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

June 21, 2019

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT – ISSUANCE OF RELIEF REQUEST I4R-22 RE: RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (EPID L-2018-LLR-0103)

Dear Mr. Hanson:

By letter dated July 26, 2018, as supplemented by letter dated January 15, 2019 (Agencywide Documents Access and Management System Accession Nos. ML18208A150 and ML19017A005, respectively), Exelon Generation Company, LLC (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for relief from certain American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code), Section XI requirements at the James A. FitzPatrick Nuclear Power Plant (FitzPatrick).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief, and to use alternative requirements, if necessary, for inservice inspection items on the basis that the ASME Code requirement is impractical.

The NRC staff has reviewed the licensee's submittal and concludes that compliance with ASME Code examination coverage requirements are impractical for the subject welds listed in Relief Request I4R-22. Further, based on the coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. In addition, the NRC staff concludes that the licensee's best effort examinations obtained provide reasonable assurance of structural integrity of the welds. The NRC staff also concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii).

Accordingly, the NRC staff has determined 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. Therefore, the NRC grants Relief Request I4R-22 for the fourth 10-year inservice inspection interval at FitzPatrick.

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

If you have any questions, please contact the FitzPatrick Project Manager, Carleen J. Parker, at 301-415-1603 or Carleen.Parker@nrc.gov

Sincerely,

/RA/

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

Docket No. 50-333

Enclosure:
Safety Evaluation

cc: Listserv

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT – ISSUANCE OF RELIEF REQUEST I4R-22 RE: RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (EPID L-2018-LLR-0103) DATED JUNE 21, 2019

DISTRIBUTION:

Public
PM File Copy
RidsRgn1MailCenter
RidsNrrDmlrMvib
DDijamco, NRR
RidsNrrDorlLpl1
RidsNrrLALRonewicz
JQuichocho, OEDO
RidsNrrDmlrMphb
RidsNrrPMFitzPatrick
RidsACRS_MailCTR
MMcCoppin, OEDO
GCheruvenki, NRR

ADAMS Accession No.: ML19135A444 *by e-mail

OFFICE	NRR/DORL/LPL1/PM	NRR/DORL/LPL1/LA	NRR/DMLR/MVIB/BC*	NRR/DMLR/MPHB/BC*
NAME	CParker	LRonewicz	DAlley	SCumblidge
DATE	06/20/2019	05/17/2019	03/08/2019	03/21/2019
OFFICE	NRR/DORL/LPL1/BC			
NAME	JDanna			
DATE	06/21/2019			

OFFICIAL RECORD COPY

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST I4R-22

EXELON FITZPATRICK, LLC

EXELON GENERATION COMPANY, LLC

AND ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NOS. 50-333

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

1.0 INTRODUCTION

By letter dated July 26, 2018, as supplemented by letter dated January 15, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML18208A150 and ML19017A005, respectively), Exelon Generation Company, LLC (Exelon, the licensee) submitted Relief Request I4R-22 to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for the fourth 10-year inservice inspection (ISI) interval at the James A. FitzPatrick Nuclear Power Plant (FitzPatrick). Relief Request I4R-22 requested relief from the examination coverage requirements specified in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Companies," Class 1 and 2 components.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief and to use alternative requirements, if necessary, for inservice inspection items on the basis that the ASME Code requirement is impractical.

2.0 REGULATORY REQUIREMENTS

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must 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 regulation requires that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals complies with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(a)(1)(ii), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed in 10 CFR 50.55a(b)(2).

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 edition and addenda as required by

10 CFR 50.55a(g), except where specific relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). As stated in part in 10 CFR 50.55a(g)(5)(iii), licensees may determine that conformance with certain Code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination. Determination of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the Code requirements during the ISI interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial 120-month inspection interval or subsequent 120-month inspection interval for which relief is sought. The FitzPatrick fourth 10-year ISI interval began on March 1, 2007, and ended on July 31, 2017. The ASME Code of record for FitzPatrick for the fourth 10-year ISI interval was the ASME Code, Section XI, 2001 Edition through the 2003 addenda.

As stated in part in 10 CFR 50.55a(g)(6)(i):

> The Commission will evaluate determinations under paragraph (g)(5) of this section that 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 the relief and for the NRC to authorize it.

3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the request for relief from ASME Code requirements has been evaluated, and the basis for disposition is documented below. For clarity, the request has been evaluated in several parts according to ASME Code Examination Category.

3.1 Examination Category B-A, Pressure Retaining Welds in Reactor Vessel, Item No. B1.12, Longitudinal Shell Welds

3.1.1 Components Affected

Details of the reactor pressure vessel (RPV) welds under Examination Category B-A are shown in Table 1 below. This information is obtained from the July 26, 2018, request, Table I4R-22.1, “James A. FitzPatrick Nuclear Power Plant, List of Components with Limited Examination Coverage.”

