



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
REGION IV  
1600 EAST LAMAR BLVD  
ARLINGTON, TEXAS 76011-4511

October 26, 2012

Mr. Mike Perito  
Vice President Operations  
Entergy Operations, Inc.  
Grand Gulf Nuclear Station  
P. O. Box 756  
Port Gibson, MS 39150

SUBJECT: GRAND GULF NUCLEAR STATION – INDEPENDENT SPENT FUEL STORAGE  
INSTALLATION (ISFSI) INSPECTION REPORT 05000416/2012009 AND  
07200050/2012001

Dear Mr. Perito:

A routine site inspection was completed of your dry cask storage activities associated with your Independent Spent Fuel Storage Installation (ISFSI) on August 28 - 30, 2012. A preliminary exit was conducted with your staff to discuss the findings of the inspection on August 30, 2012. The inspection was continued at the Entergy Operations, Inc. permanent records storage facility at the River Bend Nuclear Station where backup documentation of your permanent records for your stored casks was maintained. An exit for that portion of the inspection was conducted on September 26, 2012. The two inspection trips reviewed the current storage activities associated with your ISFSI. The focus of this inspection was to evaluate the status of the stored casks to verify ongoing compliance with Holtec Certificate of Compliance 1014 and associated Technical Specifications, the Holtec Final Safety Analysis Report, regulations in 10 CFR Part 20 and Part 72, and any changes that had been made to your ISFSI program since the last NRC inspection. This inspection included the areas of radiation safety, cask temperature monitoring, quality assurance, corrective action program, safety evaluations, and how you addressed industry issues that affected you. One of these issues had a direct effect on your dry cask storage program that involved the helium leak testing of casks during the fabrication by the vendor. In addition, the fuel misloading error that was discovered in 2008 was reviewed to verify all final issues related to the problem had been adequately addressed. The storage casks were found to be in good physical condition. One noncited violation of NRC regulations was identified related to the helium backfill of Casks 15 thru 17.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal, privacy or proprietary information so that it can be made available to the public without redaction.

Grand Gulf Nuclear Station

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Should you have any questions concerning this inspection, please contact the undersigned at 817-200-1191 or Mr. Vincent Everett at 817-200-1198.

Sincerely,

***/RA/***

D. Blair Spitzberg, Ph.D., Chief  
Repository & Spent Fuel Safety Branch

Dockets: 50-416, 72-50

Licenses: NPF-29

Enclosure: NRC Inspection Report 05000416/2012009;07200050/2012001

w/ Attachment:

1. Supplemental Information
2. Condition Reports Reviewed During the Inspection
3. Loaded Casks at Grand Gulf Nuclear Station

Electronic distribution by RIV:

- Regional Administrator ([Elmo.Collins@nrc.gov](mailto:Elmo.Collins@nrc.gov))
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ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket: 05000416, 07200050

Licenses: NPF-29

Report Nos.: 05000416/2012009 and 07200050/2012001

Licensee: Entergy Operations, Inc.

Facility 1: Grand Gulf Nuclear Station, Unit 1  
Independent Spent Fuel Storage Installation (ISFSI)

Location 1: 7003 Baldhill Road  
Port Gibson, MS 39150

Facility 2: River Bend Nuclear Station, Unit 1  
(Backup records facility for Grand Gulf)

Location 2: 5485 US Highway 61  
St. Francisville, LA 70775

Dates: August 28-30, 2012  
September 26, 2012

Inspectors Vincent Everett, Senior Inspector  
Lee Brookhart, Inspector

Approved By: D. Blair Spitzberg, Ph.D., Chief  
Repository and Spent Fuel Safety Branch  
Division of Nuclear Materials Safety

Enclosure

## EXECUTIVE SUMMARY

### Grand Gulf Nuclear Station NRC Inspection Report 50-416/2012-09 and 72-50/2012-01

A routine inspection was conducted of your Grand Gulf Independent Spent Fuel Storage Installation (ISFSI) on August 28 - 30, 2012. The inspection covered a number of topics to evaluate your compliance with the applicable NRC regulations and the provisions of a general license in accordance with the Holtec HI-STORM 100 cask system. Seventeen casks were currently loaded and stored on the ISFSI pad, which is located within the Part 50 reactor facility protected area. The inspection found that you were safely storing spent fuel at your ISFSI in accordance with the NRC regulations and the Holtec license. Radiation levels were very low and the casks were in good physical condition. The dry fuel storage staff were knowledgeable in the licensing requirements related to storage activities and had been diligent in reviewing issues that were occurring in the industry to determine if programmatic changes were necessary at Grand Gulf. One area of concern was identified during this inspection related to the retrievability of permanent records for the casks. Considerable difficulty was evident as your staff tried to locate requested records related to particular casks. A particular concern was identified by the NRC inspectors as to whether the recalculated thermal values for Casks 4 - 7 that had been performed after the discovery of the misloading of fuel in the casks in 2008 were adequately cross referenced to the four impacted casks such that those records would be discovered and turned over with the casks upon removal of the casks from the site at some future date. The retrievability of records specific to a particular cask appears to be a generic issue to the Entergy program.

During this inspection, Hurricane Isaac impacted the U.S coastline, resulting in rain and high winds at the Grand Gulf site. The site initiated hurricane preparedness activities to secure the site for possible impact from the hurricane. Procedure 20-S-02-001, Attachment XXIV, "All Hazards Inspection for GGNS ISFSI and SFSCs" included information for responding to a hurricane that could impact the ISFSI. The procedure included specific guidance for conducting inspections of the ISFSI and the casks following environmental phenomena, including high winds and flooding that could result from a hurricane.

#### Operation of an ISFSI at Operating Plants (60855.1)

- A quality assurance audit was underway of the ISFSI which provided an opportunity for the NRC inspectors to interface with the auditors. This audit was being performed to comply with 10 CFR 72.176 and to be specific to ISFSI activities. Past ISFSI audits had been part of the plant's Part 50, Appendix B, audit program, which covered programs such as radiation protection, operations, engineering, maintenance and others that overlapped into the dry cask storage program, but did not focus on ISFSI specific topics. The recent change to the audit program being implemented by Entergy will include an ISFSI specific audit on a 24-month schedule (Section 1.2.a).
- Radiological dose rates around the ISFSI pad were less than 1 mrem/hr gamma and neutron. No unexpected radiological conditions were observed during the tour. The ISFSI pad area was properly posted (Section 1.2.b).
- Personnel doses during cask loading were typically around 0.2 person-rem per cask and ranged from 0.350 to 0.115 person-rem for the 17 casks loaded. Of this, 20 - 30 percent

was due to neutron exposure as recorded on the electronic neutron dosimeters worn by the workers. An improving trend was noted as more casks were loaded (Section 1.2.b).

- Vent surveillances of the loaded casks were being implemented in accordance with Technical Specification 3.1.2. Six months of selected records were reviewed for the time period of 2008 thru 2012. No vent blockage issues had been found during the daily vent surveillances (Section 1.2.c).
- Selected condition reports were reviewed for the period 2008 thru 2012. A wide range of issues had been identified and resolved. Resolution of the issues was appropriate for the safety significance of the issue. No adverse trends were identified during the review (Section 1.2.d).
- An issue with the spent fuel cask handling crane was reviewed concerning the north mechanical load brake. The brake had failed the annual testing in 2008 and had been identified in 2011 as still not repaired. An evaluation had been performed in 2008 which concluded that the crane could be considered single failure proof even with the north mechanical load brake inoperable. The NRC reviewed the basis for this determination and agreed with the conclusion based on the redundancy of the braking systems on the crane (Section 1.2.e).
- Retrievability of permanent records was reviewed during this inspection. Selected records related to specific casks were requested of the licensee that were required by 10 CFR Part 72. Delays and difficulty in providing the requested records resulted in extending this portion of the inspection. Though there was no evidence that the required records were not in the permanent record system, the extreme difficulty in retrieving the records in the time period of the inspection brought into question whether Grand Gulf was fully in compliance with the record requirements in 10 CFR Part 72. The licensee issued a condition report to evaluate their ability to locate all records specific to an individual cask (Section 1.2.f).
- On June 19, 2008, Entergy notified the NRC of the discovery of an error in the software used to evaluate the acceptability of selected spent fuel assemblies to meet the criteria of the Certificate of Compliance for loading into the Holtec casks. The error resulted in the misloading of three casks. An NRC inspection in 2008 resulted in two noncited violations related to the issue. This inspection reviewed the final outcome of the issue and the one-time exemption by the NRC to allow for the continued storage of the casks at the Grand Gulf ISFSI (Section 1.2.g).
- Holtec License 1014, License Condition 9, required a test of the supplemental cooling system under certain conditions. Grand Gulf had performed a test on July 13, 2011, and submitted the test results to the NRC. After the test had been completed, Grand Gulf planned to eliminate the calibration requirement for the flow meter on the system. This was identified by the NRC Inspectors as inconsistent with the requirements in the Holtec FSAR. A condition report was issued to obtain clarification from Holtec concerning the calibration requirement (Section 1.2.h).
- In 2009, a concern related to Holtec's decision to stop the helium leak testing of the Holtec canisters during fabrication was identified by the NRC. As a result, Holtec agreed to reinstate the helium leak test. However, during the interval in which testing had been suspended; a number of canisters had been distributed by Holtec that had not been

tested. Grand Gulf had received seven of the affected canisters and had loaded the canisters with spent fuel and placed them on the ISFSI pad. Five more had been received but had not been loaded. The NRC determined after review of the information provided by Entergy and Holtec, that the seven loaded canisters were acceptable for continued use. The five unloaded canisters were helium leak tested before they were loaded with spent fuel (Section 1.2.i).

