Enclosure

REQUEST FOR ADDITIONAL INFORMATION ON THE LICENSE APPLICATION AND SAFETY ANALYSIS REPORT FOR THE HUMBOLDT BAY INDEPENDENT SPENT FUEL STORAGE INSTALLATION

PACIFIC GAS AND ELECTRIC COMPANY
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CONTENTS

ACRONYMS

American Society of Civil Engineers	ASCE
American Society of Mechanical Engineers	ASME
compact disc	CD
Center for Nuclear Waste Regulatory Analyses	CNWRA
design basis earthquake	DBE
deterministic seismic hazard assessment	DSHA
Final Safety Analysis Report	FSAR
greater than class C	GTCC
Humboldt Bay	HB
Humboldt Bay Power Plant	HBPP
Independent Spent Fuel Storage Installation	ISFSI
Interim Staff Guidance	ISG
mean lower low water	MLLW
multipurpose canister	MPC
license amendment request	LAR
Pacific Gas and Electric Company	PG&E
quality assurance/quality control	QA/QC
probabilistic seismic hazard assessment	PSHA
request additional information	RAI
refueling building	RFB
safe shutdown evaluation refueling building	SSERFB
safety analysis report	SAR
Spent Fuel Projects Office	SFPO
structurals, systems, and components	SSC
trinitrotoluene	TNT
U.S. Nuclear Regulatory Commission	NRC
zero period accelerations	ZPA

1.0 INTRODUCTION

On December 15, 2003, the Pacific Gas and Electric Company (PG&E) submitted a license application in accordance with 10 CFR Part 72 to the U.S. Nuclear Regulatory Commission (NRC) to construct and operate an onsite Independent Spent Fuel Storage Installation (ISFSI). The onsite ISFSI will store spent nuclear fuel assemblies and greater than Class C (GTCC) waste from Unit 3 of the Humboldt Bay Power Plant (HBPP). The proposed Humboldt Bay (HB) ISFSI will use multi-purpose canisters (MPCs) placed in an underground vault. The applicant will be using a modified HI-STAR 100 dry cask system developed by Holtec International, with MPCs designed to accommodate the smaller fuel assemblies used at the HBPP. Documents associated with this submittal include the License Application, Environmental Report, Safety Analysis Report (SAR), Emergency Plan, Technical Specifications, Quality Assurance Program, and a Preliminary Decommissioning Plan, along with supporting Calculations and Data reports.

This document, entitled Request for Additional Information (RAI), contains additional information requirements identified by the NRC staff during its review of the PG&E application for a 10 CFR Part 72 license for the Humboldt Bay ISFSI. Each individual RAI describes information needed by the staff for it to complete its review of the application and determine whether PG&E has demonstrated compliance with the regulatory requirements. Applicable regulatory requirements are specified in the individual question or comment. The format of this RAI generally follows the chapters of NUREG–1567, “Standard Review Plan for Spent Fuel Dry Storage Facilities (NRC, 2000).”

The staff’s technical review was carried out in accordance with the applicable NRC regulations in 10 CFR Parts 20 and 72, and the NRC guidance contained in NUREG–1567, and in NUREG–1536, “Standard Review Plan for Dry Cask Storage Systems (NRC, 1997).” Note that RAI items may refer to the Spent Fuel Project Office's (SFPO) Interim Staff Guidance (ISG) documents. The ISG documents were developed as a result of NRC management decisions on several key issues related to the review and approval of spent fuel storage systems. These positions have typically been discussed in meetings with the Nuclear Energy Institute. The current ISG documents will be incorporated into the next revisions of NUREG-1567 and NUREG-1536.

2.0 REVIEW COMMENTS

Comments generated by the staff in the course of its technical review are listed in this section, based on the regulations and guidance described in Section 1.0. The request for additional information (RAI) describes additional information needed to facilitate technical review and preparation of the safety evaluation report.

Chapter 1—Introduction and General Description

The staff has not identified any additional information needs regarding the introduction and general description provided in the license application and SAR for the HB ISFSI.

Chapter 2—Site Characteristics

2-1. Provide information concerning the size and type of material used to construct the riprap.

In Section 2.6.4.2 of the SAR, the applicant discusses the coastal retreat and erosion of Buhne Point by wave action. The SAR notes that approximately 400 m [1,312 ft] of shoreline have been eroded headward between approximately 1860 and 1959. The bluff retreat was abated when the riprap was placed on the beach in front of the bluff in the 1950s. For staff to evaluate the effectiveness of the riprap in preventing further bluff erosion, the applicant should provide information concerning the size and type of material used to construct the riprap. In particular, the applicant should provide information to demonstrate that the riprap is sufficiently robust to remain in place on the beach during and after a large storm or a tsunami event such that significant erosion of the bluff will not occur.

- This information is necessary to demonstrate compliance with 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); and §72.122(b).

2-2. Provide digital files of the three-component design basis earthquake (DBE)-spectrum compatible ground motion time histories and safe shutdown evaluation refueling building (SSERFB) DBE-spectrum compatible time histories.

In Pacific Gas and Electric Company (2002a, GEO.HBIP.02.05), the applicant states that the four sets of three-component DBE-spectrum compatible ground motion time histories were included as enclosures. However, the enclosures (digital files) are not available on the compact discs (CDs) submitted by PG&E to the staff. Similarly, the applicant should provide the digital files of the four sets of three-component SSERFB DBE-spectrum compatible time histories that are discussed in Pacific Gas and Electric Company (2003a, GEO.HBIP.0301). These digital files are necessary to check compatibility of the time histories with their corresponding design spectra. These files are also necessary for staff to evaluate the adequacy of dynamic geotechnical and design analyses.

- This information is necessary to determine compliance with 10 CFR §72.90(a), (b), and (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-3. Provide updated hazard results that incorporate recently published subduction zone interface attenuation relationships or provide additional technical bases to support current hazard results based solely on the attenuation relationship of Youngs, et al. (1997).

The attenuation relationship developed by Youngs, et al. (1997) was the only attenuation relationship used to predict strong ground motions at the proposed ISFSI from earthquakes generated at the interface between the down-going and over-riding plates along the Cascadia subduction zone. However, recently published papers by Gregor, et al. (2002) and Atkinson and Boore (2003) developed attenuation relationships for interface earthquakes for the Cascadia subduction zone that appear to supersede Youngs, et al. (1997). As shown in Figure 4 of Gregor, et al. (2002), the ground motions predicted by the Gregor, et al. (2002) model are approximately 40 percent higher than those predicted by Youngs, et al. (1997). Similarly, ground motions predicted using Atkinson and Boore (2003) are considerably higher than those predicted by Youngs, et al. (1997) at frequencies below 2 to 3 Hz.

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-4. Provide updated hazard results that incorporate recently published subduction intraslab attenuation relationships or provide additional technical bases to support current hazard results based solely on the attenuation relationship by Youngs, et al. (1997).

The attenuation relationship developed by Youngs, et al. (1997) was the only attenuation relationship used to predict strong ground motions at the proposed ISFSI from earthquakes in the down-going Gorda plate. However, in a recently published paper, Atkinson and Boore (2003) developed an attenuation relationship for intraslab subduction zone earthquakes that appears to supersede Youngs, et al. (1997). For example, during a 7.5-magnitude earthquake at an epicenter distance of 7 km [4.3 mi], Atkinson and Boore (2003) predicted significantly higher ground motion (up to a factor of 2×) for frequencies below 5 Hz. At 1 Hz, the ground motion predicted using Atkinson and Boore (2003) is three times higher than that predicted by Youngs, et al. (1997).

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-5. Provide the following information with regard to uncertainties in earthquake ground motion assessment:

(a) Approach used to quantify uncertainty (both aleatory and epistemic) in source characterization, ground motion prediction, site response, and deterministic and probabilistic seismic hazard analyses.

(b) Fractile hazard curves from the probabilistic seismic hazard assessment (PSHA) (e.g., 5th, 15th, 85th, and 95th percentile hazard curves) or other measures of

uncertainty with discussion of the relative contribution of various inputs of the hazard assessment to uncertainty.

