MEMPHIS STATE UNIVERSITY
MEMPHIS, TENNESSEE 38152

August 12, 1982

Center for Nuclear Studies
Office of the Director
(901) 454-2687

Director
Region II, USNRC
Office of Inspection and Enforcement
101 Marietta Street, Suite 3100
Atlanta, GA 30303

Dear Sir:

Enclosed is the followup report to a reportable event that occurred at the Memphis State University AGN-201 Nuclear Reactor Facility on August 11, 1982. The report is submitted in accordance with section 6.9.2 of Appendix A to Facility Operating License R-127, Docket No. 50-538.

The reactor was being prepared for startup when a faulty microswitch was discovered in the Shield Water Level Safety Channel. No operating limits were violated. Initial notification was made to your office by telephone and confirmed by mailgram on August 11, 1982.

The faulty switch was replaced and tested, and normal reactor operations were immediately resumed.

Sincerely,

D. W. Jones

RLD:DWJ/mm

Enclosure: Followup Report to
Reportable Occurrence No. 82-1

cc: Mr. R. L. Dietz
Mr. Austin Hardin, Region II USNRC
Dr. J. A. Rhodes
Mr. J. R. Caves
Mr. J. P. Williams
Mr. C. V. Holm
Dr. D. K. Holmes

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cc: Document Control Desk (DCD)
USNRC
Washington, DC 20555

Reactor Safety Committee Members:

Ms. Patricia Bracken
Dr. Don Brady
Dr. D. Wayne Cooke
Mr. Glen W. Davis
Dr. K. K. Holmes
Dr. Larry W. Houk
Dr. Siraj M. Khan
Dr. W. Reed Langford
Mr. L. B. O'Kelley
Dr. Priscilla S. Rushton
Mr. Charles E. Tomlinson
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MEMPHIS STATE UNIVERSITY

AGN-201 NUCLEAR REACTOR FACILITY

LICENSE R-127, DOCKET NO. 50-538

FOLLOW-UP REPORT TO REPORTABLE OCCURRENCE NO. 82-1

Date of Report: August 12, 1982
Date of Occurrence: August 11, 1982
Initial NRC Notification: August 11, 1982

1. Reactor.

AGN-201, Serial 108. Located at the Center for Nuclear Studies, Memphis State University, Memphis, Tennessee. Facility Operating License No. R-127; Docket No. 50-538.

2. Reportable Occurrence.

Shield Water Level Float Switch Assembly failed to initiate protective trip signal during Prestartup Checkoff. Item 6.9.2.a(5) of the Facility Technical Specifications applies.

3. Conditions at Time of Occurrence.

a. The reactor was shutdown.

b. Shield water level was 8 inches below the highest point on the tank manhole opening which is the normal operating level for the system.

c. Prestartup Checks of the Shield Water Level Safety Channel were in progress per Facility Operating Procedure OP-2.

4. Narrative.

At 9:45 a.m., CST, on August 11, 1982 Prestartup Checks of the AGN-201, Serial 108 Reactor were being performed to verify operability of the Shield Water Level Safety Channel. The check is a Channel Test which consists of manually depressing the water level float to operate an associated microswitch and thereby interrupt the Interlock Line continuity circuit. Interruption of the Interlock Line initiates a protective trip signal by deenergizing the system's main scram relay which removes power from—and/or prevents application of power to—the control rod drive/latch magnets. The Channel Test is performed while the reactor is shutdown and with normal water level in the Shield Tank.

Upon depressing the float to its lowest level, simulating a water level of approximately 9.5 inches below the tank top, the operator did not hear an audible "click" of the associated microswitch which is physically located about 2½ inches above the water line nor was the Interlock line continuity circuit interrupted as observed by the Senior Operator stationed at the control console.

Operation of the reactor was prohibited. The event was reported to the Region II, U. S. Nuclear Regulatory Commission Office of Inspection and Enforcement via telephone conversation between the AGN-201 Reactor Supervisor and Mr. Austin Hardin, and confirmed by mailgram on August 11, 1982 in accordance with Section 6.9.2a of the Facility Technical Specifications.

