



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

July 6, 2010

Mr. Christopher R. Costanzo  
Vice President  
Duane Arnold Energy Center  
3277 DAEC Road  
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER – SAFETY EVALUATION FOR REQUEST FOR RELIEF FROM CERTAIN REQUIREMENTS OF THE ASME CODE TO ALLOW PERFORMANCE OF LIMITED EXAMINATIONS OF SELECTED WELDS (TAC NO. ME1821)

Dear Mr. Costanzo:

In a letter to the Nuclear Regulatory Commission (NRC) dated July 30, 2009 as supplemented by a letters dated February 25, 2010 and June 15, 2010, NextEra Duane Arnold, LLC (NextEra Energy, the licensee) requested relief from certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) requirements at Duane Arnold Energy Center (DAEC). As an alternative to the ASME Code, Section XI requirements, NextEra Energy requested relief from Subarticle IWB-2500 to allow performance of limited examinations of selected welds. This relief is requested for the fourth 10-year interval of the Inservice Inspection (ISI) Program for the DAEC, which ends on February 21, 2014.

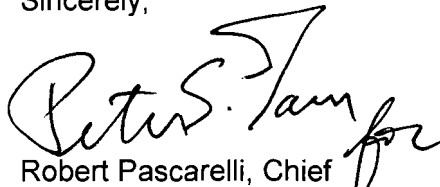
Based on the information provided in the relief request and the responses to the NRC staff's requests for additional information, the NRC staff concludes that compliance with the Code requirement would result in hardship without a compensating increase in the level of quality and safety, and the licensee's proposed alternative provides reasonable assurance of structural integrity. Therefore, the requested relief is authorized in accordance with Title 10 of the *Code of Federal Regulations* 50.55a(g)(6)(i), for the fourth 10-year interval of the ISI Program at DAEC.

C. Costanzo

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If you have any questions regarding this matter, please contact Karl Feintuch at (301) 415-3079.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert Pascarelli". The signature is written in a cursive style with a large, stylized initial "R".

Robert Pascarelli, Chief  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:  
Safety Evaluation

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
ON THE RELIEF FROM IWB-2500 FOR 1<sup>ST</sup> PERIOD OF FOURTH 10-YEAR INTERVAL OF  
INSERVICE INSPECTION PROGRAM FOR VARIOUS WELDS

NEXTERA ENERGY DUANE ARNOLD, LLC

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

TAC NO. ME1821

1.0 INTRODUCTION

The Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the information provided by NextEra Energy Duane Arnold, LLC (the licensee) in its letter, NG-09-0539, dated July 30, 2009<sup>1</sup>, which requested relief from IWB-2500 to allow performance of limited examinations of various welds for the Duane Arnold Energy Center (DAEC). In response to NRC requests for additional information (RAI), the licensee submitted further information in a letter, NG-10-0094, dated February 25, 2010 and a second letter, NG-10-0328, dated June 15, 2010<sup>2</sup>. The relief request was made pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii) for the 1<sup>st</sup> period of the fourth 10-year inservice inspection (ISI) interval.

2.0 REGULATORY REQUIREMENTS

The construction permit for the DAEC reactor pressure vessel (RPV) was issued in June of 1970, and the operating license was issued in 1974. The ISI of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (the Code), and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i).

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the

<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML092230346,

<sup>2</sup> ADAMS ML100680431 and ML101660124.

preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, which was incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for the DAEC fourth 10-year interval ISI program, which started on November 1, 2006, was the 2001 Edition of Section XI of the ASME Boiler and Pressure Vessel Code, with 2003 addenda.

### 3.0 TECHNICAL EVALUATION

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

#### 3.1 Item B1.40, Request for Relief, Examination Category B-A, Reactor Vessel Head-to-Flange Weld – HCC-C001

ASME Code, Section XI, Examination Category B-A, Item B1.40 requires 100 percent volumetric examination, as defined by Figure IWB-2500-5, as applicable, of the head-to-flange weld on the RPV with the required examination volume defined in the figure. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG 1.147), states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code required 100 percent volumetric examination for the Category B-A, Item B1.40 RPV head-to-flange weld.

The licensee's basis for the relief request was that parameters for accessibility were not requirements at the time when DAEC was designed and built. The licensee has performed the required volumetric inspection on the RPV head-to-flange weld, but the examination was limited (about 76 percent) due to the weld configuration. The use of this specific nondestructive evaluation (NDE) procedure was an alternative to the ASME Code-required examination that the NRC authorized for the remainder of the fourth ISI interval at DAEC.<sup>3</sup> The approved alternative inspection is done from the head surface of the weld and any other access is impractical.

