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

April 28, 2020

Mr. Rod Penfield
Site Vice President
Energy Harbor Nuclear Corp.
Beaver Valley Power Station
Mail Stop A-BV-SEB1
P.O. Box 4, Route 168
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT 2 - RELIEF REQUESTS 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2-TYP-3-C1.30-1, AND 2-TYP-3-RA-1 REGARDING WELD EXAMINATION COVERAGE FOR THE THIRD INSERVICE INSPECTION INTERVAL (EPID L-2019-LLR-0082)

Dear Mr. Penfield:

By letter dated August 27, 2019, FirstEnergy Nuclear Operating Company (the licensee)[1] requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI. Relief Requests 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2-TYP-3-C1.30-1, and 2-TYP-3-RA-1 pertain to examination coverage of Class 2 vessel welds and Class 1 and 2 pipe welds at the Beaver Valley Power Station (Beaver Valley), Unit 2.

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

The U.S. Nuclear Regulatory Commission (NRC) staff has concluded that the proposed alternatives in Relief Requests 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2-TYP-3-C1.30-1, and 2-TYP-3-RA-1 provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternatives for the third 10-year inservice inspection interval, which commenced on August 29, 2008, and concluded on August 15, 2019.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

[1] On February 27, 2020, the NRC approved an order and conforming amendments for the license transfer from FirstEnergy Nuclear Operating Company to Energy Harbor (ADAMS Accession No. ML20030A440).

If you have any questions please contact the Beaver Valley Project Manager, Jennifer Tobin, at 301-415-2328 or Jennifer.Tobin@nrc.gov.

Sincerely,

/RA/

James G. Danna, Chief
Plant Licensing Branch 1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412

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 REQUESTS 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1,

2-TYP-3-C1.30-1, AND 2-TYP-3-RA-1

REGARDING WELD EXAMINATION COVERAGE

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNIT 2

DOCKET NO. 50-412

1.0 INTRODUCTION

By letter dated August 27, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession ML19239A405), FirstEnergy Nuclear Operating Company (the licensee)[1] requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI. Relief Requests 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2 TYP-3-C1.30-1, and 2-TYP-3-RA-1 pertain to examination coverage of Class 2 vessel welds and Class 1 and 2 pipe welds at the Beaver Valley Power Station (Beaver Valley), Unit 1.

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

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4)(ii), ISI 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 10 CFR 50.55a(a), 12 months before the start of the 120-month inspection interval (or the optional ASME Code Cases listed in Regulatory Guide (RG) 1.147, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1,” when using ASME Code, Section XI, as incorporated by reference in 10 CFR 50.55a (a)(3)(ii), subject to the conditions listed in 10 CFR 50.55a(b).

Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with ASME Code requirements is impractical for its facility, the licensee must notify the U.S. Nuclear

[1] On February 27, 2020, the NRC approved an order and conforming amendments for the license transfer from FirstEnergy Nuclear Operating Company to Energy Harbor (ADAMS Accession No. ML20030A440).

Regulatory Commission (NRC or the Commission) and submit, as specified in 10 CFR 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 ASME Code requirements during the ISI 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 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations under 10 CFR 50.55a(g)(5) 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, and 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 Background

By letter dated March 23, 2011 (ADAMS Accession No. ML110630403), the NRC approved implementation of the risk-informed inservice inspection (RI-ISI) program for the Class 1 pipe welds (Examination Categories B-F and B-J) and the Class 2 pipe welds in the fourth 10-year ISI interval of Beaver Valley, Unit No. 1. The licensee developed the Beaver Valley RI-ISI program in accordance with methodology described in WCAP-14572, Revision 1-NP-A, “Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report.”

3.2 Component Affected

In its letter dated August 27, 2019, the licensee submitted Relief Requests 2-TYP-3-B3.110-1 as Enclosure A, 2-TYP-3-C2.21-1 as Enclosure B, 2-TYP-3-C1.30-1 as Enclosure C, and 2-TYP-3-RA-1 as Enclosure D. The licensee identified the affected welds in each of the enclosures to the letter, which are identified below.

