UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001
June 29, 2009

Mr. Mark J. Ajluni
Manager, Nuclear Licensing
Southern Nuclear Operating Company, Inc
40 Inverness Center Parkway
Birmingham, Alabama 35201

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2, EVALUATION OF THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUESTS FOR RELIEF (TAC NOS. MD9742, MD9744, MD9745, MD9746, MD9747, MD9748, MD9749, MD9750, AND MD9751)

Dear Mr. Ajluni:

By letter to the U.S. Nuclear Regulatory Commission (NRC, the Commission), dated September 22, 2008, as supplemented on April 24, 2009, Southern Nuclear Operating Company, Inc. (SNC, the licensee) submitted Relief Requests (RRs) RR-62, RR-64, RR-65, RR-66, RR-67, RR-68 and RR-69 for Joseph M. Farley Nuclear Plant (FNP) Unit 1 and RR-61 and RR-62 for FNP Unit 2, from certain requirements of Section XI of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), under the provisions of *Title 10 of the Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a.

Based on a review of SNC's submittals, the NRC staff finds that the ASME Code examination coverage requirements are impractical for the welds in RR-62, RR-64, RR-65, RR-66 (two welds as discussed in the Enclosure), RR-67, and RR-69 for FNP, Unit 1, and RR-61 and RR-62 for FNP, Unit 2, and that the examinations performed to the extent practical provided reasonable assurance of structural integrity. Granting relief pursuant to 10 CFR 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.

Sincerely,

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

Docket Nos. 50-348 and 50-364

Enclosure: Safety Evaluation

cc w/encls: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF (RR)

ON THE THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2

SOUTHERN NUCLEAR OPERATING COMPANY

DOCKET NO. 50-348 AND 50-364

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC, the Commission, dated September 22, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082670627), as supplemented by letter dated April 24, 2009 (ADAMS Accession No. ML091170252), Southern Nuclear Operating Company, (SNC, the licensee), submitted requests for relief from certain examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) at Joseph M. Farley Nuclear Plant (FNP), for piping welds listed in Relief Request (RR) RR-62, RR-64, RR-65, RR-67, and RR-69 for Unit 1 and in RR-61 and RR-62 for Unit 2, and reactor vessel welds in RR-66 for Unit 1 and reactor vessel head welds in RR-68, for Unit 1. Of the welds in RR-66 and RR-68, only reactor vessel welds ALA1-1100-1, ALA1-1100-8 in RR-66 require the granting of relief, as discussed in the following sections. Specifically, the requests for relief were for less than ASME Code inservice inspection (ISI) coverage requirements. The request is for the third 10-year interval ISI which began December 1, 1997 for FNP Unit 1, and July 31, 2001, for FNP Unit 2.

2.0 REGULATORY REQUIREMENTS

The ISI of ASME Code Class 1, 2, and 3, components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, as required by Title 10 of the Code of Federal Regulations (10 CFR) 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3, components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the

components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, which was incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for FNP Units 1 and 2, third 10-year interval ISI programs, is the 1989 Edition, with no Addenda, of Section XI of the ASME Code.

3.0 EVALUATION

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

3.1 Piping Welds

For clarity, the request has been evaluated in several parts according to ASME Code Examination Category.

3.1.1 Requests for Relief RR-64 and RR-67 Unit1, Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume(s) for the piping welds listed in Table 3.1.1 below.

Table 3.1.1 – Examination Category B-J Examinations

Component Number	Description	Coverage Obtained
ALA1-4202-3	6" Elbow to Pipe	75%
ALA1-4202-4	6" Elbow to Pipe	50%
ALA1-4202-5	6" Elbow to Pipe	50%
ALA1-4204-4	6" Elbow to Pipe	48%
ALA1-4204-5	6" Elbow to Pipe	50%
ALA1-4103-4	Valve to Pipe	90%

ASME Code Requirement: Examination Category B-J, Item B9.11, requires essentially 100% surface and volumetric examination, as defined by Figure IWB-2500-8, of the length of selected Class 1 circumferential welds in piping systems. "Essentially 100%", as clarified by ASME Code Case N-460 (N-460), *Alternative Examination Coverage for Class 1 and Class 2 Welds*, is greater than 90% coverage of the examination volume, or surface area, as applicable. N-460 has been approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 15, *Inservice Inspection Code Case Acceptability*.

Licensee's Basis for Relief Request (as stated):

> Physical limitations due to geometric configuration of the welded areas restricted coverage of the examination volume as required by Figures IWB2500-8(c). The examinations were performed to the maximum extent possible. Appreciably

increasing coverage was impractical due to the limitations described. A surface examination (liquid penetrant technique) was performed on these welds. The ultrasonic examinations were performed after the implementation of Appendix VIII, except for weld ALA1-4103-4, which was examined to the requirements of Section XI Appendix III, and consisted of primarily a single-sided examination from the pipe side of the weld. The root of the weld was interrogated with both a 45° shear wave and a 60° refracted longitudinal wave looking for circumferential cracking. In addition, VT-2 visual examinations associated with the Class 1 leakage test are performed each refueling outage for the welds listed in the licensee's Table[1] RR-64-1 and each ISI period for the welds listed in the licensee's Table[1] RR-64-2.

