

January 13, 2011

Dr. M. Gottfredson
Executive Vice Chancellor
University of California - Irvine
Irvine, CA 92697-2025

SUBJECT: UNIVERSITY OF CALIFORNIA – IRVINE, NRC ROUTINE INSPECTION
REPORT NO. 50-326/2010-201 AND NOTICE OF VIOLATION

Dear Dr. Gottfredson:

On December 13-16, 2010, the U. S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the University of California - Irvine Nuclear Reactor Facility (Inspection Report No. 50-326/2010-201). The enclosed report presents the results of that inspection.

This inspection was an examination of 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. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements has occurred. The violation was evaluated in accordance with the NRC Enforcement Policy included on the NRC's Web site at www.nrc.gov; select **What We Do, Enforcement**, then **Enforcement Policy**. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it constitutes a failure to meet a regulatory requirement that has more than minor safety significance and the licensee failed to identify the violation.

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

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.390 "Public inspections, exemptions, requests for withholding," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (Agencywide Document Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Greg Schoenebeck at 301-415-6345.

Sincerely,

/RA/

Thomas B. Blount, Acting Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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

Enclosures: 1. NRC Inspection Report No. 50-326/2010-201
2. Notice of Violation

cc: w/encls: See next page

University of California - Irvine

Docket No. 50-326

Dr. Donald Blake, 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

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DATE	1/7/11	1/7/11	1/13/11	1/13/11

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NOTICE OF VIOLATION

University of California-Irvine
Nuclear Reactor Facility

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

During a U. S. Nuclear Regulatory Commission (NRC) inspection conducted December 13-16, 2010, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.54(q) states that research and test reactors (RTRs) shall follow and maintain in effect emergency plans that meet the requirements of [Appendix E to 10 CFR Part 50](#). Subsequently, Appendix E to 10 CFR Part 50 states that Regulatory Guide 2.6 will be used as guidance for the acceptability of research and test reactor emergency response plans. Subsequently, Regulatory Guide 2.6 endorses ANSI-15.16-1982, "Emergency Planning for Research Reactors."

Section 10.2 "Drills and Exercises" of the NRC-approved University of California-Irvine Nuclear Reactor Facility Emergency Plan requires that "an on-site emergency exercise of such type shall be conducted annually."

Contrary to Section 10.2 "Drills and Exercises" of the Emergency Plan for the University of California Nuclear Reactor Facility, the licensee failed to conduct the required annual onsite emergency drill; the last record for an on-site drill was in 2007.

This has been determined to be a Severity Level IV violation (Supplement I)

Pursuant to the provisions of 10 CFR 2.201, the University of California-Irvine is hereby required to submit a written statement or explanation to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001 with a copy to the responsible inspector, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of the NRC's

Agencywide Documents Access and Management System (ADAMS), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

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

Dated this day of January, 2011

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

Docket No: 50-326

License No: R-116

Report No: 50-326/2010-201

Licensee: The Regents of the University of California

Facility: University of California - Irvine
Nuclear Reactor Facility

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

Dates: December 13-16, 2010

Inspector: Greg Schoenebeck
Craig Bassett

Approved by: Johnny H. Eads, Jr., 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. 50-326/2010-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of California - Irvine (the licensee) Class II research reactor facility safety programs including organization and staffing; operations logs and records; procedures; requalification training; surveillance and limiting conditions for operation; experiments; radiation protection program; effluent and environmental monitoring; design changes and committees, audits and reviews; emergency planning; maintenance logs and records; fuel handling logs and records; transportation; and follow-up on previously identified items since the last NRC inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety, and were generally in compliance with U. S. Nuclear Regulatory Commission (NRC) requirements.

Organization and Staffing

- The operations organizational structure and responsibilities were consistent with Technical Specification requirements.
- Shift staffing met the minimum requirements for current operations.

Operations Logs and Records

- Within the scope of this review, the licensee's operations record keeping program conformed to Technical Specification requirements.

Procedures

- Facility procedural review, revision, and implementation satisfied Technical Specification requirements.

Requalification Training

- Operator requalification was generally conducted as required by the Requalification Program due to the relaxation of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 55.59 constraints. An unresolved item has been opened to determine if this matter is an acceptable item, a deviation, a nonconformance, or a violation.

