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

June 25, 2020

Mr. Don Moul
Vice President, Nuclear Division
and Chief Nuclear Officer
Florida Power & Light Company
Mail Stop: NT3/JW
15430 Endeavor Drive
Jupiter, FL 33478

SUBJECT: ST. LUCIE PLANT, UNIT NO. 1 – SAFETY EVALUATION FOR RELIEF REQUEST FOR FIFTH TEN-YEAR INSERVICE INSPECTION INTERVAL – ALTERNATIVE RISK-INFORMED INSERVICE INSPECTION PROGRAM FOR CLASS 1 AND 2 PIPING WELDS (EPID L-2019-LLR-0044)

Dear Mr. Moul:

By letter dated May 8, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19129A115), Florida Power & Light Company (the licensee) requested relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI for the St. Lucie Nuclear Plant, Unit 1 (St. Lucie, Unit 1) Fifth Ten-Year Inservice Inspection (ISI) Interval. Specifically, the licensee proposed the application of a Risk-Informed Inservice Inspection Program (RI-ISI) as described in Electric Power Research Institute (EPRI) Topical Report (TR), EPRI TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure" (ADAMS Accession No. ML013470102). This was proposed as an alternative to the ASME Code, Section XI, Class 1 and 2 piping examination requirements for Categories B-F, B-J, C-F-1, and C-F-2 of Tables IWB-2500-1 and IWC-2500-1.

The U.S. Nuclear Regulatory Commission (NRC or Commission) staff reviewed the submittal and, as supported by the enclosed safety evaluation, finds that the proposed alternative provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1) and is in compliance with the ASME Code's requirements. Therefore, the NRC staff grants use of the alternative RI-ISI program at St. Lucie, Unit 1 for the fifth 10-year ISI interval, which commenced on February 11, 2018, and will end on February 10, 2028.

If you have any questions regarding this issue, please contact the project manager, Mr. Natreon Jordan, at (301) 415-7410 or by e-mail at Natreon.Jordan@nrc.gov.

Sincerely,

Kimberly J. Green

Digitally signed by Kimberly J. Green
Date: 2020.06.25 16:43:57 -04'00'

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-335

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 1 REGARDING RISK INFORMED INSERVICE INSPECTION PROGRAM FOR ASME CLASS 1 AND 2 PIPING WELDS

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT, UNIT NO. 1

DOCKET NO. 50-335

1.0 INTRODUCTION

By letter dated May 8, 2019, Florida Power and Light (the licensee) submitted Relief Request No. 1 (RR-1) for the use of an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components, ASME Code Class 1 and 2 piping examination requirements at St. Lucie Nuclear Plant, Unit No. 1 (St. Lucie, Unit 1).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested U.S. Nuclear Regulatory Commission (NRC or Commission) authorization to use an alternative Risk-Informed Inservice Inspection (RI-ISI) program for ASME Code, Class 1 and 2 piping welds. The licensee proposed the alternative on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), "Throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components (including supports) that are classified as ASME Code Class 1, 2, and 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of Editions and Addenda of the ASME Code that become effective subsequent to editions specified in paragraphs (g)(2) and (3) of 10 CFR 50.55a and that are incorporated by reference in paragraph (a)(1)(ii) of 10 CFR 50.55a, to the extent practical within the limitations of design, geometry, and materials of construction of the components."

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a, or portions thereof, may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. Section 50.55a(z)(1) of 10 CFR states that alternatives to the requirements of paragraphs (b) through (h) may be used when authorized by

the NRC if the licensee demonstrates that "the proposed alternative would provide an acceptable level of quality and safety."

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

3.0 TECHNICAL EVALUATION

3.1 Applicable ASME Code and Components Affected

The Code of record for St. Lucie, Unit 1 during the fifth 10-year ISI interval is the 2007 Edition through 2008 Addenda of the ASME Code, Section XI. The applicable ASME Code components affected are Class 1 and 2 piping welds. Specifically, ASME Code Class 1, examination Category B-F, Item Nos. B5.10, B5.20, and B5.40; ASME Code Class 1, examination Category B-J, Item Nos. B9.11, B9.21, B9.22, B9.31, B9.32, and B9.40; ASME Code Class 2, examination Category C-F-1, Item Nos. C5.11, C5.21, C5.30, and C5.41; and ASME Code Class 2, examination Category C-F-2, Item Nos. C5.51, C5.61, and C5.81. The licensee identified the systems and the number of subject ASME Code, Section XI Class 1 and Class 2 piping welds, and the number that would be selected for the current RI-ISI program in Table 5-1 of RR-1.

