



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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December 15, 2008

James R. Douet
Vice President of Operations
Grand Gulf Nuclear Station
Entergy Operations, Inc.
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: NRC INSPECTION REPORT 050-00416/08-008; 072-00050/08-02

Dear Mr. Douet:

An inspection of the storage and loading operations associated with the Grand Gulf Independent Spent Fuel Storage Installation (ISFSI) was conducted on November 17-19, 2008. The purpose of the inspection was to review the circumstances associated with the fuel misloading event that was reported to the NRC in Special Report 2008-001 and to review the final resolution of the crane deficiencies that were discovered during the preoperational inspection conducted in 2006. A portion of the spent fuel cask crane maintenance procedures and records were also reviewed by the inspectors between May 8 and September 11, 2008. The enclosed inspection report documents the results of this inspection, which were discussed with members of your staff on November 19, 2008.

Based on the results of this inspection, the NRC has determined that two violations of NRC requirements occurred. The violations involved: (1) loading spent fuel assemblies into a Multi-Purpose Canister (MPC) that exceeded the fuel decay heat and burn-up limits specified in Appendix B of the Certificate of Compliance (CoC); and (2) failure to have an operable Supplemental Cooling System in use during the loading operation of four canisters as required by Technical Specification 3.1.4.

These Severity Level IV violations are being treated as noncited violations (NCVs) consistent with Section VI.A of the Enforcement Policy. The NCVs and the circumstances surrounding the violations are described in the enclosed inspection report. These violations are not being cited, in part, because your staff discovered the deficiencies and are in the process of taking appropriate actions to prevent recurrence. If you contest the violations or severity level of the NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with a copy to the Regional Administrator, Region IV and the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact the undersigned at (817) 860-8191 or Mr. Ray Kellar at (817) 860-8164.

Sincerely,

/RA/

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

Docket: 50-416
72-050
License: NPF-29

Enclosure:
Inspection Report 050-00416/08-008; 072-00050/08-02
w/Attachment: Supplemental Information

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SUNSI Review Completed: RLK ADAMS: Yes No Initials: RLK
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RIV:DNMS/RSFS	RII/DRP	NMSS/SFST	C:RSFS
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U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Dockets: 050-0416; 072-0050

Licenses: NPF-29

Report: 050-00416/08-008; 072-00050/08-002

Licensee: Entergy Operations, Inc.

Facility: Independent Spent Fuel Storage Installation
Grand Gulf Nuclear Station
Waterloo Road
Port Gibson, MS

Dates: May 8 through November 19, 2008

Inspectors: R. Kellar, PE, ISFSI Inspector, DNMS, RIV
S. Atwater, Senior Project Engineer, DRP, RII

Approved By: B. Spitzberg, Ph.D., Chief
Repository and Spent Fuel Safety Branch

EXECUTIVE SUMMARY

Grand Gulf Nuclear Station
NRC Inspection Report 050-0458/08-008; 072-0050/08-002

An inspection of the Grand Gulf Nuclear Station Independent Spent Fuel Storage Installation facility was conducted on November 17-19, 2008. The circumstances associated with the fuel misloading event reported to the NRC in Special Report 2008-001 which was dated July 17, 2008, were reviewed with members of your staff. Representatives from Entergy corporate fuels group were on site to discuss the cause of the fuel selection error and provide details of the fuel assemblies which had been loaded into the four canisters. Information was provided of corporate plans to implement procedural changes to prevent recurrence and enhance procedures used by each site to select the fuel assemblies for loading.

During the preoperational inspections conducted during 2006, numerous deficiencies were identified on the Grand Gulf Nuclear Station spent fuel cask crane. As part of the licensee corrective action process, all the deficiencies were addressed or corrected prior to beginning the initial cask loading campaign. However, a number of the crane deficiencies were identified by the NRC as requiring additional inspection to insure that adequate maintenance and repairs had occurred. The NRC started the inspection of the crane maintenance and repair issues during May 2008 and completed the inspection on November 19, 2008.

