August 28, 2012

Dr. Donald Wall
Director, Nuclear Radiation Center
Washington State University
P.O. Box 641300
Pullman, WA 99164-1300

SUBJECT: WASHINGTON STATE UNIVERSITY – NRC ROUTINE INSPECTION REPORT NO. 50-027/2012-201

Dear Dr. Wall:

From July 31 to August 2, 2012, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection at your Washington State University TRIGA research reactor located in the Nuclear Radiation Center. The enclosed report documents the inspection results, which were discussed on August 2, 2012, 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 inspectors 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, and 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 Mike Morlang at 301-415-4092.

Sincerely,

/RA/

Gregory T. Bowman, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-027
License No. R-76
Enclosure: NRC Inspection Report No. 50-027/2012-201
cc w/encl: See next page

cc:

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

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

Dr. Jean Cloran
Radiation Safety Officer
Washington State University
P.O. Box 641302
Pullman, WA 99163-1302

Office of the Governor
Executive Policy Division
State Liaisons Officer
P.O. Box 43113
Olympia, WA 98504-3113

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

Dr. Nancy Magnuson
Vice President for Research
and Dean of the Graduate School
Washington State University
Pullman, WA 99164-1030

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DATE	8/22/2012	8/23/2012	8/28/12

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

Docket No:	50-027
License No:	R-76
Report No:	50-027/2012-201
Licensee:	Washington State University
Facility:	Nuclear Radiation Center
Location:	Pullman, WA
Dates:	July 31-August 2, 2012
Inspectors:	Mike Morlang Craig Bassett
Approved by:	Gregory T. Bowman, 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
Report No.: 50-027/2012-201

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) review, audit, and design change functions; 3) procedures; 4) radiation protection; 5) environmental monitoring; 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.

Organizational Structure and Staffing

- The organizational structure and staff responsibilities were consistent with Technical Specification Section 6 requirements.

Review and Audit and Design Change Functions

- The review and audit program was being conducted acceptably by the Reactor Safeguards Committee.

- The latest changes completed by the licensee were reviewed using the criteria specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, determined to be acceptable, and approved by the Reactor Safeguards Committee.

Procedures

- Facility procedural review, revision, control, and implementation satisfied Technical Specification 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 10 CFR Parts 19 and 20.

- 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 license and regulatory requirements.

- Releases were within the specified regulatory and Technical Specification limits.

Transportation of Radioactive Materials

- Shipments of radioactive materials were being made in accordance with the requirements of Department of Transportation regulations as required by 10 CFR 71.5(a).

REPORT DETAILS

Summary of Plant Status

Washington State University (WSU or the licensee) continued to operate the 1000 Kilowatt 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 inspectors reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specifications (TS) Sections 6.1 to 6.3, dated September 30, 2011, were being met:

- Console logs for 2010, 2011, and 2012 to present
- Management responsibilities
- WSU Nuclear Radiation Center organizational structure and staffing
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2009 to June 30, 2010
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2010 to June 30, 2011
- WSU Nuclear Radiation Center Administrative Procedure Number (No.) 1, "Responsibilities and Authority of Reactor Operating Staff" (not dated)

b. Observations and Findings

The inspectors noted that the Vice President for Research had retired and a new Vice President had been appointed. The inspectors noted that the WSU Nuclear Radiation Center organizational structure and the responsibilities of the reactor staff had not changed since the last inspection. The current licensed reactor staff consisted of four senior reactor operators (SROs) and six reactor operators (ROs).

As required by TS Section 6.2, an SRO or 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 inspectors noted that the licensee did not document who the second person was in the console log. Based on the inspectors' observations, the licensee changed the console log to include a sign-in spot for the designated second person. The inspectors determined that this issue did not represent a non-compliance with NRC requirements.

c. Conclusion

The organizational structure and functions were consistent with the requirements specified in TS Section 6.

2. Review and Audit and Design Control Functions

a. Inspection Scope (IP 69001)

In order to verify that the licensee had established and conducted reviews and audits as required in TS Sections 6.5.4 and 6.5.5 and to verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59 regarding design change control, the inspectors reviewed selected aspects of:

- Console logs for 2010, 2011, and 2012 to present
- Safety review and audit records for the past 2 years
- Reactor Safeguards Committee (RSC) meeting minutes for 2010 to the present
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2009, to June 30, 2010
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July 1, 2010, to June 30, 2011
- RSC Facility Records Quarterly Audits for 2010 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

(1) Review and Audit Functions

The inspectors verified that RSC membership satisfied TS requirements and that the RSC and/or a subcommittee thereof had semiannual meetings as required. Review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations, and ensured suitable use and oversight of the reactor.

Since the last inspection all required semiannual audits of reactor facility activities and the annual and/or biennial reviews of programs, procedures, equipment changes, and proposed tests or experiments had been completed and documented.

(2) Design Change Control

The inspectors reviewed the records and observed the changes that had been made at the facility from 2010 to the present. Prior to implementing substantive changes, the licensee was required to submit them to the RSC where they were reviewed and, if determined to be acceptable, approved by the committee. The latest modifications initiated by the licensee involved replacing the facility security system. The inspectors 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 RSC. The review and audit program was being conducted acceptably by the RSC.

