NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9375	1	71-9375	USA/9375/B(U)-96	1	OF	4

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. ISSUED TO *(Name and Address)*

Holtec International
1 Holtec Blvd.
Camden, NJ 08104

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Holtec International Report No. HI-2146312 *Safety Analysis Report for the HI-STAR ATB 1T Package,* Revision 5, dated December 9, 2022.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

(1) Model No.: HI-STAR ATB 1T

(2) Description

The HI-STAR ATB 1T, designed for transportation of radioactive non-fuel waste including segmented reactor internals, and related hardware waste, consists of three major components: the packaging body, the secondary containers, and the waste baskets.

Packaging Body

The HI-STAR ATB 1T is a rectangular-parallelepiped multi-layer steel-weldment with a closure lid secured by a custom designed locking system. Closure verification is provided by the installation of the locking wedge lock bars after closure of the lid and prior to transport. The outer surface of the packaging body inner structure is buttressed with steel for gamma shielding. The interfacing surfaces of the lid and the flange at the top of the packaging body are machined to seat two concentric elastomeric gaskets. An insulation board is used in the closure region of the packaging to ensure that the performance of the sealing gasket is not compromised. The containment system consists of the Closure Lid, Containment Wall Plates, Containment Baseplate, and Closure Lid Locking Wedges.

The HI-STAR ATB 1T may have an aluminum lid spacer placed inside the package, if needed, to minimize the movement of the contents. Retractable austenitic stainless-steel adjustable inserts are recessed in the side walls of the HI-STAR ATB 1T. The external impact absorbers, made of either aluminum, austenitic stainless steel, or of a combination of aluminum and austenitic stainless steel, are located on the top, bottom, side, end, and corner exterior surfaces of the package.

5.(a)(2) Description (continued)

Secondary Containers:

The secondary containers, called BFA-Tanks, have four design variants (T-50, T-100, T-150, T-200) each with a different wall thickness, each qualified for a certain total maximum activity and specific activity level. BFA-Tanks are painted carbon steel rectangular parallelepiped weldments with bolted lids. The lids of the BFA-Tanks are equipped with metallic seals. BFA-Tanks have external dimensions of approximately 130” long, 51” wide and 90” high.

Waste Baskets:

There are four BFA-Tank Cassette (BTCs) design variants; each BTC variant is placed within and matched to a specific BFA Tank variant. Each type of BTC is designed to accommodate contents of a given mass and activity. BTCs are rectangular steel weldments that include a baseplate and a removable upper cover plate or lid. BTCs provide supplemental gamma shielding.

A Weather Protection Cover (WPC) is secured to the top of the HI-STAR ATB 1T package to prevent dirt and water from accumulating on its external surfaces. The WPC is not a structural component of the package but is designated as a packaging component when used.

The outer dimensions of the HI-STAR ATB 1T package, with impact limiters installed, are approximately 168” long, 94” wide and 115” high. The empty packaging weighs approximately 136,686 lbs., while the maximum gross weight of the loaded HI-STAR ATB 1T package is 249,122 lbs.

(3) Drawings

The packaging shall be constructed and assembled in accordance with the following drawings:

(a) HI-STAR ATB 1T Cask Drawing 9786, Sheets 1-9, Rev. 10

(b) BFA-Tanks and Cassettes Drawing 9876, Sheets 1-4, Rev. 9

5(b) Contents

(1) Type and form of material

(a) Segmented and non-segmented activated stainless steel or Inconel reactor internals, e.g., Top Guides/Core Grids, Core Shrouds, Steam Separator Units, Core Spray Sparger Assemblies, Steam Dryers, etc.,

(b) Surface-contaminated reactor related hardware,

5(b) Contents (continued)

(c) Secondary waste (i.e., debris/chips) generated by the mechanical cutting process, chip drums (stainless steel) with surface contamination or induced activity and metallic waste filters (stainless steel or ceramic mesh screens) pre-packed in separate drums.

(2) Maximum quantity of material per package:

(a) Co-60 activity of any single waste item loaded into its respective BFA Tank not to exceed the quantities in Table 7.1.2 of the application, e.g., 1,400 GBq/Kg for the T-200 configuration.

