Table 3.4.18 STRESS RESULTS FOR HI-TRAC VW VERSION P – NORMAL HANDLING			
Item	Calculated Value (ksi)	Allowable Limit (ksi)	Safety Factor
Bottom Lid Bolts – Tensile Stress	12.07	57.5	4.76
Bottom Lid Bolts – Shear Stress on Bolt Threads	4.35	23.8	5.46
Bottom Lid Bolts – Shear Stress on Bolt	12.9	23.8	1.84
Bottom Lid – Internal Thread Shear Stress	3.12	13.2	4.23

Table 3.4.19 STRESS RESULTS FOR ANCHORAGE IN HI-STORM FW VERSION E – LEVEL A				
Item		Allowable Force	Calculated Force	Safety Factor
		F_a (lbf)	F_c (lbf)	F_a / F_c
Anchor Bolt	Under Tension~~Under Tension~~	153,982~~153982~~	138,000~~129345~~	1.12~~1.19~~
	Thread Shear~~Thread Shear~~	175,406~~175406~~	138,000~~129345~~	1.27~~1.36~~
Compression Block	Thread Shear	241,275	138,000	1.75
Nut	Thread Shear~~Thread Shear~~	240,064~~141250~~	138,000~~129345~~	1.74~~1.09~~

Table 3.4.20

STRESS RESULTS FOR ANCHORED HI-STORM FW VERSION E – LEVEL D

Item		Allowable Force	Calculated Force	Safety Factor
		F_a (lbf)	F_c (lbf)	F_a / F_c
Anchor Bolt	Under Tension	215,575	157,314	1.37
	Thread Shear	356,470	157,314	2.27
Compression Block	Thread Shear	361,912	157,314	2.30
Nut	Thread Shear	487,871	157,314	3.10

Table 3.4.21

STRESS RESULTS FOR ANCHORED HI-STORM FW VERSION E – LEVEL D

Item		Allowable Stress	Calculated Stress	Safety Factor
		σ_a (psi)	σ_c (psi)	σ_a / σ_c
Base Plate~~Base Plate~~	Under Tension~~Under Tension~~	40,300	24,130	1.67
	Under Tension + Bending ~~Under Tension + Bending~~	60,400	24,130	2.50
	Under Shear~~Under Shear~~	29,400	12,065	2.44
Other Plate Members~~Other Plate Members~~	Under Tension~~Under Tension~~	40,300	12,410	3.25
	Under Tension + Bending ~~Under Tension + Bending~~	60,400	12,410	4.87
	Under Shear~~Under Shear~~	29,400	6,205	4.74

Table 3.4.22

SAFETY FACTOR FOR HI-STORM FW VERSION E LID DURING TORNADO WIND AND MISSILE IMPACT

Part	Induced Stress - ksi	Allowable Stress -ksi	Safety Factor
Closure Lid Bolts	5.8	50.4	8.69

[3.4.27] Carette and Malhotra, Performance of Dolostone and Limestone Concretes at Sustained High Temperatures, Temperature Effects on Concrete, ASTM STP 858, 1985, p. 38-67.

[3.4.28] Holtec Report HI- 2188720~~R0~~, "Structure Calculation Package for HI-STORM FW Anchor System", Revision 1~~0~~.

[3.4.29] Holtec Report HI- 2200647, "Analysis of the Postulated Drop and Missile Impact Events for the Loaded HI-STORM FW Version E Cask and the Loaded HI-TRAC VW System", Revision 3~~0~~.

[3.4.30] Topical report of Bechtel Power Corporation, BC-TOP-9A, "Design of structures for missile impact", Revision 2.

[3.6.1] Visual Nastran 2004, MSC Software, 2004.

