



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

SAFETY EVALUATION REPORT

DOCKET NO. 72-1032  
HOLTEC INTERNATIONAL  
HI-STORM 100 FLOOD/WIND (FW)  
MULTIPURPOSE CANISTER (MPC) STORAGE SYSTEM  
CERTIFICATE OF COMPLIANCE NO. 1032, AMENDMENT NO. 0, REVISION 1

**SUMMARY**

By letter dated September 16, 2014 (ADAMS Accession No. ML14262A070), as supplemented March 12, 2015 (ADAMS Accession No. ML15071A470), Holtec International (Holtec) submitted revision request No. 1 to the U.S. Nuclear Regulatory Commission (NRC) for the HI-STORM 100 Flood/Wind (FW) Multipurpose Canister (MPC) Storage System, Certificate of Compliance (CoC) No. 1032. The application requested that CoC No. 1032 be changed to:

1. Correct the CoC expiration date (Editorial change)
2. Clarify heat load limits for helium backfill ranges
3. Clarify wording on vent blockage Limiting Conditions of Operations (LCO)
4. Revise vacuum drying system heat loads

This revised CoC, when codified through rulemaking, will be denoted as Revision No. 1, to CoC No. 1032. As a revision, the CoC will supersede the previous version of the CoC and Technical Specifications (TS), effective June 13, 2011, in its entirety. The applicant has requested a revision in lieu of a new amendment utilizing the following justifications.

- No new canisters are being requested to be added to CoC No. 1032.
- No new systems, components or structures (SSCs) are requested to be added to CoC No. 1032.
- The requested changes are minor.
- The requested changes are applicable to CoC No. 1032, in their entirety.
- Only two facilities intend to deploy CoC No. 1032, A0, prior to the scheduled approval of CoC No. 1032, A0, R1. Therefore any applicable backfitting evaluations would be minimal.

This safety evaluation report (SER) documents the review and evaluation of the proposed revision. The NRC staff (staff) followed the guidance of NUREG-1536, Revision 1, "Standard Review Plan for Dry Cask Storage Systems," Interim Staff Guidance (ISG)-11 "Cladding Considerations for the Transportation and Storage of Spent Fuel," and ISG-21 "Use of Computational Modeling Software" in performing its regulatory evaluation.

The staff's assessment is based on a review of Holtec's application and whether it meets the applicable requirements of 10 CFR Part 72 for independent storage of spent fuel. The staff's assessment focused only on modifications requested in the revision as supported by the submitted revised final safety analysis report (FSAR) and did not reassess previously approved portions of the FSAR.

## **1. GENERAL DESCRIPTION**

The objective of this chapter is to review the design changes made to the HI-STORM FW MPC Storage System to ensure that Holtec has provided a description that is adequate to familiarize reviewers and other interested parties with the pertinent features of the system, including the changes. The specific changes are described and evaluated in later sections of this SER.

### **1.1 Findings**

F1.1 The staff concludes that the information presented in the proposed FSAR pages satisfies the requirements for the general description under 10 CFR Part 72. This finding is reached on the basis of a review that considered the regulation itself, Regulatory Guide 3.61, and accepted practices. The staff concludes that the applicant's information is sufficiently detailed to allow reviewers to familiarize themselves with the pertinent features of the system and the changes requested.

## **2. PRINCIPAL DESIGN CRITERIA EVALUATION**

There were no requested changes requiring evaluating the principal design criteria related to the important to safety (ITS) SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **3. STRUCTURAL DESIGN CRITERIA EVALUATION**

There were no requested changes requiring evaluating the structural design criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **4. THERMAL EVALUATION**

### **4.1 Summary**

The objective of the thermal review is to evaluate the thermal impact of the proposed changes in Revision No. 1 of CoC No. 1032. The proposed changes that potentially impact the thermal review are to clarify (1) the heat load limits for helium backfill ranges, (2) the wording on vent blockage LCO, and (3) revise vacuum drying heat loads.

1. Clarify the heat load limits for helium backfill ranges.

The current TSs for this CoC allow for two different ranges of helium backfill pressures with the specific pressure range to be used dependent upon the specific heat load of a canister. The applicant proposed to modify the TSs to clarify that the narrower helium backfill range currently contained in the TSs but limited for use to canisters above a certain heat load limit, can be used, instead, for all canisters. The applicant stated in Attachment 1 of the application (Summary of Proposed Changes) that the CoC already allows for a wider band of helium backfill pressures for allowable heat loads and the proposed narrower band of helium backfill limits is a subset of the wider band as can be seen in Table 3.2 of Appendix A, TS.