(b) Maximum permissible Co-60 activity of a fully loaded BFA-Tank not to exceed the quantities in Table 7.1.2 of the application, e.g., 3.60×10^{15} Bq for the T-200 configuration.

(c) Radionuclides (excluding Co-60) with Gamma Energies > 0.45 MeV activity or specific activity not to exceed the quantities in Table 7.1.2 of the application.

(d) Maximum permissible Co-60 activity of non-fixed surface contamination for all BFA Tank configurations is 2.211×10^{13} Bq.

(e) The maximum permissible quantity of fissile materials is 2 g for all BFA Tanks configurations.

(f) Maximum weight of contents: 112,436 lbs, including secondary packaging.

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

(a) The package shall be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7 of the application; and

(a) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8.0 of the application.

7. The package shall be transported exclusive use only.

8. No air shipment is authorized. Flammable gas concentrations shall be less than 5% by volume.

9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

10. The package may be used in the U.S. if the BFA-Tanks and BFA-Tank Cassettes are manufactured under an NRC approved Quality Assurance Program.

11. Certified mill test reports (CMTRs) for (i) the crushable components attached externally to the cask and (ii) the closure lid impact absorbers must comply with the material properties specified in Table 8.1.5 of the application.

12. Expiration date: June 30, 2026.

REFERENCES

Holtec International Report No. HI-2146312 *Safety Analysis Report for the HI-STAR ATB 1T Package*, Revision 5, dated December 9, 2022.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Donald C. Habib

Digitally signed by Donald C. Habib
Date: 2022.12.13 16:00:04 -05'00'

Donald Habib, Acting Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: December 13, 2022.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT
Docket No. 71-9375
Model No. HI-STAR ATB 1T
Certificate of Compliance No. 9375
Revision No. 1

SUMMARY

By letter dated June 9, 2022 (Agencywide Documents Access and Management System [ADAMS] Accession No: ML22161A058), Holtec International (Holtec or the applicant), requested an amendment to Certificate of Compliance (CoC) No. 9375, for the Model No. HI-STAR ATB 1T package, and proposed a high strength material (SA-508 Grade 4N Class 2) for the construction of the containment boundary components. This material is added, as an optional material for the containment boundary, to the previously permitted American Society of Mechanical Engineers (ASME) SA-517 material, while the American Society for Testing and Materials (ASTM) A514 material is no longer authorized. The parameters of the containment boundary design are not modified by the proposed addition.

On October 14, 2022, Holtec provided responses (ML22287A138) to staff's request for additional information letter dated August 25, 2022 (ML22235A113). Holtec supplemented the application on November 1, 2022, (ML22305A603) by providing an updated calculation report, HI-2177540 Revision 7, and submitted Revision 5 of the application on December 9, 2022 ADAMS No. ML22343A260).

The ASTM A514 material is no longer authorized by the U.S. Nuclear Regulatory Commission (NRC) staff because it is not incorporated into the ASME B&PV code as a permissible material for any Section III or Section VIII component. The applicant addressed this discrepancy with both Subsection NB and with the ASTM specifications in reference to the values in Table 2.2.1A of the application and removed the A514 material from the application and the licensing drawings.

The applicant determined that the existing containment structural evaluations remain governing for the new proposed material SA-508 Grade 4N Class 2 due to its higher strength properties and higher allowable stress limits. Likewise, the sensitivity simulations for the drop analysis of the HI-STAR ATB 1T package show that the effective stress and/or deformation in the sealing region is reduced and all stress safety factors are improved with the use of the SA-508 Grade 4N Class 2 material; thus, the seal worthiness and overall structural safety function of the package are maintained.

The applicant also determined that the existing calculations in the thermal evaluation of the package remain applicable, and that no changes to the shielding calculations were required.

The NRC staff reviewed the applicant's request and found that the package meets the requirements of Title 10 *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

GENERAL INFORMATION

The applicant revised licensing drawing No. 9786 for the HI-STAR ATB 1T package to Revision 10 to allow SA-508 Grade 4N Class 2 material for the containment baseplate, the containment side and end walls, and the closure lid, and removed the A514 material from the drawings. Notes to drawings were revised and include now weld filler material options that are compatible with the SA-508 Grade 4N Class 2 containment boundary material.

