NRC RAI 1-1

Clarify, both in the application and on the licensing drawings, the criteria to determine what could be an "equivalent" or "better" material in lieu of those materials originally called for in the application for the trunnions and the GTCC overpack. The criteria should specify the minimum yield strength, minimum rupture strength, minimum rupture strain, and material standard/grade. The criteria should also describe how galvanic or chemical reactions will be precluded, and how material fracture toughness criteria will be met.

ln its response to RAI 1-2, dated May 18, 2016, the applicant stated some of the criteria that will be used to in determining material equivalency for the trunnions, shown on sheet 3 of drawing 3913, and "substitutable" material for the HB GTCC overpack, described in note E on sheet 1 of drawing 10315 but did not include this information in the SAR or licensing drawings. The RAI response is not complete and does not appear to have been updated and in cluded either in the drawings or in the application.

The staff notes that, while ISG-20 is intended to allow a degree of flexibility, it also states: "Certificate holders and shippers need to provide sufficiently detailed information in these parts for NRC staff to perform an adequate technical review." All applications should meet the specified material characteristics in accordance with the Codes and Standards for important to safety (lTS) components.

This information is required by the staff to determine compliance with 10 CFR 71.31(c).

Holtec's Response to RAI 1-1

As stated in the original response, the intent of the allowance for "equivalent material" in the HI-STAR 100 Overpack lifting trunnion design (Drawing 3913R12, sheet 3) was to allow flexibility in material specification while providing equivalent functionality and safety margin. It is understood, based on this comment, that additional information is required to fully define the definition of "equivalent". To avoid unnecessary evaluation of properties for this component where material substitution is only optional, and not utilized in currently fabricated components, this option has been removed from the lifting trunnions specified in Drawing 3913R12.

Note E on Sheet 1 of Drawing 10315 is a standard note intended to allow fabrication flexibility in the specification of product forms (as it states) if properties are identical. To remove the ambiguity that the standard note creates with the use of the word "better", the note is revised as follows (deletion shown by strikethrough):

THE ASME AND/OR ASTM DESIGNATION(S) OF EACH MATERIAL TYPE SPECIFIED HEREIN IS INTENDED TO FIX ITS CHEMICAL AND METALLURGICAL ATTRIBUTES, NOT ITS RAW MATERIAL PRODUCT FORM (VIZ. PLATE OR FORGING, SEAMLESS OR WELDED TUBE, ETC.). ALTERNATE PRODUCT FORMS HAVING THE SAME

CHEMICAL DESIGNATION AND EQUAL ~~OR BETTER~~ MECHANICAL PROPERTIES MAY BE SUBSTITUTED BY THE MANUFACTURER. ALTERNATE MATERIAL TYPES SHALL BE TESTED IN ACCORDANCE WITH THE APPLICABLE ASME CODE REQUIREMENTS FOR THE PRODUCT TYPE.

With this modification, Note E permits only the substitution of materials with equivalent chemical designation, precluding concerns about unanticipated galvanic corrosion or chemical reaction. Permitting only material forms of equivalent, not better, mechanical properties precludes concerns of identifying and evaluating the effect of material substitution on the structural performance of the components.

NRC RAI 1-2

Clarify the torque load to be applied to the lift holes in the MPC enclosure vessel lid.

In the RAI letter dated May 18, 2016, it is observed that Note 8 on Sheet 4 of licensing drawing 3923 specified a torque test that may be used to qualify lift holes threads; however, the bolt torque was not specified. In its RAI response, the applicant stated that the torque load will be in accordance with Holtec's Quality Assurance (QA) program. However, this information should be placed on the licensing drawings, contained in the operating procedures, and/or in the acceptance tests and maintenance program chapters of the application. See Section 1.5.3 of NUREG 1617 for further information.

This information is required by the staff to determine compliance with 10 CFR 71.45, 71.111, and 71.123.

Holtec's Response to RAI 1-2

Note 8 on Sheet 4 of Drawing 3923 is revised to explicitly specify a torque requirement sufficient to qualify the lift hole threads to their design load. The note reads:

MPC LIFT HOLE THREADS THAT ACCEPT NO-GO GAGE MAY BE QUALIFIED BY TORQUE TEST PERFORMED PER WRITTEN PROCEDURE AND PER HOLTEC APPROVAL. APPLIED TORQUE SHALL BE A MINIMUM OF 1403 FT-LBS AND A MAXIMUM OF 1550 FT-LBS.

