

December 13, 2017

Dr. Melinda Krahenbuhl, Director
Reed Reactor Facility
Reed College
3203 S.E. Woodstock Boulevard
Portland, OR 97202-8199

SUBJECT: REED COLLEGE – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE
INSPECTION REPORT NO. 50-288/2017-202

Dear Dr. Krahenbuhl:

From November 13–16, 2017, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your Reed Research Reactor Facility. The enclosed report documents the inspection results which were discussed on November 16, 2017, with you, Dr. Nigel Nicholson, Dean of the Faculty; April Sams, Radiation Safety Officer and Campus Environmental Director; and Ilana Novakoski, Reactor Operations Manager.

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

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, requests for withholding," 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 NRC's document system (Agencywide Documents Access and Management 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 (240) 535-1842, or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Anthony Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-288
License No. R-112

Enclosure:
As stated

cc: w/enclosure: See next page

Reed College Docket No. 50-288

cc:

Mayor of the City of Portland
1220 Southwest 5th Avenue
Portland, OR 97204

Dr. Nigel Nicholson, Dean of the Faculty
Reed College
3203 SE Woodstock Boulevard
Portland, OR 97202-8199

John Kroger, President
Reed College
3203 SE Woodstock Boulevard
Portland, OR 97202-8199

Division Administrator
Nuclear Safety Division
Oregon Department of Energy
625 Marion Street NE
Salem, OR 97301-3737

Ken Niles, Assistant Director for Nuclear Safety
Oregon Department of Energy
550 Capitol Street N.E., 1st Floor
Salem, OR 97301

Program Director
Radiation Protection Services
Public Health Division
Oregon Health Authority
800 NE Oregon Street, Suite 640
Portland, OR 97232-2162

Test, Research and Training
Reactor Newsletter
P.O. Box 118300
University of Florida
Gainesville, FL 32611

SUBJECT: REED COLLEGE – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-288/2017-202 DATE: DECEMBER 13, 2017

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

Docket No: 50-288

License No: R-112

Report No: 50-288/2017-202

Licensee: Reed College

Facility: Reed Research Reactor

Location: Portland, OR

Dates: November 13–16, 2017

Inspector: Craig Bassett

Accompanied by: Louise Lund, Division Director
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Approved by: Anthony Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Reed College
TRIGA Mark-I Research Reactor
Report No. 50-288/2017-202

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Reed College (the licensee's) Class II 250 kilowatt research reactor safety program including: (1) organization and staffing, (2) review and audit and design change functions, (3) radiation protection, (4) effluent and environmental monitoring, (5) procedures, and (6) transportation of radioactive material since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and was generally in compliance with NRC requirements.

Organizational Structure and Staffing

- Facility organization and staffing were in compliance with the requirements specified in Section 6.1 of the Technical Specification (TS).

Review and Audit and Design Change Functions

- Reviews and audits were being conducted by the Reactor Operations Committee and the Radiation Safety Committee in compliance with the requirements specified in the TSs.
- Proposed changes at the facility had been analyzed using Title 10 of the *Code of Federal Regulations* Section 50.59 safety evaluation process.

Radiation Protection Program

- Signs, notices, and postings met the regulatory requirements.
- Personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits.
- Surveys were completed and documented acceptably to permit evaluation of the radiation hazards present.
- Radiation survey and monitoring equipment was being maintained and calibrated acceptably.
- Radiation protection training was acceptable and was being conducted as required.
- The Radiation Protection and the as low as reasonably achievable programs satisfied regulatory requirements.

Environmental Monitoring Program

- Effluent monitoring satisfied licensee procedural and regulatory requirements and releases were calculated to be within the specified regulatory limits.

Procedures

- Facility procedures were acceptably reviewed, approved, and implemented.

Transportation of Radioactive Materials

- The program for shipping radioactive material satisfied regulatory requirements.

REPORT DETAILS

Summary of Plant Status

The Reed College (the licensee's) Class II 250 kilowatt TRIGA Mark-I research reactor continued to be operated in support of undergraduate instruction, laboratory experiments, reactor operator training, and various types of research. During the inspection, the reactor was operated as needed for laboratory experiments and training.

