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Revision 12

NAC-MPC

NAC Multi-Purpose Canister

FINAL SAFETY ANALYSIS REPORT

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.

11.2.2.4 NAC-MPC Performance

This analysis shows that the design basis earthquake does not affect the NAC-MPC vertical concrete cask performance. The vertical concrete cask does not tip over for the design-basis earthquake having ground accelerations of 0.25g.

11.2.2.5 Recovery and/or Corrective Actions

Response Surveillance of the storage casks at the ISFSI is required following an earthquake accident in accordance with the requirements specified in LCO 3.1.6 of the Technical Specifications to verify the heat removal systems of the casks are operable. While the cask does not tip over, there is a potential for movement of a cask relative to other casks and for superficial damage at the bottom edge due to that movement.

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11.2.3 Explosion

The flood analysis presented in Section 11.2.6 shows that the NAC-MPC system would not experience adverse effects due to a pressure of 22 psig applied to the canister. The vertical concrete cask will also be unaffected. This pressure is considered to bound any explosions occurring in the vicinity of the ISFSI.

11.2.3.1 Cause of Accident

An explosion is an unlikely event because administrative controls will exclude explosive substances in the vicinity of the ISFSI. No flammable or explosive substances are stored or used at the storage facility; therefore, an explosion affecting the site is extremely unlikely. This evaluation is provided in order to provide a bounding pressure that could be used in the event that the potential of an explosion must be considered at a given site.

11.2.3.2 Evaluation of the Explosion Event

The NAC-MPC canister shell was evaluated in Section 11.2.6 for the effects of a flood having a depth of 50 feet. The water exerts an external hydrostatic pressure of 22 psig on the canister, which results in stress in the canister shell.

The concrete cask is a monolithic structure that is not affected by the explosion overpressure.

11.2.3.2.1 Yankee-MPC Canister Stress Due to the Explosion Event

The maximum primary membrane stress calculated in the canister is 8.82 ksi. The allowable stress for accident conditions is 40.08 ksi. The margin of safety for primary membrane stress is + 3.54.

The maximum primary membrane plus bending stress calculated in the canister is 19.18 ksi. The allowable primary membrane plus bending stress for accident conditions is 60.12 ksi. The margin of safety for primary membrane plus bending stress is + 2.13.

Consequently, there is no adverse consequence to the canister as a result of the 22 psig external pressure. This pressure conservatively bounds an explosion event.

11.2.3.2.2 CY-MPC Canister Stress Due to the Explosion Event

The maximum primary membrane stress calculated in the canister is 3.91 ksi. The allowable stress for accident conditions is 40.08 ksi. The margin of safety for primary membrane stress is +9.26.

The maximum primary membrane plus bending stress calculated in the canister is 15.18 ksi. The allowable primary membrane plus bending stress for accident conditions is 60.12 ksi. The margin of safety for primary membrane plus bending stress is +2.96.

Consequently, there is no adverse consequence to the canister as a result of the 22 psig external pressure. This pressure conservatively bounds an explosion event.

11.2.3.3 Radiological Consequences

There are no radiological consequences for this accident.

11.2.3.4 NAC-MPC Performance

This analysis shows that the NAC-MPC system performance is not affected by explosion over pressure.

11.2.3.5 Recovery and/or Corrective Actions

Response Surveillance of the storage casks at the ISFSI in accordance with the requirements specified in LCO 3.1.6 of the Technical Specifications is required following an explosion event to verify the heat removal systems of the casks are operable.

11.2.6.5 Recovery and/or Corrective Actions

Response Surveillance of the NAC-MPC systems at the ISFSI shall be performed following the flood accident in accordance with the requirements specified in LCO 3.1.6 of the Technical Specifications to verify the heat removal systems of the casks are operable. Corrective actions will be taken, as required, to clear blockage of the inlet and outlet screens of each concrete cask.

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Appendix 11.A ACCIDENT ANALYSIS – MPC-LACBWR MPC STORAGE SYSTEM FOR DAIRYLAND POWER COOPERATIVE LA CROSSE BOILING WATER REACTOR

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11.A.1.3 Failure of Instrumentation

The MPC-LACBWR storage system may use a temperature-sensing system to take daily measurements of the outlet air temperature at each of the four outlets of the concrete cask in lieu of performing daily visual inspection of the concrete cask air inlet and outlet screens for obstructions. This section presents the evaluation of the MPC-LACBWR storage system for a potential failure of the temperature-sensing system. The cause, radiological consequences, and recovery actions for the event are the same as those described in MPC FSAR Sections 11.1.3.1, 11.1.3.3, and 11.1.3.5, respectively.

