August 11, 2016

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

SUBJECT: WASHINGTON STATE UNIVERSITY – NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-027/2016-201

Dear Dr. Keane:

From July 19-21, 2016, the U.S. Nuclear Regulatory Commission (NRC, the Commission) completed an inspection at your Washington State University Training, Research, Isotope Production, General, Atomics research reactor located in the Nuclear Radiation Center. The enclosed report documents the inspection results, which were discussed on July 21, 2016, with Dr. Donald Wall, Director of the Nuclear Radiation Center, 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 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 Gary Morlang at 301-415-4092 or by electronic mail at Gary.Morlang@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. 50-027
License No. R-076

Enclosure:
As stated

cc: w/enclosure: See next page

cc:

Director
Division of Radiation Protection
Department of Health
7171 Cleanwater Lane, Bldg #5
P.O. Box 47827
Olympia, WA 98504-7827

Mr. David Clark, Director
Washington State University
Radiation Safety Office
P.O. Box 641302
Pullman, WA 99164-1302

Dr. Ken Nash Chair
Washington State University
Reactor Safeguards Committee
Nuclear Radiation Center
P.O. Box 641300
Pullman, WA 99164-1300

Mr. Corey Hines, Reactor Supervisor
Washington State University
Nuclear Radiation Center
P.O. Box 641300
Pullman, WA 99164-1300

Test, Research and Training
Reactor Newsletter
P.O. Box 118300
University of Florida
Gainesville, FL 32611-8300

Dr. Donald Wall, Director
Washington State University
Nuclear Radiation Center
50 Roundtop Drive
Pullman, WA 99164-1300

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

Docket No.	50-027
License No.	R-76
Report No.	50-027/2016-201
Licensee:	Washington State University
Facility:	Nuclear Radiation Center
Location:	Pullman, WA
Dates:	July 19-21, 2016
Inspector:	Gary Morlang
Approved by:	Anthony J. Mendiola, Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Washington State University
Nuclear Radiation Center
NRC Inspection Report No. 50-027/2016-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Washington State University (the licensee's) 1000 Kilowatt Class II research reactor safety program including: (1) organizational structure and staffing; (2) operator requalification program; (3) procedures; (4) radiation protection program; (5) effluent environmental monitoring; (6) design change function; and (7) 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.

Organizational Structure and Staffing

- Organizational structure and staff responsibilities were consistent with Technical Specification (TS) Section 6 requirements.

Operator Requalification Program

- Operator requalification was conducted as required by the Reactor Requalification Plan.
- A medical examination for each reactor operator with an active license was being completed every two years as required.

Procedures

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

Radiation Protection Program

- 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) Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection Against Radiation."
- Personnel dosimetry was being worn as required and doses were well 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 and Environmental Monitoring

- Effluent monitoring satisfied licensee and regulatory requirements.
- Releases were within the specified regulatory and TSs limits.

Design Change Functions

- 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 approved by the Reactor Safeguards Committee.

Transportation of Radioactive Materials

- Shipments of radioactive materials were being made in accordance with the requirements of Department of Transportation regulations as required by Title 49 of the *Code of Federal Regulations* 71.5(a).

REPORT DETAILS

Summary of Plant Status

Washington State University (WSU, the licensee) continued to operate the 1000 Kilowatt Training, Research, Isotope Production, General, Atomics (TRIGA) 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)

The inspector reviewed the following regarding the licensee's organization and staff levels to ensure that the requirements of TS Sections 6.1-6.3, dated September 30, 2011, were being met:

- Console logs for 2015, and to date in 2016
- Management responsibilities
- WSU Nuclear Radiation Center organizational structure and staffing
- Annual Report for WSU Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2014 to June 30, 2015, dated August 7, 2015
- Annual Report for WSU Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2013 to June 30, 2014, dated August 21, 2014
- WSU Nuclear Radiation Center Administrative Procedure Number (No.) 1, "Responsibilities and Authority of Reactor Operating Staff," (not dated)
- WSU Nuclear Radiation Center Operations Log Sheets for 2015 and 2016 to date

b. Observations and Findings

The inspector noted that the WSU Nuclear Radiation Center organizational structure and the responsibilities of the reactor staff had not changed since the last inspection.