Licensee's Alternative Examination: No alternative examinations were proposed.

Evaluation: The ASME Code requires 100% coverage for the volumetric and surface examination of selected Class 1 circumferential piping welds. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining circumferential welds. However, the austenitic stainless steel materials and design configurations of the subject welded components limit ultrasonic scanning to a single side. In order to effectively increase the examination coverage, the pipe-to-elbow/valve configurations would require design modifications or replacement. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical.

The welds listed in Table 3.1.1 are pipe-to-elbow or valve-to-pipe circumferential butt welds in 6-inch outside diameter (OD) nominal pipe size (NPS) piping. These welds join austenitic stainless steel piping components to elbows or valves, where the OD surface of the elbow/valve prevents performing full ultrasonic scans from the elbow/valve side. In addition, most of the weld crowns are also OD-tapered or have weld build-up that restricts scanning the weld by placing a transducer directly over the crown area. These geometric conditions limit examinations to only the piping component side of the welds.

As shown on the sketches and technical descriptions[2] included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical with aggregate volumetric coverage ranging from 48% to 75% of the ASME Code-required volumes (see Table 3.1.1 above). The ultrasonic examinations included 45 degree shear-wave (S-wave) and 60 degree refracted longitudinal-waves (L-wave) from the pipe side of the welds. The ultrasonic examinations performed were qualified to the performance demonstration requirements of ASME Code, Section XI, Appendix VIII. The licensee has not credited coverage of the weld for the far-side (inspection through the weld material) because the inspection procedure is only considered a "best effort" for detection of far-side flaws in austenitic welds. However, refracted L-waves are capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[3,4] recommend the use of both S- and L-waves to

---

1 The licensee's tables are not included in this report.

2 Sketches and technical descriptions provided by the licensee are not included in this report.

3 Ammirato, F.V., X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

obtain the best detection results, with minimum false calls, in austenitic welds. The licensee completed the ASME Code-required surface examinations on the subject welds with no limitations. No recordable indications were observed during the ultrasonic and surface examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject piping welds due to OD surface configurations. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of both ultrasonic S- and L-wave methods to maximize this coverage, it is reasonable for the NRC staff to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.1.2 Request for Relief RR-65 Unit 1, Examination Category R-A, Dissimilar Metal Piping Welds Governed by A Risk-Informed Program, Item R1.15, Welds Subject to Primary Water Stress Corrosion Cracking (PWSCC)

Licensee's ASME Code RR: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage for Class 1 dissimilar metal piping welds ALA1-4300-26RDM-RI and ALA1-4300-27RDM-RI.

ASME Code Requirement: The examination requirements for the subject dissimilar metal piping welds are governed by a Risk-Informed Inservice Inspection (RI-ISI) program that was approved by the NRC in a safety evaluation (SE) dated March 9, 2004, (ADAMS Accession No. ML040700258). The RI-ISI program was developed in accordance with WCAP-14572, Rev. 1-NP-A, *Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report* (WCAP). As part of the NRC-approved program, the licensee has implemented inspection requirements listed in ASME Code Case N-577 (N-577), *Risk-Informed Requirements for Class 1, 2 and 3 Piping, Method A*, with more detailed provisions contained in the WCAP. The topical report includes a provision for requesting relief from volumetric examinations if 100% of the required volumes cannot be examined.

Table 1 of N-577 assigns the Examination Category R-A, Item R1.15, to dissimilar metal welds in piping inspection elements subject to PWSCC. This table requires only 100% visual, VT-2 examination of each dissimilar metal weld during each refueling outage. However, as part of the RI-ISI program at FNP, Unit 1, the licensee committed to perform 100% volumetric examination of all dissimilar metal welds on the primary coolant system during each 10-year inspection interval. This commitment was made in a November 24, 2003, response (ADAMS Accession No. ML033320218) to an NRC Request for Additional Information. N-460, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable

---

[4] Lemaitre, P., T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

provided that the reduction is less than 10%, i.e., greater than 90%, examination coverage is obtained.

Licensee Basis for Relief (as stated):

> Physical limitations due to the geometric configuration of the welded areas restricted coverage of the examination volume as required by Figure IWB-2500-8(c). The ultrasonic examinations were performed to Appendix VIII and consisted of primarily a single-sided examination from the safe-end side of the weld. The ultrasonic examination was also performed from the nozzle side to the extent possible. In addition, VT-2 visual examinations are performed for each refueling outage for these components. These welds are Alloy 690 material which was added to the plant during steam generator replacement (1 R16 Outage in Spring 2000).

