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

January 27, 2009

Mr. Charles G. Pardee
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – EVALUATION OF RELIEF REQUESTS RR-33, RR-34 and RR-35, ASSOCIATED WITH THE SECOND INSERVICE INSPECTION INTERVAL (TAC NOS. MD8071, MD8073, MD8074, MD8075, AND MD8076)

Dear Mr. Pardee:

By letter dated January 28, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080370257), as supplemented by letter dated September 8, 2008, (ADAMS Accession No. ML082550270), Exelon Generating Company, LLC submitted various proposed requests for relief (RR-33, 34 and 35) from the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, concerning the second 10-year inservice inspection (ISI) programs at Limerick Generating Station (LGS), Units 1 and 2. Additionally, RR-36, included in the January 28, 2008, submittal, was withdrawn by letter dated September 29, 2008 (ADAMS Accession No. ML082730908).

Based on the information provided, the Nuclear Regulatory Commission (NRC) staff concludes that compliance with the specified American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code*, Section XI requirements relating to relief requests RR-33, RR-34 and RR-35 is impractical. The examinations performed and the proposed alternatives by the licensee provide reasonable assurance of structural integrity of the components involved. Therefore, the Commission grants relief pursuant to 10 CFR 50.55a(g)(6)(i) for the second 10-year ISI interval at each unit. 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.

The second 10-year ISI interval, to which these requests apply, was concluded on January 31, 2007, for LGS, Units 1 and 2.

Documentation of the NRC staff review and evaluation is contained in the enclosed safety evaluation.

If you have any questions, please contact the LGS Project Manager, Mr. Peter J. Bamford, at 301-415-2833.

Sincerely,

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

Enclosure: As stated

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LIMERICK GENERATING STATION, UNITS 1 AND 2

THIRD INSERVICE INTERVAL RELIEF REQUESTS

EXELON GENERATION COMPANY, LLC

DOCKET NOS. 50-352 AND 50-353

1.0 INTRODUCTION

By letter dated January 28, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080370257), as supplemented by letter dated September 8, 2008, (ADAMS Accession No. ML082550270), Exelon Generating Company, LLC (Exelon, the licensee) submitted various proposed requests for relief (RR-33, 34 and 35) from the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, concerning the second 10-year inservice inspection (ISI) programs at Limerick Generating Station (LGS), Units 1 and 2. Additionally, RR-36, included in the January 28, 2008, submittal, was withdrawn by letter dated September 29, 2008 (ADAMS Accession No. ML082730908). Therefore, RR-36 will not be discussed further in this report. The second 10-year ISI interval, to which the proposed reliefs apply, concluded on January 31, 2007, for LGS, Units 1 and 2.

The Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has reviewed and evaluated the information provided by Exelon pursuant to 10 CFR 50.55a(g)(6)(i). Documentation of this review and evaluation is presented below.

2.0 REGULATORY EVALUATION

Inservice inspection of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3, components is to be performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (ASME Code) and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Title 10 of the *Code of Federal Regulations* paragraph 50.55a(g)(5)(iii) requires that if the licensee has determined that conformance with certain ASME Code requirements is impractical for its facility, the licensee shall notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determination. As stated in 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3, components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. Additionally, 10 CFR 50.55a(g)(5)(iv) requires that examination requirements determined to be impractical and not included in the revised inspection program as permitted by 10 CFR 50.55a(g)(4), must be submitted to the NRC no later than 12 months after the end of the respective interval. Pursuant to 10 CFR 50.55a (g)(6)(i), the NRC then evaluates such impracticality determinations. This safety evaluation documents that review by the NRC staff for LGS, Units 1 and 2, in the second ISI interval. The ASME code of record for LGS, Units 1 and 2, second 10-year interval ISI program is the 1989 Edition of Section XI.

3.0 TECHNICAL EVALUATION

3.1 Request for Relief (RR)-33 - Pressure Testing of the Reactor Pressure Vessel Head Flange Seal Leak Detection System (Unit 1 only)

ASME Code Requirements

Table IWB-2500-1, Examination Category B-P, Item Number B15.11 of the ASME Code, Section XI, requires all pressure retaining components be subject to a system hydrostatic test in accordance with IWB-5222. The NRC has approved ASME Section XI Code Case N-498-4 "Alternative Requirements for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems" that allows a system leakage test at or near the end of each inspection interval prior to reactor startup as an alternative to the 10-year system hydrostatic test required by Table IWB-2500-1, Category B-P. The pressure retaining boundary for the test conducted at or near the end of each inspection interval shall be extended to all Class 1 pressure retaining components per IWB-2500-1, Examination Category B-P (note 2). This extended boundary system leakage test is to be conducted once per inspection interval.

