



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

April 20, 2020

Dr. Steven R. Reese, Director
Oregon State University
100 Radiation Center
Corvallis, OR 97331-5903

SUBJECT: OREGON STATE UNIVERSITY – NUCLEAR REGULATORY COMMISSION
ROUTINE INSPECTION REPORT NO. 05000243/2020201

Dear Dr. Reese:

From February 24-27, 2020, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Oregon State University TRIGA Reactor facility. The enclosed report documents the inspection results which were discussed on February 27, 2020, with you and members of your staff.

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 selective 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* 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).

If you have any questions concerning this inspection, please contact Kevin Roche at (301) 415-1554, or by electronic mail at Kevin.Roche@nrc.gov.

Sincerely,

/RA/

Travis L. Tate, Chief
Non-Power Production and Utilization
Facility Oversight Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-243
License No. R-106

Enclosure:
As stated

cc: See next page

Oregon State University

Docket No. 50-243

cc:

Mayor of the City of Corvallis
Corvallis, OR 97331

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Mr. Daniel Harlan, Chairman
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Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
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University of Maryland
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College Park, MD 20742-2115

SUBJECT: OREGON STATE UNIVERSITY – NUCLEAR REGULATORY COMMISSION
ROUTINE INSPECTION REPORT NO. 05000243/2020201
DATED: APRIL 20, 2020

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

Docket No.: 50-243

License No.: R-106

Report No.: 05000243/2020201

Licensee: Oregon State University

Facility: Oregon State University TRIGA Reactor

Location: Radiation Center
Oregon State University
Corvallis, Oregon

Dates: February 24-27, 2020

Inspector: Kevin M. Roche

Approved by: Travis L. Tate, Chief
Non-Power Production and Utilization
Facility Oversight Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Oregon State University TRIGA Reactor Nuclear Regulatory Commission Inspection Report No. 05000243/2020201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Oregon State University (OSU or the licensee's) 1.1 megawatt Class II research reactor safety program, including: (1) operations logs and records; (2) requalification training; (3) surveillance and limiting conditions for operation (LCO); (4) experiments, (5) emergency planning; (6) maintenance logs and records, and (7) fuel handling logs and records 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 in compliance with NRC requirements.

Operations Logs and Records

- Operational activities were consistent with applicable technical specification (TS) and procedural requirements.

Requalification Training

- Operator requalification was being conducted and completed as required by the Operator Requalification Program.

Surveillance and Limiting Conditions for Operation

- The program for surveillance and LCO confirmation was implemented in accordance with TS requirements.

Experiments

- The program for conducting and controlling experiments satisfied the requirements specified in the regulations and TS Sections 3.8, "Limitations on Experiments," and 4.8, "Experimental Limits."

Emergency Planning

- The emergency preparedness program was generally conducted in accordance with the Emergency Plan (E-Plan).

Maintenance Logs and Records

- Maintenance activities ensured that equipment remained consistent with the safety analysis report and TS requirements.

Fuel Handling Logs and Records

- Fuel movements and inspections were being completed and documented in accordance with the requirements specified in the TS and by procedure.

REPORT DETAILS

Summary of Facility Status

OSU continued to operate the 1.1 megawatt TRIGA Mark-II research reactor in support of laboratory demonstrations, reactor surveillances, and sample irradiations. During this inspection, the reactor was started up and operated several hours per day at varying power levels for sample irradiation.

