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

October 11, 2019

Vice President, Operations
Entergy Operations, Inc.
Grand Gulf Nuclear Station
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – RELIEF REQUEST GG-ISI-023, EXAMINATION COVERAGE OF CLASS 1 PIPING AND VESSEL WELDS (EPID L-2018-LLR-0197)

Dear Sir or Madam:

By letter dated November 30, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18334A246), as supplemented by letter dated May 6, 2019 (ADAMS Accession No. ML19126A271), Entergy Operations, Inc. (the licensee) requested relief from certain 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." Relief Request GG-ISI-023 pertains to examination coverage of the Class 1 piping and vessel welds at Grand Gulf Nuclear Station, Unit 1 (Grand Gulf).

In its supplemental letter dated May 6, 2019, the licensee stated that it has determined that the inspection of piping Weld N09A-KC is outside the scope of both the ASME Code, Section XI, and Grand Gulf's risk-informed inservice inspection program. The reason for inspecting Weld N09A-KC was to meet Grand Gulf's commitment to the U.S. Nuclear Regulatory Commission (NRC) Generic Letter 88-01, "NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR [Boiling Water Reactor] Austenitic Stainless Steel Piping," dated February 4, 1992 and BWR Vessel and Internals Project (BWRVIP)-75A, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," dated October 2005 (ADAMS Accession No. ML053070149). Therefore, relief is not needed for Weld N09A-KC, and the licensee removed this weld from Relief Request GG-ISI-023.

Specifically, pursuant to paragraph 50.55a(g)(5)(iii) of Title 10 of the *Code of Federal Regulations*, the licensee requested relief from the required examination coverage and to use alternative requirements (if necessary), for inservice inspection of the Class 1 welds on the basis that the ASME Code requirement is impractical.

As set forth in the enclosed safety evaluation, the NRC staff determined that it is impractical for the licensee to comply with the ASME Code, Section XI requirement; that the proposed inspection provides reasonable assurance of structural integrity or leak tightness of the subject welds; and that 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. 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 GG-ISI-023 at Grand Gulf, for the third 10-year inservice inspection interval, which ended on November 30, 2017.

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

If you have any questions, please contact the Project Manager, Siva P. Lingam, at 301-415-1564 or via e-mail at Siva.Lingam@nrc.gov.

Sincerely,

/RA/

Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-416

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST GG-ISI-023

WELD EXAMINATION COVERAGE

ENTERGY OPERATIONS, INC.

GRAND GULF NUCLEAR STATION, UNIT 1

DOCKET NO. 50-416

1.0 INTRODUCTION

By letter dated November 30, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18334A246), as supplemented by letter dated May 6, 2019 (ADAMS Accession No. ML19126A271), Entergy Operations, Inc. (the licensee) requested relief from certain 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." Relief Request GG-ISI-023 pertains to examination coverage of the Class 1 piping and vessel welds at the Grand Gulf Nuclear Station, Unit 1 (Grand Gulf).

In the its supplemental letter dated May 6, 2019, the licensee stated that it has determined that the inspection of piping Weld N09A-KC is outside the scope of both the ASME Code, Section XI, and Grand Gulf's risk-informed inservice inspection (RI-ISI) program. The reason for inspecting Weld N09A-KC was to meet Grand Gulf's commitment to U.S. Nuclear Regulatory Commission (NRC) Generic Letter 88-01, "NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR [Boiling Water Reactor] Austenitic Stainless Steel Piping," dated February 4, 1992, and BWR Vessel and Internals Project (BWRVIP)-75A, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," dated October 2005 (ADAMS Accession No. ML053070149). Therefore, relief is not needed for Weld N09A-KC, and the licensee removed this weld from Relief Request GG-ISI-023.

Pursuant to paragraph 50.55a(g)(5)(iii), "ISI program update: Notification of impractical ISI Code requirements," of Title 10 of the *Code of Federal Regulations* (10 CFR), the licensee requested relief from the required examination coverage and to use alternative requirements (if necessary), for inservice inspection (ISI) of the Class 1 welds on the basis that the ASME Code requirement is impractical.