Licensee's Request for Relief

Relief is requested from performing the system leakage test at a pressure corresponding to nominal operating pressure during system operation. The licensee proposed an alternative inspection in lieu of the system leakage test required under IWB-5221(a) for the Reactor Vessel Head Flange Seal Leak Detection Piping.

Licensee's Basis for Requesting Relief

The Reactor Vessel Head Flange Seal Leak Detection Piping is separated from the reactor pressure boundary by one passive membrane, which is an o-ring located on the vessel flange. A second o-ring is located on the opposite side of the tap in the vessel flange. This piping is required during plant operation in order to indicate failure of the inner flange seal o-ring. Failure of the o-ring would result in the annunciation of a high pressure alarm in the Control Room. Failure of the inner o-ring is the only condition under which this line is pressurized.

The configuration of this piping precludes system pressure testing while the vessel head is removed because the configuration of the vessel tap coupled with the high test pressure requirement prevents the tap in the flange from being temporarily plugged or connected to other piping. The opening in the flange is smooth walled, making the effectiveness of a temporary seal very limited. Failure of this seal could possibly cause ejection of the device used for plugging or connecting to the vessel.

The configuration also precludes pressure testing with the vessel head installed because the seal prevents complete filling of the piping, which has no vent available. The top head of the vessel contains two grooves that hold the o-rings. The o-rings are held in place by a series of retainer clips that are housed in recessed cavities in the flange face. If a pressure test was performed with the head on, the inner o-ring would be pressurized in a direction opposite to what it would see in normal operation. This test pressure would result in a net inward force on the inner o-ring that would tend to push it into the recessed cavities that house the retainer clips. The thin o-ring material would very likely be damaged by this inward force.

Operational testing of this line is precluded, because the line will only be pressurized in the event of a failure of the inner o-ring. Purposely failing the inner o-ring in order to perform a pressure test would require purchasing a new o-ring set and the time and radiation exposure associated with replacement of the o-rings (remove reactor vessel head, install new o-rings and re-install reactor vessel head).

Licensee's Proposed Alternative

The end of interval system pressure test conducted for LGS, Unit 1 did not achieve the ASME Code-required test pressure in the Reactor Vessel Head Flange Seal Leak Detection Piping since the leak-tight integrity of the inner o-ring was maintained during the test. The associated lines were inspected during the system leakage test and no gross structural abnormalities or deficiencies were noted. For future intervals, the system leakage test and VT-2 (visual) examination will be performed on the Reactor Vessel Head Flange Seal Leak Detection Piping during flood-up of the refueling pool during a refueling outage. The hydrostatic head developed due to the water above the vessel flange during flood-up will allow for the detection of any gross indications in the piping.

NRC Staff Evaluation of RR-33

The ASME Code, Section XI requires that all Class 1 components within the reactor coolant system boundary undergo a system hydrostatic test at or near the end of each inspection interval. The NRC staff has accepted a system leakage test under Code Case N-498-4 in lieu of the system hydrostatic test. In RR-33, the licensee requested relief from performing a system leakage test of the Reactor Vessel Head Flange Seal Leak Detection Piping at the ASME Code required test pressure corresponding to the nominal operating pressure during system operation. The piping is located between the inner and the outer o-ring seals of the vessel flange and is required during plant operation in order to detect failure of the inner flange seal o-ring. The design of this line makes the ASME Code-required system leakage test impractical either with the vessel head in place or removed. The piping cannot be filled completely with water since it can not be vented to remove entrapped air from the line either with the vessel head in place or removed due to its configuration. If a pressure test were to be performed with the head in place, the space between the inner and the outer o-ring seals would be pressurized. The test pressure would exert a net inward force on the inner o-ring that would tend to push it into the recessed cavities that house the retainer with the possibility of damaging the inner o-ring seal. The configuration of this piping also

precludes system pressure testing while the vessel head is removed because the odd configuration of the vessel tap coupled with the high test pressure requirement prevents the tap in the flange from being temporarily plugged or connected to other piping. The opening in the flange is smooth walled, making the effectiveness of a temporary seal very limited. Failure of this seal could possibly cause ejection of the device used for plugging or connecting to the vessel.