3. Procedures

a. Inspection Scope (IP 69001)

The inspectors reviewed selected aspects of the following to verify that the licensee was complying with the requirements of TS Section 6.8:

- Required reading notebook
- 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)

The inspectors also observed the use and implementation of procedures by licensee personnel.

b. Observations and Findings

Procedures were available for those tasks and activities specified in the TS. Written changes were reviewed and approved by the RSC as required. The Standard Operating Procedures (SOPs) were reviewed biennially as required by TS Section 6.8. It was noted that the latest review was completed in October 2010. The most recent changes to the SOPs were changes to SOPs 1 through 6. These changes had been sent to each member of the RSC for review and approval.

Training of personnel on procedures and the applicable changes was acceptable. The licensee maintained a notebook entitled, “Required Reading,” that was used to inform staff members of current issues at the facility, including changes to procedures. The inspectors verified that licensee personnel were reading the material in the notebook and signing off to document that they had completed their required review. Through observation of reactor operations and the conduct of radiation surveys, the inspectors also verified that personnel conducted TS activities in accordance with applicable procedures. Records showed that procedures for potential malfunctions (e.g., radioactive releases, contaminations,

and reactor equipment problems) had been developed and were implemented as required.

c. Conclusion

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

4. Radiation Protection Program

a. Inspection Scope (IP 69001)

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

- Preventative Maintenance Checklists for 2011 and to date in 2012
- Radiation Monitor Calibration Schedule Forms for 2011 and to date in 2012
- Nuclear Radiation Center dosimetry records for 2010 through April of 2012
- Radiation and contamination survey records for 2011 through the present
- Calibration and periodic check records for radiation monitoring instruments documented on the applicable forms
- WSU Nuclear Radiation Center SOP No. 10, “Standard Procedure for Health Physics Surveys,” last revised August 25, 2005
- WSU Nuclear Radiation Center SOP No. 16, “Standard Procedure for Checkout and Calibration of the Area Radiation Monitors,” last revised December 3, 2008
- WSU Nuclear Radiation Center SOP No. 22, “Standard Procedure for Portable Survey Instrumentation Check and Calibration,” last revised December 4, 2003
- WSU Nuclear Radiation Center Administrative Procedure, “Radiation Protection Program,” latest revision dated December 10, 2010, with editorial changes 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 dated March 15, 1994, which also contained and outlined the ALARA policy for the facility

The inspectors also toured the facility to note any changes that may have been made and observed the use of dosimetry and radiation monitoring equipment. The inspectors also accompanied a staff member during a weekly radiation and contamination survey of controlled areas at the facility and conducted a radiation survey. Licensee personnel were interviewed and radiological signs and postings were observed as well.

b. Observations and Findings

(1) Surveys

The inspectors 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 2011 to the present. The surveys had been completed by licensee personnel as required by WSU Nuclear Radiation Center SOP No. 10. 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 inspectors observed as a licensee representative conducted radiation and contamination surveys in various areas of the facility. The inspectors also conducted a radiation survey of these areas and compared the readings detected with those found by the licensee. The results were comparable and no anomalies were noted.

(2) Postings and Notices

The inspectors 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 copies of current survey maps posted at the entrances to the areas indicated the radiation and 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 inspectors 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 2 years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limitations. The records showed that the highest annual whole body exposure received by a single individual for 2010 was 63 millirem (mr) deep dose equivalent (DDE). The highest annual extremity exposure for 2010 was 1130 mr shallow dose equivalent (SDE) and the

highest skin or other shallow dose was 86 mr SDE. The highest annual whole body exposure received by a single person for 2011 was 37 mr DDE. The highest annual extremity exposure for 2011 was 200 mr SDE and the highest skin or other shallow dose was 79 mr SDE. To date in 2012, the exposures were comparable to past years.

The inspectors verified that NRC Form 5 reports had been completed and provided to each employee who had received exposure at the facility during 2010 and 2011.

(4) Radiation Monitoring Equipment

The records of selected meters, detectors, and air monitoring equipment in use at the facility were reviewed. The inspectors noted that the calibration of portable survey meters, friskers, and fixed radiation detectors was typically completed by a contractor (Ludlum Measurements, Inc.). The inspectors 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 Program

The licensee's Radiation Protection Program was established in the WSU Nuclear Radiation Center Administrative Procedure of the same name, which was dated December 10, 2010. The program was further explained in a WSU campus document entitled, "WSU Radiation Protection Program Manual," dated March 15, 1994. The inspectors noted that the licensee's program required that all personnel who had unescorted access to work in a radiation area or with radioactive material receive training in radiation protection, policies, procedures, requirements, and facilities prior to entry. The program was being reviewed annually as required.

(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 procedure "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 Training

The inspectors reviewed documentation of the radiation protection training given to new employees by the WSU Radiation Safety Office entitled, "Radiation Safety Training Course." The content of the course given 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 inspectors verified that licensee personnel had received the training as required. Annual refresher training was also being provided to the staff at the facility.