(c) Mean, median, 14th, and 84th percentile response spectra from the deterministic seismic hazard assessment (DSHA).

The Senior Seismic Hazard Analysis Committee (Budnitz, et al., 1997) recommends keeping track of aleatory uncertainties and epistemic uncertainties in seismic hazard analyses, including ground motion prediction. NRC (2003, Regulatory Guide 3.73) indicates that a PSHA should be performed for a proposed ISFSI site partly because it can systematically take into account uncertainties and alternative hypotheses. The SAR does not provide sufficient discussion of how uncertainties were treated in the ground motion models or in the PSHA or DSHA. Pacific Gas and Electric Company (2003b, GEO.HBIP.03.04) does state that aleatory variability leads to the shape of the hazard curve, whereas epistemic uncertainty leads to alternative hazard curves. However, no discussions were given as to how the shape of the hazard curves are affected by various uncertainties in the input parameters. Only the mean hazard curves from the PSHA and 84th percentile response spectra from the DSHA were presented in the SAR and its supporting documents. The staff needs this additional information to identify sources of uncertainty in ground motion hazard and to determine whether uncertainties have been sufficiently accounted for in overall hazard results.

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-6. Provide digital files of the three-component DBE-spectrum compatible ground motion time histories and SSERFB DBE-spectrum compatible time histories and modified time histories for the Little Salmon fault and subduction zone sources that match the target spectra of the individual sources.

In Pacific Gas and Electric Company (2002a, GEO.HBIP.02.05), the applicant states that the four sets of three-component DBE-spectrum compatible ground motion time histories were included as enclosures. However, the enclosures (digital files) are not available on the CDs submitted by PG&E to the staff. Similarly, the applicant should provide the digital files of the four sets of three-component SSERFB DBE-spectrum compatible time histories that are discussed in Pacific Gas and Electric Company (2003a, GEO.HBIP.03.01). These digital files are necessary to check compatibility of the time histories with their corresponding design spectra and to evaluate the PG&E approach in combining time histories from individual sources to produce a combined time history for synchronous rupture. These files are also necessary for the staff to evaluate the adequacy of dynamic geotechnical and design analyses.

- This information is necessary to determine compliance with 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-7. Provide additional technical justifications for the approach used to develop time histories and response spectra from synchronous rupture of the main Cascadia subduction zone and the Little Salmon fault zone.

Section 2.6.6.2.5 of the SAR describes how the response spectral values and time histories for a synchronous rupture on the Cascadia subduction zone and Little Salmon fault subsources were calculated using random vibration theory (the square root of the sum of the squares) and time domain addition, respectively. This approach is new, innovative, and not well established in seismic hazard assessments of nuclear facilities. In addition, combining time histories in the time domain may not be constructive or conservative. For the staff to evaluate whether this approach is sufficient, the applicant should provide additional technical justifications for (i) using the square root of the sum of the squares to combine the response spectra (random vibration theory) from the two individual sources and (ii) using time domain addition to combine time histories from the two subsources. In addition, the applicant should assess whether strong motion records exist worldwide that could verify the approach and whether the approach has been used previously for other facilities (such as bridges) and in other areas with similar structural settings (for example, the Aleutian subduction zone).

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-8. Provide additional information to show that the vertical ground motion component has limited significance in structural and geotechnical analyses and that the approaches in the applicant's characterization of the vertical ground motion are adequate.

Section 2.6.6.1 of the SAR and Pacific Gas and Electric Company (2002b, GEO.HBIP.02.04; 2002c, GEO.HBIP.02.06; 2003b, GEO.HBIP.03.04) discuss the approaches used in the evaluation of earthquake ground motion, including vertical ground motion. The characterization of vertical ground motion is different from that of horizontal ground motion, mostly because of limited attenuation model studies for vertical ground motions. These differences include (i) vertical ground motion on soil surface which was calculated directly from the selected empirical attenuation models for deep soil site conditions; (ii) one attenuation model (Abrahamson and Silva, 1997) was used for crustal sources; and (iii) the vertical ground motion component for subduction sources was calculated using the horizontal attenuation model of Youngs, et al. (1997) for subduction sources with deep soil site conditions and the vertical-to-horizontal ratios developed in the Abrahamson and Silva (1997) crustal model. The staff needs this additional information to evaluate the applicant's conclusion that the vertical ground motion component has limited significance in structural and geotechnical stabilities at the proposed ISFSI site.

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-9. Provide soil properties, including modulus and damping parameters, as functions of shear strain used in the site response analyses to derive soil amplification factors.

Calculation file Pacific Gas and Electric Company (2002c, GEO.HBIP.02.06) states (page 5) that strain-dependent modulus and damping parameters are provided in Table 4-1 of this calculation file. However, Table 4-1 contains only density and shear

wave velocity data. The staff needs this information to evaluate the adequacy of site response analyses.

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); and §72.122(b).

2-10. Provide justification for not considering vertical ground motion in estimating seismically induced permanent displacement of sliding mass for slope stability assessment.

Section 2.6.7.5 of the SAR considers only horizontal acceleration in the analysis and excludes vertical ground motion on the basis that it contributes only approximately 10 percent or less to the slope displacement (Pacific Gas and Electric Company, 2002d, GEO.HBIP.02.07). The applicant cited a publication by Yan, et al. (1996) to support the assumption. Yan, et al. (1996) are, however, inconclusive on the contribution of vertical acceleration to slope displacement, having stated that the preliminary results indicate that the effects of the vertical ground motion on seismically induced displacement depend on material strength, configuration of slopes, and the characteristics of ground motions. The vertical upward motion would reduce the shear resistance along the slip surface in sand-like material in the soil layers (2, 3, and 4, Figure 7-6, Pacific Gas and Electric Company, 2002d, GEO.HBIP.02.07) below the storage vault and potentially reduce the estimated yield acceleration. A reduction of yield acceleration would increase permanent slope displacement. This effect is likely to be important in the proposed design because the DBE has a high vertical component of approximately 1.6g, which is greater than the horizontal ground motion.

- This information is necessary to determine compliance with 10 CFR §72.24, §72.90, §72.92, and §72.122(b)(2).

2-11. Provide a basis for the estimated seismically induced permanent slope displacement at the ISFSI site.

In Section 2.6.7.5 of the SAR, the applicant obtained a seismically induced permanent slope displacement of 0.43 m [1.4 ft] by averaging displacements from different slopes (bluff side and plant side) and different ground motions (Sets 1 and 3). The applicant concluded that the slopes at the ISFSI site would be stable during maximum seismic ground motion. As indicated in Figure 7-31 (Pacific Gas and Electric Company, 2002d, GEO.HBPP.02.07), bluff-side and plant-side slopes are on opposite sides of the ISFSI and have different slope configurations. In addition, calculated displacement in Table 7-6 (Pacific Gas and Electric Company, 2002d, GEO.HBPP.02.07) shows a maximum displacement of 1.43 m [4.7 ft] for the plant-side slope. The applicant should provide the basis for (a) averaging displacements from different slopes and clarify why calculated maximum displacement was not considered as the estimated permanent slope displacement and (b) concluding that the slopes would be stable during seismic loading, considering the maximum displacement of 1.43 m [4.7 ft] computed through the Newmark analysis (Newmark, 1965) should be interpreted as an order-of-magnitude estimate, based on State of California (1997).

- This information is necessary to determine compliance with 10 CFR §72.24; §72.90 (a), (b), (d); §72.92; and §72.122(b)(2).

2-12. Provide analyses for the Transporter Route/Transporter Stability and Storage Vault Cask Handling Activities using the DBE loads based on the 2,000-year return period ground motions.