To perform the system leakage test in accordance with the Code requirements, the Reactor Vessel Head Flange Seal Leak Detection Piping would have to be redesigned, fabricated, and installed. This would impose severe burden on the licensee. The piping in question was examined for Unit 1 in March 2006 and no gross structural abnormalities or deficiencies were noted. Furthermore, the NRC staff notes that it has already approved a proposed alternative consisting of a VT-2 exam during flood-up for each refueling outage (ADAMS Accession No. ML080500584) and that this exam would have been performed during the March 2008 refueling outage as part of the third ISI interval. These considerations provide adequate assurance of structural integrity during the second interval. Therefore, the proposed alternative for the second ISI interval is acceptable.

3.2 RR-34 – Limited Code Coverage on Nozzle-to-Vessel, Nozzle Inside Radius and Reactor Vessel Weld Examinations

The information provided by the licensee in support of this request for relief from ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the licensee's request has been evaluated according to ASME Code Examination Category.

3.2.1 RR-34, Examination Category B-A, Items B1.12 and B1.40, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement:

ASME Code, Section XI, Examination Category B-A, Items B1.12 and B1.22 require essentially 100% volumetric examination of the "accessible length" of circumferential and meridional head welds, respectively, as defined by Figure IWB-2500-3. "Essentially 100%," as clarified by ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, is greater than 90% coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in Regulatory Guide 1.147 (RG 1.147), Revision 15, *Inservice Inspection Code Case Acceptability*.

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100% volumetric examination of Class 1 reactor pressure vessel (RPV) welds shown in Table 3.2.1 below.

Table 3.2.1 – Examination Category B-A, RPV Welds

Welds	Unit	Name	Item	Coverage	Reason for Limited Coverage
BF	1	Vessel Vertical Weld	B1.12	85.9%	N17 nozzle restricted examination
BM	1	Vessel Vertical Weld	B1.12	83.1%	Insulation Interference

Table 3.2.1 – Examination Category B-A, RPV Welds					
Welds	Unit	Name	Item	Coverage	Reason for Limited Coverage
AG	1	Top Head Weld	B1.40	85%	Flange Configuration
AG	2	Top Head Weld	B1.40	88%	Head-to-Flange Configuration

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

> *The LGS, Unit 1 reactor pressure vessel has 30 vessel welds and the Unit 2 reactor pressure vessel has 31 vessel welds that require volumetric examination per [ASME Code, Section XI,] Examination Category B-A. In support of ALARA [as low as reasonably achievable] radiation protection practices, many of the nozzle-to-vessel, nozzle inside radius, and RPV welds are examined by a remote automated scanner. These techniques, however, limit the examination coverage mainly because of the scanner design. RR-34 Diagrams 1 and 2[1] identify the scan limitations for the LGS, Units 1 and Unit 2, RPV.*

Licensee's Proposed Alternative Examination: No alternative examination was proposed by the licensee other than the completion of scans to the extent practical.

NRC Staff Evaluation:

The ASME Code requires essentially 100% volumetric examination of the accessible length of the subject RPV welds. However, as shown in Table 3.2.1 above, complete examinations are restricted by several factors, including the adjacent nozzles, permanent insulation, and the geometric configurations of the vessel flange and head-to-flange weld. In order to increase the volumetric coverage on the subject welds, the RPV would require design modifications. Imposing this requirement would place a significant burden on the licensee, therefore, the ASME Code-required essentially 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[2] included in the licensee's submittal, examinations of the subject welds have been performed to the extent practical, with the licensee obtaining substantial volumetric coverage from approximately 83% to 88% (see Table 3.2.1). The NRC staff agrees with the licensee's characterization of impracticality based on a review of the geometric considerations associated with each weld. Welds BF and BM, (the LGS, Unit 1 and 2 RPV vertical seam welds), were examined using procedures that were performed with equipment, personnel and procedures qualified in accordance with ASME Code, Section XI, Appendix VIII as administered by the industry's Performance Demonstration Initiative (PDI) program. Weld AG in LGS, Units 1 and 2, was examined prior to the implementation of ASME Code, Section XI, Appendix VIII PDI requirements, but were examined using the approved technical guidance at the time of the examination.

The licensee has shown that it is impractical to meet the ASME Code-required essentially 100% volumetric examination coverage for the subject welds due to the design and proximity of other components. Imposing this requirement upon the licensee would result in severe burden as it would require re-design and re-configuration of the associated reactor vessel welds. Based on

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1 The licensee's diagrams contained in ADAMS Accession Nos. ML080370257 and ML082550270 are not included in this SE.

2 Sketches and technical descriptions provided by the licensee in ADAMS Accession Nos. ML080370257 and ML082550270 are not included in this SE.

the volumetric coverage obtained, along with the full examination of ASME Code-required volumes in other pressure-retaining RPV welds, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected by the examinations that were performed. In addition, the examinations performed to extent practical provide reasonable assurance of structural integrity of the subject RPV welds.

