NEXTera ENERGY
DUANE ARNOLD

September 21, 2016

NG-16-0180
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Duane Arnold Energy Center
Docket No. 50-331
Renewed Op. License No. DPR-49

Response to Request for Additional Information, License Amendment Request (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements – MF7486

References: 1) License Amendment Request (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements, NG-16-0052, dated March 15, 2016 (ML16077A234)
2) Electronic Communication, Request for Additional Information – Duane Arnold Energy Center (DAEC) – LAR (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements – MF7486, dated August 12, 2016

In the Reference 1 letter, NextEra Energy Duane Arnold, LLC (hereafter NextEra Energy Duane Arnold) submitted a License Amendment Request for the Duane Arnold Energy Center (DAEC) pursuant to 10 CFR 50.90. The NRC Staff requested, via Reference 2, additional information regarding that application. The Enclosure to this letter contains the requested information.

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This additional information does not impact the 10 CFR 50.92 evaluation of "No Significant Hazards Consideration" previously provided in the referenced application.

This letter does not contain any new or revised commitments.

If you have any questions or require additional information, please contact J. Michael Davis at 319-851-7032.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on September 21, 2016

T. A. Vehec
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure

cc: NRC Regional Administrator
NRC Resident Inspector
NRC Project Manager
A. Leek (State of Iowa)

Enclosure to NG-16-0180

Response to Request for Additional Information, License Amendment Request (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements

6 pages follow

## 1.0 INTRODUCTION

In Reference 1, NextEra Energy Duane Arnold, LLC (hereafter NextEra Energy Duane Arnold) submitted a License Amendment Request for the Duane Arnold Energy Center (DAEC) pursuant to 10 CFR 50.90. The NRC Staff requested, via Reference 2, additional information regarding that application. The requested information is given below.

## 2.0 RESPONSES TO NRC RAI

**Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB) Request for Additional Information (RAI)-1:**

In the license amendment request (LAR) dated March 15, 2016, the licensee states that "Additional information on the DAEC [Duane Arnold Energy Center] Boral Surveillance Program can be found in Reference 5." Reference 5 from the LAR, dated October 23, 2009 (ADAMS Accession No. ML093000504) contains RAI responses to RAIs asked during the license renewal (LR) process for DAEC. Since these RAI responses are several years old and some are obsolete (e.g., the RAI responses state that the Programmed and Remote Systems Corporation (PaR) racks will not be monitored for Boral degradation), the NRC staff requests confirmation that certain aspects of the Boral Surveillance Program described in the license renewal process are still applicable. The staff requests confirmation that the following parts of the Boral Surveillance Program still apply:

a. In the reference listed above, it is stated that the acceptance criteria for the DAEC Boral Surveillance Program are "A decrease of no more than 5% in Boron-10 content, as determined by neutron attenuation," and "An increase in thickness at any point should not exceed 10% of the initial thickness at that point." These acceptance criteria may help detect if a Boral panel has experienced a significant decrease in $_{10}B$ AD while still meeting the minimum $_{10}B$ AD acceptance criterion. Confirm that the acceptance criteria in the reference listed above still apply for the Holtec and PaR SFP racks in addition to the acceptance criteria listed in Technical Specification 5.5.15.

RESPONSE:

The statement in the LAR pointing to the aforementioned reference was meant to supplement the information on the Boral surveillance program being provided in the LAR related to the Holtec racks, as the information in the reference continues to apply to those racks. Since transmittal of the reference, a program was implemented featuring in-situ neutron attenuation testing for the PaR racks.

The quotes taken from the aforementioned reference specifically referred to the acceptance criteria for the Boral coupons of the Holtec racks at DAEC. The two

criteria, "A decrease of no more than 5% in Boron-10 content, as determined by neutron attenuation," and "An increase in thickness at any point should not exceed 10% of the initial thickness at that point," remain applicable when evaluating Boral coupons of the Holtec racks, as documented in the DAEC Boral Surveillance Program. These criteria never applied to the PaR racks, as there are no coupons available for evaluation of the PaR racks.

The PaR racks instead rely on in-situ neutron attenuation testing for monitoring. The DAEC Boral Surveillance Program notes the acceptance criteria for the PaR racks as "in-situ neutron attenuation testing will confirm that the Boral neutron absorber panels continue to meet the assumptions of the fuel pool criticality analysis."

Acceptance criteria listed in Technical Specification 5.5.15 is confirmed to apply for the Holtec and PaR SFP racks.

b. The reference cited above stated that the coupon tree is located in a spent fuel cell that is surrounded by recently discharged fuel bundles. Confirm the coupon tree is still in the same location.

