



# Research Reactor Center

University of Missouri-Columbia

1513 Research Park Drive  
Columbia, MO 65211

PHONE 573-882-4211

FAX 573-882-6360

WEB <http://web.missouri.edu/~murrwww>

February 19, 2008

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Stop P1-37  
Washington, D.C. 20555-0001

Reference: Docket Number 50-186  
University of Missouri - Columbia Research Reactor  
Amended Facility License R-103

Subject: Written communication as required by the University of Missouri  
Research Reactor Technical Specification 6.1.h (2) regarding a deviation  
from Technical Specification 3.10.b

The attached document provides the University of Missouri Research Reactor (MURR)  
Licensee Event Report (LER) for an event that occurred on January 24, 2008 that resulted  
in a deviation from MURR Technical Specification 3.10.b.

If you have any questions regarding this report, please contact Leslie P. Foyto, the facility  
Reactor Manager, at (573) 882-5276.

Sincerely,

Ralph A. Butler, P.E.  
Director

RAB:djr

Enc.

xc: Reactor Advisory Committee  
Reactor Safety Subcommittee  
Dr. Robert D. Hall, Interim Vice Provost of Research  
Mr. Alexander Adams, Jr., US NRC  
Mr. Craig Bassett, US NRC

IE22  
A020

**Licensee Event Report No. 08-01 – January 24, 2008**  
**University of Missouri Research Reactor**

**Introduction**

On January 24, 2008, with the reactor operating at 10 MW in the automatic control mode, the control room operators noted that the ‘closed position’ indication light for water addition valve V527B was no longer energized. Additionally, the valve ‘open position’ indication light had not energized. At this time, pressurizer liquid level was approximately 6.5 inches below centerline (-6.5); the level at which an automatic primary coolant system make-up water addition sequence would normally initiate – valve V527B would open and primary coolant charging pump P-533 would start and admit water to the pressurizer. After verifying that the integrity of the valve position indication light bulbs was satisfactory, it was decided that a failure of valve V527B had occurred. The reactor was shutdown by manual scram and the immediate actions of reactor emergency procedure REP-19, “Pressurizer Valves Fail to Operate,” were performed.

Primary coolant charging pump P-533 delivers makeup water to the primary coolant system via the pressurizer from makeup water storage tank T-300. In accordance with Technical Specification 3.10.b, *“the reactor shall not be operated unless the reactor makeup water system is operable and connected to a source of at least 2,000 gallons of primary grade water.”* The basis for this Specification is to provide *“...an adequate supply of primary grade water for makeup during all modes of operation.”* With a failure of coolant charging pump P-533 to start as required by system demand, the reactor makeup water system was in a degraded state and not considered operable.

**Description of the Reactor Makeup Water System**

The Reactor Makeup Water System is not specifically defined or described in the Technical Specifications or in the Hazards Summary Report. Technical Specification 3.10.b and its basis imply that the system consists of a pressurizer tank, a positive displacement pump (primary coolant charging pump P-533), automatic control valves, a primary grade water supply, and associated piping, valves, and instrumentation. These components are shown on MURR Drawing No. 2325, “Pressurizer/Nitrogen System,” which is attached as page 5 to this document. The coolant charging pump is labeled as Level Control Pump P533 on this drawing. The purpose of the nitrogen supply system is to automatically supply nitrogen gas to the pressurizer to ensure that pressure in the primary coolant system is maintained within the Limiting Safety System Settings (LSSSs) for 10 MW operation.

Pressurizer liquid level is maintained within a normal operating band of 7 inches below centerline (-7) to 4 inches above centerline (+4). This is accomplished by the addition of primary grade water with primary coolant charging pump P-533 if the level is low, and

draining water to the drain collection system if the level is high. If liquid level decreases to approximately -6.5 inches, level controller LC936 initiates a signal to automatically open water addition valve V527B and start primary coolant charging pump P-533. This occurs when valve V527B "open position" limit switch LS1-1 energizes relay 2K15, which then closes contact 3-4 in the control circuitry of coolant charging pump P-533 causing the pump to automatically start. Valve V527B is an air-operated-to-open, spring-to-close (fail-safe) diaphragm valve. This valve/pump interlock arrangement prevents the positive displacement charging pump from operating without an open discharge path.

