72-1026

BNFL Fuel Solutions

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July 16, 2001
BFS/NRC-01-011
Docket No. 72-1026
File No. CMPC.0006.2

Director, Office of Nuclear Material Safety and Safeguards
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: **Storage License Amendment Request for the FuelSolutions™ System Response to Request for Additional Information (TAC No. L23296)**

Reference: Letter from USNRC to BNFL Fuel Solutions, "Request for Additional Information for the FuelSolutions™ Spent Fuel Management System Amendment," dated May 18, 2001

Dear Sir or Madam:

This letter transmits the responses to the request for additional information (RAI) (provided via the reference letter) on the storage license amendment request (LAR) for the FuelSolutions™ W74 Canister (LAR 01-02). This LAR requests certain specific changes to the FuelSolutions™ W74 Canister Technical Specifications related to the storage and transfer of the W74 Canister, and has been revised to respond to requests made in the RAI. A summary of the changes and the bases for the changes are provided in the Summary of Changes included in the revised LAR.

The RAI responses and additional clarifications are attached. Enclosed are 10 copies of Revision 1 of the LAR, including the Summary of Changes, change pages to the FSAR Chapter 4, and change pages to the Technical Specifications and associated Bases. Also enclosed is a copy of supporting calculation CMPC.1505.400 Revision 5.

The enclosed calculation contains commercial strategic information proprietary to BFS and customarily held in confidence. In conformance with 10 CFR Section 2.790, an affidavit is enclosed, setting forth the basis on which the identified proprietary information may be withheld from public disclosure. Accordingly, it is respectfully requested that the subject information, which is proprietary to BFS, be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

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Should you or any member of your staff have any questions, please contact the undersigned at (831) 430-5220.

Sincerely,

Robert D. Quinn, P.E.
Manager of Operations

Attachments

Enclosures
1. LAR 01-02 Revision 1 (10 copies)
2. Affidavit pursuant to 10 CFR 2.790
3. Calculation CMPC.1505.400 Revision 5 (proprietary)

cc:

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27780 Blue Star Memorial Highway
Covert, MI 49043

Mr. Michael Bourassa
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Responses to Request for Additional Information for FuelSolutions™ LAR 01-02

Chapter 12 – Operating Controls and Limits

12-1 For LCO 3.3.2 and LCO 3.3.3, provide analyses and/or test results that demonstrate that a canister may be kept in the transfer cask for an indefinite period of time.

Both of these requests propose changing "return CANISTER to the fuel building and remove all fuel assemblies" to "Return CANISTER to the TRANSFER CASK" without any restrictions on the length of time the canister can remain in the transfer cask, hence making the transfer cask a "de facto" storage cask. Calculation Package No. CMPC.1505.400, Revision 4, Table 6-12 indicates that the maximum allowable fuel cladding temperature ("long term") is exceeded for normal transfer and normal hot transfer scenarios.

Regulatory Basis: 10 CFR 72.236(f) requires that storage casks must be designed to provide adequate heat removal capacity without active cooling systems.

BFS Response to 12-1

BFS has revised Calculation Package CMPC.1504.400 to calculate the temperatures for the W74 canister heat load limit of 24.8 kW. The resulting temperatures demonstrate that the BRP canister can be placed into the transfer cask under steady state conditions and maintain temperatures within acceptable values, including maintaining cladding temperatures for normal transfer and normal hot transfer conditions below the long term cladding allowable temperature. Also, it should be noted that the peak cladding temperature for the off-normal hot transfer condition for the canister inside the transfer cask (388.7°C) is bounded by that for the canister inside the storage cask (395.8°C). Therefore, it is demonstrated that a W74 canister loaded with BRP design basis fuel can be placed into the transfer cask for an indefinite period of time while satisfying the applicable long term cladding temperature limits for storage. Table 4.4-6 of the W74 FSAR has been revised accordingly

Note that it is not intended that the transfer cask be used as a "de facto" storage cask. As such, a final action to return the canister to the storage cask has been added to the required actions for LCO 3.3.2 and 3.3.3 (see response to RAI 12-2 below).

**Responses to
Request for Additional Information
for FuelSolutions™ LAR 01-02**

12-2 For LCO 3.3.2 and LCO 3.3.3, provide examples of compensatory measures that will be available to address system problems during canister storage in the transfer cask "long term" or provide justification why these measures are not necessary.

The change request does not state what alternative measures will be available to handle a problem with the transfer cask / canister system after the spent fuel pool is decommissioned, nor does the request state why such measures are not necessary.

Regulatory Basis: 10 CFR 72.122(b)(2)(ii) requires that the design bases for structures, systems, and components must reflect "appropriate combinations of the effects of normal and accident conditions and the effects of natural phenomena."