3.2.2 Request for Relief 34, Examination Category B-D, Items B3.90 and B3.100, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement

The ASME Code, Section XI, Examination Category B-D, Item B3.90 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 nozzle-to-vessel welds. The ASME Code, Section XI, Examination Category B-D, Item B3.100 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 nozzle-inside radius section. ASME Code Case N-460, as an alternative approved for use in RG 1.147, Revision 15, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

Licensee's ASME Code Relief Request

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100% volumetric examination of the nozzle-to-vessel welds and nozzle inside radius volumes listed below in Tables 3.2.2 and 3.2.3. Table 3.2.2 lists nozzle-to-vessel welds for LGS, Unit 1 and Table 3.2.3 lists nozzle-to-vessel welds and inside radius volumes for LGS, Unit 2. The licensee requested relief on the basis that conformance with the ASME Code requirements is impractical due to component configuration and access restrictions.

Table 3.2.2 – ASME Code, Section XI, Examination Category B-D Unit 1

Item	Welds	Name	Coverage
B3.90	N1A	Recirculation Suction- A Loop	75.6%
B3.90	NIB	Recirculation Suction- B Loop	60%
B3.90	N2A	Recirculation Outlet	61.9%
B3.90	N2B	Recirculation Outlet	59.3%
B3.90	N2C	Recirculation Outlet	51.9%
B3.90	N2D	Recirculation Outlet	61.9%
B3.90	N2E	Recirculation Outlet	59.3%
B3.90	N2F	Recirculation Outlet	61.9%
B3.90	N2J	Recirculation Outlet	77%
B3.90	N2K	Recirculation Outlet	80.4%
B3.90	N3A	Main Steam- A Loop	58.2%
B3.90	N3B	Main Steam- B Loop	58.2%
B3.90	N3C	Main Steam- C Loop	58.4%
B3.90	N3D	Main Steam- D Loop	58.4%
B3.90	N4A	Feed Water Injection- A Loop	68.8%
B3.90	N4B	Feed Water Injection- A Loop	64.6%
B3.90	N4C	Feed Water Injection- A Loop	64.6%
B3.90	N4D	Feed Water Injection- B Loop	55.9%
B3.90	N4E	Feed Water Injection- B Loop	79.1%

Table 3.2.2 – ASME Code, Section XI, Examination Category B-D Unit 1			
Item	Welds	Name	Coverage
B3.90	N4F	Feed Water Injection- B Loop	77.1%
B3.90	N5A	Core Spray- B Loop	61.9%
B3.90	N5B	Core Spray- A Loop	61.9%
B3.90	N6A	Head Spray	58%
B3.90	N6B	Spare Head Spray	58%
B3.90	N7	Vent	79.4%
B3.90	N8A	Jet Pump Instrument	60.1%
B3.90	N8B	Jet Pump Instrument	60.1%
B3.90	N9	Control Rod Drive Return	60.1%
B3.90	N17A	LPCI Injection- B Loop	61.9%
B3.90	N17B	LPCI Injection- D Loop	61.9%
B3.90	N17D	LPCI Injection- C Loop	61.9%

Table 3.2.3 – ASME Code, Section XI, Examination Category B-D Unit 2			
Item	Welds/ Nozzle Inner Radius	Name	Coverage
B3.90	NIB	Recirculation Suction - B Loop	71%
B3.90	N2B	Recirculation Outlet	77%
B3.90	N2C	Recirculation Outlet	77%
B3.90	N2E	Recirculation Outlet	77%
B3.90	N2F	Recirculation Outlet	77%
B3.90	N2G	Recirculation Outlet	77%
B3.90	N3A	Main Steam - A Loop	77%
B3.90	N3B	Main Steam - B Loop	77%
B3.90	N4C	Feed Water Injection - A Loop	77%
B3.90	N4D	Feed Water Injection - B Loop	66%
B3.100	N4D- Inner Radius	Feed Water Injection - B Loop Inner Radius	88%
B3.90	N5A	Core Spray - B Loop	71.75%
B3.90	N6A	Head Spray	71.75%
B3.90	N6B	Spare Head Spray	71.9%
B3.90	N7	Vent	81.25%
B3.90	N9	Control Rod Drive Return	77.1%
B3.90	N17A	LPCI Injection - B Loop	81.2%
B3.90	N17C	LPCI Injection - A Loop	77%

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

The LGS, Unit 1 and 2 RPVs each have thirty-four (34) nozzles, the welds of which require volumetric examination per [ASME Code, Section XI,] Examination Category B-D. Due to the nozzle forging configuration, portions of the ASME Code required examination volume could not be completely examined. The curvature of the radius of the nozzle forging is such that ultrasonic scanning of the weld is interrupted due to loss of contact of the ultrasonic search unit. This limitation affects both transverse and parallel scanning of the [ASME] Code-

required examination volume. RR-34 Diagram 3[3] "Typical Automated Scan Inspection Area of Limerick Nozzle to Vessel Welds," shows the inspection areas for both the parallel and transverse scans.

