



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

December 19, 2017

Mr. Dean Curtland  
Next Era Energy  
Duane Arnold Energy Center  
3277 DAEC Road  
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER – RELIEF REQUEST NO. RR-02  
PROPOSED ALTERNATIVE TO ASME CODE EXAMINATION  
REQUIREMENTS FOR BURIED PIPING RELATED TO FIFTH INSERVICE  
INSPECTION INTERVAL PROGRAM PLAN (CAC NO. MF9372;  
EPID L-2017-LLR-0109)

Dear Mr. Curtland:

By letter dated March 7, 2017, as supplemented by letter dated May 8, 2017, NextEra Energy Duane Arnold, LLC (NextEra or the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). This correspondence addresses NextEra relief request RR-02, regarding system leakage tests for certain buried piping at Duane Arnold Energy Center (DAEC). The other relief requests, RR-01, RR-03, and RR-04 will be addressed by separate correspondence.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that it would provide an acceptable level of quality and safety.

As discussed in the attached enclosure, the U.S. Nuclear Regulatory Commission (NRC) staff determined that the licensee has demonstrated that the proposed alternative provides reasonable assurance of structural integrity of the subject components, and 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, NRC staff authorizes the use of the proposed alternative for the fifth 10-Year inservice inspection interval at DAEC.

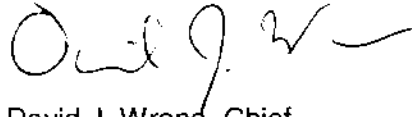
All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

D. Curtland

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If you have any questions, please contact the Project Manager, Mahesh Chawla at 301-415-8371 or via e-mail at [Mahesh.chawla@nrc.gov](mailto:Mahesh.chawla@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "D. J. Wrona", with a long horizontal flourish extending to the right.

David J. Wrona, Chief  
Plant Licensing Branch III  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:  
Safety Evaluation

cc: ListServ



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE RELIEF REQUEST RR-02

REGARDING THE PROPOSED ALTERNATIVE TO

ASME CODE EXAMINATION REQUIREMENTS FOR BURIED PIPING

NEXTERA ENERGY DUANE ARNOLD, LLC.

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated March 7, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17069A172), as supplemented by letter dated May 8, 2017 (ADAMS Accession No. ML17129A153), NextEra Energy Duane Arnold, LLC (NextEra or the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). This safety evaluation addresses licensee's relief request RR-02 regarding system leakage tests for certain buried piping at Duane Arnold Energy Center (DAEC).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that it would provide an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4)(ii), "Inservice inspection [ISI] standards requirement for operating plants," ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provision and preservice examination requirements, set forth in ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. Inservice examination of components and system pressure tests, conducted during 10-year intervals subsequent to the first interval, are required to comply with the latest edition and addenda of the ASME Code referenced by 10 CFR 50.55a(a), 12 months prior to the start of the interval.

The regulations in 10 CFR 50.55a(z) state that alternatives to the ASME Code requirements of paragraph (g) of 10 CFR 50.55a may be authorized by the U.S. Nuclear Regulatory Commission (NRC) if the licensee demonstrates that: (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensative increase in the 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 the use of an alternative and the NRC to authorize the alternative proposed by the licensee.

### 3.0 TECHNICAL EVALUATION

#### 3.1 The Licensee's Relief Request (or Alternative)

##### 3.1.1 Component Identification

ASME Code Class 3, Examination Category D-B, Item No. D2.10 piping in three piping systems:

- Greater than 1,500 feet of 24-inch diameter carbon steel river water supply system piping that runs from the river intake structure to the pump house.
- Greater than 500 feet of 16-inch diameter carbon steel residual heat removal service water (RHRSW) system piping that runs from the pump house to the turbine building.
- Greater than 500 feet of 8-inch and 6-inch diameter carbon steel emergency service water (ESW) system piping that runs from the pump house to the turbine building.