3.2 Applicable Code Requirements

The inspection requirements for ASME Code Class 1 piping welds are delineated in Table IWB-2500-1, examination Category B-F and B-J and require that Class 1 piping welds be subjected to volumetric or surface examination, or both, during successive 120-month (10-year) intervals. According to the requirements referenced in Table IWB-2500-1, 100 percent of all nozzle-to-pipe dissimilar metal welds in examination Category B-F and 25 percent of all piping welds with more than 1-inch nominal diameter in examination Category B-J shall be inspected during a 10-year ISI interval.

The inspection requirements for ASME Code Class 2 piping welds are delineated in Table IWC-2500-1, examination Category C-F-1 and C-F-2 and require that Class 2 piping welds be subjected to volumetric or surface examination, or both, during successive 120-month (10-year) intervals. According to these requirements, 7.5 percent of non-exempt piping welds for examination Categories C-F-1 and C-F-2 shall be inspected during a 10-year ISI interval.

3.3 Duration of Relief Request

The licensee submitted RR-1 for the fifth 10-year ISI interval, which commenced on February 11, 2018, and is scheduled to end on February 10, 2028. The licensee stated that it will implement the RI-ISI program before completion of the first period of the fifth 10-year ISI interval. The licensee further stated that 100 percent of the required RI-ISI inspections will be completed in the fifth ISI interval, as well as completing the period specific examination requirements for each of the three periods for the fifth 10-year ISI interval, per the requirements of ASME Section XI, paragraphs IWB-2411 and IWC-2411.

3.4 The Licensee's Proposed Alternative

The licensee's previous request to implement a RI-ISI program at St. Lucie, Unit 1 for the fourth 10-year ISI interval, was approved by NRC letter dated November 26, 2008 (ADAMS Accession No. ML082840494). The previous program had been developed in accordance with an NRC-approved methodology, as described in the Westinghouse Owners Group Technical Report WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk Informed Methods to Piping Inservice Inspection Topical Report" (ADAMS Accession No. ML012630349).

For the fifth 10-year ISI interval the licensee submitted RR-1 and requested NRC authorization to continue use of a RI-ISI program as an alternative to certain ISI requirements of ASME Code, Section XI. Specifically, the licensee's request is applicable to certain inspection requirements for ASME Code, Section XI Class 1 piping welds classified as examination Category B-F and B-J welds, and ASME Code, Section XI Class 2 piping welds classified as examination Category C-F-1 and C-F-2.

With the current submittal (i.e., RR-1) for the fifth 10-year ISI interval, the licensee requested to use a RI-ISI program for Class 1 and Class 2 piping welds. Additionally, the current requested program was developed using the methodology of another NRC-approved RI-ISI program, Electric Power Research Institute Topical Report (EPRI), "Revised Risk-Informed Inservice Inspection Procedure," Revision B-A (EPRI TR-112657) (ADAMS Accession No. ML013470102). A similar request was submitted for use at St. Lucie, Unit 2 for its fourth 10-year interval and was approved by NRC letter dated August 10, 2015 (ADAMS Accession No. ML15196A623).

3.5 Licensee's Basis for Use

The proposed RI-ISI program is based on an NRC-approved methodology delineated in EPRI TR-112657, Revision B-A, which provides procedures for the selection and categorization of inspection samples of piping welds based on their risk significance as part of a plant specific RI-ISI program. EPRI TR-112657, Revision B-A, is intended to be used as an alternate to the ISI requirements delineated by ASME Code, Section XI for Class 1 and Class 2 piping system welds. This is specifically the case for the non-destructive examination (NDE) requirements for these Class 1 and Class 2 piping system welds. The licensee stated that the proposed RI-ISI program was also developed in a manner consistent with ASME Code, Section XI, nonmandatory Appendix R, "Risk-Informed Inspection Requirements for Piping."