1. Organizational Structure and Staffing

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

To verify organization and staffing requirements specified in License Amendment Number (No.) 9 of the licensee's technical specification (TS) Section 6.1, dated September 28, 2015, were being met, the inspector reviewed selected aspects of:

- Current facility organization and staffing
- Management responsibilities as outlined in the applicable procedures
- Selected Reed Research Reactor (RRR) Procedures including standard operating procedure (SOP) 1, "Reactor Operation"
- RRR Annual Report for the period from July 1, 2015, through June 30, 2016, submitted on July 27, 2016
- RRR Annual Report for the period from July 1, 2016 through June 30, 2017, submitted on July 18, 2017

b. Observations and Findings

The organizational structure had not changed since the last U.S. Nuclear Regulatory Commission (NRC) inspection, which occurred in November 2016 (Inspection Report No. 50-288/2016-202). The current Facility Director remained in that position. It was noted that a new individual had been hired to fill the position of Reactor Operations Manager when the former manager left for another job. The radiation safety officer (RSO) for the reactor was also relatively new to that position, having been hired in May of 2016. The RSO also served as the campus Director of Environment Health and Safety.

Many of the day-to-day radiation protection duties at the facility were completed by various individuals including the Facility Director, the Reactor Operations Manager, and students who were also Reed College part-time employees. These individuals conducted surveys, completed instrument calibrations, and handled and counted samples. These activities were overseen, reviewed, and approved by the RSO.

The organizational structure and staffing at the facility were as required by the TSs. Review of records verified that management and staff responsibilities were being carried out as required by the TSs and applicable procedures.

c. Conclusion

The licensee's organization and staffing were in compliance with the requirements specified in the TSs.

2. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69001)

In order to ensure that the audits and reviews required by TS Section 6.2 were being completed, and to verify that any modifications to the facility were consistent with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, the inspector reviewed the following:

- Recent changes initiated by the licensee using the licensee's RRR 10 CFR 50.59 screen forms
- Minutes of the meetings held by the reactor operations committee (ROC) and the radiation safety committee (RSC) from October 2014 to the present
- Safety review and audit records for academic years 2014–2015, 2015–2016, and 2016–2017, as documented on RRR standard audit forms
- Various RRR Procedures including SOP 60, "Logbook Entries," SOP 62, "Changes, Tests, and Experiments," and SOP 66, "Corrective Action Report"
- RRR Annual Reports for the last two reporting periods as noted in Section 1

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed the ROC and the RSC meeting minutes from October 2014 to the present. These meeting minutes showed that the ROC met as required by the TSs with a quorum being present. Records showed that the safety reviews and audits conducted by the committee or designated individuals were completed at the TSs-required frequency. Topics of these reviews were also consistent with TS requirements and provided guidance, direction, and oversight of the reactor.

The inspector noted that the safety reviews and audits that had been completed, as well as the associated findings, were acceptably detailed and that the licensee responded and took corrective actions as needed. The inspector also reviewed the corrective action log. Various recommendations had been discussed and reviewed and a solution to each had been determined and subsequently implemented as needed.

(2) Design Change

Through review of the ROC meeting minutes, and through interviews with licensee personnel, the inspector determined that no major changes had been initiated and/or completed at the facility since the last NRC inspection. The inspector noted that the licensee used Maintenance Log forms as one means to determine whether a 10 CFR 50.59 screen was needed before proceeding with the required work. Various 10 CFR 50.59

screens were completed in 2016 and others had been completed to date in 2017. 10 CFR 50.59 screen forms were used to determine whether or not a full evaluation of a change was needed. It was also noted that, as a result of the screenings that had been conducted by the licensee, no evaluations were required to be completed in 2016 and none were required as of the date of the inspection in 2017. Because the licensee determined that the changes were minor in nature, they had been reviewed and approved by the Facility Director, but were not required to be approved by the ROC.

c. Conclusion

Review, audit, and oversight functions required by TS Section 6.2 were acceptably completed by the ROC. Proposed changes at the facility had been analyzed using the 10 CFR 50.59 review process as required.

