TRANSNUCLEAR
AN AREVA COMPANY

July 25, 2013
E-35946

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: Revision 2 to Transnuclear, Inc. (TN) Application for Amendment 2 to NUHOMS® HD Certificate of Compliance No. 1030 for Spent Fuel Storage Casks, Response to Request for Additional Information (RAI) (Docket No. 72-1030, TAC No. L24691)

Reference: Letter from Bernard H. White IV (NRC) to Don Shaw (TN), "Application for Amendment No. 2 to NUHOMS® HD Certificate of Compliance No. 1030 – Request for Additional Information," May 31, 2013 (Docket No. 72-1030, TAC No. L24691)

The referenced letter advised TN that NRC staff determined that further information is needed to complete its technical review of TN's September 28, 2012 application for Amendment 2 to the NUHOMS® HD Certificate of Compliance No. 1030.

This submittal provides responses to the RAI forwarded by the above-referenced letter. Enclosure 2 herein provides each of the RAI items followed by a TN response. Enclosures 4 and 5 provide the changed technical specifications (TS) and changed updated final safety analysis report (UFSAR) pages, respectively, which are associated with the RAI responses. In the TS, all Amendment 2 changes continue to be tracked with italicized text and revision bars, with new inserts shaded. In the USFAR, the changed pages are annotated as Revision 2 with changes indicated by italicized text and revision bars. New inserts are shaded. Enclosure 3 provides a list of changed TS and UFSAR pages with a reason for each change.

Enclosure 5 of this submittal includes proprietary information that may not be used for any purpose other than to support NRC staff review of the application. In accordance with 10 CFR 2.390, I am providing an affidavit (Enclosure 1) specifically requesting that you withhold this proprietary information from public disclosure. Enclosure 6 contains a public version of the changed proprietary UFSAR pages.

Should the NRC staff require additional information to support review of this application, please do not hesitate to contact Mr. Don Shaw at 410-910-6878 or me at 410-910-6820.

Sincerely,

Paul H Triska

Paul Triska
Vice President, Operations

cc: Bernard H. White (NRC SFST), as follows:

NMSS26

- Three paper copies of this cover letter and Enclosures 1,2, 3, 4, and 5
- Three computer disks containing this cover letter and Enclosures 1, 2, 3, 4, and 5

Enclosures:

1. Affidavit Pursuant to 10 CFR 2.390
2. RAIs and Responses
3. List of Changed TS and UFSAR Pages with Reason for Change
4. CoC 1030 Amendment 2, Revision 2 Changed TS Pages
5. CoC 1030 Amendment 2, Revision 2 Changed UFSAR Pages (Proprietary Version)
6. CoC 1030 Amendment 2, Revision 2 Changed UFSAR Pages (Public Version)

AFFIDAVIT PURSUANT
TO 10 CFR 2.390

Transnuclear, Inc.)
State of Maryland) SS.
County of Howard)

I, Paul Triska, depose and say that I am a Vice President of Transnuclear, Inc., duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the following paragraph. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is contained in Enclosure 5:

- Enclosure 5 - CoC 1030 Amendment 2, Revision 2 Changed UFSAR Pages

These pages have been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Transnuclear, Inc. in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above-referenced document, should be withheld.

1) The information sought to be withheld from public disclosure involves portions of the updated final safety analysis report related to the design of dry spent fuel storage systems which are owned and have been held in confidence by Transnuclear, Inc.

2) The information is of a type customarily held in confidence by Transnuclear, Inc. and not customarily disclosed to the public. Transnuclear, Inc. has a rational basis for determining the types of information customarily held in confidence by it.

3) Public disclosure of the information is likely to cause substantial harm to the competitive position of Transnuclear, Inc. because the information consists of descriptions of the design of dry spent fuel storage systems, the application of which provide a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Transnuclear, Inc., take marketing or other actions to improve their product's position or impair the position of Transnuclear, Inc.'s product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

Further the deponent sayeth not.

Paul A Triska
Paul Triska
Vice President, Transnuclear, Inc.

