UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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July 17, 2008

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

SUBJECT: GRAND GULF NUCLEAR STATION - NRC SUPPLEMENTAL INSPECTION REPORT 05000416/2008009

Dear Mr. Douet:

On June 12, 2008, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Grand Gulf Nuclear Station. The enclosed inspection report documents the inspection findings which were discussed on June 12, 2008, with you and other members of your staff.

As required by the NRC Reactor Oversight Process Action Matrix, this supplemental inspection was performed in accordance with Inspection Procedure 95001. The purpose of the inspection was to examine the causes for and actions taken related to the performance indicator for unplanned scrams per 7000 critical hours crossing the threshold from Green (very low risk significance) to White (low to moderate risk significance). This supplemental inspection was conducted to provide assurance that the root causes and contributing causes of the events resulting in the White performance indicator are understood, to independently assess the extent of condition, and to provide assurance that the corrective actions for risk significant performance issues are sufficient to address the root causes and contributing causes and to prevent recurrence. The inspections examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel.

The NRC concluded that your staff performed thorough evaluations for each of the four reactor trips and performed a thorough and broad-based self-assessment to identify any performance and process issues that should be addressed as a result of the performance indicator crossing the threshold from Green to White.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be 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). ADAMS is accessible from the NRC Web site at http://www.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Geoffrey B. Miller, Chief
Project Branch C
Division of Reactor Projects

Docket: 50-416

License: NPF-29

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NRC Inspection Report 05000416/2008009
w/Attachment: Supplemental Information

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SUNSI Review Completed: DRB ADAMS: √ Yes □ No Initials: DRB
√ Publicly Available □ Non-Publicly Available □ Sensitive √ Non-Sensitive

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U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket:	50-416
License:	NPF-29
Report:	05000416/2008009
Licensee:	Entergy Operations, Inc.
Facility:	Grand Gulf Nuclear Station
Location:	Waterloo Road Port Gibson, MS 39150
Dates:	June 9 through June 12, 2008
Inspector:	D.R. Bollock, Project Engineer, Branch C, DRP
Approved By:	G.B. Miller, Chief, Project Branch C, DRP

SUMMARY OF FINDINGS

IR 05000416/2008-009, 6/09 - 6/12/08, Grand Gulf Nuclear Station; Supplemental Inspection of Unplanned Reactor Scrams. Inspection Procedure 95001, Inspection for One or Two White Inputs in a Strategic Performance Area.

This inspection was conducted by one regional inspector and included an in-office inspection and four days of onsite inspection. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

Cornerstone: Initiating Events

The U.S. Nuclear Regulatory Commission performed this supplemental inspection to assess Entergy's evaluation of the White performance indicator associated with the Grand Gulf Nuclear Station scrams. This supplemental inspection assessed Entergy's problem identification, root cause evaluation, and corrective actions associated with the unplanned scram performance indicator. Based on the results of this inspection, no findings of significance were identified.

The inspector determined that the licensee identified the most probable causes for each reactor scram, performed thorough review of extent of condition and extent of cause for each individual event and a collective common cause, and established appropriate corrective actions to prevent recurrence. Therefore, consistent with Inspection Manual Chapter 0305, the performance indicator was removed from consideration in the assessment process as of July 2008 when the calculated indicator returned to a Green characterization.

REPORT DETAILS

01 INSPECTION SCOPE

The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection in accordance with NRC Inspection Procedure (IP) 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area", to assess Entergy's problem identification, cause evaluation, and corrective actions associated with the Grand Gulf Nuclear Station unplanned scram performance. This performance issue was characterized as White in the second quarter 2008 performance indicators. A total of four scrams caused the performance indicator to cross the Green to White threshold on this occasion. A summary of the four scram events, including the licensee identified root or apparent cause, and corrective actions to prevent recurrence, are listed below:

- On May 19, 2007, a reactor scram occurred due to a turbine trip. The turbine trip was the result of a loss of condenser vacuum. This loss of vacuum was caused by the high pressure condenser neck expansion joint failure. The expansion joint failed at its splice connection, due to an inadequate splice joint. To correct this inadequate joint, a new more robust splicing process and procedure was used from a new vendor, that has been successfully employed in condensers at other nuclear plants.

