RAI 6-1: Demonstrate how the effects of the site's cask array size and the site's meteorological conditions (e.g., wind) on the inlet air temperature were addressed in the thermal analysis.

The array analysis in the HI-STORM UMAX FSAR (Certificate of Compliance (CoC) No. 72-1040) was based on a 1-row array of UMAX modules. As discussed in the HI-STORM UMAX FSAR, the effects of a 1-row simulated cask array were to decrease inlet air mass flows and increase inlet air temperatures (by up to 13 deg F), such that peak cladding temperature (PCT) could increase by 34 deg F. However, the HI-STORE CIS site would have a multi-row array (500+ UMAX systems). In addition, HI-STORE SAR Section 2.3.1 indicates that moderate winds occur regularly at the site and that high seasonal period ambient temperatures are approximately 93 deg F. Therefore, a sensitivity analysis should be provided that quantifies the effects (e.g., temperatures, canister pressure) from neighboring rows of UMAX systems (i.e., a multi-row array) and takes site conditions into consideration (e.g., high seasonal period ambient temperatures, wind, UMAX module geometry). The thermal analysis should reflect any design differences (e.g., air flow from inlet to outlet, including geometry, flow areas, perforated plate open area, etc.) between the HI-STORM UMAX System approved in CoC No. 72-1040 and the site-specific UMAX system for the HI-STORE CIS Facility (i.e., drawing 10875 Rev. 0). [**Note**: HI-STORE SAR Section 6.4.3.5 that discusses wind conditions references Subsection 4.4.9 of the HI-STORM UMAX FSAR. However, wind conditions are not discussed in Subsection 4.4.9.]

The response should provide a detailed description of the FLUENT model and boundary conditions and resulting acceptance criteria (e.g., residuals, energy and mass balances, grid independence studies, and demonstration of model convergence) that justifies the appropriateness of the boundary conditions and methodology for analyzing the site conditions. This includes the extent of the pressure boundary (e.g., size and distance from array), the number of rows analyzed, turbulence models and their parameters, model inlet boundary conditions (e.g., temperatures), wind conditions, inlet/outlet vent design, etc.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

Holtec Response:

SAR Chapter 4, Section 6.4.3.5 is revised to justify the applicability of 1-row array analyses in the HI-STORM UMAX FSAR. Impact of HI-STORE UMAX design differences is evaluated and concluded that wind effects are bounded by the design evaluated in HI-STORM UMAX FSAR. High seasonal ambient temperatures comment is addressed in RAI 6-2 response. Please note that the thermal evaluations of sustained wind are discussed in Subsection 4.4.9 of the HI-STORM UMAX FSAR Revision 3, which is reference 1.0.6 in HI-STORE SAR.

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6-2: Provide thermal analyses that include the bounding ambient temperatures that accurately represent the site's average maximum temperature for the high temperature seasonal period (e.g., June, July, and August), and that reflect the effect of high air temperatures due to surrounding air outlet vents. In addition, include the resulting component temperatures, internal multi-purpose canister (MPC) gas temperatures and densities, and cavity gas pressures for normal, off-normal, and accident conditions.

According to the FLUENT model provided in the HI-STORE SAR, the inlet boundary temperature for the normal conditions model was 16.67 deg C (62 deg F), which was reported as the annual average temperature. However, this temperature does not consider that during three months of the year at the proposed site, the average monthly maximum temperature ranges from 92.57 deg F to 93.62 deg F, as reported in Table 2.3.1 of the HI-STORE SAR. In addition, the normal conditions model's inlet temperature of 62 deg F did not include the effects of hot air (higher than ambient) entering the UMAX system from the array of neighboring UMAX storage modules proposed for the HI-STORE facility (see RAI 6-1). These effects would impact site performance, as discussed in the HI-STORM UMAX FSAR, which demonstrated that for a 1-row simulated cask array, decreased inlet air mass flows and increased inlet air temperatures (by up to 13 deg F) would increase peak cladding temperature by 34 deg F. The thermal analyses should reflect any design changes (e.g., air flow from inlet to outlet, including geometry, flow areas, perforated plate open area, etc.) between the HI-STORM UMAX System approved in CoC No. 72-1040 and the site-specific UMAX system for the HI-STORE CIS Facility (e.g., drawing 10875 Rev. 0). A detailed description of the FLUENT model and boundary conditions should be provided, as described in RAI 6-1.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

Holtec Response:

It is contextual to clarify that adoption of 62 deg. F ambient temperature subsumes the effect of cited summer temperatures as defined in the HI-STORM CIS SAR for evaluation of normal condition of storage. In accordance with this definition excerpted from "glossary of terms" below (emphasis added), the annual average temperature for the site is ascertained from site data and adopted as normal storage temperature.

> "**Normal Storage Condition** temperature refers to the integrated time *average of the annual* ambient temperature at an ISFSI site. It is used, as prescribed in ISG-11 Rev3 and NUREG-1536, as the reference air inlet temperature in the ventilated cask's thermal analysis for computing the fuel cladding temperature. In non-ventilated casks, it is used as the surrounding ambient temperature for the thermal analysis of the cask under the so-called normal condition of storage."

The above definition accords with the licensing basis for Holtec storage systems approved by the NRC under HI-STORM 100 (72-1014), HI-STORM FW (72-1032) and HI-STORM UMAX (72-1040) dockets, other generic certification applicants (NAC UMS Docket 72-1015) and site specific applicants (Diablo Canyon Docket 72-26).

Thermal margins under deployment of the UMAX storage systems at the HI-STORE CIS facility are greater than the licensed UMAX systems under HI-STORM UMAX Docket 72-1040 as severity of thermally significant parameters are *less* than HI-STORM UMAX licensing basis. See table below:

Thermally Significant Parameter	HI-STORM UMAX FSAR	HI-STORE CIS	HI-STORE Remarks
Heat Load (kW) MPC-37 MPC-89	 37.06 36.72	 32.09 32.15	Less than HI-STORM UMAX FSAR
Normal Ambient Temperature (^{o}F)	80	62	Below HI-STORM UMAX FSAR
Off-Normal Ambient Temperature (^{o}F)	100	91	Below HI-STORM UMAX FSAR
Accident Ambient Temperature (^{o}F)	125	108	Below HI-STORM UMAX FSAR
Minimum Ambient Temperature (^{o}F)	-40	-11	Bounded by HI-STORM UMAX FSAR

The HI-STORM UMAX system as certified under 72-1040 Docket is authorized for storage at any Part 50 facility within United States without seasonal average limitations. As such necessity for additional requirements on a system having greater safety margins is contra-indicated.

6-3: Provide the MPC cavity gas pressure, gas temperature, and gas density associated with the normal, off-normal, and accident conditions, including off-normal environmental temperature, off-normal pressure, partial blockage of air inlet and outlet ducts, 100% blockage of air inlets and outlet ducts, 100% fuel rod rupture, extreme environmental temperature, and the conditions described in HI-STORE CIS SAR Tables 6.4.3, 6.4.4, 6.4.5, 6.4.6, 6.5.2. 6.5.3, 6.5.4. The bounding MPC (e.g., MPC-37, MPC-89) should be specified for each condition.

Although the MPC cavity pressure was provided for some (not all) of the conditions described above, the corresponding MPC cavity gas temperature and density were not provided, and therefore, an evaluation of the canister pressure to the various conditions could not be performed. The evaluation is necessary to understand the impact of site conditions on canister pressure, which is a component of structural loads and canister integrity.

It is noted that SAR Section 6.4.3.2 indicates that thermal performance would tend to increase due to rod ruptures. This should be confirmed, recognizing that cavity gas thermal conductivity, which impacts heat transfer, would tend to decrease due to rod ruptures.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

Holtec Response:

Chapter 6 Normal, Off-normal and Accident results tables revised to add MPC cavity gas temperatures under bounding MPC-37 handling and storage in the HI-TRAC-CS, UMAX and HI-STAR 190 casks. Gas density not provided as it is not relied for pressure calculations. MPC pressures computed in accordance with Ideal Gas Law as defined below:

$$P2 = T2*P1/T1$$

Where:

P1 & T1: Helium initial pressure and temperature in absolute units in accordance with backfill specifications

T2: MPC cavity average temperature

P2: Coincident pressure

SAR Section 6.4.3.2 revised to address comment.

6-4: Justify the assumption of 10% restriction of the exiting airflow (and ignoring inlet airflow) for the accident condition of the collapse of the canister transfer building (CTB) for the situations described in SAR Section 6.5.2.3. In addition, describe how the airflow restriction boundary condition was applied and describe the changes to the canister transfer facility (CTF) and HI-TRAC CS external boundary conditions from the collapsed building.

The extent of inlet and outlet vent blockages caused by a collapsing building would affect cask thermal performance and, therefore, important-to-safety SSC temperatures. SAR Section 6.5.2.3 states that only the exiting airflow is assumed to be affected by the collapse of the CTB and that restriction would be limited to 10%. However, no discussion was provided that justified blockage would not occur for inlet air flow (recognizing that inlet and outlet vents are at the same elevation) or that a collapsing corrugated aluminum Butler building would limit the airflow restriction to 10%.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

Holtec Response:

Consistent with SAR Chapter 4 Criteria a small fraction of the vents (10%) are conservatively assumed as open[1]. The airflow restriction is modeled at the vent openings as impervious boundaries.