Subscribed and sworn to me before this 25th day of July, 2013.

Zora M Dougherty
Notary Public

My Commission Expires 10 / 17 / 2015

ZORA M. DOUGHERTY
My Commission Expires
NOTARY
PUBLIC
10-17-2015
HOWARD COUNTY, MD

Enclosure 2 to TN E-35946

CoC 1030 Amendment 2, Revision 2

RAIs and Responses

REQUEST FOR ADDITIONAL INFORMATION

Chapter 4 – Thermal Evaluation

RAI 4-1:

Revise the application to show how the decay heat values, for use in the decay heat equation in Table 4B and the fuel qualification Table 4C, were determined to ensure that fuel assemblies containing BLEU will meet the heat load limits noted in Figure 2 of proposed technical specifications for Amendment No. 2 to the Model No. NUHOMS HD storage system.

The applicant described the calculations of the decay heat for the fuel assembly containing the Blended Low Enriched Uranium (BLEU) fuel material in pages T-4 and T-5 of NUHOMS HD technical specifications. The applicant should show that these calculations ensure that the decay heat from BLEU fuel will meet the limits in each zone that will store BLEU fuel.

This information is required by the staff to determine compliance with Title 10, *Code of Federal Regulations* (10 CFR) 72.236(f).

RESPONSE TO RAI 4-1

UFSAR Appendix 4.16.2 is revised to include a demonstration that the actual decay heat from the BLEU fuel is bounded by the calculated decay heat for the BLEU fuel by using Table 4B and 4C in the proposed Technical Specifications. The calculated decay heat for the BLEU fuel is used to qualify the BLEU fuel for storage; thus, the actual decay heat from the BLEU fuel meets the applicable heat load zone limit.

RAI 4-2:

Clarify whether the statement regarding the X3 value used in the decay heat calculation in Table 4B of the proposed technical specifications for BLEU fuel is accurate "For a fuel assembly containing BLEU fuel material, the decay heat is calculated using an X3 value, which corresponds to the actual cooling time minus 2.5 years."

For the decay heat calculation for enrichments less than 1.5 weight percent, the cooling time for BLEU fuel in Table 4C is the cooling time in the table plus 2.5 years, whereas for enrichments at or above 1.5 weight percent, the calculation appears to use the cooling time minus 2.5 years. Since BLEU fuel contains more cobalt than UO_2 fuel, it appears that the cooling time for BLEU fuel should be longer than for UO_2 fuel.

This information is required by the staff to determine compliance with 10 CFR 72.236(f).

RESPONSE TO RAI 4-2

The notes under Table 4B and 4C in the Technical Specifications are revised to clarify how the actual cooling time of BLEU fuel should be used in the application of Table 4B and 4C.

The decay heat equation is developed for low enriched uranium (LEU) fuel. As BLEU fuel contains a higher cobalt impurity, additional cooling time is required for BLEU fuel so that the LEU fuel dose rates are bounding. This is accomplished by requiring an additional 2.5 years of cooling time before the BLEU fuel assembly is authorized for loading.

However, since the decay heat is calculated by using Table 4B and 4C to qualify the BLEU fuel in each zone that will store BLEU fuel, it is required that the cooling time in the calculation is adjusted to be the actual BLEU fuel cooling time minus 2.5 years. This ensures the calculated decay for the BLEU fuel is higher than the actual decay heat for the BLEU fuel to prevent it from exceeding the decay heat limits for the particular zone or dose rates, as previously reported in the USFAR.

Chapter 8 – Materials Evaluation

RAI 8-1:

1. Clarify the class or classes of alloys used to construct the non-fuel hardware that is being added as authorized control components in the revised technical specifications in Table 2-1 of the amendment application.

   Components that are constructed of zirconium alloys, nickel alloys or stainless steel are usually unaffected by storage in spent fuel pools, dry casks and dry cask loading/unloading conditions. Components that are constructed from other materials may be affected by the previously listed conditions.

   The information is required to demonstrate compliance with 10 CFR 72.236(h).