3. Radiation Protection

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR Parts 19 and 20, and TS Sections 3.5 and 4.5:

- Radiological signs and posting
- Radiation work permit notebook
- Contamination Reports and Personnel Contamination Forms
- Personnel dosimetry records for 2015, 2016, and to date in 2017
- Daily reactor startup and shutdown checklists for the past 12 months
- External audits of the Radiation Safety Program conducted for ROC and RSC for the academic years 2014-2015, 2015-2016, and 2016-2017
- Selected routine surveys and monitoring records for 2016 and 2017, including biweekly, bimonthly, and semiannual checklists
- Records of maintenance and calibration of radiation survey and monitoring instruments
- As low as reasonably achievable (ALARA) program, as described in the Radioactive Materials Policy and Procedures Manual
- Various RRR SOPs dealing with radiation monitors, health physics, and Radiation Work Permits
- "Reed College Radioactive Materials Policy and Procedures Manual," dated June 2016
- RRR Radiation Protection Program Annual Review for reporting periods 2015 - 2016 and 2016 - 2017
- RRR Annual Reports for the last two reporting periods as noted in Section 1

The inspector also observed the use of dosimetry and radiation monitoring equipment during tours of the facility. The inspector also accompanied a senior reactor operator during the completion of a survey of the Reactor Bay and adjacent areas.

b. Observations and Findings

(1) Postings and Notices

Copies of current notices to workers were posted inside the reactor control room at RRR. Radiological signs were typically posted at the entrances to controlled areas as well. The posted copies of NRC Form 3, "Notice to Employees," observed at the facility were the latest issue, as required by 10 CFR 19.11, and were posted in the main hallway, in the reactor bay, and in the laboratory room.

Caution signs, postings, and controls for radiation areas were as required in 10 CFR Part 20, Subpart J. The inspector verified that licensee personnel observed the precautions for access to radiation areas.

(2) Dosimetry

The inspector determined that the licensee used optically stimulated luminescent (OSL) dosimeters for whole body monitoring of beta and gamma radiation exposure. The licensee also used thermoluminescence dosimeter (TLD) finger rings for monitoring beta and gamma radiation exposure of the extremities. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program accredited vendor. An examination of the OSL and TLD results indicating radiological exposures at the facility for the past three years showed that the highest occupational doses, as well as doses to the public, were well within 10 CFR Part 20 limitations.

Through direct observation the inspector determined that dosimetry was acceptably used by facility personnel and exit frisking practices were in accordance with facility radiation protection requirements.

The inspector verified that the licensee was providing copies of NRC Form 5 annually to those who had worked in a radiation area or who had handled radioactive material as required.

(3) Surveys

Selected daily and biweekly radiation and/or contamination surveys were reviewed by the inspector. The surveys had been completed by staff members as required. Any contamination detected in concentrations above the established action levels was noted and the area or items were decontaminated. Results of the surveys were documented so that licensee personnel would be knowledgeable of the radiological conditions that existed in the various areas of the facility.

(4) Radiation Monitoring Equipment

Examination of selected radiation monitoring equipment indicated that the instruments had an acceptable up-to-date calibration sticker attached. The instrument calibration records indicated that the calibration of

portable survey meters was typically completed by reactor staff personnel. Some meters were exchanged with another Research and Test Reactor (RTR) for calibration so that each RTR could verify that their respective calibration procedures were appropriate. Calibration frequency met procedural requirements and records were maintained as required. Fixed location radiation area monitors and stack monitors were also being calibrated as required. These monitors were also typically calibrated by reactor staff personnel.

The inspector compared selected calibration records with reactor operations logs and startup and shutdown checklists for the past 18 months. The daily startup checklists typically contained a listing of portable monitors that were available during reactor operations. The inspector determined that the instruments that were available and ready for use in the reactor bay had been calibrated as required.

