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

November 5, 2020

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: LIMERICK GENERATING STATION, UNITS 1 AND 2 – REVISED SAFETY EVALUATION OF RELIEF REQUESTS GVRR-8, 11-PRR-1, 90-PRR-1, AND 47-VRR-2 REGARDING THE FOURTH 10-YEAR INTERVAL OF THE INSERVICE TESTING PROGRAM (EPID L-2018-LLR-0384, EPID L-2018-LLR-0385, EPID L-2018-LLR-0386, AND EPID L-2018-LLR-0387)

Dear Mr. Hanson:

On October 28, 2019 (Agencywide Documents Access and Management System Accession No. ML19228A195), the U.S. Nuclear Regulatory Commission (NRC) issued a safety evaluation in response to Exelon Generation Company, LLC's (Exelon's) application dated December 17, 2018, regarding relief requests GVRR-8, 11-PRR-1, 90-PRR-1, and 47-VRR-2 for the Limerick Generating Station, Units 1 and 2 (Limerick). In the relief requests, Exelon proposed alternatives to certain inservice testing (IST) requirements of the American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants. The relief requests were for the fourth 10-year interval of the IST program at Limerick, which began on January 8, 2020.

The NRC has revised Section 4.0, "Conclusion," of the said safety evaluation as follows:

> As set forth above, the NRC staff has concluded that the proposed alternatives will provide an acceptable level of quality and safety, and that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations* 50.55a(z)(1). Therefore, the NRC staff authorizes the proposed alternatives for the fourth 10-year IST interval at Limerick that is scheduled to start on January 8, 2020.

This revision does not change the granting of the relief requests issued on October 28, 2019.

All other ASME Code requirements for which relief was not specifically requested and approved, remain applicable.

If you have any questions, please contact the Limerick project manager, Dr. V. Sreenivas, at (301) 415-2597 or by e-mail to V.Sreenivas@nrc.gov.

Sincerely,

***/RA/***

V. Sreenivas, Project Manager
Plant Licensing Branch 1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

Enclosure:
Revised Safety Evaluation

cc: Listserv

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

# REVISED SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# RELATED TO RELIEF REQUESTS GVRR-8, 11-PRR-1, 90-PRR-1 AND 47-VRR-2

# REGARDING THE FOURTH 10-YEAR INTERVAL OF THE INSERVICE TESTING PROGRAM

# EXELON GENERATION COMPANY, LLC

# LIMERICK GENERATING STATION, UNITS NO. 1 AND 2

# DOCKET NOS. 50-352 AND 50-353

## 1.0 INTRODUCTION

By letter dated December 17, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18352A227), Exelon Generation Company, LLC, the licensee, submitted alternative relief requests GVRR-8, 11-PRR-1, 90-PRR-1 and 47-VRR-2, to the U.S. Nuclear Regulatory Commission (NRC). The licensee requested alternative test plans in lieu of certain inservice testing (IST) requirements of the 2012 Edition of the American Society of Mechanical Engineers (ASME) *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) for the IST programs at Limerick Generating Station (Limerick), Units 1 and 2, during the fourth 10-year IST program interval, which is scheduled to begin on January 8, 2020, and end on January 7, 2030.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(z)(1), the licensee requested to use proposed alternative relief requests GVRR-8, 11-PRR-1, 90-PRR-1, and 47-VRR-2, on the basis that the alternatives provide an acceptable level of quality and safety.

The purpose of this letter is to provide the results of the NRC staff's review of relief requests GVRR-8, 11-PRR-1, 90-PRR-1, and 47-VRR-2, as documented in the enclosed safety evaluation. In these relief requests, Exelon proposed alternatives to certain IST requirements of the OM Code for certain pumps and valves. The NRC staff's safety evaluation concludes that the proposed alternatives will provide an acceptable level of quality and safety, and that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the proposed alternatives for the fourth 10-year IST interval at Limerick.

## 2.0 REGULATORY EVALUATION

10 CFR 50.55a(f), "Inservice Testing Requirements," requires, in part, that IST of certain ASME Code Class 1, 2, and 3 components must meet the requirements of the ASME OM Code and applicable addenda incorporated by reference in the regulations. Exceptions are allowed where alternatives have been authorized by the NRC, pursuant to paragraph 10 CFR 50.55a(z)(1).

In proposing alternatives, a licensee must demonstrate that the alternatives provide an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

Based on the above, and subject to the following technical evaluation, the NRC staff finds that the regulatory authority exists for the licensee to request, and the Commission to authorize, the alternatives requested by the licensee.

## 3.0 TECHNICAL EVALUATION

### 3.1 Licensee Relief Request GVRR-8, "Pressure Isolation Valve Leakage Test Frequency"

Applicable Code Edition/Addenda

The Code of Record for the fourth 10-year IST interval at Limerick is the 2012 Edition of the OM Code with no Addenda. The fourth 10-year IST interval is scheduled to start January 8, 2020.

Applicable Code Requirements

ASME OM Code, ISTC-3630, "Leakage Rate for Other Than Containment Isolation Valves," states, in part, that, "Category A valves with a leakage requirement not based on an owner's 10 CFR 50, Appendix J, program shall be tested to verify the seat leakages are within acceptable limits. Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied."