2.0 REGULATORY EVALUATION

The NRC staff considered the following regulatory requirements and guidance in its evaluation.

Pursuant to paragraph 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," components (including supports) that are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements in 10 CFR 50.55a throughout the service life of a BWR or pressurized water reactor. The exception is the design and access provisions and preservice examination requirements set forth in Section XI of editions and addenda of the ASME Code that become effective subsequent to editions specified in paragraphs (g)(2) and (3) of 10 CFR 50.55a, which are incorporated by reference in paragraph (a)(1)(ii) of 10 CFR 50.55a to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Pursuant to paragraph 10 CFR 50.55a(g)(4)(ii), "Applicable ISI Code: Successive 120-month intervals," "Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in paragraph (a) of [10 CFR 50.55a] 12 months before the start of the 120-month inspection interval (or the optional ASME Code Cases listed in NRC Regulatory Guide [(RG)] 1.147, ["Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1" (ADAMS Accession No. ML16321A336),] when using [ASME Code], Section XI, as incorporated by reference in paragraph (a)(3)(ii)… of [10 CFR 50.55a]), subject to the conditions listed in paragraph (b) of [10 CFR 50.55a]."

Pursuant to 10 CFR 50.55a(g)(5)(iii), "ISI program update: Notification of impractical ISI Code requirements," "If the licensee has determined that conformance with the [ASME 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 [10 CFR 50.55a] 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 [10 CFR 50.55a] 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."

Pursuant to paragraph 10 CFR 50.55a(g)(6)(i), "Impractical ISI requirements: Granting of relief," "The Commission will evaluate determinations under paragraph (g)(5) of [10 CFR 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 following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to grant the relief requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Edition and Addenda

The code of record for the third 10-year ISI interval is the 2001 Edition through 2003 Addenda of the ASME Code, Section XI.

3.2 Duration of Relief Request

The licensee submitted this relief request for the third 10-year ISI interval, which started on May 31, 2008, and ended on November 30, 2017.

3.3 Piping Components (Examination Category R-A)

3.3.1 Background

By letter dated September 21, 2007 (ADAMS Accession No. ML072430005), the NRC approved implementation of the 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 Grand Gulf. The licensee developed the Grand Gulf RI-ISI program in accordance with methodology described in ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI, Division 1."

3.3.2 Components Affected

ASME Code Class 1 piping welds are affected. The licensee identified these eight piping welds in Section 1 and Table 1 of Relief Request GG-ISI-023, in its submittal dated November 30, 2018. The description is as follows:

- Seven reactor recirculation system piping welds with a prefix of "1B33" classified as Examination Category R-A, Item No. R1.16 (elements subject to IGSCC or transgranular stress corrosion cracking) in Table 1 of ASME Code Case N-716.

- One standby liquid control system piping weld classified as Examination Category R-A, Item No. R1.20 (elements not subject to a degradation mechanism) in Table 1 of ASME Code Case N-716.

In Table 1 of Relief Request GG-ISI-023, the licensee provided nominal pipe size, materials of construction, and additional details for each weld. The licensee stated that the welds and associated components include seven pipe-to-tee welds and one elbow-to-pipe weld. The Class 1 piping welds and associated components are made of stainless steel. The licensee provided operating pressure and temperature for each of the piping welds.

3.3.3 ASME Code Requirement

The ASME Code requirements applicable to Class 1 piping welds originate in ASME Code, Section XI, Table IWB-2500-1. Alternative to the requirements for Examination Categories B-F and B-J is the Grand Gulf RI-ISI program that was developed by the licensee in accordance with methodology in ASME Code Case N-716, and that was authorized by the NRC staff in a safety evaluation dated September 21, 2007. In both the ASME Code requirements and the NRC safety evaluation, the welds under this request are required to be volumetrically examined

during each 10-year ISI interval, and 100 percent coverage of the required examination volume must be achieved.