During the inspection the inspector visited the facility's calibration range and discussed the calibration of survey meters with licensee personnel. It was noted that proper precautions and controls were implemented during calibration operations to maintain doses ALARA. Through discussions and records review, the inspector concluded that the calibration of instruments at the facility were completed using the appropriate techniques and according to procedure.

(5) Radiation Safety and ALARA Programs

The licensee's Radiation Safety and ALARA programs were established and described in the "Reed College Radioactive Materials Policy and Procedures Manual," dated June 2016, and through associated SOPs that had been reviewed and approved. The programs contained instructions concerning organization, training, monitoring, personnel responsibilities, audits, record keeping, and reports. The ALARA program provided guidance for keeping doses ALARA and was consistent with the requirements in 10 CFR Part 20. These programs, as established, appeared to be acceptable.

The inspector determined that the licensee continued to complete annual reviews of the radiation protection program as required by 10 CFR 20.1101(c). These reviews were typically conducted by a person from outside Reed College to provide a completely independent review of the licensee's program. This was viewed by the inspector as an effective means to obtain an objective view of the licensee's Radiation Safety Program.

The licensee did not require or use a respiratory protection program or planned special exposure program.

(6) Radiation Work Permit

The inspector reviewed the radiation work permit (RWP) program that had been established as stipulated in RRR SOP 53. It was noted that no

RWPs had been issued in 2016 or as of the date of the inspection in 2017. The controls specified in previously issued RWPs were generally acceptable and applicable for the types of work being done. Those RWPs had been initiated, reviewed, and approved as indicated on the forms.

(7) Radiation Protection Training

The inspector reviewed the radiation worker training given to RRR staff members and Reed faculty, to student operators and other students who worked at the facility, and to other personnel such as maintenance workers. Each group received different training that was based upon their duties and activities. Refresher training for staff and faculty was conducted every three years. The training program appeared to be acceptable.

The inspector reviewed various records that indicated that radiation worker and radioactive material handling training for student operators was given upon initial entry into the RRR operator training program and then reiterated during operator requalification training. Training records showed that personnel were acceptably trained in radiation protection practices.

(8) Facility Tours and Inspector Observations

The inspector toured the control room, the reactor bay, the mechanical room, the laboratory room, and the counting room at the facility. Control of radioactive material was acceptable, as was control of access to radiation areas.

c. Conclusion

The inspector determined that the Radiation Protection and ALARA Programs, as implemented by the licensee, satisfied regulatory requirements because: (1) postings met regulatory requirements, (2) personnel dosimetry was being worn as required and recorded doses were well within the NRC's regulatory limits, (3) surveys and associated checks were completed and documented acceptably to permit evaluation of the radiation hazards present, (4) radiation survey and monitoring equipment was being maintained and calibrated as required, and (5) the radiation protection training program was acceptable.

4. Environmental Monitoring Program

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Sections 3.5 and 4.5:

- Airborne release calculation records
- Environmental counting and analysis records

- Various RRR SOPs dealing with environmental sampling and radioactive waste handling and disposal
- ROC audits for academic years 2014-2015, 2015–2016, and 2016–2017
- Selected routine surveys and monitoring records for 2016 and 2017
- RRR Annual Reports for the last two reporting periods as noted in Section 1

b. Observation and Findings

Environmental soil and water samples were collected, prepared, and analyzed generally every two months consistent with procedural requirements. Only naturally occurring radionuclides were detected in the soil samples and no tritium or carbon-14 were detected in the water samples during 2016 and to date in 2017.

Radiation monitoring inside the reactor bay and outside the facility was completed using TLDs placed in accordance with the applicable procedures. The results were reported in the Annual Report as required. No doses above regulatory limits were noted.

The licensee calculated the airborne activity released to the environment using data from the continuous air monitor sampling. Licensee records and calculations indicated that the air emissions of radioactive material to the environment were well below the 10 millirem constraint specified in 10 CFR 20.1101(d). The inspector found no new potential release paths following observation of the facility.