- On August 21, 2007, a reactor scram on low water level occurred as the result of a closure of the Reactor Feed Pump A Turbine governor control valve. The governor control valve shut, slowing down the reactor feed pump causing a feed flow steam flow mismatch resulting in lowering water level. The governor valve shut due to a power failure interrupt signal from the feed water control system. At the time of the scram, workers were securing from routine maintenance in the Bailey INFI-90 digital feedwater control panel for Feed Pump A. Although a definite root cause was not determined, the most highly probable cause is a loss or momentary loss of the 5 vdc bus within the power module of the INFI-90 system. The long term corrective action is to replace the power supply module of the INFI-90 which is to take place during the next refueling outage.

- A manual scram occurred on January 12, 2008, due to loss of main transformer cooling. This was due to a loss of transformer auxiliary power caused by a short at the wiring termination for the Phase B power cables. The termination connection was loose, allowing a high resistance area and resultant burning of the cables. The root cause was determined to be inadequate original design of the compression type connection at the wiring terminal. The corrective action is to implement a modification to change the compression connection to a more robust crimped terminal lug bolted to the bus bar.

- On March 21, 2008, a reactor scram occurred due to a Phase C unit differential relay trip occurred. No actual differential was recorded between the current transformer (CT) at the generator neutral bushing and the CT at the output breakers in any phase. Though no root cause was determined, the analysis revealed three possible causes. First is an intermittent failure of the generator CT which had been replaced 1 year prior, second is an internal problem with the differential relay, third is an intermittent secondary circuit problem. All three of

these were analyzed and tested with no evidence of a problem with any of the three. The corrective actions to prevent recurrence are to replace the CT in question, replace the differential relay, and to test the wiring and secondary circuits. At the conclusion of this inspection, the relay had been replaced, the wiring tested, and the unit differential trip relay was connected to a different CT that had been in place and working properly without issue for years.

A common cause analysis was performed, to address the four scrams that caused the unplanned scram performance indicator to exceed the Green/White threshold in the first quarter 2008. The intent of the review was to identify common, underlying problems leading to the unit unplanned reactor scrams PI crossing the Green-White threshold and to determine the extent of cause and extent of condition. The common cause evaluation was a much broader review than each individual root cause analysis extent of condition and extent of cause evaluation, which considered both scrams and down powers dating back to January 2006. A common element was noted related to the four scrams, in that three of the scrams were related to design vulnerabilities of nonsafety-related systems. Another common element was a weakness in the life-cycle management to prevent equipment failures due to aging and material degradation. Entergy performed additional corrective actions since this common cause was believed to be well understood and would be addressed by the actions from other initiatives, such as a thorough review of all single point vulnerabilities in all the plant systems to determine whether preventive maintenance is following vendor recommendations and there is sound technical evaluation for any deviations, and updating long range plans to resolve failure risk.

Overall, the inspector concluded that Entergy adequately addressed the problem identification attributes of Inspection Procedure 95001. Regarding the problem resolution attributes of Inspection Procedure 95001, the inspector did not identify any common root causes for the four scrams; however, there were some common contributing causes including: poor life-cycle management to prevent equipment failures due to aging and material degradation and design vulnerabilities in balance of plant systems.