ASME OM Code, ISTC-3630(a), "Frequency," states that, "Tests shall be conducted at least once every 2 years."

Affected Components

The request applies to the components in the following table:

| Component | System | Code Class | Category | Type |
|---|---|---|---|---|
| HV-51-1(2)F041A-D | RHR | 1 | A/C | SA |
| HV-51-1(2)F017A-D | RHR | 1 | A | MO |
| HV-51-1(2)42A-D | RHR | 1 | A | AO |
| HV-51-1(2)F050A/B | RHR | 1 | A/C | SA |
| HV-51-1(2)F015A/B | RHR | 1 | A | MO |
| HV-51-1(2)51A/B | RHR | 1 | A | AO |
| 51-1(2)200A/B | RHR | 1 | A/C | SA |
| HV-51-1(2)F008 | RHR | 1 | A | MO |
| HV-51-1{2)F009 | RHR | 1 | A | MO |
| HV-52-1{2)F005 | CS | 1 | A | MO |
| HV-52-1(2)F006A/B | CS | 1 | A/C | SA |
| HV-52-1(2)F039A/B | CS | 1 | A | AO |
| HV-52-1(2)08 | CS | 1 | A/C | SA |

Licensee's Basis for Requesting Relief

The licensee has stated that, "ISTC-3630 requires that leakage rate testing for pressure isolation valves (PIVs) be performed at least once every two years. PIVs are not specifically included in the scope for performance-based testing as provided for in 10 CFR Part 50 Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, "Performance-Based Requirements." These motor-operated valve, air-operated valve and check valve (CV) PIVs are all containment isolation valves (CIVs) but are not all tested per Appendix J based on a justification of the penetration being a single CIV within a closed loop".

Limerick Technical Specification (TS) 6.8.4.g, "Primary Containment Leakage Rate Testing Program," states, in part:

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak-Testing Program," dated September 1995.

The licensee has stated that, "the NRC Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," endorses Nuclear Energy Institute (NEI) 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 0, dated July 26, 1995, as an acceptable method for complying with the provisions of Option B to 10 CFR Part 50, Appendix J, with certain exceptions. Sections 10.1 and 11.3 of NEI 94-01 allow an extension of up to 25 percent of the test interval (not to exceed 15 months).

The concept behind the Option B alternative for CIVs is that licensees should be allowed to adopt cost effective methods for complying with regulatory requirements. Additionally, NEI 94-01 describes the risk-informed basis for the extended test intervals under Option B. That justification shows that for CIVs which have demonstrated good performance by passing their leak rate tests for two consecutive cycles, further failures would be governed by the random failure rate of the component. NEI 94-01 also presents the results of a comprehensive risk analysis, including the conclusion that "the risk impact associated with increasing [leak rate] test intervals is negligible (less than 0.1% of total risk)."

The valves identified in this relief request are all in water applications. Testing is performed with water pressurized to the functional maximum pressure differential. This relief request is intended to provide for a performance-based scheduling of PIV tests at Limerick. The reason for requesting this relief is dose reduction to comport with the NRC and industry As Low as Reasonably Achievable (ALARA) radiation dose principles. The review of recent historical data identified that PIV testing each refueling outage results in a total personnel dose of approximately 700 milli-roentgen equivalent man (mrem). The proposed extended test interval (assuming all PIVs are on extended frequency) would provide for a savings of approximately 1.4 rem over three refueling outages.

NUREG-0933, "Resolution of Generic Safety Issues," Issue 105, "Interfacing Systems LOCA [Loss-of-Coolant Accident [ISLOCA]] at LWRs," discusses the need for PIV leak rate testing based primarily on three historical failures of applicable valves industry-wide. These failures all involved human errors in either operations or maintenance. None of these failures involved inservice equipment degradation. The performance of the PIV leak rate testing provides

assurance of acceptable seat leakage with the valve in a closed condition.

Typical PIV testing does not identify functional problems which may inhibit the valves ability to re-position from open to close. For CVs, functional testing is accomplished in accordance with ASME OM Code Section ISTC-3520, "Exercising Requirements," and Section ISTC-3522, "Category C Check Valves."

For power-operated valves, full stroke testing is performed in accordance with the ASME OM Code, Section ISTC-5100, "Power Operated Valves (POVs)" to ensure its functional capabilities. Performance of the separate two-year PIV leak rate testing does not contribute any additional assurance of functional capability; it only determines the seat tightness of the closed valves".

Licensee's Proposed Alternative and Basis for Use

In its submittal, the licensee stated:

> LGS proposes to perform PIV testing at intervals ranging from every refueling outage to every third refueling outage. The specific interval for each valve would be a function of its performance and would be established in a manner consistent with the CIV process under 10 CFR 50 Appendix J, Option B. For those valves that are also Appendix J leak tested, a conservative control will be established such that if any valve fails either the Appendix J or PIV test, the test interval for both tests will be reduced consistent with Appendix J, Option B requirements until good performance is reestablished.

