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

August 13, 2018

Dr. Christopher Keane
Vice President for Research
Washington State University
Pullman, WA 99164-6525

SUBJECT: WASHINGTON STATE UNIVERSITY – U. S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-027/2018-201

Dear Dr. Keane:

From July 16 – 18, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Washington State University TRIGA research reactor facility located in the Nuclear Science Center. The enclosed report documents the inspection results, which were discussed on July 18, 2018, with Dr. Donald Wall, Director of the Nuclear Science Center, 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 Craig Bassett at (240) 535-1842 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Licensing Projects
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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SUBJECT: WASHINGTON STATE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-027/2018-201 DATED AUGUST 13, 2018

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

Docket No.	50-027
License No.	R-76
Report No.	50-027/2018-201
Licensee:	Washington State University
Facility:	Nuclear Science Center
Location:	Pullman, WA
Dates:	July 16 – 18, 2018
Inspector:	Craig Bassett
Approved by:	Anthony J. Mendiola, Chief Research and Test Reactors Oversight Branch Division of Licensing Projects Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Washington State University
Nuclear Science Center
NRC Inspection Report No. 50-027/2018-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Washington State University (the licensee's) 1,000-kilowatt Class II research reactor safety program including: (1) organizational structure and staffing; (2) procedures; (3) health physics; (4) design changes; (5) committees, audits, and reviews, and (6) transportation of radioactive materials since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. 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 being 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) Parts 19 and 20.
- Personnel dosimetry was being worn as required and doses were within the licensee's procedural action levels and NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- Acceptable radiation protection training was being provided to staff personnel.
- The Radiation Protection Program being 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, determined to be acceptable, and reviewed and approved by the Reactor Safeguards Committee (RSC)

Committees, Audits, and Reviews

- The review and audit program was being conducted by the RSC as required.
- The composition and meeting frequency satisfied requirements specified in the TSs.

Transportation of Radioactive Materials

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

REPORT DETAILS

Summary of Plant Status

Washington State University (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. Organizational Structure and Staffing

a. Inspection Scope (Inspection Procedure [IP] 69001, Section 02.01)

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 September 30, 2011, were being met:

- Management and staff responsibilities
- Console logs for the period from 2016 to the present
- WSU Nuclear Science Center (NSC) organizational structure and staffing
- WSU Annual Report entitled "Annual Report Washington State University Nuclear Radiation Center TRIGA Reactor," for the period from July 1, 2015, through June 30, 2016, dated August 19, 2016
- WSU Annual Report entitled "Annual Operations Report for the Washington State University TRIGA Reactor," for the period from July 1, 2016, through June 30, 2017, dated August 22, 2017
- WSU Nuclear Radiation Center Administrative Procedure No. 1, "Responsibilities and Authority of Reactor Operating Staff"

b. Observations and Findings

The inspector noted that the organizational structure and the responsibilities of the reactor staff had not changed since the last inspection at the WSU NSC (previously known as the Nuclear Radiation Center).[1]

As required by TS Section 6.2, 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. It was noted that radiation protection activities and duties were carried out by the reactor operations staff. The campus Radiation Safety Office (RSO) also provided support as needed.

[1] The licensee recently changed the name of their facility from the Nuclear Radiation Center to the Nuclear Science Center. However, the titles of some facility documents and procedures have not been changed to date. The licensee is working to revise and update all their documents.

c. Conclusion

The organizational structure and staffing were consistent with the requirements specified in TS Sections 6.1 and 6.2.

2. Procedures

a. Inspection Scope (IP 69001, Section 02.03)

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
- Related logs and records documenting procedure implementation
- Records documenting procedure changes and temporary changes
- Administrative controls as outlined in WSU Nuclear Radiation Center Administrative Procedure No. 2, “Approval, Revision, and Review of Standard Operating Procedures”

b. Observations and Findings

Procedures were available for those tasks and activities specified in the TSs. Records showed that procedures for potential malfunctions (e.g., radioactive releases, contaminations, and reactor equipment problems) had been developed and were being implemented as well. Minor changes to procedures could be made by an SRO and then approved by the Facility Director. If substantive procedure changes were needed, they were reviewed and approved by the RSC as required by TS Section 6.8

The standard operating procedures (SOPs) were reviewed biennially as required by TS Section 6.4.4. It was noted that, because the licensee had changed the name of the facility from the Nuclear Radiation Center to the NSC, the operating procedures at the facility had been revised and updated. Some of the other procedures, such as the Administrative Procedures, were still in the process of being revised to reflect the change.