Table 1
Examination Category B-A, Item No. B1.12, Limited Volumetric Examination Coverage

Weld Identification	Weld Material	Examination Limitation	Percent Coverage Achieved
VV-2A	Ferritic steel	Feedwater and core spray headers	79.22
VV-2B	Ferritic steel	Feedwater and core spray headers, core spray downcommers, guide rod	78.16
VV-2C	Ferritic steel	Feedwater and core spray headers	74.78
VV-3A	Ferritic steel	Guide rod, support bracket (riser restraint and riser brace)	86.04
VV-3B	Ferritic steel	Guide rod bracket, angle bracket	88.38
VV-3C	Ferritic steel	Surveillance specimen holder, riser restraint bracket	77.03
VV-4A	Ferritic steel	Jet pump piping, core plate, gusset brackets	81.13
VV-4B	Ferritic steel	Jet pump piping, core plate, gusset brackets	85.67
VV-4C	Ferritic steel	Jet pump piping, core plate, gusset brackets	79.15

3.1.2 ASME Code Requirement

The ASME Code examination requirement is a volumetric examination of essentially 100 percent of the weld length, as specified in Table IWB-2500-1, “Examination Categories,” of the ASME Code, Section XI, Examination Category B-A. When 100 percent of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460, “Alternative Examination Coverage for Class 1 and Class 2 Welds,” allows reduction of the examination volume to 90 percent of the required volume. Code

Case N-460 has been approved for use without conditions in Regulatory Guide (RG) 1.147, Revision 18, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," which is incorporated by reference in 10 CFR 50.55a(a)(3)(ii). For Examination Category B-A, Item No. B1.12, the examination volume is defined in Figure IWB-2500-2, "Vessel Shell Longitudinal Weld Joints," of the ASME Code, Section XI.

3.1.3 Licensee's Relief Request

The licensee could not achieve the required examination coverage for the welds in Table 1 above because of the limitations summarized in the table. For the nine RPV welds, the licensee achieved 74.78 percent to 88.38 percent of the required examination volume and detected four indications in weld VV-2A, one indication in weld VV-2B, two indications in weld VV-3C, and no recordable indications in the remaining welds. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical, and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a (g)(5)(iii).

3.1.4 Basis for Relief Request

Due to the limitations on the subject RPV welds, the welds and their associated components would have to be physically modified and/or disassembled beyond their current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such modifications presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the welds to the maximum extent practical by ultrasonic testing (UT), achieving the coverages listed in Table 1 above.

3.1.5 NRC Staff Evaluation

For the RPV welds listed in Table 1 above, the licensee achieved less than 90 percent of the required volumetric examination coverage due to limitations such as the following: feedwater and cores spray headers, guide rods near the RPV inside surface, guide rod brackets, riser braces, riser restraint brackets, surveillance specimen holders, jet pump piping, core plate, and gusset brackets. The NRC staff finds these limitations to be an acceptable basis for impracticality for conforming to the ASME Code requirements and finds the modifications necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined the RPV welds listed in Table 1 above per the requirements in Table IWB-2500-1 of the ASME Code, Section XI, for Examination Category B-A. The licensee performed the required volumetric examination of the subject welds using UT to the extent practical and achieved the coverages shown in Table 1 above. The NRC staff reviewed the examination diagrams and coverage sheets provided by the licensee, which showed that the examined volumes included weld and base materials in the inner region where degradation is expected to occur (if it occurs). The licensee used 45-degree longitudinal and shear wave scanners parallel and transverse to the weld from both sides of the weld. The NRC staff finds that despite the limited coverages, the examinations were adequately performed.

The licensee detected four indications in weld VV-2A, one indication in weld VV-2B, and two indications in weld VV-3C, and determined that the indications were acceptable per IWB-3510.1 of Section XI of the ASME Code. The NRC staff noted that in the examination data sheet for these three welds, the indications are labeled "V" for volumetric. Examples of volumetric indications in welds are slag and porosity, which are fabrication defects and are not caused by service-induced loads. The NRC staff determined that since the indications are not

service-induced, they do no challenge the structural integrity of the welds, and thus determined that the licensee adequately dispositioned the indications found in the three welds.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume coverage for the subject RPV welds is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the welds for the following reasons: (1) the detected indications were not due to service-induced loads and were below the ASME Code allowable sizes; and (2) despite the limited coverages, the licensee examined regions of the welds most susceptible to service-induced degradation, should it occur.

3.2 Examination Category B-D, Full Penetration Welded Nozzles in Vessels – Inspection Program B, Item No. B3.90, Reactor Vessel Nozzle-to-Vessel Welds

3.2.1 Components Affected

Details of the RPV nozzle-to-vessel welds under Examination Category B-D are shown in Table 2 below. This information was obtained from the July 26, 2018, request, Table I4R-22.1.

