January 6, 2022

NG-22-0001
10 CFR 72.7

ATTN: Document Control Desk
Director, Division of Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20852

Duane Arnold Energy Center
Docket Nos. 50-331, 72-32
Renewed Facility Operating License No. DPR-49

Supplement to Exemption Request for Failed Fuel Can Weight in a Certificate of Compliance 1004 Renewed Amendment 17 61BTH Type 2 Dry Shielded Canister

References:

1. P. Hansen (NextEra Energy Duane Arnold, LLC) to USNRC, "Exemption Request for Failed Fuel Can Weight in a Certificate of Compliance 1004 Renewed Amendment 17 61BTH Type 2 Dry Shielded Canister," NG-21-0030, dated October 21, 2021 (ML21294A280)

2. P. Hansen (NextEra Energy Duane Arnold, LLC) to USNRC, "Supplement to Exemption Request for Failed Fuel Can Weight in a Certificate of Compliance 1004 Renewed Amendment 17 61BTH Type 2 Dry Shielded Canister," NG-21-0035, dated December 10, 2021 (ML21344A186)

In Reference 1, NextEra Energy Duane Arnold, LLC (NEDA) submitted an exemption request for the Duane Arnold Energy Center (DAEC) Independent Spent Fuel Storage Installation (ISFSI) from the requirements of 10 CFR 72.212(b)(2), (b)(3), (b)(4), (b)(5)(i), (b)(11), and 72.214. In Reference 2, NEDA supplemented the original submittal. The attachment to this letter replaces Attachment 1 of Reference 2, in its entirety.

Pursuant to 10 CFR 51.60, this supplement does not impact the environmental assessment previously provided in the referenced application.

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

Respectfully,

JMDavis for

Paul Hansen
Decommissioning Director
NextEra Energy Duane Arnold, LLC

Attachment

cc: Regional Administrator, USNRC, Region III,
Project Manager, USNRC, Duane Arnold Energy Center
Inspector, USNRC, Duane Arnold Energy Center

10 CFR 72.7 Exemption Request
Duane Arnold Energy Center
Independent Spent Fuel Storage Installation

1. Background

The CoC 1004 Standardized NUHOMS® System failed fuel can (FFC) consists of a liner with an integral bottom lid assembly and a removable top lid, designed to contain a failed fuel assembly and any associated fuel fragments/rubble to ensure assumptions made in the criticality analysis for the quantity and location of fuel rod material are maintained. The 61BTH Type 2 DSC, and the related basket structural analysis, was reviewed and approved as part of Amendment 10 to CoC 1004 and the FFC was added as approved content in Amendment 13 to CoC 1004.

A modified FFC is proposed to accommodate a damaged bail handle on a certain BWR failed fuel assembly that is to be loaded in the DAEC pool-off-load campaign. Typically, the bail handle allows for the lifting equipment to lower the failed fuel assembly into the FFC and disengage. The damaged bail handle still allows for the operators to load the fuel assembly into the FFC; however, the bail handle would come into contact with the top of a standard FFC liner before the fuel assembly came in contact with the bottom of the FFC.

The proposed FFC modification will provide the damaged bail handle adequate clearance during loading operations to lower the failed fuel assembly into place without interference from surrounding components, allowing the fuel assembly to be safely lowered into its final position using approved fuel handling devices (i.e., normal means). The modified FFC features a shortened FFC liner that is integrated with an over-sleeve which is welded to the FFC liner (see figure below). A removable lift handle is provided in the over-sleeve to move the loaded FFC into the designated cell of the DSC, and to retrieve the FFC and contents.

The modified FFC protrudes above the top of the basket and extends into the top grid assembly (TGA). The interface between the modified FFC and TGA requires a modification in the TGA to accommodate the FFC over-sleeve. The modification includes an extra set of plates on the corner of the TGA (within the quadrant that lies between 270° and 0°) to accommodate the modified FFC.