The extent of required examination coverage is reduced to essentially 100 percent by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." This code case has been incorporated by reference into 10 CFR 50.55a via inclusion in RG 1.147, Revision 18.

3.3.4 Impracticality of Compliance

The licensee stated that it was not possible to obtain greater than 90 percent of the ASME Code required examination volume or area due to limitations, which include configuration and geometry of the welds and/or the associated components and metallurgical constraints. In Section 4, Table 1, and the diagrams shown in Relief Request GG-ISI-023, the licensee described and illustrated the limitations that prevented ultrasonic scanning of the piping welds. Examples include the geometry and size of elbow that limit access to the intrados of the elbow side of the weld, the configuration and material type of pipe-to-fitting or fitting-to-pipe cap that limits full access to the weld, and that restricts the ultrasonic scanning.

The licensee stated that the burden caused by compliance includes major modification of plant components, which include redesign and replacement of the welds and associated components.

3.3.5 Bases for Relief

The licensee stated that it performed the ultrasonic testing (UT) to the maximum extent possible utilizing qualified personnel and procedures demonstrated in accordance with Appendix VIII of Section XI.

The licensee stated that the "Radiographic testing (RT) is not a desired option because RT is limited in the ability to detect service induced flaws. Additionally, the water must be drained from the [piping] systems where radiography is performed."

The licensee stated that during the third 10-year ISI interval, additional piping welds composed of the same material and exposed to a similar environment as the welds listed in Table 1 of Relief Request GG-ISI-023 were inspected by UT. Details are as follows:

- Thirteen additional reactor recirculation system piping welds with the same prefix of "1B33" as the welds in Table 1 of Relief Request GG-ISI-023 were inspected by UT as part of the ISI program. These 13 welds have the same materials of construction and are subject to the same operating conditions as the "1B33" welds in Table 1 of Relief Request GG-ISI-023. One weld is categorized as Item No. R1.16 and the other 12 welds are IGSCC Category A (Item No. R1.20) addressed in BWRVIP-75-A. The licensee obtained essentially 100 percent coverage with no unacceptable indications detected.

- One additional standby liquid control system piping Weld 1C41G136W514 was also examined. This additional Weld 1C41G136W514 is a dissimilar metal weld connecting stainless steel SA-312, TP 304L pipe-to-carbon steel SA-234, Grade WPC reducer, and subjected to the same operating condition and environment as Weld 1C41G119-03-11-11. The coverage achieved was greater than 90 percent with no unacceptable indications detected in the volume examined.

The licensee stated that given the limited coverage achieved for the subject Category R-A piping welds, it performed an evaluation to demonstrate the acceptability of the limited coverage. The change-in-risk evaluation is required by Note 3 of Table 1 of ASME Code Case N-716, if the coverage of essentially 90 percent of the required examination volume of the weld is not achievable by UT. The summary of the results of the licensee's change-in-risk evaluation for individual systems and the cumulative effect on total delta risk is as follows:

- The licensee stated that six of seven reactor recirculation system piping Welds 1B33G001W11, 1B33G10-A1-A, 1B33G10-A1-B, 1B33G001W34, 1B33G10-B1-A, and 1B33G10-B1-B were ultrasonically inspected in the second 10-year ISI interval as part of the ASME Code, Section XI, ISI program, and only 50 percent of the required examination volume of each weld was achieved (safety evaluation of Relief Request GGNS-ISI-009 regarding limited coverage of welds, dated May 25, 2010 (ADAMS Accession No. ML101410002)). In the third 10-year ISI interval, the same six welds were selected and volumetrically inspected as part of the Grand Gulf RI-ISI program, and achieved the same limited coverage of 50 percent. Therefore, there is no change in delta risk between the traditional ISI program and the RI-ISI program caused by limited coverage of these six welds.

