

May 22, 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 REACTIVE
INSPECTION REPORT NO. 50-288/2017-201

Dear Dr. Krahenbuhl:

From April 17 – May 3, 2017, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection at the TRIGA Mark-I Reed Research Reactor facility. The enclosed report documents the inspection results which were discussed on May 3, 2017, with you and Christina Barrett, Reactor Operations Manager.

This 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 and examiner reviewed selected procedures and representative records, interviewed personnel, and observed activities in progress. 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 (301) 466-4495 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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

Enclosure:
As stated

cc: See next page

Reed College Docket

No. 50-288

cc:

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SUBJECT: REED COLLEGE — U. S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-288/2017-201, DATED: 5/22/2017

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

Docket No: 50-288

License No: R-112

Report No: 50-288/2017-201

Licensee: Reed College

Facility: Reed Research Reactor Facility

Location: Portland, Oregon

Dates: April 17 – May 3, 2017

Inspector: Craig Bassett

Accompanied by: John Nguyen, License Examiner

Approved by: Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Reed College
Reed Research Reactor Facility
NRC Report No. 50-288/2017-201

The primary focus of this reactive inspection was the onsite review of selected aspects of the Reed College (the licensee's) Class II research reactor recovery actions following an extended period when certain equipment was not operational including: (1) organization and staffing, (2) review and audit and design change control, (3) installation and testing of the new fission chamber and logarithmic channel, (4) operator requalification, (5) procedures, (6) maintenance and surveillance, (7) radiation protection, (8) general facility security, and (9) material control and accounting. The licensee's actions were acceptably directed toward the protection of public health and safety and in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

Organization and Staffing

- The licensee's organization and staffing were in compliance with the requirements specified in Section 6 of the technical specifications (TSs).

Review and Audit Functions and Design Change Control

- Review and oversight functions required by TSs Section 6.2 were acceptably completed by the Reactor Operations Committee.
- Modifications or changes to the facility had undergone the required screenings and evaluations and had been reviewed and approved by the Reactor Operations Committee.

Installation and Testing of the New Fission Chamber and Logarithmic Channel

- The installation and testing of the Logarithmic (Log) Channel was conducted according to a coordinated schedule.
- Oversight functions were acceptably completed.
- After observation and evaluation of the licensee's actions to install and calibrate the new Log Channel, the NRC determined that the appropriate instrumentation repair actions had been taken and completed.

Operator Requalification

- The requalification/training program was being followed and operators who had not been able to maintain qualification because of the non-operational status of the reactor were working toward completing the established requirements.

Procedures

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

- Procedures affected by the installation of the new Log Channel were being revised as required.
- Procedure revisions will be reviewed during a future inspection.

Maintenance and Surveillance

- The program for surveillance was generally being carried out in accordance with TSs requirements.
- Completion of all the required periodic surveillance and maintenance activities at the facility will be reviewed during a future inspection at the facility

Radiation Protection

- Periodic and job specific surveys were completed and documented as required by procedure.
- Personnel dosimetry was being worn as required.
- No one received any recorded radiation exposure during the installation and testing of the new Log Channel.

General Facility Security

- Security facilities, equipment, procedures, and controls satisfied the physical security plan requirements.

Material Control and Accounting

- Required material control and accountability forms were being prepared and submitted to the appropriate regulatory agencies.
- The reactor fuel and other Special Nuclear Material was stored and secured properly.

REPORT DETAILS

Summary of Plant Status

The Reed College (the licensee's) 250 kilowatt TRIGA Mark I research reactor was typically operated in support of undergraduate instruction, laboratory experiments, reactor system testing, reactor surveillances, and operator training. During this inspection the reactor was not operated normally due to nuclear instrumentation issues. Following replacement of the Logarithmic (Log) Channel and the associated fission chamber, the reactor was operated for testing and calibration of various channels and for power calibration prior to resuming routine operations.