Table 2
Examination Category B-D, Item No. B3.90, Limited Volumetric Examination Coverage

Weld Identification	Nozzle Location	Weld Material	Examination Limitation	Percent Coverage Achieved
N-1B	28" Recirculation Outlet	Ferritic steel	Shell-to-nozzle configuration and insulation support bracket and support rings	40.35
N-2B	12" Recirculation Inlet	Ferritic steel	Nozzle-to-shell configuration, insulation support bracket, welded plate on vessel	85.90
N-2E	12" Recirculation Inlet	Ferritic steel	Nozzle-to-shell configuration, insulation support bracket, welded plate on vessel	85.90
N-2F	12" Recirculation Inlet	Ferritic steel	Nozzle-to-shell configuration, insulation support bracket	85.90
N-3D	24" Main Steam	Ferritic steel	Shell-to-nozzle configuration	35.60

Weld Identification	Nozzle Location	Weld Material	Examination Limitation	Percent Coverage Achieved
N-4A	12" Feedwater	Ferritic steel	Nozzle-to-shell configuration, Nozzle N-11	14.40
N-4B	12" Feedwater	Ferritic steel	Nozzle-to-shell configuration	16.50
N-4C	12" Feedwater	Ferritic steel	Nozzle-to-shell configuration, Nozzle N-11	14.40
N-4D	12" Feedwater	Ferritic steel	Nozzle-to-shell configuration	16.50
N-5A	10" Core Spray	Ferritic steel	Nozzle-to-shell configuration, thermocouple pad / insulation support ring	38.60
N-9	3" Control Rod Drive	Ferritic steel	Nozzle-to-shell configuration, insulation support ring	67.00
N-TH-A	5.75" RPV Closure Head Vent	Ferritic steel	Nozzle-to-shell configuration	57.60

3.2.2 ASME Code Requirement

The ASME Code examination requirement is a volumetric examination of essentially 100 percent of the applicable nozzle-to-vessel weld volume as defined in Figures IWB-2500-7(a) through IWB-2500-7(d), “Nozzle in Shell or Head,” of the ASME Code, Section XI. For some of the RPV nozzle-to-vessel welds, the licensee invoked Figure 2, “Nozzle in Shell or Head,” of ASME Code Case N-613-1, “Ultrasonic Examination of Full Penetration Nozzles in Vessels, Examination Category B-D, Item Nos. B3.10 and B3.90, Reactor Nozzle-to-Vessel Welds, Figures IWB-2500-7(a), (b), and (c),” which defines an alternative examination volume for the nozzle-to-vessel weld. ASME Code Case N-613-1 has been superseded by ASME Code Case N-613-2, which has been approved for use without conditions in RG 1.147, Revision 18. In addition, when 100 percent of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460 allows reduction of the examination volume to 90 percent. Table 2 above summarizes the coverages the licensee achieved.

3.2.3 Licensee’s Relief Request

The licensee could not achieve the required examination coverage for the welds in Table 2 above because of the limitations summarized in the table. For the 12 RPV nozzle-to-vessel

welds, the licensee achieved 14.40 percent to 85.90 percent of the required examination volume and detected no recordable indications. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical, and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

3.2.4 Basis for Relief Request

Due to the limitations on the subject RPV nozzle-to-vessel welds, the welds and their associated components would have to be physically modified and/or disassembled beyond their current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such modifications presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the welds to the maximum extent practical by UT, achieving the coverages in Table 2 above.

3.2.5 NRC Staff Evaluation

For the RPV nozzle-to-vessel welds listed in Table 2 above, the licensee achieved less than 90 percent of the required volumetric examination coverage due to limitations such as the following: nozzle configuration, insulation support brackets and rings, welded plates, proximity of nozzle N-11, and thermocouple/pad insulation support ring. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds that the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined the RPV nozzle-to-vessel welds in Table 2 above per the ASME Code, Section XI, Table IWB-2500-1 requirements for Examination Category B-D and ASME Code Case N-613-1. The licensee performed the required volumetric examination of the welds using UT to the extent practical and achieved the coverages shown in Table 2 above. The NRC staff reviewed the scan diagrams and coverage sheets, which showed that the examined volumes included weld and base materials in the inner region where degradation is expected to occur (if it occurs). The NRC staff noted that for the recirculation outlet nozzle weld, N-1B, and the four feedwater nozzle-to-vessel welds, N-4A, N-4B, N-4C, and N-4D, the licensee achieved very limited coverages in the circumferential scan direction, even though the coverages included the inner region. The circumferential coverage scans for axial indications, which are indications oriented radially from the nozzle centerline. The NRC staff noted that, potentially, the limited circumferential scan coverage is not large enough to detect a flaw, which can, therefore, challenge the structural integrity of the welds. However, the NRC staff determined that even if an axial flaw is not detected with a circumferential scan, and the axial flaw were to grow through-wall, it would cause leakage in the weld, a leakage that would be detectable by the required ASME Code, Section XI, Examination Category B-P, “All Pressure Retaining Components,” visual testing for leakage. The staff, therefore, determined that the limited coverages for these welds are acceptable. The staff reviewed the scan diagrams for the rest of the RPV nozzle-to-vessel welds in Table 2 and finds that despite the limited coverages, the examinations were adequately performed.

