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

August 20, 2020

Mr. Corey Hines, Director
Washington State University
Nuclear Radiation Center
50 Roundtop Drive
Pullman, WA 99164-1300

SUBJECT: WASHINGTON STATE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 05000027/2020201

Dear Mr. Hines:

From July 7 – 9, 2020, the U.S. Nuclear Regulatory Commission (NRC) staff completed an inspection at your Washington State University Modified TRIGA Nuclear Reactor facility located in the Nuclear Science Center. The enclosed report documents the inspection results, which were discussed on July 9, 2020, with you and other 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 selected procedures and records, observed 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 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. 50-027
License No. R-76

Enclosure:
As stated

cc: See next page

cc:

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Test, Research and Training
Reactor Newsletter
Attention: Ms. Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

SUBJECT: WASHINGTON STATE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 05000027/2020201 DATED: AUGUST 20, 2020

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

Docket No.:	50-027
License No.:	R-76
Report No.	05000027/2020201
Licensee:	Washington State University
Facility:	Washington State University Modified TRIGA Nuclear Reactor
Location:	Pullman, WA
Dates:	July 7 – 9, 2020
Inspector:	Kevin 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

Washington State University
Washington State University Modified TRIGA Nuclear Reactor
Inspection Report No. 05000027/2020201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Washington State University (WSU, licensee's) 1,000-kilowatt Class II research reactor safety program including: (1) organization and staffing; (2) procedures; (3) health physics; (4) design changes; (5) committees, audits and reviews, and (6) transportation activities since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The NRC staff determined the licensee's safety program was acceptably directed toward the protection of public health and safety. No violations or deviations were identified.

Organization and Staffing

- Organization and staffing were consistent with the requirements outlined in Section 6 of the technical specifications (TSs).

Procedures

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

Health Physics

- Surveys were completed and documented acceptably to permit evaluation of the radiation hazards present.

- Postings met the regulatory requirements specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports To Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection against Radiation."

- Personnel dosimetry was worn as required and doses were within the licensee's procedural action levels and NRC's regulatory limits.

- Radiation monitoring equipment was maintained and calibrated as required.

- Acceptable radiation protection training was provided to staff personnel.

- The Radiation Protection Program implemented by the licensee satisfied regulatory requirements.

- Effluent monitoring satisfied licensee and regulatory requirements.

- Releases were within the specified regulatory and TSs limits.

Design Changes

- The latest changes completed by the licensee were reviewed using the criteria specified in 10 CFR 50.59, “Changes, tests and experiments,” determined to be acceptable, and reviewed and approved by the Reactor Safeguards Committee (RSC)

Committees, Audits and Reviews

- The review and audit program was conducted by the RSC as required.

- The composition and meeting frequency satisfied requirements specified in the TSs.

Transportation Activities

- Shipments of radioactive material were made in accordance with the applicable regulatory and procedural requirements.

REPORT DETAILS

Summary of Facility Status

The WSU continued to operate the facility 1,000-kilowatt Class II research and test reactor in support of irradiation work for various experiments and organizations, operator training, and surveillance. During the inspection, the reactor was started up, operated, and shut down as required and in accordance with applicable procedures to support these ongoing activities.

1. Organization and Staffing

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

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Sections 6.1 and 6.2 of the facility TSs, implemented as Appendix A to the Facility Operating License, Number (No.) R-76, dated April 20, 2020, were met:

- management and staff responsibilities
- console logs for the period from 2018 to the present
- WSU Nuclear Science Center (NSC) organization structure and staffing
- WSU Annual Report entitled "Annual Operations Report," for the period from July 1, 2017, through June 30, 2018, dated August 20, 2018
- WSU Annual Report entitled "Annual Operations Report," for the period from July 1, 2018, through June 30, 2019, dated August 20, 2019
- WSU NSC Administrative Procedure No. 1, "Responsibilities and Authority of Reactor Operating Staff," Revision 0.5

b. Observations and Findings

The inspector reviewed the organization and the responsibilities of the reactor staff since the last inspection at the WSU NSC. The inspector noted that the organization and the responsibilities of the reactor staff had not changed since the last inspection, except Corey Hines was named Director of the NSC. The Director of the NSC continued to report to the Vice President for Research. The Director was responsible for ensuring the implementation of the applicable regulatory requirements. The NSC Reactor Supervisor continued to report to the Director and was responsible for guidance, oversight, and technical support of reactor operations.

