

May 20, 2008

Dr. Melinda Krahenbuhl
Director of CENTER
122 S. Central Campus Drive, Room 104
University of Utah
Salt Lake City, UT 84112

SUBJECT: NRC INSPECTION REPORT NO. 50-407/2008-201

Dear Dr. Krahenbuhl:

On May 5-8, 2008, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your University of Utah TRIGA Reactor Facility. The enclosed report documents the inspection results, which were discussed on May 8, 2008, with Dr. Thomas Parks, Interim Vice President for Research, Dr. Ronald Pugmire, Associate Vice President for Research, you, and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the NRC's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel. Based on the results of this inspection, no findings of significance were identified.

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

Should you have any questions concerning this inspection, please contact Craig Bassett at 404-358-6515.

Sincerely,

/RA/

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

Docket No. 50-407
License No. R-126

Enclosure: NRC Inspection Report No. 50-407/2008-201
cc w/enclosure: Please see next page

University of Utah

Docket No. 50-407

cc:

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Test, Research, and Training
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ACCESSION NO.: ML081360534

TEMPLATE #: NRR-106

OFFICE	PRTB:RI	PRT:LA	PRTB:BC
NAME	CBassett chb	EBarnhill eeb	JEads jhe
DATE	05/15/2008	05/19/2008	05/20/2008

OFFICIAL RECORD COPY

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

Docket No: 50-407

License No: R-126

Report No: 50-407/2008-201

Licensee: University of Utah

Facility: Center for Excellence in Nuclear Technology, Engineering,
and Research TRIGA Reactor Facility

Location: Salt Lake City, Utah

Dates: May 5-8, 2008

Inspector: Craig Bassett

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

EXECUTIVE SUMMARY

University of Utah
Center for Excellence in Nuclear Technology, Engineering, and Research
Report No. 50-407/2008-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the licensee's Class II research reactor safety program including: organizational structure and staffing, review and audit and design change functions, procedures, radiation protection, effluent and environmental monitoring, and transportation of radioactive materials since the last NRC inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

Organization and Staffing

- The licensee's organization and staffing were in compliance with requirements specified in the Technical Specifications.

Review and Audit Functions

- Audits and reviews were being conducted by designated individuals and reviewed by the Reactor Safety Committee in accordance with the requirements specified in Technical Specification Section 6.5.
- Based on the records reviewed, the inspector determined that the licensee's design change program was being implemented as required.

Procedures

- Facility procedural review, revision, control, and implementation satisfied Technical Specification requirements.

Radiation Protection Program

- Surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present.
- Postings met regulatory requirements.
- Personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The radiation protection and ALARA programs satisfied regulatory requirements.
- Training was being provided to staff members in the area of radiation protection in accordance with regulatory requirements.

Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and Technical Specification limits.

Transportation of Radioactive Materials

- The licensee transferred radioactive waste material to the campus Radiological Health Department for disposal as required.
- None of the licensee personnel had the current training required to ship radioactive material from the facility.

REPORT DETAILS

Summary of Plant Status

The licensee's one hundred kilowatt (100 kW) TRIGA Mark I research reactor continued to be operated in support of sample irradiation, reactor operator training, educational demonstrations, preventive maintenance, and operational surveillance required by the Technical Specifications. During the inspection, the reactor was not operated but typically operates one or two days a week at various power levels up to 90 kW.

1. **Organizational Structure 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 6.1-6.3, of the Technical Specifications (TS), were being met:

- Management responsibilities
- Organizational structure and staffing requirements for the facility
- Organizational guidance contained in the facility Description of Operations, Section II entitled "Organization and Responsibilities," undated
- Amendment Number (No.) 7 to Facility Operating License No. R-126, dated December 3, 1998, which amended the TS to provide clarifications

b. Observations and Findings

Through discussions with licensee representatives, the inspector determined that management responsibilities and the organizational structure at the facility had not changed since the last NRC inspection in the area of radiation protection conducted in April 2006 (NRC Inspection Report No. 50-407/2006-201). The organizational structure and staffing observed at the Center for Excellence in Nuclear Technology, Engineering, and Research (CENTER) TRIGA Reactor Facility met the requirements stated in Sections 6.1 and 6.2 of the TS.