The staff reviewed the application and the FSAR and finds that the proposed change will not impact the MPC internal pressures or the fuel cladding and cask component temperatures because the proposed narrower band of helium backfill limits is a subset of the wider band already found to be acceptable. The proposed change is bounded by the analyses already presented in the FSAR. Therefore, the staff concludes that the clarification of heat load limits for helium backfill ranges is acceptable because there is no negative impact to the thermal analyses presented and evaluated by the staff in the original application.

## 2. Clarify wording on vent blockage LCO

The original CoC TSs included a note in LCO 3.1.2 that indicated that 50% or more of each of the inlet vents should be unblocked. The applicant proposed to change the note on LCO 3.1.2 to clarify that each of the outlet vents should also be at least 50% unblocked and not just the inlet vents.

The staff reviewed the application and finds that the proposed change will not impact the MPC internal pressure or the fuel cladding and cask component temperatures because the change is just a clarification for the cask user of the requirements for the allowable blockage of vents in the HI-STORM FW overpack and does not affect any thermal analyses. The original FSAR includes analyses of 50% and 100% blockage of air inlet vents which bound evaluations of blocked outlet vents.

According to the applicant, the maximum fuel cladding temperature under long-term normal storage noted in SAR Table 4.4.3 is 375°F. Based on a thermal analysis of the effect of 50% blockage of air inlet vents, SAR Table 4.6.1 shows partially blocked inlet vents alone have a small impact on the fuel temperatures, increasing the maximum fuel cladding temperature 10°C to 385°C. This is a small change relative to the large temperature margin (185°C) available until the fuel cladding design temperature limit for off-normal conditions of 570°C is reached. In the event of both inlet and outlet vents being 50% blocked, air would still enter and exit through the partially blocked vents. The effect of partially blocked outlet vents is similar to the effect of partially blocked inlet vents; and since the effect of partially blocked inlet vents alone has a small impact on the fuel and component temperatures, the temperatures and MPC pressure due to the combined effect of 50% blocked inlet and outlet vents will still remain below the off-normal temperature and pressure limits.

As explained by the applicant, the thermal evaluation of 100% blockage of air inlet vents performed in the original FSAR is bounding. In the event of all inlet vents being 100% blocked,

air will enter the annulus through the open outlet vents creating a natural circulation of air. The amount of heat removed from the MPC external surfaces through this natural circulation is less than 7% of that under normal conditions. In the event of 100% blockage of inlet and outlet vents, the loss of this small additional heat removal capability of air through the outlet vents will result in a small temperature rise compared to the available 86°C temperature margin established from the 100% inlet vent blockage analysis. Additionally, these temperatures are determined based on a 32 hour analysis. The TS require action to be taken within 24 hours of complete blockage so temperature margins would be even greater.

The staff concludes that the clarification of wording on the vent blockage LCO is acceptable because there is no negative impact to the thermal analyses presented and evaluated by the staff in the original application since the analysis in the original application remains bounding.

### 3. Revision to Vacuum Drying System (VDS) heat loads

The original CoC TSs allow for vacuum drying to be performed on casks with high burnup fuel below a specified heat load of 34.36 kW and 34.75 kW depending on the canister configuration. The applicant proposed to reduce the limit for vacuum drying use with high burn up fuel to lower heat loads of 29.6 kW and 30.0 kW in Appendix A, Table 3-1 and Appendix B, Table 2.3-3 and 2.3-4. The applicant stated in Attachment 1 of the application (Summary of Proposed Changes) that the proposed change will not affect any thermal analyses since the proposed limit is below what has been calculated to be acceptable.

The applicant also states that the revised limit corresponds to the allowable limit in the HI-STORM 100 Cask system. In HI-STORM 100 Amendment No. 9, the VDS limit is 29 kW for high burnup fuel. In the proposed HI-STORM FW MPC Storage System revision, the VDS heat load limits for high burnup fuel are 29.6 and 30.0 kW for the two applicable MPCs. The staff finds that these allowable VDS heat loads are similar enough to substantiate the statement that the revised limits of the HI-STORM FW MPC Storage System correspond to the HI-STORM 100 Cask system.

The staff reviewed the application and finds that the proposed change will not impact the MPC internal pressure or the fuel cladding and cask component temperatures because the proposed limit is below the original higher limit previously evaluated by the staff in the applicant's original submittal. . Therefore, the staff concludes that the proposed change is acceptable because there is no impact to the thermal evaluation as a result of this change.

## 4.2 Evaluation Findings

The staff reviewed the application and concludes that the proposed changes to clarify the heat load limits for helium backfill ranges, clarify the wording on vent blockage LCO, and reduce the limits for vacuum drying heat loads are in compliance with 10 CFR Part 72 and that the applicable design and acceptance criteria have been satisfied. The evaluation of the thermal design provides reasonable assurance that the HI-STORM FW MPC Storage System will continue to provide safe storage of spent nuclear fuel. This conclusion is reached on the basis

of a review that considered the regulation itself, appropriate regulatory guides, applicable codes and standards, and accepted engineering practices.