Boundary conditions changes under collapsed condition as follows:

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6-5: Describe the evaluation method, including the model and boundary conditions, for determining the thermal time limit for all operations performed without helium in the transportation cask annulus, provide an upper temperature limit to base the thermal time limit, and describe the basis for that temperature limit. In addition, the results for a bounding canister within the HI-STAR 190 transport cask should be provided.

The Operational Limit before Step 11 of Section 10.3.3.1 of the HI-STORE SAR requires a thermal time limit be established based on specific transportation cask and canister conditions

[1] SAR Chapter 4 Criteria requires consideration of a significant blockage by corrugated sheet metal roof (See Table 4.3-5).

for the duration of all operations performed without helium in the transportation cask annulus. However, no evaluation methodology is discussed in the application, no temperature limit is described on which to base the thermal time limit, no acceptance criteria (e.g., time limits) are provided in the proposed Technical Specifications, and no bounding analysis model is provided nor results presented.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

Holtec Response:
The limit cited above is a generic requirement defined in the Operations chapter. For the specific case of bounding MPC-37 canister in HI-STAR 190 no time limits are necessary as supported by Chapter 6 thermal analysis as clarified below.

HI-STAR 190 cask thermal model is articulated to address limiting conditions under an array of operational steps defined in Chapter 10 with the cask placed in the Cask Transfer Facility (CTF) as shown in SAR Figure 6.4.1. The principal conditions are as follows:

Scenario 1: Cask annulus helium filled

Scenario 2: Annulus evacuated and replaced with nitrogen

Scenario 3: Annulus air filled following closure lid removal

Scenario 2 above is limiting as nitrogen is the least conductive gas. Thermal analysis supports operations without limits under non-helium filled annulus condition. See Chapter 6, Section 6.4.3.6 supporting ISG-11 Rev. 3 limits compliance under steady state maximum temperatures. SAR Chapter 6 text matter suitably revised for clarity.

10-9: Revise Section 15.3.4 of the HI-STORE SAR to include methods to restore the UMAX system to a normal configuration after floodwater and debris are deposited in the system.

SAR Section 15.3.4 states that HI-STORM UMAX FSAR flood accident Subsection 12.2.4 is incorporated by reference. Subsection 12.2.4.3 of the HI-STORM UMAX FSAR states that specific methods to restore a UMAX from deposited floodwater and debris "[…] shall be addressed in the site emergency action plan" and gives example methods to achieve restoration. However, these methods to restore the UMAX system were not provided in the HI-STORE SAR.

This information is needed to determine compliance with 10 CFR 72.32(a) and 72.122(b).

Holtec Response:
As detailed in HI-STORE SAR Table 15.0.1, information related to Accident Events has been incorporated by reference from HI-STORM UMAX FSAR Sections 12.2 and 12.3. The requested information in HI-STORM UMAX FSAR Subsection 12.2.4.3 is a subsection of HI-STORM UMAX FSAR Section 12.2.4 which has been specifically called out as being incorporated by reference into this section of the HI-STORE SAR. Therefore, the requested information is also included as the entirety of Section 12.2.4 is incorporated by reference.

17-1: Clarify the specific important to safety (ITS) components that are included under the description of "Special Lifting Devices" in Table 4.2.1 of the HI-STORE CIS SAR, and provide the materials of construction and their mechanical properties.

SAR Section 4.5.1 defines "special lifting devices" as those components constructed in accordance with ANSI N14.6, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 kg) or More." SAR Section 5.4 states that special lifting devices include the transport cask lift yoke, multi-purpose canister (MPC) lift attachment, HI-TRAC CS lift yoke, HI-TRAC, CS lift link, transport cask horizontal lift beam, and MPC lifting device extension. The staff notes that all of these components, except the HI-TRAC CS lift link, are included as separate line items in SAR Table 4.2.1, "ITS Classification of SSCs that Comprise the HI-STORE CIS Facility."

It is unclear to the staff whether the "Special Lifting Devices" line item in SAR Table 4.2.1 is meant to refer to the transfer cask lift link or additional lifting devices not already included in the table and described in the SAR. The materials and mechanical properties are needed to allow the staff to evaluate the design and performance of ITS structures, systems, and components (SCCs) used at the HI-STORE CIS Facility.

This information is required to demonstrate compliance with 10 CFR 72.24(c)(3) and (d).

Holtec Response:
HI-STORE SAR Table 4.2.1 has been updated so that all special lifting devices that are envisaged to be used at the HI-STORE CIS facility are individually listed, and the SSC previously listed as "Special Lifting Devices" has been deleted from the table. The HI-TRAC CS lift link was previously missing from Table 4.2.1, as correctly noted by the staff, and is now included in the updated table.

The materials of construction for all of the special lifting devices listed in Table 4.2.1 (i.e., HI-TRAC CS Lift Yoke, Transport Cask Horizontal Lift Beam, Transport Cask Lift Yoke, MPC Lift Attachment, MPC Lifting Device Extension and HI-TRAC CS Lift Link) are identified on the applicable Licensing Drawings, which are included in Section 1.5 of the HI-STORE SAR.

The material properties are briefly discussed in Subsections 5.4.4, 5.4.5, and 5.4.6 and listed in Table 5.4.10 of the HI-STORE SAR. In general, the minimum strength properties for the construction materials are obtained directly from the applicable ASTM specification or from Section II, Part D of the ASME Code [4.6.3] in accordance with the Licensing Drawings.

17-2: State whether the ferritic steels that are used to construct the special lifting devices and the cask transfer building crane require drop weight or Charpy impact testing. If not, provide the technical justification for the adequacy of the fracture toughness for these materials.

Section 4.2.6 of ANSI N14.6-1993, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4 500 Kg) or More" requires, with some exceptions, that ferritic steels for loadbearing members be tested with the ASTM drop weight or Charpy impact standard to establish adequate fracture toughness.

Section 4212 of ASME NOG-1-2015, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," also requires, with some exceptions, that materials for structural components be tested with the ASTM drop weight or Charpy impact standard to establish adequate fracture toughness.

The staff notes that the HI-STORE special lifting devices and cranes are designed in accordance with ANSI N14.6 and ASME NOG-1, respectively; however, fracture toughness testing requirements do not appear in the SAR or drawings for the HI-TRAC CS lift yoke, transport cask lift yoke, transport cask horizontal lift beam, MPC lift attachment, MPC lifting device extension, HI-TRAC CS lift link, vertical cask transporter, and cask transfer building crane.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:
Subsection 17.4.3 of the HI-STORE SAR discusses the general approach for protection against brittle fracture of ferritic steel parts. In cases where the construction material is not exempt from fracture toughness testing on the basis of the lowest service temperature (per NF-2311(b)(10)), then further steps are taken to assure adequate material fracture toughness. Specifically, the fracture toughness requirements for the vertical cask transporter (VCT) are discussed in Paragraph 4.5.3.9 of the HI-STORE SAR. The construction materials for the cask transfer building (CTB) crane shall comply with the fracture toughness requirements per paragraph 4212 of NOG-1-2015, which is now clarified in Paragraph 4.5.2.9 of the HI-STORE SAR.

For the special lifting devices identified in the RAI, adequate material fracture toughness is demonstrated by using one of the following two methods:

i) Perform a fracture toughness analysis demonstrating that a flaw in the material (equal to the maximum permissible size per inspection) will not propagate under the maximum load condition (i.e., maximum rated lift).
ii) Demonstrate compliance with the fracture toughness requirements per NF-2300 of the ASME Code, Section III.

The above information related to special lifting devices has been added in Paragraph 4.5.1.2 of the HI-STORE SAR.

17-3: Clarify the acceptable materials of construction for the cask transfer building (CTB) crane and vertical cask transporter (VCT).

SAR Sections 4.5.3.3 and 4.5.3.9 state that the VCT beam and lifting tower materials "shall be consistent with the ITS category of the part." The staff is unable to find in the SAR a description of how the ITS category of a part determines the material of construction.

SAR Table 4.5.2, "Design Parameters for the CTB Crane," states that the material of construction includes a carbon steel frame. However, Section 4200 of the crane design standard, ASME NOG-1-2015, provides specific steel grades that are considered acceptable. SAR Table 4.5.2 should reference these acceptable grades or a justification should be provided for not following the design standard.

This information is required to demonstrate compliance with 10 CFR 72.24(c)(3).

Holtec Response:
The referenced statement in HI-STORE SAR Paragraphs 4.5.3.3 and 4.5.3.9 has been revised to read as follows:

> "All materials used in the design of the overhead beam and lifting towers shall be ASTM or ASME approved."

HI-STORE SAR Table 4.5.2 has been revised to indicate that the construction materials for the load bearing members of the CTB Crane structure shall be in compliance with Subsection 4200 of ASME NOG-1 [3.0.1]. Section 4.5.2.9 has also been added to the HI-STORE SAR to further clarify the material requirements for the CTB Crane.

17-5: Provide the technical justification for the structural performance of the Metamic-HT fuel basket for MPCs with an indefinitely long service life.

