

October 26, 2001

Dr. Stephen Binney, Director
Oregon State University
Radiation Center, A100
Corvallis, OR 97331-5903

SUBJECT: NRC INSPECTION REPORT NO. 50-243/2001-201 AND NOTICE OF VIOLATION

Dear Dr. Binney:

This letter refers to the inspection conducted on August 6-9, 2001, at your Radiation Center TRIGA Mark-II Reactor Facility. The enclosed report presents the results of that inspection. Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, the NRC has identified a violation of NRC requirements. The violation is cited in the enclosed Notice of Violation (Notice). The circumstances surrounding it are described in detail in the subject inspection report. The violation is of concern because it should have been prevented by your staff performing a survey following the installation of the In-Core Irradiation Tube to determine the radiation levels that were produced during operation of the reactor.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response in accordance with its policies to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/NRC/ADAMS/index.html>. Should you have any questions concerning this inspection, please contact Craig Bassett at (404) 562-4712.

Sincerely,

/RA by Patrick M. Madden Acting for/

Eugene V. Imbro, Acting Chief
Operational Experience and
Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-243
License No. R-106

Enclosures: 1) Notice of Violation
2) NRC Inspection Report No. 50-243/2001-201

cc w/enclosures: Please see next page

Oregon State University

Docket No. 50-243

cc:

Mayor of the City of Corvallis
Corvallis, OR 97331

David Stewart-Smith
Oregon Office of Energy
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George Holdren, Interim Vice Provost
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Dr. Jack F. Higginbotham, Chairman
Reactor Operations Committee
Oregon State University
Radiation Center, A-100
Corvallis, OR 97331-5904

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

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Enclosure 1

NOTICE OF VIOLATION

Oregon State University
Oregon State University TRIGA Reactor

Docket No.: 50-243
License No.: R-106

During an NRC inspection conducted on August 6-9, 2001, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violation is listed below:

10 CFR 20.1501 requires that each licensee make or cause to be made surveys that may be necessary for the licensee to comply with the regulations in Part 20 and that are reasonable under the circumstances to evaluate the extent of radiation levels, concentrations or quantities of radioactive materials, and the potential radiological hazards that could be present.

Pursuant to 10 CFR 20.1003, *survey* means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation.

Contrary to the above, the licensee did not make a survey to assure compliance with 10 CFR 20.1501. Specifically, the licensee installed an In-Core Irradiation Tube in the reactor on December 3, 1998. A survey was reportedly performed after installation but no high radiation levels were detected. On August 13, 1999, during a routine survey of the reactor top, a collimated beam of radiation measuring approximately 7,000 millirem per hour (gamma and neutron) was detected on top of the reactor when the reactor was operating at a power level of one megawatt.

This is a Severity Level IV violation (Supplement IV).

Pursuant to the provisions of 10 CFR 2.201, Oregon State University is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to the responsible inspector, U.S. Nuclear Regulatory Commission, Region II, 61 Forsyth St. S. W., Suite 23T85, Atlanta, GA 30303, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps, if any, that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Because your response will be placed in the NRC Public Document room (PDR), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure or information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated at Rockville, Maryland
this 26th day of October 2001.

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

Docket No: 50-243

License No: R-106

Report No: 50-243/2001-201

Licensee: Oregon State University

Facility: TRIGA Mark-II Reactor Facility

Location: Radiation Center, Oregon State University
Corvallis, Oregon

Dates: August 6-9, 2001

Inspector: Craig Bassett

Approved by: Eugene V. Imbro, Acting Chief
Operational Experience and
Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

This routine, announced inspection included onsite review of selected aspects of the following: organizational structure, review and audit program, radiation protection program, safeguards program, security program, and transportation program since the last NRC inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements. One apparent violation was identified for failure to perform an adequate survey following installation of a new experimental facility.

Organizational Structure and Functions

The organizational structure and functions were consistent with Technical Specification requirements.

Review and Audit Functions

The review and audit program satisfied Technical Specification requirements.

Radiation Protection

One apparent violation was identified for failure to conduct an adequate survey following a modification to the reactor involving installation of an In-Core Irradiation Tube. The problem, which resulted in a failure to control a high radiation area, was subsequently discovered by the licensee, reported to the NRC, and actions were taken to control the high radiation area on the reactor top.