1. Operations Logs and Records

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

To ensure that the requirements of TS 6.4, "Procedures," and TS 6.8, "Records," were being met, the inspector reviewed:

- Oregon State TRIGA Reactor (OSTR) Operating Procedures (OSTROP) 2, "Reactor Startup Checklist Procedures," Revision low-enriched uranium (LEU)-11
- OSTROP 3, "Reactor Shutdown Checklist Procedures," Revision LEU-6
- OSTROP 4, "Reactor Operating Procedures," Revision LEU-9
- OSTROP 5, "Procedures for Maintaining Reactor Operations Records," Rev LEU-10
- OSTR Reactor Daily Power Log
- Selected entries from OSTR Log books 170-175 (October 30, 2017, – February 25, 2020)
- Selected Startup and Shutdown Checklists
- Reactor Supervisor's Log, Volume 16, for the past 2 years
- OSU Radiation Center and TRIGA Reactor Annual Reports for the past 2 years

b. Observations and Findings

The inspector reviewed selected log book entries, request for operations, and pre-start and post-shutdown forms and determined that logs and records are maintained as required by the licensee's administrative procedures. Records also showed that operational conditions and parameters were consistent with the license and TS requirements. The inspector also observed the reactor staff perform the required pre-start, post-shutdown, and area radiation survey checkout and a reactor startup and shutdown and the completion of the associated records and logs. The inspector determined that reactor operations were carried out following written procedures as required by TS 6.4 and TS 6.8.

c. Conclusion

Operational activities were consistent with applicable TS and procedural requirements.

2. Requalification Training

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:

- “Requalification Program for Licensed Operators of the Oregon State TRIGA Reactor,” Revision 1, dated September 21, 2004
- Operator physical examination records of selected operators
- OSTR operator requalification training sessions for 2018 and 2019
- OSTR operator requalification written examination records for the past 2 years
- OSTROP 14, “Quarterly Surveillance and Maintenance Procedures,” Revision LEU-6
- Completed OSTROP 14 sheets for 2018 and 2019
- OSTR operator requalification operational exercise records for the past 2 years
- OSTR console operating experience records for the past 2 years

b. Observations and Findings

As of the date of this inspection, all the operators’ licenses were current. All operators were enrolled in the licensee’s NRC-approved requalification and training program and had completed a minimum of four hours of shift functions per quarter. The inspector noted that operators were receiving the required biennial medical examinations.

A review of the logs and records showed that training was being conducted in accordance with the program. Requalification program data such as completion of written examinations and operation tests was documented as required. Records of reactivity manipulations, and other operations activities were being maintained throughout the year. The inspector observed an operations test and found the questions acceptable and the operator knowledgeable.

c. Conclusion

Operator requalification was being conducted and completed as required by the Operator Requalification Program.

3. Surveillance and Limiting Conditions for Operation

a. Inspection Scope (IP 69001)

To determine that surveillance requirements and LCO verifications were being completed as required by TS 3, “Limiting Conditions of Operation,” and TS 4, “Surveillance Requirements,” and that maintenance activities were conducted when required, the inspector reviewed:

- OSTROP 8, "Reactor Power Calibration Procedures," Revision LEU-4
- OSTROP 9, "Control Rod Calibration Procedures," Revision LEU-5
- OSTROP 13, "Monthly Surveillance and Maintenance Procedures," Revision LEU-8
- OSTROP 14, "Quarterly Surveillance and Maintenance Procedures," Revision LEU-6
- OSTROP 15, "Semi-Annual Surveillance and Maintenance Procedures," Revision LEU-8
- OSTROP 16, "Annual Surveillance and Maintenance Procedures," Revision LEU-7
- TSs through Amendment 25, dated June 18, 2019
- Completed OSTROP 13 Sheets from 2018, 2019, and January of 2020
- Completed OSTROP 14 Sheets from 2018 and 2019
- Completed OSTROP 15 Sheets from 2018 and 2019
- Completed OSTROP 16 Sheets from 2018 and 2019
- Power calibrations log entries from 2018 and 2019
- Control Rod calibrations from 2018 and 2019
- Reactor Supervisor's Log, Volume 16, for the past 2 years
- Console logbooks #170-175
- OSU Radiation Center and TRIGA Reactor Annual Reports for the past 2 years

b. Observations and Findings

The inspector performed a random sampling of the daily, weekly, monthly, quarterly, semi-annual, and other periodic checks, tests, and verifications for TS required LCOs and determined that they were completed in the specified time frame and in accordance with licensee procedures. The records and logs reviewed were complete and were being maintained as required. The inspector noted that the licensee maintained an effective record keeping system that helped ensure that all required tests, LCO verifications, and calibrations were completed in a timely manner.