(8) Facility Tours

The inspectors 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 inspectors 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.

5. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001)

The inspectors 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 2011 and to date in 2012
- Radiation Monitor Calibration Schedule Forms for 2011 and to date in 2012
- WSU Monthly Console Auxiliary Equipment Maintenance Checklists and WSU Monthly Reactor Auxiliary Equipment Maintenance Checklists for 2011 and to date in 2012
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July1, 2009 to June 30, 2010, submitted August 30, 2010
- Annual Report for Washington State University Nuclear Radiation Center TRIGA Reactor for the Reporting Period of July1, 2010 to June 30, 2011, submitted August 29, 2011
- Airborne release records documented in the average monthly concentration of Argon-41 released section of the Reactor Operations Summary Log for the period from 2010 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 2010 to the present

- WSU Nuclear Radiation Center SOP No. 11, "Standard Procedure for Analysis of Liquid Waste Samples," last revised November 29, 2006
- WSU Nuclear Radiation Center SOP No. 17, "Standard Procedure for Ar-41 Monitor Checkout and Calibration," last revised February 9, 2006
- WSU Nuclear Radiation Center SOP No. 20, "Standard Procedure for Environmental Monitoring," last revised December 4, 2003
- WSU Nuclear Radiation Center SOP No. 21, "Standard Procedure for TLD Environmental Monitoring Program," last revised December 4, 2003
- WSU Nuclear Radiation Center SOP No. 25, "Standard Procedure for Continuous Air Monitor Check and Calibration," last revised December 4, 2003
- WSU Nuclear Radiation Center SOP No. 27, "Standard Procedure for CAM (Continuous Air Monitor) Filter Analysis," last revised September 29, 2005

b. Observation and Findings

The inspectors 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 setpoint verification, alarm check, and operability records for the monitoring equipment were also reviewed. Corrective actions, including recalibration, were completed if the setpoint values were exceeded.

The inspectors also reviewed the records documenting liquid and airborne releases to the environment for the past 2 years. The inspectors 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 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 2.9 E-4 millirem per year (mr/yr) for the period from July 2009 through June 2010 and 4.9 E-4 mr/yr for the period from July 2010 through June 2011. 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 analysis indicated that they met regulatory requirements for discharge into the sanitary sewer. Through observation of the facility, the inspectors 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 above were acceptably reported in the Reactor Operations Annual Report for 2009 to 2010 and 2010 to 2011.

c. Conclusion

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits.

6. Transportation

a. Inspection Scope (IP 86740)

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

- Records of radioactive material shipments for January 2011 and to the present
- WSU Nuclear Radiation Center SOP No. 30, "Standard Procedure for Off-Site Shipment of Radioactive Material," last revised November 30, 1995
- WSU Nuclear Radiation Center SOP No. 32, "Standard Procedure for Receiving and Opening Packages Containing Licensed Materials," last revised December 4, 2003
- WSU Nuclear Radiation Center SOP No. 33, "Standard Procedure for Handling Iridium Irradiations/Shipment," last revised September 29, 2005

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspectors 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. A few minor problems were noted but, in general, all radioactive material shipment records reviewed by the inspectors had been completed in accordance with Department of Transportation (DOT) and NRC requirements.

On Tuesday, during the inspection, the inspectors observed the preparation of three containers of Iridium-192 for shipment. The dose rate of each of the containers was measured so that the activity of the material inside could be calculated. Each container was subsequently brought up into a shielded cask and transferred to a shipping cask. The shipping casks were then surveyed and the appropriately completed labels and markings applied. The shipping paperwork was completed in accordance with the regulatory requirements. Finally, the shipping casks were placed on a truck for shipment to the consignee. The inspectors noted that the casks were adequately secured inside the trailer for transport and the proper placards were also placed on the truck trailer as required. No problems or deficiencies were noted.

The inspectors noted that two staff members had received the training for shipping radioactive material and/or "Dangerous Goods." The most recent training was completed on February 18, 2010. The inspectors verified 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 10 CFR 71.5(a).

7. Exit Interview

The inspection scope and results were summarized on August 2, 2012, with members of licensee management. The inspectors described the areas inspected and discussed in detail the inspection findings. The licensee acknowledged the results of the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

C. Hines	Reactor Supervisor
M. King	Reactor Technician I/Senior Reactor Operator
D. Wall	Director, Nuclear Radiation Center
K. Henry	Senior Reactor Operator

Other Personnel

J. Cloran	WSU Radiation Safety Officer

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
DDE	Deep dose equivalent
DOT	Department of Transportation
IP	Inspection Procedure
mr	millirem
mr/yr	millirem per year
No.	Number
NRC	Nuclear Regulatory Commission
OSL	Optically stimulated luminescent (dosimeter)
RO	Reactor Operator
RSC	Reactor Safeguards Committee
RSO	Radiation Safety Office
SDE	Shallow dose equivalent
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TLD	Thermoluminescent dosimeter
TS	Technical Specifications
WSU	Washington State University