STRUCTURAL EVALUATION

The staff reviewed the amendment request to allow the use of the ASME SA-508 4N Class 2 as a construction material for the containment boundary components of the HI-STAR ATB 1T package, i.e., the containment baseplate, the containment side walls, the containment end walls, and the closure lid. The SA-508 4N material was proposed by the applicant as an alternate construction material to the ASME SA-517 high-yield alloy steel that was already found acceptable for the HI STAR ATB 1T package per CoC No. 9375, Revision 0, (ML21172A200). Considering that the new material only incorporates changes to the material properties specified in the structural analyses, and since no other parameters of the containment boundary design were altered by the proposed change, this structural evaluation specifically addresses the changes to the current structural evaluation due to the use of SA-508 4N as an alternate construction material for the containment boundary components. All other components not altered by the proposed change remain unaffected, and the previously approved structural safety bases remain acceptable for the HI STAR ATB 1T package.

The amendment request includes a sensitivity simulation analysis to demonstrate adequate structural safety and integrity of the containment boundary components when the proposed SA-508 4N is used as a construction material. Appendix E of calculation package HI-2177539, “Drop Analysis of the HI-STAR ATB 1T Transport Package,” Revision 7, provides the resultant stress intensities obtained from the simulation analysis when the new SA-508 4N material is used. The applicant compared the results from the new SA-508 4N material with the results obtained from the initial analysis using the original SA-517 material to evaluate the adequacy of SA-508 4N as a construction material for the containment boundary components. The applicant also revised the cask licensing drawing no. 9786 to include the SA-508 4N Class 2 as an optional material for the construction of the containment boundary components.

The staff reviewed the proposed amendment request using applicable portions of the guidance in NUREG-1609, “Standard Review Plan for Transportation Packages for Radioactive Material.” For structural purposes, the containment boundary of the package is evaluated with the ASME Boiler and Pressure Vessel (B&PV) Code Section III, Division 1, Subsection NB, consistent with Regulatory Guide 7.6, “Design Criteria for the Structural Analysis of Shipping Cask Containment Vessels.” The review evaluates the analyses performed by the applicant to demonstrate that the package provides adequate structural protection under normal conditions of transport (NCT) and hypothetical accident conditions (HAC) when the SA 508 4N material is used, and to ensure that the package has adequate structural safety and integrity to meet the requirements of 10 CFR Part 71.

Material Strength Properties and Allowable Limits for SA-508 Grade 4N Class 2

The applicant proposed the use of the SA-508 Grade 4N Class 2 material due to its higher strength and excellent fracture toughness properties. Table E1, “HI-STAR ATB 1T Containment Material Strength Properties,” in Appendix E of calculation package HI-2177539, compared the new material properties with the materials properties of SA-517 to demonstrate that the SA-508 4N material has higher strength properties than the SA-517 material used in previous analyses.

Similarly, Table E2, “HI-STAR ATB 1T Containment Material Stress Limits for HAC drops,” demonstrated that the new material has higher allowable stress limits than the ones used in the initial analysis for the SA-517 material. By comparison, the new material resulted in an overall increase in capacity of 9.5% for the allowable stress limits. Therefore, considering the mechanical properties of the proposed SA-508 Grade 4N material, the staff finds that the SA-508 Grade 4N Class 2 material provides superior strength properties due to higher yield stress and ultimate strength when compared to the SA-517 material.

Sensitivity Simulation Analysis for the Newly Proposed SA 508 Grade 4N Class 2 Material

Normal Conditions of Transport

The applicant initially modeled the package with the LS-DYNA computer program to simulate the 0.3 m free drop tests. The results of these drop simulations were used to evaluate the structural integrity of the package under NCT by comparing the component stress intensity results from the drop simulations to the design basis requirements of the ASME Code Section III, Division 1, Subsection NB, and the Level A stress intensity limits for the containment boundary components. Although this analysis was performed for the original SA-517 material, the analysis remains a bounding condition for the SA 508 Grade 4N material because (a) the SA-508 Grade 4N material has higher strength properties than the SA-517 material, (b) the initial analysis has shown that the primary stresses of the containment components remain below the material yield strength during NCT, and (c) no other containment boundary design parameter is changed by this amendment request. Therefore, the staff finds that the previously approved structural safety bases under CoC No. 9375, Revision 0, remains acceptable for the HI-STAR ATB 1T package when using the SA-508 Grade 4N Class 2 material for the containment boundary components.

