November 2017
Revision 17A

NAC-MPC

NAC Multi-Purpose Cask

MPC-LACBWR Technical Specification Changes

Non-Proprietary Version

Docket No. 72-1025

NAC INTERNATIONAL

Atlanta Corporate Headquarters: 3930 East Jones Bridge Road, Norcross, Georgia 30092 USA
Phone 770-447-1144, Fax 770-447-1797, www.nacintl.com

NAC INTERNATIONAL

Atlanta Corporate Headquarters
3930 East Jones Bridge Road, Suite 200
Norcross, GA 30092
Phone 770-447-1144
Fax 770-447-1797
www.nacintl.com

November 14, 2017

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Attn: Document Control Desk

Subject: Submission of a Request to Amend the U.S. Nuclear Regulatory Commission Certificate of Compliance No. 1025 for the NAC-MPC® Cask System

Docket No. 72-1025

References:
1. U.S. Nuclear Regulatory Commission (NRC) Certificate of Compliance (CoC) No. 1025 for the NAC International Multi-Purpose Cask (MPC) System, Amendment No. 6, October 18, 2010
2. NAC-MPC System Final Safety Analysis Report (FSAR), Revision 10, NAC International, January 2014

NAC International (NAC) hereby submits a request to revise Reference 1, Appendix A and associated bases presented in Reference 2. The following summarizes the changes requested:

1. Reference 1, Section A 3.1.6, "CONCRETE CASK Heat Removal System"
   a. Added a note indicating that LCO 3.1.6 and Surveillance Requirement (SR) 3.1.6.1 is not applicable to MPC-LACBWR canisters
2. Reference 1, Section A 5.3, "Surveillance After an Off-Normal, Accident, or Natural Phenomena Event"
   a. Deleted response surveillance since it is, in principle, covered by existing Limited Condition for Operations (LCO) surveillance requirements and frequencies
3. Reference 2, revised MPC-LACBWR drawing implementing a finer mesh inlet and outlet vent screen
4. Reference 2, Chapter 3, Section 3.A.4.4.3.3, first paragraph corrected a typo, added a second paragraph describing MPC-LACBWR evaluation with heat loads of 2.8 kW and no air flow in the cask annulus
5. Reference 2, Chapter 4, added new Section 4.A.4 "Thermal Evaluation of MPC-LACBWR with a Heat Load of 2.8 kW"
6. Reference 2, Chapter 4, moved reference section from 4.A.4 to Section 4.A.5
7. Reference 2, Chapter 9, Section 9.2 and 9.A.3.1, have been revised to remove the unnecessary response surveillance and reference to Section A 5.3.
8. Reference 2, Chapter 9, Section 9.A.3.1, added bullet to the top of Page 9.A.3-2, to visually inspect the inlet and outlet screens at part of the annual maintenance program

9. Reference 2, Chapter 12, page 12C3-19, LCO Bases 3.1.6 and SR3.1.6.1 were revised removing MPC-LACBWR from the applicability, actions, and surveillance requirements sections; and A.1 was revised to provide additional guidance for the intent of "immediate" actions (i.e., in the context of restoring the heat removal capabilities of the concrete cask).

The existing licensing basis for the MPC-LACBWR canister does not credit convective cooling of the canister when it is loaded into its concrete storage overpack. The only mode of heat transfer credited is radiative cooling of the canister shell to the concrete overpack inner steel liner. All canister, internals, and contents temperatures remain below allowables for all licensed conditions. However, the original analysis resulted in the concrete overpack marginally exceeding its allowable temperature limits. NAC addressed this by referencing the existing analysis for the CY-MPC concrete overpack which had a higher analyzed heat load and also credited convective cooling of the systems annulus region as justification that the MPC-LACBWR concrete overpack would not exceed its allowable temperatures limits during all storage conditions. Thus, the original licensing basis approved in 2010 for the MPC-LACBWR required convective cooling even though it was not needed for the MPC-LACBWR canister.

In an effort to eliminate the need for daily surveillances that verify the concrete cask heat removal system is operable for the MPC-LACBWR system (i.e., visual inspections of the concrete overpack inlet/outlet vents or remote temperature monitoring of the concrete overpack outlet vents), NAC has revised the original thermal evaluation by reducing the canister heat load to 2.8 kW. The original licensing basis heat load is 4.5 kW. All MPC-LACBWR systems have been loaded and have been in storage since 2012. Over this time period the decay heat of these systems has decreased. NAC has credited a new lower bounding decay heat load (i.e., 2.8 kW) to justify the concrete overpack temperatures remain below allowables for all storage conditions. The revised proprietary calculation, which uses the existing licensed method of evaluation, is provided via Enclosure 4. NAC recognizes that it is important to still maintain ventilation of the annulus region even though it is not needed for canister and concrete overpack cooling. Thus, NAC has revised the annual maintenance chapter of Reference 2 to incorporate an annual inspection of the vents in order to verify they are not obstructed.

NAC is also requesting a change to the MPC-LACBWR license drawing that details the screen mesh size for the concrete overpack (i.e., license drawing 630045-866, Rev. 1). Since convective cooling is not required, NAC is requesting a finer mesh to further prevent the entrance of foreign objects. NAC is providing an internal document detailing the change in lieu of providing a revised drawing. This is because the current revision of the drawing (i.e., Rev. 2) incorporates changes that support the NRC review of the Waste Control Specialists (WCS)

NAC INTERNATIONAL

centralized interim storage facility (CISF) site-specific license application. Thus, NAC is providing Design Change Request for Licensing (DCR(L)) 630045-866-2A within Enclosure 5. This is an internal NAC document not to be released for public disclosure along with the proprietary calculation in Enclosure 4 via the attached affidavit.

Consistent with NAC administrative practice, this proposed FSAR revision is numbered to uniquely identify the applicable changed pages. Revision bars mark the FSAR text changes on the Revision 17A pages. The included List of Effective Pages identifies the revision level of all pages in the Reference 2 FSAR with Revision 17A pages.

