

August 6, 2012

Dr. Barry M. Klein, Reactor Director  
5335 Price Avenue, Bldg. 258  
McClellan AFB, CA 95652-2504

SUBJECT: UNIVERSITY OF CALIFORNIA-DAVIS – NRC ROUTINE INSPECTION  
REPORT NO. 50-607/2012-203 AND NOTICE OF VIOLATION

Dear Dr. Klein:

From July 9 to 11, 2012, the U.S. Nuclear Regulatory Commission (NRC or the Commission) conducted an inspection at your University of California-Davis/McClellan Nuclear Research Center. The enclosed report documents the inspection results, which were discussed on July 12, 2012, with members of your staff, including Walter Steingass, Associate Director for Reactor Operations, and David Reap, Radiation Safety Officer.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred. The violation was evaluated in accordance with the NRC Enforcement Policy included on the NRC's Web site at [www.nrc.gov](http://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 regulatory requirements that has more than minor safety significance and the licensee failed to identify the violation.

You are required to respond to this letter within 30 days 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* Section 2.390, "Public inspections, exemptions, and requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

B. Klein

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Should you have any questions concerning this inspection, please contact Craig Bassett at (301) 466-4495 or by electronic mail at [Craig.Bassett@nrc.gov](mailto:Craig.Bassett@nrc.gov).

Sincerely,

*/RA/*

Mary Muessle, Deputy Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-607  
License No. R-130

Enclosures:

1. Notice of Violation
2. NRC Inspection Report No. 50-607/2012-203

cc: w/encls: See next page

University of California – Davis/McClellan MNRC

Docket No. 50-607

cc:

Mr. David Reap, Radiation Safety Officer  
5335 Price Avenue, Bldg. 258  
McClellan AFB, CA 95652-2504

Mr. Walter Steingass, Reactor Supervisor  
5335 Price Avenue, Bldg. 258  
McClellan AFB, CA 95652-2504

California Energy Commission  
1516 Ninth Street, MS-34  
Sacramento, CA 95814

Radiological Health Branch  
P.O. Box 997414, MS 7610  
Sacramento, CA 95899-7414

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

B. Klein

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CBassett, NRR			

**ACCESSION NO.: ML12208A034**

**\*concurrence via e-mail**

**TEMPLATE #: NRC-002**

OFFICE	PROB:RI *	PRPB:LA	PROB:BC	DPR:DD
NAME	CBassett	GLappert	GBowman	MMuessle
DATE	7/19/2012	7/26/2012	8/6/12	8/6/12

**OFFICIAL RECORD COPY**

## NOTICE OF VIOLATION

University of California-Davis  
McClellan Nuclear Research Center

Docket No. 50-607  
License No. R-130

During a U.S. Nuclear Regulatory Commission (NRC) inspection conducted July 9-11, 2012, 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 19.13(b) states that each licensee shall make dose information available to workers as shown in records maintained by the licensee under the provisions of 10 CFR 20.2106. The licensee shall provide an annual report to each individual monitored under 10 CFR 20.1502 of the dose received in that monitoring year if: (1) the individual's occupational dose exceeds 1 millisievert (mSv) (100 millirem (mrem)) total effective dose equivalent or 1mSv (100 mrem) to any individual organ or tissue; or (2) the individual requests his or her annual dose report.

10 CFR 20.1502 states that each licensee shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits of this part. As a minimum – (a) each licensee shall monitor occupational exposure to radiation from licensed and unlicensed radiation sources under the control of the licensee and shall supply and require the use of individual monitoring devices by – (1) adults likely to receive in 1 year from sources external to the body, a dose in excess of 10 percent of the limits of 20.1201(a), (2) minors . . ., (3) declared pregnant women . . ., and (4) individuals entering a high or very high radiation area.

Contrary to the above requirements, the licensee did not provide an annual report to each individual monitored under 10 CFR 20.1502 for 3 years. Specifically, three different staff personnel, whose exposures to radiation and radioactive material were monitored in accordance with Subparagraphs (1) and (4) of Paragraph (a) of 10 CFR 20.1502 and who received exposures exceeding 100 mrem TEDE and/or 100 mrem to an individual organ or tissue, did not receive an annual report containing their dose information for exposures received in 2009, 2010, or 2011.

This has been determined to be a Severity Level IV violation (Section 6.7).