Surveillance and Limiting Conditions for Operation

- Operations were found to be in compliance with the limiting conditions for operation and surveillances requirements as stated in the Technical Specifications.

Experiments

- Experiments were being reviewed and performed in accordance with Technical Specification 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 met the regulatory requirements specified in 10 CFR Parts 19 and 20.
- Personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- 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 Technical Specification limits.

Design Changes and Committees, Audits and Reviews Functions

- No new changes, tests, or experiments subject to 10 CFR Section 50.59 reporting were performed since the previous inspection
- The Reactor Operations Committee provided the oversight required by the Technical Specifications.

Emergency Planning

- The emergency preparedness program was generally conducted in accordance with the Emergency Plan, except for the conduct of an onsite annual drill. This failure has been determined to be a Severity Level IV violation.

Maintenance Logs and Records

- The licensee maintained records documenting principal maintenance activities.
- Groundwater incursion into reactor bay floor storage pits will be tracked as an inspector follow-up item.

Fuel Handling Logs and Records

- Fuel handling and inspection activities were being completed and documented in accordance with the requirements specified in the Technical Specification and facility procedures.

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, the licensee's) 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 with no licensed activities occurring.

1. Organizational Structure and Staffing

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

The inspectors reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Section 6.1 of Technical Specifications (TS), Amendment No. 6, latest revision dated October 2007, were being met:

- Staff qualifications
- Management responsibilities
- Staffing requirements for the safe operation of the facility
- Selected portions of the operations log for the past year through the present
- University of California, Irvine Nuclear Reactor Facility (UCI NRF) organizational structure and staffing
- UCI NRF Standard Operating Procedure (SOP) Number (No.) 1, "Introduction," Revision (Rev.) 3.2, approval dated January 2010
- UCI NRF SOP No. 3, "Personnel," Rev. 3, approval dated March 2000

b. Observations and Findings

The licensee's organizational structure and staffing had not functionally changed since the last inspection. The reactor staff consisted of one permanent member (who was the Reactor Supervisor as well as a licensed Senior Reactor Operator [SRO]); a part-time licensed SRO, two part-time Reactor Operators (RO), and support staff consisting of one part-time student. Because all the aforementioned individuals have various other ongoing duties and activities besides those related to the reactor, the time that they can dedicate to reactor operation and maintenance is limited.

The campus health physics (HP) staff consisted of the Radiation Safety Officer (RSO), one Health Physicist, and a technician. In addition to having responsibility for the university's broad scope state byproduct license, they provided support to the reactor staff when requested and performed specific quarterly audits/inspections/surveys of the reactor. The reactor staff performed most HP functions at the reactor. Coordination of radiation protection activities between the HP staff and the reactor staff was acceptable. The reactor operations staff satisfied the training and experience requirements stipulated in the TS. The operations log and associated records confirmed that shift staffing met the minimum requirements for duty and on-call personnel.

c. Conclusion

The organizational structure and functions were consistent with TS requirements.

2. Operations Logs and Records

a. Inspection Scope (IP 69001)

The inspectors reviewed selected parts of the following reactor operations records to verify that the requirements of TS Section 6.6, Plant Operating Records, were being met:

- UCI NRF Standard Operating Procedures, Rev. 3, Approved March 2000
- Reactor Logbook #37, June 27, 2003 to June 15, 2006
- Reactor Logbook #38, June 20, 2006 to present
- Daily Startup Checklists, December 2, 2007 to present
- Shutdown Checklists, December 2, 2007 to present

b. Observations and Findings

The UCI NRF procedures specified a records system that was commensurate with the small facility, staff, and utilization factor. Procedures called for most operational data to be recorded in the reactor logbooks, startup checklists, and shutdown checklists. Data recorded indicated that the reactor was operated within the envelope of safety parameters established in the reactor license and TS.

c. Conclusion

Within the scope of this review, the licensee's operations record keeping program conformed to TS requirements.

