

August 11, 2016

Mr. Robert Agasie, Reactor Director
Nuclear Reactor Laboratory
University of Wisconsin - Madison
1513 University Avenue, Room 1215
Madison, WI 53706-1687

SUBJECT: UNIVERSITY OF WISCONSIN – U.S. NUCLEAR REGULATORY
COMMISSION ROUTINE INSPECTION REPORT NO. 50-156/2016-202

Dear Mr. Agasie:

From July 18-21, 2016, the U.S. Nuclear Regulatory Commission (NRC or the Commission) conducted an inspection at the University of Wisconsin Nuclear Reactor Laboratory. The enclosed report documents the inspection results which were discussed on July 21, 2016, with you and the Reactor Supervisor.

This 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 various activities, and interviewed various 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).

R. Agasie

- 2 -

If you have any questions concerning this inspection, please contact Craig Bassett at (301) 466-4495 or by electronic mail at Craig.Bassett@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. 50-156
License No. R-74

Enclosure:
As stated

cc: See next page

University of Wisconsin

Docket No. 50-156

cc:

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Chairman, Public Service
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Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
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Jason Timm, Assistant Director
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Madison, WI 53715

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

Docket No: 50-156

License No: R-74

Report No: 50-156/2016-202

Licensee: University of Wisconsin

Facility: Nuclear Reactor Laboratory

Location: Madison, WI

Dates: July 18 – 21, 2016

Inspector: Craig Bassett

Accompanied by: J. Draper, Resident Inspector, Byron Nuclear Power Station,
Division of Reactor Projects, NRC Region III
C. Hunt, Resident Inspector-in-Training, LaSalle Nuclear Power Station,
Division of Reactor Projects, NRC Region III
J. McGhee, Senior Resident Inspector, Byron Nuclear Power Station,
Division of Reactor Projects, NRC Region III
R. Ruiz, Senior Resident Inspector, LaSalle Nuclear Power Station,
Division of Reactor Projects, NRC Region III

Approved by: Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Wisconsin - Madison
Nuclear Reactor Laboratory
NRC Report No. 50-156/2016-202

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Wisconsin (the licensee's) one megawatt Class II research reactor safety program including: (1) organizational structure and staffing; (2) review and audit and change control functions; (3) radiation protection, (4) effluent and environmental monitoring; and, (5) transportation of radioactive material 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 facility organization and staffing were in compliance with the requirements specified in the Technical Specifications (TSs).

Review and Audit and Change Control Functions

- The review and audit functions required by TSs Section 6.2 were being acceptably completed by the Reactor Safety Committee.
- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59 change process at the facility was being followed as required and no recent changes required NRC approval.

Radiation Protection

- Surveys were being completed and documented acceptably.
- Postings met the regulatory requirements.
- Personnel dosimetry was being worn as required and doses were well within NRC regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- Acceptable radiation protection training was being provided to staff members.
- The Radiation Protection Program and the As Low As Reasonably Achievable Program were being acceptably implemented.

Effluent and Environmental Monitoring

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

Transportation of Radioactive Materials

- Radioactive materials produced in the reactor were either transferred to the campus's broad scope license and shipped under the auspices of that license or transferred to other authorized users on campus.
- Some radioactive material was maintained at the reactor facility for use in labs in accordance with procedure.

REPORT DETAILS

Summary of Plant Status

The University of Wisconsin (UW or the licensee) continued to operate the one megawatt TRIGA conversion reactor as needed in support of laboratory and lecture courses, research in the area of neutron irradiation, and the Reactor Sharing Program. During this inspection the reactor was not operated because one beam port experiment was being removed and the licensee then needed to replace all the required shielding before resuming normal operations.