In order to better facilitate the review process, NAC is providing the Revision 17A change pages with appropriate backing pages. In accordance with NAC's administrative practices, upon final acceptance of this application, the 17A changed pages will be reformatted and incorporated into the next revision of the NAC-MPC FSAR.

If you have any comments or questions, please contact me on my direct line at 678-328-1236.

Sincerely,

Wren Fowler
Director, Licensing
Engineering

Attachment
Attachment 1 – Proprietary Affidavit

Enclosures:

Enclosure 1 – List of FSAR Changes for the NAC-MPC FSAR, Amendment 7
Enclosure 2 – List of Drawing Changes for the NAC-MPC, Amendment 7
Enclosure 3 – Proposed Changes for the NAC-MPC Technical Specifications, Amendment 7
Enclosure 4 – Supporting Calculations for the NAC-MPC FSAR, Amendment 7
Enclosure 5 – FSAR Changed Pages and LOEP for NAC-MPC FSAR, Amendment 7

Attachment 1

Proprietary Affidavit

NAC INTERNATIONAL
AFFIDAVIT PURSUANT TO 10 CFR 2.390

Steve Buckner (Affiant), Senior Vice President, Projects, of NAC International, hereinafter referred to as NAC, at 3930 East Jones Bridge Road, Norcross, Georgia 30092, being duly sworn, deposes and says that:

1. Affiant has reviewed the information described in Item 2 and is personally familiar with the trade secrets and privileged information contained therein, and is authorized to request its withholding.

2. The information to be withheld includes the following NAC Proprietary Information that is being provided to support the technical review of NAC's Request for a Certificate of Compliance (CoC) (No. 1025) for the NAC International NAC-MPC, Multi-Purpose Cask.

   - NAC-MPC FSAR 17A, Proprietary Version, Drawing 630045-866, DCR(L) 630045-866-2A
   - NAC Calculation 63004500-3001, Rev. 3 and Data Disk 1 of 1

   NAC is the owner of the information contained in the aforementioned pages/document, so they are considered NAC Proprietary Information.

3. NAC makes this application for withholding of proprietary information based upon the exemption from disclosure set forth in: the Freedom of Information Act ("FOIA"); 5 USC Sec. 552(b)(4) and the Trade Secrets Act; 18 USC Sec. 1905; and NRC Regulations 10 CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial financial information obtained from a person, and privileged or confidential" (Exemption 4). The information for which exemption from disclosure is herein sought is all "confidential commercial information," and some portions may also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4.

4. Examples of categories of information that fit into the definition of proprietary information are:

   a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by competitors of NAC, without license from NAC, constitutes a competitive economic advantage over other companies.

   b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality or licensing of a similar product.

   c. Information that reveals cost or price information, production capacities, budget levels or commercial strategies of NAC, its customers, or its suppliers.

   d. Information that reveals aspects of past, present or future NAC customer-funded development plans and programs of potential commercial value to NAC.

e. Information that discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information that is sought to be withheld is considered to be proprietary for the reasons set forth in Items 4.a, 4.b, and 4.d.

5. The information to be withheld is being transmitted to the NRC in confidence.

6. The information sought to be withheld, including that compiled from many sources, is of a sort customarily held in confidence by NAC, and is, in fact, so held. This information has, to the best of my knowledge and belief, consistently been held in confidence by NAC. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements, which provide for maintenance of the information in confidence. Its initial designation as proprietary information and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in Items 7 and 8 following.

7. Initial approval of proprietary treatment of a document/information is made by the Vice President, Engineering, the Project Manager, the Licensing Engineer, or the Director, Licensing – the persons most likely to know the value and sensitivity of the information in relation to industry knowledge. Access to proprietary documents within NAC is limited via "controlled distribution" to individuals on a "need to know" basis. The procedure for external release of NAC proprietary documents typically requires the approval of the Project Manager based on a review of the documents for technical content, competitive effect and accuracy of the proprietary designation. Disclosures of proprietary documents outside of NAC are limited to regulatory agencies, customers and potential customers and their agents, suppliers, licensees and contractors with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

8. NAC has invested a significant amount of time and money in the research, development, engineering and analytical costs to develop the information that is sought to be withheld as proprietary. This information is considered to be proprietary because it contains detailed descriptions of analytical approaches, methodologies, technical data and/or evaluation results not available elsewhere. The precise value of the expertise required to develop the proprietary information is difficult to quantify, but it is clearly substantial.

   Public disclosure of the information to be withheld is likely to cause substantial harm to the competitive position of NAC, as the owner of the information, and reduce or eliminate the availability of profit-making opportunities. The proprietary information is part of NAC's comprehensive spent fuel storage and transport technology base, and its commercial value extends beyond the original development cost to include the development of the expertise to determine and apply the appropriate evaluation process. The value of this proprietary information and the competitive advantage that it provides to NAC would be lost if the information were disclosed to the public. Making such information available to other parties, including competitors, without their having to make similar investments of time, labor and money would provide competitors with an unfair advantage and deprive NAC of the opportunity to seek an adequate return on its large investment.

NAC INTERNATIONAL
AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)

STATE OF GEORGIA, COUNTY OF GWINNETT

Mr. Steve Buckner, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated herein are true and correct to the best of his knowledge, information and belief.

Executed at Norcross, Georgia, this 14th day of NOVEMBER 2017.

Steve Buckner
Senior Vice President, Projects
NAC International

Subscribed and sworn before me this 14th day of November, 2017.

Deborah R Chapman
Notary Public

DEBORAH R CHAPMAN
My Commission Expires
NOTARY PUBLIC
02-27-2021
GWINNETT COUNTY, GEORGIA

Enclosure 1

List of Changes

NAC-MPC FSAR, Amendment 7

(Docket No. 72-1025)

NAC International

November 2017

List of Changes, NAC-MPC FSAR, Amendment 7

Chapter 1

- Page 1.A.7-1, updated the MPC-LACBWR License Drawings list.

