

September 19, 2006

Dr. Leslie Tolbert  
Vice President for Research  
University of Arizona  
Tucson, AZ 85721-0066

SUBJECT: NRC ROUTINE, ANNOUNCED INSPECTION REPORT NO. 50-113/2006-201

Dear Dr. Tolbert:

This letter refers to the inspection conducted on August 15-17, 2006, at your University of Arizona Research Reactor. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concerns or noncompliance with NRC requirements were identified. No response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Kevin M. Witt at 301-415-4075.

Sincerely,

**/RA/**

Johnny Eads, Branch Chief  
Research and Test Reactors Branch B  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-113  
License No. R-52

Enclosure: NRC Inspection Report No. 50-113/2006-201  
cc w/enclosure: See next page

University of Arizona

Docket No. 50-113

cc w/encl:

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**U. S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION**

Docket No: 50-113

License No: R-52

Report No: 50-113/2006-201

Licensee: University of Arizona

Facility: Nuclear Reactor Laboratory

Location: Engineering Building  
Tucson, Arizona

Dates: August 15-17, 2006

Inspector: Kevin M. Witt

Approved by: Johnny Eads, Branch Chief  
Research and Test Reactors Branch B  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

University of Arizona  
Nuclear Reactor Laboratory TRIGA Reactor  
Inspection Report No.: 50-113/2006-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects and activities since the last NRC inspection of the licensee's Class II non-power reactor safety programs including: organization and staffing, procedures, experiments, radiation protection program, design changes, committees, audits and reviews, and fuel handling.

The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

### Organization and Staffing

- The organization and staffing were consistent with Technical Specification requirements.

### Procedures

- Procedural control and implementation satisfied Technical Specification requirements.

### Experiments

- The approval and control of experiments met Technical Specification and applicable regulatory requirements.

### Radiation Protection Program

- Surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present.
- Postings met the regulatory requirements specified in 10 CFR Parts 19 and 20.
- Personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The Radiation Protection Program satisfied regulatory requirements.
- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and Technical Specification limits.

### Design Changes

- Based on the records reviewed, the inspector determined that the licensee's design change program was being implemented as required.

### Committees, Audits and Reviews

- Review and oversight functions required by the Technical Specifications were acceptably completed by the Reactor Committee.

### Fuel Handling

- Fuel handling and control rod inspection activities were completed and documented as required by Technical Specification and facility procedures.

## REPORT DETAILS

### Summary of Plant Status

The licensee's 100 kilowatt Training Research Isotope Production General Atomics (TRIGA) Mark I research reactor has been operated in support of experiments, reactor operator training, and periodic equipment surveillance's. During the inspection, the reactor was operated at 100 kilowatts for an operator licensing examination. The licensee indicated that there has been no transportation of radioactive materials since the previous inspection.

### 1. Organization and Staffing

#### a. Inspection Scope (Inspection Procedure [IP] 69001)

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Sections 6.1 of Technical Specifications (TS), Amendment No. 18, dated April 9, 2001, were being met:

- University of Arizona (UA) Nuclear Reactor Laboratory (NRL) organizational structure and staffing
- management responsibilities and staff qualifications
- administrative controls
- Operating Logbook Number (No.) 47
- University of Arizona Research Reactor (UARR) Procedure, UARR 100, "Administrative and Operating Procedures," Revision (Rev.) dated May 1999

#### b. Observations and Findings

The UA NRL organizational structure and the responsibilities of the reactor management had not changed since the last inspection (see NRC Inspection Report No. 50-113/2005-201). Current facility staff consisted of three full time staff members and one student assistant. The licensed facility staff include the Reactor Facility Director (RFD) and the Reactor Supervisor (RS), both of whom are licensed Senior Reactor Operators (SROs). The former RS recently left the facility since the previous inspection and one of the SRO's was promoted to the RS position. The inspector confirmed that the background of the individual exceeds the qualifications listed for level two management in Standard ANSI/ANS-15.4-1988, "Selection and Training of Personnel for Research Reactors."

The NRL staff's qualifications satisfied the training and experience requirements stipulated in the TS. The operations log and associated records confirmed that shift staffing met the minimum requirements for duty personnel. Review of records verified that management responsibilities were administered as required by TS and applicable procedures.

During the inspection, the NRC conducted a licensing examination for one SRO that had been training at the facility for approximately one year. A separate report will be sent to the licensee and the candidate summarizing the results of the examination.

c. Conclusion

The organization and staffing were consistent with TS requirements.