NRC RAI 1-3

lndicate on the drawings the weld filler material specifications and the electrode classification that will be used for the welds specified on the plans.

ln the RAI letter dated May 18,2016, the staff noted that "Calculations in the application have assumed base material mechanical properties for welds. However, weld filler material and welding process have not been provided. Reference to the ASME codes alone is insufficient." The applicant responded that material tensile strength is indicated in the application. This material property is described in the electrode classification and should be placed on the drawings along with the weld filler specification for the staff to perform its inspection to identify material conditions regarding unintended galvanic or corrosive reactions, embrittlement, diminished structural performance, and ensures that proper NDE techniques are applied for QA purposes.

Additionally, the applicant stated: "The weld process is not specified, since this would limit the possibility ta make process improvements as improved technology becomes available. We believe that this approach meets the intent of ISG-20."While ISG-20 is intended to allow a degree of flexibility it also states: "Certificate holders and shippers need to provide sufficiently detailed information in these parts for NRC staff to perform an adequate technical review.

The staff notes that new processes and technology have to have adequate supporting information to ensure adequate structural performance, fabrication, and inspection especially if the welding technique/process is not contained in the code of interest (ASME code). Such welding information should also be placed on the licensing drawings.

This information is required by the staff to determine compliance with 10 CFR 71 .31 (c).

Holtec's Response to RAI 1-3

After further review of the SAR documents, we believe that the presentation of the information may have caused some confusion with respect to the control of the welding for the HI-STAR system. The NRC reviewer has raised a concern that the information provided does not allow for a review to insure that the welding will not result in "… material conditions regarding unintended galvanic or corrosive reactions, embrittlement, diminished structural performance, and ensures that proper NDE techniques are applied for QA purposes." We believe that this concern may have been initiated by the statement in Table 8.1.4 of the SAR that Welding Fabrication and Qualifications for the Cask Dose Blocker Steel Components (Intermediate Shells) are Non-Code. It was not our intention that there would be no qualification of these welds, but rather that welding qualification and performance could be implemented under a national consensus standard other than the ASME code. Specifically, Note 19 on the HI-STAR cask drawing 3913, states "For Non-Code welds, the provisions of either ASME IX or AWS may be followed." Thus under this guidance, the qualification of weld procedures, weld materials,

and welders are performed to insure that the welds have sufficient strength and ductility for the application. Both ASME Section IX and ASW D1.1 include tensile tests and bend tests to confirm that welding will result in the necessary material strength and ductility required by the cask design and thus embrittlement and diminished structural performance are addressed. All other welds in the HI-STAR system are subject to qualification under Section IX of the ASME code through direct reference or via the applicable Section III reference which ultimately leads back to Section IX.

Galvanic or corrosive effects on the welding are not a concern for the HI-STAR system design due to the fact that the HI-STAR surfaces are coated with robust epoxy coatings rated for the service temperatures of the cask system. These coatings prevent oxygen and water contact with the weld filler material and the base metal such that corrosion is not possible. The welds on the MPC system are performed using stainless steel filler material which affords corrosion protection during the time prior to placing the canister in service, after which it is placed in an inert helium environment, which prevents any corrosive attack.

The NDE requirements for the HI-STAR system are noted on the drawings and in Section 8.1.2 and Table 8.1.4 of the SAR.

Therefore, we believe that the SAR and drawings provide sufficient information for the NRC to conclude that welding will be performed with sufficient testing and qualification to support the safety case. In order to improve the clarity of the requirements, Holtec has changed the entry in Table 8.1.4 for the Cask Dose Blocker Steel Components (Intermediate Shells) from Non-Code to ASME Code Section IX or AWS D1.1 so that the pedigree of the qualification is clear.

NRC RAI 1-4

Clarify the weld information specified in the licensing drawings for the GTCC overpack assembly.

In the RAI letter dated May 18, 2016, the staff noted that Note 2 on sheet 1 of drawing10315 states that "all weld sizes are minimums" and that the applicant had stated "additional welds may be added by the fabricator as deemed necessary, except where specified by Holtec." The staff asked the applicant to (i) describe what codes will be used with non-minimum weld sizes and to what extent they will they will be increased, (ii) clarify where additional welds will be made and their size. The staff noted that (i)increased/extra welds can alter the load path of the package and affect its performance with respect to normal conditions of transport and hypothetical accident conditions, (ii) it was unclear how quality control measures, from a QA point of view, can be ensured if the location of additional welds are unidentified. This comment also pertains to the GTCC waste container (note 7 on sheet 1 of drawing 10316).

The applicant responded to this RAI by stating that “Additional welds are fully evaluated by Holtec engineering to confirm that unintended consequences are avoided, with additional analysis if required”. Such justification should be provided in the application and noted in the engineering drawings as part of package description, to support that the package will be able to meet the requirements of normal conditions of transportation and hypothetical accident conditions. NDE techniques for these additional welds should be noted on the licensing drawings per ASME Code requirements for inspection and pertinent NDE.

This information is required by the staff to determine compliance with 71.33(a)(5), 71.71, and71.73.