In Section 3.2.4 of the SAR, the applicant proposes to reduce the DBE loads, which are based on the 2,000-year return period ground motions, by the exposure frequency of the casks during transport and loading operation. Using the exposure frequency, the applicant concludes that the appropriate DBEs for these operations should be based on the 50- and 25-year return period ground motions. The staff considers this approach inconsistent with the requirements in 10 CFR §72.103 and associated guidance in NRC Regulatory Guide 3.73 (NRC, 2003). The staff considers that the DBE spectra should be based on the 2,000-year return period ground motions. The applicant should use the 2,000-year return period ground motion earthquake loads as specified in Regulatory Guide 3.73 to demonstrate that cask performance will maintain radiological safety during transport and loading in accordance with 10 CFR §72.106(b).

- This information is necessary to determine compliance with the regulatory requirements in 10 CFR §72.90(a), (b), (d); §72.92(a), (c); §72.98(c)(3); §72.103(b), (f); §72.106(b); and §72.122(b).

2-13. Provide the basis for the conclusion that the slope displacement along the transporter route is neglible, or demonstrate that the cask would continue to perform its safety function if the stability of the slope is impaired during transport.

In the Pacific Gas and Electric Company calculation (2002e, GEO.HBIP.02.08), the estimated displacement of the slope at the critical cross section along the transporter route for seismic ground motion and yield acceleration of 0.84g ranges from 0.8 to 2.7 m [2.6 to 9.0 ft]. Section 2.6.7.8 of the SAR concluded that the displacement would be negligible because the ground motion is less than yield acceleration. As identified in RAI 2-12, the use of a reduced level design basis event must be consistent with the requirements of 10 CFR 72.103 and NRC Regulatory Guide 3.73. Provide the basis for the conclusion, or demonstrate that the cask would continue to perform its safety function if the stability of the slope is impaired. Identify the consequences associated with permanent slope displacement during seismic events along the transporter route.

- This information is necessary to determine compliance with 10 CFR §72.24, §72.90, §72.92, and §72.122(b)(2).

2-14. Provide adequate justification for precluding liquefaction potential at the ISFSI site in the vicinity of the concrete vault.

The applicant concluded that the ISFSI site is not liquefaction susceptible on the basis that standard penetration test blow counts converted to clean sand (silt and clay <5 percent) equivalent $(N_1)_{60cs}$ is less than 30 as shown in Figure 2 of PG&E's calculation (2002f, GEO.HBIP.02.02). The clean sand blow count was obtained by applying corrections on standard 60-percent energy ratio blow count $(N_1)_{60}$, as discussed in Youd,

et al. (2001), and the threshold value of 30 is based on a limit established for magnitude 7.5 earthquakes with data from liquefaction case histories in Figure 2 of Youd, et al. (2001). Although the applicant's argument can be accepted for soil below elevation −15 mean lower low water (MLLW), data presented from this analysis in Figure 2 and the table on page 17 of Pacific Gas and Electric Company (2002f, GEO.HBIP.02.02) are not sufficient to eliminate potential liquefaction, particularly for the soil layer between elevation 5 to −10 MLLW, which is approximate 7.6 to 12.2 [25 to 40 ft] below the cask vault.

As indicated in Figure 2 of Pacific Gas and Electric Company (2002f, GEO.HBIP.02.02), 6 standard penetration test data available in the soil layer between 5 and −10 MLLW are from bore holes 99-1, 99-2, 99-3, 99-4, and 99-5. The blow count data from bore hole 99-3 (below the vault) are 46, 39, and 22; from 99-4 is 32; from 99-5 is 32; from 99-2 is 24. Only one bore hole, 99-3, is located on the footprint of the cask vault 23.2 × 6.1 m [76 × 20 ft]. Bore holes 99-4, 99-5, and 99-2 are within reasonably close proximity of the cask vault. The blow count data from bore hole 99-1 is excluded because this bore hole is too far from the cask vault. Of six data points, approximately 30 percent of the blow count data are less than the threshold blow count of 30 ,and two blow counts (32) are close to the threshold value. In addition, all blow count data between −4 and −10 MLLW (blow counts 22 and 24) are less than 30. Therefore, data presented in Figure 2 (Pacific Gas and Electric Company, 2002f, GEO.HBIP.02.02) are not sufficient to eliminate potential liquefaction of the soil. Boring logs presented in Data Report B (Pacific Gas and Electric Company, 2002g) and Soil Laboratory Test Data presented in Data Report E (Pacific Gas and Electric Company, 2002h) indicate the soil within that layer primarily consists of sand and silt. Soil directly below the cask vault at depth 53 (elevation −10 MLLW) in bore hole 99-3 has been classified as ML (inorganic silt) with very low plasticity. Fine contents of this soil (fines passing through No. 200 sieve) is 88 percent, with 68-percent silt and 20-percent clay, and the plasticity index is 7. In addition, sand fine is approximately 12 percent. In general, the soil classified as ML is susceptible to liquefaction. The standard blow count $(N_1)_{60}$ of 14 and clean sand blow count $(N_1)_{60cs}$ of 22 at this location is less than threshold value of 30, indicating a potential for liquefaction.

Pacific Gas and Electric Company (2002f, GEO.HBIP.02.02) presented shear wave velocity along depth for bore holes 99-1 and 99-2 in Figures 4 and 5. The velocity profile in bore hole 99-2, which is closest to the cask vault, shows least shear wave velocity between elevation 0 to −10 MLLW and may represent a critical layer for potential liquefaction. Pacific Gas and Electric Company (2002f, GEO.HBIP.02.02) did not provide any analysis of shear wave velocity for assessing liquefaction potential of soil below the cask vault.

The information provided by the applicant is not sufficient to eliminate potential liquefaction of the soil. Further analysis is needed to (i) demonstrate that the factor of safety against liquefaction is adequate, considering the DBE used in the design analysis of concrete vault structure, (ii) analyze data from other tests (e.g., shear wave velocity), and (iii) evaluate the extent of layer susceptible to liquefaction.

- This information is necessary to determine compliance with 10 CFR §72.24, §72.90, §72.92, and §72.102(c).

Chapter 3—Operational Systems

3-1. Provide information that demonstrates that the technical specifications and operational procedures will ensure that the leakage rates for those casks with damaged fuel are in accordance with the requirements of the HI-STAR 100 Final SAR (Holtec International, 2002a, HI–2012610).

The HI-STAR 100 Final SAR identifies that casks with damaged fuel have a different acceptance criteria for leakage rate than casks without damaged fuel. The applicant should remove all references to “leak tight” from the SAR. Interim Staff Guidance (ISG)–18 refers to the qualification of final closure welds on austenitic stainless steels as providing “no credible leakage.” This terminology provides an equivalent level of safety to “leak tight,” however it is not the same as the formal definition of leak tight, which can be found in ANSI N14.5.

- This information is necessary to determine compliance with 10 CFR §72.24(b) and §72.44(c).

3-2. Provide details regarding the operational inspection of the ISFSI drainage system. Figure 3.2-1, Sheets 4 and 5 of 5 show that a drainage system is provided as part of the reinforced concrete storage vault cells. As part of the operational inspection made during the storage of the HI-STAR 100 HB casks, identify the method(s) and interval to be used to verify that the drainage system is functioning efficiently in each of the six cells of the storage vault. Identify whether the inspection methods are experience-based, and how they can account for unanticipated moisture conditions in the vault, such as accumulation of water from condensation in the vault. If accumulation of water from condensation is a concern, provide information of the propensity for this to occur. Consideration of normal operational temperatures, as well as the peak temperatures, and 20 additional years of cooling of the fuel should be made in this analysis. Long-term wetting of the cask and vault steel liner may result in corrosion that may affect their ability to perform their safety function.

- This information is necessary to determine compliance with 10 CFR §72.24(b).

Chapter 4—Structures, Systems, and Components and Design Criteria Evaluation

4-1. Provide a discussion of the effects of the design basis tsunami created based on the 2,000-year return period DBE on onsite cask transport.

Section 3.2.3.2 of the SAR states that a 50-year return period earthquake spectrum is used to evaluate the onsite cask transport, and this earthquake does not have sufficient energy to produce a tsunami that would cause flooding on the transport route. The staff does not accept using a 50-year return period earthquake spectrum as a seismic design basis for onsite cask transport (see RAI 2-12). In accordance with 10 CFR §72.103, and associated guidance in NRC Regulatory Guide 3.73 (2003), PG&E uses a 2,000-year return period earthquake as the DBE for the HB ISFSI. Consequently, as in RAI 2-12, this same DBE should be used for assessing performance of onsite cask transport.