Environmental Protection

The environmental protection program satisfied NRC requirements.

Procedures

The procedural control and implementation program satisfied Technical Specification requirements.

Material Control and Accountability

Special Nuclear Materials were acceptably controlled and inventoried.

Security

Security activities and systems satisfied Physical Security Plan requirements.

Transportation of Radioactive Material

The program for transportation of radioactive materials satisfied NRC requirements.

Operator Licenses, Requalification, and Medical Activities

The requalification/training program was up-to-date but a medical examination for one individual had not been completed in a timely manner.

Operations and Maintenance

Reactor operations were conducted in accordance with Technical Specification requirements and applicable procedures. The maintenance program satisfied NRC requirements.

Report Details

Summary of Plant Status

During the inspection, the licensee's TRIGA Mark-II reactor was operated several days to support experiments, education, operator training, and surveillance activities.

1. Organizational Structure and Functions

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

The inspector reviewed selected aspects of:

- organization and staffing
- management responsibilities
- administrative controls

b. Observations and Findings

The organizational structure and staffing with respect to the health physics organization had changed since the last inspection. The former Senior Health Physicist had retired and the Health Physicist, who has worked at the facility since 1994, was promoted to that position. One Health Physicist position has been added to the organizational structure as well.

The organizational structure and staffing as a whole at the facility, and as reported in the Annual Report, were as required by Technical Specification. Qualifications of the staff met ANSI Standard 15.4, "Standard for the Selection and Training of Personnel for Research Reactors," recommendations. Review of records verified that management responsibilities were administered as required by Technical Specifications and applicable procedures.

c. Conclusions

The organizational structure and functions were consistent with Technical Specification requirements.

2. Review and Audit Functions

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- Reactor Operations Committee (ROC) meeting minutes/records
- ROC safety review and audit records
- responses to safety reviews and audits

b. Observations and Findings

Records showed that safety reviews and audits were conducted by various members of the ROC or other designated persons as required and at the Technical Specification required frequency. Topics of these reviews were also consistent with Technical Specification requirements to provide guidance, direction, and oversight, and to ensure acceptable use of the reactor. The inspector noted that the safety reviews and audits and the associated findings were acceptably detailed and that the licensee responded and took corrective actions as needed.

c. Conclusions

The review and audit program satisfied Technical Specification requirements.

3. Radiation Protection

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- the Radiation Protection Program
- radiological signs and posting
- routine surveys and monitoring
- dosimetry records
- maintenance and calibration of radiation monitoring equipment
- As Low As Reasonably Achievable (ALARA) reviews

b. Observations and Findings

(1) General Radiation Protection functions

The radiation protection program had not changed since the last inspection. The licensee reviewed the radiation protection program at least annually in accordance with 10 CFR 20.1101(c); no weaknesses were reported. The licensee showed that the air emissions of radioactive material to the environment were below the 10 millirem constraint specified in 10 CFR 20.1101(d).

Copies of NRC Form 3, "Notice to Employees," were posted in accordance with 10 CFR 19.11. Caution signs, postings, and controls for radiation areas were as required in 10 CFR Part 20, Subpart J. Licensee personnel observed the precautions for access to radiation areas.

The use of dosimeters and exit frisking practices were in accordance with radiation protection requirements. The licensee used a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor to process dosimetry. Radiological exposure records showed that occupational doses and doses to the public were within the limits specified in 10 CFR Part 20.

Radiation monitoring and survey activities were being completed at the required frequencies. Equipment used for these activities were maintained, calibrated, and used acceptably. ALARA reviews were acceptably performed as required.

The licensee did not require or have a respiratory protection program or planned special exposure program.

Training records showed that personnel were generally acceptably trained in radiation protection practices. However, it was noted that the last biennial training completed at the facility was in 1999. The licensee was informed that the NRC will track the issue of conducting the biennial radiation protection training as an Inspector Follow-up Item (IFI) to ensure that it is completed as required (IFI 50-243/2001-201-01).