**2. Procedures**

a. Inspection Scope (IP 69001)

To verify compliance with TS Section 6.3.a, the inspector reviewed selected portions of the following:

- Reactor Committee (RC) meeting minutes documenting procedure change reviews and approvals
- administrative controls
- procedural implementation
- selected administrative and operations procedures
- records of changes and temporary deviations to procedures
- UARR 165, "Procedure for Review of Changes, Tests, and Experiments for the University of Arizona Research Reactor," Rev. dated August 31, 2004
- UARR 168, "Procedure for Use of the Rabbit Pulse Timer," Rev. dated March 2006

b. Observations and Findings

Administrative policies and controls had been developed for changing and reviewing procedures. Training of personnel on procedures and changes was acceptable. Oversight and review of procedure implementation was provided by facility management and the RC. NRL staff members conducted TS activities in accordance with applicable procedures. Records showed that procedures required by TS 6.3.a were available as required. The TSs require that substantive changes to procedures be approved by the RC, while temporary changes may be approved by the RFD and subsequently reviewed by the RC. The inspector confirmed that all procedure changes are reviewed by licensed operators during requalification training sessions.

Review of RC meeting minutes and discussions with the licensee indicated the request and approval of one new procedure since the previous inspection. The procedure pertains to the operation of a new timer for automatically inserting and removing samples from the pneumatic transfer system. The inspector noted that the new procedure lays out an effective method of ensuring the experiments utilizing this facility are carried out in a safe manner.

c. Conclusions

Procedural control and implementation satisfied TS requirements.



### 3. Experiments

#### a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with TS Sections 3.7 and 6.8:

- experimental program requirements
- approved reactor experiments documented in Experiment Plans
- RC meeting minutes for 2005 and 2006
- experimental administrative controls and precautions
- Operating Logbook No. 47
- TRIGA Irradiation Request and Material Transfer Forms
- UARR 10, "Neutron Irradiation and Radioisotope Production in the University of Arizona Nuclear Reactor," Rev. dated November 1998
- UARR 110, "Procedures for Performing Irradiations in the Irradiation Facilities or in the Water Outside the Reactor Core," Rev. dated July 1994
- UARR 116, "Procedures for Installation and Removal of In-Core Irradiation Facilities," Rev. dated July 1994
- UARR 130, "Procedures for the Review and Performance of Experiments," Rev. dated March 2001
- UARR 159, "TRIGA Audit of Operations," Rev. dated May 2000

#### b. Observations and Findings

The experiments that have been conducted at the NRL primarily utilize the pneumatic transfer system. There have been four irradiations consisting of multiple samples since the previous inspection. Samples can be loaded and unloaded from the pneumatic system while the reactor is at power. Samples that have been irradiated at the NRL include meteorites and soil. The Requests for Irradiation forms that had been completed for irradiating samples during the inspection period contained the appropriate information, hazards analyses as applicable, and had been reviewed and approved as required by TS and procedure.

No new experiments had been initiated, reviewed, or approved since September 2001 at the facility. If any experiments were to be initiated, they would be reviewed and approved by the RFD, or his designee, and the RC. All new experiments would be completed under the supervision of the RS and in accordance with TS requirements (e.g., reactivity limitations, corrosion resistance, etc.). One experiment that will be conducted in the near future utilizes the pneumatic sample transfer system in the reactor pulse mode. A new procedure has been created for this experiment and the licensee has stated that RC approval will be necessary for utilizing a new sample counting and storage system. The new sample counting and storage system will automatically take the sample once it is extracted from the core and hold it in a spare fuel storage pit until it is ready to be analyzed. The sample analysis equipment will be located in the same area and is to be operated in concurrence with the automatic sample removal system.

c. Conclusions

The approval and control of experiments met TS and applicable regulatory requirements.

**4. Radiation Protection Program**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR Parts 19 and 20, and TS Sections 3.4, 4.4, and 6.3.b requirements:

- radiological signs and posting in various areas of the facility
- facility and equipment during tours
- organization and staffing
- radiation protection training records
- instrument calibration records
- waste transfer and liquid discharge records from 2004 to present
- facility monthly, quarterly, and other periodic contamination and area radiation surveys from 2005 to present
- bi-monthly dosimetry records for staff and students for 2004 through present
- NRL Visitor Dosimetry Logbook
- calibration records for the Area Radiation Monitors, the Continuous Air Monitor (CAM), and the Water Monitor from 2004 to present
- Radiation Control Program (RCP) for the University of Arizona Nuclear Reactor Laboratory, dated September 30, 1998
- Radiation Protection Program Review from January 2005 to present
- UARR 104, "Procedures for Calibration of CAM," Rev. dated December 1999
- UARR 106, "Procedures for Calibration of the Water Monitor," Rev. dated July 1994
- UARR 114, "Procedures for Responding to Suspected Primary Coolant Leaks," Rev. dated July 1994
- UARR 131, "Procedures for Calibration of Area Monitors and Neutron Survey Meter," Rev. dated July 1994
- UARR 137, "Procedure for Collection and Use of Reactor Pool Water," Rev. dated July 1994
- UARR 138, "Procedure for Documenting Visitors and Assigning Radiation Dosimeters," Rev. dated July 1994
- UARR 148, "Instructions for Use of the Frisker," Rev. dated October 1993
- UARR 149, "Radiation Protection Instructions for the Nuclear Reactor Laboratory," Rev. dated October 1993
- UARR 150, "Reactor Operational Rules," Rev. dated September 2000
- UARR 151 "Instructions for Daily Surveillance of Reactor Instrumentation, Safety Systems, Area Monitors, and Continuous Air Monitor," Rev. dated December 2000
- UARR 155, "Monthly Checklist," Rev. dated June 1999
- UARR 156, "Annual Checklist," Rev. dated December 2000

- Completed UARR 155 forms, dated from January 2005 to present
- Completed UARR 156 forms, dated from January 2005 to present
- UARR Annual Reports for the periods from July 1, 2004 - June 30, 2005 and July 1, 2005 - June 30, 2006, dated August 15, 2005 and August 25, 2006, respectively
- semi-annual memos from John G. Williams to the Radiation Control Office (RCO), "Environmental Release and Physical Inventory of Radioactive Material," from January 2005 to present

b. Observations and Findings

(1) Facility Tour

The inspector toured the reactor facility, the radiation detector calibration room and accompanying facilities. Control of radioactive material and control of access to radiation and high radiation areas were observed to be acceptable. The postings and signs for these areas were appropriate.

(2) Surveys

The inspector reviewed monthly radiation and contamination surveys of licensee controlled areas and quarterly full power surveys of the Reactor Room conducted by campus RCO personnel. The results were documented on the appropriate forms, evaluated as required, and corrective actions taken when readings or results exceeded set action levels. The number and location of survey points was adequate to characterize the radiological conditions. Surveys by the RCO staff were conducted in accordance with the appropriate procedure and logged on the appropriate forms. No elevated readings were discovered.

(3) Postings and Notices

The inspector reviewed the postings required by 10 CFR Part 19 at the entrances to various controlled areas including the Reactor Bay, and radioactive material storage areas. The postings were acceptable and indicated the radiation and contamination hazards present. The facility's radioactive material storage areas were found to be properly posted. No unmarked radioactive material was found in the facility.

(4) Dosimetry

The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor to process personnel dosimetry. Through direct observation, the inspector determined that dosimetry was used in an acceptable manner by facility personnel. For visitors to the facility, a direct read pocket dosimeter is issued to individuals for general tours. Records indicate that no abnormal readings were obtained.

An examination of the records for the inspection period showed that all exposures were well within NRC limits and within licensee action levels. Four individuals are currently monitored at the facility. All of the students and staff associated with the facility wear Optically Stimulated Luminescence Dosimeter (OSLD) badges and minimal doses were recorded for 2004 through present. The licensee investigates any dosimetry readings that indicate a monthly exposure above typical levels for a reactor staff member. The as low as reasonably achievable (ALARA) goal specified in the UA RCP is to keep deep dose exposures to less than 500 millirem (mrem) per year and the licensee consistently meets this goal.

(5) Radiation Monitoring Equipment

The calibration of portable survey meters and friskers was completed by RCO personnel at the calibration lab while fixed radiation detectors, the CAM and water monitor were calibrated at the facility using a portable source. The calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Calibration frequency met the requirements established in the applicable procedures while records were being maintained as required.

The inspector reviewed the calibration records of the area and air monitoring systems. These systems had been calibrated annually as required by procedure. The daily set point verifications for the monitoring equipment were completed as required. CAM filters were changed and analyzed monthly as required. No activity above the lower limit of detection was detected on the air filters.

During the inspection, the inspector visited the calibration range located in the basement of the UA hospital. The Deputy Director of the RCO described the equipment in the facility for the inspector. The calibration records reviewed were thorough and were completed using the appropriate techniques and according to procedure. The inspector observed that proper precautions are always used to maintain doses ALARA.