As required by TS Section 6.2, the inspector verified that a senior reactor operator (SRO) or reactor operator (RO) was present in the control room during reactor operations. If the SRO on duty was also the RO on duty, then a second person was available at the facility. The licensee documented this by individual log entries. The inspector noted that radiation protection activities and duties were carried out by the reactor operations staff. The campus Radiation Safety Officer (RSO) also provided support as needed.

c. Conclusion

The inspector concluded that the organization and staffing were consistent with the requirements specified in TS Sections 6.1 and 6.2.

2. 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 6.4 and 6.8:

- required reading notebook (O.15)
- selected administrative and standard operating procedures (SOPs)
- change summary log for SOPs Revision 0.5 from RSC Meeting on May 11, 2020.
- related logs and records documenting procedure implementation
- records documenting procedure changes and temporary changes
- administrative controls as outlined in WSU NSC Administrative Procedure No. 2, “Approval, Revision, and review of SOPs,” Revision 0.5
- changes to SOP A.2-A, dated May 8, 2020

b. Observations and Findings

The licensee used procedures for those tasks and activities specified in the TSs. The licensee developed and implemented procedures for potential malfunctions (e.g., radioactive releases, contaminations, and reactor equipment problems). SROs could make minor changes to procedures and then those changes were approved by the Facility Director. The inspector verified that the RSC reviewed and approved substantive procedure changes as required by TS Section 6.8. The inspector also verified that SOPs were reviewed biennially as required by TS Section 6.4.4.

The licensee maintained a notebook entitled, “Required Reading,” that was designed to keep staff members informed about current issues at the facility including changes to procedures. The inspector verified that licensee personnel were reading the material in the notebook and signing off to document that they had completed their required review. The inspector also verified that, once the newly revised procedures were approved by the RSC, all operations staff members were required to read them and sign off signifying that they had completed the task and understood the changes made. Through observation of reactor operations, the inspector verified that personnel conducted TS-related activities in accordance with applicable procedures.

c. Conclusion

The inspector determined procedural review, revision, control, and implementation satisfied TS requirements for the procedures reviewed.

3. Health Physics

a. Inspection Scope (IP 69001)

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

- continuous air monitor system maintenance log
- preventative maintenance checklists from 2018 to the present
- personnel and facility dosimetry records from 2018 to June 2020
- equipment maintenance records for the argon monitoring system
- continuous air monitor channel test forms from 2018 to the present
- exhaust gas monitor channel test forms from 2018 to the present
- radiation monitor calibration schedule forms from 2018 to the present
- NSC neutron survey sheets documenting surveys from 2018 to the present
- weekly swipes and survey forms documenting radiation and contamination surveys conducted from August 2018 to the present
- calibration and periodic check records for radiation monitoring instruments documented on the applicable forms
- WSU monthly reactor and console auxiliary equipment maintenance checklists from 2018 to the present
- airborne release records documented in the average monthly concentration of Argon-41 released section of the reactor operations summary log for the period from 2018 to the present
- liquid release records documented in the reactor operations summary log and calculated on the appropriate forms in the liquid waste tank release data log for the period from 2018 to the present
- SOP 6, “Standard Procedure for Maintenance of the Area Radiation Monitors;” Revision 0.5
- SOP 7, “Standard Procedure for Maintenance of the Exhaust Gas Monitor;” Revision 0.5
- SOP 8, “Standard Procedure for Maintenance of the Continuous Air Monitor;” Revision 0.5
- SOP 12, “Standard Procedure for Operation of the Liquid Waste Retention System;” Revision 0.5
- SOP 16, “Standard Procedure for Health Physics Surveys;” No. 17, “Standard Procedure for Environmental Monitoring;” Revision 0.5
- SOP 18, “Standard Procedure for Portable Survey Instrumentation Calibration,” Revision 0.5
- WSU NSC administrative procedure, “Radiation Protection Program,” dated August, 2018, which outlined the program and also contained and explained the as low as reasonably achievable (ALARA) policy for the facility
- WSU radiation protection program manual which contained and outlined campus practices and the ALARA policy
- WSU annual reports for the two most recent reporting periods