Pursuant to the provisions of 10 CFR 2.201, the University of California-Davis 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 6<sup>th</sup> day of August, 2012

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

Docket No: 50-607

Report No: 50-607/2012-203

Licensee: University of California-Davis

Facility: McClellan Nuclear Research Center

Location: McClellan Park  
Sacramento, California

Dates: July 9-11, 2012

Inspector: Craig Bassett

Approved by: Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

University of California-Davis  
McClellan Nuclear Research Center  
Report No: 50-607/2012-203

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of California-Davis (the licensee's) Class I research and test reactor safety program including: 1) organizational structure and staffing; 2) review, audit, and design change functions; 3) procedures; 4) radiation protection; 5) environmental monitoring; 6) transportation of radioactive materials; and, 7) material control and accounting since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements.

### Organizational Structure and Functions

- The organizational structure and staffing were consistent with the requirements specified in Technical Specifications Section 6.

### Review and Audit and Design Change Functions

- The Nuclear Safety Committee was meeting at the required frequency, reviewing the topics outlined in the Technical Specifications, and conducting audits of facility programs as required.
- The design change program, including review, evaluation, and documentation of changes to the facility, satisfied NRC requirements.

### Procedures

- The procedure review, revision, control, and implementation program satisfied Technical Specifications requirements.

### 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 Title 10 of the *Code of Federal Regulations* 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 survey and monitoring equipment was being maintained and calibrated as required.
- Acceptable radiation protection training was being provided to facility personnel.



- One severity level IV violation was noted for failure to provide McClellan Nuclear Research Center personnel with an NRC Form 5 for the past 3 years as required by 10 CFR 19.13.

#### Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified Technical Specification and regulatory limits.

#### Transportation of Radioactive Materials

- Radioactive material was being shipped in accordance with the applicable regulations.

#### Material Control and Accounting

- Special nuclear material was acceptably controlled and tracked as required by 10 CFR Parts 70 and 74.

## REPORT DETAILS

### Summary of Plant Status

The University of California-Davis (UCD, the licensee's) two megawatt (MW) TRIGA reactor continued to be operated in support of neutron radiography, medical isotope production, neutron tomography, and experimental sample irradiation. During the inspection, the reactor was operated up to eight hours per day at a nominal power level of one MW to support neutron radiography and sample irradiation.

### 1. Organization and Staffing

#### a. Inspection Scope (Inspection Procedure [IP] 69006)

The inspector reviewed the following regarding the University of California-Davis/McClellan Nuclear Research Center (UCD/MNRC) organization, staffing, and responsibilities to ensure that the requirements of Technical Specification (TS) Section 6.1, Revision (Rev.) 13, dated March 28, 2003, were being met:

- Management responsibilities
- Qualifications of facility personnel
- Current UCD/MNRC organizational structure and staffing
- Staffing requirements for safe operation of the research reactor facility
- Selected UCD/MNRC Operations Logs and UCD/MNRC Startup Checklists for 2012 documenting shift staffing
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- University of California, Davis/McClellan Nuclear Research Center 2011 Annual Report, submitted to the NRC on June 25, 2012
- Facility Procedure UCD/MNRC-0004-DOC-13, "Technical Specifications for the McClellan Nuclear Research Center (MNRC) Reactor Facility," Rev. 13, approval date March 28, 2003
- Facility Procedure UCD/MNRC-0045-DOC-01, "Quality Assurance Program for McClellan Nuclear Research Center (MNRC)," Rev. 1, approval date November 22, 1999
- American Nuclear Society Standard 15.4-1988, "Selection and Training of Personnel for Research Reactors," standard approval dated June 9, 1988

#### b. Observations and Findings

The organization at the UCD/MNRC was as required by TS Section 6. The Vice Chancellor was the one designated as the licensee for the university. The UCD/MNRC facility was under the direct control of the Reactor Director who reported to and was accountable to the Vice Chancellor for the safe operation and maintenance of the facility. Individuals at the facility in management positions such as the Reactor Supervisor and the Radiation Safety Officer reported to the Reactor Director and were responsible for implementing UCD/MNRC policies, for operation of the facility, for safeguarding facility

personnel and the public from undue radiation exposure, and for adhering to the operating license and technical specifications.