##### 3.1.2 Code Requirements for Which Relief is Requested

The 2007 Edition with 2008 Addenda of ASME Code, Section XI, Table IWD-2500-1, Examination Category D-B, Item No. D2.10 requires a system leakage test and a VT-2 visual examinations in accordance with the general requirements of Article IWA-5000. For buried components where a VT-2 visual examination cannot be performed, IWA-5244(b)(1) requires that:

The system pressure test for buried components that are isolable by means of valves shall consist of a test that determines the rate of pressure loss. Alternatively, the test may determine the change in flow between the ends of the buried components. The acceptable rate of pressure loss or flow shall be established by the Owner.

##### 3.1.3 Licensee's Proposed Alternative

NextEra proposes to use the requirements of IWA-5244(b)(2), which states that:

The system pressure test for nonisolable buried components shall consist of a test to confirm that flow during operation is not impaired.

##### *River Water Supply System and RHRSW System*

The unimpaired flow in the river water supply and the RHRSW systems will be verified during quarterly pump testing.

##### *ESW System*

The unimpaired flow in the ESW system will be verified during combination of quarterly pump

testing and by confirming that adequate flow is supplied to the cooling loads as provided by the installed instrumentation. In addition visual examination will be performed on the ground surface areas above the buried ESW piping during each refueling cycle.

#### 3.1.4 Licensee's Duration of Relief Request

The proposed alternative will be used for the fifth ISI interval for DAEC that began on November 1, 2016, and is scheduled to end on October 31, 2026.

#### 3.1.5 Licensee's Basis for Relief

NextEra stated that for the respective systems addressed by this relief request, the piping designs have isolation valves, but they are not capable of supporting a pressure loss test of the type described in IWA-5244(b)(1), given the volume of the piping and the capacity of the test pumps. The valves were only intended to provide isolation for maintenance activities with static system pressure. Furthermore, the licensee stated that the respective systems do not have the necessary instrumentation to determine the flow difference between the ends of the piping, which is given as the alternative to the pressure loss test in IWA-5244(b)(1). NextEra also stated that the systems have single flow elements per train, with those of the river water supply and ESW systems being located in the pump house, and that of the RHRSW system being located in the reactor building before the RHR system heat exchanger. The ESW system has additional flow instrumentation on some downstream components but not for every branch on a train.

Instead of performing a system pressure test in accordance with the requirements specified in IWA-5244(b)(1), NextEra proposes to use the provisions of IWA-5244(b)(2) which states that the system pressure test for nonisolable buried components shall consist of a test to confirm that flow during operation is not impaired. NextEra stated that the proposed alternative provides an acceptable level of quality and safety, thereby, satisfying the requirements of 10 CFR 50.55a(z)(1).

The licensee stated that the integrity of the buried piping for the river water supply and RHRSW systems will be verified during quarterly pump testing in accordance with the American Society of Mechanical Engineers Code for Operations and Maintenance of Nuclear Power Plants (ASME OM Code), 2004 Edition through 2006 Addenda, and documented in the test record. NextEra stated that significant through-wall leakage from the buried pipes would be indicated by the measurement of diminished pump head during the testing. Should the pump test results fail to meet the acceptance criteria of the ASME OM Code, additional testing and evaluations will be performed to determine the cause of the condition.

For the ESW system, the licensee stated that the integrity of the buried piping will be verified during the combination of the quarterly pump testing and by measuring the flow to instrumented cooling loads fed by the system. Pump testing will be performed in accordance with the ASME OM Code, and the instrumented cooling loads represent a large fraction of the total critical load flow required to be supplied by ESW. The licensee further stated that, significant through-wall leakage from the buried pipes would be detected by the measurement of diminished flow downstream of the instrumented loads during the testing. In addition, the licensee proposes to perform visual examination of the ground surface area immediately above each buried section of ESW during each refueling cycle. The visual examinations will be performed only after the subject piping has been in operation at nominal operating conditions for a minimum of 24 hours.