RESPONSE TO RAI 8-1

A description of the materials, including classes of alloys for non-fuel hardware, is already included in UFSAR Chapter 5 and was incorporated as part of Amendment 1. As requested by the staff, the application is revised with the addition of the following paragraph to UFSAR Section 2.1.1:

> *The cladding materials for the CCs include stainless steel, nickel based alloys such as Inconel, zirconium based alloys such as Zircaloy, M5 or Zirlo. The internal component materials include non-fuel materials like Inconel, B_4C, Ag-In-Cd, Al_2O_3, etc.*

RAI 8-2:

2. Justify and provide examples of weld filler materials that do not have 0.20% minimum copper content and have a minimum 1% nickel content, citing widely recognized industry welding codes.

   The welding of weathering steels, steels intentionally alloyed with copper, are typically welded with electrodes that contain a combination of nickel and copper or higher nickel content than what is required in the application for an amendment to the certificate of compliance.

   The information is required to demonstrate compliance with 10 CFR 72.236(g).

RESPONSE TO RAI 8-2

This change is requested because nickel-bearing weld filler material is available in more product forms (e.g., AWS/ASME A/SFA-5.5 E-8018-C1 covered electrode, A/SFA-5.28 ER80S-Ni2 solid or ER70C-Ni2 metal cored bare wire, and A/SFA-5.29 E7XT8-Ni2 or E8XT-Ni2 flux cored wire) than the copper-bearing weld material. Furthermore, weld filler material with 1% or more nickel has atmospheric chloride corrosion resistance equal to or better than weld material with 0.20% copper. Reference 1 evaluated corrosion resistance testing of steels with various amounts of copper, nickel, chromium, silicon, and phosphorus. It shows that 1% nickel with only residual amounts of the other elements corroded 9.6 mils in 15.5 years at Kure Beach, compared to 11.2 mils in 15.5 years for 0.24% copper, with residual amounts of the other elements. Thus, comparable corrosion resistance is independently exhibited at the specified thresholds.

Reference 1: Larrabee, C. P. and Coburn, S. K. (1962). "The Atmospheric Corrosion of Steels as Influenced by Changes in Chemical Composition." Proceedings of First International Congress on Metallic Corrosion, Butterworths, London, pages 276-285.

This justification was previously provided in CoC 1004 Amendment 11 as Enclosure 3 to TN E-28173 (ML092330416) and Reference 1 above was included as Enclosure 4 to E-28173. This provision is discussed in Preliminary Safety Evaluation Report, Transnuclear Inc., Standardized NUHOMS Horizontal Modular Storage System for Irradiated Nuclear Fuel, Docket No. 72-1004.

Enclosure 3 to TN E-35946

CoC 1030 Amendment 2, Revision 2

List of Changed TS and UFSAR Pages with Reason for Change

List of Changed TS and UFSAR Pages with Reason for Change

Page #	**Reason for Change**
Tech Spec Pages	
T-4	RAI 4-2
T-5	RAI 4-2
SAR Pages	
2-1	RAI 8-1
2-1a	Text shift
2-1b	Text shift
Table 2-2B	RAI 4-2
Table 2-2C	RAI 4-2
4.16.2-i	RAI 4-1
4.16.2-3	RAI 4-1
4.16.2-4	RAI 4-1
Table 4.16.2-6	RAI 4-1
Table 4.16.2-7	RAI 4-1

Enclosure 4 to TN E-35946

CoC 1030 Amendment 2, Revision 2

CoC 1030 Amendment 2, Revision 2 Changed TS Pages

Table 4A

Maximum Allowable Assembly *Average* Burnup as a Function of Assembly Average Initial Enrichment

Assembly Average Initial Enrichment (X2) wt. % U-235)	Maximum Assembly *Average* Burnup (X1) (GW*d*/MTU)
$0.2 \leq X2 < 0.3$	20
$0.3 \leq X2 < 0.7$	25
$0.7 \leq X2 < 1.5$	32
$1.5 \leq X2 < 2.5$	55
$2.5 \leq X2 < 5.00$	60

Table 4B

For Assembly Average Initial Enrichment Greater Than or Equal to 1.50 wt. % U-235

For an assembly average initial enrichment greater than or equal to 1.50 *wt. % U-235*, the equation shown below to calculate the decay heat shall be employed. UFSAR Table 2-2D provides example tables, which may be used at the discretion of the user, to verify the proper use of the equation.

