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April 14, 1993

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

Reference: Docket No. 50-186
University of Missouri Research Reactor
License R-103

Subject: Report as required by Technical Specification 6.1.b(2) concerning reactor operation with one of the four Primary Coolant Low Pressure scram setpoints not within Technical Specification limits.

Introduction:

On March 16, 1993, while performing low pressure scram compliance testing (CP-22), the scram setpoint for Primary Coolant Low Pressure provided by pressure transmitter 944B (PT-944B) was found to be 2.5 psi below the Limiting Safety System Setpoint (LSSS) of 75 psia required by Technical Specification 2.2. This Primary Coolant Low Pressure Scram is one of four low pressure scrams required by Technical Specification 3.3. Technical Specification 3.3 states:

The safety system and the number (N) of associated instrument channels necessary to provide the following scrams shall be operable whenever the reactor is operated. Each of the safety system functions shall have 1/N logic where N is the number of instrument channels required for the corresponding mode of operation.

The reactor safety system was still capable of performing its safety function if an actual low pressure condition had occurred, since the remaining low pressure scrams (PT-944A, PS-938 and PT-943) were operable.

Description:

On March 16, 1993, while operating at steady state power of 10 MW, a reactor scram occurred as a result of what was found to be a spurious trip from either PT-944A or PT-944B (Reactor Outlet Pressure). One of these two channels was suspected because the scram was accompanied by the primary system shutdown also initiated by these pressure transmitters. There was no actual low pressure condition indicated on any instrumentation. As part of the normal investigation of the

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cause of the scram, compliance testing (Compliance Procedure, CP-22) of PT-944A and PT-944B revealed that the PT-944B meter indication did not track input test pressures in a linear fashion with decreasing pressure increments. Numerous scram trip tests of PT-944B revealed a repeatable scram trip at 72.5 psia (57.8 psig) which is 2.5 psi below the LSSS for the low pressure scram. PT-944A was tested and found to be within specifications. The two other low pressure scrams which are initiated by PT-943 (Reactor Inlet Pressure) and by PS-938 (Pressurizer Low Pressure) have been tested to be in compliance with Technical Specification requirements. The last compliance test of PT-944B (with PT-944A and PT-943) was on October 26, 1992. At that time the PT-944B scram setpoint was within compliance procedure limits.

Analysis:

The meter relay trip unit (GE model 195) that initiates the scram trip from PT-944B was tested by performing Compliance Procedure CP-22. This procedure is performed with the reactor shutdown and involves isolating the pressure transmitter from the primary system and connecting a pressure test rig which enables the pressure to be varied over its calibration range using a calibrated Heise gauge. Data taken while decreasing pressure over its indicating range showed that the indications were non-linear. The output of the transmitter PT-944B was checked over its range and its output was correct, indicating a problem in the PT-944B meter assembly. The PT-944B meter was replaced and the transmitter was zero and span checked. The compliance test (linearity check and scram test) for PT-944B was completed with the results within proper limits. The problem with the PT-944B meter relay trip unit is believed to be binding or sluggish response of the meter movement. Bench testing of this meter movement, however, has not been able to verify the source of the problem. This is the first failure of this type for the meter relay trip units in the 27 years of use at MURR.

The PT-944B safety trip is one of seven safety system instrument channels that contain meter relay trip units at MURR. The others are PT-944A, PT-943, Hx-980A (temperature), Hx-980B (temperature), and PT-917 (high and low reflector Δp). These meter relay trip units were extremely reliable for the first twelve years of service (1966 through 1978) before the initial failure occurred July 3, 1978. From 1978 through 1987 there were four failures of the meter relay trip units, all associated with reduced capacitance of electrolytic capacitors. Between December 1987 and March 1988 all of the meter relay trip units were replaced with new equipment of the same design. This failure is the first one since the new equipment has been installed. These trip units will be monitored to ensure this type problem is not recurring. All of the meter relay trip unit safety functions are on a semi-annual compliance schedule. With 27 years operating experience with these trip units, we have no reason to suspect this to be a generic problem.

The reactor coolant low pressure scrams have two purposes--to ensure that steady state operation of the reactor is well within safety limits and to initiate protective action in the event of a Loss of Coolant Accident (a double-ended piping rupture) by sensing the resulting pressure drop and scramming the reactor. PT-944A and PT-944B not only initiate a scram function when tripped (one in the green leg, the other in the yellow leg of the safety system), but also cause the primary isolation valves (V 507A/B) to close, the primary pumps (P 501A/B) to secure and the anti-siphon valves (V 543A/B) to open.

The LSSS for reactor primary pressurizer pressure is 75 psia, a margin of 15 psi above the safety limit of 60 psia. The pressurized primary system at MURR contains four (4) independent pressure transmitters which are capable of causing a reactor scram in the event of a loss of

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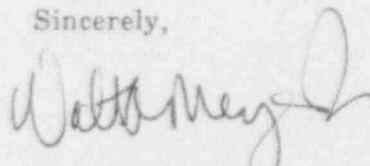
pressure transient, thus ensuring that the low pressure safety limit will not be violated (Ref: Hazard Summary Addendum 4, Appendix H).

If the safety channel for PT-944B had not responded to an actual low pressure condition during steady state operation there were three independent low pressure scrams (PT-944A, PT-943 and PS-938) that would have provided the required scram. Likewise, if PT-944B had not responded to an actual loss of coolant low pressure condition, PT-944A would have provided the primary system shutdown described above which either PT-944A or PT-944B can initiate.

Corrective Actions:

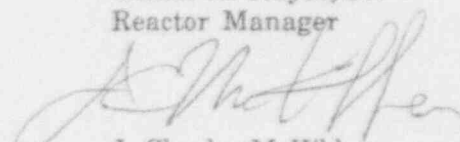
When the PT-944B meter relay trip unit did not respond properly, the meter movement for the unit was replaced. The pressure transmitter (PT-944B) was tested and found to be operating properly. After replacing the meter movement, compliance testing of the safety channel for PT-944B indicated it was operating within compliance procedure limits. As followup to this problem, the scram setpoints for PT-944B have been retested on two occasions, March 29 and April 12, 1993, to ensure that there is no setpoint drift. The regularly scheduled compliance testing of the safety channels for PT-944A, PT-944B and PT-943 is scheduled to be done in April 1993.

Sincerely,



Walter A. Meyer, Jr.
Reactor Manager

ENDORSEMENT:
Reviewed and Approved



J. Charles McKibben
Associate Director

WAM:bjb

xc: Regional Administrator, NRC, Region III
Reactor Advisory Committee
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