b. Observations and Findings

(1) Surveys

The inspector reviewed selected weekly general area radiation and contamination surveys and semiannual neutron surveys of the Pool Room, the Beam Room, the Radiochemistry Laboratory, and other support areas from 2018 to the present. The inspector determined that the licensee completed surveys as required by WSU NSC SOP No. 16 and documented the results on the appropriate forms and evaluated as required. The inspector verified that operators took corrective actions when readings or results exceeded set action levels.

During the inspection, the inspector accompanied an SRO during the completion of a routine radiation and contamination survey. The licensee surveyed the Control Room, the Pool Room, the Radiochemistry Laboratory, and the Beam Room. The inspector directly observed radiation readings and compared the results to the radiation levels observed by the licensee. The readings were comparable and no anomalies were noted by the inspector.

(2) Postings and Notices

The inspector reviewed the postings at the entrances to various controlled areas including the Control Room, the Pool Room, the Beam Room, and various laboratories in the NSC. The inspector found the reviewed postings indicated the levels of radiation and/or contamination present. Other postings also showed the industrial hygiene hazards present in the areas. The inspector verified the licensee properly posted the facility's radioactive material storage areas. No unmarked radioactive material was identified in the facility by the inspector.

The inspector verified licensee posted copies of current notices to workers, including copies of NRC Form 3, required by 10 CFR 19.11, "Posting of notices to workers," on various bulletin boards throughout the facility including in the stairway leading to the Control Room, in the Reactor Shop area, and in the Conference Room.

(3) Dosimetry

The inspector determined that the licensee used optically stimulated luminescent (OSL) dosimeters for whole body monitoring of beta and gamma radiation exposure (with an additional component to measure neutron radiation). The licensee also used thermoluminescent dosimeter (TLD) finger rings for extremity monitoring. The campus RSO supplied dosimetry, and it was processed by a National Voluntary Laboratory Accreditation Program accredited vendor (Landauer). The inspector reviewed the OSL and TLD results indicating radiological exposures at the facility for the past 2 years and determined that the highest occupational doses were within 10 CFR Part 20 limitations.

The inspector verified that NRC Form 5, “Occupational Dose Record for a Monitoring Period,” equivalent reports, as required by 10 CFR 19.13, “Notifications and reports to individuals,” were completed and provided to each employee who received exposure at the facility during 2018 and 2019.

(4) Radiation Monitoring Equipment

The inspector reviewed records of selected meters, detectors, and air monitoring equipment in use at the facility. The inspector noted that the calibration of dose rate instruments (i.e., portable survey meters) was typically completed by a contractor (Ludlum Measurements, Inc.). Count rate instruments (i.e., instruments typically used for measuring the amount of contamination present) were usually calibrated by campus RSO personnel. The inspector verified that calibrations were completed and that appropriate calibration records were maintained by the licensee as required.

(5) Radiation Protection Training

The inspector reviewed documentation of the radiation protection training given to new employees by the WSU RSO entitled, “Radiation Safety Training Course.” The course was offered online to provide greater access to all personnel. The inspector found the content of the course given, along with various additional modules, acceptable and the training program satisfied the requirements in 10 CFR 19.12, “Instruction to workers.” Through a review of selected training records, the inspector verified that newly hired licensee personnel had received initial training as required. The inspector also verified that the licensee provided annual refresher training for staff members who were at the facility for over a year.

(6) Radiation Protection Program

The Administrative Procedure, “Radiation Protection Program,” dated August 2018 established the radiation protection program guidance. The campus program was outlined and explained in a WSU campus document entitled, “WSU Radiation Protection Program Manual.” The inspector noted that the licensee’s program outlined personal dose limits; surveys, monitoring, and records; reports and audits; as well as the ALARA program. The inspector verified all personnel received training in radiation protection, policies, procedures, requirements, and facilities prior to entering a radiation area or working with radioactive material. The inspector confirmed the program was reviewed annually as required.