Enclosure A: Six Class 1, Examination Category B-D, Item Number B3.110 nozzle-to-vessel welds in the pressurizer:

- Surge nozzle weld 2RCS*PRE21-N-9
- Safety relief nozzle weld 2RCS*PRE21-N-10
- Safety relief nozzle weld 2RCS*PRE21-N-11
- Safety relief nozzle weld 2RCS*PRE21-N-12
- Power operated relief nozzle weld 2RCS*PRE21-N-13

Enclosure B: One Class 2, Examination Category C-B, Item Number C2.21 “A” steam generator feedwater inlet nozzle-to-vessel weld:

- Feedwater nozzle-to-vessel weld 2RCS*SG21A-N-09

Enclosure C: Two Class 2, Examination Category C-A, Item Number C1.30 “A” recirculation spray cooler tubesheet-to-shell welds:

- Tubesheet-to-shell weld 2RSS-E21A-C-1
- Tubesheet-to-shell weld 2RSS-E21A-C-11

Enclosure D: Sixteen Class 2, Examination Category R-A, Item Number R1.11 piping welds:

- Pipe-to-valve weld 2CHS-072-F02
- Pipe-to-valve weld 2CHS-072-F03
- Pipe-to-valve weld 2CHS-072-F06
- Pipe-to-valve weld 2CHS-072-F07
- Pipe-to-valve weld 2CHS-015-F02
- Pipe-to-valve weld 2CHS-015-F03
- Pipe-to-valve weld 2CHS-015-F06
- Pipe-to-valve weld 2CHS-015-F07
- Pipe-to-valve weld 2CHS-357-F13-C
- Pipe-to-valve weld 2CHS-357-F12-C
- Pipe-to-valve weld 2SIS-047-F-06
- Pipe-to-valve weld 2SIS-047-F-07
- Pipe-to-valve weld 2SIS-048-F-509
- Pipe-to-valve weld 2SIS-048-F-05A
- Pipe-to-valve weld 2SIS-091-F01
- Pipe-to-valve weld 2SIS-091-F511

In each enclosure, the licensee provided the nominal pipe size, materials of construction, and additional details for each weld.

3.3 Applicable Code Edition and Addenda

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

3.4 Duration of Relief Request

The licensee submitted Relief Requests 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2 TYP-3-C1.30-1, and 2-TYP-3-RA-1 for the third 10-year ISI interval, which started on August 29, 2008, and ended on August 15, 2019. The licensee stated that the third 10-year ISI interval was extended from August 28, 2018, to August 15, 2019, in accordance with ASME Code, Section XI, IWA-2430.

3.5 ASME Code Requirement

For the Class 1, Examination Category B-D, Item Number B3.110 nozzle-to-vessel welds, the applicable ASME Code examination requirements are in Table IWB-2500-1, “Examination

Category B-D, Full Penetration Welded Nozzles in Vessels Inspection Program B." For these welds, the ASME Code requires volumetric examination of all nozzles.

For the Class 2, Examination Category C-B, Item Number C2.21 "A" steam generator feedwater inlet nozzle-to-vessel weld, the applicable ASME Code examination requirement is in Table IWC--2500-1, "Examination Category C-B, Pressure Retaining Nozzle Welds in Vessels." For this weld, the ASME Code requires surface and volumetric examinations of the nozzle at terminal end of the piping run.

For the Class 2, Examination Category C-A, Item Number C1.30 "A" recirculation spray cooler tubesheet-to-shell welds, the applicable ASME Code examination requirements are in Table IWC--2500-1. For these welds, the ASME Code requires volumetric examinations of the tubesheet-to-shell welds.

The ASME Code requirements applicable to the Class 2, Examination Category R-A, Item Number R1.11 piping welds originate in Section XI, Table IWC-2500-1. The Beaver Valley RI-ISI program was approved as an alternative to the ASME Code requirements by the NRC in a safety evaluation dated March 23, 2011 (ADAMS Accession No. ML110630403). In accordance with the licensee's RI-ISI program, the piping welds in 2-TYP-3-RA-1 are required to be volumetrically examined.