The DSC basket support ring is modified by removing a three-inch section of the ring at the perimeter cell location of the FFC to provide adequate clearance for the modified FFC to clear the support ring.

Technical Specification Table 1-1t requires that the total weight of each failed fuel can plus all its content be less than 705 lb. In considering this weight limit, the removable lift handle is not included in the combined weight since it is removed after the FFC is loaded in the DSC. The weight of the modified FFC includes the liner, the bottom cover assembly, the top cap assembly, and the over-sleeve. The failed fuel assembly to be loaded in the FFC is fuel designation GE3 with a nominal weight of 676 lb. (including the fuel channel). The total weight of the FFC plus contents exceeds the 705 lb. weight limit of the TS.

The FFC and TGA modifications described here will be evaluated pursuant to 10 CFR 72.48, but the necessity to load the nominally 676 lb. fuel assembly into the modified FFC exceeds the

TS requirement to be less than 705 lb. and therefore an exemption is needed to load an FFC and its contents up to 800 lbs.

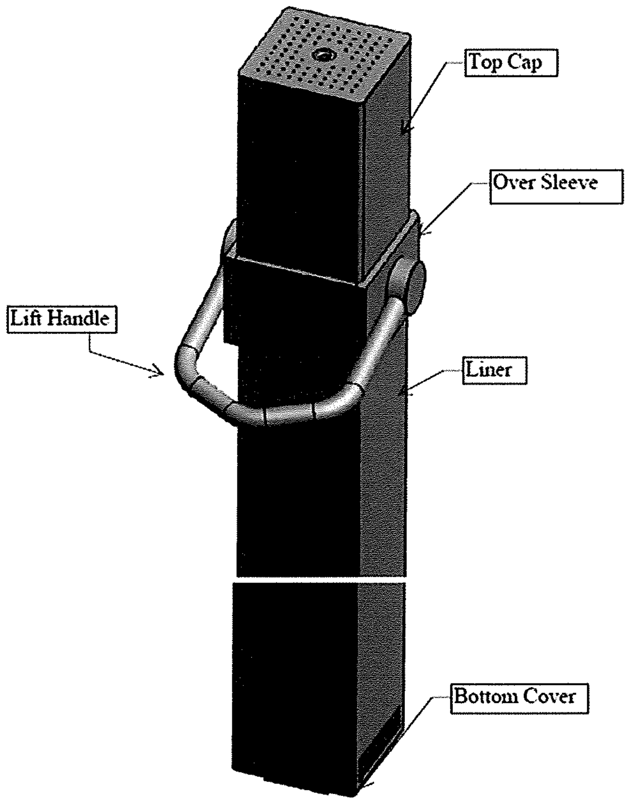


Figure 1: Modified FFC

2. Request for Exemption

In accordance with 10 CFR 72.7, "Specific exemptions," NextEra Energy Duane Arnold, LLC (NEDA) is requesting NRC approval of a one-time exemption for Campaign IV DSC No. 30, from the following requirements of 10 CFR Part 72, due to an inability to comply with the terms and conditions of CoC 1004 Renewed Amendment 17:

- 72.212(a)(2)
- 72.212(b)(2)
- 72.212(b)(3)
- 72.212(b)(4)
- 72.212(b)(5)(i)
- 72.212(b)(11)
- 72.214

These requirements all involve conforming to, or complying with, the terms, conditions, and specifications of a CoC or an amended CoC.

Specifically, the exemption request involves approval to exceed the weight limit of a failed fuel can (FFC), plus its contents, relative to the terms, conditions, and specifications of CoC 1004, Renewed Amendment 17. NEDA has identified a failed fuel assembly which weighs nominally 676 pounds and when stored with a modified FFC, exceeds the CoC Appendix B, Technical Specification (TS) Table 1-1t requirement that, "The total weight of each failed fuel can plus all its content shall be less than 705 lb."