Licensee's Proposed Alternative Examination: No alternative examinations were proposed.

Evaluation: The examination requirements for the subject piping welds are governed by a RI-ISI program that was approved by the NRC in an SE dated March 9, 2004. This program assigns Examination Category R-A, Item R1.15, to dissimilar metal piping elements subject to PWSCC, and a commitment within the program requires inspection of 100% of the examination location volumes for all dissimilar metal welds on the primary coolant system during each 10-year inspection interval. However, OD tapers on the safe end side of Welds ALA1-4300-26RDM-RI and ALA1-4300-27RDM-RI limit the required volumetric examinations. In order to meet the RI-ISI program coverage requirements, these components would have to be re-designed and modified. Therefore, 100% coverage for volumetric examinations is considered impractical for the subject dissimilar metal piping welds.

Welds ALA1-4300-26RDM-RI and ALA1-4300-27RDM-RI are Class 1 dissimilar metal welds joining a replacement steam generator to the primary coolant system. The welds consist of a carbon steel nozzle, buttered with Alloy 52/152, and welded with Alloy 52/152 to a stainless steel safe end. Alloy 52/152 is believed more resistant to PWSCC than the original materials used for these dissimilar metal welds. The steam generator carbon steel nozzles are thicker than the primary coolant system piping; therefore, an OD axial transition (or taper) occurs on the safe end to accommodate this change in thickness. For inspections from the OD surface, this taper must be taken into account (1) to apply ultrasonic energy at the proper angle of impact with the ID surface for detection of PWSCC, and (2) to ensure that adequate coverage of the required volume of material is being obtained.

The licensee used procedures, personnel, and equipment that meet the requirements of ASME Code, Section XI, Appendix VIII, for performance demonstration, as qualified through the industry's Performance Demonstration Initiative (PDI). In addition to the PDI qualification, the licensee also performed a site-specific demonstration on a mock-up built to represent the replacement steam generator dissimilar metal welds. This mock-up included an 11 degree taper on the safe end, and the licensee consulted the Electric Power Research Institute to assist in modeling the volumetric coverage with modified probes to account for this taper. Based on the site demonstration, it was

determined that 100% of the required inspection volume would be scanned with refracted longitudinal waves at 45 and 56 degrees to the ID surface.

However, during the examination of the subject welds, it was determined that OD surfaces of these replacement welds contain two axially-adjacent tapers in the ultrasonic scanning area on the safe end side of the welds. The second taper caused a limitation to the applied ultrasonic sound fields such that only approximately 52% of the examination volume could be completed for axial scans (scans looking for circumferential flaws). The licensee was able to complete 100% of the required volume for circumferential scans (scans looking for axial flaws).

As shown in the licensee's drawings and technical descriptions[5] included in the submittal, examinations of the subject dissimilar metal welds have been completed to the extent practical with the currently demonstrated ultrasonic procedures and methods. The as-built configuration of these welds, including a second taper region, limits the currently qualified examination of the welds for detection of circumferentially-oriented flaws to approximately 52% of the required inspection volume. However, based on the volumetric coverage obtained, including 100% coverage for axially-oriented flaws, and considering the PWSCC-resistant Alloy 52/152 materials used in the dissimilar metal welds, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would be have been detected by the examination that was performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

The NRC staff notes that the licensee is planning on re-evaluating the current ultrasonic procedures, with respect to volumetric coverage, based on results from other similar applications that are currently underway within the industry. The licensee stated:

> [The licensee] continues to evaluate the use of advanced ultrasonic techniques (e.g., phased array automated examinations) for these welds due to the multi-tapered surface. Another utility and a vendor are utilizing phased array to try to increase coverage on this type of configuration during the spring 2009 outage season. SNC will perform a detailed evaluation of the Farley configuration if this work is successful. Note: Some limitations may still exist due to the tapered surfaces.

It is incumbent on the licensee to modify procedures and techniques to establish ultrasonic methods that will provide for continued reliable inspections on primary system components, specifically, those that have been replaced with new welds. Therefore, it is anticipated that the licensee will apply any new technology that results from this evaluation, and perform further site-specific demonstration. Mock-up(s) used to develop UT techniques should have configurations similar to the as-built dissimilar metal welds being inspected at FNP, Units 1 and 2.

---

[5] The licensee's drawings and technical descriptions are not included in this report.

3.1.3 Request for Relief RR-62 FNP Units 1 and 2, Examination Category R-A, Austenitic Piping Welds Governed by A Risk-Informed Program, Item R1.11, Welds Subject to Thermal Fatigue

Licensee's ASME Code RR: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the volumetric examination coverage requirements contained for the Class 2 piping welds shown in Table 3.3.1 below.