The extent of required examination coverage for all of the welds in these relief requests is defined to be essentially 100 percent (i.e., greater than 90 percent coverage) by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI." This Code Case has been incorporated by reference into 10 CFR 50.55a by inclusion in RG 1.147, Revision 18.

3.6 Impracticality of Compliance

For the Class 1, Examination Category B-D, Item Number B3.110 nozzle-to-vessel welds, the licensee stated that examination volume requirements were determined to be impractical. The licensee stated that obtaining the specified volumetric examination volume would require redesign and replacement of the pressurizer tank nozzles and heater penetrations. In Enclosure A, the licensee described and illustrated in detail the limitations that prevented ultrasonic volumetric examination of the welds using ultrasonic testing (UT).

For the Class 2, Examination Category C-B, Item Number C2.21 "A" steam generator feedwater inlet nozzle-to-vessel weld, the licensee stated that examination volume requirements were determined to be impractical. The licensee stated that obtaining the specified volumetric examination volume would require redesign and replacement of the steam generator feedwater nozzle. The licensee stated that it would also include removing insulation bracket obstructions, which would require an excessive amount of man hours and radiological dose to obtain the best possible coverage. In Enclosure B, the licensee described in detail the limitations that prevented UT examination of the welds. There were no coverage limitations for the surface examinations; therefore, relief for the surface examination requirement was not requested.

For the Class 2, Examination Category C-A, Item Number C1.30 "A" recirculation spray cooler tubesheet-to-shell welds, the licensee stated that examination volume requirements were determined to be impractical. The licensee stated that obtaining the specified volumetric examination volume would require redesign and replacement of the seismic lugs, tubesheet, or

nozzle on the recirculation spray cooler. In Enclosure C, the licensee described in detail the limitations that prevented UT examination of the welds.

For the Class 2, Examination Category R-A, Item Number R1.11 piping welds, the licensee stated that it was not possible to obtain greater than 90 percent of the ASME Code-required examination volume due to limitations, which include configuration and geometry of the subject piping welds and associated components, obstructions by other components, surface conditions, and/or metallurgical constraints. In Section 4 and Table 1 of Enclosure D to Relief Request 2-TYP-3-RA-1, the licensee described the limitations that prevented UT scanning of the welds. Examples include valve body that limits access to valve side of the weld and geometry of elbow or flange that limits access to the weld and restricts the UT scanning.

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

3.7 Proposed Alternative and Basis for Use

For the Class 1, Examination Category B-D, Item Number B3.110 nozzle-to-vessel welds, the alternative that the licensee proposed is performing the UT examination to the maximum extent practical and performing the periodic pressure testing in accordance with Category C-H of the ASME Code, Section XI.

The licensee stated that (1) the Examination Category C-H periodic pressure test and UT examination coverage detailed in its submittal provide reasonable assurance of continued reliability of these welds, (2) a review of previous plant-specific and industry examinations showed no history of indications within these welds, and (3) condition monitoring already in place would detect a through-wall leak within a reasonable amount of time.

For the Class 2, Examination Category C-B, Item Number C2.21 “A” steam generator feedwater inlet nozzle-to-vessel weld, the alternative that the licensee proposed is performing the UT examination to the maximum extent practical, monitoring for leakage, and continuing leakage walkdowns.

The licensee stated that (1) the Examination Category C-H periodic pressure test, completed surface examinations, and UT examination coverage detailed in its submittal provide reasonable assurance of continued reliability of these welds; 2) a review of previous plant-specific and industry examinations showed no history of indications within these welds; and 3) condition monitoring already in place would detect a through-wall leak within a reasonable amount of time.

For the Class 2, Examination Category C-A, Item Number C1.30 “A” recirculation spray cooler tubesheet-to-shell welds, the alternative that the licensee proposed is performing the UT examination to the maximum extent practical and leakage walkdowns.