The NRC Staff's Evaluation

The licensee has proposed an alternative test in lieu of the requirements found in 2012 Edition of the ASME OM Code, Section ISTC-3630(a) for 56 PIVs. Specifically, the licensee proposed to functionally test and verify the leakage rate of 56 PIVs using the 10 CFR Part 50, Appendix J, Option B performance-based schedule. Valves would initially be tested at the required interval schedule which is currently every refueling outage (RFO) or two years as specified by ASME OM Code Section ISTC-3630(a). Valves that have demonstrated good performance for two consecutive cycles may have their test interval extended to every third RFO not to exceed six years. Any PIV leakage test failure would require the component to return to the initial interval of every RFO or two years until good performance can again be established.

Pressure isolation valves are defined as two valves in series within the reactor coolant pressure boundary which separate the high-pressure reactor coolant system from an attached lower pressure system. Failure of a PIV could result in an over-pressurization event which could lead to a system rupture and possible release of fission products to the environment. This type of failure event was analyzed under NUREG/CR-5928, "ISLOCA Research Program (ADAMS Accession No. ML072430731). The purpose of NUREG/CR-5928 was to quantify the risk associated with an ISLOCA event. NUREG/CR-5928 analyzed boiling water reactor (BWR) and pressurized water reactor designs. The conclusion of the analysis resulted in ISLOCA not being a risk concern for BWR design. Limerick, Units 1 and 2, are a BWR design.

The regulations in 10 CFR Part 50, Appendix J, Option B is a performance-based leakage test program. Guidance for implementation of acceptable leakage rate test methods, procedures, and analyses is provided in RG 1.163, "Performance Based Containment Leak Test Program" (ADAMS Accession No. ML003740058). RG 1.163 endorses NEI Topical Report 94-01,

Revision 0, “Industry Guideline for Implementing Performance Based Option of 10 CFR 50, Appendix J” dated July 26, 1995, with the limitation that Type C components test interval cannot extend greater than 60 months. The current version of NEI 94-01 is Revision 3-A which allows Type C containment isolation valve test intervals to be extended to 75 months with a permissible extension for non-routine emergent conditions of nine months (84 months total). The NRC staff finds the guidance in NEI 94-01, Revision 3-A to be acceptable (ADAMS Accession Nos. ML121030286 and ML12226A546) with the following conditions:

1) Extended interval for Type C LLRTs may be increased to 75 months with the requirement that a licensee’s post outage report include the margin between Type B and Type C leakage rate summation and its regulatory limit. In addition, a corrective action plan shall be developed to restore the margin to an acceptable level. Extensions of up to nine months (total maximum interval of 84 months for Type C tests) are permissible only for non-routine emergent conditions. This provision (nine-month extension) does not apply to valves that are restricted and/or limited to 30-month intervals in Section 10.2 (such as BWR MSIVs) or to valves held to the base interval (30 months) due to unsatisfactory LLRT performance.

2) When routinely scheduling any LLRT valve interval beyond 60-months and up to 75-months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Type B & C total and must be included in a licensee’s post-outage report. The report must include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

The NRC staff finds the licensee’s proposed alternative to be acceptable because it is consistent with 10 CFR Part 50, Appendix J, Option B and because of the low level of risk associated with ISLOCA. The level of risk associated with ISLOCA is described in NUREG/CR-5928 and is found to be very low for BWRs. Additionally, the staff notes that the licensee identified an ALARA hardship associated with the current test interval. While hardship is not a consideration in authorizing an alternative under 10 CFR 50.55a(z)(1) and is not the basis for this authorization, the existence of this hardship is noted by the NRC staff.#The NRC staff concludes that the licensee’s proposed alternative provides an acceptable level of quality and safety and is authorized under 10 CFR 50.55a(z)(1).

The licensee is authorized to implement a performance-based program for 56 PIVs at Limerick, Units 1 and 2. The performance-based program interval shall not exceed 3 RFO or 75 months. Non-routine emergent conditions may extend the program interval, nine months.

3.2 Licensee Relief Request 11-PRR-1, “Use of Code Case OMN-16, ESW Pump Test Using Pump Curves”

Applicable Code Edition/Addenda

The Code of Record for the fourth 10-year IST interval at Limerick is the 2012 Edition of the OM Code with no Addenda. The fourth 10-Year IST interval is scheduled to start January 8, 2020.

Applicable Code Requirements

ASME OM Code 2012 Edition

ISTA-3130, "Application of Code Cases," subparagraph (b), states, "Code Cases shall be applicable to the edition and addenda specified in the test plan."

Code Case OMN-16, Revision 1, "Use of a Pump Curve for Testing"

Affected Components

The request applies to the pumps in the following table. The emergency service water (ESW) pumps are motor-driven, vertical line shaft pumps.

| Component ID | Description | Code Class | Group |
|---|---|---|---|
| 0A-P548 | ESW Pump A | 3 | A |
| 0B-P548 | ESW Pump B | 3 | A |
| 0C-P548 | ESW Pump C | 3 | A |
| 0D-P548 | ESW Pump D | 3 | A |

Licensee's Basis for Requesting Relief

The licensee stated:

> Pursuant to 10 CFR 50.55a, *Codes and standards,* paragraph (z)(1), an alternative is proposed to ISTA-3130(b) requirements for implementing Code Case OMN-16, "Use of a Pump Curve for Testing," Revision 1. The basis of this request is that the proposed alternative would provide an acceptable level of quality and safety.
>
> ISTA-3130(b) states, "Code Cases shall be applicable to the edition and addenda specified in the test plan." ASME has approved Code Case (CC) OMN-16, Revision 1. This CC is conditionally approved for use by the Nuclear Regulatory Commission (NRC) in Table 2 of Regulatory Guide (RG) 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," Revision 2. However, CC OMN-16, Revision 1, *Applicability,* states that it is applicable to the "1998 Edition and subsequent editions and addenda through the OMa-2011 Addenda." During the fourth ten-year IST interval, LIMERICK, Units 1 and 2, will be implementing the ASME OM Code 2012 Edition and also proposes to implement CC OMN-16, Revision 1, for testing the ESW pumps.
>
> The ESW System includes a large number of variable heat loads. In addition, the temperature of the system is seasonally dependent and can vary significantly. Therefore, it is extremely difficult to vary the resistance of the system to establish flow or differential pressure conditions at any fixed reference point. Operations personnel would need to assume local manual control of automatic room cooler valves and equipment modulating valves. This requires access to Emergency Core Cooling System (ECCS) room coolers and other safety related equipment causing numerous entries into Radiological Controlled Areas (RCAs) to adjust flow to a fixed reference point in order to perform this

quarterly test, which would also result in additional dose. Establishment of multiple sets of reference values would not improve the capability to set either variable at a fixed point.

Limerick was authorized to use CC OMN-16 during the previous third 10-year IST interval and proposes to continue with the use of CC OMN-16, Revision 1, in the subsequent fourth IST interval, to use pump reference curves during IST of the ESW pumps. Circumstances and basis for previous NRC approval in the safety evaluation for the third 10-year IST interval for use of CC OMN-16 have not changed.

Licensee's Proposed Alternative and Basis for Use

The licensee stated:

An alternative to ISTA-3130(b) is proposed to implement CC OMN-16, Revision 1, since the CC Applicability statement only covers through the OMa-2011 Addenda, and ISTA-3130(b) requires applicability to the OM 2012 Edition for LGS, Units 1 and 2.

RG 1.192, Revision 2, Table 2, *Conditionally Acceptable OM Code Cases,* approves use of CC OMN-16, Revision 1, with the following condition: "Figure 1 was inadvertently omitted from OMN-16, Revision 1, in the 2012 Edition of the OM Code. The Code Case is approved for use provided it is supplemented with Figure 1 of OMN-16 that is in the 2006 Addendum of the OM Code. (Note: CC OMN-16, 2006 Addenda, was unconditionally approved in Revision 1 of RG 1.192.)"

In order to monitor the ESW pumps for degradation and assure their operational readiness, reference curves as described in Code Case OMN-16, Revision 1, will be used for inservice testing. This revision of the Code Case will be supplemented with Figure 1, *Examples of Graphical Evaluation of Tests Using Reference Curves,* from the version of OMN-16 that is in the OMb-2006 Addenda of the OM Code, which will address the condition stated in Table 2 of RG 1.192, Revision 2.

Pump testing is performed quarterly using these pump curves. Flow, normally in the range of 3000 to 4100 gpm, is measured and total dynamic head is calculated from the pump discharge pressure and the level of the Spray Pond (i.e., suction). The test point is then compared to the pump curve and determined to be within the acceptance range of Table ISTB-5221-1 (0.95 to 1.10 $P_r$ [reference pressure] for the Group A test or 0.95 to 1.06 $P_r$ for the Comprehensive Test), which is also plotted on the pump curve. Corrective action, if required, shall meet the requirements of ISTB-6200.

The original pump curves were prepared during flow balancing activities before commercial operation of Limerick, Unit 2, and include many empirical data points taken over the entire operating range of the pumps, essentially from shutoff head to approximately 1.5 times the maximum flow required for safe shutdown or accident mitigation. As the pumps have been replaced, new curves have been generated based on the preservice test requirements of ISTB-5210. These

curves exceed the requirements of OMN-16 for a minimum of 3 data points and at least one data point for each 20% of the maximum pump curve range for the portion of the maximum pump curve established by the reference curve.

Vibration readings are taken in accordance with ISTB-3540. In addition to the Code-required vibration readings, several additional readings are taken and analyzed in accordance with the Limerick Predictive Maintenance Program. Since these pumps show little variation in vibration over their normal operating range, the acceptance criteria for vibration testing complies with the requirements of Table ISTB-5221-1.

Using the provisions of this request as an alternative to the requirements of ISTA-3130(b), will provide adequate detection of observable ESW pump degradation, and along with the pump testing per CC OMN-16, Revision 1, will continue to provide reasonable assurance of the operational readiness of the LGS, Units 1 and 2, ESW pumps. Therefore, the proposed alternative provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(z)(1).

The NRC Staff's Evaluation

The 2012 Edition of the ASME OM Code, Section ISTB-5221, "Group A Test Procedure," requires vertical line shaft centrifugal pumps to be adjusted to a specific reference point for testing. Section ISTA-3130(b) states that Code Cases shall be applicable to the ASME OM Code edition and addenda specified in the test plan. The licensee proposed to apply ASME OM Code Case OMN-16, Revision 1, to the 2012 Edition of the ASME OM Code to allow the use of a pump reference curve instead of using a single data point during Group A of the ESW pumps.