BFS Response to 12-2

There are no anticipated problems with temporary storage of the canister in the transfer cask. The cask will be secured in the horizontal position in an appropriate location by the licensee, with a cask centerline height not exceeding 108 inches and a support base at least 131 inches wide (consistent with the licensing basis in FSAR Chapter 3), such as provided by the skid/trailer system. Further, as discussed in response to RAI 12-1 above, the long-term storage thermal limits are satisfied for the canister in the transfer cask for normal and off normal conditions. For accident and natural phenomena, the canister and transfer cask have been evaluated for the effects of loss of neutron shield and side drop accidents, and fire, tornado wind and missile, and earthquake. The transfer cask has been demonstrated to provide adequate protection of the canister for all of these events. Further, the transfer cask side drop evaluation bounds the effect of any tip over of the transfer cask on the skid and trailer, and as such the effects of flood velocity are bounded. The canister is evaluated for the external pressure due to the postulated flood and shown to be adequate (see Section 3.7.7 of the W74 FSAR). The licensee will address the storage of the canister in the transfer cask in their 72.212 evaluation for site-specific conditions, and will provide supplemental shielding as required to satisfy ALARA, ISFSI, and site boundary dose limits. Thus there is no event which would lead to a problem with the transfer cask / canister system during temporary storage in the transfer cask.

To provide further margin against the occurrence of an unforeseen circumstance, an additional Required Action has been added to LCO 3.3.2 and LCO 3.3.3. Specifically, B.3 of LCO 3.3.2 and C.2 of LCO 3.3.3 have been added with the Action: "Return CANISTER to repaired or replacement STORAGE CASK," and Completion Time: "270 days." The Bases are also modified accordingly.

**Responses to
Request for Additional Information
for FuelSolutions™ LAR 01-02**

12-3 In TS 2.1.1, Fuel to be Stored in the FuelSolutions™ W74 canister, provide additional clarification and details in what is meant by "any other non-fissile material object."

In accordance with 10 CFR 72.2, only power reactor spent fuel and other radioactive materials associated with spent fuel storage are authorized to be stored in a canister.

BFS Response to 12-3

The terminology "any other non-fissile material object" was intended to include any fuel assembly related item that displaces less water than a fuel rod. It was not intended to permit storage of any material not associated with the spent fuel assembly hardware. To clarify the intent, the terminology of TS 2.1.1, Table 2.1-3 (paragraph 2, 2nd sentence) is modified to read, "...or stainless steel rods, neutron source rods, or any similar non-fissile fuel assembly component that displaces less water ..." This clarifying sentence has also been added to Table 2.1-4 (paragraph 1, 3rd sentence).

Additional Clarifications for FuelSolutions™ LAR 01-02

Revision of Change to LCO 3.3.2 Related to Thermocouple Call Out and Associated Temperature

LAR 01-01 included changes to LCO 3.3.2, specifically changing the reference to the thermocouple used for temperature monitoring from the liner thermocouple to the cask (i.e. mid-wall) thermocouple. This change was made to be consistent with the value that was specified in the LCO, which is the cask concrete mid-wall temperature as reported in FSAR Section 4.4, Table 4.4-2, Table 4.4-3 and Table 4.5-1. However, as noted in Section 2.4.3.2 of the Storage System FSAR, "the liner thermocouple is used to directly monitor concrete temperatures during dry storage. The mid-thickness thermocouple provides additional concrete temperature monitoring capability, should it be necessary. The *technical specifications* for monitoring cask temperatures using the liner thermocouple are contained in Section 12.3 of this FSAR."

While it is technically adequate to use the mid-wall thermocouple temperature to monitor cask thermal performance, the liner thermocouple will react more quickly to changes in thermal conditions. Thus, it is appropriate to change LCO 3.3.2 to indicate that the liner thermocouple should be used (as originally indicated) and change the temperatures to match that at the liner location. Thus, LCO 3.3.2 is revised to read, "The temperature of a STORAGE CASK with a W74 CANISTER containing fuel assemblies, as indicated by the liner thermocouple, shall meet the following limits: (a) The measured temperature shall not exceed 163°F (73°C) under normal ambient conditions (average ambient temperature up to 100°F (38°C)); (b) The measured temperature shall not exceed 192°F (89°C) under off-normal ambient conditions (average ambient temperature up to 125°F (52°C))."

Also, Section 4.4.1.10 and Tables 4.4-2, 4.4-3 and 4.5-1 of the W74 FSAR are revised to report the liner thermocouple temperature. For consistency with these revised tables, FSAR Table 4.6-1 has been editorially revised to call out the liner thermocouple. SR 3.3.3.1 of LCO 3.3.3 has also been editorially revised for clarity and consistency.

AFFIDAVIT PURSUANT TO 10 CFR 2.790

State of California)
) SS.
County of Santa Cruz)

I, Robert D. Quinn, depose and say as follows:

(1) I am Manager of Operations of BNFL Fuel Solutions Corporation (BFS), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been duly authorized to apply for its withholding.

(2) The information sought to be withheld is contained in calculation CMPC.1505.400. This document has been appropriately designated as proprietary.

(3) I have personal knowledge of the criteria and procedures used by BFS in designating information as trade secret, privileged, or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of 10 CFR 2.790, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, including the information as designated in paragraph (2) above, should be withheld.

(i) The information sought to be withheld from public disclosure is included in the report documenting information regarding nuclear fuel design, properties, and data which is owned and has been held in confidence by BFS.