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 Section 6.1 of the technical specifications (TSs) (which comprised Appendix A of Facility License Number R-112, dated February 29, 2016), were being met:

- Main (Reactor Console) Log – Numbers (Nos.) 89 – 90
- Reed Research Reactor (RRR) facility organization and staffing during reactor maintenance and testing
- Administrative controls and management responsibilities specified in the TSs and facility procedures
- RRR Administrative Procedures, Section 1, "Personnel," and Section 3, "Reactor Operations," dated 2016
- RRR Standard Operating Procedure (SOP) 60, "Logbook Entries"

b. Observations and Findings

Through discussions with licensee representatives, the inspector determined that management responsibilities and the organizational structure at the RRR facility had not changed since a Nuclear Regulatory Commission (NRC) inspection of licensee's programs and reactor operations in October - December 2016 (Inspection Report No. 50-288/ 2016-202). The inspector determined that the Facility Director retained direct control and overall responsibility for management of the facility as specified in the TSs. The Facility Director reported to the President of Reed College through the Dean of Faculty. This organization was consistent with that specified in the TSs.

The licensee's current operational organization consisted of the Facility Director, a Reactor Operations Manager, a Radiation Safety Officer, an Operations Supervisor, a Training Supervisor, an Assistant Training Supervisor, a Projects Supervisor, a Requalification Supervisor, and various student operators. The Facility Director, Reactor Operations Manager, and Radiation Safety Officer were full-time employees of the college while the rest were part-time positions filled by students. Except for the Radiation Safety Officer, the aforementioned individuals were qualified reactor operators (ROs) or senior reactor operators (SROs); this in addition to their administrative duties. It was noted that there were a total of

16 SROs and 18 ROs licensed to operate the RRR. However, when the inspection started, only two SROs were in requalification status and thus the only two at that time authorized to operate the reactor.

c. Conclusion

Organizational structure and staffing were in compliance with the requirements specified in TS Section 6.1.

2. Review and Audit Functions and Design Change Control

a. Inspection Scope (IP 69001)

In order to verify that the licensee had established and conducted reviews and audits as required, and to determine whether facility modifications and change reviews were consistent with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, and TS Section 6.2, the inspector and the examiner reviewed selected portions of the following:

- Selected Corrective Action Reports for 2016 and to date in 2017
- Selected design changes reviewed under 10 CFR 50.59 for 2016 and 2017
- Reactor Operations Committee (ROC) meeting minutes from October 2016 through the present
- RRR Administrative Procedures, Section 1, "Personnel;" Section 2, "Reactor Review Committee;" and Section 9, "Record Retention;" dated 2016
- Various RRR SOPs including: SOP 62, "Changes, Tests, and Experiments," and the associated 62A forms, "10 CFR 50.59 Screen Forms;" and SOP 69, "Corrective Action Report;" and associated forms, "Corrective Action Reports"
- 10 CFR 50.59 Screen Form, No. 16-01, "Installation of Fission Chamber and Log Channel," dated November 21, 2016, with Addendum No. 16-01A, "Placement of Fission Chamber and Clarifications," dated April 19, 2017, and Addendum, No. 16-01B, "Moving the Source Interlock to the Wide Range Channel on the Channel," dated April 25, 2017

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed ROC meeting minutes from October 2016 through the present. These meeting minutes showed that the committee was meeting at the required frequency and was considering the types of topics outlined by the TSs. The inspector noted that the appropriate audits were being completed by the ROC in the various areas outlined in the TSs.

(2) Design Change Control

The inspector reviewed the licensee's 10 CFR 50.59 screening forms concerning selected changes or modifications that had been initiated at the facility for 2016 and to date in 2017, including the Screen Form dealing with the installation of the new fission chamber and Log Channel

and the attached Addenda. The results indicated that the screening required no further evaluation under 10 CFR 50.59. Neither this change nor the other changes reviewed by the inspector met any of the criteria of 10 CFR 50.59(c)(1) and (2), which would have required a TS change or a license amendment from the NRC. The changes had been reviewed and approved by the ROC.