Licensee's Proposed Alternative Examination (as stated):

No alternate provisions are practical for the subject welds. Examinations were performed to the maximum extent practical.

NRC Staff Evaluation:

The ASME Code requires 100% volumetric examination of full penetration welded nozzles and inside radius sections in Class 1 vessels. However, examinations of the nozzles listed in Tables 3.2.2 and 3.2.3 are limited by the design of the components, and the curvature of the nozzle forging blend radius, or a combination of the nozzle configuration and adjacent components (such as nozzles, I-beams or drain lines). This precludes ultrasonic examination to the extent required by the ASME Code for the subject nozzles. In order for the licensee to obtain 100% of the ASME Code-required examination coverage of the nozzle-to-vessel welds or nozzle inner radius volume, both the reactor vessel and the nozzles would need to be redesigned. Imposing this requirement would place a burden on the licensee, therefore, the ASME Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[4] included in the licensee's submittal, examination of the subject nozzles has been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 52% to 80%. Ultrasonic scanning is primarily conducted from the vessel side of the welds due to the set-in design of the nozzles, which makes the weld through-wall axis parallel to the nozzle forging, and severely limits scanning from the nozzle side. In addition, where scanning of a portion of the weld volume is possible from the nozzle side, the blend radius curvature of the nozzle forgings is such that contact of the ultrasonic search unit is interrupted. This blend radius limitation affects both transverse and parallel scanning of the ASME Code-required examination volume from the nozzle side of the welds.

Examinations of nine of the nozzle-to-vessel welds listed in the tables were performed using personnel, equipment and procedures qualified through the PDI program; the remaining nozzles were examined using the approved ASME Code technical guidance at the time of the examinations. No unacceptable indications were noted during any of the examinations on the subject welds.

The licensee has shown that examining the ASME Code-required volumes of the nozzle-to-vessel welds and nozzle inner radius listed in Tables 3.2.2 and 3.2.3 are impractical. Imposing this requirement upon the licensee would result in severe burden as it would require re-design and re-configuration of the reactor vessel and the associated nozzles. However, based on the volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds or nozzle inner radius volume, evidence of it would have been detected by the examinations that were performed. In addition, the examinations performed with the coverage noted in Tables 3.2.2 and 3.2.3 provide reasonable assurance of structural integrity of the subject nozzle-to-vessel welds and the nozzle inside radius volumes.

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3 The licensee's diagram submitted with ADAMS Accession No. ML080370257 is not included in this SE.

4 Sketches and technical descriptions provided by the licensee in ADAMS Accession Nos. ML080370257 and ML082550270 are not included in this SE.

3.3 RR-35 – Limited Code Coverage on Piping Weld Examinations

The information provided by the licensee in support of this request for relief from ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the licensee's request has been evaluated according to ASME Code Examination Category.

3.3.1 RR-35, (revised by letter dated September 8, 2008), Examination Category B-J, Pressure Retaining Welds in Piping

ASME Code Requirement

ASME Code, Section XI, Examination Category B-J, Item B9.11 requires essentially 100% volumetric and surface examinations, as defined by Figure IWB-2500-8, for piping circumferential welds 4-inch nominal pipe size, and greater, in diameter. "Essentially 100%," as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for in RG 1.147, Revision 15.

Licensee's ASME Code Relief Request

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the essentially 100% volumetric examination requirement for certain ASME Code Class 1 and 2 piping welds shown in Tables 3.3.1.1 and 3.3.1.2 below. The licensee's bases for impracticality are due to component configuration and access restrictions (see descriptions in the tables below).