(ii) The information of a type customarily held in confidence by BFS and not customarily disclosed to the public. BFS has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes BFS policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

a. The information reveals the distinguishing aspects of a process or component, structure, tool, method, etc., and the prevention of its use by BFS' competitors, without license from BFS, gives BFS a competitive economic advantage.

b. The information consists of supporting data (including test data) relative to a process or component, structure, tool, method, etc. and gives BFS a competitive economic advantage, e.g., by optimization or improved marketability.

c. The information, if used by a competitor, would reduce the competitor's expenditure of resources or improve the competitor's advantage in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

d. The information reveals cost or price information, production capacities, budget levels, or commercial strategies of BFS, its customers or suppliers.

e. The information reveals aspects of past, present, or future BFS or customer funded development plans and programs of potential commercial value to BFS.

f. The information contains patentable ideas, for which patent protection may be desirable.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked and being transmitted by BFS to the Document Control Desk. The proprietary information has been presented to the Nuclear Regulatory Commission and is being voluntarily provided by BFS.

(vi) Public disclosure of the information is likely to cause substantial harm to the competitive position of BFS because:

(i) Similar products are manufactured and sold by competitors of BFS.

(ii) The development of this information by BFS is the result of a significant expenditure of staff effort and a considerable sum of money. To the best of my knowledge and belief, a competitor would have to undergo similar effort and expense in generating equivalent information.

(iii) In order to acquire such information, a competitor would also require considerable time and inconvenience related to the development of a design of a canister-based spent fuel storage and transportation system.

(iv) The information consists of design, analysis and fabrication of a transportable spent fuel storage system, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with BFS, take marketing or other actions to improve their product's position or impair the position of BFS' product, and avoid developing fabrication data in support of their processes, methods, and/or apparatus.

(v) In pricing BFS' products and services, significant research, development, engineering, analytical, licensing, fabrication, quality assurance and other costs must be included. The ability of BFS' competitors to utilize such

information without similar expenditure of resources may enable them to sell their product at prices reflecting significantly lower costs.

Further the deponent sayeth not.

Robert D. Quinn
Manager of Operations
BNFL Fuel Solutions Corporation

Subscribed and sworn before me this 16th day of July, 2001.

Rosemarie C. Esponilla
Notary Public

ROSEMARIE C. ESPONILLA
Comm. # 1244720
NOTARY PUBLIC-CALIFORNIA
Santa Cruz County
My Comm. Expires Dec. 5, 2003

FuelSolutions™ Storage System License Amendment Request

LAR 01-02, Revision 1
July 2001

C of C Reference: WSNF-203 System

Docket No. 72-1026

Prepared by:

BNFL Fuel Solutions Corporation
Scotts Valley, California

TABLE OF CONTENTS

Tab 1

Summary of Changes

FuelSolutions™ Spent Fuel Storage System

C of C Number 72-1026

LAR 01-02, Revision 1

Summary of Changes (3 pages)

Item	Section	Description	Basis
1	4.4.1.10, last para.	Change the temperature to correspond to the value for the limiting 24.8 kW heat load.	This is an editorial correction to use the lower temperature limit associated with the limiting heat load for the W74 canister.
2	Table 4.4-2 Table 4.4-3 Table 4.5-1	Change the temperatures reported for Cask Thermocouple to the Liner Thermocouple temperatures.	Per Section 2.4.3.2 of the Storage System FSAR, the liner thermocouple is to be used to monitor concrete temperatures. The mid-wall temperatures were listed in the table and also used in LCO 3.3.2 (see Item 4).
3	Table 4.4-6	Revise the peak fuel rod cladding temperatures to correspond to the W74 canister heat load limit of 24.8 kW.	This change provides a reporting of the peak fuel rod cladding temperatures consistent with other tables for normal and off-normal conditions, and shows that the cladding temperatures in the transfer cask remain below the long term cladding allowable temperatures.
4	Table 4.6-1	Change the callout from Cask Thermocouple to Liner Thermocouple.	This is an editorial correction to clarify the location of the reported temperatures, consistent with the change in Item 2.
5	TS 2.1.1	Change the description of the other non-fissile material permitted to be in the fuel assembly.	This clarification is provided to assure compliance with 10 CFR 72.2.

FuelSolutions™ Spent Fuel Storage System

C of C Number 72-1026

LAR 01-02, Revision 1

Summary of Changes (3 pages)

Item	Section	Description	Basis
6	LCO 3.3.2	In LCO 3.3.2, change the temperatures to correspond the liner thermocouple.	The mid-wall temperatures were incorrectly used in the LCO for normal and off-normal conditions. The purpose of this change is to correct the monitored temperature to correspond to the specified thermocouple location.
7	LCO 3.3.2	Change required action B.2 from "Return CANISTER to the fuel building and remove all fuel assemblies" to "Return CANISTER to TRANSFER CASK." Add required action B.3, "Return CANISTER to repaired or replacement STORAGE CASK" with a completion time of 270 days.	The original Action was based on the availability of a spent fuel pool. This basis is not supportable for decommissioning facilities such as Big Rock Point. As such, it is proposed that an alternative mitigating action be performed. Retrieval of the canister into the transfer cask provides an adequate mitigating action, as the transfer cask is shown in Chapter 4 of the FSAR to provide adequate cooling for the canister. As such, this mitigation precludes the need for a spent fuel pool. To assure that the canister is returned to a storage cask for continued long term storage, an action is added to require placing the canister into a repaired or replacement storage cask.