As required by TS Section 6.2 a Senior Reactor Operator (SRO) or Reactor Operator (RO) must be present in the control room during reactor operations. If the SRO on duty is also the RO on duty then a second person must be available at the facility. The licensee documented this by individual log entries.

c. Conclusion

The organizational structure and functions were consistent with the requirements specified in TS Section 6.1.

2. Operator Requalification Program

a. Inspection Scope (IP 69001)

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

- Biennial written examination records for 2014 through 2015
- Operator medical examination records from 2014 to the present
- Operator license status and effective dates of current operator licenses
- WSUNRC Reactor Staff Requalification Program, latest revision, dated May 15, 2010
- Active duty status and Annual Reactor Operating Test results noted and maintained in the Operator Requalification Schedule forms (A.3)
- Logs and records of reactivity manipulations maintained in the Quarterly RO/SRO Activity Report (O.14) Notebook and documented on forms entitled, "Quarterly Operational Hours for Reactor Operators and Senior Reactor Operators"

b. Observations and Findings

At the time of the inspection, there were 3 licensed SROs and 9 licensed ROs working at the facility. The inspector noted that all the licenses of the operators were current.

A review of the logs and records showed that the training and requalification program was being followed and that biennial written examinations had been completed as required. An annual operating test had been conducted for each operator by the Assistant Facility Director as required by the program. It was also verified that each operator had completed the required number of hours of reactor operations and reactivity manipulations.

The inspector reviewed records documenting the completion of physical examinations for selected operators. It was noted that licensed operators were receiving biennial medical examinations as required.

c. Conclusion

The requalification and training program was current and being acceptably maintained. Medical examinations for each operator were being completed biennially as required.

3. 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 Section 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," (not dated)

b. Observations and Findings

Procedures were available for those tasks and activities specified in the TS. Records showed that procedures for potential malfunctions (e.g., radioactive releases, contaminations, and reactor equipment problems) had been developed and were being implemented as required. If procedure changes were needed, they were reviewed and approved by the Reactor Safeguards Committee as required. The Standard Operating Procedures were reviewed biennially as required by TS Section 6.8. It was noted that all the operating procedures at the facility had been revised and updated to more fully reflect current operational activities

Training of personnel on procedures and the applicable changes was acceptable. The licensee maintained a notebook entitled, "Required Reading," that was used to keep staff members of 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 Reactor Safeguards Committee, all operations staff members would be 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 also verified that personnel conducted TS activities in accordance with applicable procedures.

c. Conclusion

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

4. Radiation Protection Program

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection Against Radiation," TS Sections 3.5, 4.5, and procedural requirements:

- Preventative Maintenance Checklists for 2015 and to date in 2016
- Radiation Monitor Calibration Schedule Forms for 2015 and to date in 2016

- Nuclear Radiation Center dosimetry records for 2015 through April 2016
- Radiation and contamination survey records for 2015 through the present
- Calibration and periodic check records for radiation monitoring instruments documented on the applicable forms
- Various WSU Nuclear Radiation Center Standard Operating Procedures (SOPs) including: No. 16, "Standard Procedure for Health Physics Surveys," No. 6, "Standard Procedure for Maintenance of the Area Radiation Monitors," and No. 18, "Standard Procedure for Portable Survey Instrumentation Calibration"
- WSU Nuclear Radiation Center Administrative Procedure, "Radiation Protection Program," latest revision dated March 20, 2012, 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 the Campus practices and ALARA Policy

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, and other associated laboratories and support areas from 2015 to the present. The surveys had been completed by licensee personnel as required by WSU Nuclear Radiation Center Standard Operating Procedure 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.

(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 Nuclear Radiation Center. The postings were acceptable and typically indicated the radiation and/or contamination hazards 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 required by 10 CFR Part 19 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 was provided 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 was also provided thermoluminescent dosimeter (TLD) finger rings for extremity monitoring. The dosimetry was supplied by the campus Radiation Safety Office 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 two years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limitations.

The inspector verified that NRC Form-5 reports had been completed and provided to each employee who had received exposure at the facility during 2015 and 2016.

(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 portable survey meters, friskers, and fixed radiation detectors was typically completed by a contractor (Ludlum Measurements, Inc.). 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 Radiation Safety Office 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, “Instruction to workers.” Through a review of selected training records, the inspector verified that newly hired licensee personnel had received the training as required. Annual refresher training was also being provided to the staff who had been at the facility for over a year.

(6) ALARA Policy

The ALARA Policy was also 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 as low as reasonably achievable and was consistent with the guidance in 10 CFR Part 20.