Operation of an Independent Spent Fuel Storage Installation (60855.1)

- Entergy identified eight fuel assemblies that had been loaded into Multi-Purpose Canister serial number 45, that did not meet the fuel specifications for maximum allowable decay heat or fuel burn-up limits as set forth in Appendix B to HI-STORM 100, Certificate of Compliance 1014, Amendment 2. This was a violation of Condition 6 of the Certificate of Compliance, which required that the fuel loaded into the MPC must meet the Appendix B fuel specifications. This noncited violation was self-identified and appropriate corrective actions are being taken by the licensee (Section 1.2.a).
- Entergy identified that fuel assemblies with burn-up values which exceeded 45,000 MWD/MTU had been loaded into Multi-Purpose Canister serial numbers 45, 69, 214, and 215 without the use of the Supplemental Cooling System. This was a violation of Technical Specification 3.1.4 that required the use of an operational Supplemental Cooling System when the Multi-Purpose Canister contained one or more fuel assemblies with an average burn-up greater than 45,000 MWD/MTU. This noncited violation was self-identified and appropriate corrective actions are being taken by the licensee (Section 1.2.a).
- The inspection of the Grand Gulf Nuclear Station spent fuel cask crane conducted in October 2006 resulted in the identification of numerous deficiencies and maintenance issues. The NRC reviewed the corrective actions and procedural changes that the licensee had performed. The previously identified deficiencies had been repaired and procedural changes had been implemented to ensure that adequate maintenance and testing of the spent fuel cask crane would occur (Section 1.2.b).

REPORT DETAILS

Summary of Facility Status

Grand Gulf Nuclear Station (GGNS) is a General Electric boiling water reactor (BWR) owned by Entergy. The facility is located near Port Gibson, Mississippi. A total of seven spent fuel storage casks had been loaded and placed on the Independent Spent Fuel Storage Installation (ISFSI) pad. The licensee had loaded the casks under the general license requirements of the Holtec HI-STORM 100, Certificate of Compliance (CoC) 1014, Amendment 2.

1 Operation of an ISFSI (60855.1)

1.1 Inspection Scope

An inspection of the Grand Gulf Nuclear Station ISFSI was conducted to investigate the licensee's June 24, 2008, report of spent fuel assemblies that had been loaded into Holtec HI-STORM 100 Multi-Purpose Canisters (MPCs) that did not meet the fuel specifications contained in CoC 1014, Appendix B. Additionally, a follow-up inspection was conducted to evaluate the GGNS spent fuel cask crane maintenance issues and crane deficiencies that had been identified during the preoperational ISFSI inspections conducted in 2006.

1.2 Observations and Findings

a. Fuel Loading Error

The inspector reviewed Root Cause Analysis Report RCER 2008-12, "Cask Loader Database Error," CR-GGN-2008-00 2844, dated July 17, 2008, and Special Report 2008-001, "Violation of Certificate of Compliance 1014 Cask Load Limits for HI-STORM 100 System," dated July 17, 2008. The two reports provided the sequence of events that had occurred leading to the fuel loading error, the extent of conditions which had been investigated by Entergy, and the corrective actions that had been taken. Supplemental fuel assembly data that compared the fuel characteristics at the time of loading to the calculated values in 2008 were provided in a white paper prepared by the licensee titled, "BWR Fuels' Input to Licensing Regarding the GGNS Cask Loader Error." Relevant facts from the reports along with information gathered during interviews with representatives of the corporate fuels group are presented in the following paragraphs.

On June 18, 2008, an Entergy employee was updating the CASKLOADER database which was used to identify the fuel assemblies that met the Holtec HI-STORM 100, CoC 1014, requirements for loading into MPC canisters. It was discovered during this review that the decay heat and fuel burn-up exposure data shown in the CASKLOADER database for Fuel Assembly GEA265 appeared to be lower than anticipated. During the subsequent investigation into the fuel assembly data, several other fuel assemblies were also identified that had not been correctly maintained and updated in the CASKLOADER database. The corrected decay heat and burn-up fuel assembly values exceeded the fuel assembly limits which were specified in the CoC 1014, Appendix B, requirements.

