

From: Beasley, Benjamin
Sent: Monday, March 28, 2022 2:02 PM
To: Nicole Schlichting; Jim Tomkins
Cc: Lehman, Bryce; Colaccino, Joseph; Drew Peebles; Darrell Gardner; Martin Bryan
Subject: Questions for the General Audit of Hermes PSAR

Nichole and Jim,

Below are some questions on structural items from sections 3.4 and 3.5 of the Hermes PSAR for the general audit. We would like to schedule an audit meeting when you are ready to discuss these.

Regards,
Ben

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| 3.4-1 | <p>PSAR Figure 3.4-1 provides the horizontal and vertical design response spectra for the Kairos site. These spectra peak above 10 Hz and are relatively low between 1 and 10 Hz. This shape is likely adequate for seismic design of high-frequency sensitive components; however, it is inadequate for the design of structures whose resonance generally occurs between 1 and 10 Hz.</p> <p>Explain how the design response spectra, shown in Figure 3.4-1, provide adequate capacity between the important frequencies of 1 to 10 Hz, where most of the safety related SSCs have their resonance frequencies.</p> |
| 3.4-2 | <p>PSAR Section 3.4 notes that safety-related SSCs are designated as Seismic Design Category (SDC) 3. However, no justification is provided for this designation.</p> <p>Explain how it was determined that safety-related structures should be designated as SDC 3.</p>                                                                                                                                                                                                                                                                                                                                              |
| 3.4-3 | <p>PSAR Section 3.4.1.5 notes that the Reactor Building is represented by a three-dimensional finite-element model developed in accordance with ASCE 4-16. Additional detail on the model is not provided.</p> <p>Provide additional details regarding the finite element model, such as program used, elements used, mesh size, etc.</p>                                                                                                                                                                                                                                                                             |
| 3.4-4 | <p>PSAR Section 3.4.1.5 notes that the structural mass in the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

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|       | <p>model also accounts for a portion of design live loads with 25% of the live loads for loads less than 200psf or 50psf otherwise, and 25% of the snow load. The Standard Review Plan (SRP), NUREG-0800, identifies criteria the NRC staff uses when determining if a power reactor design is adequate. SRP Section 3.7.2, Acceptance Criteria 3.D notes that, “in addition to the structural mass, mass equivalent to a floor load of 50 psf should be included, to represent miscellaneous dead weights .... Also, mass equivalent to 25 percent of the floor design live load and 75 percent of the roof design snow load, as applicable, should be included.”</p> <p>Recognizing that Hermes is a test reactor, clarify whether an additional floor load has been included in the model to account for miscellaneous dead weight and justify the additional value, or lack thereof. Also explain why the floor and snow load values identified in the PSAR are adequate.</p> |
| 3.4-5 | <p>PSAR Section 3.4.1.6 notes that soil-structure interaction (SSI) effects are considered based on the guidance of Chapter 5 of ASCE 4-16. No additional information is provided regarding the SSI analysis. Additional information on the SSI analysis is necessary for the staff to determine that the seismic design is adequate.</p> <p>Provide additional information regarding the SSI analysis, including the modeling methods, how the analysis was performed, and key assumptions of the analysis.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3.4-6 | <p>PSAR Section 3.4.1.6 notes that the seismic response analysis is performed using linear analysis and follows the guidance in Chapter 4 of ASCE 4-16. No additional information is provided regarding the response analysis.</p> <p>Provide a more detailed explanation of how the seismic response analysis is performed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3.4-7 | <p>PSAR Section 3.4.1.6 notes that the seismic response analysis is performed to develop structural forces and in-structure response spectra (ISRS); however, no details are provided on the analysis.</p> <p>Provide additional details on the analysis, including how the ISRS is developed and how ground motions are combined.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3.5-2 | <p>PSAR Section 3.5 notes that the non-safety portion of the Reactor Building is designed so that its failure does not interfere with safety functions. Section 3.4.2 notes that non-safety related SSCs are designed in accordance with the 2012 IBC. The non-safety portion of the reactor building surrounds the safety-related portion.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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|       | <p>Explain how the safety-related portion of the Reactor Building is protected from possible failure of the non-safety portion.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 3.5-3 | <p>PSAR Section 3.5.3 notes that the safety related portion of the reactor building is designed to meet ACI 349-2013. NRC Regulatory Guide 1.142 endorses the use of ACI 349-13 with certain conditions.</p> <p>Since Hermes is not required to meet Regulatory Guide 1.142, explain if these conditions will be addressed, or why they are not applicable.</p>                                                                                                                                                                                                                                                                                                        |
| 3.5-4 | <p>PSAR Section 3.5.3.3.2 notes that the design uses a seismic isolation system. Based on other statements in the PSAR it appears the system will be designed in accordance with Chapter 9 of ASCE 43-19; however, this is not clearly stated in the PSAR.</p> <p>Identify which code or standard will be used for the design of the seismic isolation system. If ASCE 43-19 will be used, identify and justify any provisions in the standard that will not be met. Also, explain how the seismic isolation system was accounted for in the structural analysis (this can also be addressed in the responses to questions in 3.4 regarding the seismic analysis).</p> |
| 3.5-5 | <p>PSAR Section 3.5.3.3.2 notes that the design uses a seismic isolation system; however, the type of isolators (e.g., elastomeric bearings, sliding isolation bearings) are not discussed in the PSAR.</p> <p>Explain what type of isolators the seismic isolation system will use.</p>                                                                                                                                                                                                                                                                                                                                                                               |
| 3.5-6 | <p>PSAR Section 3.5.4 notes that a monitoring and inspection program will meet the requirements of ASCE 43-19 Section 9.2.16. It appears the section which the PSAR references should be 9.2.1.6.</p> <p>The ASCE inspection program recommends testing isolators at 10-year intervals. The facility will likely be operated for 4 years. What is the plan for the inspection of the seismic isolators?</p>                                                                                                                                                                                                                                                            |

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