NEDA hereby commits that at least two fuel cells adjacent to the FFC location in Campaign IV DSC No. 30 will remain empty as described in Attachment 2, and requests approval that the failed fuel can in question, plus all its contents, may weigh up to 800 lbs.

3. Technical Analysis

The 61BTH Type 2 DSC is designed to transfer the decay heat from the fuel to the canister body via the basket and ultimately to the ambient via either the HSM in storage mode or the TC in the transfer mode. The FFC is protected by the basket fuel compartment tubes and its only design functions are to contain the failed fuel and allow its retrieval from the basket fuel compartment under normal and off-normal conditions.

a. Thermal Design Function

As the thermal material properties and heat loads remain the same as those described in the CoC 1004 updated final safety analysis report (UFSAR) Revision 20, the overall basket temperature distribution and the thermal gradients are not affected by the proposed exemption. Therefore, the thermal design functions of the 61BTH Type 2 DSC and basket described in the UFSAR remain unaffected by this change.

b. Radiation Shielding Design Function

The proposed modification to the FFC for lifting adds additional material. The addition of materials around the FFC liner provides improved shielding effectiveness. Therefore, the shielding design function of the 61BTH Type 2 DSC and basket described in the UFSAR are not adversely affected by this change.

c. Confinement Design Function

Although its design function is to contain the failed fuel, the FFC does not constitute a confinement boundary. Therefore, the confinement design function of the 61BTH Type 2 DSC described in the UFSAR remains unaffected by this change.

d. Criticality Design Function

The FFC performs a criticality design function to contain a failed fuel assembly and any associated fuel fragments/rubble within the designated storage compartment in the 61BTH Type 2 basket, ensuring that assumptions made in the criticality analysis for the quantity and location

of fuel contents are maintained. The proposed exemption only affects the weight of the FFC plus contents and not the ability of the FFC to contain the failed fuel. Therefore, the criticality design function of the 61BTH Type 2 DSC and basket described in the UFSAR remains unaffected by this change.

e. Structural Design Function

CoC 1004 UFSAR Revision 20 is used to support the following discussion.

Figure 1 presents the various components that make up the modified FFC. The modified FFC is based on the generic FFC approved as part of Amendment 13 to CoC 1004. The generic FFC is 178.50" long as shown in Drawing NUH61BTH-72-1105 of the UFSAR and is supported by the basket assembly which is 164" long and the 14.50" top grid assembly as seen from Sheet 2 of Drawing NUH61TH-2002-SAR. Similar to the generic design, only part of the modified FFC weight is supported by the basket assembly when the DSC is in a horizontal orientation.

The basket assembly spans 164" and only supports the FFC liner (35 lb.), FFC spacer (10 lb.) and FFC bottom cover (2.5 lb.) along with the failed fuel assembly (676 lb.). The FFC oversleeve (17 lb.) and the FFC top cap (4 lb.) are outside the basket assembly envelope and are supported within the top grid assembly. Including the failed fuel assembly, the total weight of the modified FCC is approximately 745 lbs. To account for any further modifications during fabrication/additional information regarding the failed fuel, this exemption request considers the weight of the FFC and its contents up to 800 lbs.

Within the basket assembly, the maximum load is exerted onto the basket assembly by the failed fuel assembly and the FFC liner which weigh about 711 lb. The FFC bottom cover and the FFC spacer are towards the bottom of the basket assembly with a combined weight of approximately 13 lb. and weigh significantly less than the failed fuel assembly. The weight of the FFC oversleeve and the FFC top cap of 21 lb. is supported by the top grid assembly and not by the basket assembly as discussed above. In addition, the variability in the weight of the modified FFC from approximately 745 lbs to 800 lbs will not alter the location of the maximum load. Therefore, only the failed fuel assembly and FFC liner are considered in determining the bounding pressure.