The licensee invoked Figure 2 of ASME Code Case N-613-1 as an alternative examination volume for the some of the RPV nozzle-to-vessel welds. As the NRC staff noted earlier, ASME Code Case N-613-1 has been superseded by ASME Code Case N-613-2. In accordance with RG 1.147, the older or superseded version of a Code case cannot be applied by the licensee for the first time. However, a licensee who implemented the Code case prior to annulment (being superseded in this case) may continue to use that Code case through the end of the present ISI

interval. During the majority of the fourth 10-year ISI interval, Code Case N-613-1 was the approved revision in RG 1.147. Therefore, the licensee's use of Code Case N-613-1 was appropriate for the fourth 10-year ISI interval at FitzPatrick. Additionally, the NRC staff reviewed the differences between Figure 2 of ASME Code Case N-613-1 and Figure 2 of ASME Code Case N-613-2, and determined that the required examination volumes are identical. Therefore, the NRC staff determined that the licensee, by examining the required volume defined in Figure 2 of Code Case N-613-1 has examined the required volume specified in Code Case N-613-2.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for the RPV nozzle-to-vessel welds in Table 2 above is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the welds for the following reasons: (1) no recordable indications was detected; (2) welds N-1B, N-4A, N-4B, N-4C, and N-4D would leak long before the RPV is challenged, and that leakage would be detected by required visual examinations; and (3) despite the limited coverages, the licensee examined regions of the welds most susceptible to service-induced degradation, should it occur.

3.3 Examination Category B-G-1, Pressure Retaining Bolting, Greater than 2 inches (in) (50.8 millimeter (mm) in Diameter B6.40 Threads-in-Flange

3.3.1 Components Affected

The components under Examination Category B-G-1, Item No. B6.40, are 15 RPV threads-in-flange, ligaments 18 to 32.

3.3.2 ASME Code Requirement

The examination requirement is a volumetric examination of essentially 100 percent of the threads-in-flange volume defined in Figure IWB-2500-12, "Closure Stud and Threads in Flange Stud Hole," of the ASME Code, Section XI.

3.3.3 Licensee's Relief Request

The licensee could not achieve the required examination coverage for the RPV threads-in-flange, ligaments 18 to 32, due to the cladding on the inner side of the flange and the RPV seal ring groove on the outer side of the RPV stud holes. The licensee achieved 79 percent coverage for the 15 RPV threads-in-flange and detected no recordable indications. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical, and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

3.3.4 Basis for Relief Request

Due to the limitations, the RPV flange would have to be physically modified beyond its current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such a modification presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the RPV threads-in-flange to the maximum extent practical by UT, achieving 79 percent coverage.

3.3.5 NRC Staff Evaluation

For the RPV threads-in-flange, ligaments 18 to 32, the licensee did not achieve the required volumetric examination coverage due to the cladding on the inner side of the flange and the RPV seal ring groove on the outer side of the RPV stud holes. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined the RPV threads-in-flange, ligaments 18 to 32, per the requirements in Table IWB-2500-1 of ASME Code, Section XI, for Examination Category B-G-1. The licensee performed the required volumetric examination of the weld using UT to the maximum extent practical and achieved 79 percent coverage with no recordable indications. The licensee did not provide a scan diagram for this examination but stated that there was no change from the previous examination results. The NRC staff reviewed the examination coverage and sketch in relief request RR-CRV-1 from the previous (third) 10-year ISI interval (ADAMS Accession No. ML081290489), which the licensee submitted in 2008, and which the NRC staff approved in 2009 (ADAMS Accession No. ML091070210). The NRC staff determined that the coverages and limitations in the third ISI interval are the same as those for the fourth ISI interval. The sketch in the 2008 submittal (Attachment 10 to Enclosure 1) shows that a portion of the circumference of a typical RPV ligament stud hole is not accessible. For the accessible portion, the NRC staff determined that it is reasonable to infer that the scanner probe covered the 1-inch annular flange volume (as depicted in ASME Code Case Figure IWB-2500-12) from the flange threads grooves. The NRC staff, therefore, determined that the examined volumes in the RPV threads-in-flange included RPV flange material in the grooves of the thread where degradation is expected to initiate, should it occur.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for the RPV threads-in-flange in ligaments 18 to 32 is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the RPV threads-in-flange because no recordable indications were detected, and despite the limited coverages, the licensee-examined regions of the threads-in-flange most susceptible to service-induced degradation, should it occur.

3.4 Examination Category B-J, Pressure Retaining Welds in Piping, Item No. B9.11, Circumferential Welds

3.4.1 Components Affected

Jet pump instrument safe end-to-eccentric reducer weld 4-02-2-117 and jet pump instrument eccentric reducer-to-eccentric reducer weld N8B-SE-1.

3.4.2 ASME Code Requirement

The examination requirement is a surface and volumetric examination of essentially 100 percent of the weld length, as specified in Table IWB-2500-1. When 100 percent of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460 allows reduction of the examination volume to 90 percent. For Examination

Category B9.11, the examination volume is defined in Figure IWB-2500-8, “Similar and Dissimilar Metal Welds in Components, Nozzles and Piping,” of the ASME Code, Section XI.

