

August 24, 2015

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. 50-027/2015-201

Dear Dr. Keane:

From July 28 - 30, 2015, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at your Washington State University TRIGA research reactor located in the Nuclear Radiation Center (Inspection Report No. 50-027/2015-201). The enclosed report documents the inspection results, which were discussed on July 30, 2015, with Dr. Donald Wall, Director of the Nuclear Radiation 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 noncompliance 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 Mr. Mike Morlang at 301-415-4092 or electronic mail at Gary.Morlang@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, 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:
NRC Inspection
Report No. 50-027/2015-201

cc: See next page

C. Keane

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Washington State University

Docket No. 50-27

cc:

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

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

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

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

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

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

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

August 26, 2015

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. 50-027/2015-201

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/RA/

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Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-027

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Enclosure:
NRC Inspection
Report No. 50-027/2015-201

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DATE	8/26/2015	8/26/2015

OFFICIAL RECORD COPY

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

Docket No: 50-027

License No: R-076

Report No: 50-027/2015-201

Licensee: Washington State University

Facility: Nuclear Radiation Center

Location: Pullman, WA

Dates: July 28 to 30, 2015

Inspector: Mike Morlang

Approved by: Kevin Hsueh, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Washington State University
Nuclear Radiation Center
Report No.: 50-027/2015-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the Washington State University (the licensee's) Class II research and test reactor safety program including: 1) organizational structure and staffing, 2) operations logs and records, 3) requalification program, 4) surveillance and limiting conditions for operations, 5) experiments, 6) committees, audits and reviews 7) emergency preparedness, 8) maintenance logs and records, and 9) fuel handling since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements.

Organizational Structure and Staffing

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

Operations Logs and Records

- Operational activities were consistent with applicable Technical Specifications and procedural requirements.

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.

Surveillance and Limiting Conditions for Operations

- The program for tracking and completing surveillance checks and Limiting Conditions for Operation satisfied Technical Specifications requirements.

Experiments

- Conduct and control of experiments and irradiations met the requirements specified in the Technical Specifications, the applicable experiment irradiation authorizations, and associated procedures.

Committees, Audits and Reviews

- The review and audit program was being conducted by the Reactor Safeguards Committee. The composition and meeting frequency satisfied requirements specified in Technical Specifications.

Emergency Preparedness

- The Emergency Plan and Implementing Procedures were being reviewed and updated as required.
- Emergency response facilities and equipment were being maintained as required and responders were knowledgeable of proper actions to be taken in case of an emergency.
- Off-site support was acceptable and communications capabilities were adequate.
- Annual drills were being conducted and critiques were being held as required by the Emergency Plan.

Maintenance Logs and Records

- Maintenance logs, records, performance, and reviews satisfied Technical Specifications and procedure requirements.

Fuel Handling

- Fuel handling activities and documentation were in compliance with the requirements specified in the Technical Specifications and procedures.

REPORT DETAILS

Summary of Facility Status

The Washington State University (WSU, the licensee's) one megawatt (MW) TRIGA research and test reactor continued normal, routine operations. A review of the applicable records indicated that the reactor was operated as needed in support of education, operator training, and irradiation of various materials. During the inspection, the reactor was operated at levels up to 1 MW and in accordance with applicable procedures to support ongoing irradiation activities.

1. Organizational Structure 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 6.1-6.3 of Technical Specifications, dated September 30, 2011, were being met:

- Reactor Safeguards Committee Minutes for 2014 and 2015
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2013, through June 30, 2014, dated August 21, 2014
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2014, through June 30, 2015, dated August 12, 2015
- Washington State University Nuclear Radiation Center (WSUNRC) organizational structure and staffing
- WSUNRC Operating Log (O.1) sheets from January 2014 through July 2015
- WSUNRC Administrative Procedure, Section No. 1, entitled "Responsibilities and Authority of Reactor Operating Staff," (not dated)

b. Observations and Findings

The inspector noted that the WSUNRC organizational structure and the responsibilities of the reactor staff had not changed since the last inspection. The reactor staff currently consisted of 5 licensed senior reactor operators and 8 reactor operators. The inspector determined that the reactor operations staff met the training and experience requirements as stipulated in the Technical Specifications. In addition, the operations log and associated records confirmed that shift staffing satisfied the minimum requirements for duty and on-call personnel.

c. Conclusion

The operations organizational structure and responsibilities were consistent with Technical Specifications requirements. Shift staffing met the requirements for current operations.

