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U.S. Nuclear Regulatory Commission
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Subject: Response to NRC Request in IR 50-458/00-02
River Bend Station
License No. NPF-47
Docket No. 50-458

File Nos.: G9.5, G15.4.1

RBG-45380
RBF1-00-0133

Ladies and Gentlemen:

Inspection Report 50-458/00-02 of May 16, 2000, requested that Entergy Operations, Inc. (EOI) submit to NRC a response outlining current and future activities to address and correct emergency diesel generator operability, reliability, and availability issues. This letter is submitted pursuant to that request.

EOI fully understands the safety significance of challenges to the reliability of the diesel generators and is actively resolving those issues. While the majority of the issues involving the diesel generators did not affect safety function, they have impacted system availability. A sustained high level of performance is our goal.

Key elements of our plans regarding improvement of diesel generator performance, as well as addressing the other issues concerning operability evaluations and correction of repetitive problems are summarized in the attached response.

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There are no new commitments in this document. Should you have any questions regarding the attached information, please contact Mr. Joe Leavines of my staff at (225)381-4642.

Sincerely,



RJK/dhw
Attachment

CC:

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Background:

An assessment was chartered in March 1999 to review emergency diesel generator (DG) performance. This assessment used historical information and corrective action records to characterize the performance of the DG's. A condition report was generated on March 18, 1999, to document an adverse trend for the Division I and II emergency diesel generators. This condition report identified the occurrence of non-safety trips and component failures that resulted in increased unplanned availability and extended LCO's.

In response to the adverse trend identified in the condition report, a multi-department team was established to address issues involving the emergency diesel generators, to include the engines, the lube oil, jacket water, control and starting air systems, and the generators. This team's initial tasks were to:

- assure that all previous assessment recommendations were evaluated and entered in the corrective action process, as appropriate,
- review and prioritize existing modification requests and initiate new modification requests to address material conditions that directly impacted DG reliability,
- focus on improving interdepartmental communications, and
- reduce corrective maintenance backlogs.

The diesel team has been effective in establishing priorities for diesel work and facilitating coordination among organizations to achieve these priorities. A number of modifications have been completed, as described below. Additionally, a number of other equipment changes are currently being designed and planned to further improve reliability. The concerted focus on diesel performance has reduced the corrective maintenance backlog to five maintenance action requests for all three diesels combined as of the date of this letter. Further, the system engineers are more actively engaged in all maintenance activities to assure improved reliability and performance.

To achieve a sustained high level of performance for the diesels, a charter for the diesel team was developed to provide long-term expectations and responsibilities. The team will continue to maintain focus on diesel reliability and availability through review of corrective actions for adverse trends and review of equipment performance trends. The team will continue to champion new initiatives based on trends and performance data.

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Past significant challenges to the function of the DG's involved the starting/control air systems on the Division I and II DG's, and the engine-driven fuel pump on the Division I DG.

Starting / Control Air Systems

During the NRC inspection of River Bend's corrective action program in June 1998, questions were raised regarding the design and function of the subsystem that provides compressed air for the electro-pneumatic control system and for engine starting. Station engineers discovered in subsequent investigation that an error in the original design of the Division I and II DG's caused a condition in which the control system would cause an engine shutdown while in the emergency operating mode if control air pressure were lost. This is not consistent with the intended design in which the DG should continue to operate in the emergency mode if control air pressure is lost. This condition was confirmed in discussions with the DG vendor, who subsequently issued a 10CFR21 notification to the industry. In October 1998, the control systems were modified to restore the originally intended design function of the control air system.

In February 1999, River Bend engineers completed a failure modes and effects analysis (Engineering Report No. E/IC-99-003) to evaluate the electro-pneumatic control systems and determine whether the DG's would continue to operate upon a decrease in control air pressure leading to a complete loss of all control air pressure. This analysis also evaluated the effects of a restoration of air pressure in the system. The analysis used a combination of calculational methods and bench testing of components. Based on the analysis and testing, it was concluded that the DG's would not shut down on a loss of control air pressure, confirming our understanding of the system's functional design, and that no other problems remained undetected.

While the failure modes and effects analysis was being conducted, further modifications to the DG air systems were installed to maximize the reliability of the system and reduce its maintenance requirements. In the first and second quarters of 1999, the air compressors were replaced with units of an improved, safety-related design. Additionally, the electrical power supplies for the compressors were moved

to the standby switchgear supplied by the respective DG's and the air dryers were changed to a newer design that require no external power. RBS considers the installation of safety-related air compressors and more reliable power to be prudent to "harden" the system and not a required action (since air is not needed after starting). This view is held because the system's design intent has been restored by correcting the original design deficiency.

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Fuel Oil Pump

In March 1999, the Division I DG was undergoing a scheduled surveillance test when the engine-driven fuel pump failed, causing the DG electrical load to become erratic. The DG was secured and declared inoperable. The root cause of this event was the failure to adequately stake the fuel pump coupling taper pin during the maintenance activity on February 24, 1999. In addition, the work instructions being used did not require the use of sealing compound on the taper pin as specified in a vendor service memorandum. Corrective actions included personnel training, the development of a standard work plans for this work activity, and an update to the vendor technical manual to improve correlation of Service Information Memoranda. This event was reported in LER 50-458/99-003-00 on April 23, 1999.

