

July 22, 2016

Dr. Howard Gillman
Executive Vice Chancellor
University of California - Irvine
Irvine, CA 92697-2025

SUBJECT: UNIVERSITY OF CALIFORNIA – IRVINE, U.S. NUCLEAR REGULATORY
COMMISSION ROUTINE INSPECTION REPORT NO. 50-326/2016-202

Dear Dr. Gillman:

From June 14-16, 2016, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the University of California - Irvine Nuclear Reactor Facility. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

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 selective examinations of procedures and records, observed various activities, and interviewed various personnel. Based on the results of this inspection, no safety concern or noncompliance of requirements was 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 Publicly Available Records component of 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).

H. Gillman

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Should you have any questions concerning this inspection, please contact Johnny Eads at 301-415-0136 or by electronic mail at Johnny.Eads@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. 50-326
License No. R-116

Enclosure:
As stated

cc: w/enclosure: See next page

University of California - Irvine

Docket No. 50-326

cc:

Dr. Reginald M. Penner, Chair
Department of Chemistry
University of California, Irvine
Irvine, CA 92697-2025

Dr. George E. Miller
Department of Chemistry
University of California, Irvine
Irvine, CA 92697-2025

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

H. Gillman

- 2 -

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

Docket No. 50-326

License No. R-116

Report No. 50-326/2016-202

Licensee: The Regents of the University of California

Facility: University of California - Irvine
Nuclear Reactor Facility

Location: Department of Chemistry
University of California, Irvine
Irvine, CA

Dates: June 14-16, 2016

Inspector: Johnny Eads

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 California - Irvine
Nuclear Reactor Facility
NRC Inspection Report No. 50-326/2016-202

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of California - Irvine Class II research reactor facility safety programs including: (1) procedures; (2) experiments; (3) radiation protection program; (4) effluent and environmental monitoring; (5) committees, audits and reviews; (6) design change functions; and (7) transportation. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with Nuclear Regulatory Commission (NRC) requirements.

Procedures

- Facility procedural review, revision, and implementation satisfied technical specification (TS) requirements.

Experiments

- Experiments were being reviewed and performed in accordance with TS requirements and the licensee's written procedures.

Radiation Protection Program

- Surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present.
- Postings and Notices met the regulatory requirements specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection Against Radiation."
- Personnel dosimetry was being worn as required, and doses were well within the licensee's procedural action levels and NRC's regulatory limits.
- The Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.

Effluent and Environmental Monitoring

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

Design Changes

- The changes were reviewed and approved by the Reactor Operations Committee as required.

Committees, Audits and Reviews Functions

- The Reactor Operations Committee provided the oversight required by the TSs.
- Annual audits of facility programs were being completed as required.

Transportation

- The licensee's program for transportation of radioactive material including preparing packages for shipment and completing shipping papers was acceptable.

REPORT DETAILS

Summary of Facility Status

The University of California - Irvine (UCI) Nuclear Reactor Facility (NRF) 250 kilowatt TRIGA Mark-I research reactor continued to be operated in support of graduate and undergraduate research and laboratory instruction. During the inspection, the reactor was operated in support of ongoing work and research.

1. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify that the licensee was complying with the requirements of Technical Specifications (TSs) 6.2, 6.3, and 6.7:

- Records of procedure changes
- Observation of procedure implementation
- Administrative controls as outlined in UCI NRF Standard Operating Procedure (SOP) No. 1, "Introduction," Revision (Rev.) 3.2, approval dated January 2010
- UCI NRF SOP No. 5, "Radiological Safety Program," Rev. 3.2, approval dated December 2009
- TS for the UC Irvine TRIGA Mark I Nuclear Reactor, Revised October 2007
- UCI Letter, Reply to Violation, dated February 14, 2012

b. Observations and Findings

The inspector reviewed the licensee's written procedures and revisions to procedures. The SOP manual was organized to address the full scope of activities conducted at the UCI NRF. The inspector noted that procedural changes were being reviewed and approved by the Reactor Operations Committee (ROC) as required by TS. Training of personnel on procedures and changes was acceptable. Through observation of various activities at the facility, including reactor operation, the inspector determined that licensee personnel conducted activities in accordance with applicable procedures.