1. Organizational Structure and Staffing

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

To verify that the organization and staffing requirements specified in Technical Specifications (TS) 6.1 of the facility and associated procedures were being met, the inspector reviewed:

- Management responsibilities stipulated in the TS
- Staffing requirements for operation of the reactor facility
- Organizational structure for the Nuclear Reactor Laboratory
- Selected Operations Log Sheets, checklists, and associated forms and records for 2015 and to date in 2016
- University of Wisconsin Nuclear Reactor (UWNR) Procedure Number (No.) 001, "Standing Operating Instructions," Revision (Rev.) 16
- "The University of Wisconsin Nuclear Reactor Laboratory Fiscal Year 2013 – 2014 Annual Operating Report," for the period from July 2013 through June 2014, submitted to the U.S. Nuclear Regulatory Commission (NRC) on July 18, 2014
- "The University of Wisconsin Nuclear Reactor Laboratory Fiscal Year 2014 – 2015 Annual Operating Report," for the period from July 2014 through June 2015, submitted to the NRC on July 31, 2015

b. Observations and Findings

Through discussions with licensee representatives, it was noted that management responsibilities and the organization at the UW Nuclear Reactor Laboratory had not changed since the previous NRC inspection of radiation protection in May 2014 (Inspection Report No. 50-156/2014-201). The Reactor Director was responsible for all activities at the facility as stipulated in the TS. The Reactor Supervisor retained direct control and overall responsibility for safe operation and maintenance of the reactor. The Reactor Director reported to the Chancellor of UW-Madison through the Chair of the Engineering Physics Department as required. It was noted that there are currently two full-time staff members and six part-time operations staff/students working at the facility.

Enclosure

Through review of records and logs and through discussions with licensee personnel, the inspector determined that the staffing at the facility was acceptable to support the current workload and ongoing activities. The staffing was as stipulated in the TS.

Conclusion

The licensee's organization and staffing remain in compliance with the requirements specified in the TS.

2. Review and Audit and Change Control Functions

a. Inspection Scope (IP 69001)

In order to verify that the reviews and audits required by TS 6.2.3 and TS 6.2.4 had been completed by the Reactor Safety Committee (RSC), and to determine whether modifications to the facility were consistent with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59 "Changes, tests and experiments," the inspector reviewed:

- RSC meeting minutes from May 2014 through the present
- Records of changes and/or modifications to the facility documented on forms entitled, "UWNR Modification Checklist," "Safety Screening," and "Safety Evaluation"
- Audits completed by Radiation Safety Office staff personnel documented in monthly reports submitted to the RSC entitled "Nuclear Reactor Audit and Report" for 2014, 2015, and to date in 2016
- Audits completed by operations staff personnel documented in monthly reports submitted to the RSC entitled "Monthly Operations Summary," for 2014, 2015, and to date in 2016
- Annual As Low As Reasonably Achievable (ALARA) Audits (also known as Annual Radiation Safety Audits) of the facility Radiation Protection Program for the past two years completed by personnel delegated that responsibility by the RSC
- UWNR Procedure No. 005, "UWNR Administrative Guide," Rev. 60
- UWNR Procedure No. 019, "Changes, Tests, and Experiments," Rev. 3
- UWNR Procedure No. 020, "UWNR Modification Checklist," Rev. 2
- Safety Screening No. 20, documented in RSC Item No. 1269, "Change to NLI-1000 Period Amplifier Output Channel," RSC approval dated May 18, 2016
- Safety Evaluation No. 2, documented in RSC Item No. 1258, "Bismuth Special Reflector," RSC review dated December 4, 2015
- UWNR Annual Operating Reports for the past two years

b. Observations and Findings

(1) Review and Audits Functions

The inspector reviewed the minutes of the RSC meetings from May 2014 to the present. These meeting minutes demonstrated that the RSC had met at the required frequency and that a quorum was present. The minutes also indicated that the RSC, or a designated subcommittee, was completing reviews of those items and documents required by the TS. Through review of the meeting minutes, the inspector noted that the RSC appeared to be providing appropriate oversight and direction for reactor.

The inspector noted that various audits had been conducted of the facility in the areas of reactor operations, radiation protection, emergency preparedness, security, requalification of operators, and procedures. The inspector noted that the RSC reviewed the results of these audits as required. The radiation protection and operations audits were structured so that various aspects of the licensee's radiation protection and safety programs were reviewed on a monthly basis. The other areas mentioned above, as well as major facility documents and plans, were reviewed annually. The inspector noted that the audits and the resulting findings were adequately documented and that the licensee responded and took corrective actions to the findings as needed.

