

August 25, 2007

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, 2006, through June 30, 2007, 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 extended the 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 is built with one-inch i.d. clear Lexan tubing, and incorporates an electronic timer which automatically ejects the sample capsule just after a pulse. As we tested the system, rabbit capsules emerged coated with water droplets. We sent open capsules containing paper towels down the rabbit tubing. The water was non-radioactive, and we believe it was condensate. At the time we maintained our pool water at 47°F. After drying the rabbit tubing, we increased our pool water temperature to 60°F. Water droplets have not been evident since the temperature increase.

We calibrated the power channel by the calorimetric method. We found our settings read 1½ % high. We measured the worths of the Regulating, Shim, and Transient control rods finding them to be \$4.04, \$3.18, and \$2.47, respectively. The largest change in worth was 1¼ % of total worth on the Regulating control rod.

Our maximum reactivity insertion rates were \$0.17/sec, \$0.11/sec, and \$0.17/sec for the Regulating, Shim, and Transient rods, respectively. All three insertion rates met the facility technical specification requirements.

We twice inspected the Transient control rod drive assembly during the reporting period. Both piston seals were found to be in satisfactory condition and no wear or rust accumulation was present in the air cylinder.

Rod drop times from full out to full insertion were measured to be 0.33, 0.35, and 0.96 seconds for the Regulating, Shim, and Transient rods, respectively. The Regulating and Shim rods fell 8% faster this year; the Transient 10% slower. All three drop times met the facility technical specifications requirements. Control rod inspections were not due during this reporting period.

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

2. The reactor was critical for a total of 83.5 hours, producing 2105.3 kW-hours (0.088 MW-days) of thermal energy. Our cumulative energy output since the facility was commissioned is 10.012 MW-days.

We performed 130 pulses or reactivity insertions greater than \$1.00 during this reporting period. We have performed 2,374 pulses since 1958. We inspected and measured all fuel rods for length and bend in June.

The reactor was in operation 59 days during the reporting period, with 107.1 hours of operating time, as recorded by the console clock.

3. No inadvertent reactor SCRAMs occurred during the reporting period.

There was one item of interest during this reporting period.

- A. The morning of July 5<sup>th</sup> during preliminary startup checks, the reactor pool filtration pump was noticed to be emitting white smoke, until the pump was replaced on August 7<sup>th</sup>.
4. Major maintenance included:
    - A. Replacement of the pool circulation pump. Operators detected smoke coming from the pump motor during startup checks on July 5, 2006. There had been heavy rains the night before. They secured the pump and cancelled the reactor run. We visually performed weekly core integrity checks. We determined a MTH model C41AB pump and motor combination to be an equivalent, and its makeup was of the same materials—stainless steel and aluminum. The University's Facilities Management Department installed the new pump, motor and piping on August 7, 2006. Additionally, the electricians replaced aging electrical connections with newer components. Technicians from the University's Radiation Control Office monitored all maintenance personnel and old components. No pool water went to the environment. The collected pool water was allowed to evaporate on site. After determining the old components—pump, motor, and piping—were non-radioactive, the Radiation Control Office disposed of the materials.

5. The Reactor Committee met four times during the reporting period: August 29 and December 11 in 2006, and March 4 and May 14 in 2007.

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.

In August 2006, the Committee conducted a 50.59 review using our administrative procedure, UARR 165. The review concerned the extended rabbit system referred to previously in section 1 of this report. The Committee found that the change to our rabbit system was in compliance with 10CFR50.59 and could be made without a change to the facility Technical Specifications.

The reactor committee approved our administrative procedures granting sensitive area access required by your ORDER IMPOSING FINGERPRINTING AND CRIMINAL HISTORY RECORDS CHECK REQUIREMENTS FOR UNESCORTED ACCESS TO RESEARCH AND TEST REACTORS (EA-07-074) and your FINGERPRINTING AND CRIMINAL HISTORY RECORDS CHECK REQUIREMENTS FOR ACCESS TO SAFEGUARDS INFORMATION (EA-06-203).

6. We discharged no liquid or solid waste from the facility during the reporting period. We transferred four bags of dry, solid waste with only background radioactivity to technicians from the University's Radiation Control Office for final disposal.

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  $\mu\text{Ci}$  per kilowatt-hr of reactor operation. The pneumatic transfer system produces approximately 0.05  $\mu\text{Ci}$  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 ( $\mu\text{Ci}$ ) from Pool Surface	Argon-41 ( $\mu\text{Ci}$ ) from Pneumatic Transfer System	Argon-41 ( $\mu\text{Ci}$ ) Total
July to December, 2006	280.1	0	280.1
January to June, 2007	1557.9	833.1	2391.0
TOTAL	1838.0	833.1	2671.1

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. The maximum total estimated Argon-41 release from the facility during the reporting period is 2.7 milliCuries. There were no other gaseous effluents from the facility during the reporting period.

7. Four (4) 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 using the reactor laboratory. The most an individual received was a 21-millirem exposure.

Seventy-eight (78) non-badged persons were admitted to the Reactor Laboratory in tours, inspections, maintenance, or other official business during the twelve-month reporting period. All were issued self-reading pocket dosimeters. Pocket dosimeters issued to visitors indicated that no exposure was received.

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 (RCO) 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 surfaces of the irradiation facilities). Members of the reactor laboratory staff performed other radiation surveys when necessary. No radiation exposure, which can be attributed to reactor operations, has been detected outside the reactor laboratory.

8. Three environmental TLD monitors on the roof of the Engineering Building and ten environmental TLD monitor sites on the roofs of ten 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 2006-the period for which RCO data exists-the dose rate, after subtraction of the average background reading for 11 of 13 TLDs were zero mR/yr. One TLD on the Arizona Health Sciences Center and another TLD atop the Art Building read 5.6 mR/yr and 39.6 mR/yr, respectively. These higher readings are attributed to building materials and remain consistent with radiation doses found in prior years at these locations.

There is no evidence that radiation exposures in the vicinity of the reactor are higher than normal. Eight TLD monitors were placed at the periphery of the restricted area, and two TLD monitors were placed in an office area far removed from the restricted area to provide a baseline reference for the Engineering Building background. The exposures recorded by TLDs on the periphery of the NRL ranged from 8 mR/yr to 103 mR/yr. The areas where monitors exceeded 100 mR/yr were surveyed using a calibrated ion chamber quarterly by the Radiation Control Office with the reactor operating at 100 kW. No radiation fields were detected that exceeded background levels (0.01 mR/hr).

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

The area in the UARR Environmental TLD monitors at three locations on the roof of the Engineering Building, where the monitor readings exceeded 100 mrem/yr (without background subtraction) was surveyed with a calibrated ion chamber, with the UARR operating at 100 kW. No radiation fields were detected that exceeded background levels (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 mR/hr. With the reactor operating at maximum power (100kW), all instruments read under 0.01 mR/hr. To estimate the radiation dose from external and internal radiation sources, the highest environmental monitor reading is summed with the  $^{41}\text{Ar}$  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 103 mR/year. Our COMPLY Code estimated dose 0.49 mR/year. These are summed and multiplied by the occupancy factor (0.25) to yield an estimate dose to the public of 25.8 mRem/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. Kevin Witt, U.S. Nuclear Regulatory Commission

Mr. Marvin Mendonca, U.S. Nuclear Regulatory Commission

Dr. Leslie Tolbert, Vice President for Research, University of Arizona

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