Based on a review of the applicant’s analysis for NCT the staff finds that the applicant satisfied the requirements of 10 CFR 71.71(c)(7) for the HI-STAR ATB 1T package when using the SA-508 Grade 4N Class 2 material for the containment boundary components. The staff also finds that previously approved structural bases for the evaluation of other conditions and tests under 10 CFR 71.71(c) remains unaffected by this amendment request.

Hypothetical Accident Conditions

The applicant evaluated the structural integrity of the containment boundary components under HAC by comparing the component stress intensity results from the LS-DYNA drop simulations to the design basis requirements of the ASME Code Section III, Division 1, Subsection NB, and the Level D stress intensity limits of the SA-508 Grade 4N material. Two governing drop orientations were selected from the initial (original) drop simulations to determine the component’s stress intensity results: Simulation 1 - top end drop, and Simulation 6 - oblique drop onto top lid. These two drop orientations were selected for the sensitivity simulations of the

new SA-508 Grade 4N material as they were shown to produce the maximum stresses in the closure sealing region of the package when the original SA-517 material was used for the evaluation of the containment boundary components. In addition to the sensitivity simulations, the applicant assessed whether the containment system remained leak resistant during the HAC free drop, which the applicant considered as the cask lid locking system remains in the elastic range and the gaskets remain compressed.

Considering that the HI-STAR ATB 1T system structural members are modeled in LS-DYNA based on a true-stress-true-strain relationship, the applicant replaced the SA-517 material true-stress-true-strain data used in the original simulations for the containment components with the true-stress-true-strain data developed as the bounding material for SA-508. All other input parameters used in the sensitivity simulations remained identical to the original simulations. The true-stress-true-strain curve data used in the simulations was developed using the same methodology described in Section 2.2.3 of the application submitted for CoC No. 9375, Revision 0, (ML21172A200). However, it was noted that the true-stress-true-strain curve of the bounding material used for the sensitivity simulations only bounded the true-stress-true-strain curve of the SA-508 Grade 4N material for strains up to 21 percent. For strains exceeding the 21 percent, the bounding material true stress used in the simulations was below the stress curve of the SA-508 Grade 4N material by less than 2.5 percent. To evaluate this condition, the staff reviewed the results from the sensitivity simulations and noted that the effective strain developed during the simulations remains less than the 21 percent strain for the containment boundary components. Therefore, the staff finds that the use of the bounding material data is acceptable because the resultant strains and stresses from the simulations remain within the bounded region for the containment boundary components.

The results of the LS-DYNA sensitivity simulations showed that the containment components stresses remained within the Level D stress intensity limits and all the stress safety factors for the package containment boundary components were slightly improved, as compared to the base (original) simulations using SA-517 material for the containment boundary components. The results also demonstrated that the effective stress and/or deformation in the sealing region is reduced when the SA-508 Grade 4N material is used, ensuring leak resistance during the HAC free drops.

Based on a review of the applicant's analyses and simulations, the staff finds that the applicant satisfied the requirements of 10 CFR 71.73(c)(1) for the HI-STAR ATB 1T package when using the SA-508 Grade 4N Class 2 material for the containment boundary components. The staff also finds that previously approved structural bases for the evaluation of crush, puncture, thermal and immersions tests remain unaffected by this amendment request.

Use of Low Strength Weld Material in Drop Simulation Analysis

In the applicant's response to request for additional information (RAI) 2-2 (ML22287A138), the applicant added to calculation No. HI-2177539 (Enclosure 6) a new Appendix F, "Sensitivity Simulation for the Containment Weld Material," to demonstrate that the use of a low strength SS-308 weld in prior finite element simulations renders conservative results which bound the use of a higher-strength weld material for ferritic steel components.