For the surface examinations, the licensee invoked Code Case N-663, “Alternative Requirements for Classes 1 and 2 Surface Examinations.” Code Case N-663 is approved for use without conditions in RG 1.147. The NRC staff notes that using Code Case N-663 is acceptable, and therefore, the required surface examination is not part of this request.

3.4.3 Licensee’s Relief Request

The licensee could not achieve the required examination coverage for welds 4-02-2-117 and N8B-SE-1 due to the weld configuration. The licensee achieved 75 percent coverage for both welds and detected no indications. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

3.4.4 Basis for Relief Request

Due to the limitations, the welds and their associated components would have to be physically modified and/or disassembled beyond their current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such a modification presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the welds to the maximum extent practical by UT, achieving 75 percent coverage.

3.4.5 NRC Staff Evaluation

Jet pump instrument safe end-to-eccentric reducer weld 4-02-2-117 and jet pump instrument eccentric reducer-to-eccentric reducer weld N8B-SE-1 are composed of austenitic stainless steel. Unlike carbon and low-alloy steel welds, stainless welds under the ASME Code B-J Category is susceptible to intergranular stress corrosion cracking (IGSCC) in boiling-water reactors such as FitzPatrick. IGSCC cracking in stainless steel welds occur in the heat-affected zone. The inspection coverage that was obtained for stainless steel welds 4-02-2-117 and N8B-SE-1 during the fourth ISI examinations was 75 percent. Examinations of these welds with a limited inspection coverage do not provide adequate information on the extent of damage that could potentially occur in the uninspected area due to IGSCC in these piping systems. Therefore, the NRC staff issued a request for additional information related to inspection coverage of stainless welds that are susceptible to IGSCC dated December 20, 2018 (ADAMS Accession No. ML18353B511).

In its January 15, 2019, supplement, the licensee stated that it performed a case-by-case review for R-A category welds (see discussion of Code Case N-578 in Section 5.7 below) to determine if any additional or alternative welds could have been examined to supplement the reduced coverage of volumetric examination of the welds. After its review, the licensee determined that no other welds were selected for examination that would have a better examination coverage. This decision was based on configuration of the weld assembly, delta core damage frequency values, the systems involved, and inspection history. During the outage examination, the plant personnel reviewed examination coverage issues and reviewed the systems for selecting alternative welds.

Furthermore, the licensee stated that it inspected an augmented inspection population, and the inspection results for augmented population for the fourth 10-year ISI interval were satisfactory, with two exceptions. In addition, the licensee stated that it implemented On-line Noble Chemical (OLNC) addition in 2011 as part the mitigation techniques to minimize the occurrence of IGSCC. For welds in the augmented inspection population that are protected by OLNC, the inspection frequency is every 10 years. For welds that are not protected by OLNC (i.e., normal water chemistry), the inspection frequency is every 6 years. The licensee reiterated that during the fourth ISI interval, several welds in the augmented inspection program were inspected, and with the exception of two welds that required weld overlay, the inspection results of the remaining welds were satisfactory. Based on this, the licensee accepted the inspection results of the welds 4-02-2-117 and N8B-SE-1 (limited coverage).

For jet pump instrument safe end-to-eccentric reducer weld 4-02-2-117 and jet pump instrument eccentric reducer-to-eccentric reducer weld N8B-SE-1, the licensee achieved less than 90 percent of the required volumetric examination coverage due to the welds configurations. To obtain the ASME Code-required coverage of 90 percent or greater for the piping welds listed in this request would require modification and/or disassembly beyond their current design. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined welds 4-02-2-117 and N8B-SE-1 per the requirements in Table IWC-2500-1 of the ASME Code, Section XI, for Examination Category B-J. The licensee performed the required volumetric examination of the weld using UT to the extent practical and achieved 75 percent coverage. The NRC staff reviewed the scan diagrams the licensee provided, which showed that the examined volumes included weld and base materials in the inner region where degradation is expected to occur (if it occurs). Accordingly, the NRC staff finds that despite the limited coverage, the examination was adequately performed.

The licensee could not find additional welds with similar configuration that would supplement the reduced coverage of the volumetric examination that was obtained for B-J welds. Since the inspection results of the welds in the augmented inspection program during the fourth 10-year ISI interval were satisfactory (with the exception of two welds), the NRC staff concluded that inspections with satisfactory results of the welds (under augmented inspection program) provide reasonable assurance that the aging effects due to IGSCC were adequately managed by the licensee during the fourth ISI interval at FitzPatrick.

With respect to the inspection of the welds in the augmented inspection program, the NRC staff noted that in addition to ASME Code, Section XI examinations, the licensee inspected welds in the augmented inspection program in accordance with BWRVIP-75-A, “BWR Vessel Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules.” The inspection techniques used in these examinations included liquid penetrant testing, magnetic particle testing, and UT. Implementation of inspection frequencies addressed in BWRVIP-75-A for the welds with mitigation protection due to OLNC addition and for welds without any hydrogen protection provides reasonable assurance that any cracking due to IGSCC can be identified in a timely manner.