The inspector also reviewed the licensee's current safety analysis report (SAR) "Reed Research Reactor Safety Analysis Report," dated July 2010. It was noted that Chapter 7 of the SAR, "Instrument and Control Systems," Section 7.2.3, "System Description," mentioned the fission chamber but did not stipulate specifically where each of the power monitoring channels should be located. The licensee chose to place the new fission chamber in the southwest position where the previous chamber had been. The inspector also reviewed the licensee's current TSs. Section 3.2.2 of the RRR TSs, mentions the Log Channel, which is associated with the fission chamber, but only mentions that it is required for operation. The section then addresses checks, tests, or calibrations of the power measuring channels. There was not an actively functioning scram associated with the Log Channel, only the Source Interlock.

c. Conclusion

Review and oversight functions required by TS Section 6.2 were acceptably completed by the ROC. Modifications or changes to the facility had undergone the required screenings and evaluations and had been reviewed and approved by the ROC.

3. Installation and Testing of the New Fission Chamber and Logarithmic Channel

a. Inspection Scope (IP 69001)

To ensure that installation and testing activities were being accomplished appropriately and to determine that surveillance activities and calibrations were being completed as required by TS Section 4, the inspector and examiner reviewed selected aspects of:

- Main (Reactor Console) Log Nos. 89 – 90
- Maintenance Log pages completed for unscheduled work
- Associated surveillance and calibration data and records for 2016-2017
- Maintenance and surveillance activities conducted by the licensee during the period from April 17 to May 3, 2017
- "Other Checklists" Notebook which contained calibration forms, inspection forms, and various checklists
- Various RRR SOPs and Appendices including: SOP 25, "Semiannual Checklist;" SOP 25, with Appendix A, "Reed Research Reactor Semiannual Checklist;" SOP 26, "Annual Checklist;" SOP 26, with Appendix A, "Annual Checklist Form;" SOP 33, "Nuclear Instruments;" with Appendix B, "Nuclear Instruments Calibration Form;" SOP 34, "Control Rods;" with SOP 34, Appendix A, "Control Rod Calibration Form;" and, SOP 60, "Logbook Entries;" and associated Appendix A, "Maintenance Log" forms

b. Observations and Findings

(1) Installation and Testing Planning and Support

A review of the scheduling calendar and various logbooks associated with the instrumentation repair project indicated that the installation and testing activities for the new channel had been planned out in advance of the project. And, when problems arose, the calendar was revised to reflect any needed changes. This included the eventual testing and calibration of the new channel prior to it being placed into operation.

Installation and testing activities were tracked and overseen by RRR licensee personnel with the help of others. The Development Engineer (an electronics specialist) from Oregon State University (OSU) and a management representative from ThermoFisher Scientific (TFS) were on hand to assist with these activities during the first week of channel installation. During the following week, a Senior Field Service Engineer from TFS also provided needed support for the project (see the following paragraphs).

(2) Review of Receipt of the new Log Channel and Fission Chamber

On Wednesday, April 19, the inspector and examiner observed as the wooden crate containing the fission chamber and Log Channel was delivered to the licensee. The crate was surveyed before being taken off the truck and was then removed from the truck using a fork lift. After opening the crate, all the contents were surveyed and then removed from the container and placed inside the Reactor Bay.

(3) Installation Activities

On succeeding days during the week, preparations were made to install the chamber. The cable used to connect the chamber to the output box containing all the electronics of the Log Channel was pulled through the cable tray from the Reactor Bay into the Control Room. The fission chamber and connecting tubing were placed into the reactor pool in a position next to the reactor core. It was placed into the same position where the previous fission chamber had been located.

(4) Testing Activities

After wiring connections were made up, testing and adjustments to the electronics in the TFS Neutron Flux Monitor/Log Channel Console began. Following a period of testing and adjustments it appeared that everything was functioning properly. However, during the last test, it was noticed that the readings were fluctuating and were not as expected. The TFS representative found that a cable inside the box was not soldered correctly and a new cable had to be ordered. After the new cable arrived on Saturday, it was placed in service in the Log Channel Console and the reactor appeared to be functional and operational. An initial power calibration was conducted and everything appeared to be correct. The

reactor was operated at moderate power as a test to allow the TFS representative to observe that the reactor instrumentation was operating as expected.

