UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

1/27/92

December 26, 1991

NRC INFORMATION NOTICE 91-85: POTENTIAL FAILURES OF THERMOSTATIC CONTROL VALVES FOR DIESEL GENERATOR JACKET COOLING WATER

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for failure of thermostatic control valves for diesel generator jacket cooling water. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On September 10, 1991, at the Catawba Nuclear Station, Unit 2, the Duke Power Company (the licensee) removed emergency diesel generator (EDG) 2A from service for minor corrective and preventive maintenance. The next day, the engine was successfully tested for its performance in a no load condition for 5 minutes and was shut down. Shortly afterwards, the engine was restarted for a 1-hour operability test. After operating the EDG for 15 minutes at full load, operators observed that the engine cooling water and lube oil temperatures were increasing abnormally. The engine oil level was checked and found to be within normal range. After about 20 minutes, alarms for high lube oil inlet and outlet (175°F) and high jacket water (175°F) temperatures were received. Responding to these alarms, an operator verified that the nuclear service water supply valve was open and that the flow was within normal range. After operating for about 28 minutes, the engine tripped on a high lube oil outlet temperature (200°F). After the trip and while the engine was coasting to a stop, an explosion occurred in the crankcase. Upon examining the engine, the licensee determined that a thermostatic valve in the jacket cooling water system had failed resulting in the engine overheating, which resulted in significant engine damage.

Further details of the event may be found in Licensee Event Report 50-414/91-10 or NRC Inspection Report 50-414/91-21.

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Discussion

At Catawba, the cooling water system for the Transamerica Delaval DSRV-16-4 (16 cylinder) diesel generator engine supplies cooling water to the engine jacket, the engine lube oil cooler, the combustion air after-coolers, and the governor lube oil cooler. An engine-driven circulation pump circulates cooling water through the closed loop system that includes a three-way thermostatic control valve (AMOT Model 8D). When the jacket water temperature is low, the AMOT valve, which works similarly to the thermostat in an automobile engine, diverts diesel jacket cooling flow from the heat exchanger, which is cooled by nuclear service water. The AMOT valve modulates open to control the temperature of the diesel jacket water to about 165°F as the engine reaches operating temperature. Heat is transferred through the heat exchanger to the plant's nuclear service water system.

The licensee's investigation revealed that the AMOT thermostat valve had malfunctioned and caused the engine to overheat. During the operability test, the AMOT valve only partially opened from the bypass position, thus allowing the jacket and lube oil temperatures to rise above normal operating temperatures. With the engine fully loaded, the temperature of the oil and water rose to 200°F. At these elevated temperatures, the oil emitted an increased amount of vapors. The elevated temperatures also affected the clearances between the moving parts and reduced the oil's lubricating qualities. The heat generated by the friction between the piston and liner ignited the oil vapors. The ignition of the oil vapors caused the rapid pressure increase and the explosion in the crankcase.

The AMOT valve malfunctioned because two of the four "power elements" (sensing elements) in the valve had failed. Licensee personnel examined these elements at the licensee's metallurgical laboratory and attributed the root cause of the failure to slow growing intergranular stress corrosion cracking. The cracking caused small openings that allowed the thermally active medium of the power element to leak out. This loss of thermally active medium directly affects the actuating rod travel (valve stroke). The failed elements were those originally provided with the engine in 1979. The licensee had also found degraded power elements during a recent inspection of the Unit 1 diesel engines. The vendor's documentation indicates that the power elements have a 15-year shelf life and should be inspected at intervals of 2 to 3 years to detect and make provision for normal wear.

The licensee's corrective actions include changing the AMOT power element replacement schedule and evaluating changing the engine oil to a type with increased film strength and greater stability at elevated temperatures.

Related Generic Communications

A similar failure of a thermostatic control valve, but resulting from a different failure mechanism, was discussed in NRC Information Notice 82-56, "Robertshaw Thermostatic Flow Control Valves," December 30, 1982.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Attachment: List of Recently Issued NRC Information Notices

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LIST OF RECENTLY ISSUED
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Information Notice No.	Subject	Date of Issuance	Issued to
91-84	Problems with Criticality Alarm Components/Systems	12/26/91	All Nuclear Regulatory Commission (NRC) fuel cycle licensees, interim spent fuel storage licensees, and critical mass licensees.
91-83	Solenoid-Operated Valve Failures Resulted in Turbine Overspeed	12/20/91	All holders of OLs or CPs for nuclear power reactors.
91-18, Supp. 1	High-Energy Piping Failures Caused by Wall Thinning	12/18/91	All holders of OLs or CPs for nuclear power reactors.
91-82	Problems with Diaphragms in Safety-Related Tanks	12/18/91	All holders of OLs or CPs for nuclear power reactors.
91-81	Switchyard Problems that Contribute to Loss of Offsite Power	12/16/91	All holders of OLs or CPs for nuclear power reactors.
91-80	Failure of Anchor Head Threads on Post-Tensioning System During Surveillance Inspection	12/11/91	All holders of OLs or CPs for nuclear power reactors.
91-79	Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials	12/06/91	All holders of OLs or CPs for nuclear power reactors.
88-92, Supp. 1	Potential for Spent Fuel Pool Draindown	11/29/91	All holders of OLs or CPs for nuclear power reactors.
91-78	Status Indication of Control Power for Circuit Breakers Used in Safety-Related Applications	11/28/91	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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PCWen	REMartin	DMatthews	JZeiler	WTOrders
12/11/91	12/12/91	12/12/91	12/11/91	12/11/91

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Document Name: EDG THERMOSTATIC CONTROL VALVE

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