The Decay Heat (DH) in watts is expressed as:

$$F1 = A + B*X1 + C*X2 + D*X1^2 + E*X1*X2 + F*X2^2$$
$$DH = F1*Exp(\{[1-(5/X3)]*G\}*[(X3/X1)^H]*[(X2/X1)^I])$$

where,

F1 Intermediate Function
X1 Assembly *Average* Burnup in GW*d*/MTU
X2 Assembly Average Initial Enrichment in wt. % U-235 (*$1.5 \leq X2 \leq 5.0$*)
X3 Cooling Time in Years (min*imum* 5 yrs)

A = 13.69479	B=25.79539	C=-3.547739	D= 0.307917	E=-3.809025
F = 14.00256	G=-0.831522	H= 0.078607	I =-0.095900	

- *When irradiated stainless steel rods are present in the reconstituted fuel assembly, the decay heat is calculated with using an X3 value, which corresponds to the actual cooling time minus one year. This restriction is applicable only when the cooling time of the reconstituted fuel assembly is less than 10 years. This fuel assembly is qualified if X3 is greater than 5 years. Further, this calculated decay heat shall be employed to determine the applicable Heat Load Zone shown in Figure 2.*
- *For a fuel assembly containing BLEU fuel material, the decay heat is calculated using an X3 value, which corresponds to the actual cooling time of BLEU fuel minus 2.5 years.*

This fuel assembly is qualified if X3 is greater than 5 years. Further, this calculated decay heat shall be employed to determine the applicable Heat Load Zone shown in Figure 2.

- *The calculated decay heat with actual cooling time shall be employed to determine the total heat load of the DSC as shown in Figure 2.*
- *Any fuel assembly that is qualified from a thermal standpoint is also qualified from a radiological standpoint.*
- *Any fuel assembly with a burnup and enrichment combination that is encompassed by that specified in Table 4A is qualified from a radiological standpoint.*
- *The qualification of fuel assemblies with assembly average initial enrichment between 0.2 wt. % U-235 and 1.5 wt. % U-235 as a function of burnup and cooling time is specified in Table 4C.*

Table 4C

For Assembly Average Initial Enrichment Less Than 1.50 wt. % U-235

For an assembly average initial enrichment less than 1.5 wt. % U-235, the following qualification shall be employed.

Assembly Average Initial Enrichment Range (wt. % U-235)	Maximum *Assembly Average* Burnup (GWd/MTU)	Cooling Time (Years)	Decay Heat (Watts)
$0.7 \leq X2 < 1.5$	32	5	1100
	32	6	900
	32	7	780
	32	10	540
$0.3 \leq X2 < 0.7$	25	5	970
	25	6	800
	25	10	620
$0.2 \leq X2 < 0.3$	20	5	652

Notes:

1. For an assembly average enrichment between 0.2 and 0.3 wt. % U-235, fuel assemblies with a*n assembly average* burnup below 20 GWd/MTU and a cooling time greater than *5* years are qualified for storage anywhere in the basket.
2. For an assembly average enrichment between 0.3 and 0.7 wt. % U-235, fuel assemblies with a*n assembly average* burnup below 25 GWd/MTU and a cooling time greater than 6 years are qualified for storage anywhere in the basket.
3. For an assembly average enrichment between 0.7 and 1.5 wt. % U-235, fuel assemblies with a*n assembly average* burnup below 32 GWd/MTU and a cooling time greater than 7 years are qualified for storage anywhere in the basket.
4. *For fuel assemblies containing BLEU fuel material, the cooling time used in the table corresponds to the actual cooling time of BLEU fuel minus 2.5 years. For example, an assembly average enrichment between 0.7 and 1.5 wt. % U-235 containing BLEU fuel material, fuel assemblies with an assembly average burnup below 32 GWd/MTU and a cooling time greater than 7.5 years, the maximum decay heat is less than or equal to 1100 Watts.*

