Evaluation for the effects of small diameter solid spherical missiles on the 24PT1-DSC is not required, as there are no openings in the AHSM which lead directly to the canister. Blocked vents which could result from tornado/wind debris are addressed in Chapters 3 and 11.

2.2.2 Water Level (Flood) Design

The 24PT1-DSC and AHSM are designed for an enveloping design basis flood, postulated to result from natural phenomena such as tsunami, and seiches, as specified by 10CFR 72.122(b). For the purpose of this generic evaluation, a flood height of 50 feet with a water velocity of 15 fps is used. The 24PT1-DSC is subjected to an external hydrostatic pressure equivalent to the 50 feet head of water or 21.7 psi. The AHSM is evaluated for the effects of a water current of 15 fps impinging on the sides of a submerged AHSM. For the flood case that submerges the AHSM, the inside of the AHSM will be rapidly filled with water through the AHSM vents. Therefore, the AHSM components are not evaluated for the resulting static head of water. The effects of flooding and submergence on the canister are addressed in Chapters 3, 4 and 11.

2.2.2.1 Flood Elevations

It is anticipated that the 24PT1-DSC and AHSM will be located on flood-dry sites. However, as stated above, the AHSM and 24PT1-DSC are designed for a flood elevation 50 ft. above the base of the AHSM.

2.2.2.2 Phenomena Considered in Design Load Calculations

The AHSM is designed to withstand loads from forces developed by the probable maximum flood including dynamic phenomena such as momentum and drag. The 24PT1-DSC is designed for the hydrostatic head equal to 50 ft. water submergence.

2.2.2.3 Flood Force Application

All flood loadings and effects from floods on the Advanced NUHOMS® System are discussed in Chapters 3 and 11.

2.2.2.4 Flood Protection

Flood protection measures for the Advanced NUHOMS® System are discussed in Chapters 3 and 11.

2.2.3 Seismic Design

Seismic design criteria are dependent on the specific site location. These criteria are established based on the general requirements as stated in 10CFR Part 72.102. The design earthquake (DE) for use in the design of the casks must be equivalent to the safe shutdown earthquake (SSE) for a co-located nuclear power plant, the site of which has been evaluated under the criteria of 10CFR 100, Appendix A.

2.2.3.1 Input Criteria

The design basis response spectra of the Advanced NUHOMS® System design is based on the standard spectrum shape in NRC Regulatory Guide 1.60 [2.4], anchored at 1.5g ZPA for the horizontal direction. The vertical design spectrum is set at two-thirds of the horizontal direction over the entire frequency range. The horizontal and vertical spectra are specified at the top of the basemat.

The horizontal and vertical components of the design response spectra are shown in Figure 2.2-1 and Figure 2.2-2.

2.2.3.2 Seismic-System Analyses

1. Seismic Analysis Methods. Both linear and non-linear analysis methods are used to determine the maximum seismic response of the Advanced NUHOMS® System. These analytical methods are discussed in Chapters 3 and 11.

2. Methods to Determine Overturning Moments. Non-linear analysis methods are used to determine overturning moments of the AHSM. These analysis methods are discussed in Chapters 3 and 11.

2.2.4 Snow and Ice Loadings

Snow and ice loads for the AHSM are derived from ASCE 7 [2.8]. The maximum 100 year roof snow load, specified for most areas of the continental United States for an unheated structure, of 110 psf is assumed. There are no credible snow and ice loads applied to the 24PT1-DSC as the AHSM and TC provide the environmental protection. Snow and ice loads for the TC with a loaded 24PT1-DSC are negligible due to the smooth curved surface of the cask, the heat rejection of the SFAs, and the infrequent short term use of the cask.

2.2.5 Tsunami

Specific analyses including analyses for tip-over are not done for tsunamis as they are typically bounded by the tornado, wind and flooding load conditions. The licensee should evaluate site specific impacts of a tsunami.

2.2.6 Lightning

A lightning strike will not cause a significant thermal effect on the AHSM or stored 24PT1-DSC. The effects on the AHSM resulting from a lightning strike are discussed in Chapter 11.

2.2.7 Combined Load Criteria

2.2.7.1 Advanced Horizontal Storage Module

The reinforced concrete AHSM is designed to meet the requirements of ACI 349-97 [2.6]. The alternate temperature criteria of NUREG-1536 will be utilized as discussed in Chapters 3 and 11.