The licensee's proposed RI-ISI program will replace the NDE requirements of certain ASME Code Class 1 piping welds for examination Categories B-F and B-J and Class 2 piping welds for examination Categories C-F-1 and C-F-2. Other portions of the ASME Code, Section XI requirements and other required St. Lucie, Unit 1, Augmented Inspection programs will not be affected.

The licensee stated that its proposed RI-ISI provides an acceptable level of quality and safety.

3.6 NRC Staff Evaluation

3.6.1 Regulatory Guidance

The NRC staff reviewed and evaluated the licensee's proposed RI-ISI program, including those portions related to the applicable risk-informed methodology and processes, according to the guidelines for acceptance provided in the following guidance documents:

- Regulatory Guide (RG) 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (ADAMS Accession No. ML17317A256). RG 1.174 provides guidance on the use of probabilistic risk assessment (PRA) findings and risk insights in support of licensee requests for changes to a plant's current licensing basis. RG 1.174 also defines an acceptable approach to analyzing and evaluating proposed current licensing basis changes. The approach includes traditional engineering evaluations supported by insights derived from the use of PRA methods about the risk significance of the proposed changes. In implementing risk-informed decision making, the NRC expects current licensing basis changes to meet the acceptance guidelines and key principles of risk-informed regulation specified in RG 1.174.

- RG 1.178, Revision 1, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping" (ADAMS Accession No. ML032510128). RG 1.178 describes methods acceptable to the NRC for integrating insights from PRA techniques with traditional engineering analyses into ISI programs for piping. RG 1.178 describes a risk informed ISI program as one that incorporates risk insights that can focus inspections on more important locations while, at the same time, maintaining or improving public health and safety.

- RG 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (ADAMS Accession No. ML090410014). RG 1.200 describes one acceptable approach for determining whether the technical adequacy of the PRA, in total or the parts that are used to support an application, is consistent with accepted practices and sufficient to provide confidence in the results such that the PRA can be used in regulatory decision making.

- NUREG-0800, Chapter 3.9.8, "Standard Review Plan (SRP) for the Review of Risk-Informed In-service Inspection of Piping" (ADAMS Accession No. ML032510135). SRP Chapter 3.9.8 describes review procedures and acceptance guidelines for NRC staff reviews of proposed plant-specific, risk-informed changes to a licensee's ISI program for piping.

- EPRI TR-112657, Revision B-A, "Revised Risk-Informed In-service Inspection Evaluation Procedure." Licensees may implement the EPRI TR-112657, Revision B-A, methodology, by requesting relief to implement the RI-ISI as an alternative to the requirements of the ASME Code, Section XI for inservice inspection pursuant to 10 CFR 50.55a(z)(1) on the basis that the alternative provides an acceptable level of quality and safety.

- EPRI TR-1021467-A, "Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed In-Service Inspection Programs."

Licensees may implement the EPRI TR-112657, Revision B-A, methodology, as modified by the conditions and limitations and applicant/licensee action items, to provide reasonable assurance that the PRA has sufficient quality to support the development of an RI-ISI program (ADAMS Accession No. ML11262A206).

3.6.2 Licensee's Basis for Use

The licensee stated that its proposed RI-ISI program is based on the NRC-approved EPRI TR-112657, Revision B-A, methodology. The report provides technical guidance for selecting and categorizing piping components based on their risk significance as part of a plant-specific RI-ISI program, which will serve as an alternative to the ASME Code NDE requirements for ISI of Class 1 and Class 2 piping welds.

The licensee stated that its proposed RI-ISI program will replace the current requirements of Class 1 and 2 examination Categories B-F, B-J, C-F-1, and C-F-2 as specified in Table IWB--2500-1 and Table IWC-2500-1 of ASME Code, Section XI, 2007 Edition through the 2008 Addenda. Other non-related portions of the ASME Code, Section XI will be unaffected.

The licensee stated that its proposed RI-ISI program meets the intent and principles of RGs 1.174 and 1.178, the technical adequacy of the St. Lucie PRA with respect to this application to the RI-ISI program as endorsed by RG 1.200, and the principles of defense-in-depth philosophy.