Enclosure 6 to TN E-35946

CoC 1030 Amendment 2, Revision 2

CoC 1030 Amendment 2, Revision 2 Changed UFSAR Pages
(Public Version)

2. PRINCIPAL DESIGN CRITERIA

The design criteria described herein for the 32PTH DSC and the OS187H TC are also applicable to the 32PTH Type 1 DSC and the OS187H Type 1 TC discussed in Appendix A. Design criteria applicable specifically to the 32PTH Type 1 DSC and the OS187H Type 1 TC are described in Appendix A, Chapter A.2.

2.1 Spent Fuel to be Stored

The NUHOMS® HD System components have currently been designed for the storage of 32 intact and or up to 16 damaged with remaining intact, Westinghouse 15x15 (WE 15x15), Combustion Engineering 16x16 (CE 16x16), Westinghouse 17x17 (WE 17x17), and Combustion Engineering 14x14 (CE 14x14) class PWR fuel assemblies. Equivalent reload fuel assemblies that are enveloped by the fuel assembly design characteristics listed in Table 2-1 for a given assembly class are also acceptable. *WE 15x15 and WE 17x17 class fuel assemblies containing Instrument Tube Tie Rods (ITTRs) are also qualified for storage in the NUHOMS® HD System.* Additional payloads may be defined in future amendments to this application. 72.48

The thermal and radiological characteristics for the PWR spent fuel were generated using the SCALE computer code package [1]. The physical characteristics for the PWR fuel assembly types are shown in Table 2-3. Free volume in the 32PTH DSC cavity is addressed in Chapter 4. Specific gamma and neutron source spectra are given in Chapter 5.

Although analyses in this *UF*SAR are performed only for the design basis fuel, any other intact or damaged PWR fuel *that* falls within the geometric, thermal, and nuclear limits established for the design basis fuel can be stored in the 32PTH DSC.

2.1.1 Detailed Payload Description

The NUHOMS® HD System is designed to store intact (including reconstituted) and/or damaged PWR fuel assemblies as specified in Table 2-1 and Table 2-3. The fuel to be stored is limited to a maximum *planar* average initial enrichment of 5.0 wt. % U-235. The maximum allowable assembly average burnup is limited to 60 GWd/MTU and the minimum cooling time is 5 years. The system is also designed to store Control Components (CCs) with thermal and radiological characteristics as listed in Table 2-4. *Authorized* CCs include Burnable Poison Rod Assemblies (BPRAs), Thimble Plug Assemblies (TPAs), Control Rod Assemblies (CRAs), Control Element Assemblies (CEAs), Rod Cluster Control Assemblies (RCCAs), Axial Power Shaping Rod Assemblies (APSRAs), Orifice Rod Assemblies (ORAs), Vibration Suppression Inserts (VSIs), Neutron Source Assemblies (NSAs) and Neutron Sources. *Nonfuel hardware that are positioned within the fuel assembly after the fuel assembly is discharged from the core such as Guide Tubes or Instrument Tube Tie Rods or Anchors, Guide Tube Inserts, BPRA Spacer Plates or devices that are positioned and operated within the fuel assembly during reactor operation such as those listed above are also considered to be authorized CCs. The cladding materials for the CCs include stainless steel, nickel based alloys such as Inconel, zirconium based alloys such as Zircaloy, M5, or Zirlo. The internal component materials include non-fuel materials like Inconel, B_4C, Ag-In-Cd, Al_2O_3, etc.*

Reconstituted assemblies containing up to 10 replacement irradiated stainless steel rods per assembly or an unlimited number of lower enrichment UO_2 rods, or Zr rods, or Zr pellets, or unirradiated stainless steel rods are acceptable for storage in 32PTH DSC as intact fuel assemblies with a slightly longer cooling time than that required for a standard assembly. The stainless steel rods are assumed to have two-thirds the irradiation time as the same irradiation history as the entire fuel assembly. The reconstituted rods can be at any location in the fuel assemblies. The maximum number of reconstituted fuel assemblies with irradiated stainless steel replacement rods per DSC is *4* and 32 for all other reconstituted fuel assemblies.