(2) Change Control Functions

Through review of applicable records and interviews with licensee personnel, the inspector determined that various modifications and changes had been initiated at the facility since the last NRC operations inspection. Some of the recent changes included changes to the Period Amplifier output circuit and initiating a new experiment involving a Bismuth Reflector.

The inspector verified that the licensee was following the established change control program and that the required reviews and approvals of the changes had been completed by the RSC, if required, prior to implementation. It was noted that the change control procedure had been revised to help licensee personnel determine whether or not a full safety evaluation was required when a change was proposed. The procedure incorporated screening criteria for this purpose. The licensee determined that none of the changes that had been proposed to date met the criteria of 10 CFR 50.59(c)(2) paragraphs (i) through (viii) which would require NRC approval of the changes.

c. Conclusions

Review and audit functions required by TS 6.2 were acceptably completed by the RSC. The 10 CFR 50.59 process for reviewing and approving changes at the facility was being followed as required and no recent changes required NRC approval.

3. Radiation Protection

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," and TSs 3.4, 4.2.3, 5.4, 6.6, and TS 6.7.2:

- UWNR dosimetry records for 2014 through the present
- Radiological signs and posting in various areas of the facility
- Monthly Operation Summary Reports for 2014 through the present
- Monthly Health Physics Nuclear Reactor Audits and Reports for 2014 through the present
- Annual ALARA Audits, also known as Annual Radiation Safety Audits, dated February 3, 2015, and January 20, 2016
- Calibration and periodic check records for radiation monitoring instruments
- Various Radiation Protection and ALARA Program documents
- UW Environmental Health and Safety Department manual entitled "Radiation Safety for Radiation Workers," 2005 Edition (available online)
- Various UWNR Procedure Forms including: No. 031 "Procedure for Facility Familiarization," Rev. 3; and, No. 100, "Surveillance Activities," Rev. 57
- Various UWNR Procedures including: No. 117, "Air Monitor Operating Procedure," Rev. 23; No. 118, "Area Radiation Monitor Operating Checks," Rev. 2; No. 171, "Air Monitor Calibration and Records," Rev. 32; No. 172, "Sampling and Calculation Procedure - Air Particulate Activity Samples," Rev. 17; and, No. 177, "Procedure for Use and Calibration of Health Physics Instruments," Rev. 27
- UWNR Annual Operating Reports for the past two years

The inspector also toured the licensee's facility and interviewed staff members as well.

b. Observations and Findings

(1) Surveys

The inspector reviewed monthly radiation and contamination surveys of licensee-controlled areas completed by UW Environmental Health and Safety (EH&S) Division personnel. The inspector also reviewed various weekly monitor checks and monthly general area radiation and contamination surveys conducted by reactor staff personnel. The various periodic contamination and radiation surveys had been completed within the prescribed time frame required by procedure. Survey results were evaluated to ensure that established action levels had not been exceeded. If items or areas were found to be contaminated, they would be immediately decontaminated and resurveyed.

In addition to reviewing the various surveys and evaluating the results, the inspector conducted an independent radiation survey of various areas of the facility. The radiation levels noted by the inspector were similar to those found by UW EH&S personnel and the licensee. No anomalies or problems were noted.

(2) Postings and Notices

During tours of the facility, the inspector observed that caution signs and postings were in place. It was also noted that restrictions established for the controlled areas were acceptable for the hazards involving radiation, high radiation, and contamination and were posted as required by 10 CFR Part 20, Subpart J, "Precautionary Procedures."

Copies of current notices to workers were posted in various areas in the facility. The copies of NRC Form 3, "Notice to Employees," noted at the facility were the latest issue and were posted in various areas throughout the facility as required by 10 CFR 19.11, "Posting of notices to workers."

(3) Dosimetry

The inspector determined that the licensee used optically-stimulated luminescent dosimeters (OSLs) for whole body monitoring of beta and gamma radiation exposure with an additional component to measure neutron radiation. The licensee also used thermoluminescent dosimeter (TLD) finger rings for monitoring beta and gamma radiation exposure of the extremities. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program accredited vendor. Through direct observation the inspector determined that dosimetry was acceptably used by facility personnel and was in accordance with facility radiation protection requirements. Examination of the OSL and TLD results indicating radiological exposures at the facility for the past three

years showed that the highest occupational doses were well within 10 CFR Part 20 limitations.