Table 3.3.1 – Examination Category R-A, Item R1.11, Austenitic Piping Welds

Component Number	Unit	Weld Description	Coverage Obtained
ALA2-4540-32-RI	1	Valve to Pipe	50%
APR2-4503-23-RI	2	Flange to Pipe	50%
APR2-4503-34-RI	2	Flange to Pipe	50%
APR2-4509A-33-RI	2	Valve to Pipe	50%
APR2-4509A-36-RI	2	Valve to Pipe	50%
APR2-4511-2-RI	2	Valve to Pipe	50%

ASME Code Requirement: The examination requirements for the subject piping welds are governed by a RI-ISI program that was approved by the NRC in a safety evaluation dated March 9, 2004 (ADAMS Accession No. ML040700258). The RI-ISI program was developed in accordance with WCAP-14572, Rev. 1-NP-A. As part of the NRC-approved program, the licensee has implemented inspection requirements listed in N-577 with more detailed provisions contained in the WCAP. The topical report includes a provision for requesting relief from volumetric examinations if 100% of the required volumes cannot be examined.

Table 1 of N-577 assigns the Examination Category R-A, Item R1.11, to piping inspection elements subject to thermal fatigue cracking. This table requires 100% of the examination location volume, as described in Figures IWB-2500-7, 8, 9, 10, or 11, as applicable, be completed for selected Class 1 circumferential piping welds. N-460, is an alternative approved for use by the NRC in RG 1.147, Revision 15, which states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld, is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

Licensee Basis for Relief (as stated):

> Physical limitations due to the geometric configuration of the welded areas restricted coverage of the examination volume as required by Figure IWC-25007(a). The Class 2 weld with limitations is described in Table RR-62[6]. The examinations were performed to the maximum extent possible. Table RR-62[6] shows a typical representation of a single-side access examination with a valve, along with limitations. Appreciably increasing coverage was impractical due to the limitations described in the table.

[6] The licensee's tables and figures are not included in this report.

Licensee's Alternative Examination: No alternative examinations were proposed.

Evaluation: The examination requirements for the subject piping welds at FNP, Unit 2, are governed by a RI-ISI program that was approved by the NRC in an safety evaluation report dated March 9, 2004. This program assigns Examination Category R-A, Item R1.11, to piping elements subject to thermal fatigue, and requires inspection of 100% of the examination location volume for selected circumferential piping welds. The volumetric examination must be applied from both sides of the weld to maximize coverage. However, volumetric examinations are limited by the pipe-to-valve/flange geometries of the welds, which restrict scanning to the pipe side only. To gain access for examination, the welds would require design modifications. Imposition of this requirement would create a significant burden on the licensee; therefore, the ASME Code-required 100% volumetric examination from both sides of the welds is impractical.

As shown on the sketches and technical descriptions[7] included in the licensee's submittal, access for examination of the subject welds is limited to the pipe side only due to the cast material of the valves, and limited scan regions caused by the valve-to-pipe, or flange-to-pipe, weld configurations. The ultrasonic methods employed for these welds have been qualified through the industry's PDI, which meets ASME Code, Appendix VIII, requirements. These methods have been qualified for flaws located on the near-side of austenitic welds; far-side detection of flaws is considered to be a "best effort." For this reason, the licensee has taken credit for completing only 50% coverage of the ASME Code-required inspection volume on the subject piping weld.

The licensee's ultrasonic techniques included 45 degree and 70 degree S-waves for piping wall thicknesses less than ½-inch, and 45 degree S- and refracted L-waves – angle dependent on weld configuration) for piping greater than ½-inch thickness. These techniques have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds[8,9]. While the licensee has only taken credit for obtaining 50% volumetric coverage, the techniques applied would have provided coverage beyond the near-side of the welds. A review of the typical weld cross-sectional information[10] indicates that limited volumetric coverage on the far-side of the subject piping welds has been obtained by the licensee. No service-induced defects have been identified in these welds.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject piping welds due to their design and ultrasonic access restrictions. Although the ASME Code-required coverage could not be obtained, the ultrasonic techniques employed would have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the inner

---

7 Skethces and technical descriptions provided by the licensee are not included in this report.

8 Ammirato, F.V., X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

9 Lemaitre, P., T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

10 Cross-sectional data is not included in this report.

weld fusion zone and base materials on the opposite side of the welds. Based on the aggregate coverage obtained for the subject welds, and considering the licensee's performance of ultrasonic techniques used to maximize this coverage, it is reasonable for the NRC staff to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.1.4 Request for Relief 69 Unit 1, Examination Category C-F-2, Item C5.81, Pressure Retaining Welds in Carbon or Low Alloy Steel Piping,

Licensee's ASME Code RR: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% surface examination for Class 2 ferritic piping branch connection Weld ALA2-4101-12BC on the main steam line.