(7) 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 being reviewed annually as required.

(8) Facility Tours

The inspector toured the Control Room, Pool Room, Beam Room, and selected support laboratories and offices. Control of radioactive material and control 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 well within the NRC's regulatory limits; (4) radiation monitoring equipment was being maintained and calibrated as required; and (5) acceptable radiation protection training was being provided to facility personnel.

5. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Sections 3.5, 4.5 and 6.10:

- Continuous Air Monitor System Maintenance Log
- Equipment Maintenance Record for the Argon Monitoring System
- Preventative Maintenance Checklists for 2015 and to date in 2016
- Continuous Air Monitor Channel Test forms for 2015 and to date in 2016
- Exhaust Gas Monitor Channel Test forms for 2015 and to date in 2016
- WSU Monthly Console Auxiliary Equipment Maintenance Checklists and WSU Monthly Reactor Auxiliary Equipment Maintenance Checklists for 2015 and to date in 2016
- Annual Report for WSU Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2014 to June 30, 2015, dated August 7, 2015
- Annual Report for WSU Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2013 to June 30, 2014, dated August 21, 2014
- Airborne release records documented in the Average Monthly Concentration of Argon-41 Released section of the Reactor Operations Summary Log for the period from 2015 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 2015 to the present

b. Observation and Findings

The inspector reviewed the calibration records of the area radiation monitoring system, the exhaust gas or stack monitoring system, and the continuous air monitoring system. 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 also reviewed the records documenting liquid and airborne releases to the environment for the past two 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, “Radiation protection programs,” paragraph (d), the licensee used the COMPLY 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 4.9 E-4 millirem per year (mr/yr) for the period from July 2013 through June 2014 and 2.4 E-4 mr/yr for the period from July 2014 through June 2015. 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 a SRO after analysis 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 Reactor Operations Annual Reports for 2013-2014 and 2014-2015.

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.

c. Conclusion

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits. The licensee was complying with all the requirements specified in TS Sections 3.5 and 4.5.

6. Design Change Function

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR 50.59, "Changes, tests and experiments," regarding design change control:

- Console Logs for 2015 and 2016 to present
- Safety review and audit records for the past two years
- Reactor Safeguards Committee meeting minutes for 2015 to the present
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2014 to June 30, 2015, dated August 7, 2015
- Annual Report for WSU Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2013 to June 30, 2014, dated August 21, 2014
- Reactor Safeguards Committee Facility Records Quarterly Audits for 2015 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," (not dated)

b. Observations and Findings

The inspector reviewed the records and observed the changes that had been made at the facility from 2014 to the present. Prior to implementing substantive changes, the licensee was required to submit them to the Reactor Safeguards Committee where they were reviewed and, if determined to be acceptable, approved by the committee. The inspector noted that the facility modification procedure was followed and an evaluation was completed as required. The licensee considered the criteria included in 10 CFR 50.59 and concluded that the changes were acceptable under the regulations. None of the changes constituted a safety question or required a change to the TS.

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 approved by the Reactor Safeguards Committee.

7. Transportation of Radioactive Materials

a. Inspection Scope (IP 86740)

The inspector reviewed the following to verify compliance with procedural requirements for transferring licensed material:

- Records of radioactive material shipments for January 2015 and to the present

- Training records of the individuals who were designated as “shippers” at the facility
- Various records of the recipients’ licenses to possess the radioactive material which the licensee had shipped to them
- WSU Nuclear Radiation Center SOP, No. 19, “Standard Procedure for Off-Site Shipment of Radioactive Material,” No. 32, “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 (DOT) and NRC requirements.

The inspector noted that two staff members had received the required training for shipping radioactive material and/or “Dangerous Goods.” The most recent training was completed on February 19, 2015. 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 requirements of DOT regulations as required by Title 49 of the *Code of Federal Regulations* 71.5(a).

8. Exit Interview

The inspection scope and results were summarized on July 21, 2016, 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

C. Hines	Associate Director
D. Wall	Director, Nuclear Radiation Center
K. Restis	Senior Reactor Operator
H. Bennet	Reactor Operator
S. King	Reactor Operator
T, Vole	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

None

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
No.	Number
NRC	Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescent
RO	Reactor Operator
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TLD	Thermoluminescent dosimeter
TS	Technical Specification
WSU	Washington State University