The NRC was contacted with preliminary data from the licensee's discovery on June 24, 2008. During the phone call, the licensee also reported that supplemental cooling should have been utilized during the cask loading operations as required by Technical Specification 3.1.4. However, supplemental cooling equipment had not been available

during the cask loading operations because all the spent fuel assemblies were believed at the time to be below the burn-up value that required the use of supplemental cooling of 45,000 megawatt days (MWD) per metric-ton uranium (MTU). Following the discovery of the fuel assembly documentation discrepancy, the licensee reviewed the fuel assembly data and reported that all of the loaded casks were currently in compliance with the Technical Specification decay heat requirements as of June 24, 2008.

Special Report 2008-001 was submitted to the NRC on July 17, 2008, in accordance with the 30-day requirement specified in HI-STORM 100, CoC 1014, Amendment 2, Appendix B, Section 2.2. The report provided a summary of the cause of the event along with immediate corrective actions taken. Long-term corrective actions were to be addressed by Condition Report CR-GGN-2008-02844. An exemption request was planned to address the fuel assemblies that had been loaded which did not meet the CoC or Technical Specification requirements.

The licensee reported that the cause of the event could be attributed to an engineer that had modified an existing CASKLOADER database, which was in use at another Entergy BWR plant, for use at GGNS. The CASKLOADER database was used to identify the fuel assemblies that were eligible for loading into the Holtec MPC in accordance with the CoC requirements. The engineer did not know that the fuel assembly burn-up information was intended to be updated annually in the CASKLOADER database. Therefore, when the modified CASKLOADER database was established for use at GGNS, this annual update of fuel assembly information was not incorporated into the process of maintaining the CASKLOADER database for GGNS fuel assemblies. The GGNS CASKLOADER database was established using the fuel assemblies from the first 10 fuel cycles. As the GGNS fuel assemblies in the CASKLOADER database were used in Fuel Cycle 11 and beyond, the subsequent burn-up data was never updated to reflect the actual burn-up information. Both the initiating engineer and the second engineer responsible for reviewing the documentation failed to recognize that the database should be updated annually to capture changes to the fuel characteristics, including burn-up and decay heat.

Entergy implemented immediate corrective actions, which included a review of the fuel assembly burn-up data for the entire GGNS CASKLOADER database. Additional corrective actions included a review of the burn-up information in the River Bend Station CASKLOADER database and a sample of the burn-up information from each discharge cycle in the Arkansas Nuclear One database. The fuel assembly databases associated with other Entergy plants, consisting of Fitzpatrick, Indian Point, Vermont Yankee, and Palisades, were confirmed to not be affected.

The data supplied with Special Report 2008-001 indicated that eight fuel assemblies loaded into MPC serial number 45 exceeded the maximum allowable decay heat limit or the fuel burn-up limit at the time of loading. A review of the database included with the licensee whitepaper, "BWR Fuels' Input to Licensing Regarding the GGNS Cask Loader Error," indicated that eight assemblies exceeded the decay heat limit of 414 watts and six of these same assemblies also exceeded the burn-up limit of 43,087 MWD/MTU at the time of loading. Appendix B of the CoC lists the fuel specifications which must be met before the fuel can be loaded into the Holtec MPC, including limits on decay heat and burn-up. Failure to meet the fuel specifications set forth in Appendix B is a violation of CoC 1014, Condition 6, which specified that the contents of the HI-STORM 100 cask system must meet the fuel specifications given in Appendix B of the CoC. This violation was identified by the licensee and has been entered into their corrective action program

as Condition Report CR-GGN-2008-2844. This Severity Level IV violation is being treated as a noncited violation (NCV), consistent with Section VI.A of the NRC Enforcement Policy (NCV 72-50/0802-01).