Consequently, the design basis tsunami for onsite cask transport should be the design basis tsunami created based on the 2,000-year return period DBE instead of the 50-year return period earthquake.

- This information is needed to determine compliance with 10 CFR §72.92(a), (b), (c) and §72.122(b)(2)(i).

Chapter 5—Installation and Structural Evaluation

5-1. Provide the following information regarding the MPC-HB fuel basket spacers and the basket cell walls (Holtec International, 2003a, HI–2033046; see Figure 3.3-2, sheet 2 of 3):

(a) The rationale for using Subsection NG instead of Subsection NF (ASME International, 1995) for designing the fuel basket spacers and the basket cell walls should be provided. These components do not appear to fall within the jurisdictional boundary of Subsection NG (ASME International, 1995, Article NG–1131) because the basket and the spacers attached to it should be considered as an internal structure.

(b) The buckling load computed in Section 5 of Supplement 2 (Holtec International, 2003a, HI–2033046) does not apply to the design of components with relatively small slenderness ratio. Provide the rationale for not using Subsection NF (ASME International, 2001, NF–3322) and Appendix F (ASME International, 2001, F–1334), which refer to the design of linear component supports and Level D service limits, respectively.

(c) The applicant should provide analyses that demonstrate the basket cell walls satisfy the design requirements of Appendix F–1331.1(c)(2) (ASME International, 2001). In addition, the local buckling criterion for the basket cell walls and the loading condition of nonuniform compression of the cell walls should be considered.

(d) The applicant should provide an evaluation of the shear rupture strength of the cell walls for the stress transfer from the basket spacers to the basket cell walls.

- This information is necessary to determine compliance with 10 CFR §72.24(c) and (d).

5-2. Provide an updated version of the detailed design drawing of the HI-STAR HB cask top flange at 0 and 180 degrees (Figure 3.3-3 of the SAR; sheet 3 of 7) correcting the apparent inconsistency in the 3.81-cm [1.5-in] and 2.54-cm [1-in] minimum shell thickness dimensions at the base of the trunnion thread.

- This information is necessary to determine compliance with 10 CFR §72.24(c) and (d).

5-3. Provide documentation demonstrating that the Visual Nastran® finite element analysis program has been sufficiently validated for performing cask drop and tip-over analyses as described in Holtec International (2003a, HI–2033046). The information on cask drop and tip over analysis for Holtec International (2003a, HI–2033046) is provided in Holtec International (2002a, HI–2012610). However, the HI-STAR FSAR (Holtec International, 2002a, HI–2012610) cask drop and tip-over analyses, as identified in Appendix 3.A "HI-STAR Deceleration under Postulated Drop Events and Tipover", were performed using DYNA3D® rather than Visual Nastran®.

- This information is necessary to determine compliance with 10 CFR §72.24(d), and §72.122(b)

5-4. (a) Provide documentation demonstrating that the reinforced concrete storage vault–soil system can be treated as a rigid body following the guidance provided in Section 3.2.5.3 of ASCE 4–98 (American Society of Civil Engineers, 1998) and the uniform hazard spectra presented in Figures 2.6-66 through 2.6-72 of the SAR. This information is needed to validate the use of the zero period accelerations (ZPA) as the basis for the concrete storage vault seismic design analyses.

(b) In the event that the reinforced concrete vault cannot be treated as a rigid body, the applicant should provide a revised seismic design analysis of the reinforced concrete vault (Holtec International, 2003b, HI–2033013), and the seismic response of HI-STAR HB in the vault (Holtec International, 2003c, HI–2033014). The analyses should consider the uncertainties associated with thermal effects, potential cracking of the concrete storage vault, nonlinear material behavior of the soil, and dynamic amplifications effects. Furthermore, the analyses should demonstrate that (i) the maximum vertical displacement of the cask does not cause interactions with the lid of the vault liner and (ii) the peak acceleration of the casks is below the design basis limiting value of 60g. Include the acceleration response spectra of the four ground motions used in the analysis to show that the spectral acceleration at the frequency of the vault–soil system is estimated correctly.

- This information is necessary to determine compliance with 10 CFR §72.24(c), (d); §72.92(c); §72.103(b), (c); and §72.122(b)(2).

(c) If the reinforced concrete vault does not behave as a rigid body, demonstrate that a quasi-static seismic analysis for the reinforced concrete vault–soil system provides adequate safety margins with respect to a seismic dynamic analysis. The assessment should address the effects of higher vibrational modes not considered in the quasi-static analysis, particularly for partial loaded scenarios that do not present uniform mass distribution.

- This information is necessary to determine compliance with 10 CFR §72.24(c), (d); §72.92(c); §72.103(b), (c); and §72.122(b)(2).

5-5. Provide the maximum stresses and displacements of the reinforced concrete vault when subjected to the required load combinations [see Section 5.4.3 of NUREG–1567

(NRC, 2000)]. The information presented in Chapters 3, 4, and 8 of the SAR, and the Holtec International (2003b, HI–2033013) is not sufficient to perform a review of the analysis process.

- This information is necessary to determine compliance with 10 CFR §72.24(c), and (d).

5-6. (a) Provide information concerning the rebar arrangement of the reinforced concrete vault (Holtec International, 2003b, HI–2033013). Section 5.5.3.1 of NRC (2000, NUREG–1567) states that, as a minimum, the SAR documentation should provide the dimensions of all sections that have a structural role including locations, sizes, configuration, spacing, enclosure (e.g., spirals, stirrups), and depth of cover or reinforcement for the important-to-safety reinforced concrete structures, systems, and components (SSCs). This information is needed to verify minimum and maximum clearance among bars, coverage of the concrete, and seismic detailing of the reinforcement.

(b) Clarify the inconsistencies in the rebar information provided for the vault in Chapter 3 of the SAR and the Holtec International (2003b, HI–2033013). Figure 3.2.1, sheet 2 of 5, of the SAR indicates number 8 bar with spacing 30.5 cm [12 in] for the primary reinforcement, whereas Input 4.6 and calculations presented in Holtec International (2003b, HI–2033013) indicate number 9 with spacing of 30.5 cm [12 in]. In addition, Holtec International (2003b, HI–2033013, Appendix F) indicates that the concrete cover for the reinforcement is 5.1 cm [2 in]. This value is below the minimum cover of 7.6 cm [3 in] for concrete that will be exposed to earth or extreme weather (American Concrete Institute, 2001, Section 7.7.1).

- This information is necessary to determine compliance with 10 CFR §72.24(c).

5-7. Provide the cement and aggregate types used in the construction of the concrete storage vault. The requested information is needed to determine the thermal conditions at which the potential loss of concrete strength and stiffness must be considered in accordance with NUREG–1567 (NRC, 2000, Subsection 6.5.2.3; American Concrete Institute, 2001, Appendix A). In addition, the durability requirements of American Concrete Institute (2001, Appendix A) pertaining to the corrosion of the reinforcement when exposed to salt water should be addressed.

- This information is necessary to determine compliance with 10 CFR §72.24(a), (b), (c), and (d).

5-8. Provide more information about the criteria used for segregating cracked and uncracked concrete sections of the storage vault. Holtec International (2003b, HI–2033013, Section 8.7) simply states that cracked section properties are used between adjacent cells where the axial tension is excessive.

- This information is necessary to determine compliance with 10 CFR §72.24(a), (b), (c), and (d).

5-9. Provide an assessment of potential settlement of the reinforced-concrete storage vault and how the settlement could affect the internal wall of the steel liner, considering that the walls need to remain vertical to allow extraction of the casks when necessary.

Settlement of the storage vault may result from subsoil compression, bearing-capacity failure of the subsurface materials, slope instability, or seismically induced vibratory ground motion.

