THE OHIO STATE UNIVERSITY

Nuclear Reactor Laboratory

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3/12/93

Jim McCormick-Barger
US NRC Region III
Glen Ellyn, IL 60137

Subject: Reportable Occurrence at the OSURR, Docket 50-150, License R-75 regarding failure of Control Rod #1 to drop following a slow scram signal.

Dear Jim:

This letter addresses several issues concerning the recent malfunction of Shim Safety #1 Control Rod in response to a slow scram, and our corrective actions taken and proposed in order to restart the reactor. The event is postulated to have happened due to a short occurring between the engage limit switch assembly and the magnet coil assembly, allowing Shim Safety #1 Control Rod to remain energized and not drop into the core.

This could be due to moisture causing increased corrosion of connectors used in the assemblies, a nick caused by rubbing of the wire harness inside its mounting bracket, or a design flaw of the system.

a. Corrosion: Corrosion of the connectors between the wiring harness, magnet coil, and the engage limit switch could have resulted in a short to the metallic outer magnet assembly. The wires were wet with moisture allowing conduction, and one of the connectors to the magnet coil was loose due to corrosion of the wire.

b. Nick in wire: A nick in the outer sheath of the magnet coil wire of the wiring harness was observed where the harness is clamped to the top of the magnet coil assembly. Due to the motion of the magnet assembly, the wiring harness moves up and down inside the control rod housing's lower shell. Over a period of time, the movement could cause rubbing which may have eventually worn down the outer sheath of the magnet coil wire allowing it to short against the magnet coil assembly.

c. Design Flaw: A possible design flaw could have contributed to the event. The present design does not electrically "float" the system, nor perform online checks for shorts in the cable, which could have alerted the operator to the condition.

In order to prepare to restart the reactor, the following items have been completed:

1. Replacement of Shim Safety #1 Control Rod's magnet coil.

2. Repair and replacement of connectors for both the magnet coil and the engage limit switch.

3. Repositioning of the 'Wrist-Lock' quick disconnects to a position above the magnet coil assembly, above a phenolic positioning spacer to reduce condensation of moisture on the magnet coil wires and connectors.

4. Repaired Magnet Current Amplifier #1 module and performed a design change to ensure the slow scram signal goes directly through the relay rather than a comparator.

5. Examined the other two Shim Safety Control Rod drive mechanisms for indication of similar problems as that found in Shim Safety #1. Very little condensation was found on the magnet coil assemblies. The connectors were found to be in satisfactory condition, and the corrosion was much less than that found on Shim Safety #1.

6. Existing procedure OM-01, Reactor Power Changes was amended to instruct operators to turn the front panel On-Off switch to off should they observe the Shim Safety rod's current not decrease following receipt of a slow scram signal, and to verify the control rods are on the bottom following a reactor scram.

The Long-Term plan to prevent the recurrence of this type of event consists of analyzing our Preventive Maintenance Program, evaluating and redesigning our Magnet Current Amplifier design, and having the Reactor Operations Committee review this event.

a. Preventive Maintenance Program:

   1. Examine magnet coil connectors for corrosion on a quarterly basis starting JULY 93. Following these inspections, a determination will be made on the necessity of providing auxiliary ventilation to remove condensation.

   2. Create a procedure to monitor the magnet coil cable on a monthly basis to check for electrical grounds. This item should be completed by 1 APRIL 93.

   3. Review existing Preventive Maintenance schedule to determine if any additional safety related items should be put on the schedule. This should be completed by JULY 93.

b. Evaluation and Redesign of Magnet Current Amplifiers:

1. The Nuclear Reactor Laboratory shall design and install a Magnet Current Amplifier that "electrically floats", to preclude a ground on the system from causing an inability for the magnet to deenergize following receipt of a scram signal.

2. Design a system to monitor the magnet coil cable to continuously check the integrity of the lines and provide an alarm to notify the operator if a problem develops.

The above listed modifications shall be reviewed by the Reactor Operations Committee by 31 JULY 93. Following their review and approval, the system shall be installed by 31 DEC 93.

c. Reactor Operations Committee:

The Reactor Operations Committee shall review the completed items in this letter, the event, and our proposed actions at their next meeting scheduled in APRIL 93.

We await your review and approval of this information prior to restarting the reactor. Please contact me or Joel Hatch with any questions.

Sincerely,

Richard D. Myser

Richard D. Myser, Associate Director

cc: ROC members
cc: NRL file