The analysis of the MPC-LACBWR storage system temperature-sensing system failure event is essentially the same as that of the Yankee-MPC storage system. Failure of the temperature-sensing system does not have any adverse effects on the storage system. When the concrete cask air inlets are clear, no significant changes in the MPC-LACBWR storage system temperatures will occur during the time that it takes to indentify and correct the condition causing the failure of the temperature-sensing system. Furthermore, even under the worst-case fully blocked inlets and outlets accident condition evaluated in Section 11.A.2.8, the temperatures of the MPC-LACBWR storage system components do not reach or exceed their allowable temperature limits in 24 hours. Therefore, the 24-hour inspection interval provides sufficient time to identify and correct the condition causing the temperature-sensing system failure.

11.A.1.4 Severe Environmental Conditions (105°F and -40°F)

This section evaluates the MPC-LACBWR storage system for the steady-state effects of high and low ambient temperature conditions.

11.A.1.4.1 Cause of Event

To bound the expected steady state temperatures of the canister and storage cask during severe ambient conditions, analyses were performed to calculate the steady state storage cask, canister, and fuel cladding temperatures for a 105°F ambient temperature and 24-hour average solar loads. Similarly, winter weather analyses were performed for a -40°F ambient temperature with no solar load. A bounding heat load of 4.5 kW is conservatively used for the MPC-LACBWR storage system thermal analyses.

11.A.1.4.2 Analysis of the Off-Normal Ambient Temperature Event

Off-normal temperature conditions are evaluated using the thermal models described in Section 4.A.3.1.1. This evaluation shows that the component temperatures are within the allowable values for the off-normal ambient conditions. The principal component temperatures for each of these ambient temperature conditions are summarized as follows:

MPC-LACBWR Component	Maximum Temperature (°F)		Allowable Temperature (°F)
	105°F Ambient	-40°F Ambient	
Fuel Cladding	459	377	806
Support Disks	454	370	800
Heat Transfer Disks	452	368	700
Canister Shell	365	280	800
Concrete(1)	196	5	350

1. Concrete temperature is from Table 4.1-4 for NAC-MPC with a heat load of 12.5 kW.

The thermal stress evaluation for the MPC-LACBWR concrete cask for these off-normal conditions is bounded by that for the accident condition with 125°F ambient temperature (Section 11.2.10), since the heat load for MPC-LACBWR is much lower than the heat load for NAC-MPC and the accident condition has the maximum temperature gradient through the storage cask concrete wall.

The thermal stresses for the MPC-LACBWR canister, the support disks and weldments are classified as secondary stress in accordance with the ASME Code, which need not be evaluated for off-normal and accident conditions.

11.A.1.4.3 Radiological Consequences

There are no radiological consequences for this off-normal event.

11.A.1.4.4 MPC-LACBWR Performance

There are no adverse consequences for this off-normal condition. The maximum component temperatures are within the allowable temperature values. The materials used are not subject to low temperature brittle fracture.

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 inoperable, actions shall be taken immediately to ensure adequate heat removal is occurring in order to prevent the limiting CONCRETE CASK component temperatures do not exceed their short term allowable limits. Immediately, defined as the required action to be pursued without delay and in a controlled manner, provides a reasonable period of time (i.e., within the design basis time limit as presented in Section 11.2.8 or within the time limit for a less than design basis heat load case, as evaluated) to take action to remove the obstructions in the air flow path. <u>AND</u> <u>A.2</u> If the CONCRETE CASK heat removal system has been determined to be not OPERABLE, it must be restored to a fully OPERABLE status within 25 days.

(continued)

ACTIONS
(continued)

B.1

If Required Action A.1 or A.2 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 5 days will ensure that the CANISTER remains in a safe, analyzed condition.

OR

B.2

Place the affected NAC-MPC SYSTEM in a safe condition. The Completion Time for this Required Action of 5 days 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.

SURVEILLANCE REQUIREMENTS

SR 3.2.2.1

This SR ensures that the CONCRETE CASK average surface dose rates are within the LCO limits prior to STORAGE OPERATIONS. This Frequency is acceptable as corrective actions can be taken before off-site dose limits are compromised. The surface dose rates are measured approximately at the locations indicated on Figure A.3-1, following standard industry practices for determining average surface dose rates for large containers.

REFERENCES

1. 10 CFR Parts 20 and 72.
2. FSAR Sections 5.1, 5.A.1, 8.2 and 8.A.2.

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