Specifically, the staff finds:

- F4.1 The HI-STORM FW is designed with a heat-removal capability having verifiability and reliability consistent with its importance to safety. The cask is designed to provide adequate heat removal capacity without active cooling systems.
- F4.2 The spent fuel cladding is protected against degradation leading to gross ruptures under long-term storage by maintaining cladding temperatures below 752°F (400°C). Protection of the cladding against degradation is expected to allow ready retrieval of spent fuel for further processing or disposal.
- F4.3 The spent fuel cladding is protected against degradation leading to gross ruptures under off-normal and accident conditions by maintaining cladding temperatures below 1058°F (570°C). Protection of the cladding against degradation is expected to allow ready retrieval of spent fuel for further processing or disposal.

## **5.0 CONFINEMENT EVALUATION**

There were no requested changes requiring evaluating the confinement criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **6.0 SHIELDING EVALUATION**

There were no requested changes requiring shielding evaluation related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **7.0 CRITICALITY EVALUATION**

There were no requested changes requiring evaluating the criticality criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **8.0 MATERIALS EVALUATION**

There were no requested changes requiring evaluating the materials criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **9.0 OPERATING PROCEDURES EVALUATION**

There were no requested changes requiring evaluating the operating procedures criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

## **10.0 ACCEPTANCE TESTS EVALUATION**

There were no requested changes requiring evaluating the acceptance tests criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

### **11.0 RADIATION PROTECTION EVALUATION**

There were no requested changes requiring evaluating the radiation protection criteria related to the ITS SSCs to ensure compliance with the relevant general criteria established in 10 CFR Part 72.

### **12.0 ACCIDENT ANALYSIS EVALUATION**

The applicant submitted revised thermal analyses that acceptably analyzed the effects of the 1) the heat load limits for helium backfill ranges, (2) the wording on vent blockage LCO, and (3) revise vacuum drying heat load for normal, off-normal and accident conditions. These were evaluated by the staff in Chapter 4 of this SER.

### **13.0 CoC AND TECHNICAL SPECIFICATIONS**

#### **13.1 Review Objective**

The objectives of this review were to ensure that the changes to the operating controls and limits or the TS in CoC No. 1032, Revision No. 1, meet the requirements of 10 CFR Part 72. The evaluation is based on information provided by the applicant in this revision request, a review of the FSAR, as well as consideration of accepted practices. Specifically, the proposed changes were reviewed to ensure that they acceptably supported the changes requested by the applicant. The technical and safety aspects of these changes were evaluated by the staff in previous sections of this SER and were found to be acceptable. The applicant proposed technical and editorial TS changes. Changes and additions that required TS change evaluations were as follows:

1. Correct the CoC expiration date (Editorial change)
2. Clarify heat load limits for helium backfill ranges
3. Clarify wording on vent blockage Limiting LCO
4. Revise vacuum drying system heat loads

The corresponding TS changes are

- (1) CoC – Correct the expiration date to June 12, 2031.
- (2) Appendix A, Table 3-2 is modified to show that the narrower helium backfill range can be used for all canisters instead of only those above a certain limit. Additionally, the footnotes on this table are revised.
- (3) Appendix A, LCO 3.1.2 – Revised the note to clarify that each of the inlet and outlet vents should be 50% unblocked.
- (4) Appendix A, Table 3-1 and Appendix B, Tables 2.3-3 and 2.3-4. –

Appendix A, Table 3-1 is revised to limit the MPC heat load limit for using VDS to a lower value, and the table notes are revised accordingly.

Appendix B, Tables 2.3-3 and 2.3-4 are revised for the per cell heat load limits to correspond to the lower MPC heat load limit.

## **13.2 Findings**

F13.1 The staff finds that correcting the CoC expiration date to reflect a 20 year versus a 40 year certification is an editorial change based on the original HI-STORM FW MPC Storage System application and SER. The expiration date error was an error made in final CoC processing.

F13.2 The staff finds that CoC No. 1032 identifies necessary TS to satisfy 10 CFR Part 72 and that the applicable criteria of 10 CFR 72.236 have been satisfied. The proposed TS changes provide reasonable assurance that the HI-STORM FW MPC Storage System will allow safe storage of spent nuclear fuel.

## **14.0 CONCLUSIONS**

Based on its review of the revision request to CoC No. 1032, Revision No. 1, the staff has determined that there is reasonable assurance that: (i) the activities authorized by the revised certificate can be conducted without endangering the health and safety of the public and (ii) these activities will be conducted in compliance with the applicable regulations of 10 CFR Part 72. The staff has further determined that the issuance of the revision will not be inimical to the common defense and security. Therefore, the revision should be approved.

April 25, 2016