May 22, 2018

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. 50-156/2018-202

Dear Mr. Agasie:

From April 16-18, 2018, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the University of Wisconsin Nuclear Reactor Laboratory. The enclosed report documents the inspection results which were discussed on April 19, 2018, 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 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 <a href="http://www.nrc.gov/reading-rm/adams.html">http://www.nrc.gov/reading-rm/adams.html</a> (the Public Electronic Reading Room).

If you have any questions concerning this inspection, please contact Craig Bassett at (240) 535-1842 or by electronic mail at <u>Craig.Bassett@nrc.gov</u>.

Sincerely,

#### /**RA**/

Anthony J. Mendiola, Chief Research and Test Reactors Oversight Branch Division of Licensing Projects Office of Nuclear Reactor Regulation

Docket No. 50-156 License No. R-74

Enclosure: As stated

cc: See next page

#### University of Wisconsin

CC:

Mayor of Madison City Hall 210 Martin Luther King Jr. Boulevard Room 403 Madison, Wisconsin 53703

Chairman, Public Service Commission of Wisconsin 610 North Whitney Way Madison, WI 53707-7854

Paul Schmidt, Manager Radiation Protection Section Division of Public Health Wisconsin Department of Health Services P.O. Box 2659 Madison, WI 53701-2659

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

Jason Timm, Assistant Director & Radiation Safety Officer University of Madison - Wisconsin Department Environmental Health & Safety Environmental Protection and Safety Bldg. 30 E. Campus Mall Madison, WI 53715

# R. Agasie

SUBJECT: UNIVERSITY OF WISCONSIN – U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 50-156/2018-202 DATE: MAY 22, 2018

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# U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Docket No:	50-156
License No:	R-74
Report No:	50-156/2018-202
Licensee:	University of Wisconsin
Facility:	Nuclear Reactor Laboratory
Location:	Madison, WI
Dates:	April 16 – 18, 2018
Inspector:	Craig Bassett
Approved by:	Anthony J. Mendiola, Chief Research and Test Reactors Oversight Branch Division of Licensing Projects Office of Nuclear Reactor Regulation

### **EXECUTIVE SUMMARY**

#### University of Wisconsin - Madison Nuclear Reactor Laboratory Report No. 50-156/2018-202

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Wisconsin (UW or the licensee's) 1 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 Design Change Functions

- The review and audit functions required by TS Section 6.2 were being acceptably completed by the Reactor Safety Committee (RSC).
- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests and experiments," 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 (ALARA) Program were being acceptably implemented.

#### Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements.
- Releases were within the specified regulatory and TS 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 UW (or the licensee) continued to operate the 1 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 operated several hours per day on Monday and Wednesday, at varying power levels, in support of training and sample irradiations.

#### 1. Organizational Structure and Staffing

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

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

- Management responsibilities stipulated in the TSs
- 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 2017 and to date in 2018
- UW Nuclear Reactor (UWNR) Procedure Number (No.) 001, "Standing Operating Instructions," Revision (Rev.) 16
- "The University of Wisconsin Nuclear Reactor Laboratory Fiscal Year 2015 – 2016 Annual Operating Report," for the period from July 2015 through June 2016, submitted to the NRC on July 29, 2016
- "The University of Wisconsin Nuclear Reactor Laboratory Fiscal Year 2016 – 2017 Annual Operating Report," for the period from July 2016 through June 2017, submitted to the NRC on July 17, 2017

#### b. Observations and Findings

Through discussions with licensee representatives, it was noted that management responsibilities and the organization at the UWNR Laboratory had not changed since the previous NRC inspection of radiation protection in July 2016 (Inspection Report No. 50-156/2016-202). 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 were currently two full-time staff members working at the facility, the Reactor Director and the Reactor Supervisor. There were also three students working part-time at the facility as reactor operators and four students working part-time as operator trainees.

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 TSs.

### **Conclusion**

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

### 2. Review and Audit and Design Change Functions

#### a. Inspection Scope (IP 69001)

In order to verify that the reviews and audits required by TS Section 6.2 had been completed by the RSC, and to determine whether modifications to the facility were consistent with 10 CFR 50.59 the inspector reviewed:

- RSC meeting minutes from November 2016 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 2016, 2017, and to date in 2018
- Audits completed by operations staff personnel documented in monthly reports submitted to the RSC entitled "Monthly Operations Summary," for 2016, 2017, and to date in 2018
- Annual ALARA audits (also known as Annual Radiation Safety Audits) of the facility Radiation Protection Program for the past 2 years completed by personnel delegated that responsibility by the RSC
- UWNR Procedure No. 005, "UWNR Administrative Guide," Rev. 61
- UWNR Procedure No. 019, "Changes, Tests, and Experiments," Rev. 4
- UWNR Procedure No. 020, "UWNR Modification Checklist," Rev. 2
- Experiment Modification Questionnaire, "RSC 1287, Irradiation of Radiation Tolerant Camera in UWNR," dated November 22, 2016, with the associated Safety Evaluation No. 3, and RSC approval dated November 30, 2016
- UWNR Modification Checklist, "RSC 1299, Replacement of Control Element Drop Timer," dated May 11, 2017, with the associated Safety Screening dated May 10, 2017, and RSC approval dated May 25, 2017
- Experiment Modification Questionnaire, "RSC 1296, Advanced Instrumentation Testing in UWNR," dated May 9, 2017, with the Safety Evaluation No. 4, dated May 9, 2017, and senior reactor operator (SRO) approval dated December 20, 2017, and RSC approval dated May 25, 2017
- Experiment Modification Questionnaire, "RSC 1317, Micro Pocket Fission Detector Assemblies," dated December 6, 2017, with the associated Safety Evaluation No. 5, and RSC approval dated December 20, 2017
- UWNR Annual Operating Reports for the past 2 years

### b. <u>Observations and Findings</u>

(1) Review and Audits Functions

The inspector reviewed the minutes of the RSC meetings from November 2016 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 the 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 one modification had been initiated at the facility and three new or modified experiments had been proposed since the last NRC inspection.

The inspector verified that the licensee was following their 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. The licensee determined that, although three of the changes required a safety evaluation, none met the criteria of 10 CFR 50.59(c)(2) paragraphs (i) through (viii) which would require NRC approval of the changes.

### c. <u>Conclusions</u>

Review and audit functions required by TS Section 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 TS Sections 3.7 and 4.7:

- UWNR dosimetry records for 2016 through the present
- Radiological signs and posting in various areas of the facility

- Monthly Operation Summary Reports for 2016 through the present
- Monthly Health Physics Nuclear Reactor Audits and Reports for 2016 through the present
- Annual ALARA Audits, also known as Annual Radiation Safety Audits, dated January 20, 2016, January 23, 2017, and January 19, 2018
- Calibration and periodic check records for radiation monitoring instruments
- Various Radiation Protection and ALARA Program documents
- UW Environmental Health and Safety (EH&S) Department manual entitled "Radiation Safety for Radiation Workers," 2005 Edition (available online)
- Various UWNR Procedure Forms including: No. 031 "Procedure for Facility Familiarization," Rev. 5; and, No. 100, "Surveillance Activities," Rev. 57
- Various UWNR Procedures including: No. 117, "Air Monitor Operating Procedure," Rev. 24; 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. 28
- 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 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 accompanied reactor staff members during routine radiation and contamination surveys of the controlled areas of the facility. The inspector also conducted an independent radiation survey of these areas. The radiation levels noted by the inspector were similar to those found by licensee staff personnel. 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 years showed that the highest occupational doses were well within 10 CFR Part 20 limitations. (Since the campus Radiation Safety Department initiated a program to process reactor staff dosimetry on a quarterly basis, no data was available for the current year [2018].)

(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. The inspector verified that all reactor staff members had completed the initial and all subsequent training as required.

(8) Tours of the Facility

On various occasions during the inspection, the inspector toured the licensee's facility and observed the use of dosimetry and radiation monitoring equipment. No problems were noted.

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 TS Sections 3.7 and 4.7:

- Liquid release records for the period from 2016 through the present
- Airborne release records documented in the UWNR Laboratory Monthly Operations Summary Reports provided to the RSC for the period from November 2016 to the present
- UWNR Procedure Form No. 100, "Surveillance Activities," Rev. 57, forms for the period from December 2016 to the present
- Various UWNR Procedures including: No. 100 B, "Solid Waste Disposal Record, Rev. 4; No. 100C, "Procedure for Gross Gamma Counting of Water Samples," Rev. 23; No. 109, "Procedure for Liquid Waste Disposal," Rev. 27; No. 117, "Air Monitor Operating Procedure," Rev. 24; 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 March 27, 2018

- 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 September 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 2 years

# b. <u>Observation and Findings</u>

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 SRO 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 2015-2016 and 2016-2017, as required by TS Section 6.7.1.

c. <u>Conclusion</u>

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

### 5. Transportation of Radioactive Materials

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 2016 to the present

- Various UWNR Procedures including: No. 005, "UWNR Administrative Guide," Rev. 61; 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. 4; 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 (generally isotopes) 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. If radioactive waste was to be shipped, the material was transferred to the UW EH&S Radiation Safety Department and then would be shipped off for disposal as noted above.

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. <u>Conclusion</u>

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.

# 6. Exit Meeting Summary

The inspection scope and results were summarized on April 19, 2018, 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

- T. Adams Auxiliary Operator/RO Candidate
- R. Agasie Reactor Director
- C. Edwards Reactor Supervisor T. DeGuire Auxiliary Operator/RO Can
- T. DeGuire Auxiliary Operator/RO Candidate
- Z. Fiscus Reactor Operator
- J. Masse Auxiliary Operator/RO Candidate
- T. Montenegro Auxiliary Operator/RO Candidate
- J. Quincy Reactor Operator
- K. Zander Reactor Operator

#### Other Personnel

J. Rusch 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

<u>Opened</u>

None

#### <u>Closed</u>

None

### LIST OF ACRONYMS USED

10 CFR	Title 10 of the Code of Federal Regulations
ALARA	As Low As Reasonably Achievable
CORD	Central Ordering, Receiving, and Distribution
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
SRO	Senior Reactor Operator
TLD	Thermoluminescent dosimeter
TS	Technical Specification
UW	University of Wisconsin
UWNR	University of Wisconsin Nuclear Reactor