In Section 2.2 of the request, the licensee discussed the various augmented inspection programs that address common piping considered to be within the scope (i.e., Class 1 and 2 piping) during the development of the RI-ISI program.

3.6.3 NRC Staff Evaluation

The NRC staff reviewed and evaluated the licensee's proposed RI-ISI program, including those portions related to the applicable risk-informed methodology and process, according to the guidelines for acceptance provided in RGs 1.174 and 1.178, SRP 3.9.8, and EPRI TR-112657, Revision B-A. During the evaluation, NRC staff focused on whether the proposed alternative provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(z)(1).

In support of this licensing action, the licensee applied the methodology of the NRC-approved EPRI TR-112657, Revision B-A, to develop the proposed St. Lucie, Unit 1 RI-ISI program. In addition, the licensee utilized the guidance in RGs 1.174, 1.178, and 1.200 to assess the nature and impact of the licensing basis change, which is supported with risk insights. The EPRI method provides technical guidance for selecting and categorizing the risk significance of piping components for the purpose of developing a plant-specific RI-ISI program. This can serve as an alternative to the ISI program that is required by the ASME Code. In accordance with the NRC safety evaluation of EPRI TR-112657, Revision B-A, it is acceptable to use this technical guidance provided it is supplemented by plant-specific information. The plant-specific information includes the scope of the proposed RI-ISI program, plant-specific engineering analysis, and the implementation and monitoring program.

Evaluation of the Scope of the Proposed Plant-Specific RI-ISI Program

The NRC staff verified that the scope of the licensee's proposed RI-ISI program is limited to Class 1 examination Category B-F nozzle-to-pipe dissimilar metal welds; Class 1 examination Category B-J similar and dissimilar metal piping welds; Class 2 examination Category C-F-1 piping welds; and Class 2 examination Category C-F-2 piping welds. The NRC staff also verified that the licensee followed the procedure and guidelines contained in the NRC-approved EPRI TR-112657, Revision B-A, to develop the proposed St. Lucie, Unit 1 RI-ISI program. As an example, the licensee used industry operating experience and plant-specific piping failure information to identify piping degradation mechanisms and failure modes at St. Lucie, Unit 1; performed consequence evaluations and pipe failure assessments to establish piping segment safety ranking; and determined inspection locations and risk significant welds. Therefore, the NRC staff determined that the scope of the proposed changes are acceptable since it is consistent with the guidance provided in RG 1.174. Furthermore, the NRC staff verified that the licensee implemented augmented inspection programs to address generic piping degradation problems, as required either by the NRC to preclude piping failure or by the industry's good practice guidelines. The augmented inspection programs will not be changed by the proposed RI-ISI program and will continue to be implemented as follows:

Augmented inspections for managing thermal stratification of pressurizer surge line:

St. Lucie, Unit 1 has an augmented inspection program as part of its Aging Management Program from license renewal. Consequently, all of the pressurizer surge line welds will be examined by volumetric examination during the fifth 10-year ISI interval. This program will not be changed by the application of the RI-ISI program. However, if the examination criteria for this augmented program also satisfies the RI-ISI program, then the licensee stated that it may take credit for it as part of the RI-ISI as well, provided the examination criteria for both programs are met.

Augmented inspection program for the primary water stress corrosion cracking (PWSCC) susceptible Alloy 600/82/182 dissimilar metal butt welds pursuant to 10 CFR 50.55a(g)(6)(ii)(F):

St. Lucie, Unit 1 has an augmented examination program in accordance with 10 CFR 50.55a(g)(6)(ii)(F) and subject to the criteria of ASME Code, Section XI, Code Case N-770-2 for Alloy 600/82/182 butt welds. Welds that are only subject to PWSCC will be selected to be examined according to Code Case N-770-2. The welds that are examined under this program are in accordance with 10 CFR 50.55a(g)(6)(ii)(F) and will not be considered during the RI-ISI element selection process. St. Lucie, Unit 1 has one Alloy 600/82/182 weld, which has another postulated degradation mechanism other than PWSCC. This weld is overlayed, therefore, the St. Lucie, Unit 1 Code Case N-770-2 program is not affected by the application of the RI-ISI program.