Through review of records and logs and through discussions with licensee personnel, the inspector determined that the staffing at the facility was acceptable to support the current workload and ongoing activities. Each member of the facility staff listed in Figure 6.1 of the TS met or exceeded the minimum qualifications of ANS 15.4, "Standard for the Selection and Training of Personnel for Research Reactors," as required by TS Section 6.3.

c. Conclusions

The organizational structure and staffing were consistent with TS requirements.

2. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR 50.59 and to ensure that the reviews and audits stipulated in the requirements of the TS Section 6.5 were being completed:

- Reactor Safety Committee meeting minutes from December 2006 to the present
- Radiation Safety and ALARA Audits completed during the past two years and licensee responses to the safety reviews and audits
- Guidance contained in Description of Operations, Section II entitled "Organization and Responsibilities," undated
- Form CENTER-035 R2, "Audit and Review Program Checklist," RSC approval dated October 5, 2005, which documented the audits that had been completed
- "University of Utah CENTER Audit and Review Plan for NRC License R-126: TRIGA Nuclear Reactor (Docket No. 50-407)," Revision (Rev.) 1, dated February 28, 1996
- The University of Utah TRIGA Reactor Annual Operating Reports for the periods: July 2005 - June 2006, and July 2006 - June 2007

b. Observations and Findings

(1) Review and Audit

The inspector verified that Reactor Safety Committee (RSC) membership satisfied TS requirements and that the RSC and/or a subcommittee had quarterly meetings as required. Review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations, and ensured acceptable use and oversight of the reactor.

Since the last inspection, all required audits of reactor facility activities and reviews of programs, procedures, equipment changes, and proposed tests or experiments, had been completed and documented as required. The audits were completed by designated individuals and reviewed by the RSC. Additionally, the annual review of the Radiation Protection Program and the biennial reviews of the emergency and security plans had been conducted and acceptably documented. The inspector noted that the safety reviews and audits and the associated findings were acceptably detailed and that the licensee responded and took corrective actions as needed.

(2) Design Change Functions

The inspector verified with the licensee that there had been no facility changes and consequently no 10 CFR 50.59 evaluations initiated or completed in 2006 or 2007. From past reviews, the inspector determined that facility design change evaluations contained the required supporting documentation and information and that the 10 CFR 50.59 reviews and approvals were focused on safety and met TS requirements.

c. Conclusions

Audits and reviews were being conducted as required and reviewed by the RSC in accordance with the requirements specified in TS Section 6.5. Based on review of records of past changes, the inspector determined that the licensee's design change program was being implemented as required.

3. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify that the licensee was complying with the requirements of TS Sections 6.5.4 and 6.8:

- Records of procedure changes
- Selected administrative and health physics procedures
- RSC meeting minutes from December 2006 to the present
- Related logs and records documenting procedure implementation
- Administrative controls as outlined in Description of Operations, Section III entitled "Documentation," undated
- Form CENTER-035 R2, "Audit and Review Program Checklist," RSC approval dated October 5, 2005, which documented the audits that had been completed

b. Observations and Findings

The inspector noted that the licensee typically used checklists or forms in place of specific procedures to conduct operations at the facility. These forms were available for those tasks and items required by the TS. Written changes were reviewed and approved by the RSC as required. The facility forms or checklists were reviewed biennially as required by TS Section 6.5.4 with the last review being completed May 30, 2007. Training of personnel on procedures and the applicable changes was acceptable.

In the area of radiation protection, the licensee did not have facility-specific procedures but rather used those contained in the "Radiation Safety Policy Manual" of the university. Those procedures were reviewed and revised as needed. The latest revision of the "Radiation Safety Policy Manual" was issued April 9, 2008, and was reviewed and approved by the university's Radiation Safety Committee.

c. Conclusions

Procedural review, revision, control, and implementation satisfied TS requirements.

4. Radiation Protection Program

a. Inspection Scope (IP 69001)

To verify compliance with 10 CFR Parts 19 and 20 and TS Sections 4.3.3, 5.4, and 6.10, the inspector reviewed selected aspects of:

- Radiological signs and postings at the facility
- Dosimetry records for 2006, 2007, and to date in 2008
- Routine surveys and monitoring documented on Form CENTER-020
- As Low As Reasonably Achievable (ALARA) reviews for the past two years
- Maintenance and calibration of radiation monitoring equipment documented on Form CENTER-023
- University of Utah Radiation Procedures and Records (RPR) No. 1, "Radiation User Personal Data," dated September 2005
- RPR No. 12, "Bioassays for Internal Radioactivity," dated June 2006
- RPR No. 44, "Radiation User's Safety Training," dated March 2007
- RPR No. 45, "Radiological Emergency Notification and Responses," dated March 2007
- RPR No. 46, "Personnel Exposure Investigation and Reporting," dated June 2006
- RPR No. 50, "Radioisotope Laboratory Evaluations," dated December 2003 and associated forms
- RPR No. 52, "Portable Radiation Survey Instruments Use and Calibration," dated June 2001
- Form CENTER-020 R12, "Monthly Inspection Checklist," RSC approval dated April 2, 2004
- Form CENTER-023 R4, "Annual Maintenance and Calibration of the Area Radiation Monitors (ARMS) and Continuous Air Monitor (CAM)," RSC approval dated December 17, 1997
- Form RPR 50A, "Laboratory Evaluation Checklist," form dated December 2003
- Form RPR 50B, "Total Contamination Survey," form dated December 2003
- Form RPR 50C, "Removable Contamination Survey," form dated December 2003
- Form RPR 50D, "Exposure Rate Survey," form dated December 2003
- Form RPR 50E, "Radioisotope Laboratory Evaluation Report" form dated March 2003
- Form RPR 52A, "Exposure Rate Meter Calibration Record," form dated June 2001
- Form RPR 52B, "Contamination Survey Meter Efficiency Calibration Record," form dated June 2001
- The University of Utah TRIGA Reactor Annual Operating Reports for the periods: July 2005 - June 2006, and July 2006 - June 2007

b. Observations and Findings

(1) Surveys

The inspector reviewed monthly radiation and contamination surveys of licensee controlled areas conducted by campus Radiological Health Department staff personnel. The inspector also reviewed monthly general area radiation surveys of the Reactor Room and support areas from 2006 to date. These latter surveys had been completed by licensee personnel as required by Form CENTER-020 R12, "Monthly Inspection Checklist." The results of all the surveys were documented and evaluated as required and corrective actions were taken when readings or results exceeded set action levels. During the inspection, the inspector conducted a radiation survey of the Reactor Room and compared the readings detected with those recorded on survey maps which had been completed by a campus

Radiological Analyst. The survey results noted by the inspector were comparable to those found by the Radiological Analyst and no anomalies were noted.

(2) Postings and Notices

The inspector reviewed the postings at the entrances to various controlled areas including the Control Room, the Reactor Room, and various laboratories in the CENTER. The postings were acceptable and indicated the radiation and contamination hazards present. Other postings also showed the industrial hygiene hazards present in the areas. The facility's radioactive material storage areas were noted to be properly posted. No unmarked radioactive material was detected in the facility. Copies of current notices to workers required by 10 CFR Part 19 were posted on various bulletin boards in the facility, including one in the Control Room on the door leading to the Reactor Room.

(3) Dosimetry

The licensee used a National Voluntary Laboratory Accreditation Program accredited vendor (Landauer) to process personnel dosimetry. Through direct observation, the inspector determined that dosimetry was acceptably used by facility personnel.

An examination of the records for the past two years and through March 2008 showed that all exposures were within NRC limits. The inspector determined that the licensee used optically stimulated luminescent (OSL) dosimeters for whole body monitoring of beta and gamma radiation exposure. The licensee used thermoluminescent dosimeters (TLD) finger rings for extremity monitoring as needed. An examination of the OSL and TLD results for the past two years showed that the highest annual whole body exposure received by a single individual for 2006 was 28 millirem (mr) deep dose equivalent (DDE). The highest annual extremity exposure for 2006 was 160 mr shallow dose equivalent (SDE). The highest annual whole body exposure received by a single person for 2007 was 46 mr DDE. The highest annual extremity exposure for 2007 was 2430 mr SDE.

The licensee indicated that the extremity dose to the individual for 2007 was unrealistically high in view of the types of activities that went on during the year and the sources of radiation at the facility. The licensee conducted an investigation into this matter and could not determine any reasonable cause for the high dose. However, the dosimetry vendor stated that the dose was correct so the "high" dose was assigned to the individual.

(4) Radiation Monitoring Equipment

The use and calibration of radiation monitoring equipment was reviewed by the inspector. Portable survey meters and friskers were calibrated by Radiological Health Department personnel. Fixed radiation detectors and the continuous air monitor were typically calibrated by licensee staff personnel. The calibration records showed that calibration frequency met the requirements established in the

applicable surveillance procedures and records were being maintained as required. Through observation the inspector determined that the equipment was being used and maintained acceptably. It was noted that instruments awaiting repair and/or calibration, or those that were in storage and not calibrated, were labeled with a red tag to preclude inadvertent use.