- For one remaining reactor recirculation system piping Weld 1B33G10-A1-E, the licensee demonstrated that the effect of limited coverage on the delta risk for this system is well below the required acceptable limits of 1E-07 and 1E-08 in core damage frequency (CDF) and large early release frequency (LERF), respectively.

- The licensee stated that Weld 1C41G119-03-11-11, in the standby liquid control system, was not examined volumetrically under the traditional ISI program; therefore, any volumetric examination performed as part of the risk-based program is an improvement in risk. In its evaluation, the licensee demonstrated that the effect of limited coverage on the delta risk for this system is well below the acceptable limits of 1E-07 and 1E-08 in CDF and LERF, respectively.

- In its initial request dated September 22, 2006 (ADAMS Accession No. ML062720254) for use of the RI-ISI program in the third 10-year ISI interval, the licensee provided the delta risk for individual systems and cumulatively for all systems. The licensee's evaluation demonstrated that the cumulative effect of limited coverage on the total delta risk is well below the acceptable limits of 1E-07 and 1E-08 in CDF and LERF, respectively.

For the piping welds in this relief request, with single sided access as shown in the diagrams in Relief Request GG-ISI-023, the licensee extended the ultrasonic beam path into the far side of the weld centerline to examine to the extent practical the other side of weld as a "best effort" examination. However, no credit was claimed for the "best effort" examination because a UT procedure must be qualified with flaws on the inaccessible side of the weld. Currently, there are no qualified single-side examination procedures, and the existing UT technology is not capable of reliably detecting or sizing flaws on the far side of an austenitic weld. No unacceptable indications were identified.

The licensee stated that the piping welds in this relief request have been subjected to system leakage testing in the third 10-year ISI interval, and no sign of leakage has been identified.

3.3.6 Proposed Alternative

In Table 1 of Relief Request GG-ISI-023, the licensee reported the percent coverage achieved for each piping weld examined. This is summarized in the table below.

Weld Designation	UT Coverage Obtained (Percent)
1B33G001W11	75
1B33G10-A1-A	75
1B33G10-A1-B	75
1B33G10-A1-E	50
1B33G001W34	50
1B33G10-B1-A	50
1B33G10-B1-B	50
1C41G119-03-11-11	87.7

The licensee proposed the above alternative coverage in lieu of the Code required essentially 100 percent coverage.

3.3.7 NRC Staff Evaluation

The NRC staff has evaluated Relief Request GG-ISI-023 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the Code-required inspections would result in a burden to the licensee; and (3) that the licensee's proposed alternative (accepting the reduced inspection coverage in this case) provides reasonable assurance of structural integrity and leak tightness of the subject welds. The NRC staff finds that if these three criteria are met, that the requirements of 10 CFR 50.55a(g)(6)(i), (i.e., granting the requested relief 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") will also be met.

Impracticality of Compliance

As described and demonstrated in the licensee's submittal dated November 30, 2018, Table 1, and the figures in Relief Request GG-ISI-023, the predominant limitations that prevented the licensee's UT to achieve essentially 100 percent coverage of the ASME Code-required volume were the pipe-to-valve, pipe-to-reducer, pipe-to-elbow, and pipe-to-tee configurations and/or the metallurgical constraints. The licensee performed the UT from one side of the welds because scanning from the other side of the welds was not possible (single-sided scan). The NRC staff confirms that each weld's particular design configuration prevented the licensee from scanning the welds from both sides. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100 percent 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 welds and their associated

components. The NRC staff finds that replacing or reconfiguring the components of the subject welds is the only reasonable means to achieve dual sided coverage of these welds and that replacement or reconfiguration of the pipe, elbow, fitting, and tee constitutes a burden on the licensee without a commensurate increase in safety.

Structural Integrity and Leak Tightness

The NRC staff considered whether the licensee's proposed alternative provided reasonable assurance of structural integrity and leak tightness of the subject weld based on: (1) the examination coverage achieved and (2) safety significance of unexamined volumes and unachievable coverage (e.g., the presence or absence of known active degradation mechanisms and essentially 100 percent coverage achieved for similar welds in similar environments subject to similar degradation mechanisms).