Augmented examination program in accordance with EPRI Materials Reliability Program (MRP): Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines (MRP-146):

St. Lucie, Unit 1 has an augmented examination program, in accordance with MRP-146, to manage thermal fatigue in normally non-isolable reactor coolant system branch lines. While the licensee’s proposed RI-ISI program considers this degradation mechanism, it does not include all the criteria of MRP-146. Therefore, the licensee’s augmented inspection program, in accordance with MRP-146, will not be affected by the implementation of the RI-ISI program.

Augmented inspection program for high energy main steam and feedwater piping welds in accordance with NUREG-0800, Standard Review Plan 6.6, Branch Technical Position MEB 3-1, and UFSAR Appendix 3J:

St. Lucie, Unit 1 has an augmented inspection program for the examination of piping welds for high energy main steam and main feedwater piping. This is due to high energy line break concerns. Because the proposed RI-ISI program does not address the examination of welds due to high energy line breaks, licensee's existing augmented program will not be affected.

Augmented examination program on feedwater piping as a result of the continuation of NRC Bulletin 79-13 and NRC Information Notice 93-20:

St. Lucie, Unit 1 performs ultrasonic examinations as a result of continued implementation of NRC Bulletin 79-13, and by additional information provided by Information Notice 93-20. Specifically, licensee performs enhanced ultrasonic examinations starting at the feedwater nozzle ramp and extending out to the elbow, to address thermal cracking at these locations as identified by NRC Bulletin 79-13 and Information Notice 93-20. The proposed RI-ISI program considers thermal fatigue as a degradation mechanism, but it does not include all of the criteria of the existing augmented examinations. Consequently, this augmented inspection program will not be affected.

Augmented examination program for piping in accordance with NRC Generic Letter 89-08 to examine for Flow Accelerated Corrosion (FAC):

St. Lucie, Unit 1 performs augmented examinations, in accordance with NRC Generic Letter 89-08, to address FAC for carbon steel piping systems. The licensee stated that examination of piping due to FAC is considered administratively for its proposed RI-ISI. However, the existing FAC program will be implemented and is not changed due to the proposed RI-ISI.

Evaluation of Plant-Specific Engineering Analysis

Consistent with the guidance in RG 1.174, an acceptable plant-specific engineering evaluation should include both traditional and probabilistic analyses; should be based on the as-built, as operated, and maintained plant; and should reflect the operating experience at the plant. The NRC staff verified that the licensee's plant-specific analysis included traditional engineering methods combined with insights from PRA. This is consistent with the guidance in RG 1.174 which requires an engineering evaluation of the proposed changes by using a traditional engineering analysis integrated with PRA. The outcome of the plant-specific engineering analysis aided the licensee in categorizing the risk significance of the piping segments at the plant, determination of the number of locations to be inspected, selection of the inspection locations, and determination of inspection methods.

The NRC staff found that the licensee's plant-specific engineering analysis included defining piping segments, determining failure potential of each segment, determining consequences of failure of piping segments, and risk characterization (as shown in Tables 3.1, 3.3, 3.4, 3.5, 3.6, 5-1 and 5-2). In defining piping segments, the licensee identified the segments as continuous lengths of pipe whose failure leads to the same consequence due to exposure to the same degradation mechanisms. Some lengths of pipe whose failure would lead to the same consequences are split into more segments when different regions are exposed to different degradation mechanisms. In determining piping failure potential and failure degradation

mechanism categories, the licensee utilized existing industrywide failure history, operating experience, and the actual service experience at St. Lucie, Unit 1. In evaluating consequence of piping segment failure, the licensee included direct and indirect effects of the pipe failure. In risk characterization, the licensee evaluated the potential of failure and failure consequence of each run of piping to determine its impact in terms of the probability of core damage and large early release. Risk groups are then defined as welds within a single system potentially susceptible to the same degradation mechanism and whose failure would result in the same consequence. The licensee ranked risk groups based upon their risk-significance as defined in EPRI TR-112657, Revision B-A. The licensee determined the number of weld inspections and the level of inspection from the safety significance. Based on its evaluation, the NRC staff determined that the process followed by the licensee to conduct plant-specific engineering analysis for the purpose of determining risk significant locations and locations where failure mechanisms are likely to be present is acceptable because the process is consistent with the procedure prescribed in EPRI TR-112657, Revision B-A, and the general guidance in RGs 1.174 and 1.178.