The evaluation must include the live loading conditions that cause the largest differential settlements of the vault. Holtec International (2003b, HI–2033013, Section 8.5) addresses only two loading conditions (i.e., one cell loaded and all the cells loaded). Because the loading sequence will start at one end of the storage vault and will move to the other end in a sequential manner, the applicant should show that all partial loading conditions are bounded by the aforementioned loading scenarios. The justification for values of soil properties used to calculate settlement and bearing capacity must be addressed in the discussion.

- This information is necessary to determine compliance with 10 CFR §72.24(a), (c), (d); §72.103(d); and §72.122(b)(2).

5-10. Provide the important-to-safety designation of the reinforced-concrete storage vault drainage pipe (see Figure 3.2-1 of SAR, sheet 4 of 5).

(a) If the drainage pipe is designated as important-to-safety, provide an assessment of potential settlement of the reinforced-concrete storage vault and its effects on: (i) the structural integrity of the steel drain pipe, including the transition zone from areas of the pipe covered with concrete to areas of the pipe resting on soil, and (ii) the slope of the pipe needed to ensure gravity drainage toward the monitoring well. The settlement evaluation should be in accordance with RAI 5-9.

(b) If the drainage pipe is not designated as important-to-safety, provide an assessment of the potential effects that standing water within the storage vault cells can have on the structural, thermal, and corrosion performance characteristics of the cask and storage vault system.

(c) The accumulation of silt and soil is expected to occur at the base of the cask within the storage vault cell regardless of whether the drainage system is functional or not. As a result, the effects that this accumulation will have on the structural, thermal, and corrosion performance characteristics of the cask and storage vault system should be assessed.

- This information is necessary to determine compliance with 10 CFR §72.24(a), (c), (d); §72.103(d); and §72.122(b)(2).

5-11. Provide information about the structural adequacy of the removable seismic restraint gussets attached to the steel liners in concrete vault to withstand loads transmitted by the overpack during a seismic event (Holtec International, 2003b, HI–2033013, see Figure 3.2-1, sheet 3 of 5). The applicant should identify the failure modes for these seismic restraints, specifically the potential failure caused by buckling.

- This information is necessary to determine compliance with 10 CFR §72.24(a), (b), (c), (d), and (i).

5-12. Identify the governing codes and standards used to design the rigging (including attachment points to the transporter and cask) to prevent relative motion between transporter and cask. In addition, provide information about the applicable design basis loads for the rigging.

Holtec International (2003d, HI–2033036) indicates that no significant horizontal displacements or rigid body rotations of the cask, relative to the transporter, have been assumed during transport. Proper function of the rigging is required to prevent relative motion between transporter and cask. The cask rigging restraints are addressed in Section 3.3.3.2.9 of the SAR, and the design basis should be identified. The safety classification of the rigging should be identified in Table 4.3-1, "Important-To-Safety Components of the Cask Transportation System" of the SAR.

- This information is necessary to determine compliance with 10 CFR §72.24(c), (d) and §72.122(b)(2).

5-13. Provide calculations demonstrating that tornado-missiles will cause only localized denting of the steel vault lid (Section 8.2.2.2.3 of the SAR).

In addition, reconcile Sections 3.3.2.3.1 and 8.2.2.2.3 of the SAR. The former section states that the storage vault is designed to withstand tornado-generated missiles, whereas the latter section indicates no tornado missile analyses were performed for the vault structure.

- This information is necessary to determine compliance with 10 CFR §72.24(c), (d) and §72.122(b)(2).

Chapter 6—Thermal Evaluation

6-1. Provide the details of the HI-STAR HB cask and MPC heat-transfer models. Provide fluent thermal analysis input files and the Excel® and Mathcad® calculation sheets cited in Holtec International (2003e, HI–2033033). This information should include the assumptions, analysis techniques, calculation sheets, computer program input files (electronic version), and results obtained from these models.

The requested information is needed to complete the review of the HI-STAR HB cask decay heat removal capabilities. Section 6.4.4 of NUREG–1567 (NRC, 2000) specifies that the applicant shall discuss the basis for the parameters used in the thermal analyses.

- The requested information is needed to assess compliance with 10 CFR §72.122(b).

6-2. Provide justification for the assumption that the soil thermal conductivity can be based on a soil moisture content of at least 20 percent in the vicinity of the ISFSI, given that

the storage vault concrete surface temperature is, at a minimum, 56.7 °C [134 °F] Holtec International (2003e, HI–2033033).

This justification should address (i) the ambient water content of the unsaturated zone at the proposed ISFSI site as a function of depth; (ii) the seasonality of ephemeral perched water; (iii) the ambient water content of the unsaturated zone at the proposed ISFSI site as a function of season; (iv) the thickness of the capillary fringe associated with the ephemeral perched water; and (v) the potential spatial extent of the dry-out zone. Alternatively, institutional controls could be used to maintain water content within acceptable levels (i.e., keeping the storage vault out of the saturated zone while maintaining enough soil moisture content to ensure that the soil thermal conductivity used to approximate the storage vault temperatures is not overestimated). Section 6.4.4 of NUREG–1567 (NRC, 2000) specifies that the applicant shall discuss the basis for the parameters used in the thermal analyses.

- The requested information is needed to assess compliance with 10 CFR §72.122(b).

6-3. Provide updated documentation addressing the apparent inconsistency between the assumption that the fire height is the same height as the cask in Holtec International (2003f, HI–203006, Section 2.2.2) and the fire heights used in the calculations (Holtec International, 2003f, HI–203006, Appendix B). Specifically, the calculations presented in Holtec International (2003f, HI–203006, Appendix B) use a fire height of 30.5 m [100 ft] for the Nos. 1 and 2 Fuel Oil Tanks and a flame height equal to the width of the pool for the smaller service tanks when estimating the potential fire heat flux acting on the HI-STAR HB cask and storage vault lids.

- The requested information is needed to assess compliance with 10 CFR §72.122(c).

6-4. Provide updated documentation addressing the apparent inconsistency pertaining to the assumed 37.8 °C [100 °F] ambient temperature (Holtec International, 2003b, HI–2030013, Section 5.2) and the 11.1 °C [52 °F] ambient temperature used in the calculations (Holtec International, 2003b, HI–2030013, Appendix B).

- The requested information is needed to assess compliance with 10 CFR §72.122(c).

6-5. Provide justification for the assumption that the convective heat transfer coefficients for the HI-STAR HB cask and the storage vault cell cover are the same (Holtec International, 2003f, HI–203006, Appendix B).

- The requested information is needed to assess compliance with 10 CFR §72.122(c).

6-6. Provide the basis for the fire-to-cask and fire-to-vault view factor equations used in the fire assessment calculations (Holtec International, 2003f, HI–203006, Appendix B).

- The requested information is needed to assess compliance with 10 CFR §72.122(c).

Chapter 7—Shielding Evaluation

7-1. Provide digital files as listed in Holtec International (2003g, HI–2033047, Section 8) and Holtec International (1997, HI–971608, Revision 13).

In Holtec International (2003g, HI-2033047), the applicant describes the computer programs and methods used for the source term determinations and dose calculations. However, the digital files are not available on the CDs submitted by PG&E to the staff. These files are necessary for the staff to evaluate the input to the computer program, reasonableness of results, and use of the results in developing projected doses. The list of computer input files is presented in table form in Holtec International (2003g, HI-2033047, Section 8). The method of MCNP® tally normalization is described in reference Holtec International (1997, HI-971608, Revision 13), which should also be provided for review.

- This information is necessary to determine compliance with 10 CFR §72.104(a), §72.106(b), §72.128(a)(2), §20.1201, and §72.24(d) and (m).

7-2. Justify use of the HI-STORM 100 FSAR Section 5.4.2 damaged fuel analysis to determine that loading of the Humboldt Bay damaged fuel into the HI-STAR HB will not significantly affect dose rates.

In SAR Section 7.2.1.1, the applicant relies upon Section 5.4.2 of the HI-STORM 100 FSAR (Rev. 1) to conclude that loading damaged fuel assemblies will not significantly affect dose rates. Therefore, a specific evaluation of damaged Humboldt Bay assemblies was not performed.