SAR Table 17.0.2 states that the materials and mechanical properties for the Metamic-HT fuel basket are incorporated by reference from the HI-STORM UMAX FSAR, which, in turn, references the HI-STORM FW FSAR. Section 1.2.1.4.1 of the HI-STORM FW FSAR refers to the Metamic-HT Sourcebook for the technical basis for the properties of this material.

The staff notes that the Metamic-HT Sourcebook does not discuss mechanical properties beyond 40 years of service, and MPCs stored at the HI-STORE site may have a service life significantly longer that that time period. Additional technical justification is needed to demonstrate that the long-term effects at elevated temperatures will not prevent the fuel basket from fulfilling its structural function.

This information is required to demonstrate compliance with 10 CFR 72.24(d).

Holtec Response:
Per SAR Table 17.0.1, the target license life for the initial application of the HI-STORE CIS Facility is 40 years, which is consistent with the data presented in the Metamic-HT Sourcebook. The following conservative test conditions are also noted:

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These conservative test conditions demonstrate the ability of Metamic-HT to have a service life significantly longer than 40 years.

17-6: In SAR Section 5.4, provide a description, design criteria, material properties, and a summary of the structural analyses of the metallic components of the canister transfer facility.

SAR Chapter 5, "Installation and Structural Evaluation," provides design information and structural analyses for all ITS components at the HI-STORE CIS Facility; however, the canister transfer facility is missing from this discussion. The staff notes that SAR Section 5.3.3 discusses the canister transfer facility concrete foundation, but there is no discussion of the structural steel components of the facility. This information is needed to allow the staff to evaluate the design and performance of the canister transfer facility and the maintenance requirements in SAR Section 10.3 that are frequently specific to the design-code of the SSC. This information is required to demonstrate compliance with 10 CFR 72.24(c)(3) and (d).

Holtec Response:
The requested information has been added to the HI-STORE SAR in Section 5.4.7.

17-7: For the components unique to the HI-STORE CIS Facility, provide the mechanical properties used to support the structural evaluation.

SAR Chapter 5, "Installation and Structural Evaluation," frequently states that mechanical properties are obtained from applicable specifications, without providing the property data (e.g., SAR Sections 5.4.4.3, 5.4.5.3, 5.4.6.3, 5.5.1.3). In addition, in some cases, the SAR states that only the strength properties are obtained from applicable specifications, without reference to other properties included in those specifications (e.g., elongation).

The staff's materials review includes the verification that property data from materials codes and standards are being used correctly, including the appropriate consideration of temperature and time-dependent properties. This information is needed to allow the staff to evaluate the design and performance of ITS SCCs used at the HI-STORE CIS Facility.

This information is required to demonstrate compliance with 10 CFR 72.24(c)(3) and (d).

Holtec Response:
Sections 5.4 and 5.5 of the HI-STORE SAR have been updated to include the mechanical properties used to support the structural evaluations for the components unique to the HI-STORE CIS Facility. These properties can be found in Table 5.4.10.

17-10: Reconcile the difference between the permissible temperature limit for shielding concrete provided in HI-STORE SAR Table 4.4.1 and Holtec Position Paper DS-289.

HI-STORE SAR Table 4.4.1, "Permissible Temperature Limits for HI-TRAC CS and CTF Materials," includes a 650 °F temperature limit for shielding concrete under accident conditions. This table references the analysis on concrete requirements in the HI-STORM 100 FSAR, Revision 14. However, the staff notes that Revision 15 of the HI-STORM 100 FSAR has a 572 °F allowable temperature limit, based on the latest revision of Holtec Position Paper DS- 289, "Maximum Permissible Temperature in Plain Concrete in HI-STORM System Components Under Off-Normal and Accident Conditions."

This information is required to demonstrate compliance with 10 CFR 72.24(d) and (e).

Holtec Response:
HI-STORE SAR Table 4.4.1 has been updated to align with the latest revision of Holtec Position Paper DS-289. Accordingly, the maximum temperature limit for shielding concrete under accident conditions has been reduced from 650°F to 572°F.

17-11: Justify the elevated-temperature performance of the cask transfer building slab and canister transfer facility foundation.

HI-STORE SAR Table 6.4.5 states that, while positioned inside the canister transfer facility, the enclosure shell of the transportation cask may reach 336 °F (160 °C). The SAR does not provide information on the temperature of the adjacent concrete structures.

SAR Sections 4.6.2 and 5.3.3 state that the cask transfer building slab and canister transfer facility foundation are designed to meet the strength requirements of ACI 318-05, "Building Code Requirements for Structural Concrete." The staff notes that ACI 318 does not include provisions for high temperature exposure; however, ACI 349, "Code Requirements for Nuclear Safety Related Concrete Structures," has a 150 °F (66 °C) limit for normal operation. Data on the effect of temperature on the strength of concrete indicates that compressive strength drops by more than 20 percent after a few days of exposure to temperatures near 150 °C (Carette and Malhotra, 1985). It is unclear to the staff whether the cask transfer building slab and canister transfer facility may reach temperatures that could degrade the concrete strength and, if so, if the loss of strength may affect the concrete structural performance.

This information is required to demonstrate compliance with 10 CFR 72.24(d) and 72.120(d).

Reference:
Carette, G.G. and Malhotra, V.M.," Performance of Dolostone and Limestone Concretes at Sustained High Temperatures," Temperature Effects on Concrete, ASTM STP 959, T.R. Naik, Ed., American Society for Testing and Materials, Philadelphia, 1985, pp. 38-67.

Holtec Response:
The local temperature of the concrete beneath a loaded HI-TRAC CS or Transport Cask could reach as high as 150°C (302°F) assuming that the stored contents are at the maximum allowable heat load. Thus, some degradation and loss of concrete strength may occur. However, the cask transfer building (CTB) slab and the canister transfer facility (CTF) foundation have substantial built-in safety margins, which can withstand a decrease in compressive strength by as much as 50% without causing the factored shear and moment loads to exceed the degraded capacities. In other words, if the compressive strength of the concrete were reduced from 4,500 psi to 2,250 psi in Supplement 11 of Holtec report HI-2177585 [5.4.6], all calculated safety factors would remain above 1.0, with one minor exception. For the bearing load on the CTB slab beneath the CTB crane rails, the concrete compressive strength must remain above 4,500 psi. This is not an issue since the concrete material directly beneath the CTB crane rails is not exposed to elevated temperatures.

A similar conservative approach to consider a 50% reduction in compressive strength of plain concrete in HI-STORM 100 casks is used in Amendments 11 and 12 of HI-STORM 100 FSAR.

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Holtec Response:

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17-16: State the qualification requirements of personnel performing inspections of the ISFSI pad, and clarify the method used to confirm that ISFSI pad settlement will be within the design basis.

HI-STORE SAR Table 10.3.1 states that, as part of the maintenance program, the ISFSI pad will be inspected annually for cracks and, every five years, settlement will be confirmed to be within the design basis. SAR Section 18.8 also states that the Reinforced Concrete AMP will include annual inspection for concrete degradation, and the acceptance criteria for those inspection will be in accordance with American Concrete Institute (ACI) 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures."

Chapter 7 of ACI 349.3R-02 includes minimum personnel qualification requirements for the responsible engineer and the inspectors to ensure that concrete inspections are property implemented. In addition, ACI 349.3R-02 references specific methods by which settlement can be measured (e.g., surveying techniques).

The SAR descriptions of the maintenance and AMP do not reference the ACI Code for personnel qualification, and it is unclear to the staff how personnel will be trained to ensure that concrete degradation will be appropriately identified and evaluated. Also, the SAR does not state the method by which pad settlement will be confirmed to be within the design basis every five years.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:

Since the acceptance criteria for the pad are in accordance with ACI 349.3R-02, the personnel shall also be qualified in accordance with the same code. However, it should be noted that ACI-349 is not currently explicitly referenced in the HI-STORE SAR but is in the supporting report HI-2167378. This report has been updated to include the personnel qualification.

Similarly, the settlement will be measured in accordance with ACI-349. This information has been included in the revised aging management supporting report HI-2167378.

17-17: Include the groundwater chemistry monitoring activities in Holtec Report No. HI-2167378, "Aging Assessment and Management Program for HI-STORE CIS."

SAR Section 18.8 provides a summary of the Reinforced Concrete AMP, which includes a description of groundwater chemistry monitoring. However, the detailed description of the program in the Holtec Report No. HI-2167378 does not mention this activity.

In order to allow the staff to evaluate the efficacy of the program to address potential degradation of the concrete, the staff requires additional information on the groundwater monitoring activity (e.g., parameters monitored, monitoring frequency, acceptance criteria).

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:

The reinforced concrete AMP in HI-2167378 has been updated to include the groundwater monitoring activities.

17-18: Provide a technical justification for the MPC inspection sample size and inspection frequency in the Canister AMP.

SAR Section 18.5, "Canister Aging Management Program," states that one MPC will be inspected every five years. The SAR does not provide a technical basis for the adequacy of this inspection approach to identify stress corrosion cracking of the potential population of 500 MPCs at the HI-STORE CIS Facility.