Chapter 2

- No changes.

Chapter 3

- Page 3.A-iii, updated the List of Tables to reflect text flow change.
- Page 3.A.4-34, changed a number in the middle of the first paragraph of Section 3.A.4.4.3.3.
- Page 3.A.4-35, added a second paragraph to the end of Section 3.A.4.4.3.3.
- Page 3.A.4-36, text flow changes.

Chapter 4

- Page 4.A-i, updated the Table of Contents.
- Page 4.A.1-1, modified the third paragraph of Section 4.A.1.
- Page 4.A.3-35, modified the text in Section 4.A.3.6.
- Pages 4.A.4-1 thru 4.A.4-2, added new Section 4.A.4.
- Page 4.A.5-1, updated Section number.

Chapter 5

- No changes.

Chapter 6

- No changes.

Chapter 7

- No changes.

Chapter 8

- No changes.

Chapter 9

- Page 9.2-1, deleted paragraph in middle of page.
- Page 9.A.3-1, deleted paragraph in middle of page.
- Page 9.A.3-2, inserted bullet at top of the page (second to last bullet of Section 9.A.3.1).

Chapter 10

- No changes.

Chapter 11

- No changes.

Chapter 12

- Page 12.C.3-30, added sentence to the end of "Actions"; deleted text at the end of A.1.
- Page 12.C.3-31, added sentence to the end of the second paragraph of SR 3.1.6.1.

Chapter 13

- No changes.

Chapter 14

- No changes.

Chapter 15

- No changes.

Enclosure 2

List of Drawing Changes

NAC-MPC FSAR, Amendment 7

(Docket No. 72-1025)

NAC International

November 2017

List of Drawing Changes, NAC-MPC FSAR, Amendment 7

Drawing 630045-866, Sheet 1 of 5, Revision 1, plus proposed changes via DCR(L) 630045-866-2A

Sheet 1:

1. Add note 22 that reads: "4 x 4 x .032" welded wire cloth or 18 x 18 x .02" woven wire cloth."
2. B.O.M., Item 17 (Screen), revise description to "See Note 22", was "4 x 4 x .032" welded wire cloth".
3. B.O.M., Item 29 (Inlet Screen), revise description to "See Note 22", was "18 x 18 x .02" woven wire cloth".

Enclosure 3

Proposed Changes for the

NAC-MPC Technical Specifications, Amendment 7

(Docket No. 72-1025)

NAC International

November 2017

LOADING OPERATIONS	LOADING OPERATIONS include all activities on an NAC-MPC SYSTEM while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the CANISTER and end when the NAC-MPC SYSTEM is secured on the transporter. LOADING OPERATIONS do not include post-storage operations, i.e., CANISTER transfer operations between the TRANSFER CASK and the CONCRETE CASK or transport cask after STORAGE OPERATIONS.
MPC-LACBWR	MPC-LACBWR is a NAC-MPC SYSTEM having a fuel basket designed to accommodate La Crosse BWR (LACBWR) reactor spent fuel. The MPC-LACBWR meets the NAC-MPC SYSTEM requirements.
NAC-MPC SYSTEM	NAC-MPC SYSTEM includes the components approved for loading and storage of spent fuel assemblies at the ISFSI. The NAC-MPC SYSTEM consists of a CONCRETE CASK, a TRANSFER CASK, and a CANISTER. The NAC-MPC SYSTEM is provided in three configurations: the YANKEE-MPC, CY-MPC, and MPC-LACBWR.
OPERABLE	An OPERABLE CONCRETE CASK heat removal system transfers sufficient heat away from the fuel assemblies such that the fuel cladding, CANISTER component and CONCRETE CASK temperatures do not exceed applicable limits. The CONCRETE CASK heat removal system is considered OPERABLE if the difference between the ISFSI ambient temperature and the average outlet air temperature is ≤ 92°F for the YANKEE-MPC; or ≤ 110°F for the CY-MPC, or if all four air inlet and outlet screens are visually verified to be unobstructed. Failing this, a CONCRETE CASK heat removal system may be declared OPERABLE if an engineering evaluation determines the CONCRETE CASK has adequate heat transfer capabilities to assure continued spent fuel, CANISTER and CONCRETE CASK integrity.

(continued)

A 3.1 NAC-MPC SYSTEM Integrity

A 3.1.6 CONCRETE CASK Heat Removal System

LCO 3.1.6 The CONCRETE CASK Heat Removal System shall be OPERABLE.

APPLICABILITY: During STORAGE OPERATIONS

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each NAC-MPC SYSTEM. LCO 3.1.6 is not applicable to the MPC-LACBWR CANISTER.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met	A.1 Restore CONCRETE CASK Heat Removal System to OPERABLE status	8 hours
B. Required Action and associated Completion Time not met	B.1 Perform SR 3.1.6.1	Immediately and every 6 hours thereafter
	AND	
	B.2.1 Perform an engineering evaluation to determine that the CONCRETE CASK Heat Removal System is OPERABLE	12 hours
	OR	
	B.2.2 Place the NAC-MPC SYSTEM in a safe condition	12 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
[1]SR 3.1.6.1	Verify the difference between the average CONCRETE CASK air outlet temperature and ISFSI ambient temperature is ≤92°F for the YANKEE-MPC CANISTER or ≤110°F for the CY-MPC CANISTER.	24 hours
	OR	
	Visually verify all four air inlet and outlet screens are unobstructed.	24 hours

[1] SR 3.1.6.1 is not applicable to the MPC-LACBWR CANISTER. Convective cooling is not required for the MPC-LACBWR CANISTER.