As discussed in ASME OM Code Case, OMN-16, Revision 1, when testing a centrifugal pump or vertical line shaft pump where adjusting the pump to a specific reference value is impractical, the establishment of additional pump curves for reference flow rates, differential pressures, and vibration is acceptable. Application of ASME OM Code Cases are addressed in 10 CFR 50.55a(b)(6) through reference to RG 1.192, Revision 2, which lists acceptable and conditionally acceptable Code Cases for implementation in the IST program and Snubber program. RG 1.192, Revision 2, Table 2 shows that Code Case OMN-16, Revision 1, is conditionally approved, provided it is supplemented with Figure 1 in Code Case OMN-16 published with the 2006 Addenda. Code Case OMN-16, Revision 1, was published with the 2012 Edition of the ASME OM Code, and it is applicable to the 1995 Edition through the 2011 Addenda of the ASME OM Code.

The licensee stated that its use of Code Case OMN-16, Revision 1, will be supplemented with Figure 1 in Code Case OMN-16 published with the 2006 Addenda to satisfy the condition in RG 1.192, Revision 2. Further, the NRC staff reviewed the 2012 Edition of the ASME OM Code and Code Case OMN-16, Revision 1, and confirmed that there are no changes in the applicable Code sections referenced within the Code Case OMN-16, Revision 1. Based on this evaluation, the staff determined that the use of Code Case OMN-16, Revision 1, with the 2012 Edition of the ASME OM Code is acceptable. Therefore, the NRC staff concludes that the licensee's proposed alternative provides an acceptable level of quality and safety and is authorized under 10 CFR 50.55a(z)(1).

3.3 Licensee Relief Request 90-PRR-1, "Installed Pump Flow Instrumentation Accuracy Greater than 2%"

Applicable Code Edition/Addenda

The Code of Record for the fourth 10-year IST interval at Limerick is the 2012 Edition of the OM Code with no Addenda. The fourth 10-year IST interval is scheduled to start January 8, 2020.

Applicable Code Requirements

ISTB-3510, "General," (a), "Accuracy," states, in part, "Instrument accuracy shall be within the limits of Table ISTB-3510-1. If a parameter is determined by analytical methods instead of measurement, then the determination shall meet the parameter accuracy requirement of Table

ISTB-3510-1 (e.g., flow rate determination shall be accurate to within ±2% of actual). For individual analog instruments, the required accuracy is percent of full-scale."

ISTB-3510(b), "Range," (1) states, "The full-scale range of each analog instrument shall be not greater than three times the reference value."

Table ISTB-3510-1, "Required Instrument Accuracy," specifies an accuracy requirement of ±2 percent for flow rate instruments.

Affected Components

The licensee requested Affected Components for flow rate instruments is listed below:

| Component | Description | ASME Code Class | Group |
|---|---|---|---|
| 0AP162 | Main Control Room Chilled Water Pump A | 3 | A |
| 0BP162 | Main Control Room Chilled Water Pump B | 3 | A |

Licensee's Basis for Requesting Relief

The licensee stated:

> Pursuant to 10 CFR 50.55a, *Codes and standards,* paragraph (z)(1), an alternative is proposed to the requirement of ASME OM Code ISTB-3510(a). The basis of this request is that the proposed alternative would provide an acceptable level of quality and safety.
>
> For instruments to be in compliance with the Code, both requirements stated above must be met, individually, for each instrument. The combination of the two requirements (i.e., accuracy equal to ±2% of full-scale and full scale being up to 3 times the reference value) yields a permissible inaccuracy of ±6% of the reference value.
>
> The permanently installed flow instruments, FI-90-34A and FI-90-34B, as shown in Table 1 below are calibrated to an accuracy that does not meet the ±2% of full-scale requirement.

Licensee's Proposed Alternative and Basis for Use

The licensee stated:

> As a proposed alternative, LGS [Limerick Generating Station] proposes to use the currently installed analog instruments, FI-90-034A and FI-90-034B, for measurement of discharge flow for the Main Control Room Chilled Water pumps. Although these instruments do not meet Code requirements, they provide better indication accuracy at the reference value than that which is permitted by the Code.
>
> NUREG-1482, Revision 2, Section 5.5.1, *Range and Accuracy of Analog Instruments,* states, in part, "When the range of a permanently installed analog instrument is greater than three times the reference value, but the accuracy of the instrument is more conservative than that required by the Code, the staff may grant relief when the combination of the range and accuracy yields a reading that is at least equivalent to that achieved using instruments that meet the Code requirements (i.e., up to ±6 percent for Group A and B tests...)."
>
> Table 2 shows the instrument accuracy and full-scale range of the flow instruments used to conduct inservice testing of the Main Control Room Chilled Water pumps listed above. The resulting instrument tolerance and indicated accuracy are calculated and also listed in Table 1. The full-scale range of the installed flow measuring instruments is within the required three times the reference value and meets the OM Code requirement specified in ISTB-3510(b)(1). However, the instrument accuracy is greater than the required ±2 percent of full scale. The indicated accuracy at the reference value is shown to be within the required ±6 percent.