The staff requires additional information to justify the inspection sample size and inspection frequency, considering:

- The history of the canisters prior to arriving at the HI-STORE CIS Facility. SAR Section 18.5 states that the ranking of canisters at the site will consider the prior site; however, it is not clear how information on the potential storage conditions at prior sites (e.g., proximity to chloride sources, humidity) was considered in developing the inspection sample size of one MPC and frequency of every five years.
- The proximity to chloride sources at the HI-STORE CIS Facility (see RAI 17-11).
- The potential for deliquescence of deposited salts, based on weather station data, canister temperatures, and potential deposited salt compositions. SAR Chapter 2 describes the site has having low humidity; however, the SAR does not provide a quantitative evaluation of when

atmospheric moisture may deliquesce. The staff notes that the combination of the minerals in the surrounding area could lead to salt mixtures that undergo deliquescence at levels of relative humidity significantly lower than that for a single salt alone. For example, adding potassium chloride to sodium chloride can depress deliquescence relative humidity from about 74% to 68%, while additions of magnesium chloride can depress the deliquescence relative humidity much further (24% for pure magnesium chloride). (Yang et al., 2011)

- An estimate of the stress corrosion crack growth rates, considering laboratory data, field experience, and time of canister wetness (deliquescence).

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Reference:

Yang, L., R. Pabalan, P. Shukla, M. Juckett, X. He, K.T. Chiang, H. Gonzalez, and T. Ahn, "Corrosion of Alloy 22 Induced by Dust Deliquescence Brines," Report Prepared for the Nuclear Regulatory Commission, March 2011, ADAMS ML110730489.

Holtec Response:

The MPC inspection sample size and inspection frequency of the canisters are based on NRC guidance in NUREG-1927 and draft NUREG-2214. Both documents indicate one canister every 5 years as appropriate. The MPC canisters to be stored at HI-STORE are identical in material and environment to those described in the guidance documents. Those guidance documents indicate the need to choose the most susceptible canisters, as outlined in the HI-STORE SAR. However, those guidance documents do not indicate that the guidance applies to a maximum number of canisters, nor to a specific site location. The environment at the HI-STORE site is not significantly different than other areas of the United States to which the guidance appears to apply. The HI-STORE AMP is a learning based program which allows for expanding the number of canisters to be inspected if any indications are found.

17-19: Include the MPC eddy current activities in the Canister AMP in Holtec Report No. HI-2167378, "Aging Assessment and Management Program for HI-STORE CIS," and clarify the criteria that prompts the performance of this testing.

SAR Section 18.5 provides a summary of the Canister AMP, which includes a brief description of eddy current testing. However, the detailed description of the program in Holtec Report No. HI-2167378 does not mention this activity. In order to allow the staff to evaluate the efficacy of the program described in HI-2167378 to address potential degradation of the MPC, the staff requires additional information on the eddy current testing activity, including:

- A description of the method;
- Qualification requirements of personnel performing the testing;
- How the method will be demonstrated to be capable of identifying and sizing anomalies;
- The extent of test coverage that will be performed on an MPC(s) if a U-bend specimen exhibits defects or anomalies, and;
- The acceptance criteria for allowable flaw size.

In addition, the staff notes that SAR Section 18.5.3 states that eddy current testing may be performed if U-bend coupons indicate a defect or anomaly. The SAR does not indicate whether indications found on the MPC could also prompt eddy current testing.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:

The eddy current testing is described in the SAR as simply a defense in depth option if more information is needed about the condition of the MPC. It is not intended to be the program used for monitoring the potential degradation of the MPC. The aging management program as is credited for the MPC is outlined in HI-2167378. Indications found on the MPC are entered into the corrective action program, and that program will determine if actions (such as eddy current testing) are needed. Chapter 18 has been updated to clearly indicate that the coupon and eddy current testing are defense in depth, and not the credited AMP for the canister.

17-20: Provide additional details of the U-bend coupon testing in the Canister AMP in Holtec Report No. HI-2167378, "Aging Assessment and Management Program for HI-STORE CIS," its technical basis, and how it will be used to inform inspections in the AMP.

The staff notes that the summary of the Canister AMP in SAR Section 18.5 contains significantly more information on the U-bend testing than the full description of the program in Holtec Report No. HI-2167378. In order to allow the staff to evaluate the efficacy of the program described in HI-2167378 to address potential degradation of the MPC, the staff requires additional information on the coupon testing activity, including:

- The standard to which the coupons will be prepared;
- Details of pre-exposure examination methodology;
- Details of the post-exposure examination methodology;
- Whether coupons are placed back into service after post-exposure examinations (versus having multiple coupons that are each exposed just once), and, if so, how artifacts from the examination (e.g. dye penetrant, cleaning) that could affect the subsequent results will be avoided;
- Frequency of coupon examinations, and;
- Canister sample size. SAR Section 18.5.2 states that coupons will be installed in VVMs that contain oldest and coldest canisters where inspections are expected. The staff notes that the program proposes to inspect only one MPC, and thus it is not clear if coupons are planned to be installed in one VVM or some larger sample of VVMs.

In addition, it is not clear to the staff why U-bend coupons installed in the VVMs with the oldest and coldest canister would best serve as an early warning to predict the onset of cracking. The staff notes that this VVM would be expected to have the lowest airflow of any VVM on the site and thus the lowest potential for pulling in atmospheric contaminants. Also, the coupons will not have had the exposure history of the oldest and coldest canister (i.e., exposure at original storage site). SAR Section 18.5.2 states that the coupon testing will help provide insight into the long term aging behavior; however, it does not appear that the AMP provides adequate consideration of possible false negative coupon results (i.e., assuming that no corrosion of the coupon means no corrosion of the canister) and the potential to inappropriately relax MPC inspections in the future based on coupon results. As a result, the staff requires additional information regarding:

- The technical basis for choosing the VVM with the oldest and coldest canister for the coupon testing;
- Whether a VVM's position on the pad may influence the degree to which is it exposed to contaminants from the surrounding area (and thus whether VVM position should be considered in coupon placement), and;

- Given the coupon limitations discussed above, how the AMP will prevent the results of coupon testing from inappropriately relaxing the AMP activities in the future.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:

U-Bend coupons are prepared in accordance with following ASTM Standard:

> "Standard Practice for Making and Using U-Bend Stress-Corrosion Test Specimens", ASTM G30 – 97 (Reapproved 2009).

Pre and post-exposure examination methodology is in accordance with Section 12 Inspection guidelines defined in the ASTM Standard cited above. Following post-examinations coupons will be returned to service. In this manner coupon exposure time and concomitant potential for Stress Corrosion Cracking is maximized. Artifacts from examination such as dye penetrant will be cleaned in accordance with following standard:

> "Practice for Preparing, Cleaning and Evaluating Corrosion Test Specimens", ASTM G1 – 03(2017).

U-bend coupons are installed in VVMs loaded with oldest and coldest canisters as the potential for salt deliquescence and concomitant Chloride Induced Stress Corrosion Cracking (CISCC) is maximized on cold canisters. For this reason canister decay heat is defined as the principal parameter in SAR Section 18.5 for ranking CISCC susceptibility.

VVM position on a pad is evaluated as a second order effect as contaminants are drawn from a common source (ambient air) by ventilation action. Potential for false negatives is not credible as coupon testing is augmented by eddy current testing of canisters as defined in SAR Section 18.5.3 and visual inspections defined in Section 18.6.

<u>Frequency of Coupon Testing and Canister Sample Size</u>

As MPC degradation is a long term process with no known or observed mechanisms that would lead to rapid thru-wall breach a suitable coupon testing plan must be fashioned to maximize learning thru an expanding database of experience and knowledge. To this end Holtec proposes an initial coupon testing plan as follows:

Initial Coupon Testing Protocol		
Test Item	Count	Remarks
Test Coupons/canister	Four Coupons	One in each quadrant located near the inlets
Canister Sample Size	Five lead canisters	Selected based on lowest canister heat load
Coupon Testing Frequency	Once Every Five Years	Frequency aligned with visual inspections (See Table 18.6.1).
Note 1: Coupon testing must not be solely relied as a basis for acceptable performance. Note 2: Coupon evaluation must be coordinated with eddy current and visual inspection results to provide a comprehensive and informed basis for future inspections.		

SAR Chapter 18 is revised to incorporate above table.

17-21: Provide the technical justification that establishes that the MPCs arriving at the HI-STORE CIS Facility will have adequate structural integrity under normal, off-normal, and accident conditions of storage.

The staff notes that the MPCs arriving at the HI-STORE CIS Facility have an undefined length of prior storage, and they may have been subject to aging mechanisms during that storage term that have the potential to challenge the integrity of the canisters. The staff also notes that, while the proposed canister leak testing described in SAR Section 10.3.3.1 provides information on the state of confinement at the time of receipt, this testing does not provide information on the structural integrity of the MPCs (i.e., presence or absence of indications, their number and size). The staff recognizes that a license or CoC under which an MPC was previously stored or transported may include some inspections capable of verifying structural integrity; however, that is not necessarily the case. The HI-STORE SAR does not incorporate by reference any such criteria from other licenses/CoCs nor does it establish minimum inspection criteria for MPCs that are received on the HI-STORE site.