BASES

APPLICABLE SAFETY ANALYSIS

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

When 50% or less of the inlet and outlet vent area is blocked (i.e., 50% to 100% of the vents are open), the heat removal system is considered operable, the blockage is considered a partial blockage, and the system is subject to off-normal condition limits in FSAR Tables 2.2.1 and 2.2.3. When greater than 50% of the inlet or outlet vent area is blocked (i.e., <50% of the vents are open), the heat removal system is considered inoperable, the blockage is considered a complete blockage and consistent with the HI-STORM FW FSAR, is considered an accident condition. As such, the system is subject to accident condition limits in FSAR Tables 2.2.1 and 2.2.3.

Analyses have been performed for the complete obstruction of half, and all inlet air ducts. Blockage of half of the inlet air ducts reduces air flow through the OVERPACK annulus and decreases heat transfer from the MPC. Under this off-normal condition, no SFSC components exceed the short term temperature limits.

The complete blockage of all inlet air ducts stops normal air cooling of the MPC. The MPC will continue to radiate heat to the relatively cooler OVERPACK. With the loss of normal air cooling, the SFSC component temperatures will increase toward their respective short-term temperature limits. None of the components reach their temperature limits over the duration of the analyzed event.

(continued)

BASES	
LCO	The SFSC Heat Removal System must be verified to be operable to preserve the assumptions of the thermal analyses. Operability is defined as either at least 50% of the inlet air ducts available for air flow (i.e., unblocked) or when differential temperature requirements are met. Operability of the heat removal system ensures that the decay heat generated by the stored fuel assemblies is transferred to the environs at a sufficient rate to maintain fuel cladding and other SFSC component temperatures within design limits. The intent of this LCO is to address those occurrences of air duct blockage that can be reasonably anticipated to occur from time to time at the ISFSI (i.e., Design Event I and II class events per ANSI/ANS-57.9). These events are of the type where corrective actions can usually be accomplished within one 8-hour operating shift to restore the heat removal system to operable status (e.g., removal of loose debris). This LCO is not intended to address low frequency, unexpected Design Event III and IV class events (ANSI/ANS-57.9) such as design basis accidents and extreme environmental phenomena that could potentially block one or more of the air ducts for an extended period of time (i.e., longer than the total Completion Time of the LCO). This class of events is addressed site-specifically as required by Section 3.4.10 of Appendix B to the CoC.
APPLICABILITY	The LCO is applicable during STORAGE OPERATIONS. Once an OVERPACK containing an MPC loaded with spent fuel has been placed in storage, the heat removal system must be operable to ensure adequate dissipation of the decay heat from the fuel assemblies.
ACTIONS	A note has been added to the ACTIONS which states that, for this LCO, separate Condition entry is allowed for each SFSC. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each SFSC not meeting the LCO. Subsequent SFSCs that don't meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

(continued)

BASES

ACTIONS (continued)

A.1

Although the heat removal system remains operable, the blockage should be cleared expeditiously. If temperature measurements are used to declare operability, no inspection of the vents is required, but if any blockage is identified, it should be removed.

B.1

If the heat removal system has been determined to be inoperable, it must be restored to operable status within eight hours. Eight hours is a reasonable period of time (typically, one operating shift) to take action to remove the obstructions in the air flow path.

C.1

If the heat removal system cannot be restored to operable status within eight hours, the innermost portion of the OVERPACK concrete may experience elevated temperatures. Therefore, dose rates are required to be measured to verify the effectiveness of the radiation shielding provided by the concrete. This Action must be performed immediately and repeated every twelve hours thereafter to provide timely and continued evaluation of the effectiveness of the concrete shielding. As necessary, the system user shall provide additional radiation protection measures such as temporary shielding. The Completion Time is reasonable considering the expected slow rate of deterioration, if any, of the concrete under elevated temperatures.

C.2.1

In addition to Required Action C.1, efforts must continue to restore cooling to the SFSC. Efforts must continue to restore the heat removal system to operable status by removing the air flow obstruction(s) unless optional Required Action C.2.2 is being implemented.

This Required Action must be complete in 24 hours. The Completion Time is consistent with the thermal analyses of this event, which show that all component temperatures remain below their short-term temperature limits up to 32 hours after event initiation.

(continued)