The current basket analysis evaluates a three-inch cross section of the basket with all compartments loaded with 705 lb. fuel assemblies, as discussed in UFSAR Section T.3.6.1.3.1. This load is applied as a pressure on the fuel compartment plates for the various load cases evaluated for normal and accident conditions along with applicable accelerations for each load case. Based on Section T.3.7.4.3.3 of the UFSAR, the pressure (p) is calculated as:

$$
\begin{aligned}
Pressure, p &= \frac{Fuel\ assembly\ wt.}{(Panel\ span\ x\ Panel\ Length)} \\
&= 0.6911\ psi
\end{aligned}
$$

where:

Fuel Assembly wt = 705 lb.
Panel span = 6.22"
Panel length = 164"

The maximum fuel assembly weight at DAEC is 676 lb. and the FFC liner weight is 35 lb. (based on 22 gauge thick liner per UFSAR Dwg NUH61BTH-72-1105). If the FFC is loaded with the heaviest fuel assembly, the resulting pressure on the fuel compartment plates from the fuel assembly and the FFC liner (676 lb. + 35 lb = 711 lb.) using the same approach is 0.6970 psi.

The increase in the pressure within the fuel compartment with the FFC is about 0.9%. This small increase is compensated by the fact that only one FFC will be loaded in DAEC DSC No. 30 and other fuel assemblies are less than the analyzed weight of 705 lbs. This reduces the load on the basket assembly by 1,740 lb. (= (705 lb. – 676 lb.) x 60 Assemblies).

In addition, DAEC commits that at least two other fuel cells within the basket assembly adjacent to the FFC location will remain empty, to increase the available margin. This will further reduce the load on the basket assembly by about 1,352 lb. resulting in a net reduction of about 3,092 lb. when combined with the lower maximum fuel assembly weight.

A review of the stress intensity plots for the bounding load cases for normal and accident conditions (see UFSAR Figure T.3.6-19a for handling/transfer load, UFSAR Figure T.3.6-31 for storage load and UFSAR Figure T.3.7-54 for the bounding side drop) shows that the maximum stresses within the basket assembly occur away from the compartments where the FFC can be loaded. The maximum stresses in the location with the FFC for the design basis analysis are shown in Figure 3 (extracted from UFSAR Figure T.3-19a) and demonstrate that they are about 3 to 4 times lower than the maximum stresses observed in the entire basket assembly.

Table 1 presents a summary of the maximum stresses for the bounding normal and accident load cases from the UFSAR. Considering the large reduction in the load on the basket assembly as discussed above, and that the maximum stresses are away from the FFC location, the results presented within the UFSAR remain bounding for DSC No. 30.

To provide additional assurance regarding the weight of the FFC variability and the support provided by the top grid assembly and to confirm that the stresses within the UFSAR remain applicable, the bounding evaluation for the Normal Handing/Transfer conditions is re-evaluated since this load case has the lowest margins. For this evaluation, the same ANSYS model of the basket assembly from Section T.3.6.1.3.1 of the UFSAR is used by modifying the following input:

1. The pressure within the fuel compartment with the FFC is conservatively based on 800 lb which is the total weight of the FFC and its contents requested in this exemption. This is conservative since part of the FFC weight is supported by the holddown ring/top grid assembly as discussed above.

Table 2 presents a summary of the maximum stresses for the bounding Normal Handling/Transfer conditions. As seen from the table, there is no change in the maximum stress within the basket or the rails due to the small increase observed in one compartment.

Figure 2 presents the stress contours for the basket assembly and compares it to design basis stress contours from the UFSAR. As seen from the figure, the maximum stresses are away from location with the FFC confirming the same behavior observed within the UFSAR.

Figure 3 presents the stress contours in the local area where the FFC would be loaded and compares it to design basis stress contours from the UFSAR. As seen from the figure, the maximum stress in this fuel compartment supporting the FFC is 4.2 ksi (3.9 ksi x 1.08) and is significantly below the allowable stress of 23.4 ksi. While an increase in the local stresses due to the increased FFC weight of 800 lb is observed in the specific compartment compared to the design basis evaluation, the maximum local stresses where the FFC is loaded remains significantly lower compared to the maximum stress observed within the entire basket assembly.

