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June 9, 2003

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 Missouri University Research Reactor (MURR) Licensee Event Report (LER) for an instrument malfunction that occurred on May 18, 2003, which resulted in a deviation from MURR Technical Specification 3.3.a. This report is submitted in accordance with Technical Specification 6.1.h (2).

Please contact Les Foyto, Interim Reactor Manager at 573-882-5276 if you have questions regarding this report.

Sincerely,

Ralph A. Butler, P.E.
Interim Director

DIANE PURCELL
Notary Public - State of Missouri
County of Boone
My Commission Expires Jan. 31, 2006

RAB:dcp

Enc.

xc: Mr. Alexander Adams, Jr., US NRC
Mr. Craig Bassett, US NRC Region II
Dr. James S. Coleman, Vice Provost of Research, University of Missouri
Reactor Advisory Committee
Reactor Safety Subcommittee

IE22
A020

Licensee Event Report No. 03-01 – May 18, 2003
University of Missouri Research Reactor

Introduction

On May 18, 2003, the duty operator initiated a manual reactor scram when primary coolant heat exchanger 503A outlet temperature instrument, TE-980A, meter indication failed downscale. The reactor was operating at 10 MW steady state at the time of the occurrence.

This instrument channel provides a reactor coolant inlet high temperature scram signal to the Reactor Safety System if coolant temperature exceeds 125% of the normal operating value, as well as visual indication of primary coolant heat exchanger outlet (reactor inlet) temperature in the Control Room.

There are two instrument channels associated with reactor coolant inlet temperature that provide scram signals: TE-980A and TE-980B, each servicing its respective primary coolant heat exchanger. In accordance with MURR Technical Specification 3.3.a, both instrument channels are required to be operable when the reactor is operating in Mode I.

The reactor was immediately shutdown by manual scram when the duty operator observed that the meter indication for TE-980A had failed downscale. Approximately 10 minutes after shutdown meter indication returned to normal.

Extensive investigation and testing by an electronics technician could not reveal the exact cause of the problem, nor could the failure be duplicated. It was suspected that the Resistance Temperature Detector (RTD) and/or its Transmitter, which are an integral unit, were the cause of the instrument failure. Similar failures had occurred on January 20, 2002, and again on January 26, 2002, when temperature instrument TE-980B meter indication also failed downscale (MURR LER No. 02-01).

After the first failure on January 20, a malfunction of the Alarm Meter Relay Unit for TE-980B was suspected and the unit was replaced. However, this did not correct the problem since an additional failure with the same symptoms occurred less than a week later. After the second failure, the RTD/Transmitter unit for TE-980B was replaced and the unit has operated continuously since that date with no additional problems. Due to this past machinery history, the RTD/Transmitter unit for TE-980A was replaced and Compliance Procedure CP-8B, which verifies instrument calibration and scram set point, was performed to verify that the instrument channel was operable.

Description of the Primary Coolant Heat Exchanger Outlet Temperature Channels

Temperature instrument channels TE-980A and TE-980B are shown as "Heat Exchanger Outlet Temperature" on the attached drawing. The sensor, an RTD, and Transmitter are Rosemount Model 444 Alphaline® units. Twenty-four volt power supply 2PS5 provides the operating voltage to both TE-980A and TE-980B. The output of the Transmitters is sent to corresponding Alarm Meter Relay Units mounted on the Instrument Panel in the Control Room.

Upon increasing temperature, the pointer moves up the meter scale. At a preset position, the pointer blocks a light beam that causes a set of contacts in the Alarm Meter Relay Unit to open. The open relay contacts interrupt current in the Reactor Safety System "Green Leg" initiating a scram.

The RTDs, Alarm Meter Relay Units, and temperature Transmitters for TE-980A and 980B were replaced in March 2001 as part of the facility instrumentation upgrade project. The upgrade was necessary because of the age of the temperature measurement system and the unavailability of replacement parts for the Transmitters and Meter Relay Units. The new Meter Relay Units, which were Simpson Model 3324As, proved to be very susceptible to radio frequency interference (RFI). These units were eventually replaced by Beede Model MR4s in September 2002.