In evaluating the licensee's proposed alternative, the NRC staff assessed compliance of the proposed changes to the ISI program with the five key principles of the risk-informed regulation as discussed in RGs 1.174 and 1.178, SRP 3.9.8, and EPRI TR-112657, Revision B-A. An acceptable RI-ISI program meets these five key principles of risk-informed decision-making as follows:

Principle 1: The proposed licensing basis change meets the current regulations unless it is explicitly related to a requested exemption.

Principle 2: The proposed licensing basis change is consistent with the defense-in-depth philosophy.

Principle 3: The proposed licensing basis change maintains sufficient safety margins.

Principle 4: When proposed licensing basis changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission’s policy statement on safety goals for the operations of nuclear power plants.

Principle 5: The impact of the proposed licensing basis change should be monitored using performance measurement strategies.

3.6.3.1 - Principle 1 Evaluation

Principle 1 states that the proposed change must meet current regulations unless it is explicitly related to a requested exemption or rule change. The regulation in 10 CFR 50.55a(z)(1) states, in part, that the Director of the Office of Nuclear Reactor Regulation may authorize an alternative to the requirements of 10 CFR 50.55a(g). The licensee’s proposed RI-ISI program is an alternative to certain ISI requirements to the ASME Code, Section Xl and may be requested under 10 CFR 50.55a(z)(1). The NRC staff determined that the licensee met Principle 1 of RG 1.174 because the proposed RI-ISI program is an alternative to the ASME Code required ISI program, as may be requested and approved pursuant to 10 CFR 50.55a(z)(1). This affirms that an exemption request is not required because the licensee's proposed current licensing basis change of using an alternative RI-ISI program meets the current regulation.

3.6.3.2 - Principle 2 Evaluation

Principle 2 states that the proposed change must be consistent with the defense-in-depth philosophy. ISI is an integral part of defense-in-depth. As part of the RI-ISI process, the risk significance categorization and the specification of the subsequent number and location of elements to inspect will maintain the basic intent of ISI to identify and repair flaws before pipe integrity is challenged. Therefore, although a reduction in the number of welds inspected is anticipated, if a licensee implements a RI-ISI program as described in the EPRI TR-112657, Revision B-A, there will be reasonable assurance that the program will provide a substantive ongoing assessment of piping condition.

In accordance with RG 1.174, engineering analysis should evaluate whether the impact of the proposed RI-ISI program is consistent with the defense-in-depth philosophy. One aspect of the engineering evaluations is to show that the fundamental safety principles on which the plant design was based are not compromised by the proposed change. The EPRI approach to maintain defense-in-depth is to characterize the role a piping system plays in the defense-in-depth design principle and to review the potential changes in piping system performance that could be conceivably brought about.

The NRC staff confirmed that, as part of the RI-ISI process, the licensee performed a plant-specific engineering analysis according to the guidance in the NRC-approved EPRI TR-112657, Revision B-A. The licensee performed this by: assessing susceptibility of each piping segment to a particular degradation mechanism that may be a precursor to leak or rupture; assessing consequence of failure of the segment independent of failure potential; and determining the risk significant locations and the number of locations to inspect. The NRC staff notes that the basic intent of the ISI is maintained by the safety-significance categorization and the specification of the subsequent number and location of elements to inspect. This is used to ensure that defense-in-depth is maintained, as discussed in NRC-approved EPRI TR-112657, Revision B-A. Therefore, the NRC staff determined that the licensee met Principle 2 of RG 1.174, and the proposed change is consistent with a defense-in-depth philosophy.

3.6.3.3 - Principle 3 Evaluation

Principle 3 states that the proposed change shall maintain sufficient safety margins. No changes to the evaluation of design basis accidents in the final safety analysis report are being made by the RI-ISI process. Therefore, the NRC staff finds that the licensee met Principle 3 of RG 1.174 and the proposed changes are consistent with maintaining sufficient safety margin.