As a result, the staff requires additional information that demonstrates that MPCs with an undefined length of prior service will have adequate structural integrity when received at the HI-STORE CIS Facility.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:

All canisters coming to the HI-STORE facility have been stored under the HI-STORM UMAX Certificate of compliance. The NRC has certified that design to maintain structural integrity for the 20 year license life of that system. The canisters will all be transported in the HI-STAR 190 transportation cask, which has also been certified by the NRC and maintains MPC structural integrity throughout transportation. The license for the HI-STORE ensures that any canisters that undergo an accident event in transport are not accepted at the HI-STORE facility. Therefore, there is no mechanism that could challenge the structural integrity of the canisters.

17-25: Clarify details in SAR Section 18.10 regarding the aging management activities for lifting devices.

SAR Section 18.10 summarizes the Lifting Device AMP. There are several details in this section that are unclear to the staff:

- The list of examples of "special lifting devices" includes canister lift cleats and cask lift brackets. The staff notes that these two subcomponents do not appear in any drawings and are not discussed in the list of special lifting devices in SAR Section 5.4.6.1. Revise SAR Section 5.4.6.1, Table 4.2.1, and Section 18.1, as needed, to clarify whether the canister lift cleats and cask lift brackets are ITS components.
- The list of items addressed by the AMP does not include the HI-TRAC CS Lift Link, which is described in SAR Section 5.4.6.1 as a special lifting device used at the HI-STORE CIS Facility. Clarify whether the program manages the aging of this component.
- SAR Section 18.10 states that the program performs visual inspections of all "internal surfaces for corrosion and integrity." Clarify what is meant by an "internal surface" of the lifting devices.

Clarify what is meant by "integrity" (i.e., coating integrity vs. structural integrity). Note that SAR Section 18.11 also uses the term "integrity."

- SAR Section 18.10 states that the Lifting Device AMP addresses ancillaries needed to carry out short term operations, but it also includes the canister transfer facility in the list of components inspected in the program. The staff notes that the canister transfer facility does not fall under the classification of "ancillaries," as defined in SAR Section 4.5. Clarify Section 18.10 to expand the scope of the program beyond ancillaries.

This information is required to demonstrate compliance with 10 CFR 72.120(a).

Holtec Response:
The above bulleted items are clarified below (in order of appearance):

- The words "canister lift cleats" are improper. The correct terminology is "MPC Lift Attachment", and the text in SAR Section 18.10 has been revised accordingly. The reference to "cask lift brackets" is also incorrect as this is a generic term used by Holtec to describe the special lifting device for above ground dry storage casks (e.g., HI-STORM 100, HI-STORM FW), which has no applicability to the HI-STORE CIS Facility. The words "cask lift brackets" have been deleted in Section 18.10.
- The Lifting Device AMP does apply to the HI-TRAC CS Lift Link. The text in Section 18.10 has been revised to indicate as such.
- The words "internal surfaces" were meant to refer to the interior surface of the Canister Transfer Facility (CTF), which was previously part of the scope of the Lifting Device AMP. As described in the response to RAI 17-26 below, the CTF has now been removed from the Lifting Device AMP and managed separately under its own AMP. As a result, the visual inspections described in Section 18.10 have been revised, and the words "internal surfaces" have been eliminated.
- Section 18.10 has been revised to eliminate the Canister Transfer Facility (CTF) from the list of components inspected per the Lifting Device AMP. The aging management program for the CTF is separately discussed in Section 18.12 of the updated SAR. See response to RAI 17-26 below.

17-26: [

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

17-28: Clarify the details of the High Burnup Fuel AMP that will be used to demonstrate fuel performance beyond 20 years of storage.

HI-STORE SAR Section 18.9 states that the High Burnup Fuel AMP will be used to monitor and assess information on fuel performance to ensure that the fuel remains in an analyzed configuration. Holtec Report No. HI-2167378, "Aging Assessment and Management Program for HI-STORE CIS," provides additional detail on the program, which relies on a surrogate demonstration program to provide fuel performance data.

The staff notes that the description of the High Burnup Fuel AMP in Holtec Report No. HI-2167378 is not clear regarding the specific requirements of a surrogate demonstration program that are needed to verify the performance of fuel at the HI-STORE site, such as:

- The specific parameters that are to be monitored or inspected in the surrogate program (i.e., what specific parameters need to be monitored by the surrogate program to make it acceptable for demonstrating fuel performance at the HI-STORE site).
- Methods that are acceptable to detect those parameters and identify potential fuel aging effects.
- Additional details on acceptance criteria. The staff notes that the acceptance criteria are vague with respect to which portions of the demonstration cask they apply.

The staff notes that the AMP is written in a manner that assumes that whatever actions are taken in the referenced U.S. Department of Energy surrogate program will necessarily be acceptable for demonstrating high burnup fuel performance beyond 20 years.

This information is required to demonstrate compliance with 10 CFR 72.120(a) and 72.122(h)(1), (h)(5), and (l).

Holtec Response:
The HBF AMP in HI-2167378 has been updated to include language similar to the guidance in draft NUREG-2214. The revised report is attached to these responses.

EP-1: Clarify the statements in Sections 4.3.3 and 4.3.12 of the proposed ERP, which refer to classification of accidents at the proposed HI-STORE CIS Facility.

The provisions of 10 CFR 72.32(a)(3), *"Classification of accidents,"* only require an "Alert" classification for accidents at an independent spent fuel installation (ISFSI), while 10 CFR 72.32(b)(3) requires a classification for accidents at a monitored retrievable storage (MRS) facility as either an "alert" or "site area emergency."

Section 3.1, "Classification System," of the proposed ERP correctly states that emergencies for the proposed ISFSI are classified as an Unusual Event or Alert. However, Section 4.3.3, "Site Emergency Director (SED)," of the proposed ERP states, in part:

> "*The SED can be reached via telephone to assist and advise the on duty EC [Emergency Coordinator] of his recommendations. These duties include:*
> *[...]*
> • *Decision to escalate to a site area emergency, if appropriate."*

In addition, Section 4.3.12, "Activation of the ERP," of the proposed ERP further states, in part:

> "*When the EC determines that an emergency exists, he/she will immediately:*
> • *Determine if the emergency involves a loss of control or potential loss of control over hazardous or radioactive materials, thus requiring further classification as an Alert, or Site Area Emergency."*

As Section 3.1 of the proposed ERP limits the emergency classification levels to a Notice of Unusual Event and Alert, consistent with 10 CFR 72.32(a)(3), clarify why Sections 4.3.3 and 4.3.12 of the proposed ERP, refer to a Site Area Emergency classification level, which is only required for an MRS facility.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

In Section 4.3.3 the duties related to declaring a site area emergency were removed and duties related to declaring an unusual event and escalating to an alert were added. In Section 4.3.12 "site area emergency" was removed. Additionally, in Appendix B the definitions of "alert" and "emergency class" were updated, the definition of "general emergency" was deleted, and the definition of "notice of unusual event" was also added.

RAI EP-2: Justify why the most recent version of the NRC endorsed guidance for the development of EALs was not used in the development of the EALs for the HI-STORE CIS Facility ERP.

The guidance used by Holtec for the development of the CIS Facility Emergency Action Levels (EALs) is Nuclear Energy Institute (NEI) document, NEI 99-01 "Methodology for Development of Emergency Action Levels," Revision 4, dated January 2003. However, the most recent version of NRC-endorsed guidance for the development of EALs is NEI 99-01, "Development of Emergency Action Levels for Non Passive Reactors," Revision 6, dated November 2012 (ADAMS Accession No. ML12326A805). In addition, the proposed EALs for the HI-STORE CIS facility, contained in Table 3.1B, "CIS Facility Malfunction Initiating Condition Matrix," are not

consistent with guidance in NEI 99-01, Revision 4.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Table 3.1.B of the ERP was revised to accommodate the conditions/requirements listed in Revision 6 of NEI 99-01.

RAI EP-3: Revise Table 3.1B of the proposed ERP to include radiation level thresholds for specific event initiating conditions at the HI-STORE CIS Facility.

Table 3.1B of the proposed ERP provides the following two initiating conditions (ICs):

- Notice of Unusual Event – UNCONTROLLED increase in radiation level at the CIS Facility, and;
- Alert - UNCONTROLLED increase in radiation level that impedes operations at the CIS Facility.
-

Since there are no radiation level value thresholds with these two ICs, the declaration of these events would appear to the staff as subjective, which would result in potential inconsistent event declaration. Explain how the Emergency Coordinator or designee would perform an accurate and timely emergency classification for these ICs, or revise accordingly consistent with NRC endorsed guidance, provided in Nuclear Energy Institute (NEI) document, NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," dated November 21, 2013 (ADAMS Accession No. ML13091A209).

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Table 3.1.B of the ERP was revised to accommodate the conditions/requirements listed in Revision 6 of NEI 99-01.

EP-4: Clarify or revise Table 3.1B of the proposed ERP to state the specific safety systems that would be affected to meet the event initiating conditions at the HI-STORE CIS Facility. Table 3.1B of the proposed ERP also provides the following two ICs:

- Notice of Unusual Event – Other severe incident that may compromise safety systems potentially resulting in a release of radioactivity at the CIS Facility, and;
- Alert - Other severe incident that compromises safety systems resulting in a release of radioactivity at the CIS Facility.