On Tuesday, April 25, the licensee made preparations to perform the official power calibration of record. During these preparations, the licensee noted that the readings on the Log Channel Console display were again not indicating the expected readings. After consulting with a TFS representative by phone, it was decided that a Field Engineer from the company would come to Reed College and check out the problems.

On Wednesday, April 26, a Senior Field Service Engineer from TFS arrived. He checked out the entire system and then tightened various cable connections. An isolation transformer supplied by TFS was also installed to provide stabilized power for the system. After re-soldering some jumpers in the Log Channel Console, the system was again tested and all values displayed appeared to be normal and as expected.

(5) Calibration Activities

The next day the licensee conducted a thermal power calibration of the reactor nuclear instrumentation. The data received from the calibration showed that the power levels indicated on the various monitoring channels were very close to the predicted levels. The percent power and log power channels were then adjusted slightly after which all channels were in agreement. All readings were as expected and the inspector agreed with the results.

On Monday, May 1, the licensee conducted the control rod calibrations. Another power calibration was also completed later. After evaluation of the licensee and support personnel actions to finalize the installation and calibration of the new log channel, the NRC concluded that the completed actions were appropriate. No further questions about the proper functioning of the Log Channel remained. The NRC agreed that the reactor could resume normal operations when the licensee, including Reed College management, and the ROC decided to do so.

(3) Staff Communication

Observation of the work as it progressed indicated that communication was effective. The licensee documented the various problems and readings taken during the testing and calibration in the Console Log. These records helped provide an indication of the ongoing activities and issues and the actions needed to correct any problems noted. Whenever problems were encountered, they were discussed and the proper course of action was discussed and agreed upon prior to proceeding. Licensee personnel were constantly aware of the conditions in the facility and the status of changes being made. Proper safety practices were stressed and there was an appropriate safety conscious work environment at the facility.

c. Conclusion

The installation and testing of the Log Channel was conducted according to a coordinated schedule. Oversight functions were acceptably completed. After observation and evaluation of the licensee's actions to install and calibrate the new Log Channel, the NRC determined that the appropriate instrumentation repair actions had been taken and completed.

4. Operator Requalification

a. Inspection Scope (IP 69001)

The inspector reviewed the following in order to determine that operator training and requalification activities were conducted as required by the requalification program and that medical requirements were met:

- Main (Reactor Console) Log Nos. 89 – 90
- Active/qualified status of all current reactor operators
- RRR Facility Requalification Program, dated July 2010
- RRR Facility Alternate Requalification Plan, dated September 2016
- Training lectures and records for the current training cycle
- NRC Form 398, "Personal Qualification Statement – Licensee"
- "Requalification Hours and Reactivity Manipulation" Sheets documenting reactivity manipulations for 2016 through the present for selected operators
- Various RRR SOPs including: SOP 63, "Requalification;" SOP 63 Appendix A, "Reactor Operator Physical Exam;" and SOP 63, Appendix B, "Accelerated Requalification Form"

b. Observations and Findings

- (1) Routine Requalification Program – For the Period from July 2016 through June 2017

The inspector noted that there were 3 trainees, 18 ROs and 16 SROs at the RRR facility. The inspector reviewed selected operators' licenses and noted that, as indicated above, only two were qualified to operate the reactor when the inspection began. It was noted that the reactor had not been fully operational since June 2016 and had not been operated since the middle of October 2016. This was the reason for the requalification issues. During the inspection more operators completed the requirements to place them back into qualified status.

The inspector reviewed the requalification program for July 2016 through July 2017. It was noted that operators typically made entries on the "Requalification Hours and Reactivity Manipulation Sheet," that was located in the control room. Since the reactor had not been operational for several months, there were no recent entries except those dealing with routine maintenance. Once testing of the new Log Channel began, various operators were again able to accumulate operating hours under observation. Through these actions the hours "on duty" and in what

capacity (i.e., RO/SRO), as well as the tasks performed, were documented.