A 5.2 Preoperational Testing and Training Exercises (continued)

k. CONCRETE CASK shield plug and lid (or lid only for MPC-LACBWR) installation

l. Transport of the CONCRETE CASK to the ISFSI

m. CANISTER unloading, including reflooding and weld removal or cutting

n. CANISTER removal from the CONCRETE CASK

A 5.3 Surveillance After an Off-Normal, Accident, or Natural Phenomena Event

The CONCRETE CASK and CANISTER shall be inspected if they experience a drop or a tip-over.

Following a natural phenomena event, the ISFSI shall be inspected to determine if movement or damage to the CONCRETE CASKS has resulted in unacceptable site boundary dose rates.

(continued)

Enclosure 4

Supporting Calculation

63004500-3001, Revision 3

NAC-MPC FSAR, Amendment 7

(Docket No. 72-1025)

NAC International

November 2017

NAC calculation withheld in it's entirety per 10 CFR 2.390.

Enclosure 5

LOEP and FSAR Change Pages

NAC-MPC FSAR, Revision 17A

(Docket No. 72-1025)

NAC International

November 2017

November 2017

Revision 17A

NAC-MPC

NAC Multi-Purpose Cask

FINAL SAFETY ANALYSIS REPORT

Non-Proprietary Version

Volume 1 of 2

Docket No. 72-1025

NAC INTERNATIONAL

Atlanta Corporate Headquarters: 3930 East Jones Bridge Road, Norcross, Georgia 30092 USA
Phone 770-447-1144, Fax 770-447-1797, www.nacintl.com

List of Effective Pages

Chapter 1

61 drawings (see Chapter 1)

<u>Appendix 1.A</u>

17 MPC-LACBWR drawings
(see Appendix 1.A)

List of Effective Pages (continued)

List of Effective Pages (continued)

List of Effective Pages (continued)

List of Effective Pages (continued)

List of Effective Pages (continued)

List of Effective Pages (continued)

List of Effective Pages (continued)

Appendix 11.A

Chapter 12

List of Effective Pages (continued)

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1.A.7 MPC-LACBWR License Drawings

This section presents the License Drawings for the MPC-LACBWR System.

Drawing Number	Title	Revision No.	No. of Sheets
630045-861	Weldment, Structure, Vertical Concrete Cask (VCC), MPC-LACBWR	4	3
630045-862	Loaded Vertical Concrete Cask (VCC), MPC-LACBWR	0	1
630045-863	Lid Assembly, Vertical Concrete Cask (VCC), MPC-LACBWR	2	1
630045-864	Name Plate, Vertical Concrete Cask (VCC) MPC-LACBWR	2	1
630045-866	Reinforcing Bar and Concrete Placement, Vertical Concrete Cask (VCC), MPC-LACBWR, plus DCR(L) 630045-866-2A	1	5
630045-870	Shell Weldment Canister (TSC), MPC-LACBWR	3	1
630045-871	Details TSC, MPC-LACBWR	5	4
630045-872	Assembly, Transportable Storage Canister (TSC), MPC-LACBWR	6	2
630045-873	Assembly, Drain Tube, TSC, MPC-LACBWR	1	1
630045-877	Bottom Weldment, Fuel Basket, MPC-LACBWR	3	1
630045-878	Top Weldment, Fuel Basket, MPC-LACBWR	1	1
630045-881	Fuel Tube Assembly, MPC-LACBWR	1	2
630045-893	Support Disk, Fuel Basket, MPC-LACBWR	1	1
630045-894	Heat Transfer Disk, Fuel Basket, MPC-LACBWR	1	1
630045-895	Fuel Basket Assembly, 68 Element BWR, MPC-LACBWR	2	3
630045-901	Assembly, Damaged Fuel Can (DFC), MPC-LACBWR	0	1
630045-902	Details, Damaged Fuel Can (DFC), MPC-LACBWR	1	2

Note: The Transfer Adapter and Transfer Cask License Drawings No. 455-859 and 455-860, respectively, are included in the MPC FSAR, Section 1.7.1.

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List of Figures

List of Tables

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3.A.4.4.3 MPC-LACBWR Vertical Concrete Cask Evaluation

The structural evaluation of the MPC-LACBWR concrete cask for normal conditions of storage is discussed in this section. As discussed in the following sections, the stresses in the concrete cask concrete shell due to dead load, live load, and normal thermal load are shown to be bounded by those calculated for the Yankee-MPC concrete cask. The bounding concrete shell stresses due to normal loads are combined with the MPC-LACBWR concrete cask shell stresses calculated for off-normal and accident conditions in Section 11.A. The maximum stresses for each load condition are factored and combined in accordance with the load combinations defined in MPC FSAR Table 2.2-1, as summarized in Table 3.A.4.4.3-1. The results of the load combination evaluation show that the maximum combined stresses in the MPC-LACBWR concrete cask concrete shell result from load combination 3, and are identical to those from the Yankee-MPC concrete cask concrete shell evaluation. As shown in MPC FSAR Table 3.4.4.2-2, the maximum compressive stress in the concrete and maximum tensile loads in the steel reinforcing bars for this controlling load combination satisfy the applicable requirements of ACI 349-85.

3.A.4.4.3.1 MPC-LACBWR Concrete Cask Dead Load

Under dead weight loading, the concrete cask concrete shell is conservatively assumed to support the entire weight of the concrete cask assembly, including the weight of the inner steel liner shell and the steel pedestal upon which the concrete shell and canister rest. No structural credit is taken for the concrete cask steel liner in the dead weight stress analysis. Since the MPC-LACBWR concrete cask weighs less than the Yankee-MPC concrete cask, and the MPC-LACBWR concrete cask concrete shell has a greater cross-section area than the Yankee-MPC concrete cask, the dead weight stress in the MPC-LACBWR concrete cask concrete shell is bounded by the maximum dead weight stress of -21.4 psi (i.e., compressive) calculated for the Yankee-MPC concrete cask concrete shell in MPC FSAR Section 3.4.4.2.1. The bounding compressive stress in the Yankee-MPC concrete cask concrete shell is conservatively used for the evaluation of the MPC-LACBWR concrete cask concrete shell.