(5) Radiation Protection Program and ALARA Policy

The licensee's Radiation Protection Program was established in various University of Utah campus documents including, "Radiation Safety Policy Manual," latest revision dated April 9, 2008, "The University of Utah Radiation Protection Program," undated, and "Radiation Procedures and Records," last updated December 13, 2005. The program stated that all personnel who had unescorted access to work in a radiation area or who worked with radioactive material were required to receive training in radiation protection policies, principles, procedures, and requirements prior to starting work. The inspector also confirmed that the campus radiation protection program was being reviewed annually as required.

The ALARA Policy was also outlined and established in the aforementioned "Radiation Safety Policy Manual." The ALARA program provided guidance for keeping doses as low as reasonably achievable and was consistent with the guidance in 10 CFR Part 20.

(6) Radiation Worker Training

As noted above, university personnel who handled radioactive material, including licensee staff, were required to receive training in radiation protection. This was accomplished by staff members completing a web based course entitled "General Radiation Safety Training," which lasted about two hours and then taking a quiz on the material covered. The trainees then attended a class and were required to successfully pass a written examination. The class, entitled "Radioactive Materials Safety Class," was an interactive/practical session which lasted between two and three hours and consisted of lecture, demonstration, and practical applications. Those who successfully completed the course were given a certificate. Completion of this training was verified by Radiological Health Department personnel as well as by the Reactor Administrator and/or the Reactor Supervisor. Upon completion of the course, the workers were then issued a dosimeter and allowed to work with a Responsible User.

The inspector reviewed documentation of the training provided to licensee staff members, including the certificates of completion. The documents indicated that all current staff members had received the required training. It was also noted that staff members who were also reactor operators received further continuing radiation protection training through the licensee's Operator Requalification Program. The inspector determined that the personnel training program satisfied requirements in 10 CFR 19.12. The training materials appeared to be beneficial in helping people understand the various concepts of radiation protection. The content and periodicity of training were acceptable.

(7) Facility Tours

The inspector toured the Control Room, Reactor Room, and selected support laboratories and offices. Control of radioactive material and control of access to radiation and high radiation areas were acceptable. As noted earlier, the postings and signs for these areas were appropriate.

c. Conclusions

Based on the observations made and the records reviewed, it was determined that, the Radiation Protection Program being implemented by the licensee satisfied regulatory requirements because: 1) surveys were being completed and documented acceptably; 2) postings met regulatory requirements; 3) personnel dosimetry was being worn as required and doses were well within the NRC's regulatory limits; 4) radiation monitoring equipment was being maintained and calibrated as required; and, 5) training was being conducted as required.

5. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Sections 3.4, 3.7, 4.3.3, 4.3.4, 5.4, 5.6, and 6.10:

- Dosimetry records for 2006, 2007, and to date in 2008
- Neutron Monitoring within CENTER - Exposure in mrem/gamma-beta in mrem
- Data Summary forms provided to the RSC indicating the environmental TLD results
- CENTER Area Environmental Monitor Results provided to the RSC indicating other environmental TLD results
- Maintenance and calibration of radiation monitoring equipment documented on Form CENTER-023 R4, "Annual Maintenance and Calibration of the Area Radiation Monitors (ARMS) and Continuous Air Monitor (CAM)," RSC approval dated December 17, 1997
- Form CENTER-032, R0, "Liquid Effluent Discharge Authorization," RSC approval dated March 19, 1992
- The University of Utah TRIGA Reactor Annual Operating Reports for the periods: July 2005 - June 2006, and July 2006 - June 2007

b. Observation and Findings

The inspector reviewed the ARMS and CAM calibration records. These systems had been calibrated annually according to procedure. The monthly setpoint and high radiation warning verification records for the monitoring equipment were also reviewed. Corrective actions, including recalibration, were completed if the setpoint values were exceeded.

The inspector determined that gaseous releases continued to be monitored as required, continued to be calculated according to established protocol, and were

acceptably documented in the annual reports. Airborne concentrations of gaseous releases were well within the concentrations stipulated in 10 CFR 20, Appendix B, Table 2, and TS limits. The dose rate to the public, as a result of the gaseous releases, was well below the dose constraint specified in 10 CFR 20.1101(d) of 10 millirem per year (mr/yr). COMPLY code results indicated an annual dose to the public of 1.2×10^{-1} mr/yr for 2005 for the entire campus. Data for 2006 indicated an annual dose to the public of 1.1×10^{-1} mr/yr for the campus. Completed dose calculations and data for 2007 were not yet available.

