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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, 2008, through June 30, 2009, 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.

1. 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 an ion chamber for measuring dose rate and decay. 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 calibrated the power channel by the calorimetric method. We found our settings read 1.6 % high. We measured the worths of the Regulating, Shim, and Transient control rods finding them to be $4.04, $3.13, and $2.43, respectively. The largest change in worth was 1.3 % of total worth on the Shim control rod.

Our maximum reactivity insertion rates were $0.17/sec, $0.11/sec, and $0.16/sec for the Regulating, Shim, and Transient control rods, respectively. All three insertion rates met the facility technical specification requirements and agree closely with the values determined last year.

We measured the rod drop times from full out to full insertion to be 0.32, 0.34, and 0.79 seconds for the Regulating, Shim, and Transient rods, respectively. The Regulating rod fell 9% faster, the Shim rod fell 14% faster this year; and the Transient rod dropped 2% faster. All three rod drop times met the facility technical specifications requirements.

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.

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

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2. The reactor was critical for a total of 54.9 hours, producing 1,463.5 kW-hours (0.0610 MW-days) of thermal energy. Our cumulative energy output since the facility was commissioned is 10.147 MW-days.

We performed 41 pulses or reactivity insertions greater than $1.00 during this reporting period. We have performed 2,509 pulses since 1958. Our five-year inspection and measurement of all fuel rods was not due during this period.

The reactor was in operation 73 days during the reporting period, with 88.2 hours of operating time, as recorded by the console clock.

We recorded no inadvertent reactor SCRAMs during this reporting period.

3. The major maintenance performed was an <u>ion exchange resin change</u>. In April, 2008, the conductivity of the reactor pool water rose above 3 $^{\mu mhos}/_{cm}$ for the first time in two decades. Over the spring and summer months the conductivity of the reactor pool water rose and continued circulation could not lower the conductivity below 3 $^{\mu mhos}/_{cm}$. We briefed the Reactor Committee at its May 8 Meeting. By September the conductivity sporadically bumps above 5 $^{\mu mhos}/_{cm}$ though it never exceeds our Technical Specification requirements. Replacement ion exchange resins were on hand, stored in Engineering Room 124A. We inventoried and operationally checked all materials and motors for resin replacement. We set September 17, 2008, as resin replacement date hoping for an end of the monsoon season and a diminution of outdoor temperatures. We briefed the resin replacement operation again at the August 27 Reactor Committee Meeting. On September 17 we evacuated the demineralizer tank. We removed the expended resins discovering the upper diffuser was broken. After repairing the upper diffuser, we poured 2½ cubic feet of new Purolite NRW37 mixed ion exchange resin into the demineralizer tank and buttoned up the system. Immediately following resin replacement the pool conductivity read 5.1 $^{\mu mhos}/_{cm}$. We moved five gallon plastic pails of the wet, spent resin into Engineering Room 124A to allow the tritiated water to evaporate. Continued operation of the recirculation pump over the next 48 hours lowered the conductivity down to 1 $^{\mu mho}/_{cm}$. The demineralizer piping, cage, and pit area show no leaks. Radiation surveys about the demineralizer cage remained at background levels. Over the next eight months our spent resins and waste continued drying, and decaying, in Engineering Room 124A before we transferred the resin to the University's Radiation Control Office for disposal. The pool water filtration system continued to perform reliably since the resin replacement with the pool conductivity remaining below 1.0 $^{\mu mho}/_{cm}$.

4. The Reactor Committee met four times during this reporting period: August 27 and December 11 in 2008, and March 12 and May 8 in 2009.

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 one modified administrative and operational procedure. There were no changes to our facility that required a 10CFR50.59 review.

5. We discharged no liquid or solid waste from the facility during the reporting period. We transferred two bags of dry, solid waste with only background radioactivity to technicians from the University's Radiation Control Office for final disposal. We, additionally, conveyed the aforementioned ion exchange resin--still mildly radioactive--to RCO.

6. 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 2008	565.1	0	565.1
January to June 2009	517.9	0	517.9
TOTAL	1083.0	0	1083.0

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 no irradiations with the pneumatic transfer system. The maximum total estimated Argon-41 release from the facility during the reporting period is 1.1 milliCuries.

During the reporting period we replenished the reactor pool with 678 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 678 gallons of tritiated pool water represents about 0.0047 milliCuries.

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

7. Six (6) 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 an individual received was a 2-milliREM shallow dose equivalent exposure.

We admitted 106 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.

8. 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 2008-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 0.5 milliREMs/yr, down from 3.5 milliREMs/yr in 2007. We attribute this higher reading to building materials and the trend shows the radioactivity decaying away. The TLD atop the Computer Center showed 3.5 milliREMs/yr, up from zero in 2007. It remains consistent with the elevated radiation doses found in prior years at this location where the annual exposure averages about 3 milliREM/yr.

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 6 to 84 milliREMs/yr. The areas where the uncorrected monitors exceeded 100 milliREMs/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 milliREMs/year or 2.0 milliREMs/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 84 milliREMs/year. Our COMPLY Code estimated dose 0.1 milliREM/year. These are summed and multiplied by the occupancy factor (0.25) to yield an estimate dose to the public of 21 milliREMs/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:
Mr. John Nguyen, U.S. Nuclear Regulatory Commission
Mr. William C. Schuster IV, U.S. Nuclear Regulatory Commission
Dr. Leslie Tolbert, Vice President for Research, University of Arizona
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