- Grand Gulf had reviewed a number of industry issues that could have an impact on the dry fuel storage program. This included issues related to NRC Information Notice 2011-10, heat load calculations related to Holtec HIB-51, isolation of the canister while filled with water related to Holtec HIB-53, and stack-up of the transfer cask on the storage cask during canister downloading. One noncited violation was issued to Grand Gulf for their failure to place the required amount of helium into Casks 15 - 17 due to miscalculating the total heat loads of those casks (Sections 1.2.j, k, l, and m).

#### Review of 10 CFR 72.212(b) Evaluations (60856.1)

- Two revisions to the 72.212 Evaluation Report had been issued since the last NRC inspection. The changes were consistent with the current site conditions and updated information concerning loaded casks at the site.

#### Review of 10 CFR 72.48 Evaluations (60857)

- The 10 CFR 72.48 screenings reviewed during this inspection were determined to be adequate. No 10 CFR 72.48 evaluations had been performed in the past 4 years. The required reports related to the 10 CFR 72.48 evaluations had been submitted to the NRC.

## Report Details

### Summary of Facility Status

A routine periodic inspection of the Grand Gulf dry cask storage program was completed. The program was being effectively implemented and the 17 casks stored at the ISFSI were found to be in good physical condition. Radiation levels around the ISFSI pad were very low, less than 1 mR/hr. The temperature monitoring program, as required by Technical Specification 3.1.2, was being implemented. The records reviewed during this inspection found no cases of problems with the vents and the cooling of the casks. The ISFSI was well secured and located within the plant's Part 50 protected area. Additional locked fences were around the pad to further restrict personnel from the area.

The cask design used at Grand Gulf was the Holtec HI-STORM 100S Version B storage cask, the MPC-68 canister, and the HI-TRAC 125D transfer cask. Each canister holds 68 boiling water reactor spent fuel assemblies. To date, the licensee has loaded only intact spent fuel assemblies and has maintained the total decay heat load of each cask to less than 20 kilowatts (kW) except for one cask. Plans are to continue this strategy, which minimizes the thermal heat levels of the canister and the radiation levels, to facilitate a better working environment during loading, deconning, and welding operations.

The first seven casks were loaded between 2006 and 2008. These casks were loaded to Certificate of Compliance 1014, Amendment 2, and Holtec Final Safety Analysis Report (FSAR), Revision 3. Casks 8 - 17 were loaded to Certificate of Compliance 1014, Amendment 5 and Holtec FSAR, Revision 7. The current ISFSI pad can hold 40 casks with provisions for four additional spaces to allow for cask unloading, if required. Future plans are to add a second pad that will increase the capacity of the ISFSI to 88 storage locations with 4 spare locations.

## **1 Operations of an Independent Spent Fuel Storage Installation (ISFSI) at Operating Plants (60855.1)**

### **1.1 Inspection Scope**

An inspection of the status of the loaded casks at the Grand Gulf ISFSI was completed to verify compliance with requirements of the Holtec Certificate of Compliance and FSAR. The inspection reviewed a broad range of topics from quality assurance oversight of activities to the current radiological conditions at the ISFSI pad. Condition reports issued since the last NRC inspection in 2008 were reviewed to verify that issues related to the ISFSI and the spent fuel cask handling crane were being captured, adequately evaluated, and properly resolved. A special focus of this inspection was dedicated to the storage and retrievability of permanent records. This portion involved activities at the Grand Gulf site and at the backup records center located at the River Bend station. Follow-up was completed concerning the 2008 misloading of several spent fuel assemblies, which required additional analysis and interface with the NRC to confirm that the assemblies could continue to be stored at the ISFSI. Industry issues that could affect the Grand Gulf dry cask storage program were reviewed to verify that the licensee was aware of the issue and had performed an evaluation to determine if the issue affected the Grand Gulf dry cask storage program.



## 1.2 Observations and Findings

### a. Quality Assurance Audits and Surveillances

During the week of this inspection, Entergy was in the process of conducting an ISFSI audit. This was the first ISFSI specific audit performed at Grand Gulf. Past audits had been conducted as Part 50, Appendix B, quality assurance audits. These audits had covered a broad range of programs that were also implemented for ISFSI activities such as radiation protection, maintenance, engineering design, etc., but only looked at limited issues related specifically to the ISFSI. A meeting was conducted with the audit team to discuss the Entergy-wide audit process that was being implemented with the new audit program. In July 2011, Condition Report CR-HQN-2011-0732 had been issued that recognized that audits conducted of Part 50 programs that overlapped the ISFSI programs may not fully meet the intent of the 10 CFR 72.176 requirements for ISFSI audits. Since this issue was generic to the other Entergy sites, the condition report was issued as an Entergy fleet-wide condition report to address the need to develop an audit program specific to the ISFSIs that applied to all Entergy sites. As a result of Condition Report CR-HQN-2011-0732, Entergy established a stand-alone ISFSI inspection requirement as Audit 20 in Attachment 9.2, "List of Required Audits for Operating Plants", to Procedure EN-QV-109 "Audit Process," Revision 21. Dry fuel storage inspections were required on a 24-month frequency. A standardized audit template was developed as Audit Template QA-20-2012-XXX-01, which provided topics and attributes for inclusion in the ISFSI audits. The audit team at Grand Gulf was very enthusiastic and had a good understanding of the ISFSI areas that they were auditing.

Several quality assurance surveillances had been performed over the past several years at Grand Gulf that included ISFSI activities. During the period of 2008 thru 2011, ISFSI related surveillances included the adequacy of records related to work orders and training/qualifications of personnel, dewatering and welding of the canister, implementation of radiological controls, movement of spent fuel into the canister, observation of cask movement activities and crane operations, observation of transport operations of a loaded cask, observation of activities at the ISFSI pad, use of personnel protective equipment, and calibration and use of the leak testing equipment. The surveillances covered a wide range of activities and found a number of issues that required correction.

In response to a problem identified during an NRC inspection of the Holtec fabrication facility in July 2009, the quality assurance organization conducted a surveillance of the leak testing activities of several canisters at Grand Gulf in response to Condition Report CR-GGN-2009-3928. This condition report was issued as a result of Holtec not performing helium leak tests during the fabrication process for several canisters that were delivered to Grand Gulf. This issue is discussed in more detail in this inspection report in Section 1.2(i). The QA surveillance included observation of selected portions of the helium leak test, verification of the qualifications and certification of the leak test engineer, review of the procedure used for the testing, and confirmation that the equipment was in calibration.

b. Radiological Conditions

The ISFSI pad was located within the protected area and bounded on the north side by the protected area fence. The other three sides were fenced to keep blowing trash and personnel away from the casks. Thermoluminescent dosimeters (TLDs) were placed near the outer protected area security fence, but no TLDs were placed on the other three fences around the pad. Dosimeters M-71 and M-72 were the nearest TLDs to the casks at a distance of approximately 120 to 140 feet away. Dosimeter M-71 was near the northeast corner of the ISFSI and dosimeter M-72 was near the northwest corner. There were more casks located on the northeast side of the pad than on the northwest side. For 2011, Dosimeter M-71 recorded 21.2 mrem and Dosimeter M-72 recorded 12.1 mrem.

A tour of the ISFSI was conducted and radiation readings were taken at selected areas around the casks by a health physics technician from the plant staff. A remball survey instrument was used for neutron measurements and a RAM GAM Geiger-Muller detector was used for the gamma survey. Prior to approaching the ISFSI pad, background levels were 0.02 mR/hr gamma and 0 mrem/hr neutron. There were 17 casks located on the pad. At a distance of 8-10 feet from the casks, radiation levels were typically 0.4 to 0.6 mR/hr gamma and 0.1 to 0.2 mrem/hr neutron. A roped-off area several feet from the casks was posted as a radioactive materials area. Along the roped area, a few feet from the nearest cask, the highest radiation levels measured were 1.0 mR/hr gamma. Approximately 60 - 80 feet from the casks was the Combo building. Readings near the building were 0.04 mR/hr gamma and 0.02 mrem/hr neutron. No unusual or unexpected radiation levels were found during the survey. The radiation readings were consistent with the licensee's radiation survey performed July 31, 2012. During the July 31, 2012 survey, contamination smears were collected, with no detectable contamination found on the ISFSI pad or cask surfaces.

