2-1 Justify the use of materials specifications and their properties for the ITS HI-STAR ATB 1T containment boundary that are not included as permissible materials for ASME Section III Subsection NB.

SAR Section 1.2 “Description of Packaging Components and Their Design & Operational Features” states, “The governing Code for the design of the Containment Boundary of HI-STAR ATB 1T is ASME Code Subsection NB [1.2.1] which has well-articulated rules for plate & shell type structures operating under ambient conditions.” SAR Table 2.1.7: Applicable Codes and Standards for the Materials Procured/Fabricated for the HI-STAR ATB 1T Packaging specifically cites ASME Code Section III Subsection NB for the containment boundary components. SAR Section 4.1, “Containment Boundary”, the applicant states that, “The containment boundary system components for the HI-STAR ATB 1T system are designed and fabricated in accordance with the requirements of ASME Code, Section III, Subsection NB.”

However, the HI-STAR ATB 1T design proposes to use two materials that are not approved as permissible materials for ASME Section III Class 1 construction, SA-508 Class 4N Grade 2, and ASTM A514. In ASME BPV Code Section III, 2013 Edition, there is no entry for SA-508 4N Class 2. While SA-508 4N, Class 2 is included in the 2021 edition, per Table 2A, it is not permitted for use in Section III. ASTM A514 has not been incorporated into the ASME B&PV code as a permissible material for any Section III or Section VIII component. Consequently, the ASME code does not include values of tensile strength, yield strength, design stress and design stress intensity as a function of temperature.

In addition, for thickness greater than 2.5”, the ASTM specification for A514 specifies a minimum tensile strength of 100 ksi. The staff notes that the HI-STAR ATB 1T containment baseplate is greater than 2.5” thick. Table 2.2.1A of Enclosure 3, lists the Su as 105 ksi.

The staff requests the applicant to address this discrepancy in the application with Subsection NB and with the ASTM specification with the values in Table 2.2.1A to account for the material properties of a HI-STAR ATB 1T containment baseplate manufactured using ASTM A514.

This information is requested by the staff to demonstrate compliance with 10 CFR 71.31(c), 71.33(a) and 71.51(a).

Holtec Response:
Holtec acknowledges the discrepancies involving two of the proposed materials for the HI-STAR ATB-1T containment boundary and specific statements in the HI-STAR ATB 1T SAR, as noted by the staff. This was not our intention, and we have made changes to the SAR, including the licensing drawings, to rectify the previous material contradiction.

Specifically, ASTM A514 has been removed completely from the SAR, including all chapters and the licensing drawings, and it is no longer specified as a material option for the HI-STAR ATB 1T containment boundary.

SA-508 Class 4N, Grade 2 remains a candidate material for the HI-STAR ATB 1T containment boundary, but it has been added to the list of ASME Code Alternatives in SAR Table 8.1.3 and

properly justified. The technical justification for allowing the use of SA-508 Class 4N, Grade 2 as an optional containment boundary material, despite the fact that it is not permitted for use in Section III, is presented below.

i) SA-508 Class 4N, Grade 2 is listed in Section II, Part A of the 2013 Code Edition, and permitted for use in construction of Section VIII pressure vessels (Div. 1 & 2) according to Tables 1A and 5A of Section II, Part D. The 2021 Code Edition also lists SA-508 Class 4N, Grade 2 in Table 2A of Section II, Part D, and the material is expressly permitted for use in construction of Section VIII, Division 2, Class 1 pressure vessels.

ii) The design internal pressure for the HI-STAR ATB 1T transport cask is only 5 psig per SAR Table 1.2.1. Per paragraph U-1 of ASME Section VIII, Division 1, vessels having an internal pressure less than or equal to 15 psig are not included in the scope of Division 1, and in general they are not considered as ASME pressure vessels. Also, containment systems with a maximum normal operating pressure of 5 psig or less are exempt from internal pressure testing per 10CFR71.85.

iii) SA-508 Class 4N, Grade 2 has excellent strength and fracture toughness properties, exceeding those of SA-517.

iv) The calculated stresses in the HI-STAR ATB 1T containment boundary system, for all NCT and HAC loading conditions, meet the stress intensity limits per ASME Section III, Subsection NB based on the strength properties of SA-508 Class 4N, Grade 2.

In summary, the low pressure and temperature design of the HI-STAR ATB 1T significantly reduces the risks associated with the transport cask system, and thereby permits the use of SA-508 Class 4N, Grade 2 (an ASME Section VIII material) as a suitable containment boundary material, especially in view of its high strength and enhanced fracture toughness.

2-2 Provide the material properties of welds used in modeling of the containment boundary or provide a justification for why the properties of the welds do not need to be explicitly considered.

In Enclosure 6, Section 3.6 states, “Trivial simplifications and approximations are considered in the finite element model as follows, without compromising the quality and accuracy of the simulation model: 1. The welded connections between the containment walls and the baseplates are explicitly represented in the FE model by distinct parts. For conservatism, the analytical (FE) model considers the SS-308 weld material properties to develop the true-stress-vs-strain curve.”

The staff notes that a true-stress true-strain curve was developed for the Type 308 weld filler metal in Enclosure 6 Appendix A. The ATB 1B 308 weld metal would be representative of the welded connections for the Type 304 Stainless Steel Dose Blocker Plates which serve as a shielding component but not for the welds for the ferritic steel containment boundary, which have different material procurement and NDE acceptance criteria.

The containment boundary is to be manufactured using ferritic steels including ASTM A514, or ASME SA-517 or ASME SA-508 Class 4N Grade 2. It is not clear whether the mechanical properties of the containment boundary welds were specifically considered but Enclosure 6 does not contain true-stress true-strain curves for the containment

boundary welds.

This information is requested by the staff to demonstrate compliance with 10 CFR 71.31(c), 71.33(a) and 71.51(a).

Holtec Response:
It is correctly noted by the staff that the containment boundary components are made of high strength ferritic steel, and the corresponding welds must be consistent.

As noted in Section 3.6 of Enclosure 6 to the initial amendment request, the containment boundary welds are explicitly represented in the finite element (LS-DYNA) model. However, the true-stress true-strain curve assigned to these welds in the LS-DYNA simulations is based on the lower strength Type 308 (S/S) weld filler material.

The following table summarizes the minimum weld strength properties used for the LS-DYNA simulations in Enclosure 6 and the actual strength properties of the weld material for joining ASME SA-517 or ASME SA-508 Class 4N, Grade 2 ferritic steels.

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

[1] ASME Boiler & Pressure Vessel Code, Section II, Parts A, C and D, 2013.
[2] Weld Strength based on AWS A5.23.2011, ASME SFA-5.23, From Lincolnweld 888 Flux LAC 690 Electrode
[3] Weld Certification from ESAB Group, Dated 06/29/2022.

The following figure compares the true-stress true-strain curve for the weld as represented in the finite element (LS-DYNA) simulations and that based on the actual weld strength data from above table.

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

Based on the above comparisons, the following observations are made:

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]