All the recorded results for the activities reviewed by the inspector were within the TS required parameters.

c. Conclusion

The program for surveillance and LCO confirmation was implemented in accordance with TS requirements.

4. **Experiments**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify that experiments were being conducted within approved guidelines specified in TS Sections 3.8 and 4.8:

- Selected approved experiments
- OSTR Thermal Column Radiation Monitoring forms

- Potential hazards identification and control of irradiated items
- Documentation of experiment review and approval by the Reactor Oversight Committee (ROC)
- Selected OSTR Irradiation Request Information Sheet forms for the past 2 years
- Reactor operations documented in various Reactor Console Logbooks, Nos. 170-175
- OSTROP 18, "Procedures for the Approval and Use of Reactor Experiments," Revision LEU-2
- OSTROP 18 Appendix A, "Procedures for Irradiating Samples in the Oregon State TRIGA Reactor," Revision LEU-5
- OSU Radiation Center and TRIGA Reactor Annual Reports for the past 2 years

b. Observations and Findings

The licensee had three types of experiments at the facility, based generally on the reactivity, amount of shielding required, and the amounts of radioisotopes produced. The inspector noted that there were currently five approved reactor experiments available for use. The inspector verified that all the active experiments had been reviewed and approved by the ROC as required. The inspector noted that one additional experiment was approved this year.

A review of the records maintained by the licensee indicated that all experiments were completed under the cognizance of the Reactor Supervisor as required. The results of the experiments were documented appropriately. Irradiation Request forms, required for irradiating samples in the reactor, were also reviewed. The Irradiation Request forms were being completed as required. The forms documented the individual users, the required approvals and licenses, the length of the irradiations, the expected resulting radionuclides that would be produced, and the ultimate disposition of the material following the irradiations.

While onsite the inspector observed the removal of a radioactive isotope. The inspector observed that proper radiological and safety precautions outlined in OSTROP 10 were taken including radiation level monitoring, additional sample shielding, and maximizing possible distance from the sample. The OSTR staff also used the personal protective equipment used for the crane operations that were required to retrieve the sample.

c. Conclusion

The license's program for the control of experiments satisfied regulatory and TSs requirements.

5. **Emergency Planning**

a. Inspection Scope (IP 69001)

To ensure that the requirements of emergency plan (E-Plan) were being met, the inspector reviewed:

- "Oregon State University Radiation Center and Oregon State TRIGA Reactor (OSTR) Emergency Response Plan," Revision 8
- "Oregon State University Radiation Center and Oregon State TRIGA Reactor (OSTR) Emergency Response Plan," Revision 9
- "Oregon State University Radiation Center and Oregon State TRIGA Reactor (OSTR) Emergency Response Plan," Revision 10
- Record of Emergency Response Plan #18-06, "Record of a series of drills with the Corvallis Fire Department and the Emergency Department from Good Samaritan Regional Medical Center."
- Record of Emergency Response Plan #19-04, "Record of the annual emergency drill performed."
- Fire Department Operating Guidelines
- Annual Records from for the past 2 years
 - E-Plan Training
 - Emergency Drill and Critique
 - Plan Review
 - Inventory of emergency supplies

b. Observations and Findings

The inspector reviewed the latest three revisions to the E-Plan and determined that the effectiveness was not reduced.

The inspector confirmed that the E-Plan was being audited and reviewed annually as required. Implementing procedures were reviewed and revised as needed to effectively implement the E-Plan. Emergency preparedness and response training for reactor staff was completed during operator requalification and documented in the program's records. Emergency equipment (meters, supplies, communications, security, and alarms) was being maintained and inventoried annually as required in the E-Plan.

The inspector visited the Good Samaritan Regional Medical Center and the toured the Emergency Room and discussed their interaction with the facility. They participate in annual facility tours and training. The inspector examined selected items from the radiological emergency supply kit, which were accounted for and the instruments were in calibration. The inspector found that they are prepared to respond to an event at the facility.