Table 1
Main Control Room Chilled Water Pumps Discharge Flow Measuring Instrument Accuracies

| Instrument Number | Reference Value (gpm) | Instrument Range (Full-Scale) | Instrument Accuracy | Instrument Tolerance | Indicated Accuracy |
|---|---|---|---|---|---|
| FI-90-034A | 600 | 0 - 800 | 3.08% | 24.64 | 4.11% |
| FI-90-034B | 600 | 0 - 800 | 3.04% | 24.32 | 4.05% |

> Based on Section 5.5.1 of NUREG 1482, Revision 2, and the information provided herein, the existing permanently installed pump instrumentation is considered acceptable in meeting the intent of the ASME OM Code-2012, paragraphs ISTB 3510(a) and 3510(b)(1). Thus, utilizing the permanently installed instrumentation for measuring the Main Control Room Chilled Water pumps' discharge flow provides an acceptable level of quality and safety; therefore, this alternative is proposed in accordance with 10 CFR 50.55a(z)(1).
>
> Circumstances and basis for previous NRC approval of Relief Request 90-PRR-1, Revision 1 for use during the third IST interval have not changed. This request updates the Code reference for use during the fourth IST interval.

The NRC Staff's Evaluation

The licensee requested an alternative to ASME OM Code paragraph ISTB-3510(a) for the main control room chilled water pumps discharge flow measuring instruments. ASME OM Code paragraph ISTB-3510(a) refers to Table ISTB-3510-1, which states that flow measuring instrumentation accuracy must be within ± 2 percent full-scale. ASME OM Code paragraph ISTB-3510(b)(1) states that the full-scale range of each analog instrument shall be not greater than three times the reference value. The combination of these two requirements results in an effective accuracy requirement of ±6 percent of the reference value. The licensee proposed to use existing installed analog flow instrumentation FI-90-034A and FI-90-034B, which currently do not meet all of the ASME OM Code requirements.

NUREG-1482, Guidelines for Inservice Testing at Nuclear Power Plants, Inservice Testing of Pumps and Valves and Inservice Examination and Testing of Dynamic Restraints (Snubbers) at Nuclear Power Plants, Revision 2, dated September 2013 (published October 2013}. Revision 2, Section 5.5.1 states that relief may be granted when the combination of the range and accuracy yields a reading that is at least equivalent to that achieved using instruments that meet the ASME OM Code requirements (i.e., up to ±6 percent for flow instruments for Preservice, Group A, Group B and comprehensive tests).

In this request for an alternative, the full-scale range of the installed flow measuring instruments is within the required three times the reference value. However, the instrument accuracy is greater than the ASME OM Code-required ±2 percent of full scale. Considered together, the indicated accuracy achieved from the installed flow measuring instruments FI-90-034A and FI-90-034B is ±4.11 percent and ±4.05 percent respectively, which is less than the ±6 percent mentioned above. Based on this evaluation, the staff determined that the proposed alternative to the requirements of ASME OM Code ISTB-3510(a) is acceptable. Therefore, the NRC staff concludes that the licensee's proposed alternative provides an acceptable level of quality and safety and is authorized under 10 CFR 50.55a(z)(1).

3.4 Licensee Relief Request 47-VRR-2, "Control Rod Drive Scram Valves"

Applicable Code Edition/Addenda

The Code of Record for the fourth 10-year IST interval at Limerick is the 2012 Edition of the OM Code with no Addenda. The fourth 10-year IST interval is scheduled to start January 8, 2020.

Applicable Code Requirements

ASME OM Code 2012 Edition

ISTC-3510, "Exercising Test Frequency," states, in part, that "Active Category A, Category B, and Category C check valves shall be exercised nominally every 3 mon., except as provided by paras. ISTC-3520, ISTC-3540, ISTC-3550, ISTC-3570, ISTC-5221, and ISTC-5222."

ISTC-3560, "Fail-Safe Valves," states, "Valves with fail safe actuators shall be tested by observing the operation of the actuator upon loss of valve actuating power in accordance with the exercising frequency of para. ISTC-3510."

ISTC-5131, “Valve Stroke Testing,” subparagraph (a), states “Active valves shall have their stroke time measured when exercised in accordance with para. ISTC-3500.”

ISTC-5221, “Valve Obturator Movement,” subparagraph (a)(2), states, in part, that “Check valves that have a safety function in only the open direction shall be exercised by initiating flow and observing that the obturator has traveled [to] either the full open position or to the position required to perform its intended function(s) ... and verify closure.”

