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Reference: Vogtle Electric Generating Plant - Units 1 & 2; 50-424, 50-425
Diesel Generator Jacket Water Heat Exchanger
Letter GN-1079, dated September 17, 1986

In the referenced letter, Georgia Power Company (GPC) notified the NRC of a reportable condition under 10CFR50.55(e) involving damage to the emergency diesel generator's jacket water heat exchanger during flushing on Unit 1. This heat exchanger was repaired and installed in Unit 2, but was damaged again during testing for Unit 2. The subsequent investigation resulted in a 10CFR21 notification by the vendor to the NRC of a potential defect in the jacket water heat exchanger.

The attached report for Unit 2 modifies our previous report on this subject and provides additional information relating to the root cause of the heat exchanger damage. GPC has concluded that this condition is also reportable under 10CFR21. This reponse contains no proprietary information and may be placed in the NRC Public Document Room.

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Attachment

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EVALUATION OF A POTENTIALLY REPORTABLE CONDITION - UNIT 2
DIESEL GENERATOR JACKET WATER HEAT EXCHANGER

Initial Report: On April 10, 1986, Mr. R. E. Folker, Vogtle Quality Assurance Engineer, informed Mr. E. F. Christnot of the USNRC Region II of a potentially reportable condition concerning the diesel generator jacket water heat exchanger. In letter GN-1079, dated September 17, 1986, GPC provided an evaluation of this condition which concluded that a reportable condition per 10CFR50.55(e) did exist.

Background Information: The class 1E diesel generators provide an onsite supply of emergency electrical power to safety-related equipment to ensure their continued operation in the event of a loss of offsite power. The diesel generator jacket water heat exchanger (shell and tube type) removes heat from the diesel generator coolant loop during engine operation. The jacket water flows through the shell side of the heat exchanger, and cooling water from the nuclear service cooling water (NSCW) system flows through the tube side. The engine driven jacket water pump circulates coolant through the engine cooling system. The amount of coolant flow varies according to its temperature and is controlled by a three-way thermostatic valve installed at the inlet of the shell side of the heat exchanger.

The diesel generator cooling water system provides a sufficient heat sink to permit the diesel engine to start and operate for three minutes without flow from the NSCW system. This margin is provided because the NSCW pumps require approximately 85 seconds to regain full flow following a loss of preferred power.

During the time that NSCW is not supplied to the diesel generator jacket water coolers, the temperature of the jacket water will rise. The thermostatic valve will continue to open, allowing more flow through the heat exchangers (up to a maximum of 1800 gpm). This will continue until the NSCW flow is restored and provides sufficient cooling to lower the jacket water temperature at the thermostatic valve.

During flushing operations of the Unit 1 train A diesel generator engine jacket water system in 1985, it was observed that the jacket water design flow of 1800 gpm could not be achieved through the shell side of the heat exchanger. Inspection of the heat exhanger revealed that the restricted flow was the result of heat exchanger tubes bent at the shell side inlet and outlet nozzles. This damaged heat exchanger was returned for repair and a replacement was obtained from Unit 2. The replacement heat exchanger successfully passed the flushing operation which put the design flow through the heat exchanger, and the repaired heat exhanger was installed on the Unit 2 diesel generator.

During recent flushing operations of the Unit 2 diesel generator, the previously repaired heat exchanger was damaged again. The tube bundle was bent and forced against the discharge port on the jacket water side, resulting in water leakage due to tube damage.

Bent tubes in the heat exchanger could restrict the flow through the tubes and through the shell inlet and outlet nozzles. This flow restriction through the heat exchanger could result in an increase in engine coolant temperature, which in turn could cause an engine trip on high jacket water temperature. The diesel generator jacket water heat exchangers used at Vogtle were manufactured by Thermxchanger Inc., a company no longer in business and are No. 2422, Type AEW.

Engineering Evaluation: Investigation as a result of the initial condition in 1985 concluded that the jacket water heat exchanger design flow of 1800 gpm had probably been exceeded during flushing operations. A flush cloth was used in addition to the wire mesh strainer normally used in the evaluation of system cleanliness. The flushing log indicated that the flush cloth failed to hold and broke. It was suspected the flush cloth may have collected enough particles to severely restrict system flow, which caused the cloth to eventually fail. It was concluded that this restriction and subsequent release probably resulted in a flow surge transient in the system that could have caused the damage to the heat exchanger tubes.

When the heat exchanger was damaged during Unit 2 flushing, a flow surge transient was not suspected to have caused the tube damage. Investigation of heat exchanger design indicates that the damage was a result of the 1800 gpm flow used during the flushing operation. Flushing was performed at the design flow rate specified by the manufacturer. However, calculations reveal that actual inlet and outlet nozzle velocities exceed the standards established by the Tubular Exchanger Manufacturers Association (TEMA).

Review for Quality Assurance Program Breakdown: A review for a Quality Assurance Program Breakdown has been conducted. The review concluded that this deficiency does not represent a significant breakdown in the quality assurance program of the diesel generator manufacturer.

Conclusion: Georgia Power Company has evaluated this condition and concluded that a reportable condition as defined by 10CFR21 does exist, in addition to the previously reported 10CFR50.55(e). Based on the guidance in NUREG-0302, Revision 1, concerning duplicate reporting of an event, Georgia Power Company is reporting this event per the criteria of 10CFR50.55(e). This report provides additional information relating to the cause of the heat exchanger damage and the new corrective action proposed. The previous determination that a reportable event exists per 10CFR50.55(e) has not changed.

Corrective Action: The Unit 2 diesel generator thermostatic valves are being modified by adding mechanical stops to limit jacket water flow through the heat exchanger to a maximum of 750 gpm. IMO Delaval Inc., (the diesel generator vendor) concludes that this flow is within TEMA standards and will be sufficient for flushing. IMO Delaval also states that normal operating flow required for proper heat transfer in this installation is 500 gpm.

This modification will be made on Unit 2 commensurate with the Unit 2 construction schedule prior to fuel load.