2. Operations Logs and Records

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with Technical Specifications Section 6.2 and the applicable procedures:

- WSUNRC Technical Specifications dated
- September 30, 2011
- Observation of selected operations activities on July 28 and July 29, 2015
- Scram Summary Log (S.1) entries for 2014 and 2015
- Pulsing Summary Log (S.2) entries for 2014 and 2015
- WSUNRC Maintenance Log (O.8) from January 2014 to present
- Reactor Operating Log (O.1) sheets from January 2014 through July 2015, entitled "WSU Nuclear Radiation Center Reactor Log," NRC Form No. 22, latest form revision (October 2009)
- Selected entries on Reactor Start-Up Check-off (O.3) forms entitled WSUNRC Form No. 34, "WSU Reactor Start-Up Check-off," latest form revision (April 2015)
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2013, through June 30, 2014, dated August 21, 2014
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2014, through June 30, 2015 (August 2015)
- WSUNRC Administrative Procedure, Section No. 1, entitled "Responsibilities and Authority of Reactor Operating Staff," (not dated)
- WSUNRC Standard Operating Procedure (SOP) No. 1, "Standard Procedure for Use of the Reactor," (April 2015)
- WSUNRC SOP No. 2, "Standard Procedure for Startup, Operation, and Shutdown of the Reactor," (April 2015)

b. Observations and Findings

Reactor operations were carried out following written procedures and in accordance with Technical Specification requirements. As noted above, shift staffing satisfied the minimum requirements for duty and on-call personnel. Quarterly audits were conducted by Reactor Safeguards Committee personnel. Accurate correlation between reactor logs, scram logs, pulse logs, and maintenance logs was noted. Equipment problems and events were well documented and resolved, with Senior Reactor Operator approval if required for restart of the reactor.

c. Conclusion

The operational activities were found to be consistent with applicable Technical Specifications and procedural requirements.

3. 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 2013 to the present
- Operator license status and effective dates of current operator licenses
- WSUNRC Reactor Staff Requalification Program, latest revision (Rev.) 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

As noted in Section 1, at the time of the inspection, there were 5 licensed senior reactor operators and 8 licensed reactor operators 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.

4. Surveillance and Limiting Conditions for Operations

a. Inspection Scope (IP 69001)

To verify compliance with Technical Specifications Sections 3, 4, and 5, the inspector reviewed selected aspects of:

- Reactor Operating Log (O.1) sheets from January 2014 through July 2015, entitled "WSU Nuclear Radiation Center Reactor Log," NRC Form No. 22, latest form revision (October 2009)
- Control Element Inspection Log (O.5) for 2014 and 2015
- Monthly Core Reactivity Parameters Log (O.7) for 2014 thru July 2015
- Maintenance Log, Volume 1 (O.8), pages 137-148
- Preventative Maintenance Checklists (O.2) for 2014 and to date in 2015
- Reactor Safeguards Committee meeting minutes for 2014 and 2015
- Power Calibration Log forms (also in O.2) for 2014 and to date in 2015
- Monthly Console and Auxiliary Equipment Checklist Log (O.9) containing documentation of equipment maintenance as indicated on the WSUNRC Form No. 40, entitled "Console Auxiliary Equipment Maintenance Checklist," latest form revision (June 2013)
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2013, through June 30, 2014, dated August 21, 2014
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2014, through June 30, 2015, (August 2015)
- WSUNRC SOP No. 5, "Standard Procedure for Performing Preventive Maintenance on the Reactor and Associated Equipment," dated March 12, 2015
- WSUNRC SOP No. 11, "Standard Procedure for Control Element Maintenance, Removal, and Replacement," dated March 12, 2015
- WSU Nuclear Radiation Center SOP No. 20, "Standard Procedure for Performing Power Calibrations," dated March 12, 2015
- WSUNRC SOP No. 23, "Standard Procedure for Annual Fuel Inspection," dated March 12, 2015
- WSUNRC SOP No. 24, "Standard Procedure for Fuel Burnup Calculation," dated March 12, 2015
- WSUNRC SOP No. 25, "Standard Procedure for Core Changes and Fuel Movement," dated March 12, 2015

b. Observations and Findings

The Inspector determined that the daily, weekly, monthly, semiannual, and other periodic checks, tests, and verifications for Technical Specifications required Limiting Conditions for Operations were being completed as required. Extensive checklists were used to track completion of the various required surveillances

and Limiting Conditions for Operations verifications. The checklists included the date and name that each activity was completed. All recorded results observed by the inspector were within prescribed Technical Specifications and procedure parameters and in close agreement with the previous surveillance results.

c. Conclusion

The surveillance logs, records, performance, and reviews satisfied Technical Specification and procedure requirements. The program for tracking and completing surveillance requirements was detailed and thorough.