Emergency drills had been conducted annually as required by the E-Plan. During the previous inspection, Inspection follow-up item (IFI) 50-243/2017-202-01 was opened to follow up on implementation of corrective actions related to a minor violation identified for not including written scenarios for drills. The inspector found that all recent drills conducted had written scenarios and contained lessons learned. IFI 50-243/2017-202-01 is now closed.

c. Conclusion

The emergency preparedness program was generally conducted in accordance with the E-Plan.

6. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

To ensure that maintenance activities associated with the requirements of TS 3 and TS 4 were being completed, the inspector reviewed:

- Reactor Supervisor's Log, Volume 16, for the past 2 years
- Console logbooks #170-175
- OSU Radiation Center and TRIGA Reactor Annual Reports for the past 2 years

b. Observations and Findings

The inspector reviewed the records regarding scheduled and unscheduled preventive and corrective maintenance activities the past 2 years. The records contained thorough documentation describing the maintenance activity and the repair setup. These records were controlled and maintained in the maintenance and/or operations log as required. After completion of maintenance activities, system operational checks were performed to ensure that the affected systems functioned properly before returning them to service.

c. Conclusion

Maintenance activities ensured that equipment remained consistent with the safety analysis report and TS requirements.

7. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001)

To ensure that the fuel handling and inspection requirements specified in TS 4.1, "Reactor Core Parameters," TS 4.2, "Reactor Control and Safety Systems," TS 5.3, "Reactor Core and Fuel," TS 5.4, "Fuel Storage," TS 6.1.3, "Staffing," and TS 6.4, "Procedures," were being met, the inspector reviewed:

- Fuel handling equipment and instrumentation
- Reactor Supervisor's Log, Volume 16, for the past 2 years
- Console logbooks #167-169 (August 17, 2016 – October 27, 2017)
- OSU Radiation Center and TRIGA Reactor Annual Reports for the past 2 years
- OSTROP 11, "Fuel Element Handling Procedures," Revision LEU-6
- OSTROP 12, "Control Rod Maintenance, Removal, and Replacement Procedures," Revision LEU-3
- LEU Fuel Element Transfer Index Sheets
- OSTR Mark II Research Fuel Element History File

b. Observations and Findings

The licensee maintained a fuel element record of all their elements. The inspector reviewed selected records for fuel movements conducted for the periodic surveillance measurements and inspection of the reactor fuel and the biennial inspection of all control rods. The movements of elements and their position in the core were maintained and tracked. All fuel movements were noted in the appropriate console logbook. The inspector also verified that the fuel handling tool was secured.

c. Conclusion

Fuel movements and inspections were being completed and documented in accordance with the requirements specified in the TS and by procedure.

8. Exit Interview

The inspection scope and results were summarized on February 27, 2020, with members of licensee management and staff. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

S. Reese	Director, OSU Radiation Center
R. Schickler	Reactor Administrator
C. Oney	Reactor Supervisor
C. Kulah	Senior Reactor Operator
S. Menn	Senior Health Physicist

Other Personnel

D. Harlan	Chairman, Reactor Operations Committee
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INSPECTION PROCEDURE USED

IP 69001	Class II Non-Power Reactors
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ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

IFI	50-243/2017-202-01 follow-up on the licensee's E-Plan requirements for preparing and documenting emergency drills.
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Discussed

None

LIST OF ACRONYMS USED

IFI	Inspector Follow-Up Item
E-Plan	Emergency Plan
IP	Inspection Procedure
LCO	Limiting Conditions for Operation
LEU	Low-Enriched Uranium
NRC	Nuclear Regulatory Commission
OSU	Oregon State University
OSTR	Oregon State University TRIGA Reactor
OSTROP	Oregon State University TRIGA Reactor Operating Procedure
ROC	Reactor Oversight Committee
TS	Technical Specification