Special Report 2008-001 also stated that MPC serial numbers 45, 69, 214, and 215 contained at least one fuel assembly that required the use of supplemental cooling per the requirements of Technical Specification 3.1.4. The cask loading dates for the respective canisters were reported as MPC 45 – December 10, 2006; MPC 69 – April 13, 2008; MPC 214 – April 21, 2008; and MPC 215 – April 28, 2008. The database included with the whitepaper, “BWR Fuels’ Input to Licensing Regarding the GGNS Cask Loader Error,” documented that, at the time of cask loading, two assemblies loaded into MPC 45, two assemblies loaded into MPC 69, two assemblies loaded into MPC 214, and three assemblies loaded into MPC 215 had exceeded 45,000 MWD/MTU. At the time of the cask loading operations for MPC serial numbers 45, 69, 214, and 215, the licensee did not use a Supplemental Cooling System. This is a violation of Technical Specification 3.1.4, which required in part that the Supplemental Cooling System be operable when the MPC contained one or more fuel assemblies with an average burn-up greater than 45,000 MWD/MTU. This violation was identified by the licensee and has been entered into their corrective action program as Condition Report CR-GGN-2008-2844. This Severity Level IV violation is being treated as an NCV, consistent with Section VI.A of the NRC Enforcement Policy (NCV 72-50/0802-02).

The licensee reported that all the fuel assemblies that had been loaded into MPC serial numbers 45, 69, 214, and 215 currently meet the CoC 1014, Appendix B, fuel specifications. However, the licensee also reported that eight of the fuel assemblies loaded into MPC 45 on December 10, 2006, did not meet the applicable CoC 1014, Appendix B, Technical Specification limits for decay heat and fuel burn-up at the time of loading, but that, due to the passage of time, those assemblies have cooled further and are now within the limits specified in the CoC. The inspector discussed the licensee’s position with staff from the Division of Spent Fuel Storage and Transportation (SFST) in NRC’s Office of Nuclear Material Safety and Safeguards. SFST staff confirmed that the CoC Technical Specification requirements for the fuel are applicable at the time of fuel loading operations and not at some distant time in the future. The original analyses performed by the cask vendor and approved by the staff for the HI-STORM 100 system, CoC 1014, Amendment 2, were based on specific assumptions of the fuel characteristics at the time of loading, which in turn formed the basis for the CoC Technical Specification limits. The fact that the misloaded assemblies have subsequently cooled to a level below the Technical Specification limit does not address the concern that assemblies with heat loads greater than those previously reviewed and approved by the NRC were loaded and may have resulted in higher peak fuel cladding temperatures, an unanalyzed condition. Under the Part 72 regulations, neither the general licensee nor the cask vendor can make changes to the CoC or the Technical Specifications without receiving prior review and approval from the NRC. Therefore, the continued storage of any fuel assemblies that did not meet the CoC Technical Specification limits at the time of loading requires additional evaluation and approval of the NRC, in order to restore compliance with the regulations of 10 CFR Part 72.

Discussions with representatives from the Entergy fuels group indicated that an improved fuel selection process was under development that would utilize a corporate-wide procedure for fuel assembly selection. Until the new fuel selection process was implemented, the Entergy fuels group indicated that additional oversight would be employed to validate that the fuel met the CoC requirements.

b. Spent Fuel Cask Crane

The GGNS spent fuel cask crane was initially inspected on October 9 -13, 2006, as part of the licensee's dry fuel storage preoperational testing program. The inspection found that the crane had not been inspected, tested, or maintained in accordance with American Society of Mechanical Engineers (ASME) B30.2, "Overhead and Gantry Cranes," or NUREG 0554, "Single Failure Proof Cranes." Prior to starting the dry fuel loading campaign in December 2006, the licensee had corrected or addressed all the deficiencies that had been identified. The NRC stated in the inspection report that maintenance issues and crane deficiencies would be evaluated in a future inspection.

On May 8, 2008, the NRC began a follow-up inspection to verify that the corrective actions taken by the licensee since the 2006 inspection were effective. As part of this inspection, the identified deficiencies were reviewed and compared to the crane inspection and maintenance programs.