The inspector also reviewed the Requalification Meeting Agenda and Attendance Sheets for the period from September 2016 through the present. The review of the various logs and records showed that training had been conducted in accordance with the licensee's requalification and training program. Training reviews and examinations had been or were in the process of being completed and documented as required. The records indicated that eleven operators had completed all the required activities except for operating the reactor. Once these operators had operated the reactor under direction and had completed the required reactivity manipulations, they would be able to take operator licensing examinations scheduled for July.

(2) Alternate Requalification Plan – For the period from July 2016 until the Reactor is Operational

As noted above, the RRR had been functional and operational only sporadically since May 2016. Because of this problem, none of the operators were able to complete the operational requirements to remain fully qualified. The licensee recognized this and proposed an alternate requalification plan to the NRC in September 2016. The alternate plan was reviewed and subsequently approved.

The Alternate Requalification Plan stipulated that two Reed College SROs would go to the OSU research reactor facility and complete two hours of reactor operation under direction of OSU personnel and two hours of supervision of the other Reed College operator. These two individuals would complete one reactivity manipulation each while at OSU as well. This would suffice for the reactor operation requirements of the Alternate Requalification Program and allow the two operators to return to Reed College and observe the other Reed operators operate under their direction. This occurred September 29 of last year and the SROs were in qualified status for the remainder of 2016. However, since the reactor remained non-operational, the two SROs had to repeat the process for this year. The two SROs went to OSU on March 28, 2017, and completed their operating hours as required.

For the remainder of the operators at Reed College who did not go to OSU and were out of qualification, the alternate plan required that each operator complete six hours of operation under direction (of one of the SROs who went to OSU or of someone who had regained qualification). In addition, these operators would then need to meet the routine Reed Requalification Program requirements of two reactivity manipulations for the quarter.

The inspector reviewed the actions of the licensee to comply with the requirements of the Alternative Requalification Plan. The inspector verified that the two SROs who went to OSU had completed the required

hours of operation and the required reactivity manipulations. They then returned to Reed College and began observing other operators.

It was noted that, by the end of the inspection, approximately seven SROs and ROs had completed the requirements of the alternate requalification plan.

c. Conclusion

The requalification/training program was being followed and operators who had not been able to maintain qualification because of the non-operational status of the reactor were working toward completing the established requirements.

5. Procedures

a. Inspection Scope (IP 69001)

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

- Selected facility procedures
- Procedural implementation and compliance
- Recent minor and substantive procedural changes
- ROC and RSC meeting minutes for October 2016 through the present
- Administrative controls specified in RRR Administrative Procedures
- RRR 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.

During the inspection, the inspector noted that the licensee was working on revisions to the procedures necessitated by the installation of the new Log Channel. These included SOP 20, "Startup Checklist;" SOP 26B, "Console Checkout Form;" and SOP 33, "Nuclear Instruments." Training of personnel on these procedures and changes was just beginning at conclusion of the inspection. Those operators who were not yet qualified were noted to be operating under the direction of a qualified SRO and were being instructed during the process. Because the procedure revisions and training were not yet completed, the licensee was informed that the issue of revising the procedures and completing the appropriate training would be noted as an Inspector Follow-up Item (IFI) and would be reviewed during a subsequent inspection (IFI 50-288/2017-201-01).

c. Conclusion

Facility procedures were acceptably reviewed, approved, and implemented. Procedures affected by the installation of the new Log Channel were being revised as required. Procedure revisions will be reviewed during a future inspection.

6. Maintenance and Surveillance

a. Inspection Scope (IP 69001)

To verify that operations, surveillance activities, and calibrations were being completed as required by the TSs, the inspector reviewed selected portions of:

- Main (Reactor Console) Log Nos. 89 – 90
- Associated surveillance and calibration data and records for 2016-2017
- "Other Checklists" Notebook which contained calibration forms, inspection forms, and various checklists
- Various RRR SOPs and Appendices including: SOP 25, "Semiannual Checklist," SOP 25, with Appendix A, "Reed Research Reactor Semiannual Checklist," SOP 26, "Annual Checklist," SOP 26, with Appendix A, "Annual Checklist Form," SOP 33, "Nuclear Instruments," with Appendix B, "Nuclear Instruments Calibration Form," SOP 34, "Control Rods," with SOP 34, Appendix A, "Control Rod Calibration Form," and, SOP 60, "Logbook Entries," and associated Appendix A, "Maintenance Log" forms

b. Observations and Findings

During the past year, the licensee conducted various surveillance activities which were then documented on the appropriate forms and checklists. The inspector verified that these activities had generally been conducted within the time frame required and according to procedure. Some surveillances could not be completed because of the status of the reactor.