(2) High Radiation Area

10 CFR 20.1501 requires that each licensee make or cause to be made surveys that may be necessary for the licensee to comply with the regulations in 10 CFR Part 20 and that are reasonable under the circumstances to evaluate the extent of radiation levels, concentrations or quantities of radioactive materials, and the potential radiological hazards that could be present.

Pursuant to 10 CFR 20.1003, *survey* means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation.

The inspector reviewed an event that the licensee reported to the NRC in a letter dated September 8, 1999. While performing a radiation survey on the OSTR top on August 13, 1999, a student radiation worker noted an unusually high radiation reading above the In-Core Irradiation Tube (ICIT) which had been installed on December 3, 1998. The student notified the Reactor Supervisor and a resurvey of the area was conducted. It was determined that a highly collimated radiation beam extended above the reactor top grating and produced a dose rate of approximately 7000 millirem per hour (gamma and neutron combined) at 30 centimeters above the reactor top when the reactor was operating at one megawatt (1 Mw). This meant that the area was a high radiation area (HRA) and needed to be controlled as such. Measurements were also made on the reactor building roof and the roof was also found to be an HRA while the reactor was operating at 1 Mw with the ICIT in place.

The licensee investigated the problem and found that no abnormal personnel doses had been recorded because of the high radiation area. The highest cumulative dose to OSTR staff during the time the ICIT was used was 76 millirem (mrem) whole body and 208 mrem extremity. It was also calculated that the highest cumulative whole body dose for any worker who could potentially have entered the HRA on the roof was 11 mrem during the period

the ICIT was in use. The ICIT is only installed in the reactor when in use. Between December 3, 1998, when the ICIT was first installed and August 13, 1999, when the HRA was detected, the ICIT had been used on 27 separate days. The inspector noted that the area on top of the reactor is fully enclosed within a radiation area and only a limited number of OSTR Operations and Health Physics staff have routine access to that area. Also, the area can be entered only through locked doors with keys assigned only to OSTR staff. Further, the reactor top is readily visible from the reactor control room which is continually occupied by at least one reactor operator during reactor operation. Anyone spending an appreciable amount of time on the reactor top would be noticed by an operator and questioned as to the person's need to remain in that area. For the reasons discussed above, the inspector concluded that the potential for an overexposure from the use of the ICIT during this period was not credible.

Following discovery of the problem, the licensee took various corrective actions. As noted above, after observing the elevated radiation field, further measurements were taken to characterize the HRA. The ICIT was subsequently redesigned to reduce the radiation levels that could exist above it and an extensive radiation survey was conducted after the installation of the new ICIT to characterize the radiation levels produced. The licensee also now posts and controls the reactor top as an HRA whenever an in-core irradiation tube is in use.

The licensee reported this problem as a failure to control a high radiation area, but the NRC reviewed the event as a potential problem with the survey performed following the change to the facility. In October of 1998, the ROC had reviewed and approved an evaluation of a change to the reactor involving installation of the ICIT. On December 3, 1998, the licensee installed the ICIT in the reactor. The licensee indicated that it was the former Senior Health Physicist's recollection that a survey had been performed but no records could be found documenting the results of the survey. The inspector noted that, if a survey was conducted, it did not detect the high radiation problem because no record was made and no precautions were implemented to control the resulting high radiation area. Finally, it was noted that although the licensee did discover the problem, it had existed for nearly nine months before it was detected and the situation corrected.

The licensee was informed that failure to conduct an adequate survey of the area following installation of the ICIT was an apparent violation of 10 CFR Part 20.1501 (VIO 50-243/2001-201-02).

c. Conclusions

One apparent violation was identified for failure to conduct an adequate survey of a modification to the reactor involving installation of an In-Core Irradiation Tube. The radiation protection program satisfied NRC requirements.

4. Environmental Protection

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- the environmental monitoring program
- annual reports
- release records
- counting and analysis program

b. Observations and Findings

Environmental samples were collected, prepared, and analyzed consistent with the Technical Specification requirements. Data indicated that there were no measurable doses above any regulatory limits. This was acceptably documented in the Annual Reports. Observation of the facility found no new potential release paths.