(4) Radiation Monitoring Equipment

Calibration frequency met procedural and/or TS requirements and records were maintained as required. The inspector verified that the instruments that were stationed for use in the Reactor Bay and in adjacent labs had been calibrated and were within the allowed calibration interval.

(5) Radiation Protection Program

The licensee's Radiation Protection Program was set forth in the UW EH&S Division manual entitled "Radiation Safety for Radiation Workers," 2005 Edition, which was available in hard copy form and also maintained and available on-line. The program included requirements that all personnel who performed work in association with radioactive material were to receive training in radiation protection, policies, procedures, requirements, and facilities.

(6) ALARA Program

The ALARA Program was also outlined and established in the UW EH&S Division manual, "Radiation Safety for Radiation Workers," and in various UWNR laboratory guidance documents and procedures. The ALARA program provided guidance for keeping doses ALARA and was consistent with the guidance in 10 CFR Part 20.

(7) Radiation Protection Training

As noted above, people who handled radioactive material, including licensee personnel, were required to receive training in radiation protection. This was accomplished by staff members attending a class, reading the manual, and successfully passing a written examination. Completion of this training by reactor staff personnel was verified by EH&S Division personnel as well as by the Reactor Director and/or the Reactor Supervisor. Radiation protection refresher training was being conducted annually.

(8) Tours of the Facility

The inspector toured the licensee's facility and observed the use of dosimetry and radiation monitoring equipment. In addition, licensee personnel, accompanied by the inspector, conducted a familiarization tour of the UW Nuclear Reactor Laboratory for the NRC Resident and Senior Resident Inspectors from the Byron and LaSalle Nuclear Power Stations.

The tour was informative and allowed the Resident Inspectors to become acquainted with facility personnel and the facility layout.

c. Conclusion

The inspector determined that the Radiation Protection and ALARA Programs 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.

4. 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 TSs 3.4, 4.2.3, 5.4, 6.6, 6.7.1, and TS 6.7.2:

- Liquid release records for the period from 2014 through the present
- Airborne release records documented in the UWNR Laboratory Monthly Operations Summary Reports provided to the RSC for the period from November 2014 to the present
- UWNR Procedure Form No. 100, "Surveillance Activities," Rev. 57, – forms for the period from Dec. 2014 to the present
- Various UWNR Procedures including: No. 100 B, "Solid Waste Disposal Record, Rev. 3; No. 100C, "Procedure for Gross Gamma Counting of Water Samples," Rev. 22; No. 109, "Procedure for Liquid Waste Disposal," Rev. 27; No. 117, "Air Monitor Operating Procedure," Rev. 23; No. 118, "Area Radiation Monitor Operating Checks," Rev. 2; No. 171, "Air Monitor Calibration and Records," Rev. 32; and, No. 172, "Sampling and Calculation Procedure - Air Particulate Activity Samples," Rev.17
- Computer folder "Manual of Administrative Policies, Protocols, and Programs- MAPPP," File name "Environmental Monitor Program," last updated December 22, 2015
- Computer folder "Manual of Administrative Policies, Protocols, and Programs- MAPPP," subfolder name "Environmental TLD Map Files," last updated February 2, 2015
- Documentation of atmospheric dose calculations using the Environmental Protection Agency COMPLY program version 1.6, dated June 15, 2007, revised Sept. 13, 2007
- UWNR Laboratory Form entitled "UWNR 109A.xls form, Liquid Waste Disposal Spreadsheet," showing calculations of the amount of radioactivity in liquid waste
- UWNR Annual Operating Reports for the past two years

b. Observation and Findings

The inspector reviewed the calibration records of the area radiation monitors and the stack monitoring system. These systems had been calibrated annually according to procedure. The weekly start-up check records for the monitoring equipment were also reviewed. The checks were completed as required by procedure.

The inspector reviewed the records documenting liquid releases to the sanitary sewer for the past 2 years. The inspector determined that a senior reactor operator approved liquid releases after analyses indicated that the releases would meet regulatory requirements for discharge. The inspector also reviewed the records documenting the disposal of solid waste for the past 2 years. Solid waste was surveyed, characterized, and transferred to the UW EH&S Radiation Safety Department for disposal. The releases and transfers were accomplished in accordance with procedure and the results of the releases and waste transfers were acceptably documented in the operating log records as well as in the Annual Operating Reports as required.

On-site and off-site gamma radiation monitoring was accomplished using various environmental OSL dosimeters in accordance with the applicable procedures. The OSL dosimetry data indicated that doses to the public did not exceed any regulatory limits. These results were also acceptably reported in the Annual Operating Reports for fiscal years 2013-2014 and 2014-2015, as required by TS 6.7.1.

c. Conclusion

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

5. Transportation

a. Inspection Scope (IP 86740)

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

- Selected records of radioactive material transfers for 2014 to the present
- Various UWNR Procedures including: No. 005, "UWNR Administrative Guide," Rev. 60; No. 023, "Procedure for Receipt of Radioactive Material Shipments," Rev. 6; and, No. 131, "Production of Radioisotopes in Nuclear Reactor," Rev. 21
- Various UWNR Procedure Forms including: No. 100B, "Solid Waste Disposal Record," Rev. 3; No. 130, "Request for Isotope Production," Rev. 17; and, No. 134, "Request and Authorization for Services of the UW Reactor," Rev. 3

b. Observations and Findings

Records showed that radioactive material produced in the reactor and destined to be shipped off site was typically transferred to UW Central Ordering, Receiving, and Distribution Office (CORD) through the UW EH&S Division. Material transfers were documented on UWNR Procedure Form No. 130, "Request for Isotope Production." This radioactive material was then shipped by CORD under the campus's State broad scope license, State of Wisconsin Department of Health and Family Services, Radioactive Materials License No. 25-1323-01, Amendment No. 292, expiration date July 31, 2018.

Radioactive material to be used on campus by UW authorized personnel was also transferred to the broad scope license and distributed by CORD. A list of UW authorized personnel was maintained by the licensee and documented on UWNR Procedure Form No. 134, "Request and Authorization for Services of the UW Reactor." The program for radioactive material transfer and transport was consistent with license and procedural requirements. The documents indicated the transfer of material had been signed for by UW EH&S personnel and distributed to authorized individuals as required. The other radioactive material produced in the reactor was maintained under the reactor license for use in laboratories and used for re-irradiation or held for decay.

Although radioactive material was not typically shipped from the facility under the reactor license, both the Reactor Director and the Reactor Supervisor were qualified shippers. The inspector verified that they had received the appropriate training and the training was current.

c. Conclusion

Radioactive material produced in the reactor was typically either transferred to the campus broad scope license and shipped under the auspices of that license or transferred to other authorized users on campus. On occasion the material was maintained at the reactor facility for use in laboratories in accordance with procedure.

9. Exit Meeting Summary

The inspection scope and results were summarized on July 21, 2016, with licensee representatives. The inspector discussed the findings for each area reviewed. The licensee acknowledged the results of the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

R. Agasie	Reactor Director
C. Edwards	Reactor Supervisor
R. Deyoe	Auxiliary Operator/RO Candidate
Z. Fiscus	Auxiliary Operator/RO Candidate
A. Gross	Reactor Operator
A. Maile	Reactor Operator
J. Quincy	Auxiliary Operator/RO Candidate
K. Zander	Auxiliary Operator/RO Candidate

Other Personnel

B. Timilsina	Assistant Radiation Safety Officer, Radiation Safety Department, UW Environmental, Health, and Safety Division
T. Yadro	Health Physicist, Radiation Safety Department, UW Environmental, Health, and Safety Division

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

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ALARA	As Low As Reasonably Achievable
CORD	(UW) Central Ordering, Receiving, and Distribution (Office)
EH&S	Environmental Health and Safety
IP	Inspection Procedure
No.	Number
NRC	U.S. Nuclear Regulatory Commission
OSL	Optically-Stimulated Luminescent
Rev.	Revision
RSC	Reactor Safety Committee
TLD	Thermoluminescent dosimeter
TS	Technical Specifications
UW	University of Wisconsin
UWNR	University of Wisconsin Nuclear Reactor