The inspector determined that the licensee adequately determined the root causes and significant contributing causes of the Initiating Events Performance Index for unplanned scrams per 7000 critical hours crossing the Green-White threshold in two of the four scrams and established appropriate corrective actions to prevent recurrence for all of the scrams. The two scrams in which the specific root cause could not be determined were reviewed for all probable and contributing causes and the corrective actions should prevent all identified causes from recurrence.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

a. Determination of who (i.e., licensee, self-revealing, or NRC) identified the issue and under what conditions:

   All four unplanned reactor scrams that caused the PI to cross the Green-White threshold were self-revealing.

b. Determination of how long the issue existed and prior opportunities for identification:

   The issues that caused two of the four scrams existed at least for a short period prior to

manifesting into the failure which caused the scrams. The high pressure condenser neck expansion joint failure degraded over time. This failure could have been identified during the previous outage during a visual inspection or replacement of the expansion joint. However, due to an administrative error the replacement planned for the outage previous to the failure had been rescheduled to a later date. The licensee had planned on changing this replacement frequency regardless of the administrative error. Though this has no bearing on the root cause or significant corrective actions, had the high pressure condenser neck expansion joint been replaced during the previous outage the scram would not have occurred. The loose wire termination for the main transformer auxiliary power supply had manifested itself over a long period of time. It is possible that this could have been identified had inspections of the termination included thermography.

The inspector concluded that the licensee had prior opportunities to identify the problems in some of the cases, but this did not impact the root or possible causes of the scrams.

c. Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue:

The risk significance was addressed as part of the investigations associated with each of the four scram events. The licensee found that the events were not risk significant. One finding stemming from the loss of condenser vacuum scram was determined to have very low safety significance. The finding deals with failure to properly calibrate the main condenser hydraulic vacuum switch that established a higher trip setpoint resulting in the premature turbine trip and reactor scram. This finding is described in NRC Inspection Report 05000416/2007-004.

The inspector agreed with the risk consequences determined by the licensee.

02.02 Root Cause and Extent of Condition Evaluation

a. Evaluation of methods used to identify root cause(s) and contributing cause(s):

To evaluate these scram events, the licensee utilized the following root cause analysis techniques:

Kepner-Tregoe Problem Analysis
Event and Causal Factor Charting
Cornerstone: Barrier Analysis

The inspector concluded that the quality of the root cause evaluations provided the rigor to ensure that the root cause evaluations were appropriate to determine the root causes and significant contributing causes of the reactor scrams. The inspector observed that the final three scrams relied upon only one analysis technique, Kepner-Tregoe. Though this is a rigorous technique it may be advantageous in the future to utilize other techniques as well to help support the findings.

b. Level of detail of the root cause evaluation:

The licensee's root cause evaluations were thorough and identified the primary root causes of the performance issues with two of the scrams. Two root causes were not identified, specifically, the Power Failure Interrupt scram and the Unit Differential Trip

could not point to one specific cause. However the root cause analysis was sufficient in determining all of the probable and contributing causes for the scrams and identified appropriate corrective actions to prevent recurrence.

The inspector concluded that the root cause evaluations were thorough in determining the root and possible causes.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience:

The licensee's evaluations included a review of internal (Grand Gulf Nuclear Station) and external operating experience. In general, these sections included relevant operating experience along with a discussion of how it applied or did not apply to the specific situation. The search was narrowed in the case of the INFI 90 since the licensee did not search for scrams due to loss of feed with no feed pump trip. The licensee reviewed operating experience dealing with the INFI 90 system at Grand Gulf and also looked into electrical shorts caused by inadvertent grounding by workers themselves and the test equipment. There was a failure of the INFI 90 power supply resulting in a reactor feed pump trip and a plant transient. The inspector observed that a broader search into similar loss of feed water without feed pump trip events could assist in determining appropriate corrective actions that would prevent recurrence. The high pressure condenser neck expansion joint failure root cause reviewed numerous previous failures at Grand Gulf and other sites. The failure of the expansion joint in this case was due to an inadequate splicing method. Through an operating experience search, the licensee found a much more robust splicing method.

The inspector concluded that overall the licensee took adequate consideration to the prior occurrences of the problem and knowledge of prior operating experience.

d. Consideration of potential common cause(s) and extent of condition of the problem:

The licensee's evaluation considered the potential for common cause and extent of condition for each of the scrams. Each root cause analysis report included a section discussing extent of conditions and extent of cause. The licensee also performed a more thorough common cause analysis for the scrams and recent down powers. This common cause analysis identified common weaknesses in the licensee's programs that contributed to the scrams. These weaknesses were related to design vulnerabilities of nonsafety-related systems and a weakness in the life-cycle management of systems to prevent equipment failures due to aging and material degradation.

