

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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FACILITY NAME (1)
River Bend Station

DOCKET NUMBER (2)
05000-458

PAGE (3)
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TITLE (4)
Inability of Two Emergency Diesel Generators to Perform Safety Function Prior to 1990 Due to Original Design Error

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	04	1998	1998	00301		10	05	1998		05000
OPERATING			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)							
POWER LEVEL (10)			20.2201(b)			20.2203(a)(2)(v)			X 50.73(a)(2)(i)	50.73(a)(2)(viii)
1			20.2203(a)(1)			20.2203(a)(3)(ii)			50.73(a)(2)(ii)	50.73(a)(2)(x)
100			20.2203(a)(2)(i)			20.2203(a)(3)(iii)			50.73(a)(2)(iii)	73.71
			20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)	OTHER
			20.2203(a)(2)(iii)			50.36(c)(1)			X 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME
David N. Lorfing

TELEPHONE NUMBER (include Area Code)
225-381-4157

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES
(If yes, complete EXPECTED SUBMISSION DATE).

X NO

EXPECTED

MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 24, 1998, engineers reviewing the emergency diesel generator control logic discovered that design features were not provided to ensure adequate air pressure to the diesel control logic. Without design makeup capability, normal system leakage would result in non-safety related bypassed trips being reinstated and ultimately a diesel engine trip. Operations personnel had been trained that control air pressure was required to shutdown the diesel. Procedures were revised in 1990, apparently to ensure positive control of the diesel. These procedures were adequate to ensure operability of the diesel and therefore this condition did not result in a loss of capability of the diesel generators to perform their safety function, or in a nonconformance with Technical Specifications.

Subsequently, while investigating this issue, evaluations were performed on the condition of the diesel generators and the operating procedures for the period prior to May 1990. For the period of time prior to the revision of the diesel generator operating procedures in 1990, it is postulated that under a specific sequence of events, the Division I and II diesel generators may not have been capable of performing their safety function without operator action. A 10CFR50.72 notification was made on September 4, 1998. The apparent cause of the inadequacy of the diesel generator control air system is original design error. The reason for the design error is believed to be the owner and architect/engineer failed to recognize that the diesel engine control system requires a long-term air supply. Corrective actions include notifying the diesel vendor, training operators, and revising operator procedures. In addition, modifications will be designed and implemented to assure a reliable supply of control air in the postulated loss of offsite power event.

This Licensee Event Report is submitted in accordance with 10CFR50.73(a)(2)(v) as a condition alone that could have prevented the fulfillment of a safety function and 10CFR50.73(a)(2)(i)(B) as an operation prohibited by plant Technical Specifications.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

REPORTED CONDITION

In June 1998, following questions relating to air start and control air for the emergency diesel generators (*EK*) at the River Bend Station (RBS), Plant Engineers determined that a diesel trip could occur on falling air pressure absent operator action. If a loss of offsite power occurred, the non-Class 1E powered air compressors would not provide a supply of makeup air to the air start/control air system. At falling air pressures to below 120 psig, several trips, which are bypassed during emergency operation, are reinstated. Additionally, at pressures below 45 psig, the diesels could trip on a loss of control air. This condition was not previously recognized. The condition affects only the Division I and II diesels (the Division III diesel is a different design).

In May of 1990, operating procedures were changed to provide supplemental air to the diesels' electro-pneumatic control systems. These changes were made to ensure positive control of the diesel. Operations personnel had been trained that control air pressure was required to shut down the diesel. Engineers evaluated these procedure changes on June 24, 1998, and determined them to be adequate to ensure operability of the diesel.

A reportability evaluation initially concluded that the condition found in 1998 (i.e., recognition the diesel could trip if air pressures reached as low as 45 psig) was not reportable because the condition alone did not result in a loss of capability of the diesel generators to perform their safety function, or in a nonconformance with Technical Specifications. An operability evaluation concluded that the diesel generators were operable when crediting existing proceduralized operator action to provide a supplemental air supply that would maintain control air at adequate pressure to prevent inadvertent trip of the diesels.

Subsequent evaluations were performed on the condition of the diesel generators and the operating procedures for the period prior to May 1990. While the loss of both diesel generators due to failed control air systems was unlikely, the state of the equipment and procedures prior to May 1990 is now considered a condition that alone could have prevented the fulfillment of a safety function. A 10CFR50.72 notification was made on September 4, 1998.

This Licensee Event Report is submitted in accordance with 10CFR50.73(a)(2)(v) as a condition alone that could have prevented the fulfillment of a safety function and 10CFR50.73(a)(2)(i)(B) as an operation prohibited by plant Technical Specifications.

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BACKGROUND

RBS is equipped with three diesel generators serving three separate safety divisions. The Division I and II diesel generators were manufactured by Transamerica Delaval. Each of the diesels is individually supported by two non-safety related air compressors, aftercoolers, and dryers that maintain an inventory of air in safety-related accumulators. This air provides the motive force in the engine starting systems, and supplies an electro-pneumatic control logic system that functions to trip the engine in response to various sensors that monitor engine parameters.

The air accumulator banks are normally charged to 235-250 psig, and control air pressure is maintained by a safety-related regulator at approximately 60 psig. The starting air system is equipped with a pressure switch that actuates an alarm at the engine control panel and in the main control room if accumulator pressure drops below 210 psig. The alarm response procedure requires that an operator investigate the problem at the local engine control panel and take action to restore air pressure. Following an emergency start, the non-safety trip signals are normally bypassed, but would be reactivated at approximately 120 psig, potentially allowing an undesired trip of either of the two diesels.