The licensee provided personnel dose information associated with the loading of each of the 17 casks. The average worker dose for all 17 casks was 0.2 person-rem per cask and ranged from a high of 0.35 person-rem for Cask 5 to a low of 0.115 person-rem for Cask 16. An improving trend was evident as more casks were loaded. Attachment 3 to this inspection report provides a table with the person-rem doses per cask. Of the dose, 50-60 percent occurred during the decontamination of the transfer cask after removal from the spent fuel pool and during welding activities. Neutron data was provided by the licensee for the last five casks. All five casks had a heat load of 18 - 19 kW. The total gamma plus neutron dose ranged from 0.115 to 0.197 person-rem. Of this 20 - 30 percent was due to neutron exposures.

c. Technical Specification 3.1.2 Temperature Monitoring

Technical Specification 3.1.2 required either a daily inspection of the inlet and outlet vents for blockage or daily verification that the temperature difference between the HI-STORM outlet temperature and the ISFSI ambient temperature was  $\leq 126$  °F for casks loaded under Amendment 2 (Casks 1 - 7) and  $\leq 137$  °F for casks loaded under Amendment 5 (Casks 8 - 17). All 17 HI-STORM casks at Grand Gulf were equipped with temperature monitoring equipment. The temperature surveillances and/or vent inspections were performed using Surveillance Procedure 06-OP-1000-D-0001, Attachment 1, "Daily Operating Logs Data Sheet 1", Revision 141. Documentation was reviewed for the months of December 2008, June 2009, April 2010, October 2011,

February 2012, and June 2012 for compliance with the technical specification. Procedure 06-OP-1000-D-0001 allowed the operator to review and record the casks' temperature data or perform vent inspections for the daily required surveillance to meet the technical specification. Of the six months selected for review, the surveillance requirement was met by performing daily vent inspections. No cask vents were reported as being blocked.

d. Corrective Action Program

Selected condition reports and operational experience reviews since the last NRC inspection in 2008 were reviewed. The licensee provided a list of condition reports related to the ISFSI and the spent fuel cask handling crane from which the NRC inspectors selected a number for further review. The condition reports and a brief description of each is provided as Attachment 2 to this inspection report.

A wide variety of issues were identified in the condition reports. Resolution of the issues was appropriate for the safety significance of the issue. No significant trends were found during the review of the condition reports, which covered a four year period. The condition reports were categorized based on significance. Procedure EN-LI-102 "Corrective Action Process," Revision 19, defined Severity Level A as significant conditions adverse to quality, Severity Level B as conditions adverse to quality, Severity Level C as an event or condition of minor consequences, and Severity Level D as a condition requiring no action assignment.

e. Spent Fuel Cask Handling Crane Brakes

The Grand Gulf spent fuel cask handling crane was a Whiting crane rated at 150 tons. The crane had been installed in the late 1970's. The crane was constructed to meet the requirements of Regulatory Guide 1.104, "Overhead Crane Handling Systems for Nuclear Power Plants." This regulatory guide was later withdrawn in July 1981 and superseded by NUREG-0554, "Single Failure Proof Cranes" issued May 1979. Grand Gulf Engineering Change (EC)-12920 changed the commitment for the crane from Regulatory Guide 1.104 to NUREG-0554.

During the 2009 annual preventive maintenance inspection of the crane in accordance with Work Order 198171, the north mechanical load brake failed to pass the brake test on all three tests conducted on July 17, 2009, per Step 3.5.13 of Procedure Temp T31E-A00. The south mechanical load brake passed all tests. Condition Report CR-GGN-2009-3632 documenting the problem was issued that same day. The planned action identified in the condition report was to prepare an Engineering Change EC-16388 to accept the north mechanical load brake as inoperable and to replace the brake prior to the next cask loading campaign. The condition report noted that the Cycle 17 loading campaign had been put on hold. The condition report also noted that the brake redundancy was a requirement to meet single-failure-proof criteria.

This was not the first time the north mechanical load brake had been found to not be functional. On September 23, 2006, during testing, the north mechanical load brake failed to hold a load. A brake adjusting nut was discovered frozen such that the brake could not be adjusted. The licensee evaluated the loss of the north mechanical load brake under Engineering Request ER-GG-2005-0009-001, ERCN-004, and concluded that the loss did not adversely affect the reliability and functionality of the crane. Since

the hoist was equipped with dual, independent gear trains, either mechanical load brake was capable of holding the load during failure of the other. The two shoe type holding brakes and the eddy-current brake provided adequate protection against a load drop on failure of both electric holding brakes. Testing of the eddy current brake was performed on October 20, 2006, to verify its operability.

Engineering Change (EC)-16388, Revision 0 documented the 2009 discovery of the problem with the north mechanical load brake and evaluated the operability of the crane. The EC noted that during the 2006 north mechanical load brake problem, the lead time to repair the brake had been 6 to 8 weeks. Because the next loading campaign was scheduled to start soon and the crane was required to support the loading of the casks, the engineering change evaluated whether the crane could be considered single failure proof without the north mechanical load brake being operational. The spent fuel cask handling crane was described in the Grand Gulf Updated Final Safety Analysis Report, Section 9.1.4.2.2.3 and Appendix 9d. The Updated Final Safety Analysis Report section provided an overall description of the crane, but did not discuss the individual components, such as the brakes, gears, etc. Appendix 9d addressed the crane as being single failure proof against the NRC requirements. EC-16388 noted that the north mechanical load brake had been rebuilt and tested in 2008 and that the brake will need to be repaired. However, the crane could be considered single failure proof without the north mechanical load brake operational. This was based on an evaluation of the crane against Section 4.9 of NUREG-0554, which stated that "The minimum hoisting braking system should include one power control braking system and two holding brakes." The spent fuel cask handling crane consisted of a single wire rope drum with dual, independent gear trains, each utilizing a shoe type holding brake. Each of the two shoe type holding brakes was spring applied, electrically released. There was one shoe type holding brake and one mechanical load brake for each of the two redundant gear trains and one eddy-current brake on the hoist main drive shaft. Each shoe type holding brake was rated at 220 percent of the rated motor torque. Each of the gear boxes was equipped with a mechanical load brake. These redundant brakes were intended to control the descending load. In consultation with the crane manufacturer, Whiting Corp., the licensee determined that the crane had sufficient redundant and operational braking systems to be considered single failure proof even with the north mechanical load brake inoperable. This conclusion was confirmed during consultation between the NRC regional inspectors and NRC headquarters staff during this inspection. Step 5.0 of EC-16388 stated that the north mechanical load brake shall be replaced with a new or vendor refurbished mechanical load brake prior to the next loading campaign following Cycle 17. Cycle 17 began loading casks in mid-August 2009. Five casks were loaded.

In 2010, the annual preventive maintenance inspection on June 16, 2010 noted that the north and south mechanical load brake testing would be completed under Work Order 204609 as a re-test after the north brake repair. Section 3, "Work Plan Details," and Section 4 "Restoration" of Procedure Temp T31E-A00 was not performed. These sections included the brake tests. In 2010, no repair of the north mechanical load brake was performed.

In 2011, after five casks had been loaded for the 2011 loading campaign, Grand Gulf issued Condition Report CR-GG-2011-6019, which identified that the north mechanical load brake had not been repaired in response to the 2009 failure of the brake test at the completion of Cycle 17. The condition report referenced Work Order 204609 and the plans to order the necessary material to replace the mechanical load brake.

In addition to the problem with the north mechanical load brake, Condition Report CGGN-2009-2750 was issued May 28, 2009, identifying a problem with the gear teeth on the hoist main pinion and bull gear. During a periodic crane inspection, a significant amount of galling on the south gear set was observed. There was no galling on the north gear set. The pinion gear was a 12 inch gear with galling on most of the teeth. The bull gear was an 84 inch gear with intermittent galling to a lesser degree. Engineering Change (EC)-15316 was issued and a determination was made to use-as-is since the affected gears did not provide a safety function. Increased inspection of the gears was recommended. Procedure 20-S-02-01, Revision 2 was issued to include a requirement to inspect the galling on the gears prior to loading each cask in the 2009 campaign. If no additional wear was observed after the final cask was loaded in 2009, the gear inspection was to return to an annual frequency. This was not the first time this problem had been observed. The same problem had been identified in Condition Report CR-GG-2006-3131 where the gears had been found to be dry and galled. This was documented in NRC Inspection Report 72-50/2001-03 (Adams Accession ML063550164) issued December 21, 2006. Failure of the gears would result in automatic activation of the shoe type holding brakes on an overspeed or electrical power failure condition. This would prevent the load from dropping.

f. Permanent Record Storage

During the inspection the week of August 28 - 30, 2012 at the Grand Gulf site, a number of records were requested related to the content of the casks currently stored at the site and the records related to safety evaluations performed in compliance with 10 CFR 72.48. Delays and difficulty in providing these records prompted the NRC to expand the scope of this inspection to further evaluate the records retention program at Grand Gulf. This included the availability of permanent records in storage that are required by 10 CFR Part 72 and to verify the retrievability of these records. The permanent records for Grand Gulf are not all stored on the Grand Gulf server. Some are stored on the Entergy server and some are hard copies stored in the records vault. A backup records vault for the Grand Gulf records was located at the River Bend station. Back-up of Grand Gulf electronic records was provided on a duplicate server. On September 26, while at the River Bend Station conducting an inspection of their ISFSI program, the NRC inspectors met with the Grand Gulf licensing representative and the River Bend Supervisor of Administrative Services and continued the search for records.

