Radiation Center Oregon State University Corvallis, Oregon 97331 (503) 754-2341

December 19, 1980

U.S. Nuclear Regulatory Commission
Region 5, Office of Inspection & Enforcement
1990 N California Blvd.
Walnut Creek Plaza, Suite 202
Walnut Creek, CA 94596

Attention: Director, Region 5, OIE

Reference: Oregon State TRIGA Reactor (OSTR), Facility License No. R-106
Docket No. 50-243

Gentlemen:

In accordance with section 6.7, subsection b.2, of the Technical Specifications for the above referenced OSTR facility license, and as indicated in our phone notification to your office on December 15, 1980, we are submitting a report within 14 days of an occurrence wherein the OSTR appears to have been operated in violation of a Limiting Condition of Operation. The details of the occurrence, immediate corrective actions taken and measures planned to prevent a reoccurrence of this or similar types of situations are detailed in Attachment A.

With the submission of this written report, all actions required by section 6.4 of the Technical Specifications will be completed. Should there be any questions or a need for further information, please let us know. We regret this occurrence, but feel that our corrective actions will be effective in preventing future difficulties of this nature at the OSTR. In addition, we believe that our experience may be helpful in preventing similar occurrences at other research reactor facilities.

Very truly yours,

C. H. Wang
Reactor Administrator & Director

rk
Enc.
cc U.S. NRC, Document Management Branch, Washington, DC
U.S. NRC, Office of Inspection & Enforcement, Washington, DC
Oregon Department of Energy
S.E. Binney, Chairman, Reactor Operations Committee, OSU
T.V. Anderson, Reactor Supervisor, OSU
B. Dodd, Health Physicist, OSU
A.G. Johnson, Senior Health Physicist, OSU
J.C. Ringle, Assistant Reactor Administrator, OSU

A002 S 1/1

5

Attachment A

OREGON STATE UNIVERSITY TRIGA REACTOR (OSTR)
REPORTABLE OCCURRENCE
FACILITY LICENSE NO. R-106, DOCKET NO. 50-243

A. Date of Occurrence: December 12, 1980

B. Summary of Occurrence

The OSTR was operated for approximately one hour with a non-functioning air pump on the reactor top continuous air particulate radiation monitor. While the monitor's other electronics and radiation detectors were still functioning, operation without a pump does not appear to fully meet the intent of Technical Specification 3.6.1 under Limiting Conditions of Operation.

C. Sequence of Events Relating to the Occurrence

1. Friday, December 12, 1980

Time	Event
0856	The reactor was started up normally and operated at 1 MW for irradiation of samples in the rotating specimen rack.
1359	The reactor was shut down for addition of samples in the rotating specimen rack.
1402	The reactor was started up and operated at 1 MW for further sample irradiation.
~1500	A fuse blew in the reactor top continuous air particulate monitor (CAM) causing the pump motor and air pump to stop. There was no indication of this failure in the control room. (The time of this occurrence was deduced from the traces on the CAM chart recorders.)
1605	The reactor was shut down for the day.
1610-1700	On entry into the reactor bay to complete the routine shutdown checklist, the reactor operator noticed that the CAM motor and air pump were not running. On investigation, it was discovered that a fuse had blown. The fuse was replaced and the CAM immediately functioned correctly. It was not recognized at this time that a Limiting Condition of Operation had apparently been violated.

2. Monday, December 15, 1980

Time	Event
0815	While completing the reactor start-up checklist, the reactor operator noticed the CAM power cord arcing where it was plugged into the socket, due to a loose fit at the socket. It was also noticed that the CAM fuseholder connection was loose. Both of these items were immediately corrected and deemed to be the probably cause of the CAM fuse failure.
1101-1201	The reactor was operated at 10 KW for one hour for sample irradiation. During this time the CAM was checked every 10-15 minutes by personal observation to verify its correct operation.
1115	The Assistant Reactor Administrator and Senior Health Physicist were notified by the Reactor Supervisor of the CAM pump failure on the previous Friday (December 12). Following this notification, it was recognized that a Limiting Condition of Operation had most likely been violated.
1200	The Assistant Reactor Administrator (the Reactor Administrator was unavailable at this time), the Senior Health Physicist, and the Reactor Supervisor had a meeting to determine the correct course of action. It was decided to immediately install a light on the CAM which would be visible from the control room and would clearly indicate the presence of power to the CAM air pump motor. While the light was considered to be an interim measure to reduce the probability of reoccurrence, more permanent solutions to accurately annunciate all CAM failure modes will be implemented and are discussed in section F of this report. As a further action in the meeting, all other OSTR radiation monitoring systems listed under the Limiting Conditions of Operation were reviewed to determine if other unannunciated failure modes were possible. Conclusions and recommendations are included in section F.
~1430	The Senior Health Physicist notified the Region 5 office of the NRC of the occurrence.
1500	The installation of the temporary CAM air pump motor failure light was completed.
1530	The chairman of the Reactor Operations Committee was notified of the occurrence, was alerted to expect a written report very soon, and was requested to schedule a meeting of the committee.