(7) ALARA Policy

The inspector determined the ALARA program provided guidance for keeping doses ALARA and was consistent with the guidance in 10 CFR Part 20.

(8) Environmental Monitoring and Effluents

The inspector reviewed the calibration records of the area radiation monitors, the exhaust gas or stack monitor, and the continuous air monitor. These systems were calibrated annually according to procedure. The monthly set-point verification, alarm check, and operability records for the monitoring equipment were also reviewed by the inspector. The licensee completed corrective actions, including recalibration, if the set-point values were exceeded.

The inspector reviewed the method the licensee used to handle solid radioactive waste. Records indicated that the licensee transferred solid waste to the campus RSO after being characterized and properly packaged. The RSO disposed of the waste.

The inspector reviewed the records documenting liquid and airborne releases to the environment for the past 2 years. The inspector determined that gaseous release activity continued to be calculated as required by procedure and the results were adequately documented. The inspector determined that releases were within the 10 CFR Part 20 Appendix B concentrations and TS limits. To demonstrate compliance with the annual dose constraints of 10 CFR 20.1101, “Radiation protection programs,” paragraph (d), the licensee used the COMPLY v1.7 computer code. The highest calculated dose that could be received by a member of the public as a result of gaseous emissions from reactor operations was calculated to be 8.3 E-3 millirem per year (mr/yr) for the period from July 2017 through June 2018 and 1.7 E-3 mr/yr for the period from July 2018 through June 2019. The inspector verified that the doses were well below the 10 mr/yr limit stipulated in 10 CFR 20.1101(d). Additionally, the concentration of gaseous was well below the TS limit.

The licensee calculated activity of liquid waste discharged from the facility. The inspector verified that the Reactor Supervisor or an SRO approved releases after analyses indicated that they within regulatory requirements for discharge into the sanitary sewer. Through observation of the facility, the inspector did not identify any new potential release paths.

The licensee uses TLDs to conduct on-site and off-site environmental gamma radiation monitoring in accordance with the applicable procedures. The inspector confirmed that there were no measurable doses above any regulatory limits. The licensee reported these results in the WSU Annual Operations Reports.

From a review of the various environmental monitoring records and documents, the inspector determined that the licensee was complying with all the requirements specified in TS Sections 3.5 and 4.5.

(9) Facility Tours

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

c. Conclusion

The inspector determined that the licensee implemented a Radiation Protection Program that satisfied regulatory requirements because: (1) operators conducted and documented surveys acceptably in accordance to procedures; (2) the licensee posted the required signs; (3) licensee personnel wore dosimetry as required, and doses received were within the NRC's regulatory limits; (4) the licensee maintained and calibrated radiation monitoring equipment as required; (5) the licensee provided radiation protection training to facility personnel in accordance with the radiation protection program; (6) the licensee maintained an ALARA program in accordance with 10 CFR Part 20; (7) the licensee maintained control of radioactive materials and access to areas in accordance with the radiation protection program, and, (8) the licensee calculated effluents released as required by license and regulatory requirements, and the releases were within the specified regulatory limits.

4. Design Changes

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR 50.59, regarding design change control:

- console logs for 2018 to the present
- safety review and audit records for the past 2 years
- RSC meeting minutes for 2018 to the present
- RSC facility records quarterly audits for 2018 to the present documenting reviews of operations records, summary records, and administrative records
- WSU NSC Administrative Procedure No. 3, "Approval and Review of Facility Modifications and Special Tests or Experiments"
- Selected 50.59 screen sheets
- WSU annual reports for the two most recent reporting periods

b. Observations and Findings

The inspector reviewed selected records and observed the reviewed changes that were made at the facility from 2018 to the present. The inspector noted that a number of changes were made since the last inspection. The licensee recently developed a new form, Form 36A, Revision 8-2018 for 10 CFR 50.59 screenings. The inspector found the licensee filled out the selected forms reviewed and the RSC audited the forms in accordance with the TS. Prior to implementing substantive changes, the licensee is required to submit them to the RSC where they are reviewed and, if determined to be acceptable, approved by the committee. The licensee was in the process of updating procedure AP-3,

"Approval and Review of Facility Modificaitons and Special Tests or Experiments," to reflect changes to the process. The inspector informed the licensee that this update will be tracked by the NRC using an Inspection Follow-up Item (IFI) and reviewed during a future inspection (IFI 05000027/2020201-1).

c. Conclusion

The inspector determined that the latest changes completed by the licensee were reviewed using the criteria specified in 10 CFR 50.59 and were reviewed and approved by the RSC. The inspector identified changes to procedure AP-3 as an IFI.