Since dry cask storage facilities are typically passive with no support systems, the staff cannot readily identify which safety systems would need to be affected to meet the initiating conditions for the events. Explain which safety systems are included or should be considered to ensure accurate and timely emergency classification for these ICs, or revise accordingly consistent with NRC-endorsed guidance.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Table 3.1B was revised to remove reference to safety systems and to more appropriately align with the guidance listed in Revision 6 of NEI 99-01.

EP-5: Justify the criteria for Notification of Unusual Event in Section 3.1 of the proposed ERP.

Section 3.1 of the proposed ERP states, in part:

> *"Emergencies are classified as an Unusual Event or Alert."*

However, Section 4.2.1, "Direction and Coordination," of the proposed ERP states, in part:

> *"These duties include:*
> - *Decision to declare an Alert.*
> - *Activation of onsite emergency response organization.*
> - *Prompt notification of offsite response authorities to inform them that an Alert has been declared (normally within 15 minutes of declaring an Alert).*
> - *Notification to the NRC Operations Center at 301-816-5100 immediately after notification of offsite authorities, and in any case within 1 hour of the declaration of an Alert.*

Although the regulations only require the Alert classification, the proposed ERP proposes a classification for a Notification of Unusual Event (Unusual Event). Provide justification why the above duties do not include reference to an Unusual Event, or revise accordingly to address this inconsistency.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Section 4.2.1 was updated to remove the list of duties. Instead, a statement was included to reference section 4.3.3 for the list of duties for the Site Emergency Director. This list of duties was revised to include "decision to declare and Unusual Event" and "decision to escalate to an Alert" as stated in the response to RAI EP-1.

EP-6: Identify the intended linkage between Table 3.1B and Appendix C to the proposed ERP, and provide the missing information for Unusual Event incidents in Appendix C.

Appendix C, "Facility Emergency Action Levels," to the proposed ERP includes a listing of incidents, which would appear to identify the applicable thresholds and natural or destructive phenomena for the generic criteria contained in Table 3.1B. However, the proposed ERP does not provide a direct linkage or reference from Table 3.1B to Appendix C. In addition, the column in Appendix C identifying incidents for "Unusual Events" lists "under development" for each row. The column should identify the specific incidents that trigger the Unusual Event and Alert classifications to allow verification of sufficient differentiation between these, and to ensure accurate and timely emergency classification.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Appendix C has been revised to align with NEI 99-01 R6. Also, additional text was added to Section 3.1 to explain the connection between Appendix C and Table 3.1B.

EP-7: Justify the Alert criteria and the dose thresholds used for the radiological plume incident in Appendix C of the proposed ERP.

Appendix C contains the following Alert criteria for a radiological plume incident:

> "*>100 mrem CEDE [committed effective dose equivalent] but <500 mrem CEDE from an accidental release of radioactive material to the general public.*
>
> *--------or------*
>
> *>1 rem CEDE in a Facility from an accidental release of radioactive"*

This criteria is not consistent with the analysis in NUREG-1140, "A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees," dated January 1988, (ADAMS Accession No. ML062020791), and is more representative of the thresholds for a Site Area Emergency classification. Please provide justification for the use of these radiation levels as thresholds for an Alert classification, or revise accordingly. In addition, the use of a CEDE dose threshold is inconsistent with NRC-endorsed EAL guidance. Provide a justification for using the CEDE dose, or revise accordingly consistent with the latest NRCendorsed EAL guidance.

This information is necessary to determine compliance with 10 CFR 72.32(a)(3).

Holtec Response:

Appendix C has been revised to remove any reference to radiation thresholds and radiological plumes. Instead, requirements were listed that were more appropriately in alignment with Revision 6 of NEI 99-01.

EP-8: Provide the location where emergency response personnel will observe indications for fire and smoke alarms and for radiation monitoring instrumentation.

Section 2.2, "Detection of Accidents," of the proposed ERP states, in part:

> "*Detection of accidents is dependent on personnel observation, by fire and smoke alarms, and radiation monitoring instrumentation."*

The proposed ERP should state the specific location where personnel can observe indications of alarms and radiation monitoring instrumentation for the detection of an accident and to ensure accurate and timely emergency classification.

This information is necessary to determine compliance with the requirements of 10 CFR 72.32(a)(4), *"Detection of accidents."*

Holtec Response:

Section 2.2 has been revised to clarify the description of how and where personnel observe the initiation of alarms.

EP-9: Provide further information on the types and methods of onsite and offsite sampling and monitoring in case of a release of radioactive or other hazardous material, as well as a description of the provisions for the projection of offsite radiation exposures at the HI-STORE CIS Facility.

Section 5.2, "Accident Assessment," of the proposed ERP states:

> *"In either case the attendant RPT [Radiation Protection Technician] would collect real time data at or near the incident site and relay that data to the RSO [Radiation Safety Officer] and/or EC."*

The guidance in SFST-ISG-16, Section 3.7, "Assessment of Releases," states that the ERP:

> *"This should include the types and methods of onsite and offsite sampling and monitoring in case of a release of radioactive or other hazardous material. The provisions for projection of offsite radiation exposures should be described."*

This information is necessary to determine compliance with 10 CFR 72.32(a)(6), *"Assessment of releases."*

Holtec Response:

Section 5.2 has been updated to include reference to HI-STORE CIS Facility SAR, which provides description for the types and methods of onsite and offsite sampling and monitoring.

EP-10: Clarify what specific ERO position will perform the tasks described in the Section 3.3 of the ERP.

Section 3.3, "Information to be Communicated," of the proposed ERP states, in part:

> *"The ERO [emergency response organization] will provide clear, concise information to onsite personnel, the ERO, and offsite response organizations & agencies on the incident underway. To that end, the information from the ERO to the onsite and offsite staff and agencies will have the following attributes."*

The ERP should specify the individual and/or position that will perform these tasks.

This information is necessary to determine compliance with 10 CFR 72.32(a)(7), *"Responsibilities."*

Holtec Response:

Section 3.3 has been revised to clarify that these tasks will be performed by the SED or their designee.

EP-11: Clarify the following information regarding Emergency Coordinator staffing requirements at the HI-STORE CIS Facility:

- Section 4.2.1, "Direction and Coordination," of the proposed ERP states, in part:

  "The SED or designee is the individual who is responsible for managing the activities outlined under this ERP. The SED delegates his duties to the on shift EC until the SED arrives on site to assume command and control of the event. The SED can be reached via telephone to assist and advise the duty EC of his recommendations."

- Section 4.3.2, "ERO Members," states, in part,

  "The EC, RSO and other key ERO personnel are available by cell phone 24 hours a day."

- Section 4.3.4, "Emergency Coordinator," states, in part,
  "The EC, or alternate, is on the facility premises or on call 24 hours a day (i.e., available to respond to an emergency by reaching the facility within less than one hour if after working hours).

- Section 4.3.5, "Delegation and Assignment," states, in part,

  "The ERP identifies ECs who train to coordinate the response of the ERO to an emergency event. These personnel may not always be present at the facility when an event occurs. Depending upon the nature of the event, the on-call EC may designate certain duties to those present at the facility by phone or electronic communication."

In addition, Table 4.1, "Emergency Declaration at the CIS Facility," of the proposed ERP shows the Security Shift Supervisor listed as an Emergency Coordinator Backup and an on-shift position. However, Figure 4.2, "CIS Facility Emergency Response Organization," of the proposed ERP lists an "Emergency Coordinator" as an on-shift position. It is not clear whether the individual with the authority and responsibility to classify an event and notify offsite agencies and NRC (ERO position), is on site at all times (24-hour per day, 7 day per week).

This information is necessary to determine compliance with 10 CFR 72.32(a)(7).

Holtec Response:

Various sections have been updated with respect to EC staffing requirements. Section 4.3.2 has been updated to replace EC with SED while also removing an example list of other ERO members. Section 4.3.4 has been updated with to remove the reference to the EC and to add information relative to delegated SED responsibilities. Section 4.3.5 has been revised to state that an EC will always be on site. Table 4.1 has been revised to appropriately describe personnel designations.

EP-12: Describe the role and responsibilities of the ERO "Shift Radiation Coordinator," as described in Figure 4.2 of the proposed ERP.

Figure 4.2 of the proposed ERP lists the "Shift Radiation Coordinator" as an on-shift position. However, this position is not described anywhere else in the proposed ERP.

This information is necessary to determine compliance with 10 CFR 72.32(a)(7).

Holtec Response:

Figure 4.2 has been revised to change the title of this role to "Radiation Protection Shift Supervisor" and it has been clarified that there is, at minimum, always one person in this role on site, at all times. The information provided in Section 4.3.10 summarizes the responsibilities of all Supervisors.

EP-13: Provide the following information from Figure 4.2 of the proposed ERP:

- The composition of minimum on-shift staffing at all times, and;
- What the augmenting positions are and any reporting requirements these positions would have in the event of a declared emergency.