In the HI-STORM 100 Certificate of Compliance, the range of fuel types that can be loaded in a damaged condition is only a subset of the wider range of types that can be loaded intact. Thus, there are large differences in the characteristics of the bounding intact and permissible damaged assemblies analyzed for the HI-STORM 100. These differences can account for why the intact fuel analysis bounds the allowed damaged fuel types and therefore loading damaged fuel in the HI-STORM 100 was found to not significantly affect dose rates. These differences include the intact assembly having a longer active fuel length, a higher burnup, a shorter cooling time, and a larger uranium mass loading. However, in the Humboldt Bay application, damaged assemblies can have the same characteristics as the bounding intact assembly. Thus, the source term from the damaged fuel assembly is not necessarily bounded by the intact assembly, and loading the damaged assemblies may significantly affect the dose rates calculated in the application. Therefore, an explicit analysis of the damaged fuel source term appears to be needed. The dose rate calculations should also be modified as necessary.

- This information is needed to confirm compliance with 10 CFR 72.104(a) and 72.106(b).

7-3. Justify the statement that the radiation from crud attached to the fuel assemblies is bounded by the fuel source term.

In SAR Section 7.2.1.4, the applicant states that any source term due to crud is bounded by the fuel source term and is therefore not explicitly accounted for. Any source from crud would be in addition to the fuel source; this combined source is not bounded by the fuel source alone. The extent of the crud's source contribution should be demonstrated quantitatively.

- This information is needed to confirm compliance with 10 CFR 72.104(a) and 72.106(b).

7-4. Provide in the SAR the dose rates for, and the anticipated duration of, the worst case accident conditions (i.e., complete loss of the neutron shield). Also, include the basis for the anticipated duration of the accident conditions.

In SAR Sections 8.2.5.2.1.1 and 8.2.5.3, the applicant states that the dose rates for the worst case accident conditions are higher than normal condition dose rates, but still acceptable. Reference is then made to a proprietary calculation package containing the dose rate analysis and the anticipated duration of the accident conditions. However, this information does not appear to be proprietary. Non-proprietary information concerning the accident condition dose rates and the anticipated duration of the accident condition, including the basis for this duration, should be included in the SAR.

- This information is needed to confirm compliance with 10 CFR 72.20 and 72.106(b).

7-5. Provide the engineering drawings of the vault referenced in the calculation package HI-2033047.

In the calculation package, the applicant references the engineering drawings used as the bases for the models of the MPC, the overpack, and the storage vault. While the drawings for the MPC and the overpack are included in the SAR, the vault drawings are not included (drawings numbered 4105 and 4110). Provide the missing drawings or reference the correct ones. The engineering drawings are needed to confirm the applicability and accuracy of the calculation models.

- This information is needed to confirm compliance with 10 CFR 72.104(a), 72.106(b), and 72.128(a)(2).

7-6. Describe the characterization process that will be used to ensure that the radiation source from the greater than Class C (GTCC) waste cask remains bounded by the spent fuel cask analysis.

The radiation source of the spent fuel has particular (energy) spectral and spatial distributions. Therefore, to show that the GTCC waste's radiation source is bounded by the spent fuel's source, consideration needs to be given to the spatial and spectral distributions in addition to the total source strength. The SAR should include a

description of how the characterization process will address these aspects of the GTCC radiation source.

- This information is needed to confirm compliance with 10 CFR 72.104(a) and 72.106(b).

Chapter 8—Criticality Evaluation

8-1. Provide digital files as listed in Tables 7.3 through 7.6 of Holtec International (2003h, HI–2033010), and References 1, 2, 4, and 8 of this calculation package.

In Holtec International (2003h, HI–2033010), the applicant lists the input files for the criticality evaluation. However, the digital files are not available on the CDs submitted by PG&E to the staff. These files are necessary for staff to evaluate the adequacy of the criticality analysis model.

- This information is necessary to determine compliance with 10 CFR §72.124(a).

8-2. Provide the administrative procedures to prevent misloading of damaged fuel assemblies that could place fissile material in a configuration inconsistent with the criticality analysis.

Section 8.2.9 of the SAR relies on administrative controls for ensuring that fuel assemblies will be correctly loaded into an MPC. The criticality safety analysis is bounded by the analyzed patterns in Section 8 of the SAR. Because intact fuel may be stored in damaged fuel canisters, there is a possibility of loading outside the bounds of the analysis. Provide a description of the procedures or administrative controls to be relied upon that will preclude a misloading event. There have been several misloading events at other sites; suggesting that this could be a credible event, particularly when complicated loading schemes exist as in this application.

- This information is necessary to satisfy the requirements of 10 CFR §72.24(c)(3), (g) and (h), and §72.124.

Chapter 9—Confinement Evaluation

9-1. Provide justification for the assertion that leakage from the confinement boundary is not credible, and therefore no confinement analysis is required to be performed for the HI-STAR HB system MPC. The description of the confinement boundary in Section 7.2.2 of the SAR references Holtec license amendment request (LAR) 1014–2 for comparison to the criteria contained in ISG–18; however, this LAR has not been approved by the staff. Explain how the analysis provided in LAR 1014-2 is applicable to the HI-STAR HB MPC. Also, please note that the term "leak tight" is not appropriate in referencing a confinement boundary of no credible leakage and should not be used.

- This information is necessary to determine compliance with 10 CFR §72.122, §72.126, and §72.128.

Chapter 10—Conduct of Operations Evaluation

The staff's questions for Chapter 10 relate to the ISFSI Emergency Plan (EP), submitted as Attachment B to the License Application.

10-1. Section 2.2, Description of Facility and Site - What is the distance from the ISFSI to the controlled area boundary?

In Section 2.2 of the EP, it says that the owner controlled (HBPP boundary) area fence at its nearest point is approximately 60 feet away. In 10 CFR 72.106, the minimum distance to the controlled area should be 100 meters.

- This information is necessary to determine compliance with 10 CFR §72.32(a)(1) and §72.106.

10-2. Section 2.3 Description of Area Near the Site - How does Mean Lower Low Water relate to mean sea level?

- This information is needed to determine compliance with 10 CFR §72.32(a)(1).

10-3. Describe how the site boundary is controlled and any actions that PG&E will take if the public trail needs to be closed.

- This information is needed to determine compliance with 10 CFR §72.32(a)(1) and §72.106.

10-4. Describe land uses in the area surrounding the facility.

- This information is needed to determine compliance with 10 CFR §72.32(a)(1).

10-5. Describe any nearby sites of potential significance (chemical plants, pipelines, schools, campgrounds, etc.)

- This information is needed to determine compliance with 10 CFR §72.32(a)(1).

10-6. Section 3.5, Spectrum of Postulated Emergencies - Describe any means and/or equipment which may be used to mitigate the consequences of postulated accidents.

- This information is needed to determine compliance with 10 CFR §72.32(a)(5).

10-7. Section 3.5.3, Onsite Hazards - Describe what constitutes "significant damage or substantially affects" the structures, systems, or components. How is this defined for workers who would be the ones to identify an accident condition? The Emergency Action Level (EAL) classification for onsite hazards is defined as any hazard that causes significant damage or substantially affects the structures, systems, or components, the EAL classification is a NOUE.

- This information is needed to determine compliance with 10 CFR §72.32(a)(2), (3) and (4).

10-8. Section 4.0, Emergency Organization - Provide a brief description of the information to be communicated to off-site response groups, and local, State, and Federal agencies.

- This information is needed to determine compliance with 10 CFR §72.32(a)(9)

10-9. Section 4.1, Normal Facility Organization - Provide a brief summary of the facility's organization during normal operations. A table showing the normal staffing levels and reporting lines would be sufficient.

- This information is needed to determine compliance with 10 CFR §72.32(a)(7).

10-10. Identify the position which has responsibility for maintaining the EP and emergency implementing procedures. Who is responsible for performing the annual audit of the EP?

- This information is needed to determine compliance with 10 CFR §72.32(a)(7).