3. Procedures

a. Inspection Scope (IP 69001)

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

- Records of procedure changes
- Observation of procedure implementation
- Administrative controls as outlined in UCI NRF SOP No. 1, "Introduction," Rev 3.2, approval dated January 2010
- UCI NRF SOP No. 5, "Radiological Safety Program," Rev 3.2, approval dated December 2009

b. Observations and Findings

Operations procedures were available for those tasks and items required by the TS and facility directives. Written changes were reviewed and approved by the ROC as required. The SOPs were reviewed as necessary.

Training of personnel on procedures and changes was acceptable. Through records review the inspectors verified that personnel conducted TS activities in accordance with applicable procedures. Records showed that procedures for potential malfunctions (e.g., radioactive releases, contaminations, and reactor equipment problems) had been developed and were implemented as required. The inspector followed-up on the progress of IFI 50-326/2009-201-01 which was opened to track the progress of updating procedures to be consistent with the UCI license renewal. The inspector noted that significant progress is being made to revise the existing procedures. The inspector will leave this open to review the procedures as they relate to additional issues, such as the water incursion, which is addressed in Section 11 of this inspection report.

c. Conclusion

Procedural review, revision, and implementation satisfied TS requirements.

4. Requalification Training

a. Inspection Scope (IP 69001 and 92701)

The inspectors reviewed the following to verify that the requirements of 10 CFR Section 50.55, Operators' Licenses, were being met:

- UC Irvine Nuclear Reactor Facility Operator Requalification Program, Rev.1, April 24, 2000
- Letter from J. Eads (NRC) to G. Miller (UCI), Issuance of Renewed Senior Reactor Operator (SRO) License, September 24, 2006
- Letter from J. Eads (NRC) to A. Nilsson (UCI), Issuance of Reactor Operator (RO) License, October 6, 2010
- Letter from J. Eads (NRC) to H. Yi (UCI), Issuance of Reactor Operator License, October 6, 2010
- Letter from J. Eads (NRC) to A. Maycock (UCI), Issuance of Reactor Operator License, October 6, 2010
- Medical File for SRO G. Miller
- Letter from NRC to Dr. Smith (UCI) "Request for a Delay in 1992 Written and Operating Requalification Examinations", dated May 2, 1992
- Reactor Logbook #40, April 13, 2010 to present

b. Observations and Findings

The UCI NRF has two qualified SROs (one recent) and two recently qualified ROs. The licensee is in the process of redeveloping their requalification program to better conform to the requirements of 10 CFR 55.59; specifically, with regards to biennial written exam implementation, developing a more formal, preplanned lecture series on a regular and continuing basis throughout the license period and the simulation of emergency and abnormal conditions where required actions are to be discussed.

The inspector reviewed the requalification program records and requalification plan and compared those to 10 CFR 55.59. For contextual purposes, 10 CFR Part 55.59(a)(2) requalification requirements stipulate that each licensee shall pass a comprehensive requalification written examination and an annual operating test. Since the most recent inspection efforts at the NRF until October 6, 2010, Dr. Miller was the only licensed individual at the UCI NRF. To accommodate meeting the requirements of 10 CFR 55.59, it appears Dr. Miller was granted Commission approval to significantly deviate from the requirements of paragraphs (c)(1) through (6) of this section; this provision is covered under 10 CFR Part 55.59(c)(7) "Applicability to research and test reactor facilities." However, the inspector did not find supporting written justification on-site which explicitly states an agreed relaxation of the requirements covered under said regulations. This item has been designated as an Unresolved Item (URI)¹ pending documentation. This issue will be reviewed during a future inspection (URI 50-326/2010-201-01).

When the inspector discussed the handling of the requalification program with Dr. Miller regarding the addition of three new operators, he indicated that the duties for writing the biennial written exam shall be rotated such that no one operator is exempt from taking an exam for more than one cycle and that he will be developing a tracking sheet for the operators to log their hours of licensed activities, attendance of lecture series, and other information pertinent to completing the requirements of 10 CFR 55.59. Since this is a relatively new program being implemented in addition to the requirement of the newly licensed operators to be actively enrolled in an operator requalification program (i.e., 10 CFR Part 50.54(i-1)) the inspector will follow-up on the status of the requalification program implementation as an IFI in a subsequent inspection. This issue will be reviewed during a future inspection (IFI 50-326/2010-201-02)

The inspectors reviewed the medical files for the NRC-licensed operators at the facility and determined that they were satisfactorily completed within the required biennial periodicity.

c. Conclusion

Operator requalification was generally conducted as required by the Requalification Program due to the relaxation of 10 CFR 55.59 constraints. An URI has been opened to

¹ An Unresolved Item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.

determine if this matter is an acceptable item, a deviation, a nonconformance, or a violation.

