

November 14, 1996

Mr. Mark Woltering
Executive Vice President
AMOT Controls Corporation
401 First Street
Richmond, California 94801-2906

SUBJECT: REQUEST FOR A TECHNICAL REVIEW OF A DRAFT REVISION TO INFORMATION
NOTICE 91-85 REGARDING FAILURE OF A THERMOSTATIC CONTROL VALVE

Dear Mr. Woltering:

The U.S. Nuclear Regulatory Commission (NRC) is planning to issue a revision to Information Notice 91-85 that discusses failure of a thermostatic valve for the diesel generator jacket cooling water. The valve failure occurred at the Catawba Nuclear Station, Unit 2. We ask that you review the enclosed draft information notice to ensure the technical information is accurate. Your cooperation in this matter is appreciated. Please return any comments you may have as soon as possible. A copy of this request and your response will be placed in the Public Document Room for review by the public. Your response should be mailed to:

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Thomas Greene, NRR/PECB
MAIL STOP: 0-11E4

Please address any questions you may have on this matter to Tom Greene of my staff. Mr. Greene may be reached by phone (301) 415-1175. A copy of this letter was faxed to you on November 14, 1996. If no comments are received by close of business on November 20, 1996, we will assume the technical information in the notice is correct.

[Original signed by]
Alfred E. Chaffee, Chief
Events Assessment and
Generic Communications Branch
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Enclosure: Draft Information Notice

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

November xx, 1996

NRC INFORMATION NOTICE 91-85, REVISION 1: POTENTIAL FAILURES OF
THERMOSTATIC CONTROL VALVES
FOR DIESEL GENERATOR JACKET
COOLING WATER

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Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this revised information notice to clarify that the failure of the thermostatic control valve for the diesel generator jacket cooling water at Catawba Nuclear Station occurred beyond its normal service life. 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.

Background

On December 26, 1991, the staff issued Information Notice 91-85 to describe a failure of a thermostatic control valve for the diesel generator jacket cooling water. Since the notice was issued, additional details have emerged on the circumstances related to the valve failure. This revision provides these additional details.

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 lubricating oil temperatures were increasing abnormally. The engine oil level was checked and found to be within normal range. After about 20 minutes, alarms were received for high lubricating oil inlet and outlet (79.4 °C [175 °F]) and high jacket water (79.4 °C [175 °F]) temperatures. 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

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operating for about 28 minutes, the engine tripped on a high lubricating oil outlet temperature (93.3 °C [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 and causing 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.

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 lubricating oil cooler, the combustion air aftercoolers, and the governor lubricating oil cooler. An engine-driven 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 73.9 °C [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 opened only partially from the bypass position, thus allowing the jacket and lubricating oil temperatures to rise above normal operating temperatures. With the engine fully loaded, the temperature of the oil and water rose to 93.3 °C [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, causing 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 staff examined these elements at the licensee's metallurgical laboratory and attributed the root cause of the failure to slowly growing intergranular stress corrosion cracking (IGSCC). The licensee did not identify what factors caused the IGSCC. The cracking caused small openings that allowed the thermally active medium of the power element to leak out. This loss of a thermally active medium directly affects the travel of the actuating rod (valve stroke). The licensee had also found degraded power elements during an inspection of the Unit 1 diesel engines.

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The failed elements in Unit 2 were those originally provided with the engine in 1979. The vendor's documentation states that the power elements should be inspected every 2-3 years and that the elements have a normal service life of 6-10 years. The shelf life of the element is only 1-2 years, depending on storage conditions. Before the elements failed, the licensee had not inspected them since they were provided with the engine in 1979. The failed elements had exceeded their service life by at least 2 years. The licensee thought the elements had a 15-year service life.

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," dated 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.

Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Thomas Greene, NRR
(301) 415-1175
E-mail: tag@nrc.gov

John Zeiler, RII
(803) 831-2963
E-mail: jxz@nrc.gov

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Attachment: List of Recently Issued NRC Information Notices