Records related to the ISFSI are required to be made available to the NRC inspectors in accordance with 10 CFR 72.82 and 72.242. There are a number of record retention requirements specified in 10 CFR 72.48, 72.174, 72.212, and 72.234. These include documentation such as files related to the manufacture and testing of the casks, evaluation of changes made to the casks, information on the spent fuel stored inside the loaded casks, maintenance performed on the casks, procedures that were implemented that related to important to safety activities, etc. These records are required to be maintained for the life of the ISFSI or until the Commission terminates the license or Certificate of Compliance. The records must be retrievable.

Procedure EN-AD-103, "Document Control and Records Management Programs," Revision 13, described the Entergy records management program. This procedure specifically included requirements related to ISFSI records. ISFSI records were required to be labeled as "ISFSI Records" and were required in Section 5.6.6 to be retained as

long as the material was stored and for a period of 5 years after the material was disposed of or transferred out of the ISFSI. Records were required to be maintained at duplicate and separate locations sufficiently remote that a single event would not destroy both sets of records. Attachment 9.13, "Record Type Table," had incorporated the ISFSI records in the list of types of records for all the organizational groups at the plant that would generate these types of records, including operations, maintenance, licensing, radiation protection, and engineering.

To determine the retrievability and completeness of the records for the Grand Gulf casks that were currently loaded, specific information was requested related to the cask records required by 10 CFR 72.212(b)(12). This section of Part 72 required accurate records to be maintained that list the spent fuel stored in each cask. However, the meaning of "list of spent fuel" is not defined. Specific fuel information will need to be provided to the Department of Energy (DOE) when they take possession of the casks at some future date. Though Yucca Mountain may no longer be considered an option for final disposition of the industry's nuclear spent fuel, the Yucca Mountain effort to develop a license application conducted over several years and monitored by the NRC provided an insight into plans that DOE may have for the fuel. DOE's basic concept and modeling for a permanent repository involved repackaging the spent fuel into smaller canisters of a different design (Alloy 22) specifically developed to maximize the long-term integrity of the canister while in storage in the tunnels (drifts). DOE's plans to repackage the fuel and to establish each package within specific bounding parameters used in the long-term modeling for the licensing process required that DOE have specific information on each spent fuel assembly. This included information related to the specific type of fuel stored in each canister, the age of each assembly since removal from the reactor, the original enrichment, burn-up and operating history information per assembly, etc. This information will be needed by DOE to demonstrate compliance with license conditions and to verify the canisters placed in the repository are bounded by the modeling performed in the license application. The review of the records for the casks stored at Grand Gulf was to determine if this type of information would be available as part of the permanent records.

DOE's current concept for receipt of fuel is that not all casks will be taken from a single site at one time and that the shipments for any individual site may occur over a period of several years. As such, DOE would be accepting one or more individual casks and expecting all records for those casks to be provided at the time of removal from the licensee's site. This requires that all records related to the individual casks be readily retrievable for turnover to DOE. When considering that current estimates are beyond 2040 before any casks would be moved, many plants will be shut down and the current staff members that know how to find the records will be retired. For this reason, it is important that records for an individual cask are consolidated such that they can be located by a person with no previous knowledge of how the records were filed.

As a test of the ability to retrieve the necessary records, Grand Gulf was requested to provide information for the spent fuel stored in the currently loaded 17 casks at the site. Attachment 2 of this inspection report provides some of the information collected; however, more detail than that listed in the table was requested to determine if the data needed by DOE would be readily retrievable. The effort by Grand Gulf required several weeks with numerous contacts among various plant personnel to locate a portion of the requested records. In some cases the records were not in the permanent files but in historic caskloader files kept at the Entergy corporate office in Jackson, Miss. These

records provided the enrichment values for each assembly that were not found in the permanent record system. In addition, the misloading of Casks 4 – 7 discussed in Section 1.2.(g) of this Inspection Report, resulted in the recalculation of the heat load for those four casks. When searching the records for Cask 4, only the original data was found for the fuel assemblies, not the corrected data. The key report that re-calculated the heat load was NEAD-SR-08/021, “GGNS Dry Fuel Storage Heat Load Data.” This report was found during a search of the permanent record files for that specific document; however, the attachments to the document that contained the new heat load values were on a CD which was not available on the server. During the River Bend inspection conducted two weeks after the Grand Gulf inspection, the supervisor of administrative services at the River Bend station provided assistance to the NRC and the representative from Grand Gulf to locate the CD. She was very efficient in finding information on the electronic system that gave her the information to locate the specific box that contained the CD. The NRC accompanied the supervisor of administrative services to the permanent storage facility where she was able to locate Box 23 that had the CD. It was noted that the permanent record center was a large well protected facility with a halon system that contained many file cabinets and boxes of documents and CDs. The CD was verified as readable and the records extracted. The CD contained pdf and excel files with the corrected heat load values for Casks 4 - 7 on the files Real\_case\_N4.xls, Real\_case\_N5.xls, Real\_case\_N6.xls, and Real\_case\_N7.xls. There was no clear connection between the CD and the records for Casks 4 - 7 found in the electronic permanent files. As such, there was no evidence that the corrected heat load data for Casks 4, 5, 6, or 7 would have been included in the turnover package for the specific casks.

The effort to locate records related to the spent fuel stored in the 17 casks at Grand Gulf was extremely difficult and as such did not provide confidence that all the required records for each cask would be identified and turned over with the cask. Though there was no evidence that required records were not in the permanent system, the effort to confirm this during the short period of this inspection made it inconclusive that Grand Gulf fully meets the record requirements of Part 72. As a result, Condition Report CR-HQN-2012-1111 was issued. The condition report was written as an Entergy-wide issue. This was appropriate because, during the search of records for River Bend as part of the NRC inspection at the River Bend station, it was also found that the same problems in locating records existed.

g. Fuel Misloading of Four Canisters

On June 19, 2008, Entergy notified the NRC in Event Notification Report # 44306 of the discovery of an error in the caskloader database that may have resulted in the loading of four canisters that were not in compliance with the Certificate of Compliance. The spent fuel assemblies selected for loading in the canisters had been selected from the Entergy caskloader database, which had evaluated the assemblies through the first 10 reactor operations cycles. Cycle 10 was the cut-off. However, 188 fuel bundles were re-used in the reactor after Cycle 10, which was not reflected in the calculations in the caskloader database.

Further evaluation determined that Canister MPC-45 (Cask 4) had been loaded with a number of spent fuel assemblies that exceeded the decay heat and/or burnup limits specified in Amendment 2 of the Certificate of Compliance 1014, Appendix B “Approved Contents and Design Features.” This canister plus three others had also been loaded

without the required use of the supplemental cooling system. An NRC inspection was conducted November 17 - 19, 2008, concerning the event and documented in Inspection Report 50-416/08-08; 72-50/08-02 dated December 15, 2008 (ADAMS Accession ML083510602). As a result of the inspection, two non-cited Level IV violations were issued. Subsequent to the inspection, on December 22, 2008, Entergy submitted a one-time exemption request to the NRC. The request included information from Holtec with corrected calculations for the spent fuel assemblies that showed Canister MPC-45 had been loaded with eight spent fuel assemblies that exceeded the burnup and/or decay heat limits of the Certificate of Compliance. This included two assemblies that exceeded the 45,000 Megawatt Day/Metric Ton Uranium (MWD/MTU) limit in Technical Specification Appendix A, Section 3.1.4 which required the use of the supplemental cooling system. In addition, Canisters MPC-69 (Cask 7), MPC-214 (Cask 5), and MPC-215 (Cask 6) also contained spent fuel assemblies that exceeded the 45,000 MWD/MTU limit in Technical Specification Appendix A, Section 3.1.4 that required the use of the supplemental cooling system. On June 17, 2009, the NRC issued an evaluation (ADAMS Accession ML091670452 and ML 091670482) of the information provided by Entergy to support the exemption request and determined that the analysis performed supported the conclusion that the fuel cladding had remained below the design limit of 400 degree C. The exemption was approved to allow for the continued storage of the spent fuel in the affected four canisters. The 72.212 Evaluation Report, Section 6.4, "Exemptions," included a short discussion of the misloading event.

New heat load values and burnup values were calculated for the four affected canisters. Entergy document GNRO-2008/00065, "Entergy Request for Holtec HI-STORM 100 System, Grand Gulf Nuclear Station Unit 1" (proprietary), dated December 22, 2008, provided information on the affected spent fuel assemblies in the four canisters. Tables provided the original decay heat and burnup calculated value and the revised value for each affected spent fuel assembly. Document NEAD-SR-08/021 "GGNS Dry Fuel Storage Heat Load Data," provided a revised total heat load for the four canisters. The corrected values were on a CD and were retrieved from the backup records center at the River Bend station. The files with the correct values for the total cask heat load at the time of loading were Real\_case\_N4.xls, Real\_case\_N5.xls, Real\_case\_N6.xls, and Real\_case\_N7.xls. These corrected values have been included in Attachment 3 to this inspection report.

h. License Condition 9: Supplemental Cooling System

Holtec Certificate of Compliance 1014, Amendment 5, License Condition 9 "Special Requirements for First Systems in Place," required that each first time user of the supplemental cooling system that was not essentially identical to components or a system that had been previously tested shall measure and record coolant temperatures for the inlet and outlet of cooling provided to the annulus between the HI-TRAC transfer cask and canister, including the coolant flow rate. The user shall also record the canister operating pressure and decay heat. An analysis shall be performed, using this information that validates the thermal methods described in the FSAR which were used to determine the type and amount of supplemental cooling necessary. A report summarizing the results of each supplemental cooling system test and analysis shall be submitted to the NRC.