ASME Code Requirement: Examination Category C-F-2, Item C5.81 requires 100% surface examination, as defined by Figure IWC-2500-9, of the length of selected carbon or low alloy steel piping branch welds greater than 2-inch NPS. N-460 is an alternative approved for use by the NRC in RG 1.147 which states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90%, examination coverage is obtained.

Licensee's Basis for RR (as stated):

> Physical limitations due to the close proximity of a welded support prevented full examination coverage of the weld as required by Figure IWC-2500-9. The examination was performed to the maximum extent possible. A surface examination (magnetic particle technique) was performed on this weld. In addition, VT-2 visual examinations associated with the Class 2 leakage test are performed once every ISI period.

Licensee's Alternative Examination: No alternative examinations were proposed.

Evaluation: The ASME Code requires 100% surface examination of selected Class 2 circumferential piping welds in pressure retaining low-alloy piping systems. However, a support welded to the pipe limits the surface examination to 70% of the required coverage. Compliance with ASME Code examination requirements would require replacement of an existing segment of main steam piping, and design and replacement of the piping support to allow full examination. This would place a significant burden on the licensee; thus, the surface examination coverage is impractical.

As shown on the sketches and technical descriptions[11] included in the licensee's submittal, examination of piping branch connection Weld ALA2-4101-12BC has been completed to the extent practical with 70% coverage of the ASME Code-required surface. A welded piping support is placed directly adjacent, and slightly over, one side of the subject piping branch connection, making this portion of the weld inaccessible for

[11] Sketches and technical descriptions provided by the licensee are not included in this report.

surface examination. No reportable indications were noted during the performance of the surface examination on the portion of weld completed.

The licensee has shown that it is impractical to meet the ASME Code-required surface examination coverage for the subject piping branch connection weld due to the proximity of a welded piping support clamp. Based on the limited examination performed, the staff concludes that if significant service-induced degradation were occurring in the subject weld, there is reasonable assurance that evidence of it would have been detected. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.1.5 Request for Relief RR-61 (Unit 2 – TAC MD9742), Examination Category R-A, Ferritic Piping Welds Governed by A Risk-Informed Program, Item R1.11, Welds Subject to Thermal Fatigue

Licensee's ASME Code RR: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume for the ferritic circumferential piping welds listed in Table 3.5.1.

Table 3.5.1 - Examination Category R-A, Item R1.11, Ferritic Piping Welds

Component Number	Weld Description	Coverage Obtained
APR2-4103-2-RI	3" Branch Connection to Pipe	65%
APR2-4103-5-RI	3" Elbow to Valve	65%
APR2-4202-4-RI	3" Elbow to Elbow	83%
APR2-4202-6-RI	3" Pipe to Valve	50%
APR2-4302-2-RI	3" Branch Connection to Pipe	66.5%
APR2-4302-6-RI	3" Pipe to Valve	61.5%
APR2-4302-7-RI	3" Valve to Pipe	70.5%
APR2-4302-10-RI	3" Pipe to Valve	68.5%
APR2-4101-31-RI	6" Pipe to Valve	24%
APR2-4101-32-RI	6" Valve to Pipe	90%
APR2-4101-33-RI	6" Pipe to Valve	90%
APR2-4201-23BC-RI	6" Branch Connection	66.5%
E8 -APR2-4201-30-RI	6" Pipe to Valve	61%

ASME Code Requirement: The examination requirements for the subject piping welds are governed by a RI-ISI program that was approved by the NRC in a safety evaluation dated March 9, 2004 (ADAMS Accession No. ML040700258). The RI-ISI program was developed in accordance with WCAP-14572, Rev. 1-NP-A. As part of the NRC-approved program, the licensee has implemented inspection requirements listed in N-577 with more detailed provisions contained in the WCAP. The topical report includes a provision for requesting relief from volumetric examinations if 100% of the required volumes cannot be examined.

Table 1 of N-577 assigns the Examination Category R-A, Item R1.11, to piping inspection elements subject to thermal fatigue cracking. This table requires 100% of the

examination location volume, as described in Figure IWC-2500-7(a), be completed for selected Class 2 circumferential piping welds. N-460 is an alternative approved for use by the NRC in RG 1.147 which states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90%, examination coverage is obtained.

Licensee's Basis for RR (as stated):

> The ultrasonic examinations were performed after the implementation of Appendix VIII and consisted primarily of a single-sided examination from the carbon steel piping side due to the configuration. In general, the root area of each weld was interrogated with a shear wave looking for circumferential cracking. Because of RI-ISI requirements, 100% of the weld population of each segment was examined; therefore, a large amount of weld and base material was examined, with no recordable indications. In addition, VT-2 visual examinations are performed during each ISI period for welds listed in the licensee's Table RR-61[12] [the subject welds].

Licensee's Alternative Examination: No alternative examinations were proposed.

