Nuclear Reactor Laboratory
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U. S. Nuclear Regulatory Commission
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Re: Annual Report for License R-52, Docket 50-113

This is our Annual Report covering the period July 1, 2009, through June 30, 2010, 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 Section 50.59 of Title 10, Code of Federal Regulations.

During the reporting period, we operated our reactor for education and for neutron activation analysis under contract with the Lawrence Livermore National Laboratory. We continued using the extended pneumatic transfer system, the "Rabbit," to deposit irradiated samples down into a storage pit equipped with a solid-state gamma photon detector. The extended rabbit, first mentioned in our 2006-2007 report, automatically ejects an irradiated sample capsule immediately after a reactor pulse. Our extended rabbit system continues performing reliably.

We conducted our final operation May 18, 2010. The following day we moved all B-ring and C-ring fuel elements from the core to a storage holster outside the reflector. The core now contains insufficient fissile material or moderator present in the reactor or control rods to attain criticality under any conceivable conditions of moderation and reflection. Our operating license expired on May 21, 2010.

We calibrated the power channel by the calorimetric method. We found the measurement result anomalously low by about 10% compared to the previous calibrations. We could not explain the anomaly and could not repeat the measurement to verify it, because of our requirement to permanently take the reactor out of service by May 21. We elected not to change the positioning of the power channel instruments, because the previous settings were conservative.

We did not measure the Regulating, Shim, and Transient control rod worths or control rod drop times during this reporting period because of the requirement to take the reactor out of service by May 21. These surveillance items were not overdue.

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We twice inspected the Transient control rod drive assembly during the reporting period. Both piston seals were found in satisfactory condition with no wear or rust present in the air cylinder. The biennial control rod inspection revealed no changes to the control elements and fuel followers over the last two years.

Per existing procedures we calibrated the reactor console power channels, the area radiation monitors, the reactor pool activity monitor, and the pool conductivity meter during the reporting period.

The reactor was critical for a total of 49.5 hours, producing 607.4 kW-hours (0.0253 MW-days) of thermal energy. Our cumulative energy output since the facility was commissioned is 10.184 MW-days.

We performed 58 pulses or reactivity insertions greater than $1.00 during this reporting period. We have performed 2,567 pulses since 1958. Our five-year inspection and measurement of all fuel rods was not due during this period.

The reactor was in operation 75 days during the reporting period, with 74.5 hours of operating time, as recorded by the console clock.

We recorded two unintended reactor SCRAMs during this reporting period, on January 13, 2010, and on May 14, 2010. One was caused by a malfunctioning high-voltage power supply and the other by burned out indicator lights. Both problems were solved by replacing the defective equipment, with like components.

We performed routine minor maintenance during the reporting period.

The Reactor Committee met four times during this reporting period: August 27 and December 3 in 2009, and March 8 and May 6 in 2010.

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 log books, monthly and annual check sheets, irradiation records, and experiments performed with the reactor. The reactor committee approved two modified administrative and operational procedures. There were no changes to our facility that required a 10CFR50.59 review.

We discharged no liquid or solid waste from the facility during the reporting period.

Measurements of the Argon-41 concentration in the reactor pool water have demonstrated that the maximum rate of release of Argon-41 from reactor pool water is less than 0.74 μCi per kilowatt-hr of reactor operation. The pneumatic transfer system produces approximately 0.05 μCi of Argon-41 per kW-min of reactor operation, some of which is released when the system is operated. Presented below are the calculations of the maximum semiannual releases of Argon-41 from the reactor pool surface, the pneumatic transfer system, and the totals.

Period	Argon-41 from Pool Surface (μCi)	Argon-41 from Pneumatic Transfer System (μCi)	Argon-41 Total (μCi)
July to December 2009	344.7	3.7	348.4
January to June 2010	327.5	259.0	586.5
TOTAL	672.2	262.7	934.9

The calculations for Argon-41 release from the pneumatic transfer system include no decay of the isotope prior to release and, therefore, over-estimate our Argon-41 release. During this reporting period we performed forty (40) irradiations with the pneumatic transfer system. The maximum total estimated Argon-41 release from the facility during the reporting period is .94 milliCuries.