The inspector reviewed selected semiannual and annual forms and checklists. The inspector noted that it had been over a year since the last acceptable power calibration was performed and over six months since control rod calibrations had been completed. During the inspection the licensee completed these calibrations in order to be in compliance with the TSs requirements. Completion of all the required annual and other periodic surveillance and maintenance activities at the facility will be reviewed during the next routine inspection at the facility.

c. Conclusion

The program for surveillance was generally being carried out in accordance with TSs requirements. Completion of all the required periodic surveillance and maintenance activities at the facility will be reviewed during a future inspection at the facility.

7. Radiation Protection

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with 10 CFR Parts 19 and 20 and licensee administrative requirements:

- Radiological signs and posting
- Radiation work permit notebook
- RRR Administrative Procedures
- Personnel dosimetry records for 2016 and to date in 2017
- Daily reactor startup and shutdown checklists for the past 2 weeks
- Various RRR SOPs dealing with radiation monitors and health physics
- "Reed College Radioactive Materials Policy and Procedures Manual"

The inspector also observed the use of dosimetry and radiation monitoring equipment during tours of the facility.

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 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 and contractor personnel observed the precautions for access to controlled areas and 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 thermoluminescent 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. Visitors and contractors were issued self-reading dosimeters to track their dose. An examination of the OSL and TLD results, as well as the Visitors Log, indicating radiological exposures at the facility for the past year showed that the highest occupational doses, as well as doses to visitors and contractors, were well within 10 CFR Part 20 limitations.

Through direct observation the inspector determined that dosimetry was acceptably used by facility and contractor/visitor personnel as required. Exit frisking practices were in accordance with facility radiation protection

requirements. No one received any radiation exposure during the installation and testing of the new fission chamber.

(3) Surveys

Selected daily, weekly, biweekly, and receipt of radioactive material radiation and/or contamination surveys were reviewed by the inspector. The surveys had been completed by staff members as required. As noted above, the shipping container and the fission chamber itself had been surveyed upon receipt as required. No contamination was detected and the radiation levels were in the microrem range.

(4) Radiation Monitoring Equipment

Examination of selected radiation monitoring equipment indicated that the instruments had an acceptable up-to-date calibration sticker attached. The instruments used to survey the fission chamber, as well as those used in the Reactor Bay during installation of the chamber, had all been calibrated as required.

(5) 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 As Low As Reasonably Achievable 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, and (4) radiation survey and monitoring equipment was being maintained and calibrated as required.

8. General Facility Security

a. Inspection Scope (Inspection Procedures (IPs) 81401, 81402, 81431, and 81810)

To verify compliance with the licensee's NRC-approved physical security plan (PSP), the inspector reviewed:

- Access controls and procedures
- Reed College and RRRF security organization
- Lock and key control documented in the RRRF Security Log
- Various RRR Standard Operating Procedures including: Standard Operating Procedure (SOP) 24, "Bimonthly Checklist;" SOP 25, "Semiannual Checklist;" SOP 26, "Annual Checklist;" and, SOP 65, "Security and Visitors"

- Also RRR SOP 65 Appendices: Appendix C, "Visitor Log Form;" Appendix D, "Tour Group;" Appendix F, "Alarm Testing;" and, Appendix G, "Alarm Response"

b. Observations and Findings

The PSP in use at the facility was the same as the latest revision submitted to the NRC. Various licensee procedures were consistent with, and adequately implemented, the PSP.