The licensee stated that (1) the Examination Category C-H periodic pressure test and UT examination coverage detailed in its submittal provide reasonable assurance of continued reliability of these welds, 2) a review of previous plant-specific and industry examinations showed no history of indications within these welds, and 3) condition monitoring already in place would detect a through-wall leak within a reasonable amount of time.

For the Class 2, Examination Category R-A, Item Number R1.11 piping welds, the licensee reported the percent coverage achieved for each pipe weld examined in Table 1 of Enclosure D to Relief Request 2-TYP-3-RA-1, as summarized in the table below:

Table 1- ASME Code Coverage for Pipe Welds in 2-TYP-3-RA-1

Weld Designation	**Coverage Obtained (Percent)**
2CHS-072-F02	50
2CHS-072-F03	44
2CHS-072-F06	50
2CHS-072-F07	50
2CHS-015-F02	50
2CHS-015-F03	50
2CHS-015-F06	50
2CHS-015-F07	50
2CHS-357-F13-C	50
2CHS-357-F12-C	50
2SIS-047-F-06	50
2SIS-047-F-07	50
2SIS-048-F-509	50
2SIS-048-F-05A	50
2SIS-091-F01	50
2SIS-091-F511	45

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

The licensee described the reason for selecting two welds for examination from each of the eight piping segments. The licensee stated that as part of the RI-ISI program and due to susceptibility to thermal fatigue, the program requires one weld to be selected within each high safety-significant piping segment (i.e., CHS-026B, CHS-026D, CHS-009, CHS-008, CHS-018B, SIS-032, SIS-033, and SIS-066) and volumetrically inspected with full coverage. If the examination yields a limited coverage, the RI-ISI program requires inspection of an additional weld in the same piping segment, if available. For each of eight piping segments, the licensee determined that there were no welds to select that would not result in a single-sided examination with limited coverage. No unacceptable indications were identified in any of the welds examined.

The licensee stated that it performed the UT to the maximum extent possible. Personnel who performed the UT were qualified, and the UT procedures used were performance demonstrated in accordance with ASME Code, Section XI, Appendix VIII.

The licensee stated as an effort to achieve additional coverage, it also performed a “best effort” UT scan of the selected pipe welds. The coverage achieved from the “best effort” examination is reported as “best-effort coverage (%)” or “total % examined” in Table 1 or Section 4 tables of Enclosure D to 2-TYP-3-RA-1. No credit was taken for the “best effort” scan coverage because

the “best effort” scan is not an ASME Code-qualified examination. No unacceptable indications were identified in the volume examined by the “best effort” scan.

The licensee stated that the pipe welds in Relief Request 2-TYP-3-RA-1 have also been subjected to the ASME Code system leakage testing and VT-2 visual examination in the third 10-year ISI interval, in addition to the volumetric examination. No sign of leakage has been identified in any of the pipe welds during the VT-2 examinations.

3.8 NRC Staff Evaluation

The NRC staff has evaluated relief request 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2 TYP-3-C1.30-1, and 2-TYP-3-RA-1 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 without a commensurate increase in safety, and (3) that the licensee’s proposed alternative (accepting the reduced inspection coverage in this case) provides reasonable assurance of structural integrity and leaktightness of the subject pipe 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.

Examination Category B-D

As previously stated, ASME Code, Section XI, Table IWB-2500-1, requires volumetric examinations of all nozzles. The licensee is requesting relief from the volumetric examination requirements because the examinations are limited due to the nozzle curvature that causes the transducer to lose contact with the vessel surface. The licensee also stated that the examination of the surge nozzle weld 9 is limited by heater penetrations that surround the nozzle. The licensee stated that the UT revealed no indications.

The NRC staff reviewed the licensee’s detailed drawings of the location of the welds and applicable obstructions showing the areas for which examination access is limited. The NRC staff confirmed that each weld’s particular design configuration prevented the licensee from obtaining the required inspection coverage. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

The licensee stated that it was not possible to remove the obstructions without significant work with guarantee of increased examination coverage. The NRC staff finds that replacing or reconfiguring the components of the subject welds constitutes a burden on the licensee without a commensurate increase in safety.