D. Analysis of the Cause of the Occurrence

The most probable cause of the CAM motor and pump failure was either a loosely fitting power plug, a loose, unsoldered fuse holder connection, or a combination of both, which caused electrical arcing and resulted in a blown CAM fuse. Since there was no control room annunciator for this type of failure, the operator was unaware of the situation until he went onto the reactor top and noticed that the pump and motor were quiet.

E. Immediate Corrective Actions Taken

1. The fuse holder wire was soldered to prevent it from coming loose again.

2. The CAM plug and socket were inspected and were securely pushed together. The fit was essentially normal when the plug was fully inserted into the socket.

3. A locking-type power plug and socket have been ordered to improve the reliability of the CAM power supply connection. They will be installed upon arrival.

4. A temporary light, which is easily visible from the control room, has been connected to the CAM so that if the power fails to the air pump motor the light goes out.

F. Recommendations and Corrective Actions to Be Taken to Prevent the Probability of Reoccurrence

1. Two separate CAM failure annunciators will be connected in the control room such that each of the following two events will cause an individual alarm:

   a. Loss of CAM air flow.

   b. Low (or no) count rate on the CAM particulate channel.

2. A list of all events which may be classed as reportable occurrences is being prepared. This list will be more detailed than the one in the Technical Specifications and will be available for easy reference by the reactor operations staff.

3. The possibility of there being other unannunciated failure modes for the OSTR radiation monitoring and ventilation systems was investigated and the following conclusions and recommendations were reached:

   a. There is no apparent problem with the reactor bay ventilation system. All potential failure modes are annunciated.

b. The area radiation monitors (ARMS) also will not present a problem, as only one area radiation monitor is required by the Technical Specifications and there are 13 applicable ARM channels running off of three separate power supplies. If power should fail causing all the ARMS to fail, then other instrumentation also fails and the situation is obvious. Additionally, each individual ARM channel has a failure alarm for the detection and display system.

c. The stack exhaust monitor power system, air flow and filter paper integrity are annunciated to indicate failures.

d. One system which seems to need failure alarms is the stack exhaust monitor gas and particulate counting channels. If either counting channel now fails, there is no low count rate annunciator in the control room. The only present indication would be an abnormal slope on the control room chart recorder or visual failure on the control room count rate meters. Control room annunciators for low count rates on these two monitoring channels will be implemented as soon as components can be obtained. (We are told about six weeks based on our immediate order.) In the meantime, reactor operators will be instructed to maintain closer visual surveillance over the recorder and count rate meter displays for the stack monitoring channels to ensure early detection of a channel failure. This surveillance will be in addition to the normal observation and written record of stack monitoring status. Since these counting channels are regularly maintained and have approximately 14 years of operating history without an undetected failure, we feel that this interim surveillance action is a reasonable measure until electronic annunciators can be installed.

4. The possibility of other unannunciated failures under Limiting Conditions of Operation or in other key reactor systems will be investigated and corrected as deemed appropriate by the Reactor Operations Committee. A report of this investigation will be presented to the committee for their review and approval.

5. It is our opinion after reviewing this event that many other research reactors could undergo an identical occurrence. Most such reactors have a requirement for a continuous particulate air monitor to be in operation, and most of the research reactors use air monitoring equipment similar to that used by OSU, with the same lack of failure annunciators on one or more of the essential systems (i.e., pump motor, counting channel(s) or air flow). Therefore, it may be desirable to alert other facilities to ensure that such failures, should they occur, do not go unrecognized during periods of reactor operation.