The program for the monitoring and storage of radioactive liquid, gases, and solids was consistent with applicable regulatory requirements. Radioactive material was monitored and released when below acceptable limits or was acceptably transferred to the broad-scope license for disposition. The principles of ALARA were acceptably implemented to minimize radioactive releases. Monitoring equipment was acceptably maintained and calibrated. Records were current and acceptably maintained.

c. Conclusions

The environmental protection program satisfied NRC requirements.

5. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- administrative controls
- records for changes and temporary changes
- procedural implementation
- logs and records

b. Observations and Findings

Administrative controls of changes and associated review and approval processes were as required. Training of personnel on procedures and changes was acceptable. Licensee personnel conducted activities in accordance with applicable procedures. Records showed that procedures for potential malfunctions (e.g., radioactive releases and contaminations) were implemented as required.

c. Conclusions

The procedural control and implementation program satisfied Technical Specification requirements.

6. Material Control and Accountability

a. Inspection Scope (IP 85102)

The inspector reviewed selected aspects of:

- nuclear material inventory and locations
- accountability records

b. Observations and Findings

The inventory of material was verified. The material control and accountability program tracked locations and content of fuel and fission detectors under the research reactor license. The possession and use of special nuclear material (SNM) were limited to the locations and purposes authorized under the license. The material control and accountability forms (DOE/NRC Forms 741 and 742) were prepared and transmitted as required.

c. Conclusions

Special Nuclear Materials were acceptably controlled and inventoried.

7. Security

a. Inspection Scope (IPs 81401, 81402, and 81431)

The inspector reviewed selected aspects of:

- the Physical Security Plan (PSP) and submitted changes
- security systems, equipment, and instrumentation
- implementation of the PSP

b. Observations and Findings

The PSP was the same as the latest revision approved by the NRC. Implementing procedures were consistent with the PSP.

Physical protection systems (barriers and alarms), equipment, and instrumentation were as required by the PSP. Access control was as required. Acceptable security response and training were demonstrated through alarm response and drill response in accordance with procedures.

The inspector also reviewed a problem identified by the licensee. The licensee had failed to follow all the provisions of their Oregon State TRIGA Reactor (OSTR) PSP and had reported this to the NRC on May 22, 2001. The licensee subsequently took corrective actions to preclude this problem from recurring. As a result of this inspection and a review of the corrective actions taken, the licensee was informed that this self-identified and corrected violation will be treated as a Non-Cited Violation, consistent with Section VI.A of the NRC Enforcement Policy (NCV 50-243/2001-201-03). This item is considered closed.

c. Conclusions

Security activities and systems satisfied Physical Security Plan requirements.

8. Transportation

a. Inspection Scope (IP 86740)

The inspector reviewed selected aspects of:

- radioactive material shipping procedures
- radioactive material transportation and transfer records

b. Observations and Findings

Records showed that the radioactive waste for disposal was transferred to the broad scope license in accordance with licensee requirements. This program for radioactive material transfer was consistent with license requirements.

The transport of radiological samples was also reviewed. Records showed that the radioisotope types and quantities were generally calculated correctly and dose rates were measured. These records also showed that transportation of the radioactive materials was in accordance with applicable DOT and NRC requirements.

c. Conclusions

The program for transportation of radioactive materials satisfied NRC requirements.

9. Operator Licenses, Requalification, and Medical Activities

a. Inspection Scope (IP 69001)

To determine that operator requalification activities and training were conducted as required and that medical requirements were met, the inspector reviewed:

- active license status
- logs and records of reactivity manipulations
- written examinations
- training lectures and records

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- medical examination records

b. Observations and Findings

There are currently three qualified Senior Reactor Operators and one Reactor Operator employed at the facility and their licenses were current.

A review of the logs and records showed that training was being conducted and examinations were being administered in accordance with the licensee's requalification and training program. Lectures had been given as stipulated and training reviews had been documented. It was noted that records of quarterly reactor operations, reactivity manipulations, and other operations activities were being maintained, as were records indicating the completion of annual written and console examinations and supervisory evaluations. However, records concerning the completion of biennial physical examinations indicated that one operator had not received the required examination within the time frame allowed. This problem had been identified by the licensee and reported to the NRC. The individual was subsequently suspended from operation until the required examination was completed. As a result, the licensee was informed that this licensee-identified and corrected violation will be treated as a Non-Cited Violation, consistent with Section VI.A of the NRC Enforcement Policy (NCV 50-284/2001-201-04). This item is considered closed.

c. Conclusions

The requalification/training program was up-to-date but a medical examination for one individual had not been completed in a timely manner.