Examination Coverage Achieved

In evaluating the licensee's proposed alternative coverage, the NRC staff assessed whether the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From review of the licensee's submittal and the figures in Relief Request GG-ISI-023, the NRC staff verified that:

- The welds were examined using the appropriate equipment, ultrasonic modes of propagation, probe angles, frequencies, and scanning directions to obtain maximum coverage;

- The coverage was calculated in a reasonable manner;

- The UT procedures used were qualified as required by the regulation;

- The coverage was limited by physical access (i.e., the configuration of one side of the weld did not permit access for scanning); and

- No unacceptable indications were identified.

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 Volume

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of welds. From a review of the submittal and the figures in Relief Request GG-ISI-023, and the licensee's supplemental letter dated May 6, 2019, the NRC staff verified that:

- The licensee's UT has covered the majority of the regions (i.e., the weld root and the heat affected zone of the base material near the inner diameter surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation.

- For the austenitic stainless steel welds, the coverage obtained 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. The NRC staff verified that the far-side volume was inspected by the "best effort" examination, no indications were identified, and no credit was taken for the coverage achieved from the "best effort" examination.

- During the third 10-year ISI interval, the licensee inspected 13 additional piping welds in the reactor recirculation system and one additional piping weld in the standby liquid control system that have the same materials subject to the same operating conditions and environment as the welds in Relief Request GG-ISI-023. Greater than 90 percent examination coverage was achieved, and no unacceptable indications were detected in the volume examined.

- The licensee's change-in-risk evaluation demonstrated that the impact of the limited coverage on the delta risk remains below the required acceptable limit of 1E-07 per year in CDF and 1E-08 per year in LERF. The NRC staff finds that the licensee met the requirement of Note 3 of Table 1 in ASME Code Case N-716.

Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT, the supplemental "best effort" examinations, the examination of the weld root and its heat affected zone to the extent possible, and the delta risk evaluation, 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 this analysis, the NRC staff also found that, in addition to the required volumetric examinations, these welds have received the required system leakage test according to the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-P, during each refueling outage. Despite reduced coverage of the required examination volume, the NRC staff finds that this inspection will provide additional assurance that any pattern of degradation, if it were to occur, would be detected and the licensee would take appropriate corrective actions.

Therefore, the NRC staff finds that the volumetric examinations performed to the extent possible provide a reasonable assurance of structural integrity and leak tightness of the subject piping welds. Compliance with the ASME Code requirements for these piping welds would be a burden on the licensee without a commensurate increase in safety.

3.4 Examination Category B-A, "Pressure Retaining Welds in Reactor Pressure Vessel"

3.4.1 Applicable Code Requirements

Table IWB-2500-1, Examination Category B-A, Item No. B1.30, shell-to-flange weld, requires a volumetric examination depicted in Figure IWB-2500-4 for essentially 100 percent of the weld volume.

Table IWB-2500-1, Examination Category B-A, Item No. B1.40, head-to-flange weld, requires a volumetric and surface examination depicted in Figure IWB-2500-5 for essentially 100 percent of the weld volume and surface.

"Essentially 100 percent" as clarified by ASME Code Case N-460 is greater than 90 percent coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, Revision 18.

3.4.2 Licensee's Reason for Request

The licensee stated that for the reactor vessel (RV) shell-to-flange weld AE, Item No. B1.30, the examination is limited to a single-sided examination from the shell side due to the proximity of the RV flange.

The licensee stated that for RV head-to-flange weld AG, Item No. B1.40, the examination is limited to a single sided examination from the top head side due to the proximity of the RV top head flange.