The inspector agreed with the assessment done by the licensee for common causes and extent of condition. The corrective actions stemming from these have value in helping to prevent failures of balance of plant and critical support systems throughout the plant.

02.03 Corrective Actions

a. Appropriateness of corrective action(s):

The specified corrective actions were appropriate to the root and contributing causes that were identified in the root cause determination evaluations. In the case of the two scrams with no specific root cause found, the corrective actions taken for all of the

probable causes should prevent recurrence. The corrective actions stemming from the common cause analysis added value in reviewing all plant systems for single point vulnerable components and tracking their maintenance. This review also included ensuring that the component maintenance was following vendor recommendations or had sound technical reasoning not to.

The inspector concluded that the corrective actions taken for all four scrams are appropriate in the short term to prevent recurrence and the long term corrective actions are adequate in preventing the root causes and probable causes from recurrence.

b. Prioritization of corrective actions:

The licensee did not specify a priority for the specified corrective actions based on risk significance or regulatory compliance. However, the licensee did set dates of completion for the short term corrective actions and have scheduled completion of all long term corrective actions.

The inspector noted no examples of inappropriate prioritization of the corrective actions. The inspector concluded that the short term actions were completed in a timely manner and the long term actions scheduling is adequate to ensure safe operation of the plant and prevent future occurrences.

c. Establishment of schedule for implementing and completing the corrective actions:

The licensee established adequate schedules for completion of the specified corrective actions. As appropriate, some corrective actions were tied to scheduled equipment outages while others were more short term such as additional preventive maintenance, and procedural revisions.

The inspector did not identify any specific concerns with the scheduling or completion of established corrective actions, with the completion of all the most significant actions due at the end of their next refueling outage. The inspector did note that the system integrated plant database tool was in the process of implementation. This tool should help with managing the life-cycle of equipment to prevent failures, setting up a long term database to track materials and equipment as they age and degrade.

d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence:

The effectiveness review plan from each of the four condition reports from each scram was established to determine the measure of success of the corrective actions. Also, the system integrated plant database tool will be an additional trend of plant data to track equipment. A review of updated long range plans and a review of the design margin database in the next few months will give an indication of the effectiveness of some of the corrective actions.

The inspector concluded that sufficient action had been taken to reasonably prevent recurrence of similar events and that the effectiveness review plans will adequately measure the effectiveness of each corrective actions.

03 MANAGEMENT MEETINGS

Exit Meeting Summary

On June 12, 2008, the inspector presented the inspection results to Mr. J.R. Douet, Vice President-Nuclear and Chief Nuclear Officer, and members of his staff who acknowledged the findings. The inspector confirmed that no proprietary information was provided or examined during the inspection.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

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G. Lantz, Design Engineering Supervisor
P. Worthington, Engineering Program Supervisor
A. Fox, Senior Mechanical Engineer
C. Quick, Engineering Supervisor
M. Larsen, Licensing Manager
J. Owens, Senior Staff Licensing Engineer
J. Douet, Site Vice President

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Opened and Closed

None

Discussed

None

LIST OF DOCUMENTS REVIEWED

Work Orders

00058855 01	146454	51033534 01
111783	50292983	

Licensee Event Reports (LERs)

LER 2007-002-00	LER 2008-001-00
LER 2007-003-00	LER 2008-002-00

Condition Reports (CRs)

CR-GGN-1999-00207	CR-GGN-2007-04128	CR-GGN-2008-01476
CR-GGN-2006-01178	CR-GGN-2008-00174	
CR-GGN-2007-02743	CR-GGN-2008-00316	

Other

Grand Gulf Nuclear Station Safety Culture Review for Unplanned Scrams, April 8, 2008
Engineering Change EC 4538
Engineering Change EC 4948
Specification SPEC-08-00001-G
Contract Order No. 10195211