



UNIVERSITY OF MISSOURI

Research Reactor Facility

January 13, 1984

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Director of Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Attention: Mr. Cecil O. Thomas, Chief  
Standardization & Special Projects Branch

Reference: Docket 50-186  
University of Missouri Research Reactor  
License R-103

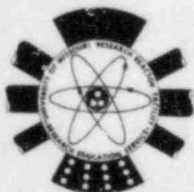
Subject: Emergency Generator

Description:

At 1515 on December 15, 1983, with the reactor operating at full power, it was discovered the emergency generator gasoline engine electrical interlock protective circuit was tripped. The protective circuit is designed to turn off the emergency generator on either high coolant temperature, low oil pressure, or engine overspeed condition. The emergency generator will not start with the protective circuit in the tripped condition. After the tripped condition was reset, the motor generator started and was run unloaded for 30 minutes. Therefore, the emergency generator was capable of being operated, but was in a reduced state since it would not have automatically assumed the emergency electrical loads on a loss of site power. This is a deviation from Technical Specification 3.10.a.

Analysis:

At 1515, December 15, while completing the Mechanical Routine Patrol, a machine shop employee discovered the trip light indicating on the emergency generator control panel. The machinist reset the tripped condition, notified the machine shop supervisor and the shift supervisor, who immediately started the engine and verified it operable. The emergency generator is housed on the third level of the north tower of the facility. Access to the towers is from the outside on the laboratory roof. The emergency generator is only observed when completing the daily mechanical routine patrol and reactor operations



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routine patrol every four hours. The emergency generator is started and run for thirty minutes weekly via an auto start exerciser clock normally set for 0800 each Thursday morning. Because of a site electrical outage and maintenance work performed the day before, the exerciser clock was off by one hour and twenty five minutes which would indicate that it started or tried to start at 0925. The generator weekly exercise was not observed by the control room operators. However, because of earlier routine patrol observations, it is felt the trip condition most likely occurred at that time.

A check of the engine oil level showed it to be full, and cooling water to the engine was available. On investigation of the protective trips, the high temperature tripped at 220°F (140°F normal operating temperature), the high RPM overspeed trip occurred at 2150 RPM (1800 RPM normal operating speed), and the low oil pressure tripped at 10 psig (45 -50 psig normal operating pressure). All trip values are in the acceptable range.

On investigation of the high temperature sensor, it was discovered that the electrical connecting wire spade lug was bent so that it was nearly grounded. Slight pressure on the wire would cause a grounding condition to occur. The three protective trips are wired in parallel, and on protective trip actuation close the ground circuit, energize the protective relay and secure the engine. Because the engine starter cranking limiter did not trip, it is suspected that the engine either started and ran, or tried to start; and either by heat expansion or vibration reached the tripped condition observed. The spade lug was repositioned and verified to be free and clear. The previous day, the thermostat on the engine was replaced and then the emergency generator was satisfactorily load tested. The thermostat is located immediately adjacent to the temperature sensor, and it is suspected that the electrical connecting wire spade lug was bent during this maintenance. Since this incident, the generator has run weekly on its automatic exerciser and CP-17, the electrical load compliance test, has been performed.

The analysis for loss of electrical power with the reactor operating at 10MW and the emergency generator failing to start is covered in Hazards Summary Report (HSR), Addendum 5, Section 2.4.1, 2.4.2, and 2.5. In this dual failure mode, the reactor will shutdown if not already shutdown and decay heat removal will be performed indefinitely by the in-pool heat exchanger. The control blades are released on loss of electrical current to their electromagnets and drop to the full inserted position by gravity. All process systems are placed in the shutdown condition due to the failsafe design of these systems; i.e. the redundant (only one is required) primary in-pool heat exchanger valves 546A and B open by spring actuation placing the convection cooling in-pool heat exchanger in service. This failsafe design of the system permits shutdown decay heat removal with no electrical power (Appendix D of Addendum 4 to HSR). The containment building integrity could not be indefinitely guaranteed if facility electrical power and emergency generator were not available, but the reactor would be shutdown and containment would not be required.

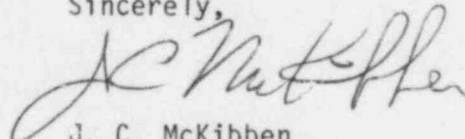
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Corrective Action:

The tripped condition was reset and the emergency generator was manually started and run for 30 minutes. Each protective trip has been tested to ensure it was operating properly. All of the trip sensor leads on the emergency generator have been placed so as to prevent an inadvertent grounding.

The emergency generator has been successfully load tested on the subsequent two maintenance days: December 29, 1983 and January 12, 1984. The cause of this problem was reviewed with personnel who perform maintenance on the emergency generator to avoid a reoccurrence on this or similar equipment.

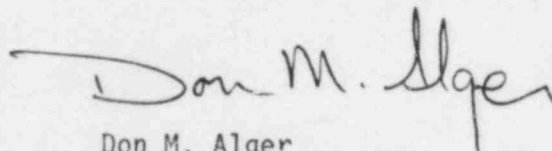
Sincerely,



J. C. McKibben  
Reactor Manager

Endorsement:

Reviewed and Approved



Don M. Alger  
Associate Director

JCMK:vs

cc: U. S. Nuclear Regulatory Commission  
c/o Document Management Branch

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Reactor Advisory Committee

Reactor Safety Committee

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