10-11. Section 4.2, Onsite Emergency Response Organization - Describe the Emergency Response Organization during holidays, weekends, and other off-hours times.

- This information is needed to determine compliance with 10 CFR §72.32(a)(7).

10-12. Table 4.2-3, Radiological Emergency Evaluator - Where are the technical qualifications specified for the interim Radiological Emergency Evaluator?

- This information is needed to determine compliance with 10 CFR §72.32(a)(7).

10-13. Table 4.2-10 Technical Advisor (Incident Command Center) - Is there a suggested list of individuals who would perform this task?

- This information is needed to determine compliance with 10 CFR §72.32(a)(7).

10-14. Section 7.2, Training Program, Drills, and Exercises - Specify the frequency of retraining on the EP for staff.

- This information is needed to determine compliance with 10 CFR §72.32(a)(10).

10-15. Section 7.2.3, Drills - Specify the frequency of health physics, fire and medical drills and communication checks.

- This information is needed to determine compliance with 10 CFR §72.32(a)(12).

10-16. Section 7.3.1, Review and Updating - Identify the criteria for the independent and technically competent organization that will perform the biennial review of the EP.

- This information is needed to determine compliance with 10 CFR §72.32(a)(12).

Chapter 11—Radiation Protection Evaluation

11-1. Describe the physical means and administrative procedures for controlling access to restricted and controlled areas of the ISFSI.

The description provided in SAR Section 7.5 shows the public trail at the controlled area boundary to be 16 m [53 ft] from the edge of the ISFSI. 10 CFR 72.106(b) states the minimum distance from the ISFSI to the nearest controlled area boundary must be at least 100 m [328.1 ft]. However, 10 CFR 72.106(c) allows for the controlled area to be traversed if appropriate and effective arrangements are made to control traffic and to protect public health and safety.

The description provided in SAR Section 7.5 states that the access to the public trail will be controlled to keep members of the public beyond a 100 m [328.1 ft] boundary during cask transport and vault loading operations. This description needs to be expanded to address the arrangements for controlling all public access, including on the public trail, on the shoreline, and in the water. Be sure to address any control measures during normal storage as well as during specific transport and vault loading operations. Description of arrangements should include any physical barriers and locked entryways, as described in NRC NUREG-1567, Section 11.4.2.2, as well as arrangements with local governing jurisdictions for limiting and controlling access. The SAR figures should be updated to reflect these arrangements.

- This information is necessary to determine compliance with 10 CFR 72.106.

11-2. Demonstrate that the annual dose equivalent to a real individual located at or beyond the controlled area boundary does not exceed 0.25 mSv [25 mrem].

10 CFR 72.104(a) states that the combined annual doses from planned discharge of radioactive materials to the general environment, direct radiation from ISFSI operations, and any other radiation from uranium fuel cycle operations in the region must not exceed 0.25 mSv [25 mrem]. The summation of doses from direct radiation, overpack loading operations, and other uranium fuel cycle operations in SAR Table 7.5-3 shows the doses at the site boundary located 16 m [53 ft] from the ISFSI could be up to 0.2596 mSv [25.96 mrem], which exceeds the 0.25 mSv [25 mrem] limit.

The applicant states in SAR Section 7.5 that access to the public trail will be controlled to keep the public beyond 100 m [328 ft] during cask transport and vault loading operations. Calculated doses at the appropriate distance must be provided to explicitly demonstrate compliance with the regulatory dose limit.

- This information is needed to show compliance with 10 CFR 72.104(a).

11-3. Provide a description of the HB ISFSI Health Physics Program.

The description should be in sufficient detail that a review according to the requirements of 10 CFR Part 72 can be completed for the separately licensed facility.

Section 7.6 of the SAR references Chapter 6.0 of the HBPP Defueled SAR (HBPP DSAR, 2002) for a description of the Health Physics Program to be used by the ISFSI. The HBPP is a 10 CFR Part 50 licensed facility that could be decommissioned if the proposed ISFSI is licensed. Decommissioning of the plant would terminate the 10 CFR Part 50 license, which could imply termination of the reactor-related health physics program. The applicant should clarify that the portions of the health physics program in the current DSAR (HBPP DSAR, 2002) applicable to the ISFSI would continue to be implemented in operating the ISFSI. The parts of the DSAR's health physics program that apply to the ISFSI need to be identified.

- This information is necessary to determine compliance with 10 CFR §20.1101, §20.1302, §20.1406, §20.1501, §20.1702, and 10 CFR §72.24(e), (h) and (l), and §72.126.

11-4. Provide a description of the environmental monitoring program to be used at the Humboldt Bay ISFSI.

10 CFR 72.44(d)(2) requires that a license authorizing the receipt, handling, and storage of spent fuel and reactor-related GTCC waste include technical specifications that require an environmental monitoring program to ensure compliance with the technical specifications for effluents. The proposed Technical Specification 5.1.2.a specifies that a program is to be established and maintained for the purpose of implementing the stated regulation. However, there appears to be no description of this program in the SAR. The SAR's General Table of Contents includes a Section 7.7 Environmental Monitoring Program, but Section 7.7 is not in the SAR. The environmental monitoring program should be described in the SAR, as it is required to be conducted for the duration of the ISFSI license.

- This information is needed to confirm compliance with 10 CFR 72.44(d)(2).

Chapter 12—Quality Assurance Evaluation

The staff has not identified any additional information needs regarding the quality assurance evaluation provided in the license application and SAR for the HB ISFSI.

Chapter 13—Decommissioning Evaluation

The staff has not identified any additional information needs regarding the decommissioning evaluation provided in the license application and SAR for the HB ISFSI.

Chapter 14—Waste Confinement Evaluation

The staff has not identified any additional information needs regarding the waste confinement evaluation provided in the license application and SAR for the HB ISFSI.

Chapter 15—Accident Analysis

15-1. Provide justification for not addressing off-normal and accidents associated with the movement of the HI-STAR HB overpack within the RFB and from the RFB to the transporter.

- This information is necessary to assess compliance with the requirements of 10 CFR §72.24, §72.90(b), and §72.128(a).

15-2. Demonstrate that a seismic event during cask handling within the RFB is not credible or that the design features would mitigate any consequences if the event occurred. The design basis for the facility is based on a 2,000-year return period seismic event. The applicant has identified a number of seismic events that are used for various operational phases of the facility. The use of a seismic event with a return period of less than 2,000 years to assess the response of SSCs during seismic loading has not been adequately justified. The applicant should demonstrate that the following accidents are not credible or identify the consequences of these events. In addition, the applicant should provide recovery actions for these events.

(a) Tipover of the storage system in the RFB as a result of a seismic event prior to completion of the MPC welding.

(b) Tipover of the storage system in the RFB after completion of the MPC welding but prior to completion of the overpack welding.

- This information is necessary to determine compliance with 10 CFR §72.40(c).

15-3. Demonstrate that a seismic event during cask transportation is not credible or that the design features would mitigate any consequences if the event occurred. The design basis for the facility is based on a 2,000-year return period seismic event. The applicant has identified a number of seismic events that are used for various operational phases of the facility. The use of a seismic event with a return period of less than 2,000 years to assess the response of SSCs during seismic loading has not been adequately justified. The applicant should demonstrate that the following accidents are not credible or identify the consequences of these events. In addition, the applicant should provide recovery actions for these events.

(a) Movement of the cask transporter off the road during a seismic event.

(b) Drop of the HI-STAR 100 HB into the storage vault during a seismic event while raising or lowering the cask into the vault.

- This information is necessary to determine compliance with 10 CFR §72.40(c).

15-4. Provide the basis for the statement in Section 8.2.2.2.2 of the SAR, "[T]he lowering operation will be a short duration (nominally less than two hours). Therefore, a tornado missile impact during cask lowering is not considered credible." Also, provide the

minimum warning time that will be available to operators for them to suspend the operation if a tornado is impending.

This information is necessary to assess whether a tornado missile impact during lowering of the cask is a credible event.

- This information is necessary to satisfy the requirements of 10 CFR §72.92(a) and (c).