The bridge and trolley travel limit switches were found to be inoperable during the preoperational inspection. New bridge and trolley limit switches were installed by Work Order (WO) 009495901 and tested as part of the initial installation that occurred in December 2006. Procedure 07-S-14-228, "Frequent PM Checks Spent Fuel Cask Crane," Revision 004, required that the limit switches be tested on a periodic basis in Operation Check 8.9.

High levels of particulate were found in the hoist motor gearbox during the preoperational inspection. The inspector found that oil samples were being taken from the spent fuel cask crane on an annual basis using Procedure 07-S-14-226, "Spent Fuel Cask Crane Periodic Inspection," Revision 008. Samples were reported to have been taken on July 7, 2007, and July 15, 2008. Based on the oil sample test results, the predictive maintenance engineer confirmed that there was no evidence of recurring metal particulate being found in the oil samples. The most recent oil sample indicated that the oil in the hoist motor gearbox was of a hybrid viscosity, which necessitated an oil change. On September 29, 2008, the oil was drained and refilled from the hoist gearbox using WO 0016225201.

The hoist primary bull gear and pinion gears were found to be dry and galled during the preoperational inspection. The galling was determined to be minor abrasive wear due to lack of lubrication by the crane vendor. The structural integrity of the gear teeth had not been challenged by the galling. The gears were relubricated prior to the initial cask loading. The licensee had revised Procedure 07-S-14-227, "Lubrication of the Spent Fuel Cask Crane," Revision 004, to require lubrication of the bull gear and pinion in step 7.2.5. Procedure 07-S-14-226, had been revised to require an inspection of the gears in step 7.3.2. The gears were last lubricated under WO 0012257401, which was dated August 20, 2008.

The wire rope equalizing system was found inoperable during the initial preoperational inspection. The nitrogen and hydraulic systems were recharged prior to the cask loading campaign. Procedure 07-S-14-226 had been updated in Revision 8 to include an inspection of the wire rope equalizing system. However, this revision was implemented after the last crane inspection had been performed in July 2008. No evidence could be found that the wire rope equalizing system had ever been inspected since the recharging that had occurred on October 23, 2006. On November 19, 2008, the inspector observed the mechanics checking the accumulator pressure using WO 00173124, "Spent Fuel

Cask Crane-Inspect Rope Equalizer,” and Procedure 07-S-14-226, Revision 8. The mechanics obtained the pressure reading on the equalizer accumulator which was 304 psig, using a calibrated pressure gage. The required minimum pressure for the accumulator was specified as 300 psig in Procedure 07-S-14-226, step 7.18. Therefore, the wire rope equalizing system was operable.

The load hang-up protection system was found to be inoperable in October 2006. Prior to the initial loading, the hoist motor overcurrent relay was set to the equivalent of 125 percent of the full rated crane load to provide protection. The licensee determined that the hoist load cell was not able to be repaired. The licensee incorporated testing and adjustment of the hoist motor overcurrent relay into Section 4.5 of Model WO 50292958. Originally, the licensee had provided two methods to protect against a load hang-up, namely a load cell and the hoist motor overcurrent relay. NUREG 0554 only required one method to protect from a load hang-up which included the use of a load cell, a motor current sensing device or a mechanical load limiting device. Therefore, the use of the overcurrent device to provide load hang-up protection met the requirement of NUREG 0554.

Several crane components were identified during the preoperational crane inspection that had not been adequately maintained. The inspector reviewed licensee procedures to verify that inspection and testing actions had been generated to adequately maintain the crane in an operable status.

