



Research Reactor Center

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July 2, 2007

U.S. Nuclear Regulatory Commission
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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.a

The attached document provides the University of Missouri Research Reactor (MURR) Licensee
Event Report (LER) for an event that occurred on June 4, 2007 that resulted in a deviation from
MURR Technical Specification 3.10.a.

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. James S. Coleman, Vice Provost of Research
Mr. Alexander Adams, Jr., US NRC
Mr. Craig Bassett, US NRC

A020

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Licensee Event Report No. 07-02 – June 4, 2007
University of Missouri Research Reactor

Introduction

On June 4, 2007, with the reactor shutdown for regularly scheduled maintenance activities, an “Alarm Condition Present” warning light and audible alarm was received on the Emergency Generator (EG) Alarm Panel located in the reactor control room. This visual and audible alarm is activated when an abnormal condition is sensed by the EG control system. Investigation as to the cause of the alarm revealed that the EG had failed to automatically start when prompted by the weekly exercise timer. The control system is programmed to automatically start the EG in the unloaded condition every week while the reactor is shutdown to verify its operability.

Because it had failed to start, it can be construed that the EG may not have been able to assume the emergency electrical load if a loss of normal electrical power event had occurred during reactor operation the previous week from May 28 to June 4. This would have resulted in a deviation from Technical Specification (TS) 3.10.a, which states, “*The reactor shall not be operated unless the emergency generator is operable.*”

Description of Emergency Electrical Power System

The emergency electrical power system is designed to provide electrical power to essential reactor components in order to monitor systems and assure personnel safety should the facility suffer a loss of normal electrical power. Emergency power is supplied by a 275-kW diesel generator housed in an addition attached to the southwest corner of the reactor laboratory building. Electrical power is supplied to the selected loads through an Automatic Transfer Switch (ATS) which transfers source power from the normal to the emergency electrical power system.

The EG, which has 731 hours of operation since it was originally placed in service August 1989, is driven by a water-cooled Cummins turbo-charged diesel engine. It is a 855-cu in, 395-HP, six-cylinder diesel unit with a mechanically driven fuel injection system. Fuel is stored in a skid mounted tank with a capacity of 270 gallons. This capacity allows for a continuous run time of approximately ten (10) hours under a full load condition. Two parallel sets of two 12-volt lead-acid batteries connected in series generate 24 volts for the starting system. A static-type, dual rate, float/equalizer charger with automatic and manual charge control maintains the startup batteries fully charged.

This four pole generator is rated for an output of 344 kVA (275 kW at 0.8 PF), 277/480-volt, three-phase, 60-cycle electrical power. It is equipped with a brushless permanent magnet exciter. The design of the exciter and regulator provides for voltage regulation of less than $\pm 2\%$. Stable generator output voltage and frequency are established within two

(2) seconds after the transition between no load and full load conditions. The unit is designed to assume full load within seven (7) seconds from a cold start and is sized to meet current and anticipated loads with an excess capacity approaching 50%.

Operation of the EG, and the transfer of electrical power from the normal source to the emergency power bus, is automatic. The EG starts approximately one second after a loss of the normal electrical power source. After reaching rated voltage and frequency, it will assume the emergency electrical load after the ATS shifts to the emergency power bus. Upon restoration of the normal electrical power source, the emergency load will be transferred back to the normal source after an adjustable time delay. After an additional adjustable time delay, which allows the unit to cool down with no load, the EG will shut down and assume its normal standby mode.

The EG is programmed to automatically start in the unloaded condition and run for 30 minutes every Monday morning while the reactor is shutdown to verify its operability. It is also exercised unloaded before a reactor startup if the reactor has been shutdown for greater than 24 hours. These checks are performed to satisfy TS surveillance requirement 5.6.b, which states, "*Operability of the emergency generator shall be verified prior to each startup following a shutdown of greater than 24 hours. In case of extended reactor operation, the generator operability shall be determined each week.*" Additionally, the EG is load tested on a quarterly basis to satisfy TS surveillance requirement 5.6.c, which states, "*The ability of the emergency generator to assume the emergency load shall be verified on semi-annual intervals.*"

Detailed Event Description

On June 4, 2007, at approximately 04:40 with the reactor shutdown for regularly scheduled maintenance activities, an "Alarm Condition Present" warning light and audible alarm was received on the EG Alarm Panel located in the reactor control room. This visual and audible alarm is activated when an alarm condition is initiated by the EG control system. An operator was immediately sent to the diesel generator room to determine the cause. The operator noted that the typical alarm lights – "Low Oil Pressure," "Alarm," and "Read Upper Meter Scales" – that indicate an attempt and failure of the EG to start were illuminated. As described in the previous section, the EG is programmed to automatically start in the unloaded condition and run for 30 minutes every Monday morning while the reactor is shutdown.