FuelSolutions™ Spent Fuel Storage System

C of C Number 72-1026

LAR 01-02, Revision 1

Summary of Changes (3 pages)

Item	Section	Description	Basis
8	LCO 3.3.3	Change required action C.1 from "Return CANISTER to the fuel building and remove all fuel assemblies" to "Return CANISTER to TRANSFER CASK." Add required action C.2, "Return CANISTER to repaired or replacement STORAGE CASK" with a completion time of 270 days.	See discussion under Item 7.
9	B3.3.2	Under ACTIONS, add "-B3" after B1 and revise discussion in accordance with Item 7.	The revised discussion reflects the revised Action, as discussed under Item 7.
10	B3.3.3	Under ACTIONS, add "-C2" after C1 and revise discussion in accordance with Item 8.	The revised discussion reflects the revised Action, as discussed under Item 8.

Tab 2

W74 FSAR Change Pages

The canister cavity helium pressure of 9.3 psig (24 psia) is conservatively assumed for heat transfer analyses under normal hot storage conditions. As discussed above, during canister closure operations, the canister is back-filled with helium in order to achieve 10 psig under normal hot storage conditions with 1% rod failures. The canister shell design, fabrication, inspection, and closure processes ensure that the canister does not leak as discussed in Section 7.1 of this FSAR. A helium loss at the allowable canister leak rate over the entire 100 year storage life does not significantly reduce the canister cavity pressure or adversely impact heat transfer.

4.4.1.9 Maximum Thermal Stresses

FuelSolutions™ W74 canister maximum thermal stresses developed within the storage cask under normal conditions are addressed in Chapter 3. Calculation of these thermal stresses is based on the maximum canister structure heat load of 26.4 kW, and is conservative (bounding) for the actual canister heat rating of 24.8 kW.

4.4.1.10 Evaluation of Canister Performance for Normal Conditions

The results of the steady-state analyses demonstrate that the storage cask allowable material temperatures under normal conditions are met for the maximum canister thermal rating, as presented in Table 4.4-1. Over the long-term storage period the spent fuel decay heat decreases, thus increasing the margins relative to the allowable temperatures. Therefore, the W74 canister is suitable for the dry storage of Big Rock Point BWR fuel within the FuelSolutions™ W150 Storage Cask.

Table 4.4-4 presents the summary of canister pressures for normal conditions of storage. As seen from the table, the canister pressurization for normal conditions of storage are within the design allowables.

The W74 canister heat balance under normal hot storage conditions and the maximum heat load rating (Q_{max}) is presented schematically in Figure 4.4-16. As can be seen, heat input to the storage cask is from spent fuel decay heat (26.4 kW, based on the canister structural heat load rating) and solar (3.03 kW on top, 2.86 kW on sides). Most of the heat is lost to natural convection air flow (24.46 kW) with the remaining heat lost through the storage cask to ambient through natural convection (1.45 kW for top, 2.16 kW from sides) and radiation (1.86 kW from top, 2.35 kW from sides).

The storage cask liner thermocouple reading (163°F) under normal hot storage conditions with the design basis W74 canister loaded is used as the basis for establishing the *technical specification* for normal daily temperature monitoring, contained in Section 12.3 of this FSAR.

Table 4.4-1 - W74 Canister Thermal Rating in Storage Cask

Applicable Fuel Group	Axial Heat Profile	Q_{max} (kW)	$LHGR_{max}$ (kW/in)
Big Rock Point BWR Fuel	Max Thermal	24.8	0.216
	Max Thermal Gradient	N/A	N/A
	Thermal Rating	**24.8**	**0.216**
W74 Canister Structure Thermal Rating		26.4	0.230
Storage Cask Thermal Rating		28.0	0.253

Table 4.4-2 - W74 Canister System Temperature at Q_{max} in Storage Cask

Component	Component Maximum Temperature (24.8 kW)	Component Maximum Temperature (26.4 kW)	Max. Allowable Temperature
Peak Fuel Rod Cladding	384.6°C	399.8°C	385.5°C
Guide Tube	690°F	716°F	800°F
Spacer Plates:			
Stainless Steel	488°F	506°F	800°F
Carbon Steel	673°F	699°F	700°F
Engagement Plate	431°F	445°F	800°F
Support Tube	563°F	584°F	800°F
Helium Bulk	495°F	513°F	N/A
Canister Shell	431°F	445°F	800°F
Max. Concrete	175°F	176°F	200°F
Liner Thermocouple(1)	163°F	166°F	N/A

Note:

(1) Estimated thermocouple reading for analyzed condition.