(6) Radiation Protection Program and ALARA

The licensee's RCP was established through the UARR procedures and in the document entitled, "Radiation Control Program for the University of Arizona Nuclear Reactor Laboratory," dated September 30, 1998. The ALARA program provides guidance for keeping doses as low as reasonably achievable and is consistent with the guidance in 10 CFR Part 20. The inspector verified that the NRL RCP was being reviewed annually as required by 10 CFR 20.1101(c). No issues related to the radiation protection program at the NRL were identified in the review of the program.

The RCP requires that all personnel who work with radioactive materials receive training in radiation protection, policies, procedures, requirements, and the facilities prior to having unescorted access at the facility. The RCO is responsible for conducting the training and all of the training is typically conducted with the Health Physicists on staff. A test is administered at the end of the training to verify that the individuals understood the material presented. The training covered the topics required to be taught in 10 CFR Part 19 and the review of training materials and tests indicated that the staff were instructed on the appropriate subjects.

(7) Environmental Monitoring

The licensee ensures compliance with NRC regulations for environmental monitoring by ensuring that all doses at the site boundary are less than the dose limits specified in 10 CFR 20.1301. Several OSLDs are strategically placed in several locations around the perimeter of the reactor bay and outside of the building. Records for 2004 and 2005 indicate slightly elevated doses that are below the applicable requirements when considering occupancy factors applied to the annual doses.

To demonstrate compliance with the annual dose constraints of 10 CFR 20.1101(d), the licensee calculated the amount of Argon-41 produced by experiments and the operation of the reactor. The results indicated that the releases were well within 10 CFR Part 20 Appendix B, Table 2 concentrations, and TS limits. The highest dose calculated that could be received as a result of gaseous emissions from reactor operations was less than 1 mrem per year. These doses were well below the limit set in 10 CFR 20.1101(d) of 10 mrem per year. The licensee has stated that the levels measured outside of the facility are within the regulatory requirements. The inspector verified that the licensee had not released any liquid from the facility during the past two years.

c. Conclusions

The inspector determined that: (1) surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present, (2) postings met the regulatory requirements specified in 10 CFR Parts 19 and 20, (3) personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits, (4) radiation monitoring equipment was being maintained and calibrated as required, (5) the RPP satisfied regulatory requirements, and (6) effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits

## 5. Design Changes

### a. Inspection Scope (IP 69001)

In order to verify that any modifications to the facility were consistent with 10 CFR 50.59 and were reviewed as stipulated in TS Sections 6.2 & 6.3, the inspector reviewed selected aspects of:

- facility design changes and records
- facility configuration and associated records
- minor and substantive procedural changes and the associated RC approval
- RC meeting minutes for 2005 and 2006
- Reactor Up-grade and Instrument Maintenance Log No. 4
- UARR Annual Reports for the periods from July 1, 2004 - June 30, 2005 and July 1, 2005 - June 30, 2006, dated August 15, 2005 and August 25, 2006, respectively
- UARR 136, "Procedure for Repair or Replacement of the Circulation Pump in the Water Purification System," Rev. dated July 1994
- UARR 165, "Procedure for Review of Changes, Tests, and Experiments for the University of Arizona Research Reactor," Rev. dated August 31, 2004

### b. Observations and Findings

Through review of applicable records and interviews with licensee personnel, the inspector determined that no changes requiring prior NRC approval had been initiated and/or completed at the facility since the last NRC operations inspection. During the past year, the licensee has initiated and completed replacement of the pump for the pool purification system. The pump replacement involved the installation of new piping connections and different size diameter pipes due to the change in operation of current pumps. The RS stated that the design of the new purification system is the same design as the previous purification system and will not require a 50.59 review. The inspector confirmed if there were to be a leak outside of the reactor pool, the purification inlet and outlet lines are designed to minimize the amount of water that is siphoned from the pool. The inspector verified that future changes or modifications to the facility will be analyzed by the staff, presented to and reviewed by the RC, determined to be acceptable, and approved as required.

### c. Conclusions

Based on the records reviewed, the inspector determined that the licensee's design change program was being implemented as required.

