The University of Arizona

College of Engineering and Mines
Department of Nuclear and Energy Engineering
Tucson, Arizona 85721

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1985

A Proud Beginning

August 26, 1985

U.S. Nuclear Regulatory Commission
Region V
Office of Inspection and Enforcement
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596

Re: Annual Report for License R-52, Docket 50-113

Gentlemen:

This is the Annual Report covering the period July 1, 1984 through June 30, 1985, for the activities of the TRIGA Mark I Reactor at the University of Arizona, Tucson, Arizona. This report is submitted in compliance with Section 6.7e of the Facility Technical Specifications and Paragraph 50.59(b) of Title 10, Code of Federal Regulations.

1. During the reporting period, the reactor was operated for research and education. It was used for reactor operator training of replacement operators at this facility and for cold license training for operators from an Arizona utility. The reactor was used for graduate thesis research and undergraduate Nuclear Engineering course experiments, including approaches to critical, control rod calibrations, measurements of the dynamic response of the reactor to step and periodic changes in reactivity, and flux mapping. The reactor was also used for neutron activation analysis and production of short-lived radioisotopes for teaching and research. Less than one percent of total reactor operating time was used for nonuniversity-related purposes.

Reactor upgrading and modification include rekeying the entrance doors to the restricted areas due to loss of keys by a laboratory staff member, addition of a bypass valve to the water purification system, changing the gear train in the stack monitor chart recorder to conserve use of chart paper, installation of new batteries in the security alarm system, and replacement of the stack monitor chart recorder.

Routine surveillance tests of the power channels, including recalibration, showed only minor changes in zero adjustment and full scale trip settings. The total worths of the regulating, shim, and transient rods were measured to be $4.00, $3.12, and $2.45 respectively. The largest change in worth was +3.3% on the shim rod which is in line with rotational changes of position of individual fuel elements from fuel movement during approach to critical experiments.

No fuel elements were measured for length or bend during the reporting period as use is below the surveillance requirements as set forth in the facility technical specifications.

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The transient rod drive assembly was inspected twice during the reporting period. Following visual inspection of the control rods, it was found that the drop time for the transient rod was approaching the maximum value allowed by the facility technical specifications. Further maintenance to the rod drive assembly was performed at this time. The piston assembly was disassembled and all parts thoroughly cleaned. All functional seals were replaced. The shock absorber was drained, cleaned, refilled with new hydraulic fluid, and refitted with necessary seals. After maintenance, the transient rod drop time was measured to have a value consistent with past measurements.

Rod drop times, from full out to full insertion, were measured to be 0.34, 0.32, and 0.63 seconds for the regulating, shim, and transient rods, respectively. There was no appreciable changes in the regulating and shim rods since the last rod drop measurements. The transient rod drop time was reduced 28 percent due to maintenance described in the preceding paragraph.

The regulating, shim, and transient rods were visually inspected during the reporting period. The control rods showed no unusual sign of wear and no deterioration. The connection between the control rod and connecting rod was found to be secure for each control rod.

2. The reactor was critical for a total of 146 hours, producing 4327 kw-hours (0.1180 Mw-day) of thermal energy. The cumulative energy output since the facility was commissioned is 7.029 Mw-days. During the reporting period 85 pulses with input reactivity greater than $1.00 were performed. The total number of pulses greater than $1.00 from the time pulsing was initiated is 1332.

3. There was one inadvertent reactor scram during the reporting period. On July 31, 1984 the transient rod dropped into the reactor core while a lightning storm was in progress. It is assumed that a momentary reduction in line voltage caused a loss of air on the transient rod drive assembly due to a change in position of the three-way solenoid-valve which supplies air to this assembly. No safety limit was exceeded.

4. Major maintenance items included work on the transient rod drive assembly as described in Section 1, replacing filter capacitors in a 15-volt power supply in the control console, installation of a new flow meter on the particulate air monitor, installation of a new center wire in the fuel handling tool, rebuilding of the continuous air monitor air pump and eventually installing a new air pump, replacing a return spring in the "up" switch for the shim rod, replacing aluminum tubing and connectors in the water purification system, and vacuuming the reactor pool. Minor maintenance included greasing exhaust fan and stack fan bearings, replacement of batteries in low water level alarm circuit, replacing light bulbs in the reactor pool, and replacing the communicator bulbs in the control console. In addition, monthly, semi-annual, and annual preventive maintenance as required by the University of Arizona Reactor Laboratory monthly and annual checklists was performed.

5. The Reactor Committee met five times during the reporting period (9/7/84, 9/26/84, 10/24/84, 2/18/85, 5/21/85). The following items of business were covered:

The Committee reviewed and approved modifications to facility procedures for neutron irradiation, inspection of the demineralizer, replacement of filter cartridges and resins in the water purification system, test of the intrusion alarm system, calibration of the continuous air monitor, and control element removal and inspection.

The Committee reviewed and approved new Emergency Procedures for the facility to accommodate requirements of the recently-approved Emergency Plan. Portions of the administrative and operating procedures which were superceded by the new Emergency Procedures were deleted while other portions, not covered by the new Emergency Procedure, were assigned a new procedure number and title.

The Committee reviewed and approved revisions to the draft of the Physical Security Plan to accommodate suggestions made by the NRC. These revisions also required modification to facility procedures defining laboratory users and persons allowed to authorize visitors entry into the laboratory, which were reviewed and approved by the Committee.