Event description

At 2020 on Sunday May 18, 2003, with the reactor operating at 10 MW in the automatic control mode, a manual scram was initiated when the control room operator observed the meter indication for TE-980A had failed downscale. Approximately 10 minutes after the reactor was shutdown meter indication returned to normal.

TE-980A, in addition to TE-980B, measures the temperature of the coolant on the outlet side of primary coolant heat exchangers 503A and 503B. 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 two (2) for Mode I operation. The required two channels for this scram are temperature instruments TE-980A and TE-980B. The failure of TE-980A resulted in non-compliance with this Technical Specification.

The MURR Chief Electronics Technician was called in to troubleshoot the instrument malfunction. Troubleshooting and testing efforts failed to yield the direct cause of the downscale failure, and the malfunction could not be reproduced. Suspecting the RTD and/or Transmitter, the Chief Electronics Technician suggested replacement of the unit. This recommendation was based on a similar failure that occurred in January 2002 when

the meter indication for TE-980B had failed downscale. 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. Following a normal maintenance day, refueling and completion of startup checks the reactor was returned to 10 MW operation and automatic control at 1844, Monday May 19, 2003.

Safety Analysis

Temperature instrument TE-980A provides an input signal to the "Green Leg" of the Reactor Safety System to initiate a reactor coolant inlet high temperature scram at a predetermined set point. The purpose of this high temperature scram is to initiate automatic protective action prior to exceeding a Limiting Safety System Setting (LSSS).

The high temperature scram function, if needed, would have been provided by TE-980B. Also, as a backup, temperature instrument TE-901B actuates a reactor scram when reactor coolant outlet temperature exceeds a preset value. Additionally, temperature instrument TE-901A, which also monitors reactor coolant inlet temperature, actuates an alarm upon high temperature; thereby alerting the operator to take corrective actions to prevent a high temperature scram.

Temperature instrument TE-980A performs only protective and indication functions, it does not perform any control functions. Therefore, during the brief time between the onset of the malfunction and the initiation of 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 yet been fully determined. The downscale failure of the system could not be duplicated, nor were there any discrepancies noted during the bench tests. The RTD/Transmitter unit for TE-980B, which appeared to have failed in January 2002, was returned to Rosemount in February 2002 for failure analysis. Failure Analysis Report No. 3672, prepared by Rosemount Inc. Failure Analysis Lab, identified a failed operational amplifier on the Transmitter's Analog Output Board, which caused transmitter output drift and improper burnout mode. This report was included as an attachment to MURR LER No. 02-01. Rosemount Inc. stated that the component might have failed due to a transient voltage or a manufacturing defect in the component. Rosemount provided MURR with replacement Model 444 Alphaline® RTD/Transmitter units for the units installed in the reactor and for the ones used as spares.

Rosemount Inc. has once again been contacted regarding the apparent repeat failure of the RTD/Transmitter unit for TE-980A. Although the warranty covering the equipment

has expired, MURR considers this a premature failure of this instrument and will continue to work with Rosemount to resolve this issue.