### 3.2 NRC Staff Evaluation

The relevant Code of Record for DAEC is the ASME Code, Section XI, 2007 Edition with 2008 Addenda. ASME Section IWA-5244(a) requires a VT-2 visual examination for evidence of leakage in buried components surrounded by an annulus. NRC staff notes that there is no annulus nor access to the buried sections of piping for the river water supply, RHRSW, and ESW systems without excavation. Therefore, the visual examination cannot be performed without excavation.

In the event that the visual examination cannot be performed, IWA-5244(b)(1) permits the licensee to satisfy the inspection requirements for isolable systems by determining the rate of pressure loss or by measuring the change in flow between the ends of the piping systems. NRC staff notes that the river water supply, RHRSW, and ESW systems are isolable by valves which, by this criterion, would require the licensee to meet the requirements of IWA-5244(b)(1). The respective systems, however, are not designed in a manner to allow for a pressure loss test or to measure the change in flow rate. Although the systems are isolable by valves, the valves are only intended to provide isolation for maintenance at static system pressure. Further, the systems do not have adequate installed instrumentation to measure flow changes at the ends of the buried pipes. Therefore, the testing required in IWA-5244(b)(1) cannot be performed.

For nonisolable buried systems, IWA-5244(b)(2) permits the licensee to conduct a test to confirm that flow during operation is not impaired. NextEra requests authorization to use the provisions specified for nonisolable systems in IWA-5244(b)(2) for the nominally isolable river water supply, RHRSW, and ESW systems, asserting that the proposed alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

NRC staff has reviewed the licensee's analysis to demonstrate that unimpaired flow in the river water supply and RHRSW systems buried piping can be qualitatively assessed during quarterly inservice pump testing and has found it to be acceptable. During the inservice pump testing, flow instruments downstream from the pump discharge can establish a reference flowrate that corresponds to a target pump head. Indication of head loss during the test could indicate either degradation of the pump performance or through-wall leakage of the buried piping. Significant through-wall leakage could be distinguished from degraded pump performance because, in the former case, the total flow rate would increase even though the downstream indicated flow rate is set at the reference value. Should the pump test fail to meet the acceptance criteria of the ASME OM Code, the licensee will perform additional tests and evaluations to determine the cause of the condition. It should be noted that this testing method may not detect small leaks in the piping if the pump still meets the acceptance criteria of the ASME OM Code. Such small leaks, however, may also be left undetected by the pressure loss test or the tests to measure the change in flow rate specified in IWA-5244(b)(1), which nevertheless satisfy NRC requirements. Therefore, NRC staff finds that the licensee's proposal to demonstrate unimpaired flow in the river water supply and RHRSW systems will provide an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1), as significant leaks will be detected prior to the loss of structural integrity.

NRC staff has also reviewed, and found acceptable, licensee's analysis to demonstrate that unimpaired flow in the ESW system buried piping can be qualitatively assessed during quarterly inservice pump testing and by verifying that adequate flow is supplied to cooling loads. During the inservice testing, the ESW pump is set at a fixed reference value. Downstream systems which account for approximately 90 percent of the ESW critical load flow have installed flow instrumentation, including the emergency diesel generator coolers, control building chillers, and

the RHR and core spray room chillers. Piping structural integrity would be demonstrated by measurement and trending of the flow rate in the downstream instrumented systems which, in the case of significant through-wall leakage would show diminished flow compared to the upstream reference value. It is also noted that at every refueling cycle, the licensee will perform a visual examination of the ground surface above buried sections of the ESW piping after the system has been at operating pressure for a minimum of 24 hours prior to the examination. Therefore, NRC staff finds that the licensee's proposal to demonstrate unimpaired flow in the ESW system will provide an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1), as significant leaks will be detected prior to the loss of structural integrity of the buried piping.

#### 4.0 CONCLUSION

As set forth above, the NRC staff determines that the licensee has demonstrated the proposed alternative provides reasonable assurance of structural integrity of the subject components, and would provide an acceptable level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, NRC staff authorizes the use of the proposed alternative for the fifth 10-year ISI interval at DAEC. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: Greg Oberson  
Roger Kalikian

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