10. Operations and Maintenance

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- Reactor Facility Master Facility Log No. 1
- Check Sheets
- maintenance forms, records, and procedures

b. Observations and Findings

The inspector reviewed a problem the licensee had with their control rods. While inspecting their control rods during November 2000, the licensee noticed that two plates that covered holes in the dashpot section of two of the three sets of control rods were missing. It was found that there were covers on the dashpot sections of the shim and safety rods. The licensee determined that the covers were added when they converted from low-enriched uranium (LEU) fuel to high-enriched uranium (HEU) fuel. Because the HEU fuel followers weighed more than the LEU followers, blocking the holes provided an increase in the dampening function of the dashpots. Previous records (Supervisor Logs from 1976) show that the control rods were sent out for modification but there was no explanation as to what was done. Close

inspection of the rods showed that the covers were installed using epoxy. While examining the covers that remained in place, the licensee found that those covers fell off with a slight tap. New covers were welded on the control rods following a review under 10 CFR 50.59 of the facility modification. The vendor, General Atomics, informed the licensee that this problem has occurred at other facilities with TRIGA reactors that were converted from LEU to HEU.

One of the cover plates was found on the top grid plate of the reactor but the other cover was never located. The licensee did verify that the unaccounted for cover was not in any location that could restrict coolant flow or movement of the control rods or fuel. After the repairs were made, the rod up travel times, rod down travel times, and rod scram times for all four rods were measured and verified to be within the normal range of values specified and that have been observed in the past. This issue is considered closed.

c. Conclusions

Reactor operations were conducted in accordance with Technical Specification requirements and applicable procedures. The maintenance program satisfied NRC requirements.

11. Exit Interview

The inspection scope and results were summarized on August 9, 2001, with licensee representatives. The inspector discussed the findings for each area reviewed. No dissenting comments were received from the licensee. Although safeguards information was reviewed during the inspection no such material is included in this report.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

S. Binney, Director, Radiation Center
K. Brock, Senior Health Physicist
J. Higginbotham, Chairman, Reactor Operations Committee
S. Reese, Reactor Administrator
S. Smith, Scientific Instrument Technician
G. Wachs, Senior Reactor Operator

INSPECTION PROCEDURES USED

IP 69001: Class II Non-Power Reactors
IP 81401: Plans, Procedures, and Reviews
IP 81402: Reports of Safeguards Events
IP 81431: Fixed Site Physical Protection of Special Nuclear Material of Low Strategic Significance
IP 85102: Material Control and Accounting - Reactors
IP 86740: Inspection of Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-243/2001-201-01	IFI	Follow-up on the licensee's actions to complete required biennial retraining for staff members in the area of radiation protection.
50-243/2001-201-02	VIO	Failure to conduct an adequate survey of the installation of the ICIT.
50-243/2001-201-03	NCV	Failure to comply with all aspects of the OSTR Physical Security Plan.
50-243/2001-201-04	NCV	Failure to meet the biennial medical examination frequency specified for a licensed reactor operator.

Closed

50-243/2001-201-03	NCV	Failure to comply with all aspects of the OSTR Physical Security Plan.
50-243/2001-201-04	NCV	Failure to meet the biennial medical examination frequency specified for a licensed reactor operator.

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
HEU	High enriched uranium (fuel)
HRA	High radiation area
ICIT	In-Core Irradiation Tube
IFI	Inspector Follow-up Item
IP	Inspection Procedure
LEU	Low enriched uranium (fuel)
mrem	millirem
Mw	Megawatt
NCV	Non-Cited Violation
NPR	Non-Power Reactor
NRC	Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OSU	Oregon State University
OSTR	Oregon State University TRIGA Reactor
PSP	Physical Security Plan
ROC	Reactor Operations Committee
SNM	Special Nuclear Material
VIO	Violation