DAEC performed examinations qualified under ASME Code, Section XI Appendix VIII that achieved the maximum practical amount of coverage obtainable within the limitations imposed

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<sup>3</sup> NDE-R008, ADAMS ML070090357.

by the design of the components; the “essentially” 100 percent coverage is impractical. The licensee concludes that they have met the ASME Code requirements to the extent practical.

The NRC staff has considered this request for relief in light of the limitations found in older plants. Complete examination of the RPV head-to-flange weld is restricted by the geometric configuration. Imposing this requirement would place a significant burden on the licensee, therefore, the ASME Code-required 100 percent volumetric examinations are impractical. A similar request from Hope Creek Generating Station has been approved by the NRC<sup>4</sup>.

As discussed above, it is impractical to meet the ASME Code-required examination coverage for the subject weld. However, based on the fact that no indications were found over the inspection coverage obtained, and the fact that the VT-2 examination that is performed on the system during system pressure tests each outage did not find any sign of leakage, the NRC staff concludes that if significant service-induced degradation had occurred, there is reasonable assurance that evidence of it would have been detected by the examination that was performed. As such, the NRC staff further concludes that there is reasonable assurance of structural integrity of the subject welds based on the examinations that have been performed.

### 3.2 Request for Relief, Examination of Reactor Water Cleanup Piping Weld (CUA-J024)

Relief Request NDE-R005<sup>5</sup> allows the use of Risk Informed ISI (RI-ISI) program<sup>6</sup> for Class 1 and 2 welds at DAEC. The RI-ISI program tries to select RI-ISI locations for examination such that a minimum of >90 percent coverage (i.e., Code Case N-460 criteria) is attainable. This weld is described as a RI-ISI Category 4, welds having a high consequence of failure, but no known degradation mechanism. The RI-ISI program requires 10 percent of the medium risk (RI-ISI Categories 4 and 5) segments to be inspected each 10-year interval.

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the RI-ISI required 100 percent volumetric examination of the RI-ISI Category 4, CUA-J024 (Reactor Water Cleanup System Piping) weld.

The licensee’s basis for the relief request was that this weld is located between a containment penetration and a motor-operated valve where only the penetration side can be scanned by the ultrasonic NDE equipment due to the configuration of the valve. Weld CUA-J024 is the only RI-ISI Category 4 weld in the Reactor Water Cleanup System. The licensee has performed the required volumetric inspection on the CUA-J024 weld, but the examination was limited (50 percent) due to the weld configuration, as described above and shown in the June 16, 2010, RAI. The forged penetration side of the weld has been solution heat treated while the valve body is a austenitic stainless steel casting, grade CF8M. Per the NRC’s stated position<sup>7</sup>, solution heat treated forgings are considered to have acceptable resistance to intergranular stress corrosion cracking (IGSCC) while welds joining CF8M castings to piping have been “relatively free of IGSCC”. Therefore, the licensee considers this weld resistant to IGSCC and can be placed in Category 4 of the RI-ISI Program.

<sup>4</sup> HC-12-RR-A25, ADAMS ML093020466.

<sup>5</sup> NRC SE for NDE-R005, ADAMS ML070090357.

<sup>6</sup> NG-02-0259 ADAMS ML020990346.

<sup>7</sup> NRC GL 88-01.

The licensee proposed no alternative examination. The licensee considers this weld resistant to IGSCC and the volumetric coverage (50 percent) obtained as acceptable for inspection of the Category 4 weld.

It is the NRC staff's evaluation that the 50 percent coverage obtained in the examination of the CUA-J024 weld does not meet the stated goal for inspection coverage in the RI-ISI program. However, for CUA-J024, there are no other RI-ISI Category 4 welds in the Reactor Water Cleanup System and, therefore, no other weld could be inspected where a higher inspection coverage could be obtained. The NRC staff considers that the subject examination is effectively 50 percent of the total weld length for the RI-ISI Category 4 welds in the Reactor Water Cleanup System. In addition, the NRC staff notes the following facts:

1. no degradation was observed on the penetration side of the weld,
2. CF8M castings are generally resistant to IGSCC,
3. the subject examination is effectively 50 percent of the total RI-ISI Category 4 weld length in the Reactor Water Cleanup System,
4. the lack of a known degradation mechanism, and
5. VT-2 examination on the system during system pressure tests each outage did not find any sign of leakage.