As noted in NRC Inspection Report No. 50-607/2008-203, the licensee's organizational chart for the UCD/MNRC as shown in the TS indicated that the chain of command included an Operations Manager who was to be in charge of reactor operations. The chart also indicated a staff position of Health Physics (HP) Supervisor. These two positions were no longer part of the facility organizational structure. During a previous inspection, the inspector noted that the licensee had initiated, reviewed, and approved a TS change to reflect the current structure. The licensee indicated that the change had been submitted to the NRC on July 15, 2011 and was thus awaiting NRC review.

The organization and staffing at the facility, required for reactor operation, were as specified in the TS. Qualifications of the staff members met program requirements. Review of records demonstrated that management responsibilities were discharged as required by applicable procedures. It was noted that no staff changes had been made since the last NRC inspection which occurred in January 2012 (refer to NRC Inspection Report No. 50-607/2012-201).

c. Conclusion

With the recent TS change submitted to the NRC, the licensee's current organization and staffing were in compliance with the requirements specified in the TS Section 6.

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

a. Inspection Scope (IP 69007)

To verify that the required reviews and audits were being completed and that facility changes were reviewed and approved as required by TS Section 6.2, the inspector reviewed selected aspects of:

- 2010 Annual Audit of the MNRC completed November 4, 2010
- 2011 Annual Audit of the MNRC completed December 9, 2011
- Nuclear Safety Committee meeting minutes for June 2011 through the present
- UCD/MNRC "Facility Modification Notebook" containing the "Facility Modification Log" forms
- Selected "Facility Modification Installation Authorization Forms" and associated "Facility Modification Checklist" forms processed during 2011 and to date in 2012
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- University of California, Davis/McClellan Nuclear Research Center 2011 Annual Report, submitted to the NRC on June 25, 2012

- Facility Procedure UCD/MNRC-0043-DOC-04, "Facility Modification Procedure," Rev. 4, approval dated January 8, 2008
- Facility Procedure UCD/MNRC-0045-DOC-01, "Quality Assurance Program for McClellan Nuclear Research Center (MNRC)," Rev. 1, approval dated November 22, 1999

b. Observations and Findings

(1) Review and Audit Functions

Composition of the Nuclear Safety Committee (NSC) and qualifications of NSC members were as specified in TS Section 6.2.1. Minutes of the NSC meetings indicated that the committee continued to meet semiannually as required by TS Section 6.2.2 and provided the reviews and oversight specified in TS Section 6.2.3. Through records review the inspector determined that reviews were conducted by the NSC or designated representatives. Topics of those reviews were as required by the TS and provided sufficient guidance, direction, and oversight to ensure acceptable use of the reactor.

The inspector reviewed the two most recent annual audits conducted at the facility. The audits were comprehensive and reviewed the activities specified in TS Section 6.2.4, including various aspects of the reactor facility operations and associated programs. No discrepancies were found but several recommendations were made as a result of the audits.

(2) Design Change Functions

The regulatory requirements stipulated in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59 "Changes, tests, and experiments," were implemented at the facility through Facility Procedure UCD/MNRC-0043-DOC-04, "Facility Modification Procedure." The procedure was developed to address activities that affected changes to the facility as described in the Safety Analysis Report (SAR), changes to MNRC procedures, and changes to or development of new tests or experiments not described in the SAR. The procedure adequately incorporated criteria provided by the regulations with additional requirements mandated by local conditions.

The inspector reviewed entries in the "Facility Modification Log" Notebook for the period from 2011 and to date in 2012. The Notebook entries showed that no modifications dealing with the radiation protection system had been proposed since the last inspection.

c. Conclusion

The NSC was meeting as required and reviewing the topics outlined in the TS. Audits of various reactor operations and programs were being conducted as required. The design change program satisfied NRC requirements.

3. **Procedures**

a. Inspection Scope (IP 69008)

To verify compliance with TS Section 6.4, the inspector reviewed selected portions of the following:

- Selected "Document Review" forms completed by staff members
- "UCD/MNRC Controlled Document Review and Approval Reference List"
- "MNRC Document List" listing all the licensee's current procedures and the date each was last reviewed
- Various memoranda from the Reactor Supervisor to the staff indicating document review assignments and responsibilities
- Facility Procedure UCD/MNRC-0005-DOC-09, "Document Control Plan," Rev. 9, approval dated February 16, 2007
- Facility Procedure UCD/MNRC-0029-DOC-18, "UCD/MNRC Radiation Protection Procedures," Rev. 18, approval dated January 29, 2008
- Various of the Addenda located in Facility Procedure UCD/MNRC-0042-DOC-9, "MNRC Health Physics Instrumentation Calibration and Test Procedures," latest reviews of the addenda were completed on January 13, 2011

b. Observations and Findings

According to TS Section 6.4 it was required that procedures be prepared and approved for the activities listed in that section. The procedures were required to be approved by the UCD/MNRC Director. Facility Procedure UCD/MNRC-0005-DOC stipulated that the UCD/MNRC staff perform a biennial review of each active document to assure that it was current. The inspector noted that Operations and Health Physics procedures were typically being reviewed annually by the licensee while maintenance and other procedures were reviewed biennially. Changes to the procedures required the approval of the UCD/MNRC Director and all changes were required to be documented.