Operating procedures in place since May 1990 direct that a supplemental air source be obtained if emergency diesel generator operation is needed for greater than two hours with no air compressors available, as in the case of a loss of offsite power.

As noted above, the Division III diesel generator is not the subject of this LER, since it is of a different design.

INVESTIGATION AND IMMEDIATE ACTIONS

Following the identification of the condition that the diesels could trip on falling air pressure, an operability evaluation concluded the diesel generators were operable when crediting procedurally controlled operator action to provide a supplemental air supply.

To support the operability evaluation, leak rate testing was performed for both the starting air subsystems in each of the Division I and II air start/pneumatic control systems. Based on the highest subsystem leakage rate measured, the engineering calculation shows that greater than 6 hours are available before air pressure decays from 180 to 130 psig. The engineering evaluation assumes that only one accumulator bank is in service, that pressure in the accumulator is just above 210 psig alarm point, and that accumulator pressure will decrease to approximately 180 psig during the engine start sequence. Minor leaks existed during the testing, and these were later repaired to further improve the time available for operator action.

EOI performed a walk-through of the existing operating procedure guidance to connect compressed air bottles to the air system to maintain pressure after an assumed loss of the compressors. It was concluded that the operation could be completed within the system decay time determined by the leak rate testing and engineering evaluation. Subsequently, the response time was improved by staging compressed air bottles near the engine rooms, and regulators, hoses, and fittings were placed in the diesel generator building.

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A sufficient inventory of compressed air has been established at the station to support control air needs for at least seven days for both diesel generators under worst case assumptions. Drills of the operating crews have been conducted to ensure proficiency in using the air bottles and connecting hardware.

ROOT CAUSE

A multi-discipline investigation team was formed to assess the condition and determine the root cause. An extensive review of historical plant documentation was conducted to determine whether the original design and licensing basis defined any requirements and expectations for the diesel generator control air design. This review included such documents as the diesel generator procurement specification, referenced standards, procurement correspondence, design records and drawings, Preliminary and Final Safety Analysis Report submittals, and the Safety Evaluation Report. The purchase specification for the diesel generators included requirements for engine auxiliaries (starting air system and compressors, fuel system, lubrication system, cooling system, governor, etc.), but did not address long-term control air system requirements. Likewise, the Final Safety Analysis Report does not address long-term control air system requirements.

The apparent cause of the inadequacy of the diesel generator control air system is original architect/engineer design error. The reason for the design error is believed to be the owner and architect/engineer failed to recognize that the diesel engine control system requires a long-term air supply. The purchase specifications for the diesel generators did not address long-term control air supply requirements. These errors were carried over into preparation of vendor technical documents, training materials, and operating procedures.

CORRECTIVE ACTIONS

Immediate actions taken in response to the reported condition are discussed above. Additionally, the following actions were taken:

- EOI has notified the diesel vendor of the discovery the reinstatement of certain diesel trip functions, and has revised the on-site manuals. The diesel vendor subsequently issued a 10 CFR Part 21 report on the condition that certain trips functions are reinstated upon falling air pressures (Reference Cooper Energy Services Letter to the USNRC dated August 28, 1998, "10CFR21 Notification, Enterprise DSR-4 and DSRV-4 Emergency Diesel Generator Starting Air Pressure Switch").
- Operating procedures have been revised to incorporate the findings of this investigation.
- EOI completed a safety evaluation of the plant impacts of the compensatory measures (i.e., operator actions to provide supplemental air).
- Operators have been trained on the correct response of the diesel generators to a loss control air pressure.

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The following corrective actions will be implemented:

- Operator training materials will be revised to reflect the possible effects of a loss of diesel control air pressure.
- EOI will design and implement modifications necessary to assure a reliable supply of control air in the postulated loss of offsite power event.
- EOI is continuing to investigate the condition from a historical standpoint and will determine if any additional actions are warranted.

PREVIOUS OCCURRENCE EVALUATION

A review of RBS records was conducted and no failures of the Division 1 and 2 diesel generators attributable to loss of pressure in the control air system were identified.

SAFETY EVALUATION

For the period of time prior to the revision of the diesel generator operating procedures in 1990, it is postulated that under a specific sequence of events, the Division I and II diesel generators may not have been capable of performing their safety function without operator action. RBS did have a designated dedicated operator for Diesel Operation during a loss of offsite power. The operators were aware that air is necessary to maintain start capability for the Diesel. The operator could have taken actions to supply air to the Diesel. In addition, while the same design and procedure deficiencies applied to both the Division I and II diesel generators, the Division III diesel generator was unaffected and was thus available to support the High Pressure Core Spray function.

An operability evaluation of the as-found condition of the diesel generators and their operating procedures in June 1998 found that the diesel generators would have been capable of performing their intended safety function crediting operator action. Procedures have been in place since May 1990, directing operators to take action to assure long-term availability of the diesel generator air supply. Pre-staging of compressed air bottles, regulators, and hoses has improved the ease of operator response as a result of this investigation, and operators have since demonstrated the ability to connect the bottles to the control air system in much less than an hour. The engineering evaluation has shown that, using the highest as-found leakage of the four subsystems and conservative assumptions, greater than six hours were available before air pressure would have decayed to a level below the trip reinstatement pressure.

Based on the above information, assuming the as-found leakage, the Division I and II diesel generators were capable of performing their safety function, crediting operator actions, subsequent to the revision of the operating procedures in 1990.

Note: Energy Industry Identifier codes are identified as (*XX*).