Additionally, if any cracking in the weld were to be detected, implementation of the sample expansion program as addressed in BWRVIP-75-A provides information on the extent of the condition. Therefore, the NRC staff has concluded that the licensee’s corrective action, trending, and monitoring programs provide reasonable assurance that if any emerging aging

degradation were to be detected, the corrective actions would be expected to resolve the issue in a timely manner. Based on the volumetric coverage obtained and satisfactory inspection results during the fourth 10-year ISI interval, considering enhanced ultrasonic capabilities on ferritic welds, it is reasonable to conclude that, if a significant service-induced degradation were to occur, evidence of it would have been detected by the examination that was performed during the fourth 10-year ISI interval.

Periodic system pressure tests and VT-2 visual examinations will continue to be performed in accordance with the ASME Code, Section XI, Examination Category B-P, for Class 1 pressure retaining welds and items during each refueling outage.

Based on the above evaluation, the NRC staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for welds 4-02-2-117 and N8B-SE-1 is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the weld, despite the limited coverage due to the augmented inspection program as discussed above.

3.5 Examination Category C-A, Pressure Retaining Welds in Pressure Vessels, Item No. C1.20, Head Circumferential Welds

3.5.1 Component Affected

Shell-to-bottom head weld BH1-A of the discharge instrument volume tank "A."

3.5.2 ASME Code Requirement

The examination requirement is a volumetric examination of essentially 100 percent of the weld length, as specified in Table IWC-2500-1, "Examination Categories," of the ASME Code, Section XI. When 100 percent of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code Case N-460 allows reduction of the examination volume to 90 percent. For Examination Category C-A, the examination volume is defined in Figure IWC-2500-1, "Vessel Circumferential Welds," of the ASME Code, Section XI.

3.5.3 Licensee's Relief Request

The licensee could not achieve the required examination coverage for weld BH1-A due to weldolets and support brackets on the shell side of the weld and due to the bottom head configuration and support brackets on the head side of the weld. The licensee achieved 42.10 percent coverage for the weld and detected one geometric root indication. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical, and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

3.5.4 Basis for Relief Request

Due to the limitations, the weld and its associated components would have to be physically modified and/or disassembled beyond its current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such a modification presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the weld to the maximum extent practical by UT, achieving 42.10 percent coverage.

3.5.5 NRC Staff Evaluation

For discharge instrument volume tank "A" weld BH1-A, the licensee achieved less than 90 percent of the required volumetric examination coverage due to weldolets, support brackets, and the configuration of the bottom head. The staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined weld BH1-A per the requirements in Table IWC-2500-1 of the ASME Code, Section XI, for Examination Category C-A. The licensee performed the required volumetric examination of the weld using UT to the extent practical and achieved 42.10 percent coverage. The NRC staff reviewed the scan diagrams the licensee provided, which showed that the examined volume included weld and base materials in the inner region where degradation is expected to show, should it occur. One diagram clearly shows the geometric root indication the licensee detected (the licensee refers to it as a "reflector"). The NRC staff noted from the diagram that the geometric root reflector is due to the change in inside radius between the root of the weld and the base metal, and is, therefore, not a service-induced indication. Thus, the NRC staff determined that the licensee adequately dispositioned the one indication in weld BH1-A. Accordingly, the NRC staff finds that despite the limited coverage, the examination was adequately performed.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for weld BH1-A is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the weld because the licensee adequately dispositioned the one detected indication, and despite the limited coverage, the licensee examined the region of the weld most susceptible to service-induced degradation, should it occur.

3.6 Examination Category C-B, Pressure Retaining Nozzle Welds in Vessels, Item No. C2.21, Nozzle-to-Shell Weld

3.6.1 Component Affected

Nozzle-to-head weld N3-A of the residual heat removal heat exchanger vessel.

3.6.2 ASME Code Requirement

The examination requirement is a volumetric and surface examinations as specified in Table IWC-2500-1 of the ASME Code, Section XI. When 100 percent of the required volume cannot be examined due to interferences, obstructions, or geometrical configuration, ASME Code

Case N-460 allows reduction of the examination volume to 90 percent. For Examination Category C-B, the examination volume and surface are defined in the applicable figure in IWC-2500-4, “Nozzle-to-Vessel Welds,” of the ASME Code, Section XI.

3.6.3 Licensee’s Relief Request

The licensee could not achieve the required volumetric examination coverage for weld N3-A due to the nozzle configuration and proximity of the N7-A nozzle. The licensee achieved 73.10 percent coverage for the weld and detected no recordable indications. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

The NRC staff noted that the licensee achieved 100 percent surface coverage, and therefore, the required surface examination is not part of this request.

3.6.4 Basis for Relief Request

Due to limitations, the weld and its associated components would have to be physically modified and/or disassembled beyond its current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such a modification presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the weld to the maximum extent practical by UT, achieving 73.10 percent volumetric coverage.