Evaluation: The examination requirements for the subject piping weld at FNP, Unit 2, are governed by a RI-ISI program that was approved by the NRC in an SE dated March 9, 2004. This program assigns Examination Category R-A, Item R1.11, to piping elements subject to thermal fatigue, and requires inspection of 100% of the examination location volume for selected circumferential piping welds. The volumetric examination must be applied from both sides of the weld to maximize coverage. However, volumetric examinations are limited by the geometrical configurations of the welds, which restrict scanning to the pipe side only. To gain access for examination, the welds would require design modifications. Imposition of this requirement would create a significant burden on the licensee; therefore, the ASME Code-required 100% volumetric examination coverage from both sides of the welds is impractical.

The subject welds are 3-inch and 6-inch NPS carbon steel piping welds having varied geometrical configurations (see Table 3.5.1 above) which restrict scanning to a single (pipe) side of the welds. The licensee provided sketches and technical descriptions[13] which indicate additional scanning restrictions due to other appurtenances such as welded pipe clamps and box restraints. Based on the configurations and access restrictions, the licensee completed volumetric examinations to the extent practical, with coverage ranging from 24% to 90% (see Table 3.5.1 above) of the ASME-required volume.

The licensee used UT procedures that meet the requirements of ASME Section XI, Appendix VIII, Supplement 3, which have been qualified for single-sided examination of these ferritic piping welds. The procedures included 45 and 70 degree S-waves, where applicable, to maximize coverage. Further, results of reliability studies[14] for

---

12 The licensee's table is not included in this report.

13 The licensee's sketches and technical descriptions are not included in this report.

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

UT examinations have shown that the probability of service-induced flaw detection in ferritic welds is typically very good, e.g., greater than 90%. No reportable indications were noted during the performance of these volumetric examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject welds due to their design configuration and scan restrictions caused by adjacent components. However, based on the volumetric coverage obtained, and considering enhanced ultrasonic capabilities on ferritic welds, it is reasonable for the NRC staff to conclude that, if significant service-induced degradation had occurred, evidence of it would be have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.2 Reactor Pressure Vessel Welds

Request for Relief RR-66 (FNP Unit 1), Examination Category B-A, Reactor Pressure Vessel Welds ASME Code Requirements

Examination of Item No. B1.30, Category B-A, Table IWB-2500-1, of ASME, Section XI (1989 Edition), components requires a volumetric examination of the reactor pressure vessel (RPV) shell-to-flange weld. The extent of the examination is listed in note 2 as essentially 100% of the weld length and the examination volume is shown in ASME Code, Section XI, Figure IWB-2500-4. Examination of Item No. B1.11, Category B-A, Table IWB-2500-1 of ASME Code, Section XI, components requires a volumetric examination of the RPV lower shell-to-bottom head circumferential weld. The extent of the examination is listed in note 2 as essentially 100% of the weld length and the examination volume is shown in ASME Code, Section XI, Figure IWB-2500-1.

Additionally, ASME Code, Section XI, Article I-2100 requires that ultrasonic examination of specified vessel welds greater than two inches in thickness be conducted in accordance with ASME Code, Section V, Article 4, as supplemented by Appendix I. ASME Code, Section V, Article 4, also requires two-directional coverage wherever feasible. Examinations conducted for the Third ISI interval were conducted using automated ultrasonic techniques qualified through the ASME Code, Section XI, Appendix VIII, process including Supplements 4 and 6 of Appendix VIII (approved by letter, May 19, 2005 TAC No. MC 2559). This use of ASME Code, Section XI, Appendix VIII instead of Article 4 as supplemented by Appendix I, was approved September 20, 2006.

System/Component for Which Relief is Requested

Relief is requested for the examinations of the RPV shell-to-flange weld and the RPV lower shell-to-bottom head circumferential weld. Specifically, these welds are identified as ALA1-1100-1 and ALA1-1100-8 in Table RR-66 of the application. The examinations of welds ALA1-1100-10 through ALA1-1100-15 were "conservatively included" in RR-66, but are in compliance with ASME Code requirements.

ASME Code Requirement for Which Relief is Requested

Relief is requested from meeting the required coverage from the ASME Code, Section XI, for these welds.

Licensee's Proposed Alternative Examination

Ultrasonic examinations of these welds were performed to the maximum extent practical using ASME Code, Section XI, Appendix VIII, qualified examination techniques. In addition VT-2 visual examinations were performed each outage for these components. No further examination will be conducted for this interval.

Licensee's Basis for Requesting Relief

For ALA1-1100-1 the licensee stated that:

> The UT examination of this circumferential weld was limited due to flange configuration, keyways, and irradiation specimen slots.

The licensee also stated that additional positioning of the UT transducer was undertaken to maximize coverage for all examinations but appreciable increase in coverage was not obtained.