## 6. Committees, Audits, and Reviews

### a. Inspection Scope (IP 69001)

In order to verify that the licensee had established and conducted reviews and audits as required in TS Section 6.2 the inspector reviewed selected aspects of:

- RC meeting minutes for 2005 and 2006
- The University of Arizona Reactor Committee Charter, dated April 4, 2003
- Appointment Letters for members of the RC, various dates
- minor and substantive procedural changes and the associated RC approval
- Reactor Up-grade and Instrument Maintenance Log No. 4
- UARR 100, "Administrative and Operating Procedures," Rev. dated May 1999
- UARR 159, "TRIGA Audit of Operations," Revision dated May 2000
- UARR 165, "Procedure for Review of Changes, Tests, and Experiments for the University of Arizona Research Reactor," Rev. dated August 31, 2004
- Completed UARR 159 forms, dated from 2005 to present

b. Observations and Findings

The RC membership satisfied TS requirements and the RC's procedural rules. The RC had quarterly meetings and a quorum was always present as required. Appointment letters for recently appointed members were current as well. Review of the minutes indicated the committees provided guidance, direction and oversight, and ensured suitable use of the reactor. The minutes provided an acceptable record of RC review and audit functions and of RC safety oversight of reactor operations.

Operations audits were performed by rotating members of the RC on a bi-monthly frequency, which met the annual frequency requirements. No issues were noted in the meeting minutes, but the inspector verified that if there were any, they would be noted in the meeting minutes. The inspector noted that the latest bi-monthly audit completed was for the months of September and October 2005. The licensee has not completed an audit of the operations of the facility since that time. The inspector determined that there are no requirements to complete these audits in a timely fashion. The inspector noted that the reviews, and the associated findings, were acceptably detailed and that the licensee responded and took corrective actions as needed.

c. Conclusions

Review and oversight functions required by the TSs were acceptably completed by the RC.

**7. Fuel Handling**

a. Inspection Scope (IP 69001)

To verify that TS Section 4.1 and procedural requirements were being met, the inspector reviewed selected aspects of:

- Operating Logbook No. 47

- fuel handling equipment and instrumentation
- fuel movement and inspection records
- UARR Fuel Element Location and Inventory Logbook
- UARR 103, "Procedures for Detection of a Faulty Fuel Element," Rev. dated July 1994
- UARR 105, "Procedures for Fuel Element Changing," Rev. dated July 1994
- UARR 116, "Procedures for Installation and Removal of In-Core Irradiation Facilities," Rev. dated July 1994
- UARR 121, "Procedures for Use of the Fuel Element Inspection Tool," Rev. dated December 1999

b. Observations and Findings

The inspector determined that the licensee was maintaining the required records of the various fuel movements that had been completed and verified that the movements were conducted and recorded in compliance with procedure. All fuel movements were noted in the Operating Logbook as well as in the Fuel Element Location and Inventory Logbook. The fuel element inspections generally included all of the fuel elements every five years and inspection of the control rods on a biennial frequency. The last fuel inspection was conducted on May 24, 2002 and the last control rod inspection was conducted on June 6, 2006. Inspections of the fuel elements and control rods showed consistency with accepted values and did not indicate any deterioration of cladding. Data recorded for fuel handling was clear and cross-referenced in fuel and operations logs. Log entries clearly identified, as required by procedure, that a minimum of two persons were present when fuel was being moved. The inspector determined that the procedures and the controls specified for these operations were acceptable. The inspector visually confirmed the location of one fuel element in storage was in the same location as specified in the Fuel Element Location and Inventory Logbook.

c. Conclusions

Fuel handling and control rod inspection activities were completed and documented as required by TS and facility procedures.

**8. Exit Meeting**

The inspector presented the inspection results to licensee management at the conclusion of the inspection on August 17, 2006. The inspector discussed the observations for each area reviewed. The licensee acknowledged the findings and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.



**PARTIAL LIST OF PERSONS CONTACTED**

Licensee

K. Carsten	Deputy Director, Radiation Control Office
A. Moden	Research Operations Assistant
R. Offerle	Reactor Supervisor
D. Silvain	Director, Radiation Control Office
J. Williams	Director, Nuclear Radiation Laboratory

**INSPECTION PROCEDURES USED**

IP 69001	CLASS II NON-POWER REACTORS
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**ITEMS OPENED, CLOSED, AND DISCUSSED**

OPENED:

None

CLOSED:

None

**LIST OF ACRONYMS USED**

ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
NRL	Nuclear Reactor Laboratory
OSLD	Optically Stimulated Luminescence Dosimeter
RC	Reactor Committee
RCO	Radiation Control Office
RCP	Radiation Control Program
RFD	Reactor Facility Director
RS	Reactor Supervisor
SRO	Senior Reactor Operator
TRIGA	Training Research Isotope Production General Atomics
TS	Technical Specification
UA	University of Arizona
UARR	University of Arizona Research Reactor