Table 3.3.1.1 – ASME Code Section XI, Examination Category B-J Limited Volumetric Examinations – Unit 1

Weld ID	Limitation Description/Interference	Volumetric Coverage
CSB 015	12" Flued Head X-16B-to-Valve HV-52-108 Limitation: Austenitic material – Single sided exam due to valve-to-pipe flued head configuration.	50%
DCA-101-1 SW2402	6" Pup Piece-to-Valve HV-44-1F001 Limitation: Austenitic material – Baseline examination 100% PT [dye penetrant] and 50% UT [ultrasonic] single sided examination due to valve-to-pipe configuration.	50%
DCA-101-1 SW2403	6" Valve HV-44-1F001-to-6" Pup Piece Limitation: Austenitic material – Baseline examination 100% PT and 50% UT single sided examination due to valve-to-pipe configuration.	50%
DCA-101-1 SW2406	6" Pup Piece-to-Valve HV-44-1F004 Limitation: Austenitic material – Baseline examination 100% PT and 50% UT single sided examination due to valve-to-pipe configuration.	50%
DCA-104-2 SW501	12" Pipe-to-Valve HV-51-1F050A Limitation: Austenitic material – Baseline exam – Single sided exam due to valve-to-pipe configuration.	50%

Table 3.3.1.1 – ASME Code Section XI, Examination Category B-J Limited Volumetric Examinations – Unit 1		
Weld ID	Limitation Description/Interference	Volumetric Coverage
DC A-104-4 SW1702 CI	12" Valve HV-51-1F050A-to-Pipe Limitation: Austenitic material – Baseline exam – Single sided exam due to valve-to-pipe configuration.	50%
RH 004	20" Pipe-to-Valve 51-1F077 Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RH 007	20" Pipe-to-Valve HV-51-1F009 Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RH 008	20" Valve HV-51-1F009-to-Pipe Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RH 015	20" Flued Head X-12-to-Valve HV-51-1F008 Limitation: Austenitic material – Single sided exam due to valve-to-pipe flued head configuration.	50%
RHA 002	12" Elbow-to-Valve 51-1F065A Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RHA 003	12" Pipe-to-Valve 51-1F065A Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RHB 002	12" Elbow-to-Valve 51-1F065B Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RHB 003	12" Valve 51-1F065B-to-Pipe Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RRB 004	28"X28"X20" Tee-to-28" Pipe Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RRB 013	28" Pump 1BP201-to-Pipe Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%
RRB 016	28" Pipe-to-Valve HV-43-1F031B Limitation: Austenitic material – Single sided exam due to valve-to-pipe configuration.	50%

Table 3.3.1.2 – ASME Code, Section XI, Examination Category B-J Limited Volumetric Examinations – Unit 2		
Weld ID	Limitation Description/Interference	Volumetric Coverage
DCA-201-1 FW10	6" Pipe-to-Valve HV-44-2F105 Limitation: Austenitic material - Single sided exam due to valve-to-pipe configuration.	50%
DCA-201-1 SW1402	6" Pipe-to-Valve HV-044-2F001 Limitation: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%

Table 3.3.1.2 – ASME Code, Section XI, Examination Category B-J Limited Volumetric Examinations – Unit 2		
Weld ID	Limitation Description/Interference	Volumetric Coverage
DCA-201-1 SW1403	Valve HV-044-2F001-to-6" Pipe Limitation: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%
DCA-201-2 SW702	6" Pipe-to-HV-044-2F004 Limitation: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%
DCA-204-2 FW1101	12" Pipe-to-Valve HV-051-2F050A Limitation: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%
DCA.204-4 FW701	Valve HV-051-2F050A-to-12" Pipe Limitation: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%
DCA-205-1 FW9	Flued Head (X-12)-to-Valve HV-51-2F008 Limitation: Austenitic material - Limited examination due to weld geometry	75%
DLA-210-1FW1	Valve HV-52-208-to-Flued HeadX-16B Limitation: Austenitic material - Limited examination due to weld geometry.	71%

Licensee's Basis for Relief Request (as stated)

The required ASME Code coverage is impractical for the subject welds since the components would require design modifications that would impose a significant burden to Exelon. [Per the requirements of 10 CFR 50.55a(b)(2)(xv)], if access is available, the weld shall be ultrasonically scanned in both directions parallel to the weld and both directions perpendicular to the weld, where required. Full credit for examination coverage may be claimed for single-side examinations on ferritic piping welds. However, for austenitic piping welds, an ultrasonic examination procedure must be qualified with flaws located in the inaccessible side of the weld. There were no known qualified PDI ultrasonic examination procedures available at the time of the second period examinations with single-side coverage that demonstrated equivalency to ultrasonic examination two-sided coverage on austenitic piping welds. At [LGS, Units 1 and 2], qualified PDI ultrasonic examination techniques have been used since 2000. However, qualified PDI procedures were not available at the time of the examination of the welds above to perform a single-sided ASME Code, Section XI, Appendix VIII demonstration using flaws on the opposite side of the weld.