RESPONSE:

The coupon tree has been confirmed to be in the same location that it was when the aforementioned reference was written (October 2009).

c. The reference listed above stated that thickness measurements are used to determine if the panels are bulging or swelling, and that visual examination, length and width measurements, and weight and specific gravity determinations are also conducted. In addition to the neutron attenuation testing as described in the LAR, confirm that these measurements and examinations are still being conducted as part of the Boral surveillance program.

RESPONSE:

It is confirmed that the measurements and examinations listed in the cited reference are still being conducted on the Boral coupons. The DAEC Boral Surveillance Program includes the requirement to perform those measurements and examinations, when evaluating Boral coupons, to ascertain the condition of the panels. Additionally, the latest Boral coupon examination report from 2011 was reviewed and each of those measurements and examinations were performed.

d. The reference also stated that coupon testing for the Holtec SFP racks can be used as an indicator for the condition of Boral in the PaR SFP racks. Confirm that neutron attenuation testing will be used to determine the condition of the Boral in the PaR SFP racks.

RESPONSE:

The PaR racks will continue to rely on in-situ neutron attenuation testing for monitoring. This requirement is noted in the DAEC Boral Surveillance Program, and is included in the proposed Technical Specification 5.5.15.

e. Provide a summary of changes that have been made to the Boral Surveillance Program that was in place when the DAEC LR was submitted in comparison to the program that will be in place under this LAR.

RESPONSE:

The Boral Surveillance Program that was in place when the DAEC License Renewal was submitted only addressed the Boral coupons in the Holtec racks. All that information still remains in the current program, with minimal, editorial changes since then.

The only significant change was the expansion of the program to include neutron attenuation in-situ testing for the PaR racks. New sections were added to specifically provide background information, procedure and acceptance criteria for the PaR racks program. Information included in the current version of the Boral Surveillance Program regarding the neutron attenuation in-situ testing for the PaR racks was provided in the LAR (Reference 1), Enclosure 1.

**ESGB RAI-2:**

On November 11, 2013, the licensee submitted a Licensee Event Report (LER) as a result of BADGER testing that revealed 11 Boral panels had a measured average $_{10}$B AD below the minimum value specified in the analysis of record. The LER stated that "A Root Cause Evaluation determined the root cause to be insufficient margin to allow for the uncertainty added by BADGER testing."

The proposed DAEC SFP criticality analysis submitted with the March 15, 2016, LAR states that the $_{10}$B AD for Boral is assumed to be 0.0162 grams $_{10}$B/cm$^2$ with an uncertainty of 0.0012 grams $_{10}$B/cm$^2$. The uncertainty added by BADGER testing as stated in this LAR would not account for the entire margin by which the 2013 BADGER test results fell below the minimum required $_{10}$B AD. In order to establish that the measured reduction in $_{10}$B AD (as reported in the 2013 LER) is not the result of Boral degradation, provide the following information:

a. Provide the basis for the conclusion that the BADGER tests results that fell below the minimum $_{10}$B AD are solely due to uncertainties, given that the uncertainty identified in the LAR (0.0012 grams $_{10}$B/cm$^2$) is less than the difference (0.0027 grams $_{10}$B/cm$^2$) between the BADGER measured $_{10}$B AD (0.0205 grams $_{10}$B/cm$^2$) and the certified minimum $_{10}$B AD (0.0232 grams $_{10}$B/cm$^2$), as reported in the LER.

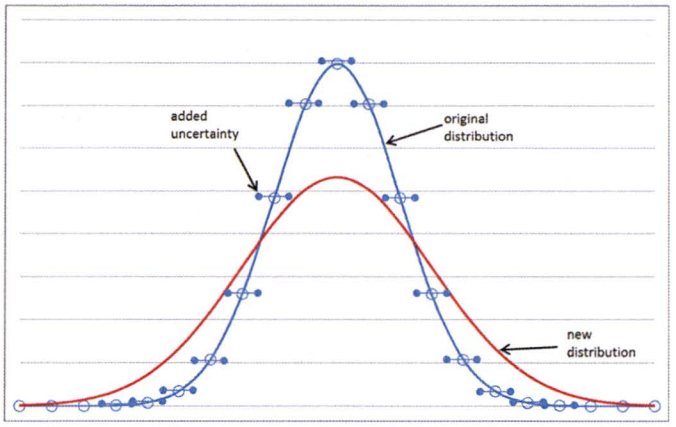
RESPONSE:

The root cause evaluation considered three main reasons for the results obtained in the DAEC BADGER test, in which some of the panels were measured to be below the minimum certified areal density. Those were:

(1) measurement uncertainty caused greater variation in results than expected,
(2) there were manufacturing defects that were not identified during the dedication process, and
(3) some of the Boral panels degraded over time.