Further this evaluation does not take credit for the following additional conservatisms applicable to DSC No. 30:

1. DSC No. 30 is loaded with fuel assemblies with a maximum weight of 676 lbs. However, the evaluation considered the design basis weight of 705 lb for all the fuel compartments without the FFC.
2. DSC No. 30 will have two fuel compartments adjacent to the FFC empty reducing the load further.
   The allowable stresses are based on a temperature of 750°F as shown in Table T.3.1-1 of the UFSAR to accommodate the maximum temperature in the center of the basket assembly based on the maximum heat load of 31.2 kW. However, the maximum heat load of DSC No. 30 is approximately 17 kW. In addition, the FFC is located in the corner of the basket assembly whereas the maximum temperature is located in the middle of the basket as seen from Chapter T.4, Figure T.4-45 of the UFSAR. Both of these factors will lead to a significant reduction in the temperature for the FFC location, resulting in a higher allowable.

Based on the above discussion and the results of the evaluation, the results presented within the UFSAR as summarized in Table 1 remain bounding for DSC No. 30.

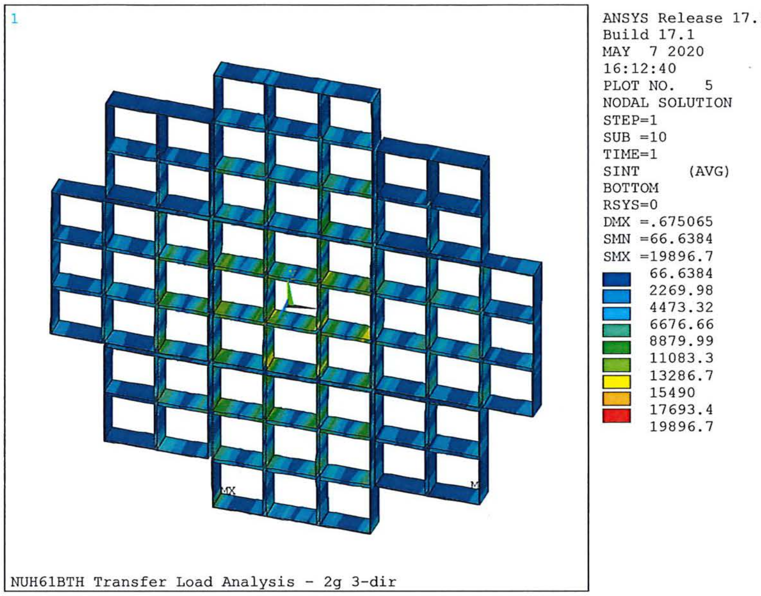
Table 1: Summary of Maximum Stresses for 61BTH Type 2 DSC

Load Case	UFSAR Reference	Max. Stress (ksi)	Allowable Stress (ksi)	Stress Ratio
Normal Handling/Transfer Conditions, Basket, P_m+P_b, 2g Axial,Vert.,Trans	Item C, Section T.3.6.1.3.3	21.49	23.4	0.92
Normal Handling/Transfer Conditions, Rails, P_m+P_b, 2g Axial,Vert.,Trans	Item C, Section T.3.6.1.3.3	22.21	23.4	0.95
Standard Seismic, Basket, P_m+P_b, 2g Axial,Vert.,Trans	Item E, Section T.3.6.1.3.4	26.88	35.1	0.77
Standard Seismic, Rails, P_m+P_b, 2g Axial,Vert.,Trans	Item E, Section T.3.6.1.3.4	24.97	35.1	0.71
161.5° Side Drop Impact on one Transfer cask Support rail, Basket, P_m+P_b	Table T.3.7-6	32.85	56.97	0.58
161.5° Side Drop Impact on one Transfer cask Support rail, Rail, P_m+P_b	Table T.3.7-6	45.95	56.97	0.81