Licensee's Proposed Alternative Examination (as stated)

No alternate provisions are practical for the subject welds. Examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100% volumetric and/or surface examination for selected Examination Category B-J pressure retaining welds in piping. Full ASME Code-required 100%

surface examinations were conducted for the subject welds. However, as shown in Tables 3.3.1 and 3.3.2 above, complete volumetric examinations are restricted by several factors, including valve configurations and branch connections. These conditions preclude the licensee obtaining full volumetric examinations from both sides of the weld. To gain access for examination, the welds would require design modifications. Imposition of this requirement would place a burden on the licensee; therefore, the ASME Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[5] included in the licensee's submittal, examinations of the subject welds have been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 50% to 71%. Various scan limitations were caused by the configuration of the welds and adjacent components (see tables above). The ultrasonic examinations conducted by the licensee included 45- and 60-degree shear waves from the pipe/tee/elbow side of the welds, which account for the aggregate coverage reported. In addition, the licensee performed 60-degree and 70-degrree refracted longitudinal wave (L-wave) examinations from the accessible side of these welds. The L-wave method is believed capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Studies[6,7] reported in the technical literature recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. The licensee completed the ASME Code-required surface examinations on the subject welds with no limitations. No recordable indications were observed during the ultrasonic and surface examinations.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the design of the welds and proximity of other components. Imposing this requirement upon the licensee would result in severe burden as it would require re-design and re-configuration of the associated welds. Considering the limited examinations performed, along with the examination of other pressure retaining piping welds, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected. In addition, the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject pressure retaining piping welds.

3.3.2 RR-35, revised by letter dated September 8, 2008, (LGS, Unit 1) Examination Category C-F-1, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping, and (Unit 2) Examination Category C-F-2, Pressure Retaining Welds in Carbon or Low Alloy Steel Piping

ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21 require volumetric and surface examinations, as defined by Figure IWC-2500-7, of essentially 100% of selected austenitic stainless steel or high alloy piping welds. ASME Code, Section XI, Examination Category C-F-2, Item C5.51, requires volumetric and surface examinations, as defined by Figure IWC-2500-7, of essentially 100% of selected carbon or low alloy steel piping welds. "Essentially 100%," as clarified by ASME Code Case N-460 is greater than 90% coverage of the

5 The licensee's sketches and technical descriptions provided in ADAMS Accession Nos. ML080370257 and ML082550270 are not included in this SE.

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

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

examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use in RG 1.147, Revision 15.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100% volumetric examination requirements of ASME Code Class 2 piping welds shown in Tables 3.3.2.1 and 3.3.2.2. The licensee's bases for impracticality are due to component configuration and access restrictions (see descriptions in the tables below).

Table 3.3.2.1 – ASME Code, Section XI, Examination Category C-F-1 Limited Volumetric Examinations – Unit 1		
Weld ID	Limitation Description/Interference	Volumetric Coverage
GBB-105-2 FW 5	16" Valve HV-51-1F016B-to-Pipe Limitation: Carbon Steel - Baseline examination limited due to the valve configuration.	69.5%
RW020	6" Valve HV-44-1F004-to-6" Pipe Limitation: Austenitic material - Single sided exam due to valve-to-pipe configuration.	50%

Table 3.3.2.2 – ASME Code, Section XI, Examination Category C-F-2 Limited Volumetric Examinations – Unit 2		
Weld ID	Limitation Description/Interference	Volumetric Coverage
DBB-203-1 FW2	Valve HV-41-2F032A-to-24"x24"x16" Reducing Tee Limitations: Carbon Steel - Limited examination due to angle between the valve and the reducing tee.	81.5%
DBB-204-1-1ASW7	24" Pipe-to-24" x 6" Sweepolet Limitations: Carbon Steel - Limited examination due to weld geometry due to the severe angle between the 24-inch pipe and the 6-inch sweepolet.	89%
DCB-202-1FW1002	6" Pipe-to-Pipe Limitations: Austenitic material - Baseline exam - Single sided exam due to location of the weld. This weld is located very close to DCB-202-1 FW1003. The welds are so close that the area between the two welds cannot be examined.	50%
DCB-202-1 FW1003	6" Pipe-to-Pipe Limitations: Austenitic material - Baseline exam - Single sided exam due to location of the weld. This weld is located very close to DCB-202-1 FW1002. The welds are so close that the area between the two welds cannot be examined.	50%
DCB-202-1 SW1001	HV-044-2F004-to-6" Pipe Limitations: Austenitic material - Baseline exam - Single sided exam due to valve-to-pipe configuration.	50%
GBB-220-1 FW2	12" Pipe-to-Valve HV-51-2F015A Limitations: Austenitic material - Single sided exam due to valve-to-pipe configuration.	50%
GBB-220-2	12" Pipe-to-Valve HV-51-2F015B	50%