The information available supported the first reason, and refuted the second and third reasons. The conclusion provided in the root cause evaluation regarding the second reason is as follows: "It is unlikely that manufacturer error resulted in panels with areal density below 0.0232 grams $^{10}$B/cm$^2$ since the panels were certified to at least meet that density." Similarly, the conclusion for the third reason, "Industry OE shows no credible degradation of BORAL in-situ. In addition, actual BADGER testing measurements show no anomalies with density or thickness of the panels. Plant chemistry data confirms that there is no loss of B10 material from the panels." On the other hand, the first reason was supported by the information available, and thus it was deemed to be the most likely cause for the event.

Statistics support the conclusion that the measurement uncertainty added by BADGER is the most likely cause. The results of the DAEC BADGER measurements documented in Revision 2 of the vendor report show the 60 panels measured had an average areal density of 0.0252 grams $^{10}$B/cm$^2$ and a standard deviation of 0.0016 grams $^{10}$B/cm$^2$. The population average areal density is close to the nominal areal density of 0.0250 grams $^{10}$B/cm$^2$, yet the population standard deviation leads to an uncertainty of 0.0033 grams $^{10}$B/cm$^2$, much larger than the initial as-built uncertainty of 0.0018 grams $^{10}$B/cm$^2$. When adding an uncertainty to a population, the resulting population will have the same average value, yet the new standard deviation will be the square root of the sum of the squares of the original and added standard deviations [$\sigma_{new} = (\sigma_{orig}^2 + \sigma_{add}^2)^{1/2}$]. The sketch below provides a pictorial representation of adding uncertainty to a distribution.




To account for the added measurement uncertainty, the new analysis documented in the LAR (Reference 1) does not use an uncertainty of 0.0012 grams $^{10}B/cm^2$. Instead, the new analysis uses a minimum areal density of 0.0150 grams $^{10}B/cm^2$, so the equivalent uncertainty, based on the nominal value of 0.0250 grams $^{10}B/cm^2$, is essentially increased from 0.0018 grams $^{10}B/cm^2$ to 0.0100 grams $^{10}B/cm^2$. The uncertainty of 0.0012 grams $^{10}B/cm^2$ is only applicable to the analysis for the Holtec racks.

b. Describe how the proposed minimum $_{10}B$ AD and BADGER uncertainty for Boral were established. Explain the factors and considerations that justify the value chosen and any margin that has been established by choosing this value (e.g., was the value chosen based on manufacturing data, other data, etc.?).

RESPONSE:

As noted in the LAR (Reference 1), bottom of page 3 of Enclosure 1, "The new analysis uses a reduced Boral areal density of 0.0150 grams $^{10}B/cm^2$ in the PaR spent fuel racks at DAEC." In the current licensing basis analysis for the Holtec racks, the nominal Boral areal density is 0.0162 grams $^{10}B/cm^2$, with an uncertainty of 0.0012 grams $^{10}B/cm^2$.

The goal behind the selection of the areal density for the PaR racks to be used in the new analysis was to ensure that a conservative value was selected to account for added measurement uncertainty or any potential degradation. For simplicity, the areal density for the PaR racks was selected to match the value for the Holtec racks after reducing it for the uncertainty (0.0162 – 0.0012 = 0.0150 grams $^{10}B/cm^2$). This new value was deemed to be acceptable as it is a considerable reduction from the PaR racks nominal areal density of 0.0250 grams $^{10}B/cm^2$, the minimum areal density of 0.0232 grams $^{10}B/cm^2$, and is well below the lowest panel measured value (0.0208 grams $^{10}B/cm^2$) during the first BADGER campaign at DAEC.

Since the minimum areal density of 0.0150 grams $^{10}B/cm^2$ used in the analysis is a considerable reduction from the nominal areal density of 0.0250 grams $^{10}B/cm^2$, no additional uncertainty for the areal density was included in the analysis to be combined with the other uncertainties. The analysis uses a minimum areal density much lower than the minimum certified areal density to cover for the increased uncertainties associated with the BADGER test results.

## 3.0 REFERENCES


1. Letter from Tom Vehec (NextEra Energy Duane Arnold) to U.S. Nuclear Regulatory Commission, "License Amendment Request (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements," NG-16-0052, March 15, 2016. (ML16077A234)
2. Email from Mahesh Chawla (U.S. Nuclear Regulatory Commission) to Laura Swenzinski et al (NextEra Energy Duane Arnold), "Request for Additional Information – Duane Arnold Energy Center (DAEC) – LAR (TSCR-159) to Revise Technical Specifications Fuel Storage Requirements – MF7486," August 12, 2016.