The inspector determined that the UCD/MNRC procedures were generally being reviewed as required, that procedures were approved by the Director, and that changes were documented as required as well. It was also noted that three of four procedures that were assigned to be reviewed by the Experiment Coordinator had not been reviewed within the two year time frame specified by procedure. These procedures were: 1) Facility Procedure UCD/MNRC-0081-DOC-00, "Experiment Coordination Checklist," last review dated January 6, 2010, 2) Facility Maintenance Procedure UCD/MNRC-0058-OMM-00, "Neutron

Irradiator,” last review dated December 18, 2009, and 3) Facility Maintenance Procedure UCD/MNRC-00-OMM-01, “Central Facility,” last review dated December 18, 2009. The licensee indicated that the former Experiment Coordinator had not reviewed the procedures in a timely manner and the new person hired for that position had not had sufficient time or experience to date to conduct the review. The licensee was informed that this issue would be followed by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-607/2012-203-01)

c. Conclusion

The current procedure review, revision, control, and implementation program satisfied TS requirements.

**4. Radiation Protection**

a. Inspection Scope (IP 69012)

The inspector reviewed selected portions of the following regarding the licensee's radiation protection program to ensure that the requirements of 10 CFR Part 20 and TS Sections 4.7 and 6.4.2 were being met:

- Calibration of selected radiation monitoring instruments
- List documenting all MNRC personnel who were authorized to handle radioactive material dated July 10, 2012
- The “Self Inspection Checklist” completed by the Radiation Safety Officer (RSO) for 2010 and 2011
- Personal monthly dosimetry results for 2010, 2011, and through May 2012
- “2010 MNRC Radiation Safety Program Review Report,” completed by members of the NSC and dated December 6, 2010
- “2011 MNRC Radiation Safety Program Review Report,” completed by members of the NSC and dated November 28, 2011
- Lesson plans, training objectives, and qualification cards for training of personnel by the RSO
- Selected daily, weekly, and quarterly contamination and radiation survey results for the past two years
- Licensee Radiological Investigation Reports for 2011 and 2012 – Numbers 11-01, 12-01, 12-02, and 12-03, as documented in the Special Surveys Notebook
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- University of California, Davis/McClellan Nuclear Research Center 2011 Annual Report, submitted to the NRC on June 25, 2012
- Facility Procedure UCD/MNRC-0029-DOC-18, “UCD/MNRC Radiation Protection Procedures,” Rev. 18, approval dated January 29, 2008

- Facility Procedure UCD/MNRC-0042-DOC-9, "MNRC Health Physics Instrumentation Calibration and Test Procedures," which included:
  - Addendum No. 01, "Beta Dose Rate Calibration Procedure," Rev. 6, dated August 22, 2007
  - Addendum No. 29, "Ludlum Model 177 Calibration Procedure," Rev. 3, dated February 22, 1999
  - Addendum No. 30, "Ludlum Model 177-54 Calibration Procedure," Rev. 3, dated February 22, 1999
  - Addendum No. 31, "Ludlum Model 3 Calibration Procedure," Rev. 4, dated September 18, 2007
  - Addendum No. 34, "RAM Calibration Procedure," Rev. 4, dated June 8, 2009
- Safety Analysis Report, Revision 4, dated December 1999, Chapter 11, "Radiation Protection and Waste Management Program," Revision 2, dated April 3, 1998
- American National Standard ANSI/ANS-15.11-1993, "Radiation Protection at Research Reactor Facilities," standard approval dated July 23, 1993

The inspector also toured the facility and observed the use of dosimetry and radiation monitoring equipment. In addition, licensee personnel were interviewed and radiological signs and postings were observed.

b. Observations and Findings

(1) Surveys

Daily checklists and weekly, quarterly, and special contamination and radiation surveys, outlined in the licensee's "UCD/MNRC Radiation Protection Procedures," were being completed by the RSO or other qualified staff members as required. Any contamination detected in concentrations above established action levels was noted and the affected area was decontaminated. Results of the surveys were typically documented on survey maps and posted at the entrances of the various areas surveyed so that facility workers could check and be knowledgeable of the radiological conditions that existed in those areas.