3.A.4.4.3.2 MPC-LACBWR Concrete Cask Live Load

The MPC-LACBWR concrete cask is evaluated for two different design basis live load conditions: (1) snow live load, and (2) transfer cask live load (i.e., weight of the fully loaded transfer cask resting on the top end of the concrete cask.) Live loads are assumed to be resisted only by the concrete cask concrete shell, conservatively neglecting support provided by the concrete cask steel liner shell. The compressive stress in the concrete shell due to live load is calculated by dividing the highest live load force by the concrete shell cross section area. The results of the live load evaluation show that the stresses in the MPC-LACBWR concrete cask concrete shell are not significant.

Since the surface area on the top end of the MPC-LACBWR concrete cask is the same as that of the Yankee-MPC concrete cask, both designs are subjected to the same design basis snow live load, which is shown to be 9 kips in MPC FSAR Section 3.4.4.2.2. Since the snow live load is much lower than the transfer cask live load, the stresses in the concrete cask concrete shell due to snow live load are bounded by those due to the transfer cask live load.

The compressive stress in the MPC-LACBWR concrete cask concrete shell due to transfer cask live load is bounded by the maximum compressive stress of -19.2 psi calculated for the Yankee-MPC concrete cask concrete shell in MPC FSAR Section 3.4.4.2.2. The cross-section area of the MPC-LACBWR concrete cask concrete shell is larger than that of the Yankee-MPC concrete cask concrete shell. However, the bounding compressive stress in the Yankee-MPC concrete cask concrete shell is conservatively used for the evaluation of the MPC-LACBWR concrete cask concrete shell.

3.A.4.4.3.3 MPC-LACBWR Concrete Cask Thermal Load

Under normal thermal conditions, the decay heat load from the canister inside the concrete cask is transferred to the environment primarily by passive convective air flow through the concrete cask ventilation ducts. However, some portion of the decay heat is transferred to the environment by conduction through the concrete cask. The thermal resistance of the concrete cask steel and concrete shells produces axial and radial temperature gradients that generate stress within the concrete cask concrete shell. Given that the MPC-LACBWR concrete cask and Yankee-MPC concrete cask designs are very similar; their heat transfer characteristics are also very similar. Therefore, since the design basis canister heat load for the MPC-LACBWR canister is much lower than that of the Yankee-MPC canister (i.e., 4.5 kW vs. 12.5 kW), the temperature gradients and thermal stresses in the MPC-LACBWR concrete cask concrete shell will be much lower than those calculated for the Yankee-MPC concrete cask concrete shell. However, the bounding thermal stresses calculated for the Yankee-MPC concrete cask concrete shell are conservatively used for evaluation of the MPC-LACBWR concrete cask concrete shell. The bounding compressive stresses in the Yankee-MPC concrete cask concrete and tensile loads in the Yankee-MPC concrete cask steel reinforcing bars are calculated in MPC FSAR Section 3.4.4.2.3.

The MPC-LACBWR system with a heat load of 2.8 kW and no air flow in the cask annulus is evaluated in Section 4.A.4. The through-wall temperature differences are slightly larger than those calculated for the Yankee-MPC concrete cask but are bounded by those for the CY-MPC concrete cask, which has a similar cask design (concrete thickness and rebar). Therefore, the thermal stress evaluation for the LACBWR MPC system with a heat load of 2.8 kW and no air flow in the cask annulus is bounded by the thermal stress evaluation for the CY-MPC concrete cask as presented in Section 3.4.4.4.3. Since the concrete thermal stresses used in the loading combinations in Table 3.A.4.4.3-1 for MPC-LACBWR remain bounding, no further evaluation is required.

Table 3.A.4.4.3-1 Stress Summary for MPC-LACBWR Concrete Cask Concrete Shell Load Combinations

Load Comb.[1]	Stress Direction	Stress[2] (psi)							Total Stress
		Dead	Live	Wind[3]	Thermal[4]	Earth-quake[5]	Tornado[6]	Flood[7]	
Outside Diameter of Concrete Shell									
1	Vertical	-30.0	-32.6	---	---	---	---	---	-62.6
2	Vertical	-22.5	-24.5	---	---	---	---	---	-47.0
3	Vertical	-22.5	-24.5	-14.7	---	---	---	---	-61.7
4	Vertical	-21.4	-19.2	---	---	---	---	---	-40.6
5	Vertical	-21.4	-19.2	---	---	-65.4	---	---	-106.0
7	Vertical	-21.4	-19.2	---	---	---	---	-10.6	-51.2
8	Vertical	-21.4	-19.2	---	---	---	-11.5	---	-52.1
Inside Diameter of Concrete Shell									
1	Vertical	-30.0	-32.6	---	---	---	---	---	-62.6
	Circumferential	---	---	---	---	---	---	---	0.0
2	Vertical	-22.5	-24.5	---	-669.9	---	---	---	-716.9
	Circumferential	---	---	---	-226.6	---	---	---	-226.6
3	Vertical	-22.5	-24.5	-9.9	-669.9	---	---	---	-726.8
	Circumferential	---	---	---	-226.6	---	---	---	-226.6
4	Vertical	-21.4	-19.2	---	-660.1	---	---	---	-700.7
	Circumferential	---	---	---	-127.5	---	---	---	-127.5
5	Vertical	-21.4	-19.2	---	-525.4	-44.9	---	---	-610.9
	Circumferential	---	---	---	-177.7	---	---	---	-177.7
7	Vertical	-21.4	-19.2	---	-525.4	---	---	-7.1	-573.1
	Circumferential	---	---	---	-177.7	---	---	---	-177.7
8	Vertical	-21.4	-19.2	---	-525.4	---	-7.7	---	-573.7
	Circumferential	---	---	---	-177.7	---	---	---	-177.7