Table 4.4-3 - Maximum W74 Canister System Temperature at Q_{max} for Storage[1]

Component	Case 5 Normal Storage[1]	Case 6 Normal Cold Storage[2]	Case 7 Normal Hot Storage[1]	Allowable Temperature
Peak Fuel Rod Cladding	373.7°C	353.2°C	384.6°C	385.5°C
Guide Tube	668°F	627°F	690°F	800°F
Spacer Plates:				
Stainless Steel	466°F	408°F	488°F	800°F
Carbon Steel	652°F	608°F	673°F	700°F
Engagement Plate	408°F	346°F	431°F	800°F
Support Tube	540°F	485°F	563°F	800°F
Helium Bulk	473°F	415°F	495°F	n/a
Canister Shell	407°F	337°F	431°F	800°F
Max. Concrete	150°F	49°F	175°F	200°F
Liner Thermocouple[3]	136°F	41°F	163°F	n/a
Reference Results From Table 4.4-7 of the FuelSolutions™ Storage System FSAR				
Canister Shell[4]	*423°F*	*337°F*	*447°F*	
Max. Concrete[4]	*169°F*	*61°F*	*197°F*	
Liner Thermocouple[3,4]	*150°F*	*48°F*	*179°F*	

Notes:

(1) Except as noted, temperatures are based on a heat load of 24.8 kW.
(2) Temperatures based on a heat load of 26.4 kW.
(3) Estimated thermocouple reading for analyzed condition.
(4) Temperatures based on heat load of 28 kW.

Table 4.4-6 - W74 System Temperatures for Normal Transfer[1]

Component	Case 13 Normal Transfer	Case 14 Normal Cold Transfer	Case 15 Normal Hot Transfer	Material Allowable[4]
Peak Fuel Rod Cladding[6]	379.0°C	362.2°C	383.6C	400°C
Guide Tube	705°F	673°F	714°F	800°F
Spacer Plates:				
Stainless Steel	652°F	617°F	661°F	800°F
Carbon Steel	693°F	658°F	700°F	700°F
Engagement Plate	496°F	459°F	506°F	800°F
Support Tube	674°F	641°F	683°F	800°F
Helium Bulk Temp.	581°F	544°F	591°F	n/a
Canister Shell	533°F	497°F	543°F	800°F
Cask Inner Shell	323°F	277°F	336°F	800°F
Cask Lead Shield	319°F	273°F	332°F	620°F
Cask Outer Shell	233°F	172°F	249°F	800°F
Liquid Neutron Shield	216°F	154°F	233°F	293°F
Neutron Shield Pressure	16.1 psia	14.6 psia	22.1 psia	60 psia[5]
Cask Thermocouple[2]	225°F	165°F	242°F	n/a
Reference Results From Table 4.4-11 of the FuelSolutions™ Storage System FSAR				
Cask Lead Shell[3]	*332°F*	*281°F*	*345°F*	
Cask Thermocouple[2,3]	*240°F*	*180°F*	*257°F*	

Notes:

(1) Except as noted, temperatures are based on a heat load of 26.4 kW.
(2) Estimated thermocouple reading for analyzed condition.
(3) Temperatures based on heat load of 28 kW.
(4) Canister allowable temperatures are from Table 4.3-1 of this FSAR. Transfer cask material allowable temperatures are from Table 4.3-2 of the FuelSolutions™ Storage System FSAR.
(5) Neutron shield allowable pressure is from Table 2.0-1 of the FuelSolutions™ Storage System FSAR.
(6) Temperatures based on heat load of 24.8 kW.

Table 4.5-1 - Maximum W74 Canister System Temperature at Q_{max} for Storage[1]

Component	Case 8 Off-Normal Cold Storage	Case 9 Off-Normal Hot Storage	Case 13b[2] Horizontal Unloading, Initial/Peak[3]	Material Allowable[4]
Peak Fuel Rod Cladding	334.2°C	395.8°C[5]	389.5°C / 391.5°C	400°C
Guide Tube	589°F	738°F	697°F / 707°F	800/1000°F
Spacer Plates:				
Stainless Steel	367°F	529°F	484°F / 623°F	800/1000°F
Carbon Steel	571°F	721°F	679°F / 698°F	700/1000°F
Engagement Plate	305°F	469°F	423°F / 422°F	800/1000°F
Support Tube	444°F	608°F	562°F / 670°F	800/1000°F
Helium Bulk	375°F	536°F	491°F / 563°F	n/a
Canister Shell	291°F	471°F	422°F / 550°F	800/1000°F
Max. Concrete	3°F	208°F	153°F / 200°F	350°F
Liner Thermocouple[6]	-5°F	192°F	139°F / 185°F	n/a
Reference Results From Tables 4.4-7 and 4.5-2 of FuelSolutions™ Storage System FSAR				
Canister Shell[7]	*290°F*	*473°F*	*423°F / 662°F*	
Max. Concrete[7]	*12°F*	*228°F*	*169°F / 348°F*	
Liner Thermocouple[6,7]	*0°F*	*210°F*	*150°F / 312°F*	

Notes:

(1) Except as noted, temperatures are based on a heat load of 26.4 kW.

(2) *Technical specification* will prevent steady-state canister temperatures from occurring for case 13b (horizontal storage cask unloading).

(3) Peak temperatures taken from 9.5 hour point in the transient analysis.

(4) Short-term steel allowable temperatures apply for cases 8 and 9. Mitigating actions are required prior to exceeding long-term allowable temperatures for case 13b (see Section 12.3 of this FSAR). Canister allowable temperatures are from Table 4.3-1 of this FSAR. Storage cask material allowable temperatures are from Table 4.3-1 of the FuelSolutions™ Storage System FSAR

(5) Peak fuel cladding temperatures, and liner thermocouple temperature for Case 9, based on a canister heat load of 24.8 kW; all other canister component temperatures assume a heat load of 26.4 kW.

(6) Estimated thermocouple reading for analyzed condition.