Training of personnel on procedures and applicable changes was acceptable. 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

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

3. Health Physics

a. Inspection Scope (IP 69001, Section 02.07)

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

- Continuous Air Monitor System Maintenance Log
- Preventative Maintenance Checklists for 2016 to the present
- Personnel and Facility dosimetry records for 2016 to June 2018
- Equipment Maintenance Record for the Argon Monitoring System
- Continuous Air Monitor Channel Test forms for 2016 to the present
- Exhaust Gas Monitor Channel Test forms for 2016 to the present
- Radiation Monitor Calibration Schedule Forms for 2016 to the present
- Nuclear Radiation Center Neutron Survey sheets documenting surveys from 2015 to the present
- Weekly Swipes and Survey forms documenting radiation and contamination surveys conducted from January 2016 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 for 2016 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 2016 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 2016 to the present
- Various WSU NSC SOPs including: No. 6, “Standard Procedure for Maintenance of the Area Radiation Monitors;” No. 7, “Standard Procedure for Maintenance of the Exhaust Gas Monitor;” No. 8, “Standard Procedure for Maintenance of the Continuous Air Monitor;” No. 12, “Standard Procedure for Operation of the Liquid Waste Retention System;” No. 16, “Standard Procedure for Health Physics Surveys;” No. 17, “Standard Procedure for Environmental Monitoring;” and, No. 18, “Standard Procedure for Portable Survey Instrumentation Calibration”
- WSU Nuclear Radiation Center Administrative Procedure, “Radiation Protection Program,” 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 2016 to the present. The surveys had been completed by licensee personnel as required by WSU NSC SOP No. 16. The results were documented on the appropriate forms and evaluated as required, and corrective actions were taken 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 areas surveyed included the Control Room, the Pool Room, the Radiochemistry Laboratory, the Beam Room, and selected laboratories. The inspector took radiation readings and compared the results to the radiation levels detected by the licensee. The readings were comparable and no anomalies were noted.

(2) Postings and Notices

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

Copies of current notices to workers, including copies of NRC Form 3, required by 10 CFR 19.11, were posted 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 as well.

(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 dosimetry was supplied through the campus RSO and processed by a National Voluntary Laboratory Accreditation Program accredited vendor (Landauer). An examination of the OSL and TLD results indicating radiological exposures at the facility for the past 2 years showed that the highest occupational doses were within 10 CFR Part 20 limitations.

The inspector verified that NRC Form 5 equivalent reports, as required by 10 CFR 19.13, had been completed and provided to each employee who had received exposure at the facility during 2016 and 2017.

(4) Radiation Monitoring Equipment

The records of selected meters, detectors, and air monitoring equipment in use at the facility were reviewed. 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 generally calibrated by campus RSO personnel. The inspector verified that calibrations were completed and that appropriate calibration records were being maintained by the licensee as required. Calibration frequency met the requirements established in the applicable manuals.

(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 content of the course given, along with various additional modules, was found to be acceptable and the training program satisfied the requirements in 10 CFR 19.12. Through a review of selected training records, the inspector verified that newly hired licensee personnel had received initial training as required. Annual refresher training was also required for, and being provided to, staff members who had been at the facility for over a year.

(6) Radiation Protection Program

The licensee’s Radiation Protection Program was established in the WSU Nuclear Radiation Center Administrative Procedure of the same name with the latest revision dated March 20, 2012. 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. It also required that all personnel receive training in radiation protection, policies, procedures, requirements, and facilities prior to entering a radiation area or working with radioactive material. The program was typically being reviewed annually as required.

(7) ALARA Policy

As noted above, the ALARA Policy was outlined and established in the WSU Nuclear Radiation Center Administrative Procedure, “Radiation Protection Program,” as well as in the campus, “WSU Radiation Protection Program Manual.” 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 had been calibrated annually according to procedure. The monthly set-point verification, alarm check, and operability records for the monitoring equipment were also reviewed. Corrective actions, including recalibration, were completed if the set-point values were exceeded.

The inspector reviewed the method the licensee used to handle solid radioactive waste. Records indicated that solid waste was transferred to the campus RSO after being characterized and properly packaged. The RSO handled the disposal 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 releases were determined to be 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(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 determined to be 2.7 E-4 millirem per year (mr/yr) for the period from July 2015 through June 2016 and 3.4 E-4 mr/yr for the period from July 2016 through June 2017. These doses were well below the 10 mr/yr limit stipulated in 10 CFR 20.1101(d).