3.6.5 NRC Staff Evaluation

For residual heat removal heat exchanger vessel weld N3-A, the licensee achieved less than 90 percent of the required volumetric examination coverage due to the nozzle configuration and proximity of the N7-A nozzle. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined weld N3-A per the requirements in Table IWC-2500-1 of the ASME Code, Section XI, for Examination Category C-B. The licensee performed the required volumetric examination of the weld using UT to the extent practical and achieved 73.10 percent coverage. The staff reviewed the scan diagrams the licensee provided, which showed that the examined volume included weld and base materials in the inner region where degradation is expected to occur (if it occurs). The examination resulted in no recordable indications. The NRC staff finds that despite the limited coverage, the examinations were adequately performed.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for weld N3-A is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the weld because no recordable indications were detected, and despite the limited coverage, the licensee examined the region of the weld most susceptible to service-induced degradation, should it occur.

3.7 Examination Category R-A, Risk-Informed Pipping Examinations, Item Nos. R1.16, Elements Subject to Intergranular or Transgranular Stress Corrosion Cracking, and R1.20, Elements Not Subject to a Damage Mechanism

3.7.1 Components Affected

Details of the RPV welds under Examination Category R-A are shown in Table 3. This information is obtained from the July 26, 2018, request, Table I4R-22.1.

Table 3
Examination Category R-A, Item Nos. R1.16 and R1.20, Limited Volumetric Examination Coverage

Weld Identification Number and Type of Weld Material	ASME Code Category	ASME Code Item Number	Aging Degradation/ Examination Coverage
12-02-2-61 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC 50%
12-02-2-78 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC 50%
22-02-2-5 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC 50%
22-02-2-11 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC 50%
22-02-2-28 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC 87%
22-02-2-29 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC/ 87%
22-02-2-62 Stainless Steel Weld	R-A Class 1	R1.16	IGSCC/ 50%
24-10-130 182 Weld	R-A Class 1	R1.16	IGSCC 66.9%
24-10-131 182 Weld	R-A Class 1	R1.16	IGSCC 46.5%
24-10-132 182 Weld	R-A Class 1	R1.16	IGSCC 50%
24-10-142 182 Weld	R-A Class 1	R1.16	IGSCC 66.9%
24-10-143 182 Weld	R-A Class 1	R1.16	IGSCC 46.5%
20-10-923 Ferritic Steel Weld	R-A Class 2	R1.20	NA 80.5%
24-10-144 182 Weld	R-A Class 1	R1.16	IGSCC 50%

3.7.2 ASME Code Requirement

The examination requirements for the subject piping welds at Fitzpatrick are governed by a risk-informed ISI program that was approved by the NRC in a safety evaluation dated

February 22, 2008 (ADAMS Accession No. ML080420427). The risk-informed ISI program was developed in accordance with Electric Power Research Institute (EPRI) Topical Report (TR) TR-112657, "Risk-Informed Inservice Inspection Evaluation Procedure."

Table 1 of ASME Code Case N-578-1 assigns the Examination Category R-A, Item R1.16, to piping inspection elements not subject to a damage mechanism, and Item R1.20 to piping inspection elements to subject to a known damage mechanism. This table required 100 percent of the examination location volume, as described in Figure IMB-8, 9, 10, or 11 (and -7 for R1-20 only), as applicable, be completed for select Class 1 circumferential piping welds. ASME Code Case N-460 allows reduction of the examination volume to 90 percent

3.7.3 Licensee's Relief Request

The licensee could not achieve the required examination coverage for the welds listed in Table 3 above due to single-sided access, cross configuration, and valve configuration. The licensee achieved the between 46.5 percent and 87 percent coverage and detected two indications in weld 22-01-2-11 and one indication in weld 20-10-923. The licensee stated that due to the limitations, complying with the ASME Code-required examination coverage is impractical, and the licensee is, thus, requesting relief pursuant to 10 CFR 50.55a(g)(5)(iii).

3.7.4 Basis for Relief Request

Due to the limitations, the welds and their associated components would have to be physically modified and/or disassembled beyond their current design to comply with the ASME Code-required examination coverage. The extensive effort that would be needed for such a modification presents a burden. In lieu of the ASME Code-required examination coverage, the licensee examined the welds to the maximum extent practical by UT, achieving the coverage indicated in Table 3 above.

3.7.5 NRC Staff Evaluation

As noted in the table above, the subject welds are composed of stainless steel, Inconel 182, and ferritic steel. Unlike carbon and low-alloy steel welds, stainless and Inconel 182 welds under the R-A Category are susceptible to intergranular stress corrosion cracking in boiling-water reactors such as FitzPatrick. IGSCC cracking in stainless steel welds occur in the heat-affected zone, whereas in 182 welds, cracking occurs in the weld metal. The inspection coverage that was obtained for stainless steel and Inconel 182 welds during the fourth ISI examinations ranged from 46 percent to 87 percent. Examinations of these welds with a limited inspection coverage do not provide adequate information on the extent of damage that could potentially occur in the uninspected area due to IGSCC in these piping systems. Therefore, the NRC staff issued a request for additional information related to inspection coverage of stainless and Inconel 182 welds that are susceptible to IGSCC dated December 20, 2018 (ADAMS Accession No. ML18353B511).