On October 14, 2011, Entergy Operations, Inc. submitted a report to the NRC (ADAMS Accession ML112870571) providing the results of the supplemental cooling system



(SCS) test conducted July 13, 2011, on HI-STORM Cask 534 (Cask 15) at the Grand Gulf site. The cask was a HI-STORM-100S-B overpack with a heat load of 18.74 kW. Data collected included SCS inlet temperature, SCS outlet temperature, and flow rate. Hourly data was collected over a 21 hour period. Backfill pressure of the cask was 51.5 pounds/square inch, which equated to a pressure of 29.3 psig at a reference temperature of 70 degree F. The SCS inlet temperature started at 145 degree F and SCS outlet temperature at 133 degree F. At the end of the 21 hours, the SCS inlet temperature was 108 degree F and the SCS outlet temperature was 100 degree F. Flow rate during the test ranged from 15 to 18 gallons/minute. The data was forwarded to Holtec for review and analysis. On September 30, 2011, Holtec responded to Entergy stating that, after review of the data provided by Grand Gulf, the SCS was determined to be operating in accordance with Appendix 2.C of the HI-STORM FSAR. The Holtec letter was attached to the October 14, 2011, letter submitted by Entergy to the NRC.

The SCS is operated at Grand Gulf using Procedure 20-S-01-150 "DFS Supplemental Cooling System Operations" which was designated as a safety-related procedure. Revision 3, TCN 001 changed the procedure to remove the calibration requirement for the flow meter that supplied water to the cask. A Process Applicability Determination was performed that determined the change could be made to the procedure to delete the calibration requirement because neither the as-purchased system design, the Certificate of Compliance, or the FSAR required a flow meter in the SCS. The FSAR, Appendix 2.C, "Supplemental Cooling System," described the SCS function, and Figure 2.C.1 provided a drawing of the system showing the system components. Neither the discussion of the system or the drawing required a flow meter.

FSAR, Section 8.0, "Introduction," stated that Table 8.1.7 summarizes some of the instrumentation used to load and unload the HI-STORM 100 System. Table 8.1.7, "HI-STORM 100 System Instrumentation Summary for Loading and Unloading Operations" listed flow rate monitors. A footnote to the table stated that all instruments required calibration. Based on Table 8.1.7, the NRC inspectors took exception to the conclusion reached that the flow meter was not required to be calibrated. Even though the flow meter may not be required for SCS operations, the use of the flow meter was necessary to satisfactorily perform the thermal validation test of License Condition 9, which specifically stated that coolant flow rate was to be measured as part of the test.

Calibration records for the flow meters were reviewed. The change to Procedure 20-S-01-150 was initiated after the SCS test required by License Condition 9 was completed. Calibration records were reviewed for the three liquid vortex flow meters (Serial Numbers E115019GF, E115021GF, and E115025GF) that were available for use on the system at the time of the thermal testing on July 13, 2011. All three flow meters had been calibrated on June 24, 2011. As such, the flow meter used to collect the data for the thermal test had been calibrated. The licensee issued Condition Report CR-GGN-2012-10254 on August 29, 2012, to address whether the flow meter required calibration after completion of the SCS test. The licensee planned to contact Holtec for clarification of the calibration requirement as it related to the supplemental cooling system.

i. Failure to Perform Helium Leak Testing of Canisters During Fabrication, Holtec Information Bulletin (HIB) - 39

The NRC issued a non-cited violation to Holtec International in a letter dated August 6, 2009 (ADAMS Accession ML092180140 *incorrectly dated as August 5, 2009*) entitled

“Exercise of Enforcement Discretion – Holtec International,” concerning a modification to the Holtec FSAR, which eliminated the requirement for the shop helium leak rate test during canister fabrication. The requirement had been in Section 7.1.3, “Seals and Welds” of Revision 3 of the FSAR and was removed in Revision 4. The leak rate test was designed to demonstrate that the canister seam shell and shell-to-baseplate welds were leaktight. The NRC disagreed with Holtec that the leak test could be eliminated and required Holtec to reinstate the leak test. Between the time the helium leak testing was discontinued during canister fabrication until the time the testing was reinitiated, several canisters had been manufactured and sent to reactor sites. Holtec informed the affected users of the issue in Holtec Information Bulletin (HIB)-39.

One of the sites affected was Grand Gulf. When Grand Gulf became aware of the issue, they initiated Condition Report CR-GGN-2009-3928 to document the problem and track corrective action of the issue. Seven affected canisters at Grand Gulf had been loaded with spent fuel. These were the first seven canisters loaded at the site. The maximum heat load of the seven canisters was determined to be 21.8197 kW at the time of placement on the ISFSI pad. Holtec provided a letter to the NRC dated September 2, 2009 (ADAMS Accession ML092470363) in response to the noncited violation issued in the August 6, 2009, NRC letter. Holtec’s response included analysis that supported continued use of the loaded canisters that had not been leak tested during fabrication.

On November 2, 2010 (ADAMS Accession ML103090653), Entergy Operations, Inc. provided information to the NRC related to the seven loaded Grand Gulf canisters. The Entergy letter provided information that had been requested by the NRC during a teleconference on December 1, 2009 (ADAM Accession ML093510008). Entergy noted that, as of June 2008, all canisters were below the 21 kW limit discussed in the teleconference, that no discernable increase in offsite dose had been detected, and that the nonconforming condition of the canisters had been entered into the site corrective action program and an operability determination had been performed which concluded that the affected canisters continued to perform within their designed safety function. The NRC responded to Entergy by letter dated January 26, 2011 (ADAMS Accession ML110270139) stating that the NRC had reviewed the information provided by Holtec and the information provided by Entergy and had determined that the affected canisters currently stored at the Grand Gulf ISFSI were acceptable for continued use. No further actions were necessary.

In addition to the seven loaded canisters, five other canisters had been received at Grand Gulf for future loading that had not been helium leak tested during fabrication. These were Canisters MPC-223 thru MPC-227 planned for loading as the 8<sup>th</sup> through 12<sup>th</sup> casks. Canister MPC-223 had been immersed in the spent fuel pool, but loading had not commenced at the time of notification of the issue. This canister was removed from the spent fuel pool and decontaminated prior to testing. Holtec personnel and Leak Testing Specialists, Inc. personnel conducted helium leak tests of the canisters at the site. NRC inspectors were present for a portion of the tests to confirm the adequacy of the testing techniques and procedures, qualifications of the testing personnel, and completeness of the records of the testing. NRC Inspection Report 72-50/2009-01 dated October 29, 2009 (ADAMS Accession ML093050016) documented the NRC’s observation of the canister tests at Grand Gulf. In addition to NRC observation of the leak testing activities, the licensee’s quality assurance organization performed a surveillance of the leak testing and issued Surveillance Report QS-2009-GGNS-014 dated August 26, 2009. The surveillance included observation of work activities to

confirm activities were being performed in compliance with procedural steps, review of personnel qualification and training documents, and review of calibration records for equipment used in the testing. All five canisters passed the leak tests. The Grand Gulf 72.212 Evaluation Report, Section 6.5 "Canister Leakage Testing," included a short paragraph documenting the issue with the affected canisters.

j. Thermal Issues During Canister Loading, NRC Information Notice 2011-10

NRC Information Notice (IN) 2011-10, "Thermal Issues Identified During Loading of Spent Fuel Storage Casks" (ADAMS Accession ML111090200) was distributed to all holders of a Part 72 license on May 2, 2011. The purpose of the notice was to inform the addressees of an incident that occurred during the loading of spent fuel storage canisters at the Byron Generation Station. The NRC expected recipients to review the information for applicability to their facilities and take appropriate actions to avoid similar problems. Byron, using the HI-STORM 100 system, experienced a canister cooling system malfunction. The circulating water in the annulus between the canister and transfer cask (annulus cooling) used to keep the fuel cladding temperatures below allowable limits was found to be inoperable after being left unattended during the night shift. The annulus cooling system was required when loading higher kW canisters using the vacuum drying option. The information notice discussed six potential issues related to the incident, five of which related to vacuum drying. Since Grand Gulf used the forced helium dehydration system instead of vacuum drying, these issues were not applicable. The sixth issue related to the use of nitrogen for blowing down the canisters to remove water prior to backfilling with helium and sealing the canister. Since Grand Gulf used helium for the blowdown, this issue was also not applicable.

k. Determination of Total Heat Load, Holtec Information Bulletin (HIB) - 51

Holtec issued Holtec Information Bulletin (HIB)-51, Revision 0, on October 25, 2011 and Revision 1 to the bulletin on December 14, 2011 to the Holtec users group. The bulletin applied to users of the Certificate of Compliance, Amendment 5 or greater. The bulletin discussed an operational issue that was discovered at Tennessee Valley Authority (TVA) by Holtec, when providing technical support to that user. Holtec determined that TVA had calculated the total heat load of their canisters by using a simple summation of the individual assembly heat loads. This practice was later found to be the case for many Holtec users, including Grand Gulf. Casks 8 - 17 had been loaded to Certificate of Compliance, Amendment 5 prior to the date of issuance of HIB-51.