- The bridge and trolley hydraulic brakes were found to be marginally operable during the preoperational inspection. Prior to loading, the brakes were inspected, cleaned, adjusted, and retested. The inspector found that the bridge and trolley hydraulic brake inspections and adjustments had been incorporated into Sections 8.1 and 8.2 of Procedure 07-S-14-228, “Frequent PM Checks Spent Fuel Cask Crane,” Revision 004. The hydraulic brake testing for the bridge and trolley had been incorporated into steps 7.11 and 7.12 of Procedure 07-S-14-226.
- The north mechanical load brake for the main hoist was found to be inoperable on September 26, 2006. The adjusting nut was frozen and the brake could not be returned to service prior to the initial cask loading campaign. The licensee reviewed the loss of the north mechanical load brake using the 10 CFR 50.59 process. Since the hoist was equipped with dual and independent gear trains, either mechanical load brake was determined to be capable of holding the load. The licensee refurbished the north mechanical load brake under WO 00102026. Inspections and necessary adjustment of the mechanical load brakes were incorporated into Section 8.3 of Procedure 07-S-14-228.
- The inspection records for the full length of the wire rope could not be located and an inspection was performed on October 17, 2006, prior to the initial cask loading. Wire rope inspection activities were found to have been incorporated into Section 7.13 of Procedure 07-S-14-226.
- In October 2006, actuation of the electric holding brakes on hoist motor overspeed and loss of phase had not been tested. The hoist motor overspeed and loss of phase feature were adjusted and satisfactorily tested prior to the initial cask loading campaign. Testing of the overspeed device and loss of phase protection was incorporated into Model WO 50292958, Sections 4.2 and 4.3.

- In October 2006, no documentation could be located that the eddy-current brake had ever been tested. The eddy-current brake serves to slow the rate of descent of the load during a loss of all holding brakes. The licensee tested the eddy-current brake on October 20, 2006, and found the operation to be within specifications. Testing of the eddy-current brake had been incorporated into Model WO 50292958, Section 4.1.

1.3 Conclusions

Entergy identified eight fuel assemblies that had been loaded into MPC serial number 45 that did not meet the fuel specifications for maximum allowable decay heat or fuel burn-up limits as set forth in Appendix B to HI-STORM 100, CoC 1014. This was a violation of Condition 6 of the CoC, which required that the fuel loaded into the MPC must meet the Appendix B fuel specifications. This NCV was self-identified and appropriate corrective actions are being taken by the licensee.

Entergy identified that fuel assemblies with burn-up values which exceeded 45,000 MWD/MTU had been loaded into MPC serial numbers 45, 69, 214, and 215 without the use of the Supplemental Cooling System. This was a violation of Technical Specification 3.1.4, which required the use of an operational Supplemental Cooling System when the MPC contained one or more fuel assemblies with an average burn-up greater than 45,000 MWD/MTU. This NCV was self-identified and appropriate corrective actions are being taken by the licensee.

The inspection of the GGNS spent fuel cask crane conducted in October 2006 resulted in the identification of numerous deficiencies and maintenance issues. The NRC reviewed the corrective actions and procedural changes that the licensee had performed. The previously identified deficiencies had been repaired and procedural changes had been implemented to ensure that adequate maintenance and testing of the spent fuel cask crane would occur.

2 Exit Meeting Summary

An exit meeting was held with members of the licensee management at the conclusion of the inspection on November 19, 2008. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSON CONTACTED

Licensee

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O. Magee, Mechanical Coordinator
S. Rodgers, Predictive Maintenance Engineer
F. Smith, Manager, Fuel & Analysis
S. Stanchfield, Supervisor, BWR Fuels

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

72-50/0802-01	NCV	Failure to meet CoC Condition 6 requirement for loading fuel in compliance with CoC Appendix B specifications
72-50/0802-02	NCV	Failure to have operable Supplemental Cooling System when fuel assemblies exceeded 45,000 MWD/MTU as required by TS 3.1.4

Closed

72-50/0802-01	NCV	Failure to meet CoC Condition 6 requirement for loading fuel in compliance with CoC Appendix B specifications
72-50/0802-02	NCV	Failure to have operable Supplemental Cooling System when fuel assemblies exceeded 45,000 MWD/MTU as required by TS 3.1.4

Discussed

None

LIST OF ACRONYMS

ASME	American Society of Mechanical Engineers
BWR	boiling water reactor
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
GGNS	Grand Gulf Nuclear Station
ISFSI	Independent Spent Fuel Storage Installation
MPC	Multi-Purpose Canister
MTU	metric-ton uranium
MWD	megawatt days
NCV	noncited violation
NRC	Nuclear Regulatory Commission
SFST	Division of Spent Fuel Storage and Transportation
WO	work order