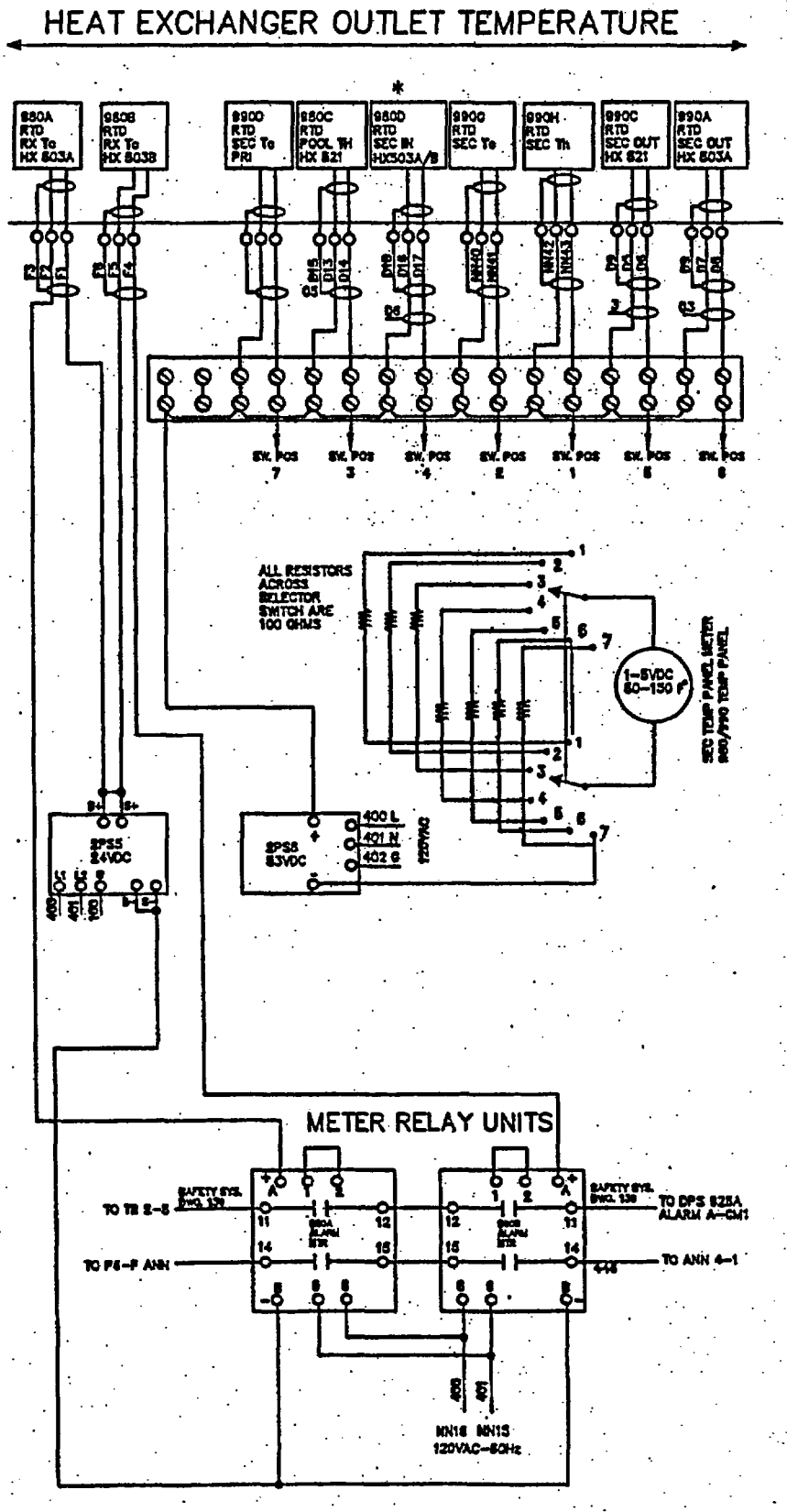
Corrective Actions

The RTD/Transmitter unit for TE-980A was replaced and tested. All tests demonstrated that the instrument was operable. Compliance Procedure CP-8B was performed during May 19 maintenance day activities, once again demonstrating that the instrument was operable.

The RTD/Transmitter unit that was removed from service is being bench tested and continues to operate in a normal manner. We are currently awaiting an additional failure analysis report from Rosemount and, if needed, any additional corrective action guidance.

If additional information is desired please call me at 573-882-5276.

Les Foyto
Interim Reactor Manager
University of Missouri Research Reactor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