Notes:

1 Load combinations are defined in MPC FSAR Table 2.2-1. See Sections 11.A.2.11 and 11.A.2.12 for the evaluation of drop/impact conditions included in load combination 6.
2 Positive stress values indicate tensile stress and negative values indicate compressive stress.
3 Stress results from Section 11.A.2.13 (Tornado) are conservatively used with a load factor of 1.275.
4 Tensile loads developed in the outer region of the concrete cask concrete shell are resisted by the steel reinforcing bars, and therefore, are not shown in this table. Stresses in the concrete cask concrete shell due to accident thermal loading are from Section 11.A.2.10.
5 Earthquake stresses are from Section 11.A.2.2.
6 Tornado stresses are from Section 11.A.2.13.
7 Flood stresses are from Section 11.A.2.6.

APPENDIX 4.A THERMAL EVALUATION – MPC-LACBWR MPC STORAGE SYSTEM FOR DAIRYLAND POWER COOPERATIVE LA CROSSE BOILING WATER REACTOR

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4.A THERMAL EVALUATION

4.A.1 Thermal Evaluation of the MPC-LACBWR System

The MPC Storage System for Dairyland Power Cooperative La Crosse Boiling Water Reactor, referred to as the MPC-LACBWR, is designed to safely store up to 68 Allis Chalmers (AC) and Exxon Nuclear (EN) undamaged and damaged spent fuel assemblies. Among the 68 loaded fuel assemblies, 32 of them can be loaded as damaged fuel assemblies in damaged fuel cans (DFCs).

The MPC-LACBWR system is designed to store the spent fuel with a maximum canister heat load of 4.5 kW, and each single fuel assembly with a maximum heat load of 66.2 W. The maximum heat load limit of 66.2 W per assembly also applies to the 32 DFCs in the outer slots of the basket.

The thermal evaluation for normal conditions of storage for the MPC-LACBWR system with the design basis heat load of 4.5 kW is presented in Section 4.A.3. An additional evaluation for the MPC-LACBWR system with a heat load of 2.8 kW is provided in Section 4.A.4.

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Therefore, the maximum normal operating condition canister internal pressure is:

$$P = \frac{\left(183.3\ \frac{\text{Moles}}{\text{Canister}}\right) \times \left(0.0821 \frac{\text{atm}\ \ell}{\text{mole K}}\right) \times 465\ \text{K}}{\left(4{,}371 \frac{\ell}{\text{Canister}}\right)} = 1.6\ \text{atm} \approx 23.5\ \text{psia} \approx 8.8\ \text{psig}$$

4.A.3.6 Maximum MPC-LACBWR Thermal Stresses for Normal Conditions

The canister and concrete storage cask thermal stresses are evaluated in Section 3.A.4.4.

4.A.3.7 Evaluation of MPC-LACBWR Performance for Normal Conditions

As shown in the preceding sections, the MPC-LACBWR system operates within the thermal design limits. Therefore, no degradation due to temperature effects on material or components is expected over the lifetime of the cask.

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4.A.4 Thermal Evaluation of MPC-LACBWR with a Heat Load of 2.8 kW

The thermal evaluation of the MPC-LACBWR System in Section 4.A.3 considers a maximum heat load of 4.5 kW per cask and the analysis results are summarized in Table 4.A.3-3. Note that the component temperatures, except the concrete temperatures, for storage conditions reported in this table are based on the three-dimensional concrete cask and canister model as described in Section 4.A.3.1.1, which does not consider air flow in the annulus of the cask. The concrete temperatures in Table 4.A.3-3 are conservatively obtained from the thermal analysis for the Yankee-MPC configuration with a heat load of 12.5 kW (Table 4.1-4). The annulus air flow is considered in the thermal model for the Yankee-MPC system.

In this Section, a thermal evaluation is performed for the MPC-LACBWR system with a heat load of 2.8 kW without consideration of air flow in the cask annulus. The primary focus of this Section is the concrete temperatures, since the temperatures of other components such as the fuel clad, support disks, heat transfer disks, canister, and other cask components are bounded by the 4.5 kW case, as evaluated in Section 4.A.3.

The MPC-LACBWR thermal model described in Section 4.A.3.1.1 (Figures 4.A.3-2 and 4.A.3-3) uses a design basis decay heat load of 4.5 kW (Section 4.A.3). In this section a steady state thermal analysis is performed to determine the concrete temperatures for the MPC-LACBWR system with a heat load of 2.8 kW. The same boundary conditions detailed in Section 4.A.3.1.1 are used except that the view factor between casks is increased to 1.0, since there are only five loaded casks on the ISFSI pad, most radiation from the cask surface is to the surrounding space.

Four of the conditions of storage listed in Table 4.A.3-1 are evaluated:

1. Normal Conditions, 75°F ambient temperature with solar insolance
2. Off-Normal Severe Cold, -40°F ambient temperature without solar insolance
3. Off-Normal Severe Hot, 105°F ambient temperature with solar insolance
4. Accident Extreme Heat, 125°F ambient temperature with solar insolance

The calculated maximum concrete temperatures with a decay heat load of 2.8 kW summarized and compared with the allowable temperatures as shown below.

Operating Condition	Ambient Temperature (°F)	Maximum Concrete Temperature (°F)	Allowable Concrete Temperature (°F)
Normal	75	126 (Bulk) 161 (Local)	150 (Bulk) 200 (Local)
Off-Normal - Cold	-40	28	200
Off-Normal - Hot	105	187	350
Accident	125	204	350

Since no air flow is modeled in the cask annulus, the analysis result for the normal storage condition bounds the analysis results for the off-normal half-inlet-blocked condition and the accident conditions of all inlets blocked and the cask burial.