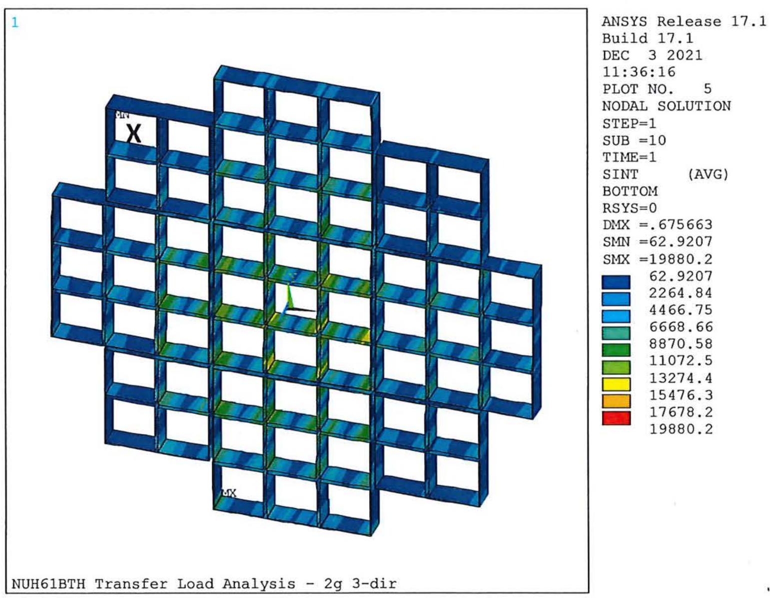
Table 2: Summary of Maximum Stresses for 61BTH Type 2 DSC with 800 lb FFC

Load Case	Max. Stress[1] (ksi)	Allowable Stress (ksi)	Stress Ratio
Normal Handling/Transfer Conditions, Basket, P_m+P_b, 2g Axial,Vert.,Trans (DSC No. 30)	21.5	23.4	0.92
Normal Handling/Transfer Conditions, Rails, P_m+P_b, 2g Axial,Vert.,Trans (DSC No. 30)	22.2	23.4	0.95

Note 1: The stress results from ANSYS are conservatively factored by 1.08 to account for the aluminum in R45 rails as noted in Item B and Item C, Section T.3.6.1.3.3 of the UFSAR.

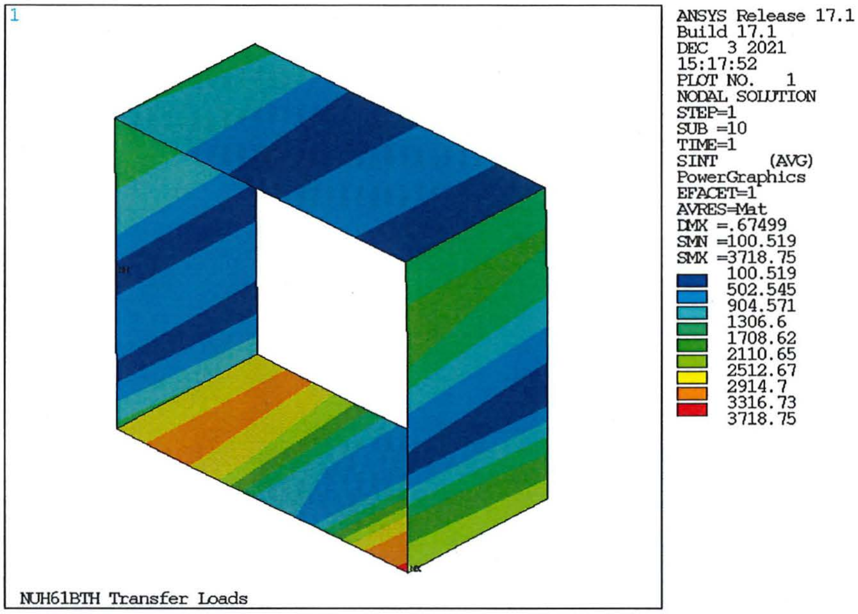


Design basis (Figure T.3.6-19a of the UFSAR)