Holtec’s Response to RAI 1-4

The intent of Additional Note 2 on Drawing 10315 and Additional Note 7 on Drawing 10316 was to provide manufacturing flexibility in cases where additional welds or increased weld size (beyond that normally associated with specified welds processes and inspection) could be employed, with sufficient analysis and justification. To eliminate the need to provide detailed justification in the licensing package for such welds, the applicable notes in each Drawing are simplified to:

ALL WELD SIZES ARE MINIMUMS.

NRC RAI 1-5

Provide tolerances specified in the licensing drawings of the GTCC overpack assembly.

ln the RAI letter dated May 18,2016, the staff requested clarification of Note F, sheet 1,of Drawing 10315 which stated in part that "dimensions indicated as nominal will vary to the extent typical in applicable fabrication operations". The staff indicated that it was unclear what the maximum and minimum values were for dimensions denoted as "nominal" based on the above description. The staff requested that the applicant clarify the tolerances on components which are neither dimensioned as nominal, minimum, maximum or reference and noted that the shells shown in Section CB-CB sheet 3 of drawing 10315 do not fall in any of the categories mentioned above as the drawing itself has no tolerance specified for such a case.

In response, the applicant stated that not providing this information was consistent with the intent of ISG-20. While ISG-20 is intended to provide some degree of flexibility in package design, it does not preclude the need for sufficient detailed information for an adequate technical review. Excessively large tolerances in material thickness and size could appreciable alter the performance of the package with respect to the drop tests specified in 10 CFR 71.71 and 71.73, as well as shielding, and so this information is requested. ISG-20 states that "The reviewer should ensure that reasonable tolerances for dimensions and weights are specified, because packaging features may be subject to some variability in fabrication".

While it is clear that tolerances allow for variability in fabrication, it is unclear what those tolerances are and their impact to package performance. Additional information regarding tolerances can be found in NUREG CR-5502, page 2, which states: “All dimensions indicated on drawings should include tolerances that are consistent with the package evaluation. Tolerances may be addressed by a drawing note that defines a general tolerance applicable to many features. If a design feature needs a more (or less) restrictive tolerance than indicated by the note, the appropriate tolerance should be specified explicitly in the dimensioning of that feature.”

Therefore, the applicant is requested to specify nominal tolerances on the engineering drawings.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Holtec’s Response to RAI 1-5

Holtec has reviewed ISG-20, NUREG/CR 5502 and NUREG 1609/1617 for guidance in evaluating the tolerances required for inclusion in this licensing drawing. In general, each guidance document states that design features that are credited in analyses and important to safety be toleranced where appropriate to support the licensing basis.

Past internal Holtec practice has been to require all toleranced dimensions shown on licensing drawings to be inspected as critical dimensions on fabrication drawings, to provide assurance of compliance with the licensing basis. As such, only key dimensions where variation within

tolerances must be tightly controlled have been specified in licensing drawings. Dimensions where variation within normally accepted fabrication practices do not impact the safety of the component (e.g. design features with large safety factors or insensitivity to dimensional variation) are left as nominal untoleranced dimensions in the licensing drawings, to provide emphasis to the toleranced dimensions and ensure their compliance during fabrication.

Drawings 10315 and 10316 have been reviewed for compliance with the above mentioned guidance and dimension tolerances have been added, where appropriate, to fully support the licensing basis assumptions. It should be noted that dimensional tolerances specified in this way are likely to exceed, in some cases, those required for the actual manufacture and fitup of components during fabrication. Tolerances shown on the licensing drawing should therefore not be used for stackup evaluation or determination of the fitup of components. Components specified as “stock” items with recognized tolerance standards (such as plate, pipe, etc.) will reference those tolerance standards, unless tighter dimensional restrictions are required.

For clarity, note F in both drawings 10315 and 10316 as been changed to:

DIMENSIONS WITHOUT TOLERANCES ARE NOMINAL VALUES. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE LIMITS ON DIMENSIONS USED IN LICENSING BASIS ANALYSIS. WHERE DIMENSIONAL VARIATION DOES NOT AFFECT THE LICENSING BASIS, DIMENSIONS ARE SHOWN AS NOMINAL VALUES FOR INFORMATION. TOLERANCES APPROPRIATE TO ENSURE COMPONENT FITUP ARE APPLIED IN THE FABRICATION DRAWING AND MAY DIFFER FROM, WITHOUT EXCEEDING, THE LICENSING BASIS TOLERANCES.