Figure 4.2 of the proposed ERP lists the on-shift positions and call-in positions. However, the proposed ERP does not provide sufficient detail to allow NRC staff to evaluate the adequacy of the proposed on-shift and augmented staffing for a declared emergency.

This information is necessary to determine compliance with 10 CFR 72.32(a)(7).

Holtec Response:

Figure 4.2 has been revised to better detail which roles are required to be on site at all times, while also detailing augmenting positions for each the aforementioned personnel.

EP-14: Clarify whether the Security Supervision and/or Officers are trained and qualified to perform the duties of the EC, as listed in Section 4.3.4 of the proposed ERP.

Section 4.3.9, "Security Supervision and Officers," of the proposed ERP states, in part:

> *"Security Supervision and/or Officers are responsible for:*
> *[…]*
> *• Acting as on shift EC for initial event response during nights, weekends and holidays.*

The ERP should specify whether these officers are trained and qualified to perform the duties of the EC.

This information is necessary to determine compliance with 10 CFR 72.32(a)(7).

Holtec Response:

Section 4.3.9 has been updated to clarify that only the Security Shift Supervisors will be trained and qualified as Emergency Coordinators. A reference to Table 4.1 has also been added in Section 4.3.4 to further clarify responsibilities.

EP-15: Provide a description, by position or title, of the person responsible for developing, maintaining and updating the ERP.

Section 7.0, "Maintaining Emergency Preparedness Capability," of the proposed ERP does not

include the identification of the personnel responsible for developing, maintaining, and updating the plan, as required in 10 CFR 72.32(a)(7).

This information is necessary to determine compliance with 10 CFR 72.32(a)(7).

Holtec Response:

Section 4.2.1 was updated to allocate duties for updating the ERP to the SED or an assigned designee. This description was also added to Section 4.3.3. Additionally, Section 7.0 was updated to detail information relative to future ERP updates.

EP-16: Provide a description of the contingency plans for the possible evacuation of the Emergency Operations Center for the HI-STORE CIS Facility.

Section 6.1, "Emergency Operations Center (EOC)," of the proposed ERP states, in part:

> *"Though unlikely, the RSO or designee will monitor for conditions that may require the evacuation of the EOC."*

However, the proposed ERP does not address the requirement in 10 CFR 72.32(a)(8), *"Notification and coordination,"* which states that, "[t]he notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination."

The ERP should describe where notification and coordination will be performed if the EOC is evacuated, and whether the alternate location has the necessary communication equipment, procedures, etc., to perform these activities.

This information is necessary to determine compliance with 10 CFR 72.32(a)(8).

Holtec Response:

Section 6.1 has been updated to state that the Security Building Main Conference room is the contingency area for Emergency Response Operations in the event the Primary EOC needs to be evacuated.

EP-17: Clarify if the New Mexico Department of Homeland Security and Emergency Management will be the only State and local entity notified and if this has been agreed upon with State and local authorities.

Section 3.3, "Information to be Communicated," of the proposed ERP states, in part:

> "*The emergency plan implementing procedures will instruct the ERO to make any protective action recommendations directly to State or local officials responsible for implementing the specific protective actions, if appropriate."*

Section 4.3.12, "Activation of the ERP," of the proposed ERP states, in part:

> *"Activation of the ERP requires notification of the following:*
>
> *• Activation of the ERP for any reason is reported to the New Mexico Department*

of Homeland Security and Emergency Management
• If an emergency is declared, notify the NRC within one hour as required by 10 CFR Part 72 of contacting off-site response agencies."

However, the e-mail from Don Shainin, New Mexico Department of Homeland Security and Emergency Management (page 71 of the ERP) states:

"Just a mention of a few things and that is the state of New Mexico [NM] by statute puts NM State police as incident commander for all hazardous materials related incidents. This would require a notification to them if an incident were to occur at your site of this nature."

This information is necessary to determine compliance with 10 CFR 72.32(a)(8).

Holtec Response:

Section 4.3.12 has been updated to include notification to the New Mexico State Police.

EP-18: Clarify the commitment for notification of the NRC operations center to align with the specific requirements of 10 CFR 72.32(a)(8) and 10 CFR 50.72(a)(3).

The provisions of 10 CFR 72.32(a)(8) require the licensee to, "commit to notify the NRC operations center immediately after notifications of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency."

However, Section 4.3.12 of the proposed ERP merely states, in part:

"If an emergency is declared, notify the NRC within one hour as required by 10 CFR Part 72 of contacting off-site response agencies."

As stated above, this could be inferred as allowing for the notification of the NRC within one hour of notifying off-site response agencies and not within the 2nd criteria of "not later than one hour after the licensee declares an emergency."

This information is necessary to determine compliance with 10 CFR 72.32(a)(8).

Holtec Response:

Section 4.3.12 has been updated to clarify that the NRC will be notified with one hour of the site declaring an emergency.

EP-19: Clarify if the location of the alternate assembly area described in Section 5.3.6 of the ERP is off-site, whether it is for augmenting personnel responding from off-site or on-site personnel and will it have the capability to perform notification and coordination activities.

The provisions of 10 CFR 72.32(a)(8) require the licensee to, "[t]he notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination."

However, Section 5.3.6, "Hostile Action Response," of the proposed ERP states, in part:

"*If necessary, Site Security and/or the SED will direct the ERO to an alternate assembly area if the location of the EOC is deemed to be unsafe."*

This information is necessary to determine compliance with 10 CFR 72.32(a)(8).

Holtec Response:

Sections 5.3.6 and 6.1 have been updated to clarify the location of the EOC contingency area.

EP-20: Revise the threshold limits in Section 5.5 of the ERP to ensure consistency with the latest version of the EPA Protective Action Guide (PAG) Manual for early phase PAGs.
Section 5.5, "Exposure Control in Radiological Emergencies," of the proposed ERP states, in part:

"*The PAG [protective action guide] threshold of concern2 for CIS Facility is based on the EPA [U.S. Environmental Protection Agency] limits of less than one Rem Committed Effective Dose Equivalent (CEDE), five Rem thyroid, or 50 Rem skin dose at the site boundary.*

_____
2 "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents," Office of Radiation Programs, USEPA, 1992"

These limits are not consistent with those provided in either Table 2-1, "PAGs for the Early Phase of a Nuclear Incident," of the Manual of Protective Action Guides and Protective Actions for Nuclear Incidents (EPA-400-R-92-001, May 1992) or in Table 1-1, "Summary Table for PAGs, Guidelines, and Planning Guidance for Radiological Incidents," of the PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents (EPA-400/R-17/001, January 2017).

This information is necessary to determine compliance with 10 CFR 72.32(a)(9), *"Information to be communicated."*

Holtec Response:

Section 5.5 has been revised to reference the current revision of the PAG Manual for Early Phase PAG's as the facility's threshold of concern.

EP-21: Provide additional description, discussion, or clarification regarding the type of information to be provided during an emergency notification, as stated in Section 4.3.12 of the ERP.

Section 4.3.12 of the proposed ERP states, in part:

"Whenever an emergency notification is made, the following information will be provided if requested:

- *The possible hazards to human health and the environment outside the facility*
- *Notify NRC as required by 10 CFR Part 72."*

The provisions of 10 CFR 72.32(a)(9) describe the information that must be communicated during an emergency, and specifically states that it should communicate facility status, radioactive releases, and recommended protective actions to be given, if any are necessary. It is not clear to staff whether the information identified in Section 3.3, "possible hazard to human health," is considered a protective action. Additionally, it is not clear why "notify NRC as required," should be part of the information provided regarding protective actions or status of the facility.

This information is necessary to determine compliance with 10 CFR 72.32(a)(9).

Holtec Response:

Section 4.3.12 has been revised to remove reference to 10CFR72 and instead, include all required 10CFR72.32(a)(9) announcements.

EP-22: Describe the proposed size and shape of the Site Controlled Area boundary, and clarify the definitions for chief elected officials in Section 5.9 of the ERP.

Section 5.9, "Emergency Planning Zone (EPZ)," of the proposed ERP states, in part:

> *"Based on the potential consequences of postulated emergencies, the EPZ for the CIS Facility has been defined as the Site Controlled Area boundary."*

Section 5.9 further states:

"The size of the EPZ is sufficiently large that:

> *• Detailed planning within the EPZ provides both an adequate basis for responding to all reasonably credible accidents and a substantial base for the expansion of response efforts in the event that this proves necessary by CIS Facility, State of New Mexico, local agencies and other organizations responsible for off-site emergency response.*
>
> *• Projected maximum doses resulting from credible accidents within the site will not require protective actions to be taken outside the EPZ.*
>
> *Chief elected officials responsible for various portions of the CIS Facility EPZ will provide the public information on operational emergencies at the CIS Facility and, based on inputs from the site and regulatory agencies, may recommend public protective actions, such as sheltering or evacuation."*

The staff needs additional description of the proposed size and shape of the Site Controlled Area boundary. The staff also needs further clarification on the definition of "Chief elected officials," as referenced in Section 5.9.

This information is necessary to determine compliance with 10 CFR 72.32(a)(1), *"Facility description,"* 72.32(a)(9), and 72.106.