For ALA1-1100-8 the licensee stated that:

> The UT examination of this circumferential weld was limited by the proximity of 4 RPV core support lugs. Scanning was conducted in both the perpendicular and parallel directions around the obstructing lug with the scan boundaries maximized by visually-assisted positioning of the remote examination head so that the scan starts and stops were as close to the core support lug as possible.

The licensee stated that they believe that:

> A large percentage of the weld root was interrogated for these eight welds [including ALA1-1100-10 through 15] and no UT indications exceed the allowable flaw tables. In addition VT-2 visual examinations are performed each refueling outage for these components. Based on the examination results plus the cumulative volumetric examination coverage of all RPV shell welds there is reasonable assurance of structural integrity.

Precedent is cited in the form of a similar Second ISI interval RR for FNP, Unit 2, (RR-56, TAC No. MC2559, ADAMS Accession No. ML040930133) that documented the limited RPV examinations at FNP, Unit 2. The licensee noted that the examinations documented in RR-56 were performed prior to the implementation of Supplements 4 and 6 to ASME Code, Section XI, Appendix VIII while the examinations in this relief request were performed after the required implementation of Supplements 4 and 6 to ASME Code, Section XI, Appendix VIII. Some differences were observed by the licensee for examination coverage due to the adoption of the ASME supplements. Approval for the limited examinations for FNP, Unit 2, was granted by the NRC via a letter dated May 19, 2005 (ADAMS Accession No. ML051160414). Further weld examination was deemed impractical as it would require significant redesign, modification, and/or replacement of the RPV. The letter dated for April 24, 2009, included

detailed sketches of weld examination volumes including indications of the regions of each weld which were inaccessible for ultrasonic examination.

Technical Evaluation

The 1989 Edition of the ASME Code, Section XI, requires a volumetric examination of the RPV shell-to-flange welds and circumferential shell welds that includes essentially 100% of the weld length. The ultrasonic examination of these welds was conducted using ultrasonic techniques qualified through the ASME Code, Section XI, Appendix VIII, process.

The ALA1-1100-1 flange-to-upper shell weld in FNP, Unit 1, is situated and configured such that examination was limited due to flange configuration, keyways, and irradiation specimen slots. A staff comparison of the effect of the flange geometry in a drawing of weld ALA1-1100-1 provided by the licensee and the corresponding ASME, Code Section XI, drawing IWB-2500-4, on accessible weld volume for ultrasonic examination made clear that the weld geometry anticipated by the ASME Code was not consistent with RPV geometries present at FNP, Unit 1. The FNP, Unit 1, flange has a clear taper where the ASME Code version displayed a gradual slope. Because of this taper, ultrasonic examination of a significant portion of the weld is impractical. In addition, the 4 keyways and 8 irradiation specimen slots present further obstacles to ultrasonic examination. Detailed sketches of the weld examination volume were included with the April 24, 2009, letter. To increase the examination volume of ALA1-1100-1 would require a redesign of the RPV, which would be an undue burden on the licensee. Therefore, based on this information the NRC staff concludes that the ASME Code requirement is impractical.

At FNP, Unit 1, there are four core support lugs near weld ALA1-1100-8. Each of these lugs is positioned immediately above the RPV lower shell-to-bottom head circumferential weld ALA1-1100-8. From drawings provided by the licensee of the ALA1-1100-8 weld, it is clearly apparent that to achieve ASME Code acceptable weld examination coverage of the ALA1-1100-8 weld would require redesign of the core support lug. Such a redesign would be an undue burden on the licensee. Licensee efforts to scan around the lug were noted in the application:

> Scanning was conducted in both the perpendicular and parallel directions around the obstructing lug with the scan boundaries maximized by visually-assisted positioning of the remote examination head so that the scan starts and stops were as close to the core support lug as possible.

The licensee further supported their conclusion with detailed sketches in their April 24, 2009, letter that illustrated the examination constraint due to the support lug. The NRC staff concludes that the licensee's attempts to maximize the scan area were acceptable and that the resulting scan coverage of 84% represents a significant portion of the weld. Therefore, the NRC staff has determined that, due to the positioning of the lugs, the ASME Code requirements are impractical.

For both the ALA1-1100-1 and ALA1-1100-8 welds, a significant volume was examined, with no unacceptable indications found. The licensee also performs VT-2 visual examinations each refueling outage on these welds. The lack of findings among the examinations of the other RPV welds provides good confidence that a representative volume of weld material has been

examined. Considering these facts, the staff finds that it is highly unlikely that any pattern of degradation exists and has gone undetected. The examination coverage achieved by the licensee provide a reasonable assurance of structural integrity of the RPV flange-to-upper shell weld (ALA1-1100-1) and lower shell-to-bottom head circumferential weld (ALA1-1100-8).