SWP MOV-77A Valve Closure

On March 16, 1999, the Division I service water supply valve to the Division III DG was closed. The DG can be supplied with service water from either Division I or Division II. The action was taken to ensure the operability of Division I service water following the in-service test failure of a check valve in the Division I supply line, and it remained closed until April 1, 1999. A condition report was initiated at the time of the failure and the check valve was declared inoperable. Contingency actions and operability considerations were evaluated, and it was concluded that the service water supplies to the Division III DG were redundant. The DG was determined at the time to remain operable based on the availability of the Division II service water supply.

River Bend's investigation of this condition found the station personnel believed that the Division I and II service water supply paths to the Division III DG were fully redundant and that no action was required when a divisional supply was out of service. This misconception led to the failure to enter the appropriate Technical Specification action statements. Consequently, the Division III DG was technically inoperable for fifteen days, which is greater than the seven days allowed by Technical Specifications. This condition was reported in Licensee Event Report 50-458/00-002-00.

The corrective action for this event included an enhancement to the station procedure for performing safety function determinations. Clarified guidance was provided regarding the application of single failure criteria, as used to determine entry into Technical Specification action statements. The procedure now details the

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fact that some system realignments or conditions may alter the design basis assumptions used to determine the single failure criteria for that system and its equipment. Safety system realignments or conditions that are not explicitly reflected in the design basis must be carefully evaluated to ensure that compliance is maintained with the operating license and design basis assumptions.

The Division III DG was not identified during the assessment as a problematic train. The assessment determined that the adverse trend was associated with Divisions I and II only. Additionally, the issue regarding the closure of one service water supply to the Division III DG was not a material condition or hardware-related challenge to the DGs and as such was not discussed with the NRC in the information exchange meeting held in December of 1999.

These challenges to the DG's mentioned above have been resolved, and the focus of River Bend's improvement plans has now shifted to equipment issues that are less significant and have less potential to cause unplanned outages of the DG systems.

Station Initiatives:

In December 1999, EOI attended an information exchange meeting at NRC Region IV headquarters to brief NRC on issues and activities regarding River Bend's emergency diesel generators (DG). EOI's presentation included discussions of DG system performance, reliability assessment, Maintenance Rule performance, and River Bend's DG improvement plan. The following is updated information regarding the actions initiated.

1. Equipment Modifications (Division I and II DG's)

The electrical control system has been problematic with respect specifically to the excitation shutdown (K1) relay. The original system design allowed, under certain conditions, the application of simultaneous latch and reset signals to the relay coils, causing overheating and failure of the reset coil. The control circuitry has been modified to eliminate the possibility of these simultaneous signals under normal operating conditions. Other sub-components scheduled for modification and/or replacement are:

- a) tachometer relay power supply,
- b) critical shuttle valves in the electro-pneumatic controls,
- c) DC fuel oil booster pump starter circuit,

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d) replacement of engine governors.

Also, an engineering study is in progress to evaluate the replacement of the electro-pneumatic controls with an electric/electronic system.

2. System Reliability and Availability

The DG system is currently classified (a)(1) under the Maintenance Rule. The Division I DG had exceeded the Maintenance Rule goal of less than or equal to one maintenance-preventable functional failure (MPFF) in the previous 18 months. Recovery goals and corrective measures have been developed and implemented. It is anticipated that if performance goals continue to be met, the DG system will be removed from (a)(1) status in September 2000.

The composite system availability rate for all three DG's has improved, and is currently greater than the goal of 97.5%.

3. NRC's inspection of River Bend's corrective action program ending in March 2000 found that the station had failed to correctly identify a condition that caused the Division III DG to become inoperable (closure of the SWP-MOV-77A valve). Our investigation of this condition found the station personnel believed that the Division I and II service water supply paths to the Division III DG were fully redundant and that no action was required when a divisional supply was out of service.

Further investigation of operability determinations has been conducted as a result of other deficiencies found during River Bend's recent corrective action inspection. A contributing cause was found to be the lack of clear procedural guidance on the identification and tracking of "operable but degraded" conditions. No formal definition of that concept had been incorporated into procedures, and no formal assignment of responsibility had been made for its administration. Interim guidance has been instituted, and further procedure revisions are being developed. Resolution of the weaknesses in identification and tracking are in progress. This includes industry benchmarking, Entergy Operations Incorporated (EOI) peer group review and revision of processes and procedures. This issue is one of procedure compliance/knowledge weaknesses, and was not caused by equipment deficiencies.

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Conclusion:

The River Bend diesel generator's performance and availability have improved, and they continue to be in an acceptable state of readiness. Our ongoing efforts to resolve the materiel condition issues related to the DG's and their support systems will maximize the reliability and availability of the units. Our initiatives to improve human performance and the station's administrative processes are aimed at preventing recurrence of the deficiencies previously seen in operability evaluations.