In its January 15, 2019, supplement, the licensee stated that it performed a case-by-case review for R-A category welds to determine if any additional or alternative welds could have been examined to supplement the reduced coverage of volumetric examination of the welds. After its review, the licensee determined that no other welds were selected for examination that would have a better examination coverage. This decision was based on configauration of the weld assembly, delta core damage frequency values, the systems involved, and inspection history.

During the outage examination, the plant personnel reviewed examination coverage issues and reviewed the systems for selecting alternative welds.

Furthermore, the licensee stated that it inspected an augmented inspection population, and the inspection results for augmented population for the fourth 10-year ISI interval were satisfactory, with two exceptions. In addition, the licensee stated that it implemented OLNC addition in 2011 as part the mitigation techniques to minimize the occurrence of IGSCC. For welds in the augmented inspection population that are protected by OLNC, the inspection frequency is every 10 years. For welds that are not protected by OLNC (i.e., normal water chemistry), the inspection frequency is every 6 years. The licensee reiterated that during the fourth ISI interval, several welds in the augmented inspection program were inspected, and with the exception of two welds that required weld overlay, the inspection results of the remaining welds were satisfactory. Based on this, the licensee accepted the inspection results of the welds in Table 3 above (limited coverage).

For the welds listed in Table 3 above, the licensee achieved less than 90 percent of the required volumetric examination coverage due to single-sided access, cross configuration, and valve configuration. To obtain the ASME Code-required coverage of 90 percent or greater for the piping welds listed in this request would require modification and/or disassembly beyond their current design. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The licensee examined the welds in Table 3 above per the requirements in ASME Code Case N-578-1, Table 1, for Examination Category R-A. The licensee performed the required volumetric examination of the welds using UT to the extent practical and achieved between 46.5 percent and 87 percent coverage. The NRC staff reviewed the scan diagrams the licensee provided, which showed that the examined volumes included weld and base materials in the inner region where degradation is expected to occur (if it occurs). Accordingly, the NRC staff finds that despite the limited coverage, the examination was adequately performed.

The licensee could not find additional welds with similar configuration that would supplement the reduced coverage of the volumetric examination that was obtained for R-A welds. Since the inspection results of the welds in the augmented inspection program during the fourth 10-year ISI interval were satisfactory (with the exception of two welds), the NRC staff concluded that inspections with satisfactory results of the welds (under augmented inspection program) provide reasonable assurance that the aging effects due to IGSCC were adequately managed by the licensee during the fourth ISI interval at FitzPatrick.

With respect to the inspection of the welds in the augmented inspection program, the NRC staff noted that in addition to ASME Code, Section XI examinations, the licensee inspected welds in the augmented inspection program in accordance with BWRVIP-75-A. The inspection techniques used in these examinations included liquid penetrant testing, magnetic particle testing, and UT. Implementation of inspection frequencies addressed in the BWRVIP-75-A for the welds with mitigation protection due to ONLC addition and for welds without any hydrogen protection provides reasonable assurance that any cracking due to IGSCC can be identified in a timely manner.

Additionally, if any cracking in the weld were to be detected, implementation of the sample expansion program as addressed in BWRVIP-75-A provides information on the extent of condition. Therefore, the NRC staff has concluded that the licensee's corrective action,

trending, and monitoring programs provide reasonable assurance that if any emerging aging degradation were to be detected, the corrective actions would be expected to resolve the issue in a timely manner. Based on the volumetric coverage obtained and satisfactory inspection results during the fourth 10-year ISI interval, considering enhanced ultrasonic capabilities on ferritic welds, it is reasonable to conclude that, if a significant service-induced degradation were to occur, evidence of it would have been detected by the examination that was performed during the fourth 10-year ISI interval.

Periodic system pressure tests and VT-2 visual examinations will continue to be performed in accordance with ASME Section XI, Examination Category B-P, for Class 1 pressure retaining welds and items during each refueling outage.

Based on the above evaluation, the NRC staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components.

Based on the above discussion, the NRC staff determined that obtaining the ASME Code-required examination volume for the welds listed in Table 3 above is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee. The NRC staff determined that the volumetric examination performed to the maximum extent practical provides reasonable assurance of structural integrity of the weld, despite the limited coverage due to the augmented inspection program as discussed above.

4.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittal and concludes that compliance with ASME Code examination coverage requirements are impractical for the subject welds listed in Relief Request I4R-22. Further, based on the coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. In addition, the NRC staff concludes that the best effort examinations obtained during the licensee's examinations provide reasonable assurance of structural integrity of the welds. The staff also concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii).

Accordingly, the NRC staff has determined that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the NRC grants Relief Request I4R-22 for the fourth 10-year ISI interval at FitzPatrick.

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

Principal Contributors: G. Cheruvenki
D. Dijamco

Date: June 21, 2019