For the sensitivity simulation, the applicant performed the Top End Drop analysis with the higher-strength weld material and compared the results to those of the previous Top End Drop analysis with the low-strength weld. The results of the sensitivity simulation showed that, when a high strength weld material property is used for the analysis, the stresses are slightly reduced, differ by less than 6%, and the effective weld stress remains below the weld material yield strength. The applicant stated that the new simulation demonstrates that the use of SS-308 weld strength and material properties remain a bounding condition when compared to the corresponding ferritic steel materials to be use for manufacturing.

Based on the review of the applicant's analyses and simulations, the staff finds that the use of low strength SS-308 material to represent welded connections of containment boundary components provides for a bounding condition. Therefore, the evaluation of the prior simulations in Appendix E of calculation package No. HI-2177539 remains bounding.

Structural Evaluation Findings

The staff reviewed the structural performance of the containment boundary components under NCT required by 10 CFR 71.71 and HAC required by 10 CFR 71.73 and concludes that the packaging maintains adequate structural safety and integrity to satisfy the containment and shielding requirements of 10 CFR 71.51(a)(1) and (2) for a Type B package when using SA-508 Grade 4N Class 2 material for the construction of the containment boundary components. The staff also concludes that all other components not altered by the proposed amendment request remain unaffected and the previously approved structural safety bases remain acceptable for the HI-STAR ATB 1T package.

Based on the review of the statements and representations in the amendment request, the staff concludes that the package has been adequately described and evaluated to demonstrate that the use of SA-508 Grade 4N Class 2 as an alternate material maintains the structural integrity to meet the requirements of 10 CFR Part 71.

MATERIALS EVALUATION

The staff reviewed and evaluated the information provided by the applicant requested in this amendment request. The specific change evaluated in this section includes an alternative high strength material (SA-508 Grade 4N Class 2) as an optional material of construction for the HI-STAR ATB 1T Cask Containment Boundary. The applicant stated that the newly proposed SA-508 Grade 4N Class 2 material offers higher fracture toughness resistance at low temperatures and possesses strength properties superior to those of the previously specified ASME SA-517 material. No other parameters of the containment boundary design are being altered by the proposed change.

The safety analysis report (SAR) changes proposed by the applicant as a result of the alternative material change include (i) changes to the licensing drawing 9786, allowing SA-508 Grade 4N Class 2 material for the containment baseplate, the containment side/end walls, and the closure lid; updates for reference to material code alternatives, (ii) addition of Table 2.1.3B and Table 2.1.4B for material properties and design allowables for SA-508 Grade 4N Class 2, removal of A514 as an alternate material, addition of Table 2.2.1B to discuss SA-508 Grade 4N Class 2 material for the cask containment boundary and removal of ASTM A514 as an alternate material, discussion in Section 2.3 of SA-508 Grade 4N Class 2 material as an alternate

material for the cask containment boundary and removal of ASTM A514 as an alternate material, (iii) discussion of drop simulations using existing SA-517 material being bounding of the new SA-508 Grade 4N Class 2 material, (iv) discussion of sensitivity simulations conducted for the SA-508 4N material, (v) removal of the HSLA-100 material throughout the application, addition of SA-508 Grade 4N Class 2 material, removal of the emissivity for polished stainless steel in Table 3.2.5, and (vi) removal of the previously added HSLA-100 to Table 8.1.2, 8.1.3, and 8.1.4 of the application, addition of the material procurement exemption in Section 8.2, and removal of the ASTM A514 material.

The staff reviewed the removal of A514 as an alternative material and determined that it was appropriately removed in SAR Sections 2.1, 2.2, 2.3, 8.1, 8.2, and the licensing drawings. In SAR Section 1.2, the applicant added a pointer to Chapter 8 stating that specific code alternatives that apply to the cask containment are presented there. SAR Sections 8.1 and 8.2 also have revisions to remove mention of the previously added HSLA-100 material in Tables 8.1.2, 8.1.3, and 8.1.4 and the staff determined that those were appropriately deleted. In SAR Section 1.3, the applicant updated the revision number for drawing number 9786 from 9 to 10. The staff also reviewed the updated licensing drawings 9786 to confirm the additions for SA-508 Grade 4N Class 2 for containment baseplate, the containment side/end walls, and the closure lid were in accordance with 10 CFR 71.33 and are therefore acceptable. In SAR Section 2.1, the applicant added a pointer to Table 8.1.3 for the Code Alternatives, updated Table 2.1.7 with the same pointer, updated their “Conformance with Reg. Guide 7.6 Provisions on the Structural Requirements for Hi-STAR ATB 1T Containment Boundary” to state that design stress intensities are established based on ASME Code for all containment boundary materials, and added Tables 2.1.3B and 2.1.4B to discuss Design, Levels A and B and Level D stress intensity for the proposed SA-508 Grade 4N Class 2 material. The staff determined that the stress intensities obtained using the criteria in ASME Section II, Part D, Mandatory Appendix 2 with material data from ASME Section II, Part D, Table Y-1, U, TE-1, and TM-1 are acceptable.