NRC RAI 2-1

Justify the use of non-code compliant NDE examination for welds at the containment boundary of the HI-STAR 100 overpack or clarify how non-code compliant NDE will meet the NDE requirements of the ASME Code requirements. The licensing drawings should be updated accordingly.

ln response to RAI 1-2 dated May 18, 2016, the applicant stated that the containment boundary welds for items such as "gamma shells" in Detail A, Detail B etc. on sheet 2 of Drawing 3913 are: (1) not part of the pressure retaining boundary, (2) are non-containment boundary, and (3) are non-structural welds. However, Figure 4.1.1 (primary containment boundary components), in Chapter 4 of the application, indicates that the bottom plate and top flange are part of the primary containment boundary. These welds structurally attach gamma shell layers to the pressure retaining boundary, and therefore, the welds should be in compliance with ASME Section III, Subsection NB, article 5262 (Structural Attachment Welded Joints) which states: "Structural attachment welded joints made to pressure retaining material shall be examined by either the magnetic particle or liquid penetrant method."

This information is required by the staff to determine compliance with 10 CFR 71 .31 (b) and 71.31(c).

Holtec's Response to RAI 2-1

Licensing Drawing 3913 has been revised to include the proscribed acceptance criteria for welds identified as "non-code" and better organize the information to distinguish between the acceptance criteria for containment boundary and other welds. Specifically, notes are changed as follows:

General Note 6: ALL WELDS REQUIRE VISUAL EXAMINATION. ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING.

General Note 8: CONTAINMENT BOUNDARY WELDS, WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER ASME SECTION IX AND ASME SECTION III, SUBSECTION NB. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III, RESPECTIVELY.

General Note 19: FOR WELDS SPECIFIED AS NON-CODE, THE PROVISIONS OF EITHER ASME IX OR AWS SHALL BE FOLLOWED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III (SUBSECTION NF FOR CLASS 3 SUPPORTS), RESPECTIVELY.

These revisions specifically define the acceptance criteria for welds specified as "non-code" to be per ASME Section III, Subsection NF for Class 3 supports. In compliance with the intent of ASME Section III, Subsection NB, these welds are required to be examined by either the

magnetic particle or liquid penetrant method. The acceptance criteria of ASME Section III, Subsection NF for Class 3 supports is considered to be sufficient for these attachment welds.

NRC RAI 2-2

Specify the optional screw material indicated in the plug weld call-out for the MPC enclosure vessel drawing.

In the RAI letter dated May 18, 2016, it was noted that Note 6 on sheet 3 of Drawing3923 indicated optional set screws to be used for penetrations contained within the closure ring of the MPC vessel. The RAI response did not indicate any material specifications. The staff does not have reasonable assurance that galvanic or corrosive reactions will not occur between dissimilar materials or from the operating environment.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5) and 71.43(d).

Holtec's Response to RAI 2-2

The set screw material is assumed to be in compliance with General Note 4 or Drawing 3923, which states that "ALL MPC ENCLOSURE VESSEL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED…" This provides assurance that galvanic or corrosive reactions will not occur between dissimilar materials. To provide clarity for the set screw material, Note 6 on Sheet 3 of Drawing 3923 is revised as follows to explicitly state that the material is ALLOY "X", as defined in General Note 5:

OPTIONAL CONSTRUCTION FOR THE CLOSURE RING PROVIDES PENETRATIONS TO ALLOW HELIUM LEAKAGE TESTING OF THE MPC LID-TO-SHELL AND VENT/DRAIN PORT COVER PLATE WELDS DURING A SINGLE TEST. PLUG WELDS IN THE CLOSURE RING ARE IDENTICAL IN SIZE AND LOCATION TO THE PLUG WELDS IN THE VENT/DRAIN PORT COVER PLATES AND, ACCORDINGLY ARE ADEQUATE TO SEAL THE MPC. ALLOY "X" SET SCREWS IN THE PENETRATIONS ARE OPTIONAL BUT MUST BE POSITIONED 1/8" BELOW FLUSH MINIMUM.

NRC RAI 2-3

Clarify the weight of the Hl-STAR HB GTCC waste container (GWC) in the application.

The applicant described the shorter GWC canister (as compared to the MPC-HB) shown in Table 2.II.2.1 as weighing 26,000 lb empty while the MPC-HB weighs approximately 27,000 lb (not including 32,000 lb of fuel). ln its RAI response, the applicant described the fuel basket as not being included in the MPC-HB weight (27,000 lb) and that it was included in the GWC canister weight (26,000 lb). This information however, was not included in the latest revision of the application (Table 2.I.2.1and Table 2.II.2.1for the MPC-HB and GWC canister respectively). The weights of the canisters, with or without fuel baskets, should be clearly indicated in Table 2.I.2.1 and Table 2.II.2.1.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(2).

Holtec's Response to RAI 2-3

Table 2.I.2.1 and Table 2.II.2.1 have been revised to clarify the weights of the MPC-HB (with basket, without basket and fully loaded) and GWC (empty and fully loaded). Note that GWC is a waste canister and does not have a fuel basket.