15-5. Section 8.2.2.2.3 of the SAR states that the effect of tornado missile impact on the vault lid has been discussed in Section 8.2.2.3. The reference is in error and should be corrected to indicate that the effect is addressed in Section 8.2.2.4.

- This information is necessary for completeness and accuracy of information to satisfy the requirements of 10 CFR §72.11.

15-6. Provide the detailed information that has been relied upon in Pacific Gas and Electric Company (2003c, PRA03–14) to arrive at the assumption that 95 percent of the aircraft approaching or departing Eureka-Arcata Airport would use the V607 route and would not pose a hazard to the proposed ISFSI. Also justify why this assumption is conservative.

This information is necessary to determine the number of flights that should be used to estimate the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-7. Provide the detailed information that has been relied upon in Pacific Gas and Electric Company (2003c, PRA03–14) to arrive at the assumption that military air taxis and helicopters that use Eureka-Arcata Airport are bounded by turbine-powered helicopters. Also justify why this assumption is conservative.

This information is necessary to use the appropriate crash rate information for estimating the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-8. Provide the detailed information that has been relied upon in Pacific Gas and Electric Company (2003c, PRA03–14) to arrive at the assumption that approximately 15 percent of all arrivals and departures for Murray Field Airport and approximately 50 percent for Eureka Municipal Airport fly directly over the proposed ISFSI site. Also justify why this assumption is conservative.

This information is necessary to determine the number of flights that should be used to estimate the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-9. Provide justification why contributions from 85 percent of all arrivals and departures for Murray Field Airport and approximately 50 percent for Eureka Municipal Airport were not considered in estimating the crash hazard probability in Pacific Gas & Electric Company, 2003c, PRA03–14) based on the methodology given in NUREG–0800 (NRC, 1981, Section 3.5.4.6, II.3).

Based on the NUREG–0800 (NRC, 1981, Section 3.5.4.6, II.3) methodology, there are two clear flight paths or trajectories from the runways of each airport, one directly over the proposed site and another in southeast or northwest quadrants. Also justify why the assumption taken in the analysis that the number of flight paths is equal to one is conservative, based on the NUREG–0800 (NRC, 1981, Section 3.5.4.6, II.3) methodology. Provide a map showing the runways of these airports in addition to the proposed site and prevailing wind directions at these airports. This information is necessary to determine the number of flights that should be used to estimate the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-10. Provide information on high-altitude aircraft traffic in the vicinity of the proposed site. Justify, based upon NUREG–0800 (NRC, 1981, Section 3.5.4.6, II.3) methodologies or other approved ones, that high-altitude traffic does not pose a credible threat to the proposed site, as assumed in Pacific Gas and Electric Company (2003c, PRA03–14). This information is necessary to determine the number of flights that should be used to estimate the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-11. Provide information why one flight per day by military aircraft has been assumed at the Murray Field Airport, in Pacific Gas and Electric Company (2003c, PRA03–14). This information is necessary to determine the number of flights that should be used to estimate the crash hazard probability at the proposed ISFSI.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-12. The formula given as Equation 3 in Pacific Gas and Electric Company (2003c, PRA03–14) is incorrect. The formula should be consistent with NUREG–0800 (NRC, 1981).

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-13. Pacific Gas and Electric Company (2003c, PRA03–14 Sheet 13), under subtitle, Conclusion, lists the total probability of aircraft crash at the ISFSI site as 7.18×10^{-7}, which is the summation of aircraft crashes at four nearby airports. This value contradicts information on Sheet 4 of this calculation, which indicates that only Eureka Municipal Airport and Murray Field Airport will be considered because they do not pass the Screening Criterion 1. This apparent discrepancy should be resolved.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-14. Clarify the inconsistency of the fraction of aircraft taking off and landing at the Eureka Municipal Airport that fly over the proposed site. In one place in Pacific Gas and Electric Company (2003c, PRA03–14), it was stated that only 15 percent of the flights fly directly over the proposed site (Sheet 12). However, in Sheet 11, the fraction is stated to be 50 percent.

- This information is needed to satisfy the requirements of 10 CFR §72.94(a), (b), (c) and §72.98(a).

15-15. Clarify the difference between the estimated explosion hazard of vehicles in Route 101 on the transporter carrying a loaded cask given in SAR Section 8.2.6.2.6 (page 8.2-35) and Pacific Gas and Electric Company (2003d, PRA03–13). The SAR gives the estimated annual frequency of this explosion hazard to be 0.76×10^{-7}, whereas Pacific Gas and Electric Company (2003d, PRA03–13) gives 8.85×10^{-7}. Also, justify the estimated exposure distance of the transporter, following NRC (1978, Regulatory Guide 1.91) used in Pacific Gas and Electric Company (2003d, PRA03–13). Plot the estimation process of the exposure distance on a site map.

- This information is necessary to satisfy the requirements of 10 CFR §72.94(a), (b); §72.98(a); and §72.122(c).

15-16. Provide basis for the assumption in Section 8.2.6.2.8 of the SAR that a simultaneous explosion of two or more tanks of the barge is considered incredible.

- This information is necessary to satisfy the requirements of 10 CFR §72.94(a), (b); §72.98(a); and §72.122(c).

15-17. Justify the estimated trinitrotoluene (TNT)-equivalent weight of 75.7 L [20 gals] of gasoline. Pacific Gas and Electric Company (2003d, PRA03–13) estimates in Sheet 4 that the TNT-equivalent weight of 75.7 L [20 gals] of gasoline would be 26.5 kg [58.53 lb]; however, in Holtec International (2003i, HI–2033041), the estimated TNT-equivalent weight is 35.5 kg [78.22 lb]. Provide the input value and basis of each parameter used in estimating the TNT-equivalent in each document.

- This information is necessary to satisfy the requirements of 10 CFR §72.94(a), (b); §72.98(a); and §72.122(c).

15-18. Justify why the characteristics of explosion-generated missiles would be bounded by tornado-generated missile characteristics (size, shape, and speed), as given in

Section 8.2.6.2.9 of the SAR, Missile Evaluations. Additionally, justify why the methodology for estimating the effects of tornado-generated missiles on an item important-to-safety would be applicable to estimate the effects of explosion-generated missiles.

- This information is necessary to satisfy the requirements of 10 CFR §72.94(a), (b); §72.98(a); and §72.122(c).

Chapter 16—Technical Specifications

16-1. Correct the editorial error in Design Features of the Proposed Technical Specifications (Attachment C) of the license application (page 4.0-1). Section 4.2.1 of the license application states "Approved alternatives to the ASME Code are listed in SAR Table 3.4-6." There is no Table 3.4-6 in the SAR. The referenced information appears to be in Table 3.4-5 of the SAR.

- This information is needed to determine compliance with 10 CFR §72.44.

16-2. Provide an addition to the proposed technical specifications for the HB ISFSI to include the Holtec QA/QC requirements for the testing of neutron absorber material(s). The appropriate procedures may be incorporated by reference.

The basis for this change is the recognition that neutron absorber materials are proprietary materials. As such, these materials are not subject to the uniform production and quality control standards that exist for ASME Code materials. Additionally, there is no reasonable manner in which to verify the performance of these materials during service. These materials perform the important function of eliminating the possibility of an inadvertent criticality. Consequently, the staff find that the production and quality control methods and requirements of these materials need to be better formalized. In this manner, no changes to the materials production methods may occur unless such proposed changes are first subjected to an independent review.

- This information is necessary to determine compliance with 10 CFR §72.124.

16-3. Provide a description of the administrative controls to be implemented for ensuring that the 2000 watt decay heat limit for each spent fuel storage cask can be met.

In Sections 4.2.3.3.5, 10.2.1.2 and Table 10.2-1 of the SAR, a maximum cask decay heat load of 2000 watts was assumed as the design basis value in the thermal analysis. The maximum MPC-HB decay heat based on the total decay heat of the eighty hottest fuel assemblies, however, is calculated to be 2629.26 watts, as documented in HI-2033023.

- This information is needed to determine compliance with 10 CFR 72.44.

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