The NRC staff considered whether the licensee’s proposed alternative provided reasonable assurance of structural integrity and leaktightness of the subject pipe welds 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).

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. The NRC staff verified that the coverage was calculated in a reasonable manner, coverage was limited by physical limitations or 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.

The pressurizer is located in the reactor containment building. As per plant technical specifications, leakage rates within containment are monitored and sources identified. The licensee stated that a VT-2 exam for leakage is conducted at operating pressure once per period per ASME Code Examination Category C-H, and that any leakage would be noted during Class 1 pressure test walkdowns performed after each outage during startup. Also, during outages, the bolted connection on the manway located on the pressurizer upper head has insulation removed and a leakage exam performed per Code requirements. The licensee stated that leakage resulting from degradation of the subject welds would be discovered within a reasonable amount of time. Despite reduced coverage of the required examination volume, the NRC staff finds that leakage monitoring will provide additional assurance that any pattern of degradation, if it were to occur, would be detected, and the licensee will take appropriate correction actions.

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

Examination Category C-B

As previously stated, ASME Code, Section XI, Table IWC-2500-1, Examination Category C-B, requires surface and volumetric examinations of all nozzles at terminal ends of piping runs.

The licensee is requesting relief from the volumetric examination requirements because the configuration of nozzle weld prohibits the UT scan from the nozzle side of the weld. The licensee also stated that the UT coverage is limited by a physical obstruction with a nearby insulation support, and the licensee noted that removing the insulation bracket would still not result in a complete exam. The surface examination was performed using magnetic particle technique and did not have a coverage limitation. The licensee stated that the UT and surface examinations revealed no indications.

The NRC staff reviewed the licensee's detailed figures of the location of the weld and applicable obstructions showing the areas for which examination access is limited. The NRC staff confirms that each weld's particular design configuration prevented the licensee from obtaining the required inspection coverage. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

The licensee stated that it was not possible to remove the obstructions without significant work and increased radiation exposure with guarantee of increased examination coverage. The NRC staff finds that replacing or reconfiguring the components of the subject welds constitutes a burden on the licensee without a commensurate increase in safety.

The NRC staff considered whether the licensee's proposed alternative provided reasonable assurance of structural integrity and leaktightness of the subject pipe welds 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).

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. The NRC staff verified that the coverage was calculated in a reasonable manner, coverage was limited by physical limitations or 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.

The steam generator is located in the reactor containment building. As per plant technical specifications, leakage rates within containment are monitored and sources identified. The licensee stated that a VT-2 exam for leakage is conducted at operating pressure once per period per ASME Code Examination Category C-H, and that any leakage would be noted during Class 1 pressure test walkdowns performed after each outage during startup. The licensee stated that leakage resulting from degradation would be discovered within a reasonable amount of time. Despite reduced coverage of the required examination volume, the NRC staff finds that leakage monitoring will provide additional assurance that any pattern of degradation, if it were to occur, would be detected, and the licensee will take appropriate correction actions.

Therefore, the NRC staff finds that the surface and UT examinations performed to the extent possible 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 without a commensurate increase in safety.

Examination Category C-A

As previously stated, ASME Code, Section XI, Table IWC-2500-1 requires volumetric examinations of the tubesheet-to-shell welds.

The licensee is requesting relief from the volumetric examination requirements because the UT was limited due to three physical obstructions. Two physical obstructions are due to seismic support lugs that are welded to the tubesheet just below and in close proximity to the weld of interest. One physical obstruction is due to a nozzle reinforcing ring welded to the vessel wall just above one of the support lugs. The licensee stated that the UT revealed no indications.

The NRC staff reviewed the licensee's detailed drawings of the location of the welds and applicable obstructions showing the areas for which examination access is limited. The NRC staff confirms that each weld's particular design configuration prevented the licensee from obtaining the required inspection coverage. Therefore, the NRC staff finds that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

The NRC staff considered whether the licensee's proposed alternative provided reasonable assurance of structural integrity and leaktightness of the subject pipe welds 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).

