



# Research Reactor Center

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February 12, 2002

US Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Subject: Docket No. 50-186  
The Curators of the University of Missouri  
License No. R-103

The attached document provides the University of Missouri Research Reactor event report for an instrument malfunction that resulted in a deviation from technical specification 3.3.a on January 20, 2002, and again on January 26, 2002. This report is submitted in accordance with Technical Specification 6.1.h (2).

Please contact Paul Hobbs, Reactor Manager at 573-882-5264 if you have questions regarding this report.

Sincerely,

Ralph A. Butler  
Interim Director

RAB:dcp

Enc.

xc: Mr. Alexander Adams, Jr., US NRC  
Mr. Craig Bassett, NRC Region II  
Dr. Robert Hall, Interim Vice-Provost  
Reactor Advisory Committee  
Reactor Safety Committee

A020

**Event Report 02-01 – January 20 and 26, 2002**  
**University of Missouri Research Reactor**

**Introduction**

On January 20, and again on January 26, 2002 a manual reactor scram was initiated when reactor coolant inlet temperature instrument 980 B began to indicate erratically. The reactor was operating at 10 MW, steady state at the time of each occurrence.

This channel of reactor coolant inlet temperature provides visual indication in the Control Room and also provides a high reactor inlet temperature scram. The automatic scram setpoint was not reached during either malfunction.

There are two channels of reactor inlet temperature instrumentation that provide scram signals. These are designated 980 A and 980 B. In accordance with technical specification 3.3.a both channels are required to be operable when the reactor is operating in mode I.

Upon both occurrences, the reactor was immediately shutdown by manual scram (unscheduled shutdown report numbers 1132 and 1133) when the operators observed the erratic behavior of the 980 B instrument. Approximately 15 minutes after each shutdown the meter indication in the Control Room returned to normal.

Following each occurrence, extensive investigation and testing by operators and an electronics technician could not reveal the exact cause of the problem, nor could the malfunction be duplicated. Upon the first occurrence on January 20 a fault in the meter relay unit in the Control Room was suspected to be the cause of the erratic indication. The meter relay unit was replaced and Compliance Procedure *CP-8B, Primary RTD's 980 A and B*, was successfully performed to demonstrate that the channel was operable.

Upon the second occurrence on January 26, the remaining two major components in the instrument were replaced. Those were the RTD and the transmitter, an integral unit. After replacement of these components, Compliance Procedure *CP-8B* was successfully performed to demonstrate operability of the instrument.

The meter relay unit and the RTD/transmitter that were replaced were subjected to continuous bench testing. The meter relay unit operated in a normal manner. The RTD/transmitter unit exhibited a small abnormal drift of plus and minus one to two degrees. The erratic indications were not observed during the bench testing.

**Description of the reactor inlet water temperature channel**

The subject temperature instruments, 980 A and 980 B are shown as "Heat Exchanger Outlet Temperature" on the attached drawing. The RTD/transmitter units are Rosemount

model 444 Alphaline instruments. The output of the transmitters is routed to corresponding meter relay units mounted on the instrument panel in the Control Room.

These Rosemount instruments and meter relay units were installed as part of the facility instrumentation upgrade. This installation was completed March 19, 2001 as Modification 01-3.

Upon increasing temperature, the meter pointer moves up the scale. At a preset position, the pointer blocks a light beam and de-energizes a photocell that results in a set of contacts in the meter relay unit opening. The open relay contacts interrupt current in the reactor safety system Green Leg initiating a scram.

This instrument, along with 980 A, measures the temperature of the reactor coolant on the outlet side of primary heat exchangers 503 A and B. Technical specification 3.3.a 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." The required number (N) for Reactor Inlet Temperature is 2 for Mode I operation. The required 2 channels for this scram are instruments 980 A and 980 B. The failure of channel 980 B resulted in non-compliance with this technical specification.

### **Event description**

At 1135 on Sunday January 20, 2002 with the reactor operating at 10 MW in the automatic control mode, a manual scram was initiated when operators observed erratic operation of reactor inlet temperature indicator 980 B. Approximately 15 minutes after the shutdown the meter indication returned to normal on its own.

The MURR Chief Electronic Technician was called in to troubleshoot the instrument. Troubleshooting and testing efforts failed to yield a cause of the erratic indication, and the malfunction could not be duplicated. Suspecting the meter relay unit the technician replaced that assembly. This thinking was based primarily on the numerous moving parts in the meter unit as compared to no moving parts in the RTD/transmitter unit. Compliance procedure CP-8B was successfully performed to demonstrate operability of the instrument.

Permission to start up the reactor was obtained from the Reactor Manager. Startup checks were performed and the reactor was returned to 10 MW in automatic control at 1728, January 20, 2002.

A similar event occurred at 2141 on January 26, and a manual scram was again initiated by the operators. The MURR Chief Electronic Technician was called in to troubleshoot the instrument. As occurred on January 20, troubleshooting and testing efforts failed to yield a cause of the erratic indication, and the malfunction could not be duplicated.

The Chief Electronic Technician replaced the remaining two major components in the instrument, the RTD and the transmitter. Compliance Procedure CP-8B was successfully performed to demonstrate operability of the instrument. The reactor was returned to 10 MW in automatic control at 0338 on January 27.

### **Safety Analysis**

The 980 B instrument provides one of 2 inputs to the Green Leg of the Reactor Safety System to initiate a scram at a specified high reactor inlet temperature setpoint. The purpose of the reactor inlet temperature scram is to initiate automatic protective action in order to prevent a safety limit from being exceeded.

The high temperature scram function, if needed, would have been provided by channel 980 A. Also, as a backup, temperature element 901 B actuates a reactor scram when the core coolant outlet temperature exceeds a preset value. In addition, temperature element 901 A, which monitors core coolant inlet temperature, actuates an alarm upon high temperature, thereby alerting the operator to take corrective action to prevent a high temperature scram.

The 980 B instrument channel performs only protection and indication functions, it does not perform any control function. Therefore, during the brief duration between the onset of the malfunction and the manual scram, the reactor and associated process parameters remained at their normal 10 MW steady state values.

### **Root Cause Determination**

The root cause of this instrument malfunction has not been determined. The erratic behavior of the instrument was intermittent and could not be duplicated.

The meter relay unit and the RTD/transmitter were subjected to continuous bench testing through February 5. The meter relay unit operated in a normal manner. The RTD/transmitter unit exhibited a small abnormal drift of plus and minus one to two degrees. The erratic indications however were not observed during the bench testing.

Although the warranty covering the equipment had expired, MURR considers this a premature failure of this instrument. The Rosemount RTD/transmitter unit has been returned to the manufacturer for failure analysis.

### **Corrective action**

The meter relay assembly for the 980 B channel was replaced and tested when the first malfunction occurred on January 20. After this replacement, all tests demonstrated that the instrument was operable in accordance with technical specifications. Compliance

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Procedure CP-8B was successfully performed on the instrument during January 21 maintenance day activities. This test demonstrated that the instrument was operable.

When the malfunction occurred again on January 26, the other two major components in the instrument, the RTD and the transmitter, an integral unit, were replaced. Compliance Procedure CP-8B was again performed on the instrument to demonstrate that it was operable. The installed instrument continues to function in a normal manner and shows no abnormalities.

If the results of the manufacturer's failure analysis show a need, additional corrective actions may be taken.

If additional information is desired please call me at 573-882-5264

Sincerely,

A handwritten signature in cursive script, appearing to read "Paul S. Hobbs".

Paul S. Hobbs PE  
Reactor Manager  
University of Missouri Research Reactor

HEAT EXCHANGER OUTLET TEMPERATURE