Review of ROC meeting minutes and discussions with the licensee indicated the request and approval of procedure changes for operating procedures were documented.

The inspector also reviewed a previously identified violation related to failure to remain at the controls while the reactor was not secured (50-326/2011-201-01). The licensee's reply to the violation including corrective actions were submitted by letter dated February, 14, 2012. Corrective actions included training for licensed reactor personnel and procedure updates. Based on a review of the completed corrective actions and interviews with involved personnel, this violation is closed.

Enclosure

c. Conclusions

The inspector determined that the procedural review, revision and implementation satisfied TS requirements.

2. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with TS 3.8:

- TS for the UC Irvine TRIGA Mark I Nuclear Reactor, Revised 1998
- UCI NRF SOP Section 2, Experiments, Rev. 3, Approved 2000
- Experiment Performance File, January 1, 2015 to present
- Select UCI Irradiation Requests for 2015 and 2016

b. Observations and Findings

The UCI NRF has experimental procedures approved for a broad class of applications. The mission of the UCI NRF is primarily to provide irradiation services to researchers and educational laboratory instruction; new experiments are uncommon. A new approved experimental procedure was created specifically for classroom applications. The goal is to separate laboratory activities from classroom activities. The experimental procedures are typically reviewed by the ROC.

During the inspections, irradiations were conducted in support of ongoing research. The inspector reviewed how experiments are performed in order to verify compliance with the TS and procedures. Additionally, from a random sampling of forms for experiments performed since the previous inspection, the inspector found that experiments were being reviewed and performed in accordance with TS requirements and the licensee's written procedures.

c. Conclusions

Experiments were being reviewed and performed in accordance with TS requirements and the licensee's written procedures.

3. Radiation Protection Program

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with Title 10 of the *Code of Federal Regulations* (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 3.3 and 4.5 requirements:

- Radiation and contamination surveys completed by reactor staff personnel
- Radiation and contamination surveys completed by Environmental Health and Safety (EHS) personnel
- UCI Nuclear Reactor Facility dosimetry records for 2015 through the present
- UCI NRF SOP No. 5, "Radiological Safety Program," including the following:
 - Section 5.1, "Personnel Responsibilities and Actions," Rev. 3, approval dated March 2000
 - Section 5.2, "Radiation Monitoring Program," Rev. 3.2, approval dated December 2009
 - Section 5.4, "Alert Levels," Rev. 3, approval dated March 2000
 - Section 5.5, "Surveillance and Calibration of Monitoring Instrumentation," Rev. 3.2, approval dated July 2007

The inspector interviewed licensee personnel, and radiological signs and postings were observed.

b. Observations and Findings

(1) Surveys

The inspector reviewed monthly radiation and contamination surveys of the licensee controlled areas conducted by the licensee staff and quarterly radiation and wipe surveys completed by campus EHS Health Physics personnel. The results of the licensee staff surveys were documented on the forms and entered into a Reactor Health Physics notebook. The results of EHS surveys were documented on survey maps and forms, reviewed as required, and forwarded to the licensee for information.

(2) Postings and Notices

The inspector reviewed the postings at the entrances to the facility controlled areas including the Control Room, the Reactor Room, and the two laboratories in the NRF. The postings were acceptable and indicated the radiation hazards present. The facility's radioactive material storage areas were noted to be properly posted.

Copies of notices to workers required by 10 CFR Part 19 were posted as required. Copies of NRC Form-3, "Notice to Employees," facility were posted in various areas throughout the facility. These locations included the bulletin board in the Outer Office/Counting Room leading to the Control Room and in the Control Room.

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 and other controlled areas.

(3) Dosimetry

The licensee used thermoluminescent dosimeters (TLDs) for whole body monitoring of beta and gamma radiation exposure with an additional component to measure neutron radiation. The licensee used TLD finger rings for extremity monitoring.