During the reporting period we replenished the reactor pool with 510 gallons of demineralized water from the campus micro-fabrication laboratory. The reactor pool water evaporated directly from the pool or was collected during maintenance and allowed to evaporate in Engineering Room 124A. The evaporated 510 gallons of tritiated pool water represents about 0.0049 milliCuries.

We discharged no gaseous or liquid effluents from the facility during the reporting period.

Five (5) persons were issued film badges on a monthly basis for all or part of the reporting period in the Nuclear Reactor Laboratory. The persons receiving badges included all reactor operators and staff members and student employees using the reactor laboratory. The most any individual received was a 2 milliREM total effective dose equivalent (TEDE) exposure.

We admitted 176 non-badged persons to the Reactor Laboratory for tours, inspections, maintenance, or other official business during the twelve-month reporting period. Pocket dosimeters issued to all visitors indicated that no exposure was received.

The University's Radiation Control Office conducted monthly direct measurement and wipe radiation surveys of the reactor room, control room, and experiment set-up room. The results show little detectable activity except where expected (i.e., irradiated samples in storage areas and internal wall surfaces of the irradiation facilities). Members of the reactor laboratory staff performed other radiation surveys when necessary. No radiation exposure attributable to reactor operations was detected outside the reactor laboratory.

Three environmental TLD monitors on the roof of the Engineering Building and environmental TLD monitor sites on the roofs of ten additional buildings provide a radio-dosimetry perimeter around the Engineering Building where the UARR is located. Two control TLD monitors are maintained in the Radiation Control Office to give a campus background. For calendar year 2009-the period for which RCO data exists-the dose rate, after subtraction of the average background reading for 11 of these 13 TLDs was zero milliREM/yr. The TLD atop the Art Building read 10 milliREM/yr, up from 0.5 milliREM/yr in 2008. The TLD atop the Computer Center showed 2.0 milliREM/yr, down from 3.5 milliREM/yr in 2008.

Radiation exposures in the vicinity of the reactor remain normal. Eight TLD monitors placed at the periphery of the restricted area provide the annual dose rate. Two TLDs in an office area far removed from the restricted area provide a baseline reference for the Engineering Building background. The background-subtracted exposures recorded by TLDs on the periphery of the NRL ranged from 4 to 75 milliREM/yr. The areas where the uncorrected monitors exceeded 100 milliREM/yr are surveyed using a calibrated ion chamber quarterly by the Radiation Control Office with the reactor operating at 100 kW. Our Radiation Control Office detected no radiation levels exceeding background level (<0.01 mR/hr).

Two background monitors are in Room 111 of the Engineering Building. The minimum detectable dose for these monitors is 1.0 milliREM/qtr for photon radiation. Area monitors are placed in and around the Reactor Room to monitor the beta dose.

Environmental TLD monitors at three locations on the roof of the Engineering Building showed no radiation level exceeding background (0.01 mR/hr.). Additionally these areas are not continuously occupied, and instrument dose rates demonstrate exposure rates to be <0.01 mR/hr.

10CFR20.1301 mandates the total effective dose to the public must not exceed 100 milliREM/year or 2.0 milliREM/hr. With the reactor operating at maximum power (100kW), all survey instruments read under 0.01 milliREM/hr. To estimate the radiation dose from external and internal radiation sources, the highest environmental monitor reading is summed with the ^{41}Ar estimated dose and multiplied by an occupancy factor (0.25). The dose in Room 124A, the middle of the North wall, adjacent to the secured electrical transformer enclosure is 71 milliREM/year. Our COMPLY Code estimated the dose of 0.1 milliREM/year. These are summed and multiplied by the occupancy factor

(0.25) to yield an estimate dose to the public of 18 milliREM/year. This meets the requirements as stated above.

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, our Technical Specifications, and the needs of the Commission. If other or more detailed information is needed, please contact me at your convenience.

Sincerely,

John G. Williams, Director
Nuclear Reactor Laboratory

cc:
Ms. Linh Tran, U.S. Nuclear Regulatory Commission
Mr. Patrick Isaac, U.S. Nuclear Regulatory Commission
Dr. Leslie Tolbert, Vice President for Research, University of Arizona
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