During the inspection the inspector accompanied a licensee representative to observe the completion of a Weekly Radiation and Contamination Survey. Areas surveyed at the facility included the Equipment Room, the Reactor Room, and associated support areas. No anomalies were noted.

(2) Postings and Notices

Copies of current notices to workers were posted in appropriate areas in the facility. The required radiological signs were posted at the entrances to controlled areas. Other postings also showed the industrial hygiene

hazards that were present in the areas as well. The copy of NRC Form-3 noted at the facility was the latest issue, as required by 10 CFR Part 19, and was posted on a bulletin board near the main entrance to the facility where visitors are required to sign the Visitors Log.

(3) Dosimetry

Personnel were observed to be properly wearing extremity and whole body dosimetry in the controlled areas. The dosimeters being used were 4-chip thermoluminescent dosimeters (TLDs) processed monthly by a NVLAP certified vendor (Mirion Technologies (formerly Global Dosimetry Solutions)). The TLDs were used for whole body monitoring and TLD finger rings were used for extremity monitoring.

An examination of the TLD results indicating radiological exposures at the facility for the past two years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limits. The highest annual whole body exposure received by a single licensee employee for 2010 was 169 millirem deep dose equivalent (DDE). The highest annual extremity exposure for 2010 was 562 millirem shallow dose equivalent (SDE) and the highest skin or other shallow dose was 171 mr SDE. The highest annual whole body exposure received by a single person for 2011 was 50 millirem DDE. The highest annual extremity exposure for 2011 was 106 millirem SDE and the highest skin or other shallow dose was 96 mr SDE. Through May 2012, the highest individual whole body exposure that had been received has been 35 millirem DDE; the highest extremity exposure has been 99 millirem SDE; and, the highest skin or other shallow dose was 142 mr SDE.

(4) Radiation Monitoring Equipment

Selected calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring instruments in use at the facility were reviewed. The records showed that the meters and detectors were either calibrated by reactor staff or the instruments were sent off site to be calibrated by a contractor. The calibrations were tracked and documented as required. The inspector confirmed that the frequencies of the calibrations satisfied the requirements established in the TS Section 4.7 and 10 CFR 20.1501(b). All instruments checked by the inspector had a current calibration sticker attached.

(5) Radiation Protection Program

The radiation protection program was described and controlled by procedures and policies that were well documented as required by TS Section 6.4.2 and 10 CFR 20.1101(a). Annual audits of the radiation protection program had been completed by the RSO on July 6, 2011, and June 18, 2012. These were documented in the form of a "Self Identification Checklist." Separate audits of the program were conducted



by members of the NSC on December 6, 2010, and November 28, 2011. These audits satisfied the periodic program review required by 10 CFR 20.1101(c). No problems were noted by the NSC audit team but various recommendations for improvements were made.

(6) Personnel Training

Personnel training required by 10 CFR 19.12, "Instruction to Workers," was provided by the RSO. In a graded approach, there were five "levels" or plans for training, designated as "A" through "E". The type of training provided to an individual was dictated by the type of work to be performed and/or what controlled area(s) the person would be required to enter. Plan A was training provided for visitors to the facility. Plan B was training provided to staff personnel who were also considered Radiation Workers. Plan C was initial training for reactor operators hired at the facility. Subsequent training on this material was provided to operators during their requalification training. Plan D was given annually to all facility faculty and staff. Plan E was for ancillary personnel such as custodial service workers.

The inspector reviewed the training given to various personnel. Three individuals had received Plan B training, as well as job specific training, and were to be involved in the Iodine-125 production program. One individual who was hired as the facility Electronic Engineer had received Plan C training. He was also participating in the Reactor Operator training program at the facility. The inspector noted that training was being completed as required and it appeared to be adequate.

(7) Radiation Work Permit Program

The inspector reviewed the Radiation Work Permits (RWPs) that had been written, used, and closed out during 2011 and those issued to date in 2012. It was noted that no Special RWPs had been issued recently. Of those RWPs that had been written for 2011 and 2012, the inspector determined that the controls, precautions, and instructions specified in the RWPs appeared to be appropriate and were being followed. It was also noted that the RWPs had been reviewed by the RSO as required.