(7) Temperatures based on heat load of 28 kW.

Table 4.6-1 - W74 Canister System Temperature for All Vents Blocked[1]

Component	Case 11 All Vents Blocked, Initial/Peak[2]	Material Allowable Temperature[5]
Peak Fuel Rod Cladding	389.5°C / 506.3°C	570°C
Guide Tube	697°F / 919°F	1000°F
Spacer Plates:		
Stainless Steel	484°F / 724°F	1000°F
Carbon Steel	679°F / 903°F	1000°F
Engagement Plate	423°F / 665°F	1000°F
Support Tube	562°F / 804°F	1000°F
Helium Bulk	491°F / 728°F	n/a
Canister Shell	422°F / 685°F	1000°F
Max. Concrete	153°F / 350°F	350°F
Liner Thermocouple[3]	139°F / 340°F	n/a
Reference Results From Table 4.4-7 and 4.6-2 of the FuelSolutions™ Storage System FSAR		
Canister Shell[4]	*423°F /644°F*	
Max. Concrete[4]	*169°F/349°F*	
Liner Thermocouple[3,4]	*150°F/334°F*	

Notes:

(1) Except as noted, temperatures are based on a heat load of 26.4 kW.

(2) Peak temperature taken from the 58 hour point in the transient analysis.

(3) Estimated thermocouple reading for analyzed condition.

(4) Temperatures based on heat load of 28 kW.

(5) Canister allowable temperatures are from Table 4.3-1 of this FSAR. Storage cask material allowable temperatures are from Table 4.3-1 of the FuelSolutions™ Storage System FSAR.

Tab 3

Technical Specification Change Pages

Table 2.1-3
FuelSolutions™ W74 Loading Specification W74-3

W74-3 Payload Configuration Parameter	Partial UO_2 Fuel Assemblies Limit/Specification
Payload Description:	≤ 64 Big Rock Point BWR partial UO_2 fuel assemblies, as defined in Table 2.1-7. Partial fuel assemblies are defined as those assemblies having one or more rods missing from the design basis assembly array. The empty array locations may contain nothing, partial length rods, hollow zircaloy or stainless steel rods, neutron source rods, or any similar non-fissile fuel assembly component that displaces less water than a design fuel rod. Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1, W74-2, and W74-4 through W74-6, subject to the limitations of those specifications. If less than 64 total fuel assemblies are loaded, a dummy fuel assembly shall be placed into each empty CANISTER basket guide tube. Each dummy fuel assembly shall be the approximate weight and size of the actual fuel being loaded.
Cladding Material/Condition:	Zircaloy cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Initial Enrichment(1):	3.55 w/o ^{235}U (missing array interior or edge rods - 9x9) 3.6 w/o ^{235}U (missing array interior or edge rods - 11x11)
Burnup:	≤ 40,000 MWd/MTU.
Cooling Time:	≥ 3.0 years. The minimum acceptable cooling time varies by fuel assembly class and enrichment, as a function of burnup; and is also dependent on the total cobalt content of the fuel and control components. The effects of the maximum acceptable decay heat, initial uranium content, and gamma and neutron sources are incorporated into the minimum cooling time determination. Fuel assemblies shall not be stored with less than the minimum acceptable cooling time indicated in Table 2.1-9.

Note: (1) Defined as lattice average enrichment.

Table 2.1-4
FuelSolutions™ W74 Loading Specification W74-4

W74-4 Payload Configuration Parameter	Partial MOX Fuel Assemblies Limit/Specification
Payload Description:	≤ 64 Big Rock Point BWR partial MOX fuel assemblies, as defined in Table 2.1-8. Partial fuel assemblies are defined as those assemblies having one or more rods missing from the design basis assembly array. The empty array locations may contain nothing, partial length rods, hollow zircaloy or stainless steel rods, neutron source rods, or any similar non-fissile fuel assembly component that displaces less water than a design fuel rod. Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1 through W74-3, W74-5, and W74-6, subject to the limitations of those specifications. If less than 64 fuel assemblies are loaded, a dummy fuel assembly shall be placed into each empty CANISTER basket guide tube. Each dummy fuel assembly shall be the approximate weight and size of the actual fuel being loaded.
Cladding Material/Condition:	Zircaloy cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Initial Enrichment:	See Table 2.1-8
Burnup:	See Table 2.1-8
Cooling Time:	See Table 2.1-8

3.3 STORAGE CASK INTEGRITY

3.3.2 Storage Cask Temperatures During Storage

LCO 3.3.2 The temperature of a STORAGE CASK with a W74 CANISTER containing fuel assemblies, as indicated by the liner thermocouple, shall meet the following limits:

a. The measured temperature shall not exceed 163°F (73°C) under normal ambient conditions (average ambient temperature up to 100°F (38°C)).

b. The measured temperature shall not exceed 192°F (89°C) under off-normal ambient conditions (average ambient temperature up to 125°F (52°C)).

c. The differential temperature between two successive daily measurements shall not exceed the corresponding differential ambient temperature plus 83°F (46°C).

APPLICABILITY: During STORAGE OPERATIONS.