5. Surveillance and Limiting Conditions for Operation

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to verify compliance with TS Section 3.0, Limiting Conditions for Operation (LCO), and to determine if the periodic surveillance tests on safety systems were performed as stipulated in TS Section 4.0, Surveillance Requirements:

- Reactor Logbook #40, April 13, 2010 to present
- Daily Startup Checklists, January 10, 2008 to December 6, 2010
- Shutdown Checklists, January 10, 2008 to December 6, 2010
- UCI NRF Standard Operating Procedures (SOP), Rev. 3, Approved March 2000

b. Observations and Findings

The inspectors selected a sample of the TS LCOs to verify implementation. The inspector also followed-up on IFI-50-326/2009-201-02 to address implementing a system which adequately tracks the required surveillances. The current TS, surveillances, and LCOs are aggregated in the UCI NRF SOP. In conjunction with the relicensing effort, the UCI NRF has submitted the "Proposed Technical Specifications for the UC Irvine TRIGA Mark I Nuclear Reactor" which is current to the recent standard (i.e., ANSI 15.1) and more clearly delineates the surveillance requirements and the LCOs. The tracking of surveillance requirements and performance of scheduled maintenance was found in several areas including a white board in the control room, the reactor log books, and on the Daily Startup Checklists. Although Dr. Miller adequately demonstrated the completion of various surveillances, he did note that the methods currently employed could be enhanced to make operations easier for the new operators and avoid missing surveillance requirements for the reactor. Dr. Miller indicated he would be looking to obtain a spreadsheet or database similar to that which is employed at UC Davis to aid with tracking and completion of scheduled surveillance items. The inspector determined that surveillances were completed on schedule and in accordance with licensee procedures. The records and logs were complete and were being maintained as required. Checks and calibrations were completed as required by TS. The IFI-50-326/2009-201-02 will remain open to track the previous commitment made for implementing a tracking system for surveillance activities.

c. Conclusion

Operations were found to be in compliance with the LCO and surveillances requirements as stated in the TS.

6. Experiments

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to verify compliance with TS 3.8, Limitations on Experiments:

- TS for the UC Irvine TRIGA Mark I Nuclear Reactor, Revised October 2007
- UCI NRF SOP Section 2, Experiments, Rev. 3, Approved 2000
- Experiment Performance File, November 16, 2005 to November 6, 2007
- Irradiation Request File, January 13, 2006 to November 6, 2007
- UCI Nuclear Reactor Facility Experiment Review Report- January 2010

b. Observations and Findings

Currently, experiments are divided into two classes: Class I (tried) and Class II (untried), following initial review by the Reactor Supervisor. Class I experiments comprise of repeated, successful experiments and of a minor modification of a previous experiment so that no additional hazard is involved. Class II experiments comprise of all other experiments. These experiments must be submitted by the Reactor Supervisor to the ROC for review and approval. The ROC may attach any requirement that it deems fit to the performance of the experiment. The inspector discussed the process for handling and the irradiation of an unknown experiment. Unlike an isotope production facility, one key aspect of the UCI NRF is that sample irradiations are driven by detector thresholds. This means that small sample quantities are irradiated with subsequent activities in the microcurie or millicurie range. These are premeditated conditions such that the samples can be handled and analyzed; with a smaller sample size, there is an inherent safety mechanism to reduce the potential for a radiation exposure limit being exceeded. Prior to sending a sample written application to the Reactor Supervisor, the Principal Investigator (PI) must determine various aspects of the experiment, including produced activity levels and radiation levels expected and to be handled; Dr. Miller has developed a computer program which helps facilitate the calculations to support the PI application for these types of parameters. In the event that an unknown sample of unknown quantities whose composition is to be determined, Dr. Miller indicated that certain provisions such as small samples or short irradiation periods could be employed to ensure that the produced activity levels will not cause a radiation hazard during handling. Unlike most Research and Test Reactors, UCI NRF is unique as it is operated out of the Chemistry Department; they have a high competency for radiochemistry analysis and laboratory safety.