Due to the configuration of the FNP, Unit 1, RPV, the ASME Code requirements with respect to weld coverage of the ALA1-1100-1 and ALA1-1100-8 welds are impractical. An imposition of the ASME Code requirements would result in a burden upon the licensee as the RPV would have to be redesigned. The weld coverage that was achieved provides reasonable assurance of structural integrity of the RPV flange-to-upper shell weld and lower shell-to-bottom head circumferential weld.

Request for Relief RR-68 (Unit 1), Examination Category B-A, Reactor Pressure Vessel Closure Head Welds

Of the four welds listed in RR-68, ALA1-1300-1, ALA1-1300-2, ALA1-1300-3, and ALA1-1300-4, the ASME Code requires that the accessible length of each weld be examined. The licensee noted this requirement of the Code and stated that "... Code relief is being conservatively submitted by this relief request." The licensee's submittal indicates that the accessible length of the welds was examined, therefore NRC staff finds that the weld examinations for these welds were within ASME Code requirements. Weld examinations for which no relief is necessary are not discussed further.

4.0 CONCLUSION

The NRC staff concludes that the ASME Code examination coverage requirements are impractical for the subject piping welds listed in Requests for Relief RR-62, RR-64, RR-65, RR-67, and RR-69 for FNP, Unit 1, and RR-61 and RR-62 for FNP, Unit 2, and RR-66 (reactor vessel welds ALA1-1100-1, ALA1-1100-8) for Unit 1. Further, based on the coverage obtained, if significant service-induced degradation were occurring, there is reasonable assurance that evidence of it would have been detected by the examinations that were performed. In addition, the examinations performed to the extent practical provided reasonable assurance of structural integrity of the subject welds.

The NRC staff has determined that, for the third 10-year ISI interval at FNP, Units 1 and 2, granting relief for the piping welds listed in RR-62, RR-64, RR-65, RR-67, and RR-69 for FNP, Unit 1, and RR-61 and RR-62 for FNP Unit 2, and RR-66 (reactor vessel welds ALA1-1100-1, ALA1-1100-8) for Unit 1, pursuant to 10 CFR 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal contributors: Donald G. Naujock
Dan S. Widrevitz

Date of issuance: June 29, 2009

June 29, 2009

Mr. Mark J. Ajluni
Manager, Nuclear Licensing
Southern Nuclear Operating Company, Inc
40 Inverness Center Parkway
Birmingham, Alabama 35201

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2, EVALUATION OF THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUESTS FOR RELIEF (TAC NOS. MD9742, MD9744, MD9745, MD9746, MD9747, MD9748, MD9749, MD9750, AND MD9751)

Dear Mr. Ajluni:

By letter to the U.S. Nuclear Regulatory Commission (NRC, the Commission), dated September 22, 2008, as supplemented on April 24, 2009, Southern Nuclear Operating Company, Inc. (SNC, the licensee) submitted Relief Requests (RRs) RR-62, RR-64, RR-65, RR-66, RR-67, RR-68 and RR-69 for Joseph M. Farley Nuclear Plant (FNP) Unit 1 and RR-61 and RR-62 for FNP Unit 2, from certain requirements of Section XI of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), under the provisions of *Title 10 of the Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a.

Based on a review of SNC's submittals, the NRC staff finds that the ASME Code examination coverage requirements are impractical for the welds in RR-62, RR-64, RR-65, RR-66 (two welds as discussed in the Enclosure), RR-67, and RR-69 for FNP, Unit 1, and RR-61 and RR-62 for FNP, Unit 2, and that the examinations performed to the extent practical provided reasonable assurance of structural integrity. Granting relief pursuant to 10 CFR 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.

Sincerely,

/RA/
Melanie C. Wong, Branch Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure: Safety Evaluation

cc w/encls: Distribution via Listserv

DISTRIBUTION:

PUBLIC	LPL2-1 R/F	RidsAcrsAcnw_MailCTR	RidsNrrDorlDPR	RidsNrrDorlLpl2-1
RidsOgcRp	RidsNrrCVIB (MMitchell)	RidsNrrCPNB (TChan)	RidsNrrLASRohrer	RidsNrrRMartin
RidsRgn2MailCenter	MCox, EDO R-II	RidsNrrPMRMartin	MWong, LPL2-1Branch Chief	
DFrumkin, DRA	RidsNRRDraAfpb Resource	RidsNrrPmda Resource	RidsNrrDirsItsbResource	
RidsFsmeDwmep Resource	DNaujock	DWiderevitz		

ADAMS Accession No. ML091730075 *memo transmitted SE dated NRR-028

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	NRR/CPNB/BC	NRR/CVIB/BC	OGC	NRR/LPL2-1/BC
NAME	RMartin	SRohrer	TChan *	MMitchell *	Waived	MWong
DATE	06/25/09	06/23/09	05/14/2009	06/08/09	ML090480460	06/29/09

OFFICIAL RECORD COPY