The NUHOMS® HD System is also authorized to store fuel assemblies containing Blended Low Enriched Uranium (BLEU) fuel material. Fuel pellets containing BLEU fuel material are no different than UO_2 fuel pellets except for the presence of a higher quantity of cobalt impurity. The consideration of cobalt impurity only affects the gamma source terms for fuel assemblies located in the DSC periphery. This does not affect any criticality, thermal or structural analysis inputs for evaluation of fuel assemblies with BLEU material. The qualification of fuel assemblies containing BLEU fuel pellets will require an additional cooling time of 2.5 years to ensure that the source terms calculated with UO_2 material are bounding.

Some versions of Westinghouse WE 15x15 and WE 17x17 class fuel assemblies, fabricated with 304 stainless steel guide tube sleeves, have been found to be susceptible to Intergranular Stress Corrosion Cracking (IGSCC). This corrosion may potentially result in failure of the bulge joints that connect the top nozzle to the guide tubes when the fuel assembly is lifted [18]. Therefore, the fuel assemblies fabricated with these sleeves risk top nozzle separation from the assembly when moved or lifted for loading/unloading into or out of the DSC using the standard fuel handling tools and procedures.

A resolution for this issue is to install a Westinghouse designed component called the Instrument Tube Tie Rod (ITTR) in each of these fuel assemblies. The ITTR consists of a long stainless steel tube inserted into the instrument tube, through the top nozzle and extends through the bottom nozzle. The bottom portion of the ITTR is fitted with an expanding tip that secures it to the bottom nozzle. The top end of the ITTR extending above the top nozzle is threaded to accept a locknut that, when installed, ties the top and bottom nozzles together. The ITTR is designed to be capable of carrying the entire weight of the fuel assembly during handling.

As noted in the NEI Letter to the NRC [18], the ITTR hardware does not need to be explicitly listed in the cask's "Approved Contents" in the CoC and a revision to the "Approved Contents" in the CoC is not necessary because they are non-separable constituent hardware, integral to the fuel assembly. TN has reviewed the addition of ITTRs to WE 15x15 and WE 17x17 fuel assemblies and determined that all the requirements specified in [18] for this change are met. 72.48

The addition of ITTRs to the WE 15x15 and WE 17x17 fuel assemblies does not alter any of the physical characteristics (unirradiated length, MTU/assembly, number of fuel rods and number of guide/instrument tubes) as listed in Table 2-1.

The NRC has reviewed closure form I-10-01 [18] and determined, as documented in the NRC Letter to the NEI [20], that it accurately documents the resolution of the RIRP Top Nozzle SCC Issue [18].

Structural, thermal, shielding and criticality analysis of the addition of ITTRs to the WE 15x15 and WE 17x17 fuel assemblies is provided in Sections 3.6, 4.6, 5.1 and 6.3, respectively.

The 32PTH DSC may store up to 32 PWR fuel assemblies arranged in accordance with a heat load zoning configuration as shown in Figure 2-1, with a maximum decay heat of 1.5 kW per assembly and a maximum heat load of 34.8 kW per DSC, (33.8 kW per DSC for CE 14x14).

Table 2-2B

For Assembly Average Initial Enrichment Greater Than or Equal to 1.50 wt. % U-235

For an assembly average initial enrichment greater than or equal to 1.50 *wt. % U-235*, the equation shown below to calculate the decay heat shall be employed. Table 2-2D provides example tables, which may be used at the discretion of the user, to verify the proper use of the equation.