The inspector noted that two active experiments were re-authorized- #5 (G. Miller, PI) for normal Neutron Activation Analysis (NAA) and isotope production work, including irradiations for the radioisotope techniques class at UCI, and #110 for General Activation Analysis NAA work under direction of Larry Kovar. One new experiment (#6, M. Nilsson) was approved for irradiations of solutions or solids containing small amounts of key elements such as transition metals, molybdenum, lanthanides, and Uranium or Thorium within established limits. The inspector discussed with the Reactor Supervisor and

determined that if fueled experiments were performed, the inventory of Iodine isotopes and Strontium would conform to TS 3.8.2.

No experiments were performed during the inspection because of the refueling outage in progress. From a random sampling of forms for experiments performed since the previous inspection the inspectors found that experiments were being reviewed and performed in accordance with TS requirements and the licensee's written procedures.

c. Conclusion

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

7. Radiation Protection Program

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to verify compliance with 10 CFR Parts 19 and 20 and TS Sections 3.3 and 4.5 requirements:

- Radiation and contamination surveys completed by reactor staff personnel
- Radiation and contamination surveys completed by Office of Environmental Health and Safety (EH&S) personnel
- UCI Nuclear Reactor Facility dosimetry records for 2008 through the present
- Calibration and periodic check records for radiation monitoring instruments
- 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 5.3, "Radiation Levels Associated with Handling of Radioactive Materials," Rev. 3, approval dated March 2000
 - 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 inspectors also toured the facility and observed the use of dosimetry and radiation monitoring equipment. Licensee personnel were interviewed and radiological signs and postings were observed as well.

b. Observations and Findings

(1) Surveys

The inspectors 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 EH&S HP personnel. The results of the licensee staff surveys were documented on the forms and entered into a Reactor Health Physics notebook. The results of EH&S surveys were documented on survey maps and forms, reviewed as required, and forwarded to the licensee for information. Corrective actions were taken when readings or results exceeded set action levels.

(2) Postings and Notices

The inspectors 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. Other postings also showed the industrial hygiene hazards present in the areas. The facility's radioactive material storage areas were noted to be properly posted.

Copies of current notices to workers required by 10 CFR Part 19 were posted as required. Other postings also showed the industrial hygiene hazards that were present in the areas as well. 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. 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 for individual monitoring. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor, Miron Technologies. Through direct observation the inspectors 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 received by a single facility employee for 2008 was 20 millirem (mrem) deep dose equivalent (DDE). The highest annual skin dose for a single individual for 2008 was 45 mrem shallow dose equivalent (SDE). The highest annual extremity exposure for 2008 was 398 mrem SDE. The highest annual whole body exposure received by a single facility employee for 2009 was 126 mrem DDE. The highest annual skin dose

for a single individual for 2009 was 251 mrem SDE. The highest annual extremity exposure for 2009 was 317 mrem SDE. The highest annual whole body exposure received by a facility employee through September 2010 was 35 mrem DDE; the highest annual skin dose for a single individual for this period was 35 mrem SDE; and, the highest annual extremity exposure was 408 mrem SDE.

(4) Radiation Monitoring Equipment

The calibration of portable survey meters and friskers was typically completed by EH&S personnel while fixed radiation detectors and air monitoring instruments were generally calibrated by licensee personnel. The calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Except for the fixed area radiation monitors in the facility, calibration frequency met the requirements established in the applicable SOPs and records were being maintained as required. The licensee and EH&S personnel were aware that the fixed area radiation monitors were overdue for calibration and were taking steps to correct the problem.

(5) Radiation Protection Program

The licensee's Radiation Protection Program was established in the UCI NRF 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 inspectors verified that licensee staff had received the required radiation protection ("rad worker") training given by the UCI EH&S.

The inspectors determined that the UCI EH&S office had completed an annual review of the radiation protection program in accordance with 10 CFR 20.1101(c) for 2008 and 2009 as required. This was accomplished by the campus Radiation Safety Officer. It was noted that the licensee did not require or have a respiratory protection program or planned special exposure program.