(8) NRC Form 5

10 CFR 19.13(b) states that each licensee shall make dose information available to workers as shown in records maintained by the licensee under the provisions of 10 CFR 20.2106. The licensee shall provide an annual report to each individual monitored under 10 CFR 20.1502 of the dose received in that monitoring year if: (1) The individual's occupational dose exceeds 1 mSv (100 mrem) TEDE or 1mSv (100 mrem) to any individual organ or tissue; or (2) The individual requests his or her annual dose report.

10 CFR 20.1502 states that each licensee shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits of this part. As a minimum – (a) Each licensee shall monitor occupational exposure to radiation from licensed and unlicensed radiation sources under the control of the licensee and shall supply and require the use of individual monitoring devices by – (1) Adults likely to receive in 1 year from sources external to the body, a dose in excess of 10 percent of the limits of 20.1201(a), (2) Minors . . . , (3) Declared pregnant women . . . , and (4) Individuals entering a high or very high radiation area.

In Paragraph 4 of the Privacy Act Statement portion of NRC Form 5, it states that the licensee must complete NRC Form 5 on each individual for whom personal monitoring is required under 10 CFR 20.1502.

As noted above, during the inspection of the MNRC Radiation Protection Program, the inspector reviewed the dosimetry records of those staff members working at the facility. It was noted that in 2009, one individual had received a dose to the skin, SDE, of 168 mrem. In 2010, two individuals received a whole body dose, TEDE, greater than 100 mrem. One person received a deep dose equivalent (DDE) of 114 mrem and the other received a DDE of 169 mrem. In 2011, one individual received a dose to the skin of 106 mrem. Because these doses exceeded the limit established that required an NRC Form 5 to be issued, the inspector asked to review the NRC Form 5 for these individuals. MNRC personnel indicated that the last annual report of dose (NRC Form 5) that anyone had received was the one for the year 2008.

The inspector was informed that the UC Davis Environmental Health and Safety (EH&S) Department handled the dosimetry for the facility and made arrangements (maintained a contract) with a vendor to issue and process the dosimetry. The vendor would be the entity that would track exposures and issue the NRC Form 5 information through the campus EH&S Department. Therefore, the EH&S Department would be the group responsible for requesting and then issuing the proper forms to MNRC personnel. Monthly dosimetry results were generally forwarded from the campus EH&S office to the MNRC RSO. However, the campus EH&S office had decided not to request NRC Form 5 for the individuals at the MNRC as a cost cutting measure. The licensee was informed that failure to provide facility personnel with NRC Form 5 information for the past three years was a violation (VIO) of 10 CFR 19.13 (VIO 50-607/ 2012-203-02).

(9) Facility Tours

The inspector toured the main Staging or Set-Up area, the Equipment Room, the Reactor Room, and various support areas with licensee representatives on various occasions and observed on-going activities. It was noted that facility radioactive material storage areas were properly

posted. No unmarked radioactive material was noted. Radiation and High Radiation Areas were posted as required and properly controlled.

c. Conclusion

The inspector determined that the Radiation Protection and As Low As Reasonably Achievable (ALARA) Programs, as implemented by the licensee, generally satisfied regulatory requirements because: 1) surveys were completed and documented acceptably to permit evaluation of the radiation hazards present; 2) postings at the facility met regulatory requirements; 3) personnel dosimetry was being worn as required and recorded doses were well within the NRC's regulatory limits; 4) radiation survey and monitoring equipment was being maintained and calibrated as required; 5) the Radiation Protection Program was acceptable and was being reviewed annually as required; and, 6) acceptable radiation protection training program was being provided to facility personnel. One apparent violation was noted for failure to provide various MNRC personnel with an NRC Form 5 for the past three years as required by 10 CFR 19.13.