3.4.3 NRC Staff Evaluation

For the two Examination Category B-A welds, the licensee achieved coverage of 69.2 percent for weld AE and 85.5 percent for weld AG. Both welds join low-alloy steel materials. Low alloy RV welds in BWRs have no known active degradation mechanisms that cause cracking. Further, the coverage achieved represents a large sample, such that, if significant degradation were present in either weld, it is likely that the degradation would have been detected. Evidence of significant service-induced degradation in the weld, if it were to occur, would likely be detected in the portions of the welds that were examined because the examined volume is the same material as the unexamined volume, is under the same loading conditions, and is exposed to the same reactor coolant environment.

The NRC staff examined Figures C and E of the Enclosure to the licensee's submittal dated November 30, 2018, which show cross sections of RV shell-to-flange AE and RV head-to-flange weld AC. The staff agrees that the configurations of these welds prevent achieving essentially 100 percent UT coverage of these welds.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for the Category B-A welds is impractical because it would impose a burden upon the licensee without a commensurate increase in safety. The staff determined that the volumetric UT examination performed to the extent possible, together with the leakage monitoring, walkdowns during refueling outages, system leakage testing, and VT-2 visual examination, provides reasonable assurance of the structural integrity of these welds for the following reasons:

- The licensee detected no relevant indications.

- There has been no plant-specific or known industry operating experience regarding failure of welds in similar service.

- Evidence of significant service-induced degradation in these welds, if it were to occur, would likely have been detected in the examined coverage of 69.2 percent and 85.5 percent of the required volume because the examined volume is the same material as the unexamined volume, is under the same loading conditions, and is exposed to the same environment.

3.5 Examination Category B-G-1, "Pressure Retaining Bolting, Greater Than 2 in. (50.8mm) in Diameter"

3.5.1 Applicable Code Requirements

Table IWB-2500-1, Examination Category B-G-1, Item No. B6.40, threads in flange, requires a volumetric examination depicted in Figure IWB-2500-12 for essentially 100 percent of the flange thread volume.

3.5.2 Licensee's Reason for Request

For the RV threads in flange and total ligament flange thread areas 1 through 76, the licensee stated that the examination is limited due to the RV flange seating surface.

3.5.3 NRC Staff Evaluation

For the RV threads in flange, the licensee identified three separate areas designated 1-25, 26-50, and 51-76. For each area, the coverage achieved was 81.5 percent. Based on Figure G of the Enclosure to the licensee's submittal dated November 30, 2018, there are 76 RV stud holes, divided into three areas, 1-25, 26-50, and 51-76, each containing 25 stud holes.

The NRC staff notes that the coverage achieved on the threads in flange represents a significant sample of the examination volume required for this item, and the staff has reasonable assurance that if degradation were present, it would have been detected. The staff also noted that, based on the figures provided, the 81.5 percent volumetric examination achieved included the root of the threads in flange, which is the region where degradation (if any) is expected. The missed coverage was only a small portion (a 3.5-inch arc around each thread in flange) of the required volume.

The NRC staff reviewed Figure G of the enclosure to the licensee's submittal dated November 30, 2018, which show the threads in flange region and the stainless steel seating surface, which prevented achieving the required examination volume. The staff observed that the sealing surface is a raised strip of stainless steel material that runs around the inner edge of the RV flange, overlapping a portion of each RV stud hole. The stainless steel material would prevent access of the UT transducer to a portion of the circumference of each stud hole, thus preventing achieving 100 percent coverage of the threads in flange region.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for the RV threads in flange is impractical because it would impose a burden upon the licensee without a commensurate increase in safety. Removal of the sealing surface would require redesign of the RV closure head and flange and an extensive modification. The staff determined that the volumetric UT examination performed to the extent possible, together with the leakage monitoring, walkdowns during refueling outages, system leakage test, and VT-2 visual examination, provides reasonable assurance of the structural integrity of the RPV threads in flange region for the following reasons:

- The licensee detected no relevant indications.

- There has been no plant-specific or known industry operating experience regarding failure of welds in similar service.

- Evidence of significant service-induced degradation in the threads, if it were to occur, would likely have been detected in the examined coverage of 81.5 percent of the required volume because the examined volume is the same material as the unexamined volume, is under the same loading conditions, and is exposed to the same environment.