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, the NRC staff verifies that the coverage was calculated in a reasonable manner, coverage was limited by physical limitations or 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 within the ASME Code.

The licensee stated that it was not possible to remove the obstructions without significant work and increased radiation exposure with guarantee of increased examination coverage. The NRC staff finds that replacing or reconfiguring the components of the subject welds constitutes a burden on the licensee without a commensurate increase in safety.

The recirculation spray cooler is located in the safeguards building, which is accessible during operation. The licensee stated that a VT-2 exam for leakage is conducted at operating pressure once per period per ASME Code Examination Category C-H and that the tank is also surveilled during monthly walkdowns. The licensee stated that leakage resulting from degradation would be discovered within a reasonable amount of time. Despite reduced coverage of the required examination volume, the NRC staff finds that leakage monitoring will provide additional assurance that any pattern of degradation, if it were to occur, would be detected, and the licensee will take appropriate correction actions.

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

Examination Category R-A

As described in Section 4 and Table 1 of Enclosure D to Relief Request 2-TYP-3-RA-1, the predominant limitations that prevented the licensee's UT from achieving essentially 100 percent coverage of the ASME Code-required volume were pipe-to-valve, pipe-to-flange, and elbow-to-flange weld configurations; obstructions; and/or the metallurgical constraints. The licensee performed the UT from one side of weld (single-sided scan) because scanning from the valve side of the welds was not possible. The NRC staff confirmed that each weld's particular design configuration prevented the licensee from fully 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.

The licensee proposed that making the pipe 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 pipe welds is the only reasonable means to achieve dual-sided coverage of these welds and that replacement or reconfiguration of the pipe, valve, elbow, and/or flange constitutes a burden on the licensee without a commensurate increase in safety.

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

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, the NRC staff verified that:

- The pipe 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 personnel and UT procedures utilized for the volumetric examination were qualified as required by the regulation;
- The coverage was limited by physical limitations or 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.

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of pipe welds and unachievable coverage. From review of the licensee's 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 of the base material near the inside diameter surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation.

- For the austenitic stainless steel welds, the NRC staff notes that 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. 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.

- As part of the RI-ISI program and the limited coverage of the weld inspected during the third 10-year ISI interval, the licensee chose one additional weld for inspection from each of the subject pipe segments that has the same materials subject to the same operating conditions and environment. Limited coverage was also achieved, and no unacceptable indications were detected in the volume examined.

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

heat-affected zone 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 UT that the licensee performed.

In this analysis, the NRC staff also found that, in addition to the required volumetric examinations, these piping welds have received the system leakage test and VT-2 according to the ASME Code, Section XI, Table IWC-2500-1, Examination Category C-H. 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 will take appropriate correction actions.

Therefore, the NRC staff finds that the UT performed to the extent possible provides a reasonable assurance of structural integrity and leaktightness of the subject pipe welds. Compliance with the ASME Code requirements for these pipe welds would be a burden on the licensee without a commensurate increase in safety.

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 inspection provides reasonable assurance of structural integrity or leaktightness 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 regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants Relief Requests 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2TYP-3-C1.30-1, and 2-TYP-3-RA-1 at Beaver Valley, Unit 2, for the third 10-year ISI interval, which commenced on August 29, 2008, and ended on August 15, 2019.

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

Principal Contributors: A. Rezai
M. Yoo

Date: April 28, 2020

SUBJECT: BEAVER VALLEY POWER STATION, UNIT 2 - RELIEF REQUESTS 2-TYP-3-B3.110-1, 2-TYP-3-C2.21-1, 2-TYP-3-C1.30-1, AND 2-TYP-3-RA-1 REGARDING WELD EXAMINATION COVERAGE FOR THE THIRD INSERVICE INSPECTION INTERVAL (EPID L-2019-LLR-0082) DATED APRIL 28, 2020

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