The inspector verified that there had been no liquid releases from the facility to the sanitary sewer within the past two years. It was noted that the last liquid release occurred in 2000. It was also noted that no solid waste had been transferred from the facility during the past two years.

On-site and off-site gamma radiation monitoring was completed using environmental TLDs in accordance with the applicable procedures. The data indicated that there were no measurable doses above any regulatory limits. These results were also acceptably reported in the Reactor Operations Annual Report for 2006 and 2007. Through observation of the facility, the inspector did not identify any new potential release paths.

c. Conclusions

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits.

6. Transportation

a. Inspection Scope (IP 86740)

The inspector reviewed selected aspects of:

- Radioactive material transfers documented on Form CENTER-027
- RPR No. 13, "Radioisotope Acquisition and Disposition," dated September 2004
- RPR No. 14, "Shipment of Limited Quantity of Radioisotopes," dated December 2004
- RPR No. 55, "Transportation of Radioactive Materials," dated December 2004
- Form CENTER-027 R4, "TRIGA Reactor Irradiation Request and Performance," RSC approval dated March 26, 1996
- Form RPR 13A, "Radioisotope Package Arrival Report," form dated September 2004
- Form RPR 13B, "Radioisotope Receipt and Verification," form dated September 2004, documenting receipt of radioactive material
- Form RPR 13E, "Radioactive Waste Tag," form dated March 2003

b. Observations and Findings

Records indicated that radioactive waste designated for disposal was typically transferred from the reactor facility to the University of Utah's broad scope license,

Utah Department of Environmental Quality, License Number 1800001, Amendment No. 49, dated March 29, 2006, in accordance with Radiological Health Department requirements. The last materials transferred from the CENTER to the broad scope license were 5 containers of resin. That occurred several years ago.

The inspector also reviewed the documentation of transfers of radioactive sources completed between the reactor facility and the Radiological Health Department. The records indicated that the shipping containers were properly packaged and surveyed and the applicable labels were filled out with the required information and attached to the shipping containers. Shipping paperwork was completed but a few problems or deficiencies were noted. During the review the inspector was informed that the shipments were made under the licensee's State of Utah broad scope license. Since the source materials were shipped under the state license, the inspector did not pursue the matter any further but did inform the licensee of the apparent discrepancies so that they, and the Radiological Health Department, could review the situation and take corrective actions as warranted. The inspector also noted that none of the licensee personnel had the current training required to ship radioactive material as required by the Department of Transportation.

c. Conclusions

The licensee transferred radioactive waste material to the campus Radiological Health Department as required. None of the licensee personnel had the current training required to ship radioactive material from the facility.

7. Exit Meeting Summary

The inspection scope and results were summarized on May 8, 2008, with licensee representatives. The inspector discussed the findings for each area reviewed. The licensee did identify as proprietary some of the material provided to or reviewed by the inspector during this inspection. However, this report does not contain any proprietary material.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

D. Choe	Reactor Supervisor and Senior Reactor Operator
M. Krahenbuhl	Reactor Administrator and Senior Reactor Operator
T. Parks	Interim Vice President for Research, University of Utah
R. Pugmire	Associate Vice President for Research, University of Utah

Campus Radiation Safety Office Personnel

K. Langley	Director, Radiological Health Department and Radiation Safety Officer, University of Utah
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INSPECTION PROCEDURE (IP) USED

IP 69001:	Class II Non-Power Reactors
IP 86740:	Inspection of Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

PARTIAL LIST OF ACRONYMS USED

ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
ARM	Area Radiation Monitor
CAM	Continuous Air Monitor
CENTER	Center for Excellence in Nuclear Technology, Engineering, and Research
CFR	Code of Federal Regulations
DDE	Deep dose equivalent
kW	kilowatt
mr	millirem
mr/hr	millirem per hour
NRC	Nuclear Regulatory Commission
OSL	Optically stimulated luminescent (dosimeter)
PARS	Publicly Available Records
RPR	Radiation Procedures and Records
RSC	Reactor Safety Committee
SDE	Shallow dose equivalent
TLD	Thermoluminescent dosimeter
TS	Technical Specifications