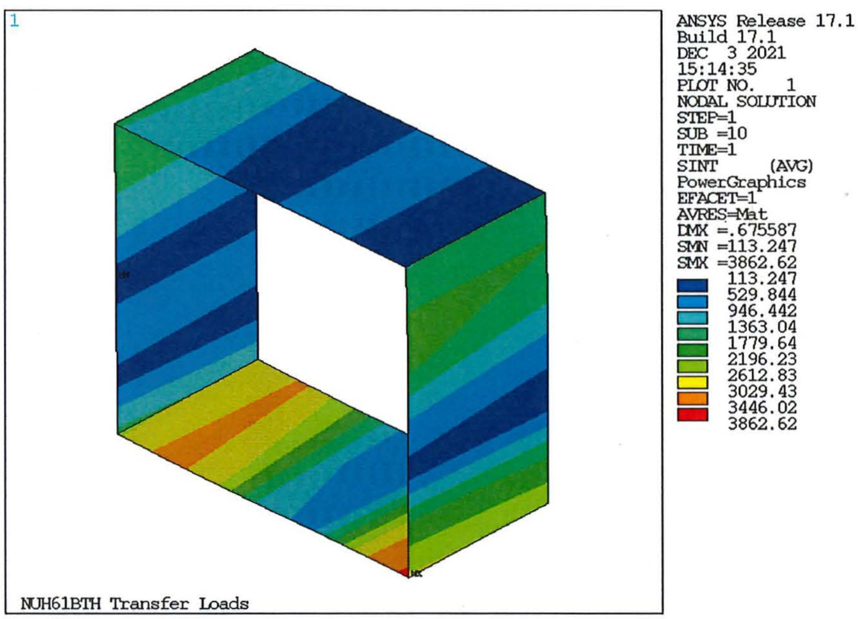


DSC No. 30: 800 lb for FFC Compartment
("X" denotes the location of the FFC)

**Figure 2: Type 2 Basket Membrane + Bending Stress Intensity (psi)
(R45 and R90 transition rail design option, Handling/Transfer Load – 2g axial + 2g transverse + 2g vertical)**



Design basis (Extracted from Figure T.3.6-19a of the UFSAR at FFC location)



DSC No. 30: 800 lb for FFC Compartment

Figure 3: Type 2 Basket Membrane + Bending Stress Intensity (psi)
(R45 and R90 transition rail design option, Handling/Transfer Load – 2g axial + 2g transverse + 2g vertical) – FFC Compartment Only

4. Basis for Approval

In accordance with 10 CFR 72.7, the NRC may, upon application by any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

a. Authorized by Law

The NRC issued 10 CFR 72. 7 under the authority granted to it under Section 133 of the Nuclear Waste Policy Act of 1982, as amended, 42 U.S.C. § 10153. Section 72.7 allows the NRC to grant exemptions from the requirements of 10 CFR Part 72. Granting the proposed exemption provides adequate protection to public health and safety, and the environment. As described below, the proposed exemption will not endanger life or property, or the common defense and security, and is otherwise in the public interest. Therefore, the exemption is authorized by law.

b. Will not Endanger Life or Property or the Common Defense and Security

DAEC has verified that loading of the modified failed fuel can, with a failed fuel assembly, with combined weight exceeding the 705 lb. limit up to 800 lb., would not impact the structural, thermal, shielding, criticality, or confinement design functions of the loaded DSC, as described in the Technical Analysis section above.

The CoC 1004 Renewed Amendment 17 Technical Specifications allow failed fuel in nearly all DSC designs. While all DSCs have a limit on Maximum Initial Uranium Content per fuel assembly, only about half retain this limit on FFC weight plus the weight of the contents, with the most recently added DSCs having had the requirement removed.