**5. Effluent and Environmental Monitoring**

a. Inspection Scope (IP 69004)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Section 6.4.2(d):

- Solid Radwaste Logbook
- Quarterly Environmental TLD Reports for 2010, 2011, and to date in 2012
- "Radioactive Material Discharged Into Sanitary Sewer" form maintained and updated for 2010, 2011, and to date in 2012
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- University of California, Davis/McClellan Nuclear Research Center 2011 Annual Report, submitted to the NRC on June 25, 2012
- Facility Procedure UCD/MNRC-0029-DOC-18, "UCD/MNRC Radiation Protection Procedures," Rev. 18, approval dated January 29, 2008
- Facility Procedure UCD/MNRC-0042-DOC-9, "MNRC Health Physics Instrumentation Calibration and Test Procedures," which included:
  - Addendum No. 08, "Stack CAM Alarm Setpoint Procedure," Rev. 7, dated May 16, 2007
  - Addendum No. 12, "Weekly Stack CAM Source Check Procedure," Rev. 4, dated October 27, 2005
  - Addendum No. 16, "Canberra 2404 Calibration Procedure," Rev. 7, dated May 14, 2008
  - Addendum No. 48, "Stack CAM Calibration Procedure," Rev. 2, dated May 10, 2007
  - Addendum No. 49, "Reactor CAM Calibration Procedure," Rev. 1, dated May 16, 2007

- Addendum No. 50, "Bay CAM Calibration Procedure," Rev. 1, dated May 21, 2007

b. Observations and Findings

The inspector determined that gaseous releases continued to be monitored as required, were acceptably analyzed, and were documented in the annual operating reports. To ensure that airborne concentrations of gaseous releases were within the concentrations stipulated in 10 CFR Part 20, Appendix B, Table 2, below the dose constraint specified in 10 CFR 20.1101(d) of 10 millirem per year, and within TS limits, the licensee completed a calculation of the dose to members of the public as the result of reactor operations. This calculation was performed using the Environmental Protection Agency (EPA) computer code, CAP88-PC, Version 3.0. The results indicated an annual dose to the public of 1.33E-2 millirem for 2010 and 1.06E-2 millirem for 2011.

There were no liquid releases from the facility during 2010, 2011, and to date in 2012. It was also noted that no solid radioactive waste had been released/shipped from the facility during 2010, 2011, and to date in 2012.

Environmental water samples were collected, prepared, and sent to a vendor for analysis consistent with procedural requirements. The results of these analyses were all within regulatory limits. On-site and off-site gamma radiation monitoring was completed using various environmental TLDs in accordance with the applicable procedures as well. The review of data indicated that there were no measurable doses above any regulatory limits. The highest unrestricted area dose measured by an environmental TLD was 23 millirem for 2010 and 17 millirem for 2011.

c. Conclusion

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

**6. Transportation**

a. Inspection Scope (IP 86740)

To verify compliance with regulatory and procedural requirements for transferring or shipping licensed radioactive material, the inspector reviewed the following:

- Selected licenses of various UCD/MNRC consignees
- Selected records of various types of radioactive material shipments including completed radiological survey forms
- Selected training records for staff personnel authorized to ship hazardous material in accordance with the regulations specified by the Department of Transportation (DOT)

- Facility Procedure UCD/MNRC-0029-DOC-18, "UCD/MNRC Radiation Protection Procedures," Rev. 18, approval dated January 29, 2008
- Appendix A, "Limited Quantity of Class 7 (Radioactive) Materials Checklist," of Section 21 of Facility Procedure UCD/MNRC-0029-DOC-18
- NUREG-1660/RAMREG-002, "U.S.-Specific Schedules of Requirements for Transportation of Specified Types of Radioactive Material Consignments," published November 1998

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that the licensee had shipped various types of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates were generally measured correctly. All radioactive material shipment records reviewed by the inspector had been completed in accordance with DOT and NRC regulations.

The inspector verified that the licensee maintained copies of shipment recipients' licenses to possess radioactive material as required and that the licenses were verified to be current prior to initiating a shipment. The inspector also reviewed the training of MNRC staff members responsible for shipping radioactive material. The inspector verified that licensee personnel designated as "shippers" had received the appropriate training covering the DOT, International Air Transport Association (IATA), and International Civil Aviation Organization (ICAO) requirements within the past three years.

c. Conclusion

Radioactive material was being shipped in accordance with the applicable regulations.