Maintenance records indicate that the microswitch had been installed by MSU personnel on October 30, 1982 as part of a routine surveillance procedure. The Shield Water Level Safety Channel had been calibrated to initiate a reactor scram at a water level of 9-1/8 inches below the highest point on the manhole

opening which conforms to the Limiting Conditions for Operation specified in Table 3.1 of the Facility Technical Specifications. Subsequent Channel Tests required by Item 4.2.d of the Technical Specifications had been satisfactorily performed at least once each month, the trip set-point verified annually, and Channel Tests satisfactorily conducted during approximately 68 Prestartup Checkoffs since the time of switch installation. The most recent satisfactory Channel Test had been performed within 24 hours of the time of failure.

The microswitch was replaced with a new switch of the same type, was tested satisfactorily, and normal operations were resumed at approximately 10:15 a.m., CST, on August 11, 1982.

5. Safety Significance of the Occurrence.

In the event of a shield water leak, failure of the Shield Water Level Safety Channel to initiate a reactor scram at water levels > 10.5 inches below the highest point on the manhole opening during critical operation would have violated the specified Limiting Conditions for Operation. At levels greater than 12 inches below the top of the tank, adequate biological shielding would not be provided during reactor operation as specified by the Safety Limit of Technical Specification 2.1.

At normal operating power, an undetected loss of shield water could increase the gamma dose-rate at the reactor exterior by a factor of 7-8 and increase the neutron background by a factor of several hundred. Compounding an undetected loss of shield water with a nuclear runaway and additional scram circuit failure could result in an exposure of 200-300 Rem of fast neutrons to a person standing next to the reactor. (Reactor Hazards Summary Report for the AGN-201 Nuclear Reactor: Aerojet-General Nucleonics Report No. 23, Revised April 1, 1959.)

6. Redundancy.

There is no design redundancy in the Shield Water Level Safety Channel. However, a loss of shield water would be indicated by the following additional means:

a. Prior to Startup

(1) Shield tank level is verified at the proper level by visual observation and documented as part of each Pre-Startup Checkout.

(2) Visual inspection of areas which would receive shield water leakage is made and documented as part of each Pre-Startup Checkout.

(3) An increase in radiation levels may be observed during Pre-Startup radiation survey.

b. During Operation

(1) An increase in reactor room radiation levels sufficient to activate the facility evacuation alarm would be detected by the area gamma monitor located approximately 6 feet from the reactor.

(2) Shield water levels below ~ 20 inches from the tank top are visible from the control room via a viewing window directly in front of the AGN console and viewing window in the reactor shield tank (Operator is approximately 17 feet from shield tank 32½ x 27½ inch viewing window).

7. Cause of Failure.

Gradual buildup of corrosion products in the internal operating mechanism of the microswitch due to its location in the humid atmosphere of the shield tank resulted in the internal switch operating lever being stuck to the ceramic switch housing (Figure 1). Spring pressure, which normally opens the active switch contacts when the float operating arm permits movement of the microswitch plunger, was insufficient to overcome the corrosion effects; thus, the switch contacts remained closed and prevented interruption of the Interlock Line.

8. Corrective Action.

The microswitch was replaced with a new switch of the same type on August 11, 1982.

Manufacturer: Micro-Switch Company; Freeport, Illinois
Type: V3-101, SPDT, 0.5 A @ 125 volts D.C.
Mechanical Life: 10,000,000 cycles
Minimum Release Force: 2 oz.

9. Measures to Prevent Recurrence.

The microswitch casing is of riveted construction which precludes periodic disassembly and cleaning of switch internals. The availability of a model more suitable to a humid environment or a model constructed such that periodic cleaning of switch internals is possible will be investigated.

10. Applicability to Other Equipment in the Reactor System.

None. Microswitches of similar internal construction but with different terminal connectors and actuating mechanisms are utilized for interlocks and position indication devices in the Rod Control System. However, due to their location outside the humid atmosphere which is characteristic of the Shield Tank and due to the greater frequency with which they are exercised during normal reactor operation, it is anticipated that corrosion will not be a problem throughout the mechanical life of the switches.

11. Similar Reportable Occurrences.

MSU Followup Report No. 79-3 dated November 26, 1979, and No. 77-1 dated June 27, 1977.