In SAR Section 2.2, the applicant added a discussion for the proposed alternative material SA-508 Grade 4N Class 2 and Table 2.2.1B to document the mechanical properties of SA-508 Grade 4N Class 2. The staff reviewed Table 2.2.1B and compared it to the values in ASME Section II Part D and confirmed the mechanical properties are in accordance with ASME Code. In SAR Section 2.3, the applicant added SA-508 Grade 4N Class 2 as a material for the inner walls and baseplate of the cask. The staff evaluation of SA-508 Grade 4N Class 2 as a code alternative material is detailed in the review of SAR Section 8.1.

In SAR Section 2.6, the applicant added language comparing the currently licensed SA-517 material to the proposed alternative material SA-508 Grade 4N Class 2, stating that since SA-508 Grade 4N Class 2 has higher strength intensity limits and strength properties than SA-517, the allowable stress amplitude based on S-N curves remained governing. The staff determined that this is acceptable as the staff confirmed the higher strength properties in ASME Section II, Part D.

In SAR Section 2.7, the applicant added a discussion on the sensitivity simulations performed for the SA-508 Grade 4N Class 2 material. The staff reviewed the details in the Holtec Calculation HI-2177539, Revision 7, “Drop Analysis for the HI-STAR ATB 1T Transport Package.” The staff noted that the weld material in the simulation is Type 308 weld filler which is of lower strength than the licensed SA-517 material and the proposed SA-508 Grade 4N Class 2 material. In Appendix F, the applicant addresses this using actual weld strength material and comparing it to the corresponding true stress versus true strain data in the drop analysis, thus comparing actual weld material data that is consistent with the high strength ferritic steel

components used in the HI-STAR ATB 1T containment boundary. The staff determined that the actual weld material data presented in Table F1 comparing prior simulations with actual weld material is consistent with ASME SFA-5.23 and, as it has higher strength values than the prior simulations which used Type 308, the prior simulations remain bounding.

In SAR Section 3.2, the applicant removed the previously proposed language for HSLA-100 in Table 3.2.1, added SA-508 Grade 4N Class 2 to Tables 3.2.2 and 3.2.3, and removed the emissivity for polished stainless steel from Table 3.2.5. The staff reviewed the proposed change and confirmed in Table TCD of Section II Part D that both SA-517 and SA-508 Grade 4N Class 2 are in Material Group C and have identical thermal conductivity and thermal diffusivity, therefore this change is acceptable. The staff found the removal of emissivity acceptable as it was consistent with a previous RAI response to RAI 3-3 from Holtec, (ML20174A485), dated June 22, 2020.

In SAR Section 8.1, the applicant updated Tables 8.1.2, 8.1.3, and 8.1.4 to include the SA-508 Grade 4N Class 2 addition as an alternative material. For Table 8.1.2, it points to 8.1.3 as it is not a ASME Code Section III NB material. Table 8.1.3 is updated to delete the previously proposed HSLA-100 language and to justify the use of SA-508 Grade 4N Class 2 as an alternative to ASME Code Section III, NB-2120 for the cask containment system, which requires materials to conform to the requirements of one of the specifications for material given in Section II, Part D, Subpart 1, Tables 2A, and 2B.

The applicant's technical justification is that:

(a) SA-508 Grade 4N, Class 2 is listed in Section II, Part A [2.1.4], 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 Grade 4N, Class 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.