ACTIONS

NOTE

Separate Condition entry is allowed for each STORAGE CASK.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. STORAGE CASK concrete temperature exceeds the specified limit.	A.1 Administratively verify correct fuel loading.	24 hours
	AND	
	A.2 Visually check all STORAGE CASK inlet and outlet screens for debris blockage in accordance with LCO 3.3.1.	24 hours
	AND	
	A.3 Check the thermocouple and related instrumentation to assure they are functioning properly.	24 hours
	AND (continued)	

3.3.2 Storage Cask Temperatures During Storage

CONDITION	REQUIRED ACTION	COMPLETION TIME
	A.4 Repair or replace thermocouple and related instrumentation as necessary.	48 hours
	AND	
	A.5 Perform visual inspection of the STORAGE CASK vent channels by removing the debris screens and using visual aids as necessary. If no obstruction is found, the interior of the STORAGE CASK, including the guide rails and heat shield, is to be visually inspected for ventilation obstructions using remote inspection tools or by temporarily removing the STORAGE CASK top cover.	48 hours
B. Required Actions and associated Completion Times are not met.	B.1 Initiate actions to cool the cask to within the limit.	96 hours
	AND	
	B.2 Return CANISTER to TRANSFER CASK.	30 days
	AND	
	B.3 Return CANISTER to repaired or replacement STORAGE CASK.	270 days

3.3.2 Storage Cask Temperatures During Storage

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.2.1	Verify that the STORAGE CASK temperatures are within limit.	24 hours
	NOTE Daily cask temperatures can be expected to vary slightly due to changes in the ambient temperature. This is acceptable as long as the temperatures remain within the specified limit.	

3.3 STORAGE CASK INTEGRITY

3.3.3 Storage Cask Temperatures During Horizontal Transfer

LCO 3.3.3 The measured temperature of a STORAGE CASK with a W74 CANISTER containing fuel assemblies, as indicated by the liner thermocouple, shall not exceed 185°F (85°C).

APPLICABILITY: During TRANSFER OPERATIONS.

ACTIONS

NOTE

Separate Condition entry is allowed for each STORAGE CASK.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. STORAGE CASK concrete temperature limit is not met.	A.1 Transfer the CANISTER into the TRANSFER CASK.	24 hours
B. Required Actions and associated Completion Times are not met.	B.1 Inspect the STORAGE CASK for damage.	5 days
	B.2.1 If no damage, transfer CANISTER to STORAGE CASK.	7 days
	OR	
	B.2.2 If damaged, transfer CANISTER to new STORAGE CASK.	21 days
C. Required Actions and associated Completion Time are not met.	C.1 Return CANISTER to TRANSFER CASK.	30 days
	AND	
	B.3 Return CANISTER to repaired or replacement STORAGE CASK.	270 days

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.3.1	After the STORAGE CASK is downended to the horizontal orientation, monitor and record STORAGE CASK concrete temperature as indicated by the STORAGE CASK liner thermocouple.	30 minutes

Tab 4

Bases Change Pages

B 3.3 STORAGE CASK INTEGRITY

B 3.3.2 Storage Cask Temperatures During Storage

BASES

BACKGROUND	After placement on the ISFSI pad, the heat from the fuel assemblies within the CANISTER is removed by air flowing past the CANISTER, entering in the inlet vents and exiting through the outlet vents in the STORAGE CASK. Monitoring of the STORAGE CASK concrete temperatures assures that the heat removal capability of the STORAGE CASK is not compromised.
APPLICABLE SAFETY ANALYSIS	The thermal analyses of the STORAGE CASK (Reference 1) and CANISTERs (Reference 2) result in STORAGE CASK concrete temperatures that correspond to the design basis conditions and configuration. Monitoring of the STORAGE CASK concrete temperature assures that the long-term concrete and fuel assembly cladding temperatures remain within allowable values. Temperatures not satisfying the limits may indicate a problem with the conditions or configuration which need to be corrected to maintain temperatures with acceptable values.
LCO	The specified temperature limits assure that the long-term storage cask concrete and fuel assembly cladding temperatures remain within allowable values. This assures long-term integrity of the STORAGE CASK concrete and the fuel assembly cladding.
APPLICABILITY	STORAGE CASK temperature monitoring is performed during STORAGE OPERATIONS.
ACTIONS	A note has been added to the Actions stating that a separate Condition entry is allowed for each STORAGE CASK. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each STORAGE CASK not meeting the LCO. Subsequent STORAGE CASKs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

(continued)

ACTIONS (continued)

A.1

If the indicated concrete temperature is greater than any of the specified limits, or if the concrete temperature rise exceeds the specified limits, then it is required to confirm that the CANISTER has been loaded with SNF assemblies that comply with the Functional and Operating limits of Section 2.0 of the W74 CANISTER Technical Specification.

Administrative verification of the fuel loading, by means such as video recordings and records of the loaded fuel assembly serial numbers, can establish whether a misloaded fuel assembly is the cause of the out-of-limit condition.

The Completion Time is sufficient to determine and correct most failure mechanisms.

A.2

All STORAGE CASK inlet and outlet vents and screens should be checked for debris blockage in accordance with LCO 3.3.2 of the FuelSolutions™ Storage System Technical Specification.

The Completion Time is sufficient to determine and correct most failure mechanisms.

A.3 - A.4

Another possible cause of exceeding the temperature limits is equipment malfunction. The thermocouple and related instrumentation should be checked to assure they are functioning properly, and repaired or replaced as necessary.