Note that the maximum concrete temperatures for the normal, off-normal and accident conditions for the 2.8 kW case calculated in this Section remain bounded by the maximum concrete temperatures presented in Section 4.A.3 (Table 4.A.3-3) and Section 11.A. The through-wall thermal gradients for the MPC-LACBWR concrete cask evaluated in this section are bounded by the thermal gradients for the CY-MPC concrete cask.

As discussed above, the MPC-LACBWR system with a heat load of 2.8 kW and no air flow in the cask annulus operates within the thermal design limits. Therefore, no degradation due to temperature effects on material or components is expected over the lifetime of the cask.

4.A.5 References

[A1] Military Handbook, MIL-HDBK-5F, November 1990.

[A2] "The Properties of Gases and Liquids," Bruce E. Poling, et al, 5th Edition, McGraw Hill, 2001

[A3] "Handbook of Concrete Engineering," M. Fintel, Van Nosttrand, Reinhold Co., New York, Second Edition, 1985.

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NAC-MPC

NAC Multi-Purpose Cask

FINAL SAFETY ANALYSIS REPORT

Non-Proprietary Version

Volume 2 of 2

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NAC INTERNATIONAL

Atlanta Corporate Headquarters: 3930 East Jones Bridge Road, Norcross, Georgia 30092 USA
Phone 770-447-1144, Fax 770-447-1797, www.nacintl.com

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9.2 Maintenance Program

The NAC-MPC storage system is a passive system. There are no active components or systems incorporated in the design. Consequently, there is a minimal amount of maintenance that is required over its lifetime.

The system has no valves, gaskets, rupture discs or seals, and there are no accessible penetrations. Consequently, there is no maintenance associated with these types of features.

The routine thermal performance surveillance requirements for a loaded NAC-MPC system are described in the Technical Specifications of Appendix A, LCO 3.1.6 of the Certificate of Compliance.

The continuing operability of the concrete cask is verified on a 24-hour frequency by completion of SR 3.1.6.1, which allows verification by visual inspection of the inlet and outlet vents for blockage, or verification by measurement of the air temperature difference between ambient and outlet average. If the operable status of the concrete cask is reduced, the concrete cask will be returned to an operable status as specified in LCO 3.1.6.

An annual inspection of the vertical concrete cask exterior is required, and includes:

- Visual inspection of concrete surfaces for chipping, spalling or other surface defects. Any defects larger than one inch in diameter (or width) and deeper than one inch shall be regrouted, according to the grout manufacturer's recommendations.

- Reapplication of corrosion-inhibiting (external) coatings on accessible surfaces.

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9.A.3 Maintenance Program

This section presents the maintenance requirements for the MPC-LACBWR system and the transfer cask.

9.A.3.1 MPC-LACBWR System Maintenance

The MPC-LACBWR system is a passive system. No active components or systems are incorporated in the design. Consequently, only a minimal amount of maintenance is required over its lifetime.

The MPC-LACBWR system has no valves, gaskets, rupture discs, seals, or accessible penetrations. Consequently, there is no maintenance associated with these types of features.

Annually, or on a frequency established by the user based on the environmental conditions at the ISFSI (i.e., higher inspection frequency may be appropriate at ISFSIs exposed to marine environments, lower frequency for sites located in dry environments, etc.), a program of visual inspections and maintenance of the loaded MPC-LACBWR systems in service shall be implemented. The concrete cask(s) shall be inspected as described herein.

- Visually inspect exterior concrete surfaces for chipping, spalling or other defects. Minor surface defects (i.e., approximately one cubic inch) shall be repaired by cleaning and regrouting.
- Visually inspect accessible exterior coated carbon steel surfaces for loss of coating, corrosion or other damage. The repair of corroded surfaces or surfaces missing coating materials shall be done by cleaning the areas and reapplying corrosion-inhibiting coatings in accordance with the coating manufacturer's recommendations. Exterior surface coatings authorized for use on the exposed carbon steel surfaces of concrete cask are not limited to those defined in Chapter 3 of the MPC FSAR or specified on the original design drawings. The user shall select coating appropriate to the ability to clean and recoat the affected surface areas.
- Visually inspect the installed lid bolts for presence of external corrosion. Excessively corroded, or missing, bolting shall be replaced with approved spare parts.
- Visually inspect the attachment hardware and the integrity of the inlet and outlet screens. Damaged or missing components shall be repaired or replaced with approved spare parts.

- Visually inspect the inlet and outlet vents to verify they are unobstructed. Remove obstructions, as necessary, to clear the vents.
- Significant damage or defects identified during the visual inspections that exceed routine maintenance shall be processed as nonconforming items.

The schedule, results and corrective actions taken during the performance of the MPC-LACBWR system inspection and maintenance program shall be documented and retained as part of the system maintenance program.

9.A.3.2 Transfer Cask Maintenance

The transfer cask trunnions and shield door assemblies shall be visually inspected for gross damage and proper function prior to each use.

Annually (or a period not exceeding 14 months), an inspection and testing program shall be performed on the transfer cask in accordance with the requirements of ANSI N14.6. The following actions or alternatives shall be performed:

- Visually inspect the lifting trunnions, shield doors and shield door rails for permanent deformation and cracking. Carbon steel-coated surfaces will be inspected for chipped, cracked or missing areas of coating, and repaired by reapplication of the approved coating(s) in accordance with the coating manufacturer's recommendations.
- In addition, one of the following testing/inspection methods shall be completed.
- Perform a load test equal to or greater than 300% of the maximum service load and a post-test visual inspection of major load-bearing welds and critical components for defects, weld cracking, material displacement or permanent deformation; or
- If surface cleanliness and conditions permit, perform a dimensional and visual inspection of load-bearing components, and a nondestructive examination of major load-bearing welds.

The annual examination and testing program may be deferred during periods of nonuse of the transfer cask, provided that the transfer cask examination or testing program is performed prior to the next use of the transfer cask. The inspection results and corrective actions taken as part of the maintenance program shall be documented and retained as part of the system maintenance program.