Dosimetry was issued to staff and visitors as outlined in licensee procedures. The issuing criteria met or exceeded the requirements of 10 CFR 20.1502, "Conditions requiring individual monitoring of external and internal occupational dose," for individual monitoring. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program accredited vendor, Miron Technologies. Through direct observation, the inspector determined that dosimetry was acceptably used by facility personnel and exit frisking practices were in accordance with facility radiation protection requirements.

An examination of the TLD monitoring results indicating radiological exposures at the facility for the past two years through the present showed that the highest occupational doses, as well as doses to the public, were well within 10 CFR Part 20 limitations. The records showed that the highest annual whole body exposure and the highest annual extremity exposure received by a facility employee in 2015 were well within the regulatory limits.

(4) Radiation Protection Program

The licensee's Radiation Protection Program was established in the UCI Nuclear Reactor Facility SOP No. 5, "Radiological Safety Program." The program was further explained in the campus document entitled, "UCI Radiation Safety Manual," latest revision dated January 2009. The program required that all personnel who had unescorted access to work in a radiation area or with radioactive material receive training in radiation protection, policies, procedures, requirements, and facilities prior to entry. The inspector verified that licensee staff had received the required radiation protection ("rad worker") training given by the UCI Office of Environmental Health and Safety.

The inspector determined that the UCI EHS office had completed an annual review of the radiation protection program in accordance with 10 CFR 20.1101(c), "Radiation protection programs," for 2015 as required. This was accomplished by the campus Radiation Safety Officer.

(5) As Low As Reasonably Achievable (ALARA) Policy

The ALARA Policy was also outlined and established in the UCI Nuclear Reactor Facility SOP No. 5, "Radiological Safety Program," and in other campus documents. The ALARA program provided guidance for keeping doses ALARA and was consistent with the guidance in 10 CFR Part 20.

(6) Facility Tours

The inspector toured the Control Room, the Reactor Room, the Pneumatic Tube Laboratory and the Preparation Laboratory within the NRF. Control of radioactive material and control of access to radiation and high radiation areas were acceptable. The postings and signs for these areas were appropriate.

c. Conclusions

The inspector determined that the Radiation Protection and ALARA Programs, as implemented by the licensee, satisfied regulatory requirements because: (1) surveys were completed and documented acceptably to permit evaluation of the radiation hazards present; (2) postings met regulatory requirements; (3) personnel dosimetry was being worn as required and recorded doses were within the NRC's regulatory limits; (4) radiation survey and monitoring equipment was being maintained and calibrated as required; (5) the Radiation Protection and ALARA Programs satisfied regulatory requirements; and, (6) the radiation protection training program was acceptable.

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 3.3 and 3.5:

- Facility radioactive effluent releases and liquid and solid waste disposal documented in the UCI Nuclear Reactor Facility Annual Report for the period from July 1, 2014 through and June 30, 2015
- UCI NRF SOP No. 5, "Radiological Safety Program," Section 5.6, "Radioactive Effluent Release Assessment," Rev. 3, approval dated March 2000
- UCI NRF SOP No. 5, "Radiological Safety Program," Section 5.7, "Radioactive Waste Procedure," Rev. 3, approval dated March 2000

b. Observation and Findings

Gaseous releases were monitored as required by TS, calculated as prescribed by procedure, and acceptably documented. The results indicated that the releases were well within Appendix B, Table 2 concentrations, and TS limits. To demonstrate compliance with the annual dose constraints of 10 CFR 20.1101 paragraph (d), the licensee used the computational method specified in UCI NRF SOP No. 5, Section 5.6.

The licensee had released liquid from the facility, but only by transferring it to the Campus EHS Office under the State of California Radioactive Material License. Solid radioactive waste was also transferred to the Campus EHS Office. The liquid and solid waste was then stored, handled, and/or disposed of in accordance with the State license requirements.

c. Conclusion

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

5. Committees, Audits, and Reviews

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the review and audit functions stipulated in the TS, as well as the 10 CFR 50.59, "Changes, tests and experiments," review functions, were being met:

- Safety review and audit records for the past two years
- ROC meeting minutes from January 2015 to the present
- UCI NRF SOP No. 1, "Introduction," Rev. 3.2, approval dated January 2010
- UCI Nuclear Reactor Facility Annual Report for the period from July 1, 2014 through June 30, 2015

b. Observations and Findings

The ROC membership satisfied TS requirements and the licensee's procedural rules. The ROC had semiannual meetings as required with a quorum being present at those meetings. Review of the committee meeting minutes indicated the ROC provided appropriate guidance and direction for reactor operations, and ensured suitable use and oversight of the reactor.

The review and audit function of the ROC stipulated in TS 6.2 was fulfilled by EHS personnel as they conducted their surveys and walk-through tours of the facility. This was reported to the ROC through the EHS Report given during the semiannual ROC meetings. Since the last inspection all required audits of reactor facility activities and reviews of programs, procedures, and facility operations had been completed and documented.

c. Conclusions

The review and audit program was being conducted acceptably by the ROC.

6. Design Change Functions

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to verify compliance with the regulatory requirements of 10 CFR 50.59:

- UCI Nuclear Reactor Facility Annual Report for the period from July 1, 2014 through and June 30, 2015
- UCI NRF SOP Nos. 1-3, "Implementation of Standard Operating Procedures and Facility Changes," Rev. 3.2, approved January 2010.

b. Observations and Findings

Facility changes or modifications were reviewed by the ROC and documented in the committee's meeting minutes. Changes were controlled by requiring a staff evaluation and an ROC review. It was noted that SOP 1 had been revised to outline the change initiation and approval process. Completion of the changes or modifications was documented on forms that had been developed for that purpose and recorded in the Reactor Operations Logbook, which was also used to document maintenance activities at the facility. The inspector noted that various changes or modifications had been initiated by the licensee and subsequently approved by the ROC as required. The documentation and information concerning these changes and modifications were acceptable. Through this review, the inspector verified that the design change process at the facility was functioning as required and was acceptable for the current operation and staffing of the facility.

c. Conclusions

The licensee's design change protocol was in place and was being implemented as required.

7. Transportation

a. Inspection Scope (IP 86740)

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

- Records of radioactive material shipments for 2013 through the date of this inspection
- UCI NRF SOP No. 5, "Radiological Safety Program," Section 5.10, "Transportation of Radioactive Material," Rev. 3.1, approval dated May 2005

The inspector also interviewed licensee and EHS personnel.

b. Observations and Findings

The transportation of radioactive material was reviewed. Through records review and discussions with licensee personnel, the inspector determined that the licensee had made various shipments of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The records also indicated that the shipping containers used were appropriate and had the appropriate markings as required. All radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation and NRC regulatory requirements.

The inspector also reviewed a previously identified violation for failure to complete the required Hazardous Material Employee Training pursuant to 10 CFR 71.5(a)(1)(vi) "Transportation of licensed material." Corrective actions included completing recurrent

Hazardous Material Employee Training for all individuals responsible for radioactive material shipping. Based on a review of this training and the documentation of subsequent material shipments, this violation (50-326/2011-201-02) is closed.

c. Conclusions

Radioactive material was shipped in accordance with licensee procedures and the applicable regulations. Staff personnel assigned to ship radioactive material had received the proper training as required as required.

8. Exit Interview

The inspection scope and results were summarized on June 16, 2016, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

A. J. Shaka Reactor Director
J. Wallick Associate Reactor Supervisor

Other Personnel

G. Bosgraaf UCI Radiation Safety Officer
R. Dendo UCI Health Physicist

INSPECTION PROCEDURES USED

IP 69001 Class II Research and Test Reactors
IP 86740 Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-326/2011-201-01 VIO Failure to remain at the controls while the reactor was not secured.

50-326/2011-201-02 VIO Failure to complete the required Hazardous Material Employee Training per 10 CFR 71.5(a)(1)(vi).

Discussed

None

PARTIAL LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
EHS	Environmental Health and Safety
EP	Emergency Plan
IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
NRF	Nuclear Reactor Facility
ROC	Reactor Operations Committee
SOP	Standard Operating Procedure
TLD	Thermoluminescent Dosimeter
TS	Technical Specification
UCI	University of California - Irvine
UCI NRF	University of California - Irvine Nuclear Reactor Facility