FW2	Limitations: Austenitic material - Single sided exam due to valve-to-pipe configuration.	
HBB-218-1FW7	ValveHV-51-2F008to20" Pipe Limitations: Austenitic material - Single sided exam due to valve-to-pipe configuration.	50%

Licensee's Basis for Relief Request (as stated)

> *The required ASME Code coverage is impractical for the subject welds since the components would require design modifications that would impose a significant burden to Exelon. If access is available, the weld shall be ultrasonically scanned in both directions parallel to the weld and both directions perpendicular to the weld, where required. Full credit for examination coverage may be claimed for single-side examinations on ferritic piping welds. However, for austenitic piping welds, an ultrasonic examination procedure must be qualified with flaws located in the inaccessible side of the weld. There were no known qualified PDI ultrasonic examination procedures available for single-side coverage that demonstrate equivalency to ultrasonic examination two-sided coverage on austenitic piping welds at the time of the examinations for the welds above. At [LGS, Units 1 and 2], qualified PDI ultrasonic examination techniques have been used since 2000. However, qualified PDI procedures were not available at the time of the examination of the welds above to perform a single-sided ASME Code, Section XI, Appendix VIII demonstration using flaws on the opposite side of the weld.*

Licensee's Proposed Alternative Examination (as stated)

> *No alternate provisions are practical for the subject welds. Examinations were performed to the maximum extent practical.*

NRC Staff Evaluation

The ASME Code requires 100% volumetric and surface examination of selected Class 2 circumferential piping welds in pressure retaining piping systems (ASME Code, Section XI, Examination Category C-F-1 and C-F-2). In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining circumferential welds. However, the design configurations of the subject welds limit ultrasonic scanning to a single side. In order to effectively increase the examination coverage, the welded joints would require design modifications or replacement. This would place a burden on the licensee; thus, 100% ASME Code-required volumetric examinations are impractical.

As shown on the sketches and technical descriptions[8] included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical with aggregate volumetric coverage of between 50% and 81% of the ASME Code-required volumes for each of these welds. The ultrasonic examinations of these welds were performed using both shear wave and longitudinal wave inspection techniques. The L-wave method is believed capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless

8 Sketches and technical descriptions provided by the licensee in ADAMS Accession Nos. ML080370257 and ML082550270 are not included in this SE.

steel welds. Recent studies[9,10] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. The licensee completed the ASME Code-required surface examinations on the subject welds with no limitations. No recordable indications were observed during the ultrasonic and surface examinations. The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject piping welds. Imposing this requirement upon the licensee would result in severe burden, as it would require re-design and re-configuration of the associated welds. Based on the volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, it would have been detected by the examinations performed. In addition, the examinations performed to extent practical provide reasonable assurance of structural integrity of the subject pressure retaining piping welds.

4.0 CONCLUSION

Based on the NRC staff's evaluation, a system leakage test of the Reactor Vessel Head Flange Seal Leak Detection Piping at the ASME Code-required test pressure corresponding to the nominal operating pressure during system operation is impractical and would cause severe burden on the licensee if the requirement is imposed. The licensee's proposed alternative provides reasonable assurance of structural integrity. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), the proposed alternative in RR-33 is authorized for the second ISI interval of LGS, Units 1 and 2.

The NRC staff also concludes that ASME Code examination coverage requirements are impractical for the subject welds and nozzle inner radius volume listed in Requests for Relief RR-34 and RR-35. Further, based on the volumetric and/or surface 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 examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components. Therefore, for the items in Requests for Relief RR-34 and RR-35, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the second ISI interval at LGS, Units 1 and 2.

The NRC staff has determined that granting Requests for Relief RR-33, RR-34 and RR-35 pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: T. McLellan
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Date: January 27, 2009

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9 F.V. Ammirato, X. Edelmann and S.M. Walker. 1987. "Examination of Dissimilar Metal Welds in Boiling Water Reactor (BWR) Nozzle-to-Safe End Joints," 8th International Conference on nondestructive testing (NDE) in the Nuclear Industry, American Society of Metals (ASM) International.

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

If you have any questions, please contact the LGS Project Manager, Mr. Peter J. Bamford, at 301-415-2833.

Sincerely,

/ra/

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Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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