Additionally, NEDA commits that at least two other cells adjacent to the FFC location in DAEC DSC No. 30 of Campaign IV will remain empty, so the overall DSC weight with this FFC will remain within the UFSAR assumptions.

Based on this, the proposed exemption does not endanger life or property or the common defense and security.

c. Otherwise in the Public Interest

The exemption will be in the public interest in that it will allow for the timely storage of spent nuclear fuel at DAEC while minimizing radiological risks and will help maintain the schedule for transitioning the spent fuel from the pool to the dry storage facility, which is the lowest risk option.

5. Environmental Consideration

The potential environmental impact of using the Standardized NUHOMS® System was initially analyzed in the environmental assessment for the final rule to add the system to the list of approved spent fuel storage casks in 10 CFR 72.214 (59 FR 65898). The environmental assessment for the December 22, 1994, final rule concluded that there would be no significant

environmental impact to adding the Standardized NUHOMS® System, and therefore, the NRC issued a finding of no significant impact, which was validated through issuance of Renewed Amendment 17 to the Certificate of Compliance on June 7, 2021.

The environmental impacts of the proposed exemption will not have an adverse impact to the environment, nor do they change assumptions in the previous environmental assessment. Therefore, the proposed action does not require any federal permits, licenses, approvals, or other entitlements.

a. Environmental Impacts of the Proposed Action

The DAEC ISFSI is a radiologically controlled Protected Area with limited access and is located inside the DAEC Owner Controlled Area. The area considered for potential environmental impact as a result of this exemption request is the area in and surrounding the ISFSI.

The interaction of a loaded 61BTH Type 2 DSC, within a horizontal storage module, with the environment is through the thermal, shielding, and confinement design functions for the NUHOMS® system. This change has no impact on the DSC heat load, the DSC radioactive source terms, or the confinement boundary components.

There are no gaseous, liquid or solid effluents (radiological or non-radiological), radiological exposures (worker or member of the public) or land disturbances associated with the proposed action.

Therefore, approval of the requested exemption to allow one DSC fuel cell to store an FFC with a failed fuel assembly, with combined weight over the weight limit, with at least two other cells empty, has no impact on the environment.

b. Adverse Environmental Effects Which Cannot be Avoided Should the Exemption be Approved

As noted previously, there are no environmental impacts associated with approval of this exemption. Therefore, there are no adverse environmental effects which cannot be avoided should the exemption request be approved.

c. Alternatives to the Proposed Action

NEDA has considered two (2) alternatives to the proposed exemption request, as follows:

1. Request that the CoC holder for CoC 1004 apply for Amendment 18 to allow the increased weight of the failed fuel canister and contents, while leaving other cells empty.

2. Dismantle the failed fuel assembly and place into separate failed fuel cans within a DSC.

d. Environmental Effects of the Alternatives to the Proposed Action

The environmental impacts of processing a change to the weight requirements for an FFC and its contents through the amendment process would not allow NEDA to complete emptying of the spent fuel pool on schedule by April 2022, which is one of the major decommissioning activities

outlined in the PSDAR. Emptying of the spent fuel pool allows for termination of spent fuel pool operation and reduces overall risk during decommissioning. This delay would also result in additional costs.

The environmental impact of dismantling the failed fuel assembly and placing portions of the FA in multiple FFCs would result in increased costs, increased risk, an occupational radiological dose greater than the projected dose in the event of approval of this exemption, and the generation of additional radiological waste.

e. Conclusion and Status of Compliance

As a result of the environmental assessment, NEDA concludes that the proposed action, which will allow NEDA to load a failed fuel assembly in a failed fuel can, within a DAEC Campaign IV DSC No. 30 fuel cell, where the combined weight of the failed fuel assembly plus the failed fuel can exceeds the 705 pound limit, while leaving at least two other DSC fuel cells empty, is in the public interest in that it avoids the adverse environmental, radiological, and financial effects associated with the alternatives to the proposed action.