C 3.1 NAC-MPC SYSTEM Integrity

C 3.1.6 CONCRETE CASK Heat Removal System

BASES

BACKGROUND

The CONCRETE CASK Heat Removal System is a passive, air-cooled convective heat transfer system, which ensures that heat from the CANISTER is transferred to the environment by the upward flow of air through the CONCRETE CASK. Relatively cool air is drawn into the annulus between the CONCRETE CASK and the CANISTER through the four air inlets at the bottom of the CONCRETE CASK. The CANISTER transfers its heat from the CANISTER surface to the air via natural convection. The buoyancy created by the heating of the air creates a chimney effect and the air flows back into the environment through the four air outlets at the top of the CONCRETE CASK.

APPLICABLE SAFETY ANALYSIS

The thermal analyses of the CONCRETE CASK take credit for the decay heat from the spent fuel assemblies being ultimately transferred to the ambient environment surrounding the CONCRETE CASK. Transfer of heat away from the fuel assemblies ensures that the fuel cladding and CANISTER component temperatures do not exceed applicable limits. Under normal storage conditions, the four air inlets and four air outlets are unobstructed and full air flow (i.e., maximum heat transfer for the given ambient temperature) occurs.

Analyses have been performed for the complete obstruction of all of the air inlets and outlets. The complete blockage of all air inlets and outlets stops air cooling of the CANISTER. The CANISTER will continue to radiate heat to the relatively cooler inner shell of the CONCRETE CASK. With the loss of air cooling, the CANISTER component temperatures will increase toward their respective short-term temperature limits. The limiting component is the CANISTER basket support and heat transfer disks, which, by analysis, approach their temperature limits in 24 hours for Yankee-MPC and CY-MPC systems, if no action is taken to restore air flow to the heat removal system.

The MPC-LACBWR analysis for all inlets and outlets blocked shows system temperatures remain below long-term limits for the 4.5 kW total heat load. Thermal performance of the MPC-LACBWR system is provided by radiation between the CANISTER and CONCRETE CASK, and air cooling convection heat transfer is not required to maintain system safety limits.

(continued)

LCO	The CONCRETE CASK Heat Removal System must be verified to be OPERABLE for Yankee-MPC and CY-MPC systems to preserve the assumptions of the thermal analyses. Operability of the heat removal system ensures that the decay heat generated by the stored fuel assemblies is transferred to the environment at a sufficient rate to maintain fuel cladding and CANISTER component temperatures within design limits for the Yankee-MPC and CY-MPC systems.
APPLICABILITY	The LCO is applicable during STORAGE OPERATIONS. Once a CONCRETE CASK containing a CANISTER loaded with spent fuel has been placed in storage, the heat removal system must be OPERABLE to ensure adequate heat transfer of the decay heat away from the fuel assemblies for the Yankee-MPC and CY-MPC systems.
ACTIONS	A note has been added to ACTIONS that states for this LCO, separate Condition entry is allowed for each CONCRETE CASK. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each CONCRETE CASK not meeting the LCO. Subsequent CONCRETE CASKs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. The note also specifies that this LCO is not applicable to the MPC-LACBWR CANISTER since convective cooling is not required to maintain system safety limits. <u>A.1</u> If the CONCRETE CASK heat removal system has been determined to be not OPERABLE, it must be restored to OPERABLE status within 8 hours. Eight hours is reasonable based on the accident analysis that shows that the limiting CONCRETE CASK component temperatures will not reach their temperature limits for 24 hours after a complete blockage of all inlets and outlets. <u>B.1</u> Until the completion of Required Action A.1, performance of SR 3.1.6.1 shall be performed on an increased Completion Time Frequency of 6 hours to document the OPERABLE status of the CONCRETE CASK heat removal system. <u>AND</u>

(continued)

ACTIONS (continued)

B.2.1

If Required Action A.1 cannot be met, an engineering evaluation is performed to verify that the CONCRETE CASK heat removal system is OPERABLE. The Completion Time for this Required Action of 12 hours will ensure that the CANISTER remains in a safe, analyzed condition.

OR

B.2.2

Place the affected NAC-MPC SYSTEM in a safe condition. The Completion Time for this Required Action of 12 hours will ensure that the NAC-MPC SYSTEM is maintained in a safe condition.

SURVEILLANCE REQUIREMENTS

SR 3.1.6.1

The long-term integrity of the stored fuel is dependent on the ability of the CONCRETE CASK to reject heat from the CANISTER to the environment. Visual observation that all four air inlet and outlet screens are unobstructed and intact ensures that air flow past the CANISTER is occurring and heat transfer is taking place. Complete blockage of more than two air inlet or outlet screens or the equivalent effective screen area renders the heat removal system not OPERABLE and this LCO is not met. Partial blockage of less than two air inlet or outlet screens or the equivalent effective screen area does not result in the heat removal system being not OPERABLE. However, corrective actions should be taken promptly to remove the obstruction and restore full flow through the affected air inlet and outlet screens. Alternatively, based on the thermal analyses, if the air temperature rise is less than the limits stated in the SR, adequate air flow and, therefore, adequate heat transfer is occurring to provide assurance of long-term fuel cladding integrity. The reference ambient temperature used to perform this Surveillance shall be measured at the ISFSI facility.

The Frequency of 24 hours is reasonable based on the time necessary for CONCRETE CASK and CANISTER components to heat up to unacceptable temperatures assuming design basis heat loads, and allowing for corrective actions to take place upon discovery of the blockage of the air inlet and outlet screens. A note has been added to this SR specifying it is not applicable to the MPC-LACBWR CANISTER since convective cooling is not required to maintain system safety limits.

(continued)

REFERENCES	1.	FSAR Chapter 4, Appendix 4.A and Chapter 11, Section 11.1.1, Section 11.2.8 and Appendix 11.A.