Holtec Response:

Section 1.2 has been revised to clarify the boundaries of the owner-controlled area. Section 5.9 has also been revised to state that the EPZ is defined as the OCA. Additionally, the term "chief elected officials" was replaced with "offsite response organizations" for clarity.

RAI EP-23: Clarify or revise the frequency and scope of the emergency planning drills and exercises, as provided in Section 7.3 of the ERP.

Section 7.3, "Drills and Exercises," of the proposed ERP states, in part:

> "*Drills will be conducted semi-annually as required by regulation.*
> *[…]*
> *Consistent with the requirements in 10 CFR 72.32 (a) and (b), documented quarterly communications checks with off-site response organizations will include the check and update of all necessary telephone numbers."*

This is not consistent with 10 CFR 72.32(a)(12), *"Exercises,"* which requires that the Emergency Plan include, "[p]rovisions for conducting semiannual communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Radiological/Health Physics, Medical, and Fire drills shall be conducted annually […]."

Section 7.3 of the ERP does not contain provision identified for radiological/health physics, medical, and fire drills to be conducted annually, or a requirement to conduct a biennial exercise. Additionally, communication checks are required semiannually, rather than quarterly as identified in Section 7.3.

This information is necessary to determine compliance with 10 CFR 72.32(a)(12).

Holtec Response:

Section 7.3 has been updated to reflect the requirements listed in 10CFR72.32(a)(12).

EP-24: Provide documentation that demonstrates that agreements are in place with the offsite organizations that will respond during an emergency or the commitment to establish these prior to receiving spent fuel.

Section 4.3.11, "Local Off-site Assistance," of the proposed ERP provides a list of the local offsite organizations that may assist the facility and states, in part:

> *"[…] that in Appendix D (Later) is documentation of the agreements reached with these organizations."*

The letters provided in Appendix D, "External Agency Agreements," are letters requesting review of the proposed REP, not agreements. Agreements, or a commitment to establish such agreements, should be in place for the following off-site organizations:

- medical treatment facilities,
- first aid personnel and/or ambulance service,
- fire-fighting assistance, and
- law enforcement assistance.

This information is necessary to determine compliance with 10 CFR 72.32(a)(15), *"Offsite*

assistance."

Holtec Response:

The appropriate MOUs have been added as an appendix to the Emergency Response Plan.

EP-25: Clarify or provide additional description of the following information from Section 4.3.11 of the ERP:

> a. Please clarify whether the City of Hobbs N.M. ambulance service has the capability to transport a radiologically contaminated, injured person.
>
> b. Please describe what services the Lea County Sheriff's department will provide related to law enforcement at the facility, if requested for a security event.

Section 4.3.11 of the proposed ERP further states, in part:

> *"The City of Hobbs N.M. has ambulance service available for the CIS Facility. Response time for medical assistance to the CIS Facility site is about 30 minutes.*
>
> *The Lea County Sheriff's department will provide traffic control and residential evacuation if required. The Sheriff's Department also provides 24-hour emergency dispatch service for all emergency response organizations."*

Additionally, Section 7.6, "Letters of Agreement," of the proposed ERP states, in part:

> "*Letters of agreement (Appendix D) for the CIS Facility from law enforcement and medical assistance providers describe their capabilities to evaluate and treat injuries from radiation, radioactive materials and other hazardous materials used in conjunction with a radioactive materials event."*

This information is necessary to determine compliance with 10 CFR 72.32(a)(15).

Holtec Response:

Section 4.3.11 has been revised to state that the City of Hobbs ambulance services have the capability to transport a radiologically contaminated and injured person. Section 4.3.11 has also been updated to describe the services that the Lea County Sheriff's department will provide with additional references to the Physical Security Plan and the Safeguards Contingency Plan.

EP-26: Clarify that the change process for the ERP under the Holtec QA Program will be evaluated in accordance with 10 CFR 72.44(f), and that maintenance and updating of the ERP will be consistent with the requirements of 10 CFR 72.32(a)(14).

Section 7.1, "Written Emergency Plan Procedures," of the proposed ERP states, in part:

> *"Changes to this ERP and all Site Emergency Procedures are made in accordance with*

the Holtec QA program. Written Emergency Procedures will be maintained and updated per 10 CFR Part 73 [Ref. 8].”

10 CFR Part 73 are requirements for physical protection of plants and materials and is not applicable to emergency plan changes.

This information is necessary to determine compliance with 10 CFR 72.44(f) and 72.32(a)(14).

Holtec Response:

Section 7.1 has been revised to reference the appropriate sections of the regulation.

EP-27: Clarify how the training of the staff at the Lea Regional Medical Center and Carlsbad Medical Center by the Waste Isolation Pilot Plant (WIPP) is verified and documented.

Section 7.2.3, “Off-Site Response Teams,” of the proposed CERP states, in part:

“Currently, the staff at the Lea Regional Medical Center in Hobbs, New Mexico and Carlsbad Medical Center in Carlsbad, New Mexico train with WIPP.”

This information is necessary to determine compliance with 10 CFR 72.32(a)(10).

Holtec Response:

The requirements of the Medical Centers have been included in the updates of the Emergency Response Plan. Verification of their acknowledgment of the requirements is implied through their respective MOUs.

WM-1: Provide quantitative annual and total waste volume estimates by facility lifecycle phase for low-level radioactive waste and nonhazardous solid waste or explain why volumes are not needed to support impact analyses (i.e., why volumes would be negligible or small).

ER Section 4.11 does not provide volume estimates for any solid wastes that could be generated in larger than negligible quantities. For negligible quantities, the applicant should provide upper-bound estimates of waste volumes that are not expected to be exceeded, so staff can understand the qualitative terms "small" or "minimal" that are used in the ER. This includes, but is not limited to, annual and cumulative total volumes of low-level radioactive waste and nonhazardous solid waste that would be generated during decommissioning.

This information is necessary to determine compliance with 10 CFR 51.45(c).

Holtec Response:
Section 4.11.1 has been revised to clarify the existing information presented. No low-level radioactive waste will be generated by the construction of the CIS Facility. The existing values for nonhazardous solid waste have been summed to provide estimates on an annual and total volume basis for phase 1 construction.

Section 4.11.2 has been updated with the estimates for construction activities based on the revisions to Section 4.11.1. Additional information has also been added to section 4.11.2 with estimated values on volume of low-level radioactive waste.

Section 4.11.3 has been updated with the appropriate information from Section 4.11.2 for operations only generated wastes.

Section 4.11.5 has been updated to clarify the expectations for low-level radioactive wastes and nonhazardous solid wastes. Annual and total volume estimates are now included.

CB-2: Clarify or provide the following information regarding the cost benefit analyses:

a) The basis for using an annual consolidated interim storage facility (CISF) operating cost of $4.5 million for the proposed action considering the no-action alternative used a value of $6.25 million per plant for essentially the same activity.

The Data Call for the CISF Environmental Report – January 2017 states that the $4.5 million estimate for operations for the proposed action was based on previous experience. However, details provided in the 2017 Data Call (Appendix G to the ER) concerning previous experience were limited, and no cost estimate range (i.e., variability) was provided. Section 9.2.1 of the ER notes that the $6.25 million (per plant) estimate for the no-action alternative is based on the average of the cost estimate range ($4.5 to $8 million) for storing SNF at shutdown reactor sites, as stated in the Blue Ribbon Commission on America's Nuclear Future - Report to the Secretary of Energy (BRC, 2012). However, the ER did not explain why the proposed action and no-action alternative used different cost estimates for essentially the same activity (i.e., storing SNF at a site without an active reactor). Provide information and/or justification for the projected lower annual cost of operating the CIS Facility, which would likely contain more fuel than an ISFSI at a shut-down reactor site, and may have ongoing activity [see RAI ER-CB-2 (b)].

b) The activities associated with the projected Holtec CISF annual operation costs, as well as the basis for using the $4.5 million estimate over the entire 40 year period. If appropriate, revise the analyses accordingly.

ER Table 9.2.5 estimates that the CIS Facility operation would cost $4.5 million annually over the entire 40 year license period. The 2017 Data Call (Appendix G to the ER) indicates that SNF transportation to the CIS Facility site contributes to the operation costs and assumes that the CIS Facility receives 250 SNF casks per year (i.e., 40 years for 10,000 casks). In contrast, ER Section 1.0 states that receipt of the 10,000 casks occurs during the first twenty years (i.e., this activity does not occur during the second half of the license period). Provide clarification concerning what activities, including SNF transportation or receipt activities, are included in the operation costs over the 40 year license period, as well as the appropriateness of using the same $4.5 million cost estimate over the entire 40 year license period.

This information is necessary to determine compliance with 10 CFR 51.45(b) and (c).

Holtec Response:

a) The $4.5 in annual ISFSI costs is based strictly on money spent on operating. The cost efficiencies from the no-action alternative primarily relate to the ISFSI storage design (HI-STORM UMAX underground vs. traditional above ground storage) which increases sight lines and reduces the staff required to maintain security.

b) See below table for the mix of our anticipated operating costs (which excludes state/local taxes and decommissioning fund). These are purely the costs to operate the facility (including receipt inspections) but do not factor in costs for transportation of fuel.

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

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