accompanied by other examinations (visual and/or augmented) provide a reasonable assurance of structural integrity and leak tightness of the subject welds. Compliance with the ASME Code requirements for these welds would be a burden on the licensee.

4.0 CONCLUSION

As set forth above, the NRC staff determines that it is impractical for the licensee to comply with the ASME Code, Section XI, requirements; that the proposed inspections provide reasonable

assurance of structural integrity or leak tightness of the subject welds; and that granting relief pursuant to 10 FR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i).

Therefore, the NRC staff grants Relief Request Number 3RR-19, Revision 1, for the SSES third 10-year ISI interval. The NRC staff grants Relief Request Number 3RR-20, Revision 1, for the SSES, third 10-year ISI interval, and imposes the requirement that the licensee inspects weld DG-DH of SSES, Unit 1, during the SSES, Unit 1, spring 2016 refueling outage. Additionally, the NRC staff grants Relief Request Number 3RR-21, Revision 1, for the SSES third 10-year ISI interval. The NRC staff grants this relief for the duration of the third 10-year ISI interval at SSES which began on June 1, 2004, and ended on May 31, 2014.

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

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Date: May 10, 2016

If you have any questions, please contact the project manager, Ms. Tanya E. Hood, at Tanya.Hood@nrc.gov or 301-415-1387.

Sincerely,

/RA/

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Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

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