Summing the individual storage cell heat loads to determine compliance with canister threshold heat load limits was not consistent with FSAR Section 2.1.9.1.2. This section in the FSAR contained a discussion on the total canister heat load ( $Q_{CoC}$ ) and how to calculate it for compliance to various Technical Specifications. For uniform loading (which is how Grand Gulf loaded fuel),  $Q_{CoC}$  is defined as the highest heat load assembly multiplied by the number of locations in a canister ( $r_{max} * n$ ). Grand Gulf used the MPC-68 canister with 68 fuel storage locations. Holtec stated that the conservative method of calculating total heat load was necessary as otherwise the system designer would have to consider an infinite number of heat load distributions and that would be practically impossible. It was easier for the system designer to assume all locations were generating a heat load of  $r_{max}$  to run the thermal model to ensure peak fuel cladding temperature limits were not exceeded. The FSAR Section 2.1.9.2 method of calculating heat load  $Q_{CoC}$  applied to the helium backfill requirement (TS Table 3-2), the

supplemental cooling system requirement (TS 3.1.4), the requirement for use of the forced helium dehydration system (TS Table 3-1), the heat removal system requirement (TS 3.1.2), and the vacuum drying time limit requirement (TS 3.1.1).

Grand Gulf had loaded all ten Amendment 5 canisters using the uniform heat load criteria but had calculated each canister's heat load using the simple summation method of summing all individual assembly's heat loads vice using the method described in FSAR Section 2.1.9.2 ( $Q_{CoC} = r_{max} * n$ ). Upon receiving HIB-51, Revision 0, from Holtec, Grand Gulf initiated Condition Report CR-RBS-2011-7579 on October 26, 2011. The condition report documented the issue and stated that information on the content of the ten casks had been sent to Holtec for analysis. Holtec submitted an analysis to Grand Gulf in "Response to Request for Technical Information (RRTI) # 2005-004" dated November 5, 2011. The RRTI documented that of the ten vulnerable casks, all of which were initially calculated to be less than 28.19 kW (using summation method); MPC serial numbers 352, 353, and 354 were in fact above 28.19 kW when calculated in accordance with the FSAR guidance ( $Q_{CoC}$ ). The  $Q_{CoC}$  values for MPC-352, MPC-353, and MPC-354 were 33.96, 33.81, and 33.92 kW, respectively. These three canisters should have been filled with the higher helium backfill pressure ( $\geq 45.5$  psig and  $\leq 48.5$  psig) per Technical Specification Table 3-2. When loading the higher kW assemblies as allowed in Amendment 5, only the higher backfill pressure scenario had been previously analyzed in the FSAR. The actual backfill pressure for MPC-352, MPC-353, and MPC-354 was 29.3, 30.2, and 29.6 psig, respectfully. In accordance with the Technical Specification action requirements, Grand Gulf, with assistance from Holtec, performed an evaluation to demonstrate all FSAR limits for cask components were met. The RRTI stated that the thermal models using the fuel characteristics of the three canisters and the actual amount of helium in those canisters demonstrated that the peak cladding temperature limits for both the short-term operations and long-term storage conditions stayed below the 752°F (400°C) limit for all three casks. The RRTI concluded that the as-loaded canisters met all applicable acceptance criteria set forth in the system's FSAR.

Condition 2 of Certificate of Compliance 1014, Amendment 5, stated that written operating procedures shall be prepared for cask handling, loading, movement, surveillance, and maintenance, and that user's site-specific written operating procedures shall be consistent with the technical basis described in Chapter 8 of the FSAR. Contrary to this requirement, Grand Gulf's site-specific written operating procedures were not consistent with the technical basis described in Chapter 8 of the FSAR. Chapter 8, Section 8.1.5 "MPC Closure" step 6.n stated "... backfill the MPC in accordance with technical specifications." Grand Gulf's Procedure EN-DC-215 "Fuel Selection for Holtec Dry Cask Storage," Revision 2, was not consistent with the technical basis because it did not contain the correct methodology to calculate cask heat load ( $Q_{CoC}$ ). As a result, from July 16 - 29, 2011, the heat loads were incorrectly calculated for Casks 15 - 17 (MPC Serial Numbers 352, 353, and 354), which caused the casks to be backfilled with less helium than specified in the technical specifications. NRC has determined that this is a Severity Level IV violation of Condition 2 of CoC 1014. Because this violation was entered into the licensee's corrective action program, an analysis was performed demonstrating that the canisters still met all criteria set forth in the FSAR, the licensee's Procedure EN-DC-215 was changed in Revision 3 to correctly calculate future cask heat load ( $Q_{CoC}$ ) values, and the issue was not a repetitive violation or willful, this violation is being treated as a Noncited violation, consistent with Section 2.3.2 of the NRC Enforcement Policy.

Condition Report CR-GGN-2012-8756 stated an additional analysis was performed by Echelon Fuels and Analysis in NEAD-SR-12-012-R0-EC38367, Revision 0. This analysis utilized Regulatory Guide 3.54 and ASB 9-2 methodology to determine what the decay heat of Canisters MPC-352, MPC-353, and MPC-354 was at the date of April 17, 2012. The recalculated values showed only Canister MPC-353 having a  $Q_{CoC}$  heat load above 28.74 kW (32.69 kW). The analysis stated that the  $Q_{CoC}$  heat load value for Canister MPC-353 would not decay below 28.78 kW until January 1, 2018. Technical Specification 3.1.2 required vent blockage to be removed from around the vents within 24 hours vice 64 hours if the heat load ( $Q_{CoC}$ ) was above 28.78 kW. As such the licensee took appropriate actions and made a change to Surveillance Procedure 06-OP-1000-D-0001 "Data Sheet Daily Operating Logs 24-Hour Requirements" Revision 142, which stated: "If more than one vent on spent fuel Cask 1F16D002AR at ISFSI Location 26 is found blocked, HI-STORM CoC 1014 Amendment 5 LCO 3.1.2 Actions C.2.1 and C.2.2 shall be limited to 24 hours vice 64 hours. This rule shall be in effect until 1/1/2018."

i. Isolation of Loaded Canisters, Holtec Information Bulletin (HIB) - 53

Holtec Information Bulletin HIB-53 was issued to the Holtec users group on December 6, 2011. The bulletin described an issue that was observed by NRC inspectors at the Waterford nuclear plant (ADAMS Accession ML12124A387). While Waterford was loading their first canister, operators isolated the canister by closing both the vent and drain port caps during installation of the remote valve operating actuators. Having both port caps closed at the same time isolated the canister without having any release path or relief valve available while the canister was filled with water and fuel. This could have pressurized the canister due to the thermal heat of the spent fuel. The Holtec bulletin reminded users that the vent and drain port caps should not be closed simultaneously and that the remote valve operating actuators must be installed one at a time in the open position when the canister is filled with water. Grand Gulf issued Condition Report CR-GGN-2012-9955 to review the bulletin and document the applicability of the issue at their site. The condition report required a change to Procedure 20-S-01-0002 "DFS Cask Loading" to include specific instructions to avoid hydraulic isolation of the canister when loaded and generating heat. This procedure change was being tracked for completion by March 28, 2013, which would be prior to the next fuel loading campaign.

m. Stack-Up During Canister Downloading Into the HI-STORM Storage Cask

At Grand Gulf, the licensee utilized a lateral seismic restraint system when downloading a canister from the HI-TRAC transfer cask into the HI-STORM storage cask. The HI-STORM is placed on the low profile transporter in a regressed platform, such that the HI-STORM is restrained by the low profile transporter. The low profile transporter is then restrained by the placement of pins on either side to ensure no movement during the stack-up evolution. The HI-TRAC is placed on top of the HI-STORM and mating device. At that time four seismic restraint arms, which are attached to various structural members in the fuel building structure, engage the top of the HI-TRAC on all sides, precluding any movement in the event of an earthquake. Condition Report CR-GGN-2011-1943 was issued March 21, 2011, to capture the stack-up issue identified in Region III related to one of their sites which had been identified as not having an adequate restraint system for protection against the affects of an earthquake during stack-up. Grand Gulf's Design Engineering group reviewed the issue and determined that the lateral restraint used at Grand Gulf provided adequate restraints.

### 1.3 Conclusions

A quality assurance audit was underway of the ISFSI which provided an opportunity for the NRC inspectors to interface with the auditors. This audit was being performed to comply with 10 CFR 72.176 and to be specific to ISFSI activities. Past ISFSI audits had been part of the plant's Part 50 Appendix B audit program which covered programs such as radiation protection, operations, engineering, maintenance and others that overlapped into the dry cask storage program, but did not focus on ISFSI specific topics. The recent change to the audit program being implemented by Entergy will include an ISFSI specific audit on a 24-month schedule.