3.6.3.4 - Principle 4 Evaluation

Principle 4 states that when proposed licensing basis changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission's policy statement on safety goals for the operations of nuclear power plants. Redirecting inspections to more risk significant locations and adaption of inspection procedures to the most likely degradation mechanisms at the specified locations is expected to contribute to a reduction of risk. This reduction of risk will partially or fully offset any risk increase from discontinuing inspections at low risk significant locations. This determination requires an estimate of the change in risk due to the alternative method. The change in the risk estimate is dependent on the location of inspections in the proposed RI-ISI program compared to the location of inspections that would be performed using the requirements of the ASME Code, Section XI. In accordance with

10 CFR 50.55a, it is not necessary for the licensee to develop a new deterministic ASME Code program for each new 10-year ISI interval. Instead, it is acceptable to compare the new proposed RI-ISI program with the last deterministic ASME ISI program.

Risk Metrics

RG 1.178 provides that any risk increases that might result from a proposed RI-ISI program and their cumulative effects be small and not exceed NRC safety goals. Risk metric limits imposed by the EPRI TR-112657, Revision B-A, methodology ensure that the change in risk of implementing the RI-ISI program meets the requirements of RGs 1.174 and 1.178. The EPRI criterion requires that the cumulative change in core damage frequency (CDF) and large early release frequency (LERF) be less than 1E-07 and 1E-08 per year per system, respectively.

The EPRI TR-112657, Revision B-A, methodology discusses four screening evaluations in order of increasing resource requirements, as follows: qualitative, bounding without credit for any increase in probability of detection, bounding with credit for increase in probability of detection, and a Markov model-based calculation. Each licensee may select any of the screening evaluations. The screening evaluations investigate the change in risk due to the change in the number and location of ISI inspections. All four screening evaluations include the assumption that there is a negligible risk increase because of the discontinuation of inspections of piping segments in the low-risk categories.

The licensee presented the results of the analysis to estimate the net change in risk due to the positive and negative influence of adding and removing locations from the inspection program. The conditional core damage probability and conditional large early release probability used for high consequence category segments were based on the highest evaluated conditional core damage probability of 3.87E-02 and conditional large early release probability of 9.06E-04. For medium consequence category segments, bounding estimates of conditional core damage probability of 1E-04 and conditional large early release probability of 1E-05 per year were applied. Table 3.6 of the submittal presents a summary of the risk impact analysis results for the RI-ISI program in comparison to ISI program requirements from an ASME Code, Section XI Code Edition. The ISI requirements are identified on a per system basis within each applicable risk category. The change in CDF and LERF risk metrics is -3.48E-8 per year and -8.15E-10 per year respectively. This is without taking credit for enhanced inspection effectiveness due to an increased probability of detection from the application of the RI-ISI approach. When credit is taken for an increase in probability of detection, the CDF and LERF risk metrics are -1.49E-7 per year and -3.50E-9 per year, respectively. A negative number indicates a decrease in risk. These values are well below the "very small" change in CDF guideline of 1E-06/year and change in LERF of 1E-07/year specified in RG 1.174. These values also meet the acceptance guidelines in EPRI TR-112657, Revision B-A.

Technical Acceptability of PRA

The fourth key principle also requires demonstration of the technical adequacy of the PRA. As discussed in RGs 1.178 and 1.200, an acceptable change in risk evaluation (and risk-ranking evaluation used to identify the most risk significant locations) requires the use of a PRA of appropriate technical adequacy that models the as-built and as-operated plant. RG 1.200 endorses the American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA standard. The ASME/ANS PRA standard provides technical supporting requirements in terms of three Capability Categories. The intent of the delineation of the capability categories within the supporting requirements is generally that the degree of scope

and level of detail, the degree of plant specificity, and the degree of realism increase from capability Category I to capability Category III. In general, the staff anticipates that current good practice, i.e., capability Category II of the ASME/ANS PRA standard, is the level of detail that is adequate for the majority of applications.