3.6 Examination Category B-O, "Pressure Retaining Welds in Control Rod Drive Housings"

3.6.1 Applicable Code Requirements

Table IWB-2500-1, Examination Category B-O, Item No. B14.10, RV welds in control rod drive (CRD) housings, requires a volumetric or surface examination depicted in Figures IWB-2500-18 of essentially 100 percent of the weld volume or surface area. Each 10-year ISI interval, the volumetric or surface examination shall be performed on 10 percent of the peripheral CRD housings.

3.6.2 Licensee's Reason for Request

The licensee stated that RV welds in CRD housings lower welds 02-35, 02-31, 02-27 and 02-23 are all Class 1 welds that requires a volumetric or surface examination in 10 percent of the peripheral CRD housings as depicted in Figures IWB-2500-18 for essentially 100 percent of the weld volume or surface area. The licensee further stated that examination is limited on these lower CRD welds due to the proximity of adjacent components. The licensee provided a photograph in Figure I, of the Enclosure to the submittal dated November 30, 2018, showing the penetrations and the obstructions.

3.6.3 NRC Staff Evaluation

In Figure H of the Enclosure of the submittal dated November 30, 2018, the licensee provided a plan view diagram showing the layout of the CRD penetrations. The penetrations examined are on the same side of the bottom head. There are 36 peripheral CRD penetrations. Table 1 of the Enclosure indicates that 50.6 percent coverage was obtained with liquid penetrant testing.

The NRC staff notes that the Category B-O welds join the nickel-based alloy (Inconel 600, SB-167) penetration tube to a stainless steel (SA-182, Type 304) forged fitting. Alloy 82 and Alloy 182 weld filler metal is typically used to join this combination of base materials. The NRC staff is not aware of any operating experience with degradation of CRD housing welds external to the RV, although some welds with Alloy 182 filler metal have cracked due to IGSCC inside the RV.

The NRC staff notes that for the second 10-year ISI interval, the licensee requested relief in a letter dated November 15, 2011 (ADAMS Accession No. ML113200448), for the Category B-O welds, stating that it could not perform the required examination due to obstruction by adjacent components. Because the relief request was not submitted within 12 months of the end of the second 10-year ISI interval, the NRC could not grant relief. However, in its safety evaluation dated November 30, 2012 (ADAMS Accession No. ML12326A331), the NRC determined there were no safety-significant issues associated with the licensee's failure to submit the relief request within the timeframe required by 10 CFR 50.55a(g)(5)(iii). In the Third 10-year ISI interval, the staff notes that the licensee achieved 50.6 percent coverage of the required examination surface with no recordable indications. The NRC staff finds that a 50.6 percent surface coverage is adequate for this subject weld since the variation of stress around the weld, if any, would be minimal.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code required examination area for the Category B-O welds is impractical because it would impose a burden upon the licensee without a commensurate increase in safety. The staff determined that the surface examination performed to the extent possible, together with the leakage monitoring, walkdowns during refueling outages, system leakage test, and VT-2 visual examination provides reasonable assurance of the structural integrity of these welds for the following reasons:

- The licensee detected no relevant indications.

- There has been no plant-specific or known industry operating experience regarding failure of welds in similar service.

- Evidence of significant service-induced degradation in these welds, if it were to occur, would likely have been detected in the examined coverage of 50.6 percent of the required area because the examined area is the same material as the unexamined area, is under the same loading conditions, and is exposed to the same environment.

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 requirement; that the proposed inspection provides reasonable assurance of structural integrity or leak tightness of the subject welds; and that 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. 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 GG-ISI-023 at Grand Gulf, for the third 10-year ISI interval which ended on November 30, 2017.

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: October 11, 2019

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – RELIEF REQUEST GG-ISI-023, EXAMINATION COVERAGE OF CLASS 1 PIPING AND VESSEL WELDS (EPID L-2018-LLR-0197) DATED OCTOBER 11, 2019

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