5. Committees, Audits and Reviews

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of documents below to verify that the licensee had an oversight committee that conducted reviews and audits as required in TS Section 6.4.

- WSU RSC meeting minutes from 2018 through the present
- safety audit records documented on WSU NSC forms entitled, "Reactor Safeguards Committee Facility Records Quarterly Audit," for the period from January 2018 through the present
- WSU NSC RSC Charter dated January 1993
- WSU annual reports for the two most recent reporting periods

b. Observations and Findings

The inspector verified that the membership of the RSC satisfied TS requirements and the Committee's charter. The RSC held meetings at least semi-annually as required. It was noted that three committee meetings were held in 2018, three committee meetings were held in 2019, and two meetings were held in 2020 to date.

The inspector's review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations. Additionally, the inspector verified the RSC conducted an annual review of the radiation protection program and the biennial reviews of the SOPs, the emergency plan, and the security plan required by TSs.

Since the last inspection, the RSC completed and documented audits of reactor facility records and reviews of operating abnormalities, changes to procedures, equipment changes, and proposed tests or experiments. The inspector noted that audits were conducted during the meetings held by the RSC.

c. Conclusion

The inspector determined that the RSC completed the review and audit program acceptably as required by TS.

6. Transportation Activities

a. Inspection Scope (IP 86740)

The inspector verified compliance with regulatory and procedural requirements for the transfer or shipment of licensed radioactive material, and reviewed the following:

- records of radioactive material shipments from June 2018 to the present
- training records of the individuals who were designated as "shippers" at the facility
- licenses of various recipients of radioactive material authorizing those entities to possess the material which the licensee had shipped to them
- inspection and testing data on the Type 7A container used to ship radioactive material
- WSU NSC SOP, No. 19, "Standard Procedure for Use, Receipt, and Transfer of Radioactive Material," Revision 0.5

b. Observations and Findings

The inspector reviewed records and held discussions with licensee personnel, and determined that the licensee shipped various types of radioactive material since the previous inspection in this area. The licensee calculated and recorded the radioisotope types and quantities. The licensee measured dose rates as required. The licensee completed all radioactive material shipment records reviewed by the inspector in accordance with Department of Transportation (DOT) and NRC requirements. The inspector observed a radioactive shipment and found that shipment was conducted in accordance DOT and NRC requirements.

The inspector noted that four current staff members had received the required training for shipping radioactive material and/or "Dangerous Goods." The most recent training was completed on May 30, 2019. The inspector also determined that the licensee maintained copies of the recipients' licenses to possess radioactive material, as required, and that the licenses were verified to be current prior to initiating a shipment.

c. Conclusion

The inspector determined the licensee made shipments of radioactive material in accordance with the applicable regulatory and procedural requirements.

7. Exit Interview

The inspection scope and results were summarized on July 9, 2020, with members of licensee management. 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

H. Bennett	Reactor Supervisor
M. Heine	Reactor Operator
C. Hines	Director, Nuclear Science Center
T. LaVoie	Senior Reactor Operator

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Inspection of Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000027/2020201-1	IFI	Follow-up on completed revision to AP-3.

Closed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
ALARA	As Low As Reasonably Achievable
DOT	Department of Transportation
IP	Inspection Procedure
mr/yr	Millirem per year
No.	Number
NRC	U.S. Nuclear Regulatory Commission
NSC	Nuclear Science Center
OSL	Optically Stimulated Luminescent (dosimeter)
RO	Reactor Operator
RSC	Reactor Safeguards Committee
RSO	Radiation Safety Office
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TLD	Thermoluminescent dosimeter
TSs	Technical Specifications
WSU	Washington State University