The program for the monitoring, storage, or transferring of radioactive liquid, gases, and solids was consistent with applicable regulatory requirements. The principles of ALARA were acceptably implemented to minimize radioactive releases. Records were current and acceptably maintained and indicated that no radioactive liquid had been released from the reactor facility during 2016 or as of the date of the inspection in 2017. Monitoring equipment was acceptably maintained and calibrated as noted previously.

c. Conclusion

Effluent monitoring satisfied procedural and regulatory requirements and releases were calculated to be within the specified regulatory and TS limits.

5. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with TS Section 6.4:

- Selected RRR facility procedures
- Procedural implementation and compliance
- Recent minor and substantive procedural changes
- ROC and RSC meeting minutes for October 2014 through the present

- Administrative controls specified in RRR Procedures including SOP 61, "Procedure Writing and Use"

b. Observations and Findings

The inspector noted that facility procedures were no longer being reviewed biennially by the ROC; that requirement had been removed from the updated TSs. The Facility Director indicated that all procedures were typically reviewed annually by the Director and the Reactor Operations Manager. Administrative control of changes to procedures, and the associated review and approval process, were as stipulated by RRR SOP 61. Substantive changes to procedures were required to be reviewed and approved by the ROC. The inspector verified that this process was being followed.

Training of personnel on procedures and changes was acceptable. Through discussions with licensee personnel, the inspector verified that reactor operations were conducted in accordance with applicable procedures. Radiation and contamination surveys were completed as required. Observation and records review also showed that procedures for instrument calibration, reactor operation, maintenance, and emergency conditions were available as required.

c. Conclusion

Facility procedures were acceptably reviewed, approved, and implemented.

6. Transportation

a. Inspection Scope (IP 86740)

To verify compliance with 10 CFR 71.5 and procedural requirements for the transfer or shipment of licensed radioactive material, the inspector reviewed the following:

- Records of radioactive material shipments completed for 2016 and to date in 2017, including completed NRC Form 540, "Uniform Low Level Radioactive Waste Manifest," (form expiration date December 31, 2016) completed September 20, 2016
- Various RRR Procedures including SOP 54, "Waste Handling and Disposal," and SOP 84, "Shipping Radioactive Material"
- RRR Annual Reports for the last two reporting periods as noted in Section 1
- State of Washington, Department of Health, Site Use Permit for the Commercial Low-Level Radioactive Waste Disposal Site, Permit Number G2124, with an expiration date of February 28, 2018

b. Observations and Findings

Through records reviews and discussions with licensee personnel, the inspector determined that the licensee had completed one shipment of licensed material since the last inspection of transportation in November 2015. The shipment consisted of a drum of solid radioactive waste. The necessary forms containing

the appropriate information were completed as required. Appropriate procedures were in place for shipping various types of radioactive material.

The inspector noted that currently there was only one individual at the facility, designated as a "shipper," who had completed the appropriate training to ship radioactive material.

c. Conclusion

The program for shipping radioactive material satisfied regulatory requirements.

7. Exit Interview

The inspection scope and results were summarized on November 16, 2017, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No proprietary material was reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

L. Arvin	Vice President and Treasurer, Reed College
S. Brodesser	Student Operations Supervisor
M. Krahenbuhl	Director, Reed Research Reactor Facility
N. Nicholson	Dean of the Faculty, Reed College
I. Novakoski	Reactor Operations Manager
A. Sams	Radiation Safety Officer and Campus Environmental Health and Safety Director
C. Whitmore	Student Training Supervisor

INSPECTION PROCEDURES USED

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

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ALARA	As Low As Reasonably Achievable
IP	Inspection Procedure
No.	Number
NRC	U.S. Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescent (dosimeter)
ROC	Reactor Operations Committee
RRR	Reed Research Reactor
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
RTR	Research and Test Reactor
RWP	Radiation Work Permit
SOP	Standard Operating Procedure
TLD	Thermoluminescent Dosimeter
TSs	Technical Specification