Affected Components

The request applies to the valves in the following table. Each of the valves listed below represents 1 of 185 control rod drive (CRD) hydraulic control units (HCU).

| Component ID | Description | Code Class | Category |
|---|---|---|---|
| XV-47-1-26 (all 185 HCUs) | U1 – Inlet Scram Valves (AOVs) | 2 | B |
| XV-47-1-27 (all 185 HCUs) | U1 – Outlet Scram Valves (AOVs) | 2 | B |
| XV-47-2-26 (all 185 HCUs) | U2 – Inlet Scram Valves (AOVs) | 2 | B |
| XV-47-2-27 (all 185 HCUs) | U2 – Outlet Scram Valves (AOVs) | 2 | B |
| 47-1-14 (all 185 HCUs) | U1 – Scram Discharge Riser Check Valve | 2 | C |
| 47-2-14 (all 185 HCUs) | U2 – Scram Discharge Riser Check Valve | 2 | C |

Licensee’s Basis for Requesting Relief

The licensee stated:

> Pursuant to 10 CFR 50.55a, Codes and standards, paragraph (z)(1), an alternative is proposed to use the guidance provided in Generic Letter (GL) 89-04, Position 7, in lieu of the Code-required exercise frequency, actuator fail-safe testing, and stroke time testing for the inlet and outlet scram valves and the scram discharge riser check valves located on each CRD HCU. The basis of the request is that the proposed alternative to the specified testing requirements would provide an acceptable level of quality and safety.
>
> GL 89-04, Position 7 discusses alternative testing of individual scram valves for control rods in Boiling Water Reactors (BWRs). Position 7 states, in part, that “for those control rod drive system valves where testing could result in the rapid insertion of one or more control rods, the rod scram test frequency identified in the facility TS [Technical Specifications] may be used as the valve testing frequency to minimize rapid reactivity transients and wear of the control rod drive mechanisms. This alternative test frequency should be clearly stated and documented in the IST [Inservice Testing] program.”
>
> NUREG-1482, Revision 2, Section 1.3, states, “The recommendations herein replace the guidance and technical positions in GL 89-04. Note that specific relief is required to implement the guidance derived from GL 89-04. However, relief justification may refer to the positions in the GL with clarifying information to clearly show how it would apply to a licensee's situation.”

Licensee's Proposed Alternative and Basis for Use

The licensee stated:

> In order to exercise the Category B valves in accordance with ISTC-3510, and test the failsafe actuators as required by ISTC-3560, the air operated inlet and outlet scram valves would need to be exercise tested at power nominally every three (3) months. The air operated inlet and outlet scram valves, XV-47-1(2)-26 and XV-47-1(2)-27, open on a signal from the Reactor Protection System (RPS) to permit rapid insertion of the control rods (scram). These valves can only be tested by scramming the CRD.
>
> ISTC-5131(a) applies to the Category B air operated inlet and outlet scram valves (XV-47-1(2)-26 and XV-47-1(2)-27). Stroke timing of the air-operated valves is impractical since they are not equipped with indication of the open and closed positions. Control room panel lights verify insertion of the control rod, not valve position. Accordingly, Code-compliant stroke time testing cannot be performed to meet the ISTC-5131(a) requirement. As a proposed alternative, scram time testing as described in GL 89-04, Position 7 will be performed in accordance with LGS, Units 1 and 2, TS SR 4.1.3.2.
>
> ISTC-3510 and ISTC-5221(a)(2) apply to the scram discharge riser CVs (47-1(2)-14). The scram discharge riser CV 47-1(2)-14 is flow actuated as a result of the outlet scram valves XV-47-1(2)-27 opening. In order to demonstrate that the safety function is exercised, these valves can only be tested by scramming the CRD.
>
> For all listed components, exercise testing at power will result in rapid insertion of control rods causing potential reactivity transients and wear of the CRD mechanisms.
>
> Accordingly, an alternative is proposed to test the valves in accordance with LGS, Units 1 and 2 Technical Specification (TS) Surveillance Requirement (SR) 4.1.3.2, *Control Rod Maximum Scram Insertion Times,* and in conformance with GL 89-04 Position 7.
>
> As a proposed alternative, the valve and scram time testing would be performed in accordance with the Limerick, Units 1 and 2 TS SR 4.1.3.2, which states:
>
> > "The maximum scram insertion time of the control rods shall be demonstrated through measurement and, during single control rod scram time tests, the control rod drive pumps shall be isolated from the accumulators:
> >
> > a. For all control rods prior to THERMAL POWER exceeding 40% of RATED THERMAL POWER with reactor coolant pressure greater than or equal to 950 psig, following CORE ALTERATIONS or after reactor shutdown that is greater than 120 days.
> >
> > b. For specifically affected individual control rods following maintenance on or modification to the control rod or control rod

drive system which could affect the scram insertion time of those specific control rods in accordance with either "1" or "2" as follows:

1.a Specifically affected individual control rods shall be scram time tested at zero reactor coolant pressure and the scram insertion time from the fully withdrawn position to notch position 05 shall not exceed 2.0 seconds, and

1.b Specifically affected individual control rods shall be scram time tested at greater than or equal to 950 psig reactor coolant pressure prior to exceeding 40% of rated thermal power.

2. Specifically affected individual control rods shall be scram time tested at greater than or equal to 950 psig reactor coolant pressure.

c. For at least 10% of the control rods, with reactor coolant pressure greater than or equal to 950 psig, on a rotating basis, and in accordance with the Surveillance Frequency Control Program."