The pump will continue to operate until liquid level is approximately +1 inches. At this time the pump will stop and valve V527B will close. At a design flow rate capacity of 50 gpm, the coolant charging pump will run for approximately 1 minute. If pressurizer liquid level continues to decrease to -11 inches, level controller LC935 will initiate a "Pressurizer Water Lo Level" annunciator alarm alerting the operators to the abnormal condition. Should pressurizer liquid level lower to -13 inches, level controller LC935 will initiate a reactor scram by opening contact K28-2 in the process input string to E3B of the Reactor Safety System Non-Coincidence Logic Units, thereby interrupting power to the control blade electromagnets. In addition, a "Pressurizer Lo Level Scram" annunciator alarm is initiated and surge line isolation valve V527C closes to prevent an introduction of nitrogen gas into the primary coolant system.

### **Detailed Event Description**

On Thursday, January 24, 2008, at approximately 04:40 with the reactor operating at 10 MW in the automatic control mode, the control room operators noted that water addition valve V527B 'closed position' indication light on the control room Instrument Panel was no longer energized. Additionally, the valve 'open position' indication light had not energized. Pressurizer liquid level was approximately 6.5 inches below centerline (-6.5); the level at which an automatic primary coolant system make-up water addition sequence would normally initiate. After verifying that the integrity of the valve position indication light bulbs was satisfactory, the Lead Senior Reactor Operator concluded that a failure of the valve or valve position indication circuitry had occurred. The reactor was shutdown by manual scram and the immediate actions of reactor emergency procedure REP-19, "Pressurizer Valves Fail to Operate," were performed.

An entry into Mechanical Equipment Room 114, which houses valve V527B, was made to determine its status. It was discovered that the valve was open, however, the valve stem disc, which actuates the valve position limit switches, had rotated to a point which prevented actuation of the 'open position' limit switch. The most likely cause of the rotation was system vibration from previous coolant charging pump operations. Following realignment and retightening, operability of the valve and the ability to add water to the primary coolant system was verified through the performance of a normal make-up water addition sequence. Additionally, all other similar air-operated-to-open, spring-to-close valves were checked to ensure proper tightness and alignment of the stem

disc. Permission to restart the reactor was obtained from the Reactor Manager. The reactor was refueled and subsequently restarted to 10 MW operation.

### **Safety Analysis**

Failure of water addition valve V527B to start primary coolant charging pump P-533 did not present a safety hazard to the reactor or any reactor coolant system. The reactor makeup water system is not part of the reactor safety system nor is it a facility design feature that is assumed to be operational in any accident analysis or reactor emergency procedure. The system provides a means for the addition of primary grade water that is lost during normal operation of the reactor through coolant sampling, pump seal leakage, etc. The system is not designed to provide makeup water for the protection against any significant leaks in the primary coolant system.

Furthermore, should a significant primary coolant system leak develop, a reactor scram would be initiated by low system pressure. Pressure transmitters PT-944A and PT-944B would also cause the primary coolant circulation pumps to stop and primary coolant isolation valves V507A and V507B to close. Closure of these valves would isolate the pressurizer and reactor water makeup system from the reactor pressure vessel and core.

### **Corrective Actions**

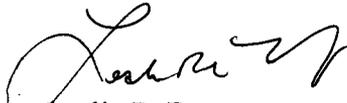
When it appeared that a Limiting Condition for Operation regarding a reactor auxiliary system was not satisfied with respect to the reactor makeup water system (Technical Specification 3.10.b), the reactor was promptly shutdown. The valve stem disc was realigned and retightened, and the operability of the valve and the ability to add water to the primary coolant system was verified through the performance of a normal make-up water addition sequence prior to restarting the reactor.

The valve stem disc is currently being redesigned such that any rotation of the stem or disc will not prevent actuation of the limit switches. Additionally, this event has been entered into the MURR Corrective Action Program as CAP entry No. 08-0006 and any additional improvements or corrective actions will be considered.

