



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 19, 2019

Dr. Howard Gillman, Chancellor
University of California – Irvine
510 Aldrich Hall
Irvine, CA 92697-1900

SUBJECT: UNIVERSITY OF CALIFORNIA IRVINE – U.S. NUCLEAR REGULATORY
COMMISSION ROUTINE INSPECTION REPORT NO. 50-326/2018-201

Dear Dr. Gillman:

From June 26-28, 2018, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the University of California (UC) - Irvine Nuclear Reactor Facility. The enclosed report presents the results of that inspection, which were discussed on June 28, 2018, with members of UC Irvine staff.

The inspection examined activities conducted under UC Irvine license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of UC Irvine license. The inspector reviewed selective procedures and records, observed various activities, and interviewed 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 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).

Should you have any questions concerning this inspection, please contact Mr. Johnny H. 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 Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-326
License No. R-116

Enclosure:
As stated

H. Gillman

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cc: w/enclosure: See next page

University of California - Irvine

Docket No. 50-326

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SUBJECT: UNIVERSITY OF CALIFORNIA IRVINE – U.S. NUCLEAR REGULATORY
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MARCH 19, 2019

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

Docket No.: 50-326

License No.: R-116

Report No: 50-326/2018-201

Licensee: The Regents of the University of California

Facility: University of California - Irvine
Nuclear Reactor Facility

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

Dates: June 26-28, 2018

Inspector: Johnny Eads

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

Enclosure

EXECUTIVE SUMMARY

University of California - Irvine
Nuclear Reactor Facility
NRC Inspection Report No. 50-326/2018-201

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) health physics; (4) design changes; (5) committees, audits and review and (6) transportation of radioactive materials procedures. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

Procedures

- The program for changing, controlling, and implementing facility procedures was acceptably maintained as required by the technical specifications (TSs) and the applicable procedures.

Experiments

- Experiments were reviewed and approved as required by TS.

Health Physics

- Surveys were being completed and documented as required.
- Postings met regulatory requirements.
- Personnel dosimetry was being worn and recorded doses were within the NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The radiation protection program satisfied regulatory requirements.
- The radiation protection-training program was being administered as required.
- Environmental monitoring satisfied license and regulatory requirements.

Design Changes

- The review, evaluation, and documentation of changes to the facility satisfied NRC requirements.

Committee Audits and Reviews

- The review and audit program was being conducted acceptably by the Reactor Operations Committee (ROC) as stipulated in TS.

Transportation of Radioactive Materials

- The program for shipping radioactive material satisfied regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The University of California (UC) - Irvine 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 shutdown.

1. Procedures

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

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

- Records of procedure changes
- Observation of procedure implementation
- Administrative controls as outlined in UC Irvine NRF Standard Operating Procedure (SOP) No. 1, "Introduction," Revision (Rev.) 3.2, approval dated January 2010
- UC Irvine NRF SOP No. 5, "Radiological Safety Program," Rev. 3.2, approval dated December 2009
- TS for the UC Irvine TRIGA Mark I Nuclear Reactor, July 7, 2016

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 UC Irvine NRF. The inspector noted that procedural changes were being reviewed and approved by the 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.

c. Conclusion

The licensee was maintaining and implementing written procedures in accordance with 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, July 7, 2016
- UC Irvine NRF SOP Section 2, Experiments, Rev. 3, Approved 2000
- Experiment Performance File, January 1, 2017, to present
- Select UC Irvine Irradiation Requests for 2017 and 2018

b. Observations and Findings

The UC Irvine NRF has experimental procedures approved for a broad class of applications. The mission of the UC Irvine 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. Conclusion

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

3. Health Physics

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 3.7 and 4.7 requirements:

- Radiation and contamination surveys completed by reactor staff personnel
- Radiation and contamination surveys completed by Environmental Health and Safety (EHS) personnel
- UC Irvine NRF dosimetry records for 2017 through the present
- UC Irvine 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. The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS 3.7:

- Facility radioactive effluent releases and liquid and solid waste disposal documented in the UC Irvine NRF Annual Report for the period from July 1, 2016, through and June 30, 2017
- UC Irvine NRF SOP No. 5, "Radiological Safety Program," Section 5.6, "Radioactive Effluent Release Assessment," Rev. 3, approval dated March 2000
- UC Irvine NRF SOP No. 5, "Radiological Safety Program," Section 5.7, "Radioactive Waste Procedures," Rev. 3, approval dated March 2000

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 2017 were well within the regulatory limits.

(4) Radiation Protection Program

The licensee’s Radiation Protection Program was established in the UC Irvine NRF SOP No. 5, “Radiological Safety Program.” The program was further explained in the campus document entitled, “Radiation Safety Manual University of California Irvine,” 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 UC Irvine Office of EHS.

The inspector determined that the UC Irvine EHS office had completed an annual review of the radiation protection program in accordance with 10 CFR 20.1101(c), “Radiation protection programs,” for 2017 as required. This was accomplished by the campus Radiation Safety Officer.

(5) As Low As Reasonably Achievable Policy

The as low as reasonable achievable (ALARA) Policy was also outlined and established in the UC Irvine NRF 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.

(7) Effluent Releases

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 UC Irvine 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

The inspector verified that the licensee's radiation protection program was effective in minimizing radiation doses to individuals through training, notices to workers, radiation monitoring and surveys, and calibrated equipment. The program met regulatory requirements. Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

4. Design Changes

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the regulatory requirements of 10 CFR 50.59, "Changes, tests and experiments," were being met:

- UC Irvine NRF Annual Report for the period from July 1, 2016, through and June 30, 2017
- UC Irvine 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. Conclusion

Records indicated that changes at the facility were acceptably reviewed in accordance with 10 CFR 50.59 and applicable licensee administrative controls.

5. Committees, Audits and Review

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 review functions, were being met:

- Safety review and audit records for the past two years
- ROC meeting minutes from January 2017 to the present
- UC Irvine NRF SOP No. 1, "Introduction," Rev. 3.2, approval dated January 2010
- UC Irvine NRF Annual Report for the period from July 1, 2016, through June 30, 2017

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. Conclusion

The ROC provided the oversight required by the TS.

6. Transportation of Radioactive Materials

a. Inspection Scope (IP 86740)

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

- Records of radioactive material shipments for 2018
- UC Irvine NRF SOP No. 5, "Radiological Safety Program," Section 5.10, "Transportation of Radioactive Material," Rev. 3.1, approval dated May 2005

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.

c. Conclusion

Radioactive material shipments were made according to procedures and regulatory requirements.

7. Exit Interview

The inspector presented the inspection results to licensee management at the conclusion of the inspection on June 28, 2018. The inspector described the areas inspected and discussed in detail the inspection observations. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

G. Bosgraff	UC Irvine Radiation Safety Officer
R. Dendo	UC Irvine Health Physicist
G. Miller	Reactor Supervisor
A. Shaka	Reactor Director
J. Wallick	Associate Reactor Supervisor

INSPECTION PROCEDURES USED

IP 69001	Class II Non-Power Reactors
IP 86740	Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened:

None

Closed:

None

Discussed:

None

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
IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
NRF	Nuclear Reactor Facility
REV	Revision
ROC	Reactor Operations Committee
SOP	Standard Operating Procedure
TLD	Thermoluminescent Dosimeter
TS	Technical Specification
UC Irvine	University of California - Irvine