The Completion Time is sufficient to determine and correct most failure mechanisms.

(continued)

BASES

ACTIONS (continued)

A.5

Another possible cause of temperatures exceeding the limits is obstruction inside the vents or the cask. Visual inspection of the STORAGE CASK vent channels is performed by removing the debris screens and using visual aids as necessary. If no obstruction is found, the interior of the STORAGE CASK, including the guide rails and heat shield, should be visually inspected for ventilation obstructions using remote inspection tools or by temporarily removing the STORAGE CASK top cover.

The Completion Time is sufficient to determine and correct most failure mechanisms.

B.1 - B.3

If the temperature cannot be successfully reduced to within the specified limits by the above actions, then mitigating actions must be taken to cool the STORAGE CASK within the limits until other measures can be employed. The CANISTER can be retrieved to the TRANSFER CASK (which has been evaluated to maintain acceptable temperatures under steady state conditions). The licensee will temporarily store the CANISTER in the TRANSFER CASK in a horizontal configuration bounded by that analyzed in the FSAR, and will provide any supplemental shielding which may be determined necessary as the result of a site-specific evaluation conducted in accordance with 10 CFR 72.212. The CANISTER will be returned to a repaired or replacement STORAGE CASK for continued long term storage. The Completion Times are reasonable based on the time required to establish cooling actions and place the CANISTER into the TRANSFER CASK, and to return CANISTER to a repaired or replacement STORAGE CASK, in an orderly manner without challenging personnel.

SURVEILLANCE REQUIREMENTS

SR 3.1.2.1

The STORAGE CASK concrete temperatures are to be checked daily to provide adequate frequency to assure that temperatures remain within the specified limits and provide adequate time to initiate corrective actions.

REFERENCES

1. FuelSolutions™ Storage System SAR, Section 4.4.
2. FuelSolutions™ W74 Canister Storage SAR, Section 4.4.

B 3.3 STORAGE CASK INTEGRITY

B 3.3.3 Storage Cask Temperatures During Horizontal Transfer

BASES

BACKGROUND	When a STORAGE CASK with a CANISTER containing fuel assemblies is in the horizontal orientation, the natural convective air flow that cools the CANISTER is altered. The STORAGE CASK thermocouple temperature is correlated through analysis to the maximum concrete temperature near the liner/concrete interface. Assuring that the storage cask thermocouple temperature limit is not exceeded assures that the short-term allowable concrete temperature is not exceeded.
APPLICABLE SAFETY ANALYSIS	The basis for maintaining this STORAGE CASK temperature limit is the thermal analysis contained in Chapter 4 of the Storage System SAR (Reference 1). The specified temperature limit is correlated to the short-term allowable concrete temperature.
LCO	Limiting the concrete temperature during horizontal CANISTER TRANSFER OPERATIONS maintains the STORAGE CASK concrete temperatures within the design basis.
APPLICABILITY	Temperature monitoring is performed during horizontal TRANSFER OPERATIONS.
ACTIONS	A note has been added to the Actions stating that a separate Condition entry is allowed for each STORAGE CASK. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each STORAGE CASK not meeting the LCO. Subsequent STORAGE CASKs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. <u>A.1</u> If the STORAGE CASK concrete temperature limit is not met, then it is required to take action to reduce the STORAGE CASK concrete temperature. This may be accomplished by removing the CANISTER from the STORAGE CASK into the TRANSFER CASK. The Completion Time is adequate to perform this task.

(continued)

BASES

ACTIONS (continued)

B.1

The STORAGE CASK should be inspected for signs of damage to the concrete. The Completion time is adequate to perform the inspection and assessment.

B.2.1

If the STORAGE CASK is undamaged, it may be reused. The Completion Time is reasonable based on the time to complete the TRANSFER OPERATIONS.

B.2.2

If the STORAGE CASK is damaged, then it may not be used. A new STORAGE CASK will be required to store the CANISTER. The Completion Time is reasonable based on the time to complete the TRANSFER OPERATIONS.

C.1 - C.2

If the CANISTER cannot be placed into storage or retrieved from storage within the specified time, mitigating actions must be initiated. The CANISTER can be retrieved to the TRANSFER CASK (which has been evaluated to maintain acceptable temperatures under steady state conditions). The licensee will temporarily store the CANISTER in the TRANSFER CASK in a horizontal configuration bounded by that analyzed in the FSAR, and will provide any supplemental shielding which may be determined necessary as the result of a site-specific evaluation conducted in accordance with 10 CFR 72.212. The CANISTER will be returned to a repaired or replacement STORAGE CASK for continued long term storage. The Completion Times are reasonable based on the time required to place the CANISTER into the TRANSFER CASK, and to return CANISTER to a repaired or replacement STORAGE CASK, in an orderly manner without challenging personnel.

SURVEILLANCE REQUIREMENTS

The STORAGE CASK concrete temperature is to be checked every 30 minutes when the STORAGE CASK is in a horizontal orientation with a CANISTER containing fuel assemblies. The frequency of inspection assumes that temperatures remain within limits and provide adequate time to initiate corrective actions.

REFERENCES

1. FuelSolutions™ Storage System SAR, Section 4.5.