The Decay Heat (DH) in watts is expressed as:

$$F1 = A + B*X1 + C*X2 + D*X1^2 + E*X1*X2 + F*X2^2$$
$$DH = F1*Exp(\{[1-(5/X3)]*G\}*[(X3/X1)^H]*[(X2/X1)^I])$$

where,

- F1 Intermediate Function
- X1 Assembly *Average* Burnup in GWd/MTU
- X2 Assembly Average Initial Enrichment in wt. % U-235 *(1.5 ≤ X2 ≤ 5.0)*
- X3 Cooling Time in Years (min*imum* 5 yrs)

A=13.69479	B= 25.79539	C= -3.547739	D= 0.307917	E= -3.809025
F= 14.00256	G= -0.831522	H= 0.078607	I= -0.095900	

- *When irradiated stainless steel rods are present in the reconstituted fuel assembly, the decay heat is calculated with using an X3 value, which corresponds to the actual cooling time minus 1 year. This restriction is applicable only when the cooling time of the reconstituted fuel assembly is less than 10 years. This fuel assembly is qualified if X3 is greater than 5 years. Further, this calculated decay heat shall be employed to determine the applicable Heat Load Zone shown in Figure 2-1.*
- *For a fuel assembly containing BLEU fuel material, the decay heat is calculated using an X3 value, which corresponds to the actual cooling time of BLEU fuel minus 2.5 years. This fuel assembly is qualified if X3 is greater than 5 years. Further, this calculated decay heat shall be employed to determine the applicable Heat Load Zone shown in Figure 2-1.*
- *The calculated decay heat with actual cooling time shall be employed to determine the total heat load of the DSC as shown in Figure 2-1.*
- *Any fuel assembly that is qualified from a thermal standpoint is also qualified from a radiological standpoint.*
- *Any fuel assembly with a burnup and enrichment combination that is encompassed by that specified in Table 2-2A is qualified from a radiological standpoint.*
- *The qualification of fuel assemblies with assembly average initial enrichment between 0.2 wt. % U-235 and 1.5 wt. % U-235 as a function of burnup and cooling time is specified in Table 2-2C.*

Table 2-2C
For Assembly Average Initial Enrichment Less Than 1.50 wt. % U-235

For an assembly average initial enrichment less than 1.5 wt. % U-235, the following qualification shall be employed.

Assembly Average Initial **Enrichment Range** *(wt. % U-235)*	**Maximum Assembly** *Average Burnup* **(GWd/MTU)**	**Cooling Time (Years)**	**Decay Heat (Watts)**
$0.7 \leq X2 < 1.5$	32	5	1100
	32	6	900
	32	7	780
	32	10	620
$0.3 \leq X2 < 0.7$	25	5	970
	25	6	800
	25	7	690
	25	10	540
$0.2 \leq X2 < 0.3$	20	5	652

Notes:

1. For an assembly average enrichment between 0.2 and 0.3 wt. % U-235, fuel assemblies with *an average* burnup below 20 GWd/MTU and a cooling time greater than 5 years are qualified for storage anywhere in the basket.
2. For an assembly average enrichment between 0.3 and 0.7 wt. % U-235, fuel assemblies with *an average* burnup below 25 GWd/MTU and a cooling time greater than 6 years are qualified for storage anywhere in the basket.
3. For an assembly average enrichment between 0.7 and 1.5 wt. % U-235, fuel assemblies with *an average* burnup below 32 GWd/MTU and a cooling time greater than 7 years are qualified for storage anywhere in the basket.
4. *For fuel assemblies containing BLEU fuel material, the cooling time used in the table corresponds to the actual cooling time of BLEU fuel minus 2.5 years. For example, an assembly average enrichment between 0.7 and 1.5 wt. % U-235 containing BLEU fuel material, fuel assemblies with an assembly average burnup below 32 GWd/MTU and a cooling time greater than 7.5 years, the maximum decay heat is less than or equal to 1100 Watts.*

APPENDIX 4.16.2

The entire contents of Appendix 4.16.2 is proprietary and the information is withheld pursuant to 10 CFR 2.390