The NRC-approved EPRI TR-112657, Revision B-A, provides guidance on the minimum acceptable quality requirement for a PRA used to support a RI-ISI program. In its letter, dated May 8, 2019, the licensee identified that the St. Lucie, Unit 1 PRA model received various peer-reviews for internal events, flooding, and external events. Through these peer reviews, the St. Lucie, Unit 1 PRA model of record fully meets all the requirements of Part 2 (internal events) and Part 3 (internal flood) of the ASME/ANS PRA Standard as endorsed by RG 1.200, Revision 2. St. Lucie, Unit 1 PRA Fire PRA is adequate to support this application, with the caveat that the PRA is a conservative representation of the fire risk from operation of St. Lucie, Unit 1. The licensee explains the Fire PRA model will be exercised to obtain quantitative fire risk insights, but refinements may need to be made on a case-by-case basis. All findings as level "A" or "B", or specified, from peer reviews or other technical reviews have been, or are currently being, addressed or closed with no impact to the RI-ISI program.

The licensee provided, in Appendix A, Attachment A, Facts and Observation results of NextEra peer review of the St. Lucie, Unit 1 PRA (internal events, internal flooding, and internal fire), along with their impact on RI-ISI application. The current open items do not significantly impact the RI-ISI application. As a result of the closure of Facts and Observations, all Supporting Requirements are now considered Met at capability Category II or higher requirements of the current ASME/ANS RA-Sa-2009 PRA standard. Supporting Requirements identify basic features of PRA analyses and describe an activity or process required to support each feature. Some Supporting Requirements describe a single variation of an activity or process that a PRA has included or not included (i.e., Met or Not-Met). Some Supporting Requirements provide three variations designated Categories I, II, and III, that differ in level of detail, degree of plant-specificity, or degree of realism. The methodology in EPRI TR-1021467-A states that not all Supporting Requirements are required to meet capability Category II to adequately support RI-ISI applications, and RG 1.200 considers it a good practice for all Supporting Requirements to meet capability Category II. Since the St. Lucie, Unit 1 PRA meets all Supporting Requirements at capability Category II and higher, the NRC staff finds that the licensee has assessed the technical adequacy of its PRA using the guidelines of RG 1.200, and the licensee's PRA is consistent with quality guidelines in EPRI TR-1021467-A.

The NRC staff finds that the impact on CDF and LERF due to the implementation of the RI-ISI program satisfies the acceptance guidelines specified in RG 1.174 and EPRI TR-112657, Revision B-A. The NRC staff also finds that the licensee has assessed the technical adequacy of its PRA using RG 1.200, and the PRA is consistent with the quality guidelines in EPRI TR-1021467-A. Therefore, the NRC staff finds that key Principle 4 is met.

3.6.3.5 - Principle 5 Evaluation

The fifth principle of risk-informed decision making requires that the impact of the proposed change be monitored by using performance measurement strategies. Implementation and performance monitoring strategies should be planned to ensure that the engineering evaluation conducted to examine the impact of the proposed changes continues to reflect the actual reliability and availability of systems that have been evaluated. When the examination of a weld under the proposed RI-ISI program is not practical, or is limited because of physical constraints

or radiation hazards, alternative inspection intervals, scope, and methods should be developed to ensure that piping degradation is detected, and structural integrity is maintained.

From review of the license amendment request, the NRC staff found that the licensee has considered the proposed St. Lucie, Unit 1 RI-ISI program as a living program. The licensee has stated that the program would require feedback of new relevant information to ensure the appropriate identification of high safety significant piping locations. As a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis. Significant changes may require updating the proposed RI-ISI program more frequently. Therefore, the NRC staff finds that the licensee demonstrated that its proposed RI-ISI program is a living RI-ISI program that will be periodically reviewed and updated. Thus, Principle 5 of RG 1.174 is met.

Based on the above, the NRC staff finds that the proposed RI-ISI program for the fifth 10-year ISI interval meets the five key principles of risk informed regulation, and therefore, provides an acceptable level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the licensee's proposed alternative provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC authorizes the use of the alternative RI-ISI program at St. Lucie, Unit 1 for the fifth 10-year ISI interval, which commenced on February 11, 2018, and will end on February 10, 2028.

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

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Date: June 25, 2020

SUBJECT: ST. LUCIE PLANT, UNIT NO. 1 – SAFETY EVALUATION FOR RELIEF REQUEST FOR FIFTH TEN-YEAR INSERVICE INSPECTION INTERVAL – ALTERNATIVE RISK-INFORMED INSERVICE INSPECTION PROGRAM FOR CLASS 1 AND 2 PIPING WELDS (EPID L-2019-LLR-0044) DATED JUNE 25, 2020

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