5. Experiments

a. Inspection Scope (IP 69001)

To verify compliance with the licensee's program for conducting experiments and irradiations as outlined in Technical Specifications Sections 3.10, 3.11, 4.3.5, and 6.5.4 and in various procedures, the inspector reviewed selected aspects of:

- WSUNRC Irradiation Data Log sheets for the period from January 2014 to the present
- WSUNRC Reactor Operating Log (O.1) sheets from January 2014 to the present
- Experiment approvals documented on WSUNRC Form No. 1, entitled "Project Initiation Request Form," latest form revision dated March 2011, with the associated experiment overviews, safety reviews and analyses, isotope production data, accident analyses, and approvals
- SOP Number (No.) 1, "Standard Procedure For Use Of The Reactor," latest revision dated March 12, 2015
- SOP No. 2, "Standard Procedure For Startup, Operations and Shutdown of The Reactor," latest revision dated March 12, 2015
- SOP No. 3, "Standard Procedure For Performing Experiments Using The Reactor," latest revision dated March 12, 2015

b. Observations and Findings

Various new experiments had been proposed since the last inspection. The inspector verified that new experiments were reviewed and approved by a Senior Reactor Operator and by either the Assistant Facility Director or the Facility Director. Certain experiments were also approved by the Reactor Safeguards Committee when required. The inspector also verified that the experiments were completed under the supervision of the Senior Reactor Operator and in accordance with Technical Specifications requirements.

The inspector reviewed the existing experiment and irradiation authorization documents, Irradiation Data Log sheets, and the Reactor Logbook, and interviewed staff members. It was noted that the information typically entered on

the Irradiation Data Log sheets was now being entered into a data base developed by facility personnel. The appropriate data was recorded and the radioactive material produced was handled and controlled as required.

c. Conclusion

The conduct and control of experiments and irradiations met the requirements specified in the Technical Specifications, the experiment irradiation authorizations, and applicable procedures.

6. Committees, Audits and Reviews

a. Inspection Scope (IP 69001)

In order to verify that the licensee had established and conducted reviews and audits as required in TS Section 6.5, the inspector reviewed selected aspects of:

- WSU Reactor Safeguards Committee meeting minutes for 2014 and to date in 2015
- Safety review and audit records documented on WSUNRC forms entitled, "Reactor Safeguards Committee Facility Records Quarterly Audit," for the period from January 2014 through the present
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2013, through June 30, 2014, dated August 21, 2014
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2014, through June 30, 2015, (August 2015)

b. Observations and Findings

The Reactor Safeguards Committee membership satisfied Technical Specification requirements and the Committee's procedural rules. The Reactor Safeguards Committee, or a subcommittee thereof, was required to hold quarterly meetings each year. It was noted that four committee meetings were held in 2013, four committee meetings in 2014, and two had been held to date in 2015.

Review of the committee meeting minutes indicated that the Reactor Safeguards Committee 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 Reactor Safeguards Committee.

c. Conclusion

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

7. Emergency Preparedness

a. Inspection Scope (IP 69001)

To ensure that the licensee was acceptably implementing the various aspects of their emergency preparedness program, the inspector reviewed selected aspects of:

- WSUNRC SOP No. 15, "Standard Procedure for Action in the Event of an Alarm" dated March 12, 2015
- Emergency Preparedness Plan for the WSUNRC dated June 24, 2010
- Emergency drills and exercises for the past two years
- Administrative Requirements Schedule Log (A.4) sheets
- Training records for licensee staff and support personnel
- Emergency response facilities, supplies, equipment, and instrumentation
- Offsite support as documented in the Letter of Agreement with the hospital
- WSUNRC Short Form Emergency Procedure, latest Rev. dated November 21, 2008
- WSUNRC SOP No. 14, "Standard Procedure in the Event of an Emergency Situation," dated March 12, 2015

b. Observations and Findings

The Emergency Plan in use at the facility, entitled "Emergency Preparedness Plan for the Nuclear Radiation Center, Washington State University," was being reviewed and updated as required by Technical Specifications.

Emergency facilities, instrumentation, and equipment were being maintained and controlled, and supplies were being inventoried as required in the Emergency Plan.

The Inspector determined through records review and through interviews with licensee personnel that emergency responders were knowledgeable of the proper actions to take in case of an emergency. The agreement with the Pullman Regional Hospital, which had been updated May 20, 2014, was being maintained in effect.

Communications capabilities with the various campus, city, and county support groups were acceptable and off-site support for the facility was verified to be acceptable and in accordance with the Emergency Plan. The alarm system had been tested weekly and monthly as stipulated in the Emergency Plan.

The inspector determined that the emergency drills were being conducted as required by the Emergency Plan. Critiques were written following the drills and they addressed problems noted during the conduct of the drill with assigned corrective actions.

c. Conclusion

The emergency preparedness program was conducted in accordance with the requirements stipulated in the Emergency Plan.

8. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

To verify compliance with Technical Specification Sections 3, 4, and 5, the inspector reviewed selected aspects of:

- Reactor Operations Summary Sheets for 2014 and to date in 2015
- Control Element Inspection Log (O.5) for 2014 and to date in 2015
- Monthly Core Reactivity Parameters Log (O.7) for 2014 and to date in 2015
- Maintenance Log, Volume 1 (O.8), pages 137-148
- Preventative Maintenance Checklists (O.2) for 2014 and to date in 2015
- Reactor Safeguards Committee meeting minutes for the past two years through the date of the inspection
- Power Calibration Log forms (also in O.2) for 2014 and to date in 2015
- Monthly Console and Auxiliary Equipment Checklist Log (O.9) containing documentation of equipment maintenance as indicated on the WSU Nuclear Radiation Center Form No. 40, entitled "Console Auxiliary Equipment Maintenance Checklist," latest form revision (June 2013)
- WSUNRC Reactor Operating Log (O.1) sheets from January 2014 to July 2015
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2013, through June 30, 2014, dated August 21, 2014
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University TRIGA Reactor" for the periods from July 1, 2014, through June 30, 2015, (August 2015)
- WSUNRC Administrative Procedure, Section No. 5, entitled "Surveillance Documentation Review," (not dated)
- WSUNRC Administrative Procedure, Section No. 6, entitled "Performance of Maintenance Activities," (not dated)

- WSUNRC SOP No. 5, "Standard Procedure for Performing Preventive Maintenance," dated March 12, 2015
- WSUNRC SOP No. 11, "Standard Procedure for Control Element Maintenance," dated March 12, 2015
- WSUNRC SOP No. 20, "Standard Procedure for Performing Power Calibrations," dated March 12, 2015

b. Observations and Findings

The Inspector noted that routine and preventive maintenance was controlled by, and documented in, the maintenance or reactor operations logs and the monthly Console Auxiliary Equipment Maintenance Checklists consistent with the Technical Specifications and licensee procedures. Unscheduled maintenance or equipment repair was reviewed to determine if the work required a 10 CFR 50.59 evaluation. Verifications and operational systems checks were performed following completion of the maintenance to ensure system operability before the equipment was returned to service.

c. Conclusion

The maintenance logs, records, performance, and reviews satisfied Technical Specifications and procedure requirements.

9. **Fuel Handling**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to ensure that the licensee was complying with Technical Specification Sections 4.4, 5.1, 5.2, 6.8, and 6.9:

- Control Element Inspection Log (O.5) for 2014 and 2015
- Monthly Core Reactivity Parameters Log (O.7) for 2014 and 2015
- Core Change Log (O.6) through July 2015
- Fuel handling equipment and instrumentation
- Selected WSUNRC Reactor Log sheets from 2014 through the present
- WSU Special Nuclear Material Physical Inventory Log sheets dated March 21, 2012, from 2014 through the present
- WSUNRC Administrative Procedure, Section No. 9, entitled "Special Nuclear Material Accountability Plan," (May 1989)
- WSUNRC SOP No. 23, "Standard Procedure Annual Fuel Inspection," dated March 12, 2015
- WSUNRC SOP No. 11, "Standard Procedure for Control Element Maintenance," dated March 12, 2015

b. Observations and Findings

Procedures for refueling, fuel movement, and Technical Specifications required surveillances ensured controlled operations for Core 35-A. A detailed plan for

performing fuel movement was required to be developed prior to each fuel movement operation.

The inspector noted that the data recorded for fuel movements that had been conducted in the past were acceptable and were required to be cross referenced in the operations logs. Log entries, indicating fuel movements, were completed under the direct supervision of a Senior Reactor Operator as required.

Through records review and interviews with licensee personnel, the inspector determined that various fuel movement operations had been conducted since the last inspection in this area. The most significant fuel movement involved removing fuel bundles from the core to allow for fuel inspection in December 2014. The inspector verified that a detailed plan had been completed for the fuel movement activities as required. The plan had been reviewed and approved by the Facility Assistant Director and the Facility Director as required.

c. Conclusion

The fuel handling activities and documentation were as required by facility Technical Specifications and procedures.

11. Exit Interview

The inspection scope and results were summarized on July 30, 2015, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. The licensee acknowledged the inspection results presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

C. Hines	Assistant Director, Nuclear Radiation Center
M. King	Reactor Technician I/Senior Reactor Operator
D. Wall	Director, Nuclear Radiation Center
K. Henry	Senior Reactor Operator
P. Wilson	Administrative Assistant
A. Donley	Reactor Operator

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
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ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
SOP	Standard Operating Procedure
WSU	Washington State University
WSUNRC	Washington State University Nuclear Radiation Center