Physical protection systems (barriers, alarms, and equipment) were reviewed and observed by the inspector and were determined to be in accordance with the PSP. The inspector verified that the various security requirements were met during the fission chamber installation. Access control was being implemented as stipulated in the PSP. The inspector also verified that the fuel and other Special Nuclear Material was being maintained and stored in a secure location in accordance with the PSP and licensee procedures.

c. Conclusion

Security was maintained in accordance with PSP requirements.

9. Material Control and Accounting Program

a. Inspection Scope (IP 85102)

The inspector reviewed selected aspects of the licensee's material control and accountability program including:

- Control of special nuclear material (SNM) storage areas
- Nuclear Material Transaction Report form (also known as Department of Energy (DOE)/NRC Form 741) for the fission chamber receipt
- Material Balance Report forms (also known as DOE/NRC Form 742) for the fission chamber receipt
- Various RRR SOPS including: "Semiannual Checklist;" SOP 26, "Annual Checklist;" and, SOP 35, "Fuel and Core"
- Various RRR forms and appendices including: SOP 25, Appendix A, "Semiannual Checklist Form;" SOP 26, Appendix A, "Annual Checklist Form;" SOP 35, Appendix A, "Core Diagram;" and SOP 35, Appendix D, "Fuel Receipt Form"

b. Observations and Findings

The inspector verified that the licensee's material control and accountability program tracked the amount and storage locations of fuel, fission detectors, and other SNM maintained under the Facility Operating License R-112. Possession and use of SNM were limited to those purposes authorized by the license. The inspector noted that the fission chamber shipped by TFS to the facility contained 1.68 grams of Uranium-235 (SNM). The appropriate material control and accountability forms (DOE/NRC Forms 741 and 742) had been prepared and submitted in a timely manner and as required by 10 CFR 74.15.

The inspector toured the facility, observed the SNM and fuel storage areas, and verified that the licensee was using and storing SNM in the designated areas. Through records review, the inspector verified that the total amount of SNM in use or in storage at the facility was within the possession limits specified in the license.

c. Conclusion

The required material control and accountability forms were being prepared and submitted to the appropriate regulatory agencies. SNM was acceptably stored and controlled.

10. Exit Interview

The inspection scope and results were summarized on May 3, 2017, with licensee representatives. The findings for each area were reviewed. The licensee acknowledged the findings and did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection of these program areas.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

C. Barrett	Reactor Operations Manager
S. Brodesser	Training Supervisor
T. Freeman	Requalification Supervisor
J. Koh	Operations Supervisor
M. Krahenbuhl	Director, Reed Reactor Facility
M. McCarthy	Projects Supervisor
N. Nicholson	Dean of the Faculty, Reed College
M. Oxley	Training Supervisor

Other Personnel

R. Barnes	Technical Support Manager, Neutron Flux Monitoring Systems, ThermoFisher Scientific
D. Miller	Senior Field Service Engineer, Neutron Flux Monitoring Systems, ThermoFisher Scientific
S. Smith	Development Engineer and Scientific Instrument Specialist, Oregon State University

INSPECTION PROCEDURES USED

IP 69001	Class II Non-Power Reactors
IP 81401:	Plans, Procedures, and Reviews
IP 81402:	Reports of Safeguards Events
IP 81431:	Fixed Site Physical Protection of Special Nuclear Material of Low Strategic Significance
IP 81810:	Protection of Safeguards Information

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

IFI 50-288/2017-201-01	Follow-up on the issue of revising the procedures dealing with the installation of the new Log Channel and completing the appropriate training.
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Closed

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
IFI	Inspector Follow-up Item
IP	Inspection Procedure
Log	Logarithmic
No.	Number
NRC	Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescent
OSU	Oregon State University
PSP	Physical Security Plan
RO	Reactor Operator
ROC	Reactor Operations Committee
RRR	Reed Research Reactor
RRRF	Reed Research Reactor Facility
SAR	Safety Analysis Report
SNM	Special Nuclear Material
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TFS	ThermoFisher Scientific
TLD	Thermoluminescent Dosimeter
TSS	Technical Specifications