Scram time testing of the control rods demonstrates that the above listed valves will perform their safety function. These valves are required to open to provide drive water and create an exhaust path for insertion of the control rods. Failure of a valve to open would result in the control rod not scramming in accordance with the TS requirements. It is noted that TS SR 4.1.3.2.a is performed at least once per refueling cycle; TS SR 4.1.3.2.b is performed following maintenance or modification to the control rod or control rod drive system; and, TS SR 4.1.3.2.c is performed at a frequency controlled by the Surveillance Frequency Control Program (SFCP). The Limerick SFCP and any changes to the surveillance frequencies in the SFCP are implemented in accordance with Limerick TS Section 6.8.4.j. GL 89-04, Position 7 states that the rod scram test frequency identified in the TS may be used as the valve testing frequency to minimize rapid reactivity transients and wear of the control rod drive mechanisms. Therefore, testing of the inlet and outlet scram valves and the scram discharge riser check valves would be performed in accordance with Limerick, Units 1 and 2 TS SR 4.1.3.2 in conformance with the Surveillance Frequency Control Program.

Monitoring and trending the stroke times of the inlet and outlet scram valves is not necessary because they are indirectly stroke timed and no meaningful correlation between the scram time and valve stroke time can be obtained. The proposed alternative of verifying that the associated control rod meets the scram insertion time limits defined in the Limerick TS allows for detecting degradation of these valves, thus ensuring valve operational readiness. Therefore, this alternative to the Code-required exercise frequency, actuator fail-safe testing, and stroke time testing for the inlet and outlet scram valves and the scram discharge riser check valves located on each CRD HCU provides an acceptable level of quality and safety, and thus, is proposed in accordance with 10 CFR 50.55a(z)(1).

The NRC Staff's Evaluation

The 2012 Edition of the ASME OM Code, paragraph ISTC-3510, requires that Category A, B, and C valves be exercised nominally every three months except as provided by paragraphs ISTC-3520, ISTC-3540, ISTC-3550, ISTC-3570, ISTC-5221, and ISTC-5222. Paragraph ISTC-3560 requires fail save valves to be tested at the three months frequency specified in ISTC-3510. For active pneumatically-operated valves (including the subject inlet and outlet scram valves), subparagraph ISTC-5131(a) requires stroke time measurement during testing to be performed in accordance with ISTC-3500. Similarly, for CVs (including the subject scram discharge riser CVs), subparagraph ISTC-5221(a)(2) requires the valves to be exercised by initiating flow, observing that the obturator travels to the position required to perform the valve's intended function, and verifying closure.

The licensee has proposed an alternative in lieu of these requirements for the subject valves. Specifically, the applicant proposed: (1) to test the valves at the rod scram test frequency identified in the plant TSs surveillance requirement (SR) 4.1.3.2, and (2) to identify valve degradation by verifying that the control rods meet the scram insertion time limits defined in the plant TSs in lieu of conducting the valve stroke time tests.

The subject pneumatically-operated valves have a safety function in ensuring control rod insertion during a reactor scram. The inlet and outlet scram valves are air operated valves with an air to close-fail open design. The outlet scram valves open to vent the control rod drive piston to the scram discharge volume allowing control rod movement. The inlet scram valves open to supply pressurized water to the bottom of the control rod drive piston which rapidly inserts the control rods into the reactor core. These valves are classified as Category B valves in accordance with the ASME OM Code. The subject CVs also have a safety function in ensuring control rod insertion during a reactor scram. The CVs are located in the scram discharge riser line which is flow actuated as a result of opening the outlet scram valves. The scram discharge riser check valves open to allow water to pass from the control rod drive pistons to the scram discharge header. These valves are classified as Category C valves in accordance with the ASME OM Code.

NUREG-1482, Revision 2, Section 4.4.6, states that for the CRD system valves (which includes the subject valves) for which testing could result in rapid insertion of one or more control rods, the rod scram test frequency identified in the facility's TSs may be used as the valve testing frequency to minimize rapid reactivity transients and wear of the CRD mechanisms. It also states that verifying that the associated control rod meets the scram insertion time limits defined in the plant's TSs can be an acceptable alternative method of detecting degradation of these valves. The NRC staff finds that the proposed alternative is consistent with the staff's position in NUREG-1482, Revision 2; therefore, the alternative provides reasonable assurance of the operational readiness of the CRD valves and provides an acceptable level of quality and safety.# Therefore, the NRC staff concludes that the licensee's proposed alternative provides an acceptable level of quality and safety and is authorized under 10 CFR 50.55a(z)(1).

The NRC staff notes that a similar alternative request was authorized for the third 10-year IST program interval at Limerick in a letter dated November 17, 2009 (ADAMS Accession No. ML093080382).

## 4.0 CONCLUSION

As set forth above, the NRC staff has concluded that the proposed alternatives will provide an acceptable level of quality and safety, and that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations* 50.55a(z)(1). Therefore, the NRC staff authorizes the proposed alternatives for the fourth 10-year IST interval at Limerick that is scheduled to start on January 8, 2020.

All other ASME OM Code requirements for which relief was not specifically requested and approved remain applicable.

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Date: October 28, 2019 (revised November 5, 2020)

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – REVISED SAFETY EVALUATION OF RELIEF REQUESTS GVRR-8, 11-PRR-1, 90-PRR-1, AND 47-VRR-2 REGARDING THE FOURTH 10-YEAR INTERVAL OF THE INSERVICE TESTING PROGRAM (EPID L-2018-LLR-0384, EPID L-2018-LLR-0385, EPID L-2018-LLR-0386, AND EPID L-2018-LLR-0387) DATED NOVEMBER 5, 2020

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