(b) The design internal pressure for the HI-STAR ATB 1T transport cask is only 5 psig per 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 10 CFR 71.85.

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

(d) 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 Grade 4N, Class 2.

The staff reviewed the above justification and finds that, per 10 CFR 71.85, the applicant is not required to pressure test as the design pressure of the cask is 5 psig which is less than the 15 psig requirement. The staff also finds that the applicant demonstrated in the review of SAR Sections 2.2 and 2.6 that the SA-508 Grade 4N Class 2 material properties are in accordance with ASME Code Section II, Part D, and are higher than those of SA-517. The stress intensity limits as discussed in the review of SAR Section 2.6 was also found to be acceptable.

Therefore, the staff finds that the applicant has provided sufficient information to justify SA-508 Grade 4N Class 2 as an alternative material for the containment.

THERMAL EVALUATION

According to Enclosure 1 to Holtec letter 2404021-NRC “Summary of Proposed Changes (SOPC) HI-STAR ATB 1T LAR 9375-1”, the amendment request application singularly considered the inclusion of an alternative high strength material (SA-508 Grade 4N Class 2) as an optional material of construction for the HI-STAR ATB 1T Cask’s containment boundary. Enclosure 1 indicated that the alternative high strength material had the same thermophysical properties as the originally analyzed material (SA-517). SAR Table 3.2.5 indicated there were no changes in surface properties (e.g., emissivity) and drawing 9786 Rev. 10 indicated there was no change in material thickness.

Although Holtec Report HI-2156585 (Revision 5) “Thermal Evaluation of HI-STAR ATB 1T Cask” stated that the NCT thermal analyses were based on the containment boundary being modeled using carbon steel thermal properties (HAC thermal analysis properties were based on high alloy steel thermal properties), which tend to have a higher thermal conductivity than the high alloy steel, the report indicated that, for this package design, the high thermal resistance of the surrounding air cavities would mitigate the impact of using the carbon steel thermal conductivity. In addition, staff found that the thermal model results presented in SAR Table 3.1.1 continue to show reasonable margins between package temperatures and the allowable temperatures reported in SAR Table 3.2.7 and Table 2.2.6. Based on the above considerations, the existing HI-STAR ATB 1T cask thermal analyses remain applicable.

Based on a review of the thermal chapter of the SAR, Holtec Report HI-2156585, and Enclosure 1 to Holtec letter 2404021-NRC, the staff has reasonable assurance that the package meets the thermal requirements of 10 CFR Part 71.

CONTAINMENT EVALUATION

According to Enclosure 1 to Holtec letter 2404021-NRC “Summary of Proposed Changes (SOPC) HI-STAR ATB 1T LAR 9375-1”, the amendment request application singularly considered the inclusion of an alternative high strength material (SA-508 Grade 4N Class 2) as an optional material of construction for the HI-STAR ATB 1T Cask’s containment boundary. Enclosure 1 stated that the application’s structural analyses indicated the existing structural evaluations remained governing. In addition, it was stated that drop sensitivity analyses indicated that the alternative high strength material resulted in reduced deformation in the sealing region and all stress safety factors were improved.

Based on the above, the staff has reasonable assurance that the package meets the containment requirements of 10 CFR Part 71.

CHAPTER 8 – ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Specific code alternatives applicable to the cask containment system are presented in Chapter 8 of the application. The applicant justified the use of SA-508 Grade 4N, Class 2 as an alternate containment boundary material because (i) it is listed in permitted for use in construction of Section VIII pressure vessels (Div. 1 & 2) and listed in the 2021 Code Edition 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 package is 5 psig and containment systems with a maximum normal operating pressure of 5 psig or less are exempt from internal pressure testing per 10CFR71.85, (iii) 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 Grade 4N, Class 2.

CONDITIONS

The following changes have been made to the CoC:

Item No. 3.b. has been updated to reflect the latest revision number of the application.

Condition No. 5(a)(3) has been revised to add revision No. 10 of the licensing drawing 9786.

The expiration date of the certificate is not changed.

The references section has been updated to include Revision No. 5 of the application.

CONCLUSION

Based on the statements contained in the application, and the conditions listed above, the staff concludes that the changes indicated do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9375, Revision No. 1.