The activity of liquid waste to be discharged from the facility was calculated as required and releases were approved by the Reactor Supervisor or an SRO after analyses indicated that they met regulatory requirements for discharge into the sanitary sewer. Through observation of the facility, the inspector did not identify any new potential release paths.

On-site and off-site environmental gamma radiation monitoring was conducted using TLDs in accordance with the applicable procedures. The data indicated that there were no measurable doses above any regulatory limits. These results and those outlined above were acceptably reported in the WSU Annual Operations Reports. However, during the review of the environmental TLDs, the inspector noted that the one positioned on the Cooling Tower fence constantly read approximately ten times higher than any of the other TLDs located in areas near the facility. The licensee indicated that this was because it was close to the Rad Waste Shed in which was stored barrels containing reflector parts. It was observed that it would be a good ALARA practice to ship these barrels off site for disposal.

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. Control of radioactive material and of access to radiation and high radiation areas were acceptable. As noted earlier, the postings and signs for these areas were appropriate.

c. Conclusion

The inspector determined that the Radiation Protection Program being implemented by the licensee satisfied regulatory requirements because: (1) surveys were being completed and documented acceptably; (2) postings met regulatory requirements; (3) personnel dosimetry was being worn as required and doses were within the NRC's regulatory limits; (4) radiation monitoring equipment was being maintained and calibrated as required; (5) acceptable radiation protection training was being provided to facility personnel, and, (6) calculations of effluents released from the facility satisfied license and regulatory requirements and releases were within the specified regulatory limits.

4. Design Changes

a. Inspection Scope (IP 69001, Section 02.08)

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

- Console Logs for 2016 to the present
- Safety review and audit records for the past 2 years
- RSC meeting minutes for 2016 to the present
- RSC Facility Records Quarterly Audits for 2016 to the present documenting reviews of operations records, summary records, and administrative records
- WSU Nuclear Radiation Center Administrative Procedure No. 3, "Approval and Review of Facility Modifications and Special Tests or Experiments"
- WSU Annual Reports for the two most recent reporting periods

b. Observations and Findings

The inspector reviewed the records and observed the changes that had been made at the facility from 2013 to the present. It was noted that no changes had been proposed in the past 2 years. Prior to implementing substantive changes, the licensee was required to submit them to the RSC where they would be reviewed and, if determined to be acceptable, approved by the committee.

The inspector noted that one change, which had been proposed, reviewed, and approved in 2013, had been completed only recently (in March of this year). It involved the area radiation monitor readouts. The modification only changed the appearance of the faceplates of the monitor. The licensee considered the criteria included in 10 CFR 50.59 and concluded that the changes screened out and did not require further evaluation. This appeared to be appropriate.

c. Conclusion

The latest changes completed by the licensee were reviewed using the criteria specified in 10 CFR 50.59, determined to be acceptable, and reviewed and approved by the RSC.

5. Committees, Audits and Reviews

a. Inspection Scope (IP 69001, Section 02.09)

In order to verify that the licensee had an oversight committee that conducted reviews and audits as required in TS Section 6.4, the inspector reviewed selected aspects of:

- WSU RSC meeting minutes for 2016 through the present
- Safety audit records documented on WSU NSC forms entitled, “Reactor Safeguards Committee Facility Records Quarterly Audit,” for the period from January 2016 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 was holding meetings at least semi-annually as required. It was noted that three committee meetings were held in 2016, three committee meetings were held in 2017, and one meeting had been held in 2018 to date.

Review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations. Additionally, the annual review of the radiation protection program and the biennial reviews of the standard operating procedures, the emergency plan, and the security plan had been conducted and documented.

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

c. Conclusion

The review and audit program was being completed acceptably by the RSC as required.

6. Transportation of Radioactive Materials

a. Inspection Scope (IP 86740)

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

- Records of radioactive material shipments for January 2016 and 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
- WSU NSC SOP, No. 19, “Standard Procedure for Use, Receipt, and Transfer of Radioactive Material”

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that the licensee had shipped various types of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. All radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation 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 June 13, 2017. 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

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

8. Exit Interview

The inspection scope and results were summarized on July 18, 2018, 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	Senior Reactor Operator
N. Endebrock	Reactor Operator
C. Hines	Associate Director
T. LaVoie	Reactor Supervisor
D. Wall	Director, Nuclear Science Center

INSPECTION PROCEDURES USED

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

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
ALARA	As Low As Reasonably Achievable
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