The Committee reviewed transient rod drive assembly and water purification system maintenance. They also reviewed escort requirements for maintenance personnel in conjunction with scheduled repair and painting of the facility.

The Committee reviewed a critique of the annual emergency drill held at this facility and a letter confirming emergency assistance from the University Police Department in agreement with delegation of responsibility as set forth in the facility Emergency Procedures.

The Committee discussed a letter from the Tucson Fire Department explaining that they could not submit a letter of emergency aid commitment to this facility because they were prohibited by city ordinance to enter into specific contractual agreements with the University. This matter was referred to the NRC, and it was determined that the primary need was acknowledgement from the Fire Department of the presence of the Reactor Laboratory. This acknowledgement was made in the original letter.

The Committee reviewed a radiological assessment of potential radioisotope accumulation in the ion exchange bed for the water purification system (located outside the restricted area) in case of fuel or experiment failure. No doses in excess of regulatory limits are expected in these cases.

The Committee also reviewed and approved modifications to the annual checklist to include calibration of the airflow meter on the Continuous Air Monitor and a check for the first calendar quarter radiation exposure report required by

10CFR20.407, a modification to the irradiation request and material transfer form, and a modification of the visitor's log form.

At its meetings and in individual reviews by committee members, the committee reviewed operations and operational records of the facility as specified by the committee charter. This included audit of preliminary check sheets, pulsing check sheets, approach to critical and termination check sheets, operations and maintenance logbooks, monthly and annual checksheets, irradiation records, and experiments performed with the reactor. The Committee received reports about new operator trainees, newly licensed operators, and reviewed the 1984 annual report to the NRC.

6. No liquid waste was discharged from the facility during the reporting period. Fourteen gallons of spent resin and water from the water purification containing 1.09 μCi Co-60, 0.15 μCi Co-58, 0.29 μCi Sb-124, 0.29 μCi Mn-54, and 0.55 μCi Zn-65 were collected by the University Radiation Control Office for burial at the state-licensed facility. A total of 3.5 cubic feet of solid waste (floor sweepings, tissues, gloves, decayed neutron activation samples, and standards) containing trace quantities of mixed irradiation products was also collected. The material was buried at the University of Arizona Waste Burial Ground, maintained under ARRA license 10-24. These collections were made in December 1984 and in March 1985.

Argon-41 was produced in concentrations that are not measurable because the radiation level is much less than natural background. However, based on a calculated upper bounding estimate for production of Argon-41 of 50 microcuries per 100 kw-hours generated, the calculated amounts of Argon-41 produced for each month of the reporting period are presented below. Most of the Argon-41 would have remained in the pool water until conversion to stable Potassium-41, since Argon-41 has a short halflife.

Month	Argon-41 (microcuries)
July 1984	< 25
August 1984	<125
September 1984	<225
October 1984	<500
November 1984	<350
December 1985	<300
January 1985	< 25
February 1985	< 50
March 1985	<400
April 1985	<100
May 1985	<425
June 1985	<100

The total of these amounts during the reporting period is 2.46 millicuries. This is less than 0.5 percent of the allowable Argon-41 release as per 10CFR20. The facility is expecting to receive an Argon-41 detecting system

from Northrup Corporation when they decommission their TRIGA reactor. It is hoped that this system will have sufficient sensitivity to allow us to report a measured value of Argon-41 release in the future.

7. Sixty-five (65) persons were issued film badges in the Department of Nuclear and Energy Engineering during the reporting period on a monthly schedule. The persons receiving badges included all reactor operators, faculty and staff members, and all students in laboratory courses. One person received a measurable dose of penetrating radiation. This person received 30 mrem on a finger ring badge while performing maintenance for a University electron accelerator laboratory on a gamma radiation detector which contained an internal calibration source. This person was a staff member who was not involved in any classes or research making use of the TRIGA reactor at the time.

Five hundred sixty-nine (569) non-badged persons were admitted to the Reactor Laboratory in classes, tours, or on official business during the reporting period. All groups were issued pocket dosimeters or were admitted only after completion of a radiation survey which showed all dose rates to be less than that in unrestricted areas as required by the facility procedures. No radiation exposure was received by any visitor, as measured by the pocket dosimeters.

8. Radiation surveys of the reactor room, control room, and experiment set-up room were conducted monthly during the reporting period by members of the University of Arizona Radiation Control Office using direct measurement and wipe tests. The results show little detectable activity except where expected (i.e., irradiated samples in storage areas and internal wall surfces of the irradiation facilities). Other radiation surveys were performed by members of the reactor laboratory staff when necessary. No radiation exposure which can be attributed to reactor operations has been detected outside the reactor laboratory.

9. Environmental TLD monitors at 3 locations on the building housing the reactor and at 10 other locations on the University campus were replaced and read monthly. The average reading of the 3 TLD's located on the building, and the average of the 10 other TLD's were not significantly different (within 1 mrem/month) from the average reading of 3 control TLD's. (In some cases, the measured readings were less than the control readings.) These minor variations are of no significance at this level, and may be due to slight differences in the efficiency of individual TLD monitors.

In writing this report, I have tried to be both complete and as brief as is reasonable, and still satisfy the requirements of 10CFR50.59, the Facility Technical Specifications, and the needs of the Commission. If other or more detailed information is needed, please contact me at your earliest convenience.

Sincerely,

GWNelson

George W. Nelson, Director
Nuclear Reactor Laboratory

GWN/km

cc: Director, Office of Inspection & Enforcement
USNRC
Washington, DC 20555