After conferring with the Lead Senior Reactor Operator (LSRO), the operator performed the EG pre-operational checklist and no abnormalities were noted. At approximately 05:00, the EG Control Panel was reset to clear all alarms and the EG was placed back in the automatic start mode. The EG then attempted and failed to automatically start three times (starting motor solenoid was engaging but the motor would not turn over), again resulting in the three alarms listed in the previous paragraph. At this point the EG automatic start switch was placed in the OFF position and the control console switch

which supplies current to the control blade electro-magnets was Danger Tagged in the OFF position, thus preventing a reactor startup with the EG in an inoperable state. Reactor Operations Management was then notified and further troubleshooting efforts by our staff were unable to determine the cause.

The vendor, which had supplied the EG, was contacted and a technician was sent to MURR. The technician found that the four 12-volt lead-acid batteries were in varying degrees of capability – one had failed, two were in reduced capacity, and one was still in fairly good condition. All four batteries were replaced, and the EG was manually started and operationally checked satisfactory. Compliance procedure CP-17 was also performed to ensure that the EG was capable of assuming the emergency electrical load.

Safety Analysis

The design of the MURR does not require electrical power to safely shut down the reactor or to maintain an acceptable shutdown condition. A loss of normal electrical power and a subsequent failure of the EG to start (i.e., complete loss of electrical power to the facility) is analyzed in Addendum 5 to the Hazards Summary Report. If this event were to occur, the reactor would scram due to the interruption of current to the electro-magnets that hold the control blades in position during operation and the core would be cooled indefinitely by natural convection circulation through the in-pool heat exchanger. Reactor and process instrumentation would still be continuously powered even after the electrical interruption by the 15-kVA Uninterruptible Power Supply (UPS) until the discharge limit of the UPS battery bank was reached (approximately two hours at a normal load current of about 54 amps and a rated battery bank life of 120 amp-hours).

In addition, the emergency electrical power system is not required for protection of the integrity of the fuel elements.

Corrective Actions

When it was determined that the EG was not operable because it was unable to start when prompted by the exercise timer, the control console magnet current switch was Danger Tagged in the OFF position to prevent reactor operation. During troubleshooting efforts, the EG vendor technician determined that three of the four 12-volt lead-acid batteries had failed or were in reduced capacity state. The batteries were replaced, the EG was tested satisfactorily and then returned to operation in the automatic start mode. Prior to this failure, the EG had automatically started by the exercise timer on May 28, 2007, and satisfactorily load tested on March 19, 2007.

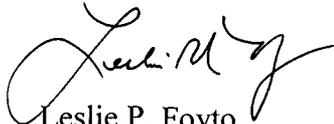
The EG batteries are replaced every three years as required by a routine Preventative Maintenance (PM) procedure. The batteries were last replaced on July 7, 2004, with Deka Model 1231 Commercial Batteries. In researching the specifications for the Deka batteries, the suggested warranty was listed as either 30 or 36 months, depending on the

supplier. The new batteries are Interstate Model 31-MHD with a suggested warranty of 36 months.

The PM procedure will be revised such that the EG batteries are now replaced every two (2) years as well as a note added to ensure that the new batteries must have a minimum suggested warranty of 36 months. Additionally, this event has been entered into the MURR Corrective Action Program as CAP entry No. 07-0031 and any additional improvements or corrective actions will be considered.

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,

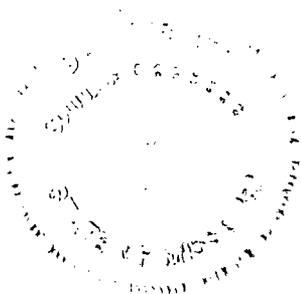

Leslie P. Foyto
Reactor Manager

ENDORSEMENT:
Reviewed and Approved,


Ralph A. Butler, P.E.
Director

State of Missouri
County of Boone

On this 2nd day of July in the year 2007,
before me, the undersigned notary public, personally appeared
Leslie Foyto & Ralph Butler, known to me to be the
person(s) whose name(s) is/are subscribed to the within
instrument and acknowledged that he/she/they executed the
same for the purposes therein contained. In witness whereof, I
hereunto set my hand and official seal.




Notary Public