**7. Material Control and Accounting**

a. Inspection Scope (IP 85102)

To verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Parts 70 and 74 and TS Sections 5.3 and 5.4, the inspector reviewed:

- UCD/MNRC Present Element Location forms
- SNM Physical Inventory forms for 2011 through 2012
- Control of Special Nuclear Material (SNM) storage areas
- MNRC Core Configuration map dated December 20, 2010
- Fuel Handling Checklists for fuel handling in December 2011
- UCD/MNRC Fuel Transfer Forms for 2011 (none had been completed to date in 2012)
- Core and Storage Boards located in the Control Room and in the Reactor Room

- Selected entries in the Fuel Movement Notebook documenting the date each element was received, fuel element movement, and current location
- Nuclear Material Transaction Reports (DOE/NRC Form 741) for the time period from October 2010 through April 2012
- Material Balance Reports (DOE/NRC Form 742) for the time period from October 2010 through April 2012
- Physical Inventory Listing forms (DOE/NRC Form 742C) for the time period from October 2010 through April 2012
- Facility Procedure UCD/MNRC-0011-OMM-5240-05, "Fuel," Rev. 5, approval dated April 19, 2001
- Facility Procedure UCD/MNRC-0019-OMM-5220-04, "Fuel Handling Tools," Rev. 4, approval dated January 12, 2009

b. Observations and Findings

Records indicated that the licensee accounted for all SNM maintained under the R-130 license. SNM material status and transaction reports, documenting what the licensee possessed and what happened to the material in 2010, 2011, and 2012, had been completed and submitted to the appropriate regulatory agencies in a timely manner and as required by 10 CFR 74.13(a). Physical inventories were conducted annually as required.

The inspector toured the facility and verified that the licensee was using and storing SNM in the designated areas as required by 10 CFR 70.41(a). Through tours and records review, the inspector verified that the total amount of SNM in use or in storage at the facility was within the possession limits specified in the license.

The inspector also observed and verified that fuel elements were being stored in the appropriate and approved locations. Because of the operations schedule, the inspector was unable to observe an inventory and verify the serial numbers of any irradiated fuel elements from the core. Fuel element locations designated on various forms were cross referenced with the latest Core and Storage Map and with the Core and Storage Boards in the Control Room and the Reactor Room. All entries matched and were correct. No problems were noted.

c. Conclusion

The licensee was acceptably controlling and tracking SNM as required by 10 CFR Parts 70 and 74.

**8. Exit Interview**

The inspection scope and results were summarized on July 11, 2012, with members of licensee management. The inspector described the areas inspected and discussed the inspection findings. 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. No dissenting comments were received from the licensee.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee Personnel

H. Bollman	Facility Manager and Senior Reactor Operator (SRO)
T. Essert	Electronics Engineer and RO Trainee
H. Egbert	Radiography Supervisor and SRO
M. Lerche	Associate Director for Research/Education Coordination and Experiment Coordinator
B. Liu	Research Support Engineer
D. Reap	Radiation Safety Officer, Security Officer, and SRO
W. Steingass	Associate Director for Reactor Operations and Reactor Supervisor
R. Walker	Radiographer/Mechanic

## **INSPECTION PROCEDURES USED**

IP 69004:	Class I Research and Test Reactor Effluent and Environmental Monitoring
IP 69006:	Class I Research and Test Reactor Organization, Operations, and Maintenance Activities
IP 69007:	Class I Research and Test Reactor Review and Audit and Design Change Functions
IP 69008:	Class I Research and Test Reactor Procedures
IP 69012:	Class I Research and Test Reactor Radiation Protection
IP 85102:	Material Control and Accounting
IP 86740:	Inspection of Transportation Activities

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

50-607/2012-201-01	IFI	Follow-up on the licensee's actions to ensure that three procedures are reviewed and revised as needed as soon as possible and appropriate.
50-607/2012-201-02	VIO	Failure to provide various MNRC facility personnel with NRC Form 5 information for the past three years as required by 10 CFR 19.13.

### Closed

None

**PARTIAL LIST OF ACRONYMS USED**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ALARA	As low as reasonably achievable
DDE	Deep dose equivalent
DOT	Department of Transportation
EPA	Environmental Protection Agency
HP	Health Physics
IFI	Inspector Follow-up Item
IP	Inspection procedure
mrem	millirem
mSv	millisievert
MNRC	McClellan Nuclear Research Center
MW	megawatt
NRC	U.S. Nuclear Regulatory Commission
NSC	Nuclear Safety Committee
PDR	Public Document Room
Rev.	Revision
RSO	Radiation Safety Officer
SRO	Senior Reactor Operator
RWP	Radiation Work Permit
SDE	Shallow dose equivalent
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent dosimeter
TS	Technical Specifications
UCD	University of California-Davis
VIO	Violation