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

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

(7) Facility Tours

The inspectors 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. Conclusion

The inspectors 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.

8. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Sections 3.3 and 3.5:

- Facility radioactive effluent releases and liquid and solid waste disposal documented in the UCI Nuclear Reactor Facility Annual Reports for the period from July 1, 2008 through June 30, 2009, and submitted to the NRC on August 11, 2009
- Facility radioactive effluent releases and liquid and solid waste disposal documented in the UCI Nuclear Reactor Facility Annual Reports for the period from July 1, 2009 through June 30, 2010, and submitted to the NRC on August 2, 2010
- Reactor pool water sample analyses documented on the applicable NRF forms
- 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(d), the licensee used the computational method specified in UCI NRF SOP No. 5, Section 5.6. The highest calculated dose that could be received as a result of gaseous emissions from reactor operations was less than 0.5 millirem for the period from July 1, 2008 through June 30, 2009, and less than 0.7 millirem for the period from July 1, 2009 through June 30, 2010. These doses were well below the limit set in 10 CFR 20.1101(d) of 10 millirem per year.

The licensee had released liquid from the facility but only by transferring it to the Campus EH&S Office under the State of California Radioactive Material License. Solid radioactive waste was also transferred to the Campus EH&S 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.

9. Review and Audit and Design Change Functions

a. Inspection Scope (69001)

The inspectors 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
- Reactor Operations Committee (ROC) meeting minutes from January 2009 to the present
- UCI NRF SOP No. 1, "Introduction," Rev 3.2, approval dated January 2010

b. Observations and Findings

(1) Review and Audit Functions

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 Section 6.2 was fulfilled by Office of Environmental Health and Safety (EH&S) personnel as they conducted their surveys and walk-through tours of the facility. This was reported to the ROC through the EH&S 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.

(2) Design Change Functions

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 inspectors 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 inspectors 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

The review and audit program was being conducted acceptably by the ROC. The licensee's design change protocol was in place and was being implemented as required.

10. Emergency Planning

a. Inspection Scope (IP 69001)

The inspectors reviewed the implementation of selected portions of the emergency preparedness program including:

- UCI & EH&S Emergency Response Plan, July 2010
- Emergency Plan for the UCINRF, Rev. 3.0 dated May 2000
- Emergency Plan for the UCINRF, Rev. 4.0 dated March 2009
- Emergency Notification List, revised October 20, 2010
- Section 1.1 "Organization" of UCI NRF Standard Operating Procedures, Rev. 3, Approved March 2000
- UCI EH&S Annual Radiation Drill: After Action Report, May 2010
- UCI EH&S ERT Radiation Scenario Exercise After Action Report (AAR), March 2009
- UC Irvine Injuries and Medical Treatment, dated August 2009

b. Observations and Findings

At the UCI campus emergency management was the responsibility of the EH&S. The NRF staff worked closely with EH&S staff in matters such as emergency preparedness and exercises. The most current revision of NRF's emergency plan is modeled in approach to reflect consistency with the National Incident Management System which the University utilizes for an all-hazards approach for its incident preparedness. There was a recent revision to the Emergency Plan where changes were made to the Reactor Emergency Organization and to other capabilities. Although, the changes appear to be minor and do not appear to decrease the overall effectiveness of the plan, it appears that the licensee did not submit a report containing a description of each change as stipulated by 10 CFR Part 50.54(q). This item has been designated as an Unresolved Item (URI)² pending documentation. This issue will be reviewed during a future inspection (URI 50-326/2010-201-03).

An exercise on March 12, 2007, simulated the theft of radioactive items from the NRF and subsequent recovery elsewhere on campus. An assessment of the performance of the various individuals and response organizations involved emphasized the things done

² An Unresolved Item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.

well during the exercise along with things to improve upon; a summary of this critique identified action items, responsible individuals and timelines. Through records reviewed, the inspector determined that this was the last onsite exercise performed at the facility. The campus performed an annual radiation drill at the EH&S building.

For contextual purposes, Research and test reactor (RTR) emergency plans address the necessary provisions for coping with radiological emergencies at each facility. Per NRC regulations, 10 CFR 50.54(q), RTRs shall follow and maintain in effect emergency plans that meet the requirements of Appendix E to 10 CFR Part 50. Guidance for the acceptability of these emergency plans is described in Regulatory Guide 2.6, "Emergency Planning for Research and Test Reactors."