Prepared by: _____
Reactor Supervisor

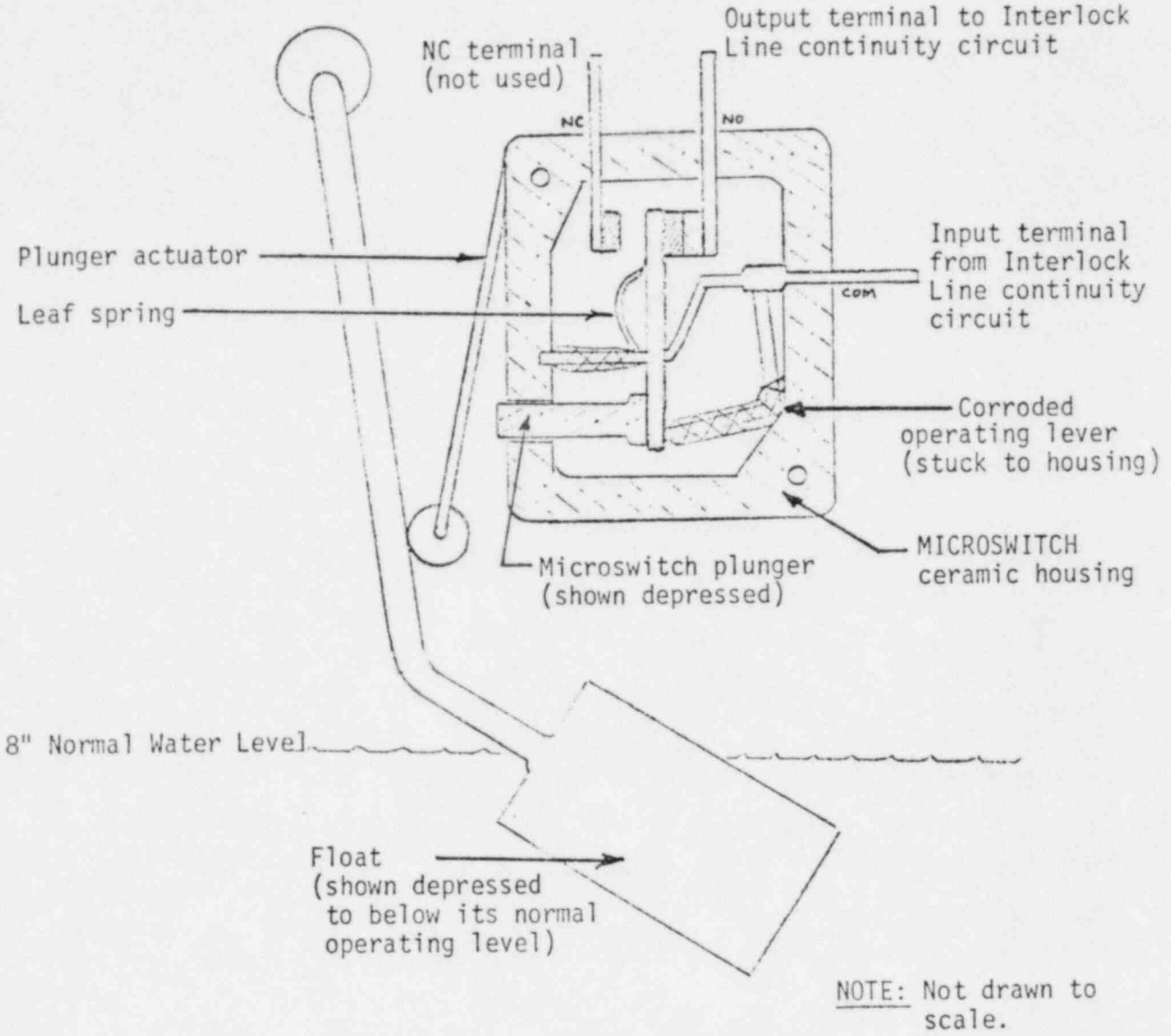

FIGURE 1. Shield Tank Float Switch Assembly (Microswitch shown in failed position)