Radiological dose rates around the ISFSI pad were less than 1 mrem/hr gamma and neutron. No unexpected radiological conditions were observed during the tour. The ISFSI pad area was properly posted.

Personnel doses during cask loading were typically around 0.2 person-rem per cask and ranged from 0.350 to 0.115 person-rem for the 17 casks loaded. Of this, 20-30 percent was due to neutron exposure as recorded on the electronic neutron dosimeters worn by the workers. An improving trend was noted as more casks were loaded.

Vent surveillances of the loaded casks were being implemented in accordance with Technical Specification 3.1.2. Six months of selected records were reviewed for the time period of 2008 - 2012. No vent blockage issues had been found during the daily vent surveillances.

Selected condition reports were reviewed for the period 2008 thru 2012. A wide range of issues had been identified and resolved. Resolution of the issues was appropriate for the safety significance of the issue. No adverse trends were identified during the review.

An issue with the spent fuel cask handling crane was reviewed concerning the north mechanical load brake. The brake had failed the annual testing in 2008 and had been identified in 2011 as still not repaired. An evaluation had been performed in 2008 which concluded that the crane could be considered single failure proof even with the north mechanical load brake inoperable. The NRC reviewed the basis for this determination and agreed with the conclusion based on the redundancy of the braking systems on the crane.

Retrievability of permanent records was reviewed during this inspection. Selected records related to specific casks were requested of the licensee that were required by 10 CFR Part 72. Delays and difficulty in providing the requested records resulted in extending this portion of the inspection. Though there was no evidence that the required records were not in the permanent record system, the extreme difficulty in retrieving the records in the time period of the inspection brought into question whether Grand Gulf was fully in compliance with the record requirements in 10 CFR Part 72. The licensee issued a condition report to evaluate their ability to locate all records specific to an individual cask.

On June 19, 2008, Entergy notified the NRC of the discovery of an error in the software used to evaluate the acceptability of selected spent fuel assemblies to meet the criteria of the Certificate of Compliance for loading into the Holtec casks. The error resulted in

the misloading of three casks. An NRC inspection in 2008 resulted in two noncited violations related to the issue.

This inspection reviewed the final outcome of the issue and the one-time exemption by the NRC to allow for the continued storage of the casks at the Grand Gulf ISFSI.

Holtec License 1014, License Condition 9, required a test of the supplemental cooling system under certain conditions. Grand Gulf had performed a test on July 13, 2011, and submitted the test results to the NRC. After the test had been completed, Grand Gulf planned to eliminate the calibration requirement for the flow meter on the system. This was identified by the NRC Inspectors as inconsistent with the requirements in the Holtec FSAR. A condition report was issued to obtain clarification from Holtec concerning the calibration requirement.

In 2009, a concern related to Holtec's decision to stop the helium leak testing of the Holtec canisters during fabrication was identified by the NRC. As a result, Holtec agreed to reinstate the helium leak test. However, during the interval in which testing had been suspended; a number of canisters had been distributed by Holtec that had not been tested. Grand Gulf had received seven of the affected canisters and had loaded the canisters with spent fuel and placed them on the ISFSI pad. Five more had been received but had not been loaded. The NRC determined after review of the information provided by Entergy and Holtec, that the seven loaded canisters were acceptable for continued use. The five unloaded canisters were helium leak tested before they were loaded with spent fuel.

Grand Gulf had reviewed a number of industry issues that could have an impact on the dry fuel storage program. This included issues related to NRC Information Notice 2011-10, heat load calculations related to Holtec HIB-51, isolation of the canister while filled with water related to Holtec HIB-53, and stack-up of the transfer cask on the storage during canister downloading. One noncited violation was issued to Grand Gulf for their failure to place the required amount of helium into Casks #15 - 17 due to miscalculating the total heat loads of those casks.

## **2 Review of 10 CFR 72.212(b) Evaluations at Operating Plants (60856.1)**

### **2.1 Inspection Scope**

Changes to the 72.212 Evaluation Report since the last NRC inspection were reviewed to verify site characteristics were still bounded by the Holtec HI-STORM 100 design basis.

### **2.2 Observations and Findings**

The current version of the 72.212 Evaluation Report was Revision 7. Two revisions had been completed since the last NRC inspection and were reviewed during this inspection. These were Revision 6 and Revision 7. License Basis Document Change Request (LBDCR) 2011-038 documented Revision 6. This revision converted the Grand Gulf 72.212 Evaluation Report to a stand-alone site-specific document instead of keeping it as an attachment in the Entergy fleet document. The change added information to reflect the 2011 cask loading campaign. License Basis Document Change Request 2012-021 documented Revision 7. The licensee made a change to add a list that contained the "placed in service date" for each of the 17 casks that were currently on the

ISFSI pad. The report was updated to document that the recently loaded canisters were constructed with a split lid, which may have transportation restrictions. This applies to MPCs 224, 225, 226, 227, 350, 351, 352, 353, and 354.

### 2.3 Conclusions

Two revisions to the 72.212 Evaluation Report had been issued since the last NRC inspection. The changes were consistent with the current site conditions and updated information concerning loaded casks at the site.

## 3 **Review of 10 CFR 72.48 Evaluations (60857)**

### 3.1 Inspection Scope

The licensee's 72.48 screenings and evaluations since the 2008 NRC inspection were reviewed to determine compliance with regulatory requirements.

### 3.2 Observations and Findings

The licensee is required by 10 CFR 72.48(d)(2) to submit a report to the NRC containing a brief description of any changes, tests, and experiments at an interval not exceeding 24 months. Reports were reviewed back to April 2007. All four reports were issued within the 24-month period. The last report was for the period through June 30, 2011. No 10 CFR 72.48 evaluations were reported for the period from April 2007 through June 2011. Since June 2011, no 10 CFR 72.48 evaluations have been performed.

The licensee utilized Procedure EN-LI-112, "10CFR72.48 Evaluations," Revision 9 for preparing, reviewing, approving, and documenting 72.48 evaluations. Procedure EN-LI-100 "Process Applicability Determination," Revision 11 was used to perform a screening of an issue to determine if a 10 CFR 72.48 evaluation was required. The licensee's system does not have the capability to list all 72.48 process applicability determinations (screenings) and evaluations that have been performed since the last inspection. Instead, specific plant modification packages must be requested and the package reviewed to find the 72.48 process applicability determination and evaluation. Two 72.48 process applicability determinations were reviewed associated with the ECS related to the revision to the 72.212 Evaluation Report (EC-29699 and LDC-2012-021), two were reviewed associated with crane engineering changes (EC-15316 and EC-16388), and one (EC-12751) was reviewed associated with the use of Certificate of Compliance, Amendment 5, and FSAR, Revision 7, for loading of future casks. None of the screenings required a full safety review. The changes made to the 72.212 Evaluation Report that were reviewed using the 10 CFR 72.48 process are discussed in the preceding section (Section 2) of this inspection report.

### 3.3 Conclusions

The 72.48 screenings reviewed during this inspection were determined to be adequate. No 72.48 evaluation had been performed in the past 4 years. The required reports related to the 72.48 evaluations had been submitted to the NRC.



#### **4 Exit Meeting**

The inspector reviewed the scope and findings of the inspection during an initial exit conducted on August 30, 2012. A final exit was conducted September 26, 2012, upon completion of the permanent records storage portion of the inspection at your back-up records center at the River Bend Station.

## ATTACHMENT 1

### SUPPLEMENTAL INSPECTION INFORMATION

#### **PARTIAL LIST OF PERSONES CONTACTED**

##### Licensee Personnel

R. Bevily, Health Physics/Chemistry Specialist III  
D. Ellis, Sr. Project Manager, Dry Fuel Storage  
N. Ernst, Quality Assurance Supervisor  
M. Lock, Sr. Lead Engineer (72.48 reviewer)  
E. Mason, Quality Assurance Auditor  
R. Scarbrough, Senior Licensing Specialist  
T. Tankersley, Nuclear Oversight Mgr  
U. Wells, Health Physics Technician

#### **INSPECTION PROCEDURES USED**

IP 60855.1 Operations of an ISFSIs at Operating Plants  
IP 60856.1 Review of 10 CFR 72.212(b) Evaluations at Operating Plants  
IP 60857 Review of 10 CFR 72.48 Evaluations

#### **LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

##### Opened

72-50/1201-01	NCV	Failure to meet CoC Condition 2 to have adequate procedures, which caused Casks 15 - 17 to be backfilled with less helium than specified in the technical specifications.
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##### Closed

72-50/1201-01	NCV	Failure to meet CoC Condition 2 to have adequate procedures, which caused Casks 15 - 17 to be backfilled with less helium than specified in the technical specifications.
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#### **LIST OF ACRONYMS**

C	Centigrade
CFR	Code of Federal Regulations Italics
CoC	Certificate of Compliance
DOE	Department of Energy
F	Fahrenheit
FSAR	Final Safety Analysis Report