Given these facts related to the inspection, the NRC staff considers the 50 percent coverage on the inspection of the CUA-J024 weld acceptable and no additional inspections are necessary.

For the reasons stated above, in accordance with 10 CFR 50.55a(g)(6)(i), the subject request for relief for the CUA-J024 weld is granted for the 1<sup>st</sup> period of the fourth ISI interval at DAEC. The NRC staff has determined that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) for the request for relief is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the authorized nuclear inservice inspector.

### 3.3 Request for Relief, Examination of Recirculation System Class 1 Weld (RMA-J004)

Relief request NDE-R005<sup>8</sup> allows the use of RI-ISI program<sup>9</sup> for Class 1 and 2 welds at DAEC. The RI-ISI program tries to select RI-ISI locations for examination such that a minimum of >90 percent coverage (i.e., Code Case N-460 criteria) is attainable. This weld is described as a RI-ISI Category 2, welds having a high consequence of failure with thermal transients as a possible degradation mechanism. The RI-ISI program requires 25 percent of the high risk (RI-ISI Categories 1, 2, and 3) segments to be inspected each 10-year interval.

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the RI-ISI required 100 percent volumetric examination of the RI-ISI Category 2, RMA-J004 weld.

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<sup>8</sup> NRC SE for NDE-R005, ADAMS ML070090357

<sup>9</sup> NG-02-0259 ADAMS ML020990346.

The RMA-J004 weld connects manifold "A" to the riser line "G" in the Recirculation System. The licensee's basis for the relief request was that the manifold side of each weld cannot be volumetrically inspected due to the geometry of the manifold.

There are seven other equivalent welds in the system (four risers coming off two different manifolds, a total of eight welds). All eight manifold-to-riser welds were solution annealed prior to being placed into service. The licensee proposes to perform another 50 percent coverage inspection of an equivalent manifold-to riser weld, but from manifold "B" rather than "A".

The subject examination of RMA-J004 weld is one of 18 inspections that DAEC is performing as part of the RI-ISI program on high RI-ISI Category segments in the recirculation system for the fourth interval. It is the NRC staff's evaluation that the 50 percent coverage obtained in this one examination does not meet the stated goal for inspection coverage of the RI-ISI program. However, for RMA-J004, there are 7 other identical RI-ISI Category 2 welds in the Recirculation System, 3 more on manifold "A" and 4 more on manifold "B". The proposed additional inspection of a second manifold-to-riser weld (two inspections with 50 percent coverage on each) would provide the equivalent of 100 percent coverage. The NRC staff notes the following facts:

1. no degradation was observed on the riser side of the weld during the inspection,
2. the welds were all solution annealed before plant startup and considered resistant to IGSCC, and
3. the VT-2 examination that is performed on the system during system pressure tests each outage did not find any sign of leakage.

Given these factors, the NRC staff considers the proposed alternative acceptable.

For the reasons stated above, in accordance with 10 CFR 50.55a(g)(6)(i), the subject request for relief for the RMA-J004 weld is granted for the 1<sup>st</sup> period of the fourth ISI interval at DAEC. The NRC staff has determined that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) for the request for relief is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the authorized nuclear inservice inspector.

#### 4.0 NRC STAFF CONCLUSIONS

NRC staff has reviewed the licensee's submittal and concludes that ASME Code examination requirements for examination coverage are impractical for the subject components listed in the licensee's request for relief. It is further concluded that, if significant service-induced degradation had occurred, there is reasonable assurance that evidence of degradation would have been detected by the examinations performed by the licensee, given the limited coverage obtained on the Category B-A, Item B1.40 head-to-flange weld and the Category R-A, RI-ISI Category 4, Reactor Water Cleanup System weld (CUA-J024). The licensee's proposed additional inspection for the Recirculation System, Category R-A, Item R1.16 weld (RMA-J004) provides reasonable assurance that degradation would be detected. Plus the uninspected

regions of the Category R-A, RI-ISI Category 2 welds are generally resistant to IGSCC. For these reasons, in accordance with 10 CFR 50.55a(g)(6)(i), the subject request for relief is granted for the 1<sup>st</sup> period of the fourth inservice inspection interval at DAEC.

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

Principal Contributor: Patrick Purtscher

Date: July 6, 2010



C. Costanzo

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If you have any questions regarding this matter, please contact Karl Feintuch at (301) 415-3079.

Sincerely,

***/RA/ Peter Tam for***

Robert Pascarelli, Chief  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:  
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