Attachment  
US Nuclear Regulatory Commission  
February 19, 2008

If there are any questions regarding this LER, please contact me at (573) 882-5276. I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,



Leslie P. Foyto  
Reactor Manager

ENDORSEMENT:  
Reviewed and Approved,

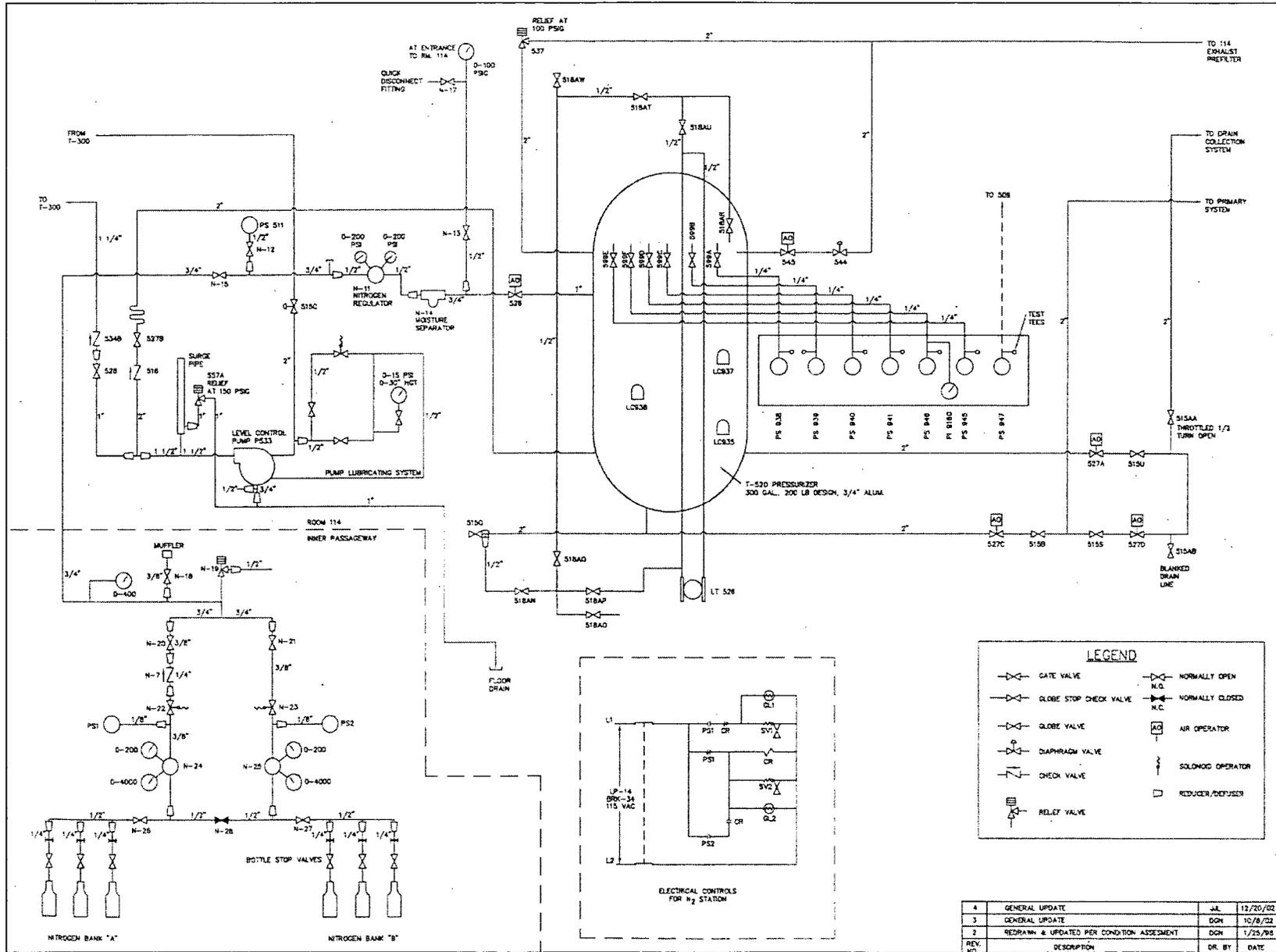


Ralph A. Butler, P.E.  
Director

*Christine M. Errante* 2/18/08

CHRISTINE M. ERRANTE  
Notary Public - Notary Seal  
State of Missouri  
Commissioned for Boone County  
My Commission Expires: April 14, 2011  
Commission Number: 07528381





REV. NO.	DESCRIPTION	DR. BY	DATE
4	GENERAL UPDATE	JAL	12/25/02
3	GENERAL UPDATE	DGN	10/8/02
2	REDRAWN & UPDATED PER CONDITION ASSESSMENT	DGN	1/25/95