HIB	Holtec information bulletin
IP	inspection procedure
ISFSI	Independent Spent Fuel Storage Installation
kW	killo-watt
MPC	multi-purpose canister
mR	milliRoentgen
MPC	multipurpose canister
mrem	milliRoentgen equivalent man
MWD/MTU	megawatt days/metric ton uranium
NRC	Nuclear Regulatory Commission
OER	operational experience review
PPM	plant procedure manual
psi	pounds per square inch
psig	pounds per square inch gauge
TLD	thermoluminescent dosimeter
TS	technical specification

## ATTACHMENT 2:

### CONDITION REPORTS REVIEWED DURING THE INSPECTION

Condition Report	Severity Level	Description
2008-6757	C	Industry problems related to cask loading at other sites was discussed in INPO Significant Events Report SER 3-08 "Problems During Dry Fuel Storage Activities." These issues were reviewed for applicability at Grand Gulf. Procedures and training were reviewed to verify that the issues in SER 3-08 were adequately addressed.
2009-0419	C	Certificate of Compliance (CoC), Amendment 5, License Condition 9, required a thermal performance test of the first cask placed in service with a heat load equal to or greater than 20 kW. The Holtec FSAR does not provide guidance on how to conduct the test. Clarification is needed from Holtec.
2009-2750	C	Galling of the gears on the spent fuel cask handling crane hoist main pinion and bull gear was found during the crane's periodic inspection. The affected gears did not provide a safety function. Engineering personnel performed an evaluation and determined that the crane could continue to be used. Increased inspections were scheduled including an inspection prior to each cask loading in 2009 and an inspection following the last cask loaded in the 2009 campaign. Further degradation would be documented on a new condition report and would require an additional engineering evaluation prior to further use.
2009-3632	C	During preventive maintenance testing of the spent fuel cask handling crane on July 17, 2009, the north load brake failed the brake test three times. The south load brake passed all three tests. The crane was declared inoperable. The condition report stated that replacement of the brake was required prior to the next loading campaign. Engineering Change (EC) 16388 was initiated.
2009-3928	C	The issue related to Holtec discontinuing the helium leak test of the canisters during fabrication is discussed in this condition report and relates to HIB-39. This issue is discussed in this inspection report in Section 1.2.(i).
2009-5396	C	An assessment was conducted of the data in the caskloader database. A review of the fuel assembly parameters in the data base found nine errors related to enrichment, total uranium, or grams U-235 listed in the data base for specific spent fuel assemblies. Eight errors were minor. The enrichment value for Assembly GEB496 was listed in the data base as 3.343%. The correct value was 3.849% (15% error). None of the fuel assemblies had been loaded in a cask. A human performance error review was completed. The data had received an independent review; however, due to the large number of parameters in the data base (14,540 parameters), fatigue was

Condition Report	Severity Level	Description
		identified as the cause for failure to recognize the error during the review.
2011-0732	B	This was a headquarters condition report related to ISFSI audits and stated that 10 CFR 72.176 audits were not being conducted as required. The issue was a result of an industry evaluation conducted at Vermont Yankee. Prior to this time, audits conducted of the Part 50 programs were credited to meeting the 10 CFR 72.176 requirement since the same program elements were being audited. However, ISFSI specific aspects of the Part 50 programs were not necessarily being audited. As a result, the audit Procedure EN-QV-109 was revised to establish the requirement for stand-alone ISFSI audits on a 24-month cycle at the Entergy sites.
2011-1943	C	NRC Region III, during an inspection at one of their sites, identified a seismic issue related to the free standing stack-up configuration of the transfer cask on top of the HI-STORM storage cask in the train bay while the loaded canister was being downloaded. This issue was reviewed for applicability to the Grand Gulf dry cask storage program. Grand Gulf uses a lateral constraint system during the downloading operation. The Condition Report moved the issue to CR-2011-0036, CA Number 120. Design engineering reviewed the issue and determined that no new actions were required by Grand Gulf and that the current lateral constraint system meets the requirements.
2011-4777	D	The ISFSI had not been incorporated into the Entergy QA audit program either as a required stand alone audit or as a scope element of an existing master audit plan. This issue was also entered into the corporate program as CR-HQN-2011-0732. As a result, Entergy established a stand-alone ISFSI inspection requirement in Procedure EN-QV-109 on a 24-month cycle.
2011-4908	C	Fuel assembly GEC 665 loaded in Cell 42 of Canister MPC-353 had a bent channel clip spring. The fuel assembly fully seated in its assigned location. The issue was observed during loading. The spent fuel assembly was removed from the canister and replaced with assembly SPF 787.
2011-6019	D	This condition report, written August 26, 2011, identified that the brake repairs on the spent fuel cask handling crane north mechanical load brake identified in Condition Report CR-GGN-2009-3632 and EC-16388 had not been completed. The crane was still considered as a single failure proof crane since the south mechanical load brake was operational and only one set of load brakes is required.
2011-7579	C	Holtec issued Holtec Information Bulletin (HIB) 51 related to calculating the heat load for the canister. This condition report reviewed the impact on Grand Gulf. This issue is discussed in this inspection report in Section 1.2.(k).

Condition Report	Severity Level	Description
2012-8756	C	As a result of the issue identified in Condition Report 2011-7579 related to HIB-51, spent fuel Cask 1F16D002AR (Cask 16) was identified as exceeding the heat load value that required implementation of a 24-hour limit for removing blockage from the vents per Technical Specification 3.1.2. This issue is discussed in this inspection report in Section 1.2.(k).
2012-9951	C	The isolation of a canister at Waterford during cask closure operations while still filled with water resulted in a condition report being issued by Waterford (CR-WF3-2012-1994) that described the incident. Grand Gulf issued a condition report that reviewed the situation and assessed how the event could apply to the Grand Gulf loading procedures. The condition report also referenced HIB-53 which had been issued by Holtec alerting the Holtec cask users of the issue.
2012-10254	C	Procedure 20-S-01-150, "Supplemental Cooling System (SCS) Operations" Revision 3 (TCN #1 dated 7/19/11), removed the requirement to calibrate the flow meter on the SCS. FSAR, Revision 7, Table 8.1.7 stated that flow rate monitors require calibration. The SCS was designated as important-to-safety (ITS-B). The flow meter was not required for the operation of the system and was not shown in the system drawings or discussed in the SCS operations manual. The licensee planned to contact Holtec for clarification of the intent of Table 8.1.7.

**ATTACHMENT 3**

**LOADED CASKS AT THE GRAND GULF NUCLEAR STATION ISFSI**

<b>LOADING ORDER</b>	<b>MPC SERIAL No.</b>	<b>HI-STORM Serial No</b>	<b>DATE ON PAD</b>	<b>HEAT LOAD (kW)</b>	<b>BURNUP MWd/MITU (max)</b>	<b>MAXIMUM FUEL ENRICHMENT %</b>	<b>PERSON-REM DOSE</b>
1	MPC-47	32	11/18/06	12.26	34,320	3.42	0.252
2	MPC-44	35	12/01/06	15.48	35,866	3.42	0.236
3	MPC-46	33	12/08/06	19.11	43,546	3.71	0.218
4	MPC-45	59	12/15/06	21.82	46,297	3.71	0.246
5	MPC-214	269	04/21/08	19.14	46,215	3.71	0.350
6	MPC-215	270	04/28/08	19.35	46,301	3.71	0.279
7	MPC-69	271	05/05/08	19.03	45,941	3.71	0.262
8	MPC-225	333	09/01/09	19.73	44,933	3.71	0.177
9	MPC-226	334	09/10/09	19.81	44,653	3.71	0.208
10	MPC-227	335	09/16/09	19.86	44,882	3.71	0.218
11	MPC-224	332	12/09/09	18.92	44,622	3.71	0.191
12	MPC-223	331	12/16/09	18.94	44,943	3.71	0.159
13	MPC-350	532	06/29/11	18.01	44,945	3.71	0.197
14	MPC-351	533	07/01/11	16.29	44,857	3.71	0.126
15	MPC-352	534	07/16/11	18.74	48,290	3.87	0.161
16	MPC-353	535	07/23/11	19.09	49,591	3.87	0.115
17	MPC-354	536	07/29/11	18.93	49,431	3.87	0.116

- NOTES:
- Heat load (kW) is the sum of the heat load values for all spent fuel assemblies in the cask
  - Burnup is the value for the spent fuel assembly with the highest individual discharge burnup
  - Fuel enrichment is the spent fuel assembly with the highest individual "initial" enrichment percent of U-235

Casks 1 – 7 were loaded under Certificate of Compliance, Amendment 2; Holtec Final Safety Analysis Report, Revision 3

Casks 8 – 17 were loaded under Certificate of Compliance, Amendment 5; Holtec Final Safety Analysis Report, Revision 7

Casks 4 – 7 Values of heat load and burnup reflect corrections to the caskloader data files in 2008. Burnup values were from the CD file Burnup\_adjustments.xls of NEAD-SR-08/021. The heat load values were from the same CD in the files Real\_case\_N4.xls through Real\_case\_N7.xls