There are 10 planning standards for research and test reactors, similar to the 16 planning standards in Appendix E to 10 CFR Part 50 for commercial nuclear power reactors. Regulatory Guide 2.6 endorses ANSI-15.16-1982, "Emergency Planning for Research Reactors." ANSI-15.16-1982 and NUREG-0849, NRC's Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors, identify the elements of an emergency plan that describes the approach to coping with emergencies and minimizing the consequences of accidents at research and test reactor facilities.

Section 10.2 Drills and Exercises" of the UCI NRF Emergency Plan::

"The Manager, Radiation Protection and the Emergency Management Coordinator shall, in coordination with other groups, establish a schedule and agenda for drills and exercises. Drills and exercises for this facility will usually be combined with training designed to refresh and prepare staff in use of procedures for handling emergencies. An on-site emergency exercise of such type shall be conducted annually.

Furthermore, Section 2 "Definitions" of the UCI NRF Emergency Plan defines "onsite" as the geographical area that is within the site boundary. "Site boundary" is defined as the area immediately surrounding and including the Operations Boundary which is identified as the areas within Rowland Hall known as the Nuclear Reactor Facility, comprising five Rooms: B54, B54A, B54B, B62, and B62A on the service floor, over which the Reactor Supervisor has direct authority. The Emergency Plan additionally identifies the all the hallways and loading dock immediately surrounding the Operations Boundary as part of the Site Boundary.

Contrary to Section 10.2 Drills and Exercises" of the UCI NRF Emergency Plan the licensee failed to conduct an annual onsite emergency drill. The licensee was informed of an apparent violation of 10 CFR Part 50, Appendix E and the University of California-Irvine NRF Emergency Plan (VIO 50-326/2010-201-04).

c. Conclusion

The emergency preparedness program was generally conducted in accordance with the Emergency Plan, except for the conduct of an onsite annual drill. This failure has been determined to be a Severity Level IV violation.

11. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

The inspectors reviewed the following selected maintenance logs and records to verify compliance with the requirements of TS Section 6.6.2, Principal Maintenance Activities:

- Reactor Logbook #40, April 13, 2010 to present
- Letter from G. Miller (UCI) to NRC, Docket 50-326 – Incident Report: Irrigation Water Incursion to Fresh Fuel in Storage, August 18, 2006
- Letter from G. Miller to Wendell C. Brase, UCI Vice Chancellor, “RE: Subsurface water under Rowland Hall- Currently at 15 Feet Below Floor Level”

b. Observations and Findings

The inspectors reviewed selected portions of the reactor logbooks governing the interval of time since the previous inspection. Major maintenance activities were found documented with detail commensurate with the safety significance of the activity.

The inspectors reviewed the on-going response (IFI-50-326/2009-201-03) to groundwater incursion into reactor bay below grade storage pits. Since 2009, the UCI NRF has been removing groundwater from the area around the fuel storage pits and the reactor in-ground pool with a temporary pump. During discussions with Dr. Miller it has become evident that the University has not made any progress with resolving the issue of mitigating the groundwater incursion or installing a permanent infrastructure to remove said water which settles in the “scooped pool” beneath the building. In a letter to Vice Chancellor Brase, Dr. Miller voices concern that there is “long term potential corrosion to building footings and to the reactor tank and other ‘pits’ if the water is allowed to remain and be static over time. Unfortunately the water is corrosive owing to the dissolving of salts from the, otherwise, dry ground.”

The inspector discussed the ongoing water removal activities and determined that water (when the reactor facility was occupied) was pumped, sampled and released. No radioactivity was observed in the water, nor was it expected, since the water flow is from the exterior surface and filtered by the soil. The inspector verified records of reactor pool level to ensure that the source of the water is not from the pool; it was determined that loss was from evaporation of routine operation.

c. Conclusion

The licensee maintained records documenting principal maintenance activities. Groundwater incursion into reactor bay floor storage pits will be tracked as an IFI (50-

326/2009-201-03).

12. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001)

To verify that TS Section 4.1 and procedural requirements were being met, the inspector reviewed selected aspects of:

- Fuel History Notebook
- Fuel handling equipment and instrumentation
- Reactor Log No. 38 for the period from June 20, 2006 through June 5, 2008
- Fuel movement and inspection records maintained on UCINRF Annual Core Examination and Fuel Element History Record forms
- UCINRF SOP Chapter 4, "Normal Operating Procedures," Section 4.8, "Fuel Element and Control Rod Removal and Measurement," Revision 3.1, approved January 21, 2005
- UCINRF SOP Chapter 4, "Normal Operating Procedures," Section 4.10, "Fuel Inventory," Revision 3.1, approved January 21, 2005

b. Observations and Findings

Procedures for refueling, fuel movement, and TS required fuel inspections and/or surveillances had been reviewed and approved as required and were available to ensure controlled operations. Fuel movement, log keeping, and data recording was being completed as directed by the procedures. The most recent five-year fuel element inspection had been completed in November 2007 as required. Data recorded for fuel handling was clear and cross-referenced in the Fuel History Notebook, on the Fuel Location Board in the Reactor Room, and in the Reactor Operations Logbooks. Log entries indicated that a minimum of three persons were present when fuel was being measured/inspected and at least one of those persons was a licensed operator as required by procedure.

Information related to material control and accountability can be found in the report for security inspection IR 50-326/2010-202 which was performed concurrent with this routine inspection of operations.

c. Conclusions

Fuel handling and inspection activities were completed and documented as required by TS and facility procedures.

13. Transportation

a. Inspection Scope (IP 86740)

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

- Records of radioactive material shipments for 2008 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 inspectors also interviewed licensee and EH&S personnel.

b. Observations and Findings

The transport 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 verified that the licensee maintained copies of the licenses to possess radioactive material of the various recipients as required and that the licenses were verified to be current prior to initiating a shipment. People designated as "shippers" had been properly trained to do so. However, it was noted that the person who was the "shipper" at the NRF had been trained in September 2007 and was, therefore, due for refresher training according to the regulations. The licensee was aware of this and was in the process of scheduling a transportation training class for the individual involved.

c. Conclusion

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 but refresher training was due.

14. Exit Interview

The inspection scope and results were summarized on December 15, 2010, with members of licensee management. The inspectors 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

G. Miller Reactor Supervisor

Other Personnel

R. Dendo UCI Health Physicist
R. Mannix UCI Radiation Safety Officer
L. Bogue Emergency Management Coordinator, Environmental Health and Safety
D. Hamano Radiation Safety Officer, Environmental Health and Safety
S. Devlin Patrol Sergeant, UCI Police Department

INSPECTION PROCEDURES USED

IP 69001 Class II Research and Test Reactors
IP 86740 Transportation
IP 92701 Follow-up

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-326/2010-201-01 URI Determination of written documentation to relax the constraints of 10 CFR 55.59 for the requalification program.
50-326/2010-201-02 IFI Enrollment of newly qualified operators into a requalification program in accordance with 10 CFR 50.54 (i-1).
50-326/2010-201-03 URI Determination of written documentation which addresses the changes made to the Emergency Plan in accordance with 10 CFR 50.54 (q).
50-326/2010-201-04 VIO Failure to conduct an annual onsite drill.

Closed

None

Discussed

50-326/2009-201-01 IFI Verify the licensee commitment for addressing and updating the procedures consistent with the license renewal

- 50-326/2009-201-02 IFI Track the licensee commitment for developing a process for periodic radiation protection surveillance completion
- 50-326/2009-201-03 IFI Follow-up on the commitment for a permanent resolution to the subsurface water ingress to Rowland Hall and the associated NRF

PARTIAL LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
EH&S	Office of Environmental Health and Safety
EP	Emergency Plan
IFI	Inspector Follow-up Item
IP	Inspection Procedure
LCO	Limiting Conditions for Operation
NAA	Neutron Activation Analysis
NRC	U. S. Nuclear Regulatory Commission
NRF	Nuclear Reactor Facility
PARS	Publicly Available Records
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TLD	thermoluminescent dosimeter
TS	Technical Specifications
VIO	Violation
UCI	University of California - Irvine
URI	Unresolved Item