NRC RAI 2-4

Revise the application to provide acceptance criteria for the GWC-HB vessel integrity that clearly define allowable degraded conditions prior to transport. The acceptance criteria should demonstrate containment integrity during hypothetical accident conditions. Discuss methods, e.g., transport inspections, used to ensure that the GWC-HB meets the proposed acceptance criteria. This is applicable to GWC-HB canisters that may be in dry storage under a 10 CFR Part 72 license for greater than 20 years:

The response to RAI 7-2, dated August 22, 2016, addressed GWC-HB canisters that provide the containment function for greater than class C waste during transportation. The response stated that concerns about potential aging mechanisms are eliminated by limiting transportation to those canisters that are stored in a non-ventilated enclosure or overpack, and that the GWC-HBs must be leak-tested prior to transportation. The response also stated that the aging management program under 10 CFR Part 72 shall confirm that the GWC-HBs are free of degradation that could significantly reduce the packaging effectiveness.

The staff notes that there are no proposed activities to verify the ability of the GWC-HB canisters to fulfill their containment function during hypothetical accident conditions. The application does not define acceptance criteria for credible degraded conditions (e.g. loss of material due to localized corrosion pits, etching, crevice corrosion; presence of corrosion products) that ensures that cracks will not develop during transport, which could compromise the validity of the leak-tightness criterion during transport. The structural evaluation of the GWC-HBs does not consider potential degraded conditions of the GWC-HB during dry storage under a Part 72 license. In addition, leak testing prior to transportation is not capable of verifying the absence of flaws that may propagate through-wall during a hypothetical accident. Therefore, the application should describe the methods used to ensure that the acceptance criteria for the GWC-HB enclosure vessel integrity are met.

The staff also notes that the reliance on a future, undefined, aging management program for storage is not an adequate approach. The staff has no assurance that a storage program will include activities to confirm that the non-ventilated enclosure prevented ingress of moisture and environmental contaminants, or will include inspections that are capable of identifying and responding to degradation specifically relevant to maintaining confinement during transportation accidents. Therefore, reliance on a 10 CFR Part 72 aging management program, to ensure compliance with the HI-STAR GWC-HB structural safety analyses, is not adequate.

This information is required by the staff to determine compliance with 10 CFR 71.55(e), 71.73 and 71.85(a).

Holtec's Response to RAI 2-4

We agree with the staff's position on the need to clarify the application. In order to provide a higher level of confidence with respect to the GWC's containment integrity under the § 71.73

free drop loading scenario than that assured by a Part 72-compliant Aging Management Plan. New Subsection 8.II.1.8 titled "GWC Enclosure Vessel Shell Surface Defect Inspection" has been incorporated into the application (provided with this RAI response) as a remedy to this matter with the following key commitments:

- GWC-HB's stored for a duration greater than 5 years under the provisions of 10CFR 72 shall undergo a GWC enclosure vessel shell surface defect inspection prior to shipment to ensure that existing defects and flaws do not develop into cracks during hypothetical accident conditions of transport. (See Subsections 7.II.1.4 and 8.II.1.8 of the application)
- The GWC shall be subject to an Eddy current testing (ECT) regimen that is capable of identifying any surface defect equal or greater than 2 mm deep anywhere on the external cylindrical surface of the enclosure vessel. (See Figure 7.II.1 of ECT Ring)
- Any flaw that exceed 2 mm in depth will disqualify the canister for transport until further investigation is performed and the NRC accepts, under the exemption process or other appropriate licensing action, the owner-provided evidence that the affected canister will survive a HAC. (See Tables 8.II.5 and 8.II.6 of the application)

Inasmuch as the ECT is considered the most definitive detector of cracks, pits and other types of surface flaws and is universally relied upon for detecting minute degradation in the tubing of critical nuclear plant heat transfer equipment such as Steam Generators, we propose to use this proven technology to determine the structural integrity status of the GWC-HB's shell.

To close the logic loop, the GWC has been additionally evaluated for both normal and hypothetical accident conditions of transport under a degraded surface condition wherein a fully extended crack is assumed to exist in the weld seams oriented in the most vulnerable orientation. The crack is oriented perpendicular to the direction of maximum tensile stress indicated by the in-tact canister analysis. A bounding residual stress in the weld is also considered in the crack stability analysis. This additional analysis, which is documented in detail in Holtec Position Paper DS-438 and briefly discussed in Subsection 2.II.7.7 of the SAR, has shown that the crack will not propagate and therefore the containment boundary integrity of the GWC will be preserved during the normal conditions of transport or in the wake of a HAC. The analysis documented in Holtec Position Paper DS-438 was performed for an MPC in the HI-STAR 190 model transport cask (Docket 71-9373); however, the evaluation is fully applicable to the HI-STAR GWC-HB in the HI-STAR HB GTCC model cask with bounding stresses due to larger HI-STAR 190 impact loads and larger diameter generic MPC canister.

We believe the above commitments provide a robust means to ensure that only those GWCs that have a structurally competent containment boundary to meet the transport accident of §71.73 will be transported in HI-STAR GTCC HB cask. The requirement in Subsection 8.II.2.1 (also discussed in Subsection 1.II.2.2) to verify that the GWC-HB is stored in a non-ventilated enclosure or overpack has been removed from the application.

NRC RAI 4-1

Commit to state that personnel approving the leakage test procedures and performing the leakage tests are qualified.

The response to RAI 4-16 provided some information on qualifications related to the leakage (non-pressure) tests, such as being in accordance with a written quality assurance program. However, the description provided in Chapter 8 does not clearly state that the leakage tests will be written, approved, or performed by qualified personnel for the GWC-HB and the HI-STAR 100 for the Diablo Canyon MPC-32.

This information is required by the staff to determine compliance with 10 CFR 71.33.

Holtec's Response to RAI 4-1

We agree with the staff's position on the need to clarify the application. Chapter 8 and Supplement 8.II (GWC-HB) of the application have been revised to clearly state that leakage rate testing procedures are required to be approved by an ASNT Level III specialist and that leakage rate testing shall be performed by personnel who are qualified and certified in accordance with the requirements of SNT-TC-1A. Chapter 4/Supplement 4.II (GWC-HB), Chapter 7 and Chapter 8/Supplement 8.II (GWC-HB) have been revised to reference the 2014 Edition of ANSI N14.5 and the 2006 Edition of SNT-TC-1A consistent with NRC Information Notice 2016-04 "ANSI N14.5-2014 Revision and Leakage Rate Testing Considerations". Chapters 4 and Supplement 4.II of the application have been revised to state that the determination of the allowable leakage rate is in accordance with the 2014 Edition of ANSI N14.5. Chapter 7 of the application now clearly references Chapter 8 of the application for the required leakage rate test acceptance criterion.

In order not to disqualify previously fabricated casks and/or loaded HI-STAR casks as well as the GWC-HB canister the following statement has been included in Subsections 8.1.4, 8.2.2, 8.II.1.4 and 8.II.2.2: "The requirements in this subsection may be implemented in accordance with the 1997 edition of ANSI N14.5 and the 1992 edition of SNT-TC-1A for leakage rate tests performed prior to 2018 and will remain valid until superseded by newly performed leakage rate tests or until expiration of the leakage rate test as applicable." Similarly the following statement has been added as a note to Tables 8.1.2 and 8.II.3: "Leakage rate tests performed prior to 2018 may be performed in accordance with either the 1997 or 2014 editions of ANSI N14.5. Leakage rate tests performed in 2018 or later shall be performed in accordance with the 2014 edition of ANSI N14.5."

No change is proposed to Supplement 7.II (GWC-HB) since it already refers to Supplement 8.II (GWC-HB) for the required leakage rate test acceptance criterion. Supplements 4.III, 7.III and 8.III (Diablo Canyon MPC-32) already appropriately refer to the discussion, assessments and/or requirements in Chapters 4, 7 and 8 (i.e. the main chapters) and therefore do not require changes.

NRC RAI 4-2

Clarify the containment leakage rate acceptance criterion for the HI-STAR 100 Diablo Canyon MPC-32.

According to ANSI N14.5, the allowable leakage rate is the ratio of the allowable release rate and the activity per unit volume. The response to RAI 4-8 stated that the release rates for the Diablo Canyon MPC-32 content is calculated by applying the free volume ratio to reflect the differences in canister volume between a nominal MPC-32 and the Diablo Canyon MPC-32. It is not clear when the free volume ratio was applied, considering that Supplement 8.III refers to the main section of Chapter 8, which only lists one leakage rate criterion in Table 8.1.1.

This information is needed to determine compliance with 10 CFR 71.33, and 71.51.

Holtec's Response to RAI 4-2

We are sorry for the confusion in the previous response to the 1st round RAI 4-8. As discussed in Sections 4.III.2.5.8 and 4.III.2.5.9, the containment leakage rate acceptance criterion for the HI-STAR 100 Diablo Canyon MPC-32 were determined using the same methodology presented in Section 4.2.5.8 for the standard length MPC-32, and the results presented in Table 4.1.1 remains bounding for the HI-STAR 100 Diablo Canyon MPC-32. Consequently, the leakage rate criterion in Table 8.1.1 remains fully applicable for the HI-STAR 100 Diablo Canyon MPC-32.

Please note that though it is discussed in the previous response and Section 4.III.0 that the final values of the containment evaluation for the Diablo Canyon MPC-32 can be directly proportional to the corresponding values for the standard length MPC-32 by applying the free volume ratio of the Diablo Canyon MPC-32 to the standard length MPC-32, however, this method was not used in the containment evaluation for the HI-STAR 100 Diablo Canyon MPC-32 in Section 4.III. Instead, as stated in Section 4.III.2.5, the same methodology and steps as those employed in the main part of the chapter for the HI-STAR 100 System were followed to determine the allowable leakage rates for the HI-STAR 100 with Diablo Canyon MPC-32, and the only difference is the free gas volume (the value for the HI-STAR 100 Diablo Canyon MPC-32 is shown in Table 4.III.2.1) used in the evaluation.

NRC RAI 4-3

Demonstrate that the GWC lid-to-shell weld has been adequately leak tested.

The response to RAI 4-16 and the text in Table 8.II.2 of the application appear to indicate that the GWC lid-to-shell weld, which is part of the containment boundary, is not leak tested. Rather, the response states that the weld is examined by volumetric testing, ultrasonic testing, or progressive multi-layer liquid penetrant examination.

The staff notes that the subject of ISG-18, which discusses examinations of closure welds, is for the closure of storage confinement boundaries and not for transportation containment boundaries.

This information is required by the staff to determine compliance with 10 CFR 71.33.

Holtec's Response to RAI 4-3

We agree with the staff's position on the need to clarify the application. In light of this RAI and second round RAI 4-5 the application has been revised to require the pre-shipment leakage rate test prior to transport regardless of whether the GWC was first placed in storage at an ISFSI and regardless of GWC storage duration. The pre-shipment leakage rate test requires the entire GWC (as-built, loaded, and sealed canister) to be leakage rate tested as a complete welded assembly. Thus the Lid-to-Shell weld is considered part of the top closure assembly of the GWC (which consists of Lid-to-Shell Weld, closure ring weld and vent and drain port cover plate welds). Due to this more stringent requirement, the leakage rate acceptance criteria has been set equal to the leakage rate acceptance criteria set in Chapter 4 to remove the over conservatism and allow the use of additional ANS N14.5 test methods (see Section 4.II.0, Subsections 4.II.1.2, 4.II.1.4, and 4.II.2.1, and Tables 4.II.2.9 and 8.II.2). The pre-shipment leakage rate acceptance criteria applies to the complete GWC therefore if parts of the GWC are tested individually, the sum of the leakages must comply with the overall leakage rate acceptance criteria for the complete GWC (see Subsection 7.II.1.4, Table 8.II.2 and Table 8.II.3). Any leakage rate testing of GWC field welds performed under 10CFR72 docket is not credited in the transport safety analysis. Similarly the volumetric testing, ultrasonic testing, or progressive multi-layer liquid penetrant examination of the lid-to-shell weld is no longer credited in the leaktightness safety case of the GWC (See Subsection 4.II.1.4). Corresponding changes have been made to Paragraph 7.II.1.3.1, Subsection 7.II.1.4 and Table 8.II.5. Table 8.II.2 now distinguishes between Fabrication Leakage Rate Test leakage rate acceptance criterion and Maintenance Leakage Rate Test leakage rate acceptance criterion. The Fabrication Leakage Rate Test leakage rate acceptance criterion remains unchanged and orders of magnitude more stringent than required for transportation for the purposes of conservatism. The defense-in-depth statement in Subsection 8.II.2.1 concerning an aging management program for containment function of the GWC is no longer applicable and has been removed.

NRC RAI 4-4

Clarify the limit for the amount of flammable gas within a canister during transportation.

The response to RAI 7-2 indicated that the Section 7.0 "Introduction" includes the sentence: "The dryness criteria under the Part 72 CoC shall be considered acceptable for use in transport under Part 71 [7.1.2], [7.1.6];" a similar sentence was provided in Supplement 7.II and Supplement 7.Ill for the HI-STAR 100 package with Diablo Canyon MPC-32.

The narrative in the application should state explicitly whether the concentration of flammable gas is less than 5% volume, when transported, for both NCT and HAC.

This information is required by the staff to determine compliance with 10 CFR 71.43.

Holtec's Response to RAI 4-4

The concentration of gasses in the containment vessel of HI-STAR 100 is discussed in subsection 4.2.3 in the main part of the Chapter 4 in HI-STAR SAR. Subsection 4.2.3 states that both the annulus region and the MPC are drained, dried, evacuated and backfilled with helium gas therefore there are no explosive gases in the overpack cavity. To further clarify this statement the following paragraph is added to end of Section 4.2.3:

"As discussed above, there is no possibility of chemical reaction that would produce gas or vapor in the containment vessel, consequently the hydrogen gas concentration remains below 5 percent by volume. Further, since the concentration of hydrogen gas is negligible, there is no time limitation required for the transport due to hydrogen generated within the containment boundary."

Since the same applies to HI-STAR HB package with MPC-HB and with Diablo Canyon MPC-32, Subsection 4.2.3 is referred to in supplement paragraphs 4.I.2.3 and 4.III.2.3. In those two subsections the following clarification is added: *"The concentration of hydrogen gas is less than 5 % by volume as described in the main part of the chapter."*

The concentration of gasses in the containment vessel of HI-STAR HB GTCC with GWC-HB is discussed in subsection 4.II.2.3 in HI-STAR SAR. It is suggested to reword this subsection as follows:
"The enclosed GWC-HB takes on the role of containment boundary for the HI-STAR HB GTCC packaging. The GWC-HB is drained, dried, evacuated and backfilled with helium gas prior to its final closure. The interior of the GWC-HB contains metallic process waste at relatively low temperatures. The process waste is thermally processed (e.g. by dry-ashing) to remove organics and other hydrogen bearing components to produce a dry concentrated residue. The potential for an explosive level of gases due to radiological decomposition in the containment vessel cavity is therefore eliminated by excluding foreign (organic) materials in the package. Therefore, there is no possibility of chemical reaction that would produce gas or vapor to significantly affect the internal pressure of the containment vessel and the hydrogen gas

concentration remains below 5 percent by volume. Further, since the concentration of hydrogen gas is negligible, there is no time limitation required for the transport due to hydrogen generated within the containment boundary."

NRC RAI 4-5

Demonstrate that the condition of a GWC-HB or Diablo Canyon MPC-32 will be reviewed, prior to transport, if stored on a pad for less than 20 years.

The response to RAI 7-2 indicated that the GWC-HB would be leak tested within a test chamber prior to transport if it has been on the storage pad for more than 20 years. However, this test was not mentioned for the Diablo Canyon MPC-32. In addition, there was no justification to show that the GWC-HB, MPC-32, or their content, would be in an appropriate condition for transport if stored on a pad for less than 20 years.

This information is required by the staff to determine compliance with 10 CFR 71.33 and 71.51, 71.87.

Holtec's Response to RAI 4-5

We agree with the staff's position on the need to clarify the application. See response to RAI 4-3 and corresponding changes to the application. In summary the application has been revised to require the pre-shipment leakage rate test prior to transport regardless of whether GWC-HB was first placed in storage at an ISFSI and regardless of GWC-HB storage duration. Unlike GWC-HB, Diablo Canyon MPC-32 does not provide a containment function and like the standard MPC, does not require leakage rate testing for transportation. The Diablo Canyon MPC-32 is transported in a standard HI-STAR 100 cask which provides the containment function and is qualified by leakage rate testing according to Chapter 8 of the application. Supplement 8.III of the application refers to the main body of Chapter 8 for all acceptance test and maintenance program; however, to further clarify the application the following statement has been added to Supplement 8.III "The requirements on the standard MPC in the main body of this chapter apply to the Diablo Canyon MPC-32."

NRC RAI 4-6

Demonstrate that the loading procedures will ensure that the source term conditions, specified in the CoC, will be satisfied.

The response to RAI 4-4 described the non-dispersible and dispersible solid content and their activity. However, there was no clear procedure in Chapter 7, or any mention of detailed procedures even in lower tier documents, that would ensure the varied content would satisfy the source terms in the CoC.

This information is required by the staff to determine compliance with 10 CFR 71.33.

Holtec's Response to RAI 4-6

The procedural steps to ensure the loading content satisfies the source term conditions are included in Chapter 7, Section 7.II.3

NRC RAI 4-7

Clarify the classification category, as defined in NUREG/CR-6407, of the containment boundary for the HI-STAR 100 with Diablo Canyon MPC-32 and the containment boundary for the GWC-HB.

The category of the containment boundaries were not clearly stated in the response to RAI 1-3 and RAI 4-17; thus, a determination could not be made.

This information is required by the staff to determine compliance with 10 CFR 71.33.

Holtec's Response to RAI 4-7

To address the categorization of the containment boundary components for the HI-STAR 100 with Diablo Canyon MPC-32, Table 1.3.3 has been revised to explicitly specify the categorization of each HI-STAR 100 cask containment boundary component (the change reverts back to the safety class specified in Revision 15 of the SAR corresponding to Revision 9 of the NRC CoC). As already noted in Supplement 1.III, Section 1.III.3 is the same as Section 1.3. Thus the proposed change also applies to all HI-STAR 100 casks.

To address the categorization of the containment boundary components for the GWC-HB, Section 1.